NCCOR
National Collaborative on Childhood Obesity Research

Advancing Measurement of Individual Behaviors Related to Childhood Obesity

Advancing Measurement of Individual Behaviors Related to Childhood Obesity: Implications and Recommendations for the Field

EXECUTIVE SUMMARY

Background

The National Collaborative on Childhood Obesity Research (NCCOR) is a public-private partnership of four leading research funders—the Centers for Disease Control and Prevention (CDC), National Institutes of Health (NIH), Robert Wood Johnson Foundation (RWJF), and the U.S. Department of Agriculture (USDA)—that addresses childhood obesity through research and evaluation and dissemination of research findings.

NCCOR aims to make an impact on childhood obesity research by creating tools for researchers and practitioners, building knowledge on key research topics, engaging with leading experts on new science, and ensuring robust communications and information dissemination. From its inception, a key priority for NCCOR has been to promote the more common use of high-quality and standardized measures and methods across childhood obesity prevention and research, surveillance, and interventions. Use of such measures enhances the potential for comparison of results across different studies and the rapid advancement of progress against childhood obesity. This progress includes the identification of individual, family, policy, and environmental factors that influence obesity risk and the development of effective interventions to address childhood obesity.

On May 20–21, 2019, NCCOR convened a workshop entitled "Advancing Measurement of Individual Behaviors Related to Childhood Obesity." This workshop was the first in a series of three workshops and focused on measurement needs to capture individual behaviors related to childhood obesity. The other two workshops planned in the series are focused on measurement needs for high-risk populations and measurement needs to capture policy and environmental influences. The workshop series is funded by The JPB Foundation.

Workshop Aims

The workshop aimed to gather together leading experts to (1) explore next steps for measurement science relevant to emerging areas for diet and physical activity in children, particularly from birth to age 12 years, and (2) examine measurement science issues in two other topics of new relevance to childhood obesity—sedentary behavior and sleep.

Workshop Proceedings

The workshop consisted of two parts. First was a series of panel presentations examining measurement needs to assess priority areas in diet (i.e., feeding practices, identifying patterns for infants and children from birth to age 12 years, responsive feeding), physical activity (i.e., physical activities of infants and young children, device-based measurement in children, physical activity in diverse settings and as studied in various types of epidemiological research), sedentary behavior, and sleep across developmental stages and settings. Moderated discussions followed each group of related presentations.

Second, after the presentations were completed, participants broke into small groups for each domain (nutrition, physical activity/sedentary behavior, sleep) to identify and prioritize actionable steps to address short-term (1–3 years) and medium-term (3–5 years) measurement needs in these areas. Several priorities areas emerged that are applicable across all the domains: (1) Develop measurement methods for children younger than age 6 years. (2) Combine measures and methods in the same study to achieve new insights through triangulation. (3) Develop recommendations for constructs for each developmental age to include in questionnaires. (4) Define terms and core indicators or domains that can be measured. (5) Examine the importance of family, social, and environmental contexts and how they evolve with age. (6) Support efforts to assess the validity and reliability of measures.

Next Steps

This white paper can be accessed on the NCCOR website at https://www.nccor.org/measurement-workshop-series/. White papers for the other two workshops also will be posted on the NCCOR website. In addition, NCCOR plans to publish a synthesis of findings and recommendations from the three workshops in the scientific literature.

It is anticipated that recommendations from these workshops will advance the development of improved measures that can be used across a range of research, surveillance, and intervention activities related to childhood obesity. By addressing the many levels of factors that influence childhood obesity and with focused work within high-risk groups, NCCOR hopes these efforts will ultimately help reduce childhood obesity.

NCCOR

Background

One of NCCOR's main goals is to create tools and resources to make childhood obesity research more effective. A key priority therefore is promoting the more common use of high-quality and standardized measures because measures are fundamental to research, including research on childhood obesity. Useful and standardized measures are critical for researchers' and practitioners' efforts to characterize and identify the many forces influencing childhood obesity and healthy weight, develop effective interventions, and evaluate the implementation of such interventions in practice.

Through the Measures Registry, NCCOR has catalogued an extensive list of measures currently being used in the field. However, gaps still remain. For example, the advent of new technologies; focus on populations, such as very young children; and the discovery or refinement of risk factors for childhood obesity are all opportunities to improve measurement.

To help advance progress in the development of measures in this field, NCCOR is hosting a series of three workshops to explore next steps for measurement science relevant to diet, physical activity, and the environments in which these behaviors occur in children.

This white paper describes the first workshop (agenda on page 28), which covered advancing measurement of individual behaviors related to childhood obesity. These behaviors include several measurement-relevant areas receiving renewed attention within diet and physical activity, such as feeding practices and developmental milestones, as well as two behaviors of emerging importance that require specific measurement tools:

- Sedentary behavior, which is increasingly considered to be a distinct construct having unique psychological and environmental causes and independent physiological consequences, and
- Sleep, which is now believed to play an important role in development of obesity and potentially in obesity disparities.

SESSIONS

Session 1: Measurement of Feeding Practices for Children Birth to 24 Months

Session 2: Measurement Needs to Better Assess Dietary Patterns

Session 3: Measurement of Physical Activity in Children Across Development Stages and Settings

Session 4: Measurement of Sedentary Behavior in Children

Session 5: Measuring Sleep and its Interaction with Childhood Obesity

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Describing the Measurement Issues And Challenges

Across five sessions, workshop presenters outlined the current status of measurement of diet, physical activity, sedentary behavior, and sleep in children. They also discussed issues and challenges in measurement and described new advances in research and practice. A particular focus was the issues involved in assessing these behaviors in infants and very young children. Moderated discussions followed each group of related presentations. The presentations are summarized in this section of the white paper. The following section, beginning on page 14, synthesizes the participants' domain-specific small group discussions and their work to prioritize actionable steps to address short- and medium-term measurement needs in all the domains.

SESSION 1: MEASUREMENT OF FEEDING PRACTICES FOR CHILDREN BIRTH TO 24 MONTHS

1. **Overview of Current Measurements and Challenges of Assessment of Feeding Practices for Birth to 24 Months at a Global Level**
   Chessa Lutter, PhD, RTI International and University of Maryland School of Public Health

2. **Assessment of Dietary Patterns for Children Birth to 24 Months: Measures and Challenges**
   Ronette Briefel, DrPH, RD, Mathematica

3. **Overview of Responsive Feeding and Measurement**
   Maureen Black, PhD, RTI International and University of Maryland School of Medicine

1 Overview of Current Measurements and Challenges of Assessment of Feeding Practices for Birth to 24 Months at a Global Level Chessa Lutter

Importance of This Topic for Childhood Obesity

Simple, valid, and reliable indicators on feeding practices of infants and toddlers ages Birth to 24 Months are important to track progress and guide policies, programs, and investments to improve nutrition and health. Specifically, these indicators are important for:

- **Assessment:** to make national and sub-national comparisons and to describe trends over time;
- **Targeting:** to identify populations at risk, target interventions, and make policy decisions about resource allocation; and
- **Monitoring and evaluation:** to monitor progress in achieving goals and to evaluate the impact of interventions.

Current Measurement of Feeding Practices Among Birth to 24 Months

The World Health Organization (WHO) and its partners began an effort to develop indicators of Birth to 24 Month feeding practices in 2003, and the first set, which included both core and optional indictors, was published in 2008. These indicators, which cover breastfeeding and complementary feeding, are intended to be implemented through periodic large-scale surveys, such as demographic and health surveys or multiple indicator cluster surveys.

In 2010, WHO and partners published a comprehensive measurement guide to facilitate collection and analysis of the indicators, and in 2017, they began a process to update the indicators. All of the updated indicators are now considered core; none are optional. In addition,

the indicators now focus on overweight, obesity, and unhealthy feeding practices (e.g., consumption of sugar-sweetened beverages) as well as undernutrition, which was the primary focus previously.

Key Strengths and Challenges

The WHO indicators are simple and practical and are universally accepted by and reported on by many low- and middle-income countries. They can be used to highlight gaps between recommendations and current practices, and they highlight practices that were not previously regarded as important. Finally, by creating momentum for assessment and tracking, they have been used to stimulate action and investment.

At the same time, countries using these indicators recognize that they also have challenges. Infant and child feeding is a dynamic process, and not every aspect of this behavior can be reflected in an indicator whose measurement depends on large-scale surveys. In addition, the development of these indicators involves value judgements on what is most important and depends on consensus among experts and stakeholders. Finally, these indicators can be influenced by several sources of bias, including recall bias, social desirability bias, as well as miscalculation or misinterpretation or both.

2 Assessment of Dietary Patterns for Children Birth to 24 Months: Measures and Challenges

Ronette Briefel

Importance of This Topic for Childhood Obesity

The dietary environment for the Birth to 24 Months age group has changed and is characterized by increased consumption of sugar-sweetened beverages and low-nutrient, energy-dense foods; limited consumption of vegetables and fruits; and increased portion sizes.

These trends increase the risk of overweight and obesity among young children, creating a need for objective diet measures for this age group that can be used for nutrition surveillance, research on the effectiveness of obesity interventions, and evaluation of nutrition programs. Yet, the development of diet measures for children Birth to 24 Months has lagged behind those for older children. For example, the Dietary Guidelines for Americans will, for the first time, cover children younger than age 2 in the 2020 iteration.

Assessing Dietary Patterns for Children Birth to 24 Months

Assessing dietary patterns involves comparing an individual's dietary quality and food consumption with dietary guidance. Current measures rely on information collected using a variety of dietary intake instruments, including 24-hour recalls, food records, food frequency questionnaires (FFQs), and survey questions.

Measures that can be used to assess dietary patterns include breastfeeding, responsive feeding, and evidence-based factors that can be used as indicators of dietary quality. These include variety in foods and food groups; limited consumption of high-sugar, high-fat foods; appropriate beverage types and amounts; appropriate snacking frequency and types of foods; and limited frequency of eating at fast food restaurants. In addition, good measures of food security have been developed, and they are increasingly being used along with other measures of diet quality to provide a more complete picture of dietary patterns.

Key Challenges

Assessing dietary patterns in infants and very young children is challenging in several respects. The Birth to 24 Month period is a time of rapid changes in diet, especially for older infants and toddlers, and few brief tools exist for this age group. In addition, this age group often has multiple caretakers, each of whom has knowledge of different aspects of the child's diet. Caretakers have difficulty in estimating the small portion sizes that young children consume, and parents tend to overestimate, rather than underestimate portion size. Finally, diets vary across subpopulations by factors such as race/ethnicity, culture, income and education, and parents' experience in feeding.

3 Overview of Responsive Feeding and Measurement

Maureen Black

Importance of This Topic for Childhood Obesity

Healthy personal development in very young children requires a strong emotional and physical attachment to at least one primary caregiver. Feeding is a behavior through which attachment can be influenced. Responsive feeding is associated with healthy growth and self-regulated eating in infants and young children, and this construct guides pediatric practice today. Children who are allowed to take the lead are less likely to be underweight or overweight.

Measuring Responsive Feeding

Responsive feeding embodies a reciprocal, bidirectional relationship between the child and caregiver, in which the child signals hunger or satiety through actions and expressions, the caregiver recognizes the cues and responds promptly in a developmentally appropriate and nurturing manner, and the child experiences the caregiver's response.

At least 33 questionnaires include measures of responsive feeding. Two recommended questionnaires are the Feeding Practices and Structure Questionnaires (FPSQ-28) and the Comprehensive Food Practice Questionnaire. In addition, three scales provide observational measures of responsive feeding. These are the Responsiveness to Child Feeding Cues Scale, the Nursing Child Assessment of Feeding Scale, and the Emotional Availability Scales.

Discussants: Summing Up and Providing Context to the Presentations

The Session I moderator invited the three presenters to comment on the key measurement needs for feeding practices for the Birth to 24 Month age group with respect to childhood obesity:

- Dr. Lutter suggested that measuring frequency of family visits to fast food establishments is needed, as this is a growing issue among low-income people in countries represented by the Pan American Health Organization. In the global context, responsive feeding also is critically important, though how to measure that in largescale surveys is still unresolved.
- Dr. Briefel noted the similarities in issues in global and U.S. settings and that close consideration of the WHO indicators will be valuable.
- Dr. Black called for increased attention to policy and environmental levels, noting that in the absence of policies and actions to create a healthy food environment, children face a heavy burden to self-regulate in the current obesogenic environment. Progress in addressing this problem in several other countries may provide lessons for the United States.

SESSION 2: MEASUREMENT NEEDS TO BETTER ASSESS DIETARY PATTERNS

1. Assessing Diet Patterns in Young Children Ages 2 to 5 Years
   Dianne Stanton Ward, EdD, University of North Carolina, Gillings School of Global Public Health

2. Overview of Current Measurements and Challenges of Assessment in Children Ages 6 to 12 Years
   Carol J. Boushey PhD, MPH, RD, University of Hawaii Cancer Center

3. Novel Measures of Individual Assessment on Obesity-Related Indicators from the STOP Project
   Lida Chatzi, MD, PhD, University of Southern California, Keck School of Medicine

Discussant: Sharon Kirkpatrick, PhD, RD, University of Waterloo

1 Assessing Diet Patterns in Young Children Ages 2 To 5 Years

Dianne Stanton Ward

Importance of this Topic for Childhood Obesity

Current dietary guidelines are shifting away from specific foods groups and nutrients to a focus on overall dietary patterns, yet little information on dietary patterns is available for children ages 2 to 5 years. Dietary patterns develop early and are associated with important health outcomes, so understanding dietary patterns in young children may have an important impact on dietary guidance and educational interventions and ultimately on childhood obesity.

Measuring Dietary Patterns in Young Children

Assessing dietary patterns of young children can be conducted using a variety of methods and indices, including documentation of plate waste; direct observation at home or in care settings; parent or caregiver reports, recalls, or records (e.g., 24-hour recalls, meal recalls, food diaries, food frequency questionnaires); or a combination of methods.

Each method has strengths and limitations. For example, plate waste methods provide a more precise estimate of food provided and consumed but require handling of food, which may not be allowed. Direct observation minimizes participant burden but requires extensive training and is resource intensive. Some recalls and records are accessible for home use but have a high potential for bias. Key considerations in choosing a method include the research question being asked, the timeframe during which data are collected, the age group being studied, the method of obtaining data, the setting, the tolerance for measurement error, and methods for managing misreporting.

Though few studies have attempted to ascertain dietary patterns in young children, diet quality has been assessed in early care and education settings using the Healthy Eating Index, for example in the Healthy Me, Healthy We study.

Key Challenges

Researchers assessing dietary patterns in young children face challenges, including the need to use proxy reporters and that data collection usually involves multiple caregivers in both home and away-from-home settings. Patterns also may differ based on setting (home versus childcare). In addition, the data may contain be influenced by biases associated with specific reporters, such as under- and over-reporting based on food type (e.g., sugar-sweetened beverages, vegetables) and reflect various types of measurement error.

Major research questions include:

- What should be the measurement standards for this age group to assure a full accounting for dietary intake?
- What methods are best to assess dietary patterns in young children? Is diet quality sufficient?
- How stable are dietary patterns across this age period and are there critical periods of change?
- How do children's patterns differ from that of parents or other caregivers?
- How can investigators account for misreporting and biases? How important are these errors?
- Are there simple ways of getting dietary intake and pattern information?

2 Overview of Current Measurements and Challenges of Assessment in Children Ages 6 to 12 Years

Carol J. Boushey

Importance of this Topic for Childhood Obesity

Food consumption during the middle childhood and young adolescent period, ages 6 to 12 years, is multidimensional and dynamic. Children ages 6 to 10 years have increased awareness about foods but are still influenced by the eating patterns of their parents. Early adolescents ages 11 to 12 years are increasingly oriented toward their peers and are interested in exploring new foods.

Measuring Dietary Patterns in Children Ages 6 to 12 Years

A variety of dietary assessment methods are needed to capture dietary intake and patterns, and current approaches include 24-hour recalls, dietary records, FFQs, and screeners or short FFQs. New technologies are being used to provide more detail about intake of a variety of foods, including web-based methods (e.g., the Automated Self-Administered 24-Hour Dietary Assessment Tool [ASA-24]) and mobile phone-based methods. Studies using these tools have had mixed results. Biomarkers or doubly labeled water also are useful methods to gathering intake data. However, they are not able to capture cooking methods, mixtures of foods eaten together, or the context in which foods are consumed.

Key Challenges

Key challenges include researchers' need to determine whether the child must use a parent proxy, can report with parental assistance, or can report independently. Schools' restrictions on recording dietary intake data also may hamper data collection. Keeping children engaged in the dietary data collection process is another key challenge.

3 Novel Measures of Individual Assessment on Obesity-related Indicators from the STOP Project

Lida Chatzi

Importance of this Topic for Childhood Obesity

Growing evidence suggests that exposures to environmental stressors play a key role in the current obesity epidemic. One hypothesis that accounts for this role is the environmental obesogen hypothesis, which posits that lipophilic persistent organic pollutants accumulate in adipose tissue and can disrupt metabolic systems. Current evidence comes from cross-sectional adult studies, and limited information exists for children. Elucidating this issue could be critical to future obesity-related interventions and educational efforts in children.

Measuring Obesity-related Indicators from the STOP Project

The Science and Technology in childhood Obesity Policy (STOP) project is a 5-year European research grant that aims to generate scientifically sound, novel, and policy relevant evidence on the factors contributing to the spread of childhood obesity in Europe. STOP uses urinary NMR metabolomics to examine the relationship between food consumption and disease risk. STOP investigators use this approach to test children in the Human Early Life Exposome (HELIX) cohort who have completed FFQs to identify nutrient consumption and assess how self-report bias varies by country, age, and parental education.

Key Challenges

Currently, significant inaccuracy is observed in objective measures of dietary intake for both adults and children. Bias varies by individual and contextual characteristics, and validation with purchase and sales data is still unsatisfactory because of data limitations. STOP data have the potential to address whether biomarkers can shed light on this type of bias and correct for it across an entire nutrition profile.

Discussant: Summing Up and Providing Context to the Presentations

The Session 2 moderator invited Sharon Kirkpatrick to comment on the key measurement needs for dietary patterns as they influence childhood obesity:

- Dr. Kirkpatrick described several key considerations for enhancing dietary measurement approaches in children. These considerations include factors such as the cognitive development of the child; the child's literacy and numeracy; and the social desirability, reactivity, and recall biases that influence results. She emphasized how these challenges could be addressed through improvements in analytical methods.

SESSION 3: MEASUREMENT OF PHYSICAL ACTIVITY IN CHILDREN ACROSS DEVELOPMENT STAGES AND SETTINGS

1. Key Activities to Capture for Physical Activity and Measurement Challenges in Children Younger Than 5 Years Old
   Mark Tremblay, PhD, DLitt, Children's Hospital of Eastern Ontario Research Institute

2. Overview and Challenges of Device-based Measurement of Physical Activity in Children
   Russell R. Pate, PhD, University of South Carolina, Arnold School of Public Health

3. Considerations for Assessing Physical Activity in Different Settings and for Different Applications
   Gregory Welk, PhD, Iowa State University

Discussant: Karin A. Pfeiffer, PhD, Michigan State University

1 Key Activities to Capture for Physical Activity and Measurement Challenges in Children Younger than 5 Years

Mark Tremblay

Importance of this Topic for Childhood Obesity

Data from countries other than the United States suggest that significant percentages of children younger than age 5 years do not meet physical activity guidelines. This evidence suggests significant room for population health improvement through modifying movement behaviors in young children. Prioritizing measurement and monitoring in the early years may help in efforts to establish healthy movement pattern trajectories and related health benefits, including maintaining healthy weight.

Measuring Physical Activity Patterns in Children Younger than Age 5 Years

The United States, Canadian, Australian, and WHO physical activity guidelines all recommend that young children engage in a variety of physical activities in a variety of contexts, and in various environments. A number of methods exist to measure these behaviors, including proxy-report questionnaires; logs or diaries completed by care providers, parents, guardians, or combinations of respondents; direct observation, including live observation coding protocols, and video surveillance; various movement sensors, such as pedometers, accelerometers, inclinometers, global positioning systems (GPS) devices, wearable technologies, and motion detectors such as home security devices; and use of doubly labeled water.

Key Challenges

Some of the challenges of measuring physical activity behaviors in very young children are similar to those for other age groups; others are particular to this age group. Cost, universal use, cultural acceptability and sensitivity, the ability of proxies to recall the behaviors, behavior reactivity, respondent burden, intrusiveness of the device, device measurement limitations, and device adverse reactions (such as skin reactions) are common challenges for measuring physical activity in all age groups. The dramatic developmental changes that occur during the age range of 0 to 5 years pose a particular challenge for researchers.

2 Overview and Challenges of Device-based Measurement of Physical Activity in Children

Russell R. Pate

Importance of this Topic for Childhood Obesity

To date, limited research has examined the potential health effects of physical activity in children younger than 3 years. Developing and refining methods to measure physical activity using accelerometry in this age group would facilitate the development of guidelines for this population as well as contribute to education and information for parents and caregivers. Recent U.S. national guidelines highlight improved weight status and cardiometabolic health as two of the health benefits of physical activity in youth.

Measuring Physical Activity Patterns in Infants and Toddlers

Knowledge linking physical activity to important health benefits in children and youth has grown steadily over the past 50 years. Methods have evolved, from experimental exercise training trials, to self-report measures, to use of various types of accelerometry. Because accelerometry can be used with all ages, it has enabled research leading to physical activity guidelines for preschool and school age youth.

The LAUNCH (Linking Activity, Nutrition, and Child Health) study aims to describe physical activity levels of infants and toddlers using accelerometers worn at the wrist, hip, and ankle. The study examines associations between accelerometry counts and directly observed physical activity intensity. Preliminary data suggest that the intensity distribution based on percent of time for non-walkers and walkers is about the same.

Key Challenges

A key challenge of work with infants and toddlers is measuring activity levels in a group that is not fully ambulatory.

3 Considerations for Assessing Physical Activity in Different Settings and for Different Applications

Gregory Welk

Importance of this Topic for Childhood Obesity

Physical activity and sedentary behavior are both known to influence obesity and health, but prevention efforts require a good understanding of the nature of youth behaviors and how they can be effectively targeted in intervention research. Because physical activity and sedentary behaviors in youth frequently depend on adult supervision, it is particularly important to understand the factors that influence these behaviors in naturalized settings, such as schools, youth sport settings, and community programs.

Measuring Physical Activity Patterns in Different Settings and for Different Applications

Unique measurement considerations come into play in each of the categories of physical activity epidemiological research (i.e., basic, health outcomes, surveillance, correlates, intervention). To advance research, it is critical to have accurate estimates of the underlying behavior. The choice of instrument and outcome measures depends on the goal of the study, but other factors—feasibility vs. validity, absolute vs. relative intensity, accuracy vs. precision, individual vs. group—also influence decisions.

The Youth Activity Profile (YAP) is a new online tool designed to assess physical activity and sedentary behaviors in and outside of school settings. YAP has been calibrated against activity monitors, so it provides reasonably accurate estimates of physical activity and sedentary behavior in youth grades 4 to 12. Results can be used for educational purposes.

Because of the unique challenges of measuring physical activity and sedentary behaviors in children and youth, integrating direct observation methods with activity monitoring—triangulation—offers advantages and can enable evaluation of setting-level behaviors and intervention implementation. In addition, the utility of report-based measures can be enhanced with calibration.

Key Challenges

Physical activity can only be assessed; it is not measurable, and this makes it challenging in several respects. It is a highly variable, multi-dimensional behavior. Assessing physical activity in youth is particularly challenging because they have more varied physical activity patterns than do adults, they perform more intermittent activity than do adults, and they have less developed cognitive ability and therefore may be less able to recall their physical activity.

Discussant: Summing Up and Providing Context to the Presentations

The Session 3 moderator invited Karin Pfeiffer to comment on the key measurement needs for physical activity patterns as they influence childhood obesity:

- Dr. Pfeiffer noted that the field has made significant progress in physical activity assessment, increasingly using analysis-based tools, such as machine learning, that can be used in processing and analyzing accelerometer data. The rapid growth and maturation of the youngest age group is a challenge. She noted that across age groups, some aspects of physical activity have not been well examined. The notion of patterns, as described for diet, has not been explored for physical activity. In addition, there are advantages to looking at dietary, sleep, and sedentary patterns as a whole and to examine how they all work together. The field lacks work on diverse groups, including at-risk populations, people with disability, and those with chronic disease. More field-based validation and direct observation are needed, as researchers frequently find that lab studies fall apart once applied in the field. Finally, advances in research on physical activity patterns need to be better disseminated.

SESSION 4: MEASUREMENT OF SEDENTARY BEHAVIOR IN CHILDREN

1 **Overview of Measurement of Sedentary Behavior in Children for Research, Surveillance, and Evaluation**
Derek Hales, PhD, University of North Carolina, Gillings School of Global Public Health

2 **Challenges of Measuring Different Activities During Sedentary Time**
John Sirard, PhD, University of Massachusetts, Amherst

Discussant: Peter T. Katzmarzyk, PhD, Pennington Biomedical Research Center

1 Overview of Measurement of Sedentary Behavior in Children for Research, Surveillance, and Evaluation
Derek Hales

Importance of this Topic for Childhood Obesity
Substantial time spent in sedentary behavior has been associated with adverse outcomes, including changes in body composition and increased adiposity, increased risk of overweight and obesity, decreased fitness, unfavorable changes in metabolic markers, lowered scores for self-esteem and pro-social behavior, and decreased academic achievement. This is important because children spend 7 to 10 hours per day in sedentary behavior. These levels tend to track through childhood and increase with age.

Measuring Sedentary Behavior Patterns in Children
Sedentary behavior is defined as "activities performed in a seated or lying posture with very low energy expenditure (less than 1.5 METS)." The definition can be operationalized by gathering self-report data and confirming it with objective data on acceleration, angle of leg, energy expenditure, and heart rate.

One primary method to assess sedentary behavior is direct observation that is setting specific (e.g., lab, home, school, child care, community), contextual (e.g., TV, eating, sitting), and intensity based. Another is self-report or caregiver report. A Taxonomy of Self-reported Sedentary Behaviour Tools (TASST) has been developed to identify optimal self-report tools for population surveillance of sedentary behaviors. TASST found that accuracy was poor for all existing tools and that they lacked evidence about sensitivity to change. Key issues for these tools include design and administration of the instrument, the number of domains/activities included, child versus parent report, and whether outcomes are calibrated or adjusted.

Several devices, including motion sensors, inclinometers, and consumer wearables (e.g., Fitbit, Actigraph) also can measure sedentary behavior.

Key Challenges

Challenges of methods to assess sedentary behavior include the design and appearance of self-report instruments, which can affect the quality of the data; the difficulty of distinguishing wear, non-wear, and sleep with devices; and the need to consider whether a behavior is modifiable before measuring it.

2 Challenges of Measuring Different Activities During Sedentary Time

John Sirard

Importance of this Topic for Childhood Obesity

Distinguishing different types of sedentary behavior may have limited utility for determining its independent effects on physical health outcomes, but this ability provides useful information for planning and implementing interventions. It is also important to distinguish sedentary behaviors from sleep and physical activity time, as these latter behaviors are associated with positive health outcomes. Advances in technology and in self-report and device-based measures may help in this regard.

Measuring Different Types of Activities During Sedentary Time

One of the strengths of using self-report to measure sedentary behavior is that these instruments are able to assess behavior type and the emotional, physical, and social contexts for sedentary behaviors.

Device-based measures include accelerometers, inclinometers/posture sensors, and physiological measures. Children do not like wearing posture sensors on the thigh, making compliance poor. For assessing physical activity in children, combining subjective and objective techniques has great value.

Key Challenges

Screen time is often used as a proxy for sedentary behavior. Researchers need to be careful about doing this because it is only one type of sedentary behavior, and the proliferation of smart phones makes screen time increasingly difficult for youth and adults to recall.

Another challenge is the need to pay careful attention to language and wording when constructing new subjective assessment instruments. Similar to dietary and physical activity assessment, bias and recall error are important challenges.

Self-report measures have unique challenges. These include the need to future-proof some questions, especially for fast-changing technology; the need to ask about sedentary behavior throughout the day; and the difficulty of accounting for multitasking. New technologies may address some of the challenges.

Discussant: Summing Up and Providing Context to the Presentations

The Session 4 moderator invited Peter Katzmarzyk to comment on the key measurement needs for sedentary behavior as they influence childhood obesity:

- Dr. Katzmarzyk pointed out that the field took a big step forward with the definition of the two key aspects of sedentary behavior—energy expenditure and posture. Though evidence is emerging about associations between sedentary behavior and adiposity, more research is needed on the mechanisms by which this behavior has health effects. Methods studies are needed, for example, to disentangle issues such as whether some activities displace others, dose-response effects, effects of long versus short bouts of sedentary behavior, transitions between active and sedentary behavior, and how to differentiate sleep from sedentary time.

SESSION 5: MEASURING SLEEP AND ITS INTERACTION WITH CHILDHOOD OBESITY

1 Overview of Measurements and Challenges of Assessing Sleep in Children

Douglas Teti, PhD, University of North Carolina, Gillings School of Global Public Health

Discussant: Chantelle Hart, PhD, Temple University, College of Public Health

1 Overview of Measurements and Challenges of Assessing Sleep in Children

Douglas Teti

Importance of this Topic for Childhood Obesity

Adequate sleep is associated with reduced risk of overweight and obesity, and a number of methods are available to assess sleep. Improved measurement in this area could further elucidate this association and assist with interventions and educational efforts.

Measuring Sleep in Children

Five approaches are used to measure sleep in children: polysomnography, videosomnography, questionnaires, daily diaries, and actigraphy. All have strengths and limitations, and the choice of method depends on the research question being asked and the type of data desired.

Polysomnography is the gold standard for assessing sleep, but it is generally only used in the lab. Videosomnography is less intrusive and can be used at home but is still labor intensive. Many types of sleep questionnaires are available. The data are easy to obtain and have a face-valid relation to sleep quality. However, they must be chosen with care to minimize bias. Daily diaries are somewhat labor intensive but do not rely on retrospective memory, and they can provide useful contextual information. Actigraphy is useful because it allows for passive and objective data collection, and it provides a comprehensive set of sleep variables. However, training is required to extract sleep data.

Key Challenges

Various factors influence the choice of method: labor-intensiveness of data collection and extraction, adequacy of the approach for capturing a representative sample of child sleep, who the reporter is and how reliable they are. In addition, parent perceptions about the child's sleep are important, as their own sleep experiences may heavily influence how they report their child's sleep.

Discussant: Summing Up and Providing Context to the Presentations

The Session 5 moderator invited Chantelle Hart to comment on the key measurement needs for sleep as they influence childhood obesity:

- Dr. Hart drew attention to a meta-analysis of sleep duration and obesity risk in children and described potential pathways linking short sleep to obesity risk. Drivers associated with obesity risk include changes in appetite or hunger, hormone levels, and opportunities to eat. She noted that an experimental study on the impact of changes in sleep duration on children's obesity risk found that after a week of sleep deprivation, children weighed about a half pound more. This finding was statistically significant. Evidence also suggests that greater variability in sleep on weekdays versus weekends is associated with obesity risk, and that later bedtimes are associated with macronutrient intake. She cautioned that intervening on sleep can be associated with changes in other behaviors.

IDENTIFYING CROSS-DOMAIN PRIORITIES TO
Advance Measurement of Individual Behaviors Related to Childhood Obesity

During the presentations and subsequent discussions, a number of priorities emerged for advancing measurement for individual behaviors related to diet, physical activity, sedentary behavior, and sleep. In addition, participants were asked to consider short-term (1–3 years) and medium-term (3–5 years) actionable steps that would be top priorities for NCCOR to pursue. Groups considered the following questions to guide their discussions:

- What are the measurement needs related to surveillance, epidemiological and intervention research, and program evaluation?
- Were any issues related to diet, physical activity, sedentary behavior, or sleep not raised during the discussions? Are any key issues missing?
- Are there specific measurement needs related to age groups?
- Are there specific measurement needs related to other frames or lenses that may have been missed?

Several priorities are applicable across all the domains and are discussed here. Others focused on one or another specific domain, and these are listed in the table that follows.

1. Develop measurement methods for children younger than age 6 years.

Measurement for young children is complicated by the fact that the early years are such a dynamic period, and that this dynamism manifests in various ways. This age is characterized by rapid growth and development, leading to rapid changes in eating and feeding practices, substantial advances in physical mobility and motor skills, and changes in sleep patterns. This is particularly true for the Birth to 24 Month period. The early years also are characterized by evolving individual preferences and a sense of autonomy by the child.

The dynamism of the early years is demonstrated in other ways as well, and these also present challenges for the measurement of obesity-related behaviors. One source of this dynamism is the multiple caregivers, settings, and environments across the day that children increasingly experience as they eat, move, and sleep. Demographic dynamism, including differences in culture, income, education, and experiences and temperaments of parents and families, also makes measurement a complex undertaking. Much has been learned in the adult literature about the different types of bias, but little is known about what this means for dietary assessment in children. For example, researchers need to consider potential over-reporting from some types of child caregivers, whereas one might expect under-reporting in adults.

Both self-report and device-based measures have been developed for older children and youth, and a priority is to develop such measures for infants and young children. Some work is already underway, and researchers are learning more about the considerations and implications for their use. For example, preliminary findings about the accuracy of device-based physical activity measurement used with very young children are encouraging, but work is needed to determine the extent to which time children spend being carried or in strollers or jumpers may influence the validity of the device counts versus observed activity. Another example is the need to consider unanticipated consequences of recommendations. “Back to sleep” recommendations for infants may lead to less “tummy time” than desirable. Given the difficulty of directly measuring physical activity in infants and very young children, it may be valuable to consider proxies or surrogates, such as milestones related to neck and shoulder strength, that may indicate levels of physical activity.

2. Combine measures and methods in the same study to achieve new insights through triangulation.

Many types of self-report instruments and device-based options are available to answer questions about diet, physical activity, sedentary behavior, and sleep. The central driver for the choice of any assessment method is the research question, and different measurement considerations come into play with each study. Each type of measurement, from report-based to monitor-based to criterion measures, has strengths as well as limitations, and the selection of measures and methods is made based on feasibility versus validity and is influenced by logistics, cost, and reality.

Consensus is growing that combining methods, such as using both self-report and a device-based method to allow for triangulation of the data, can help answer many questions that either cannot answer alone. For example, using videography in combination with actigraphy may be

a potentially useful method for collecting data about sleep behaviors. Combining use of self-report methods with new technology applications, such as using the camera in a mobile device to record dietary intake, can provide a fuller picture of dietary intake than a single method. Combining methods also may be able to identify predictive and recovery markers that can be used in validation work.

Tablets, phones, and other devices now offer the capability for monitoring diet, physical activity, and sedentary behavior. Using these devices to measure physical activity behaviors may be challenging, however, as children can use multiple devices over the course of a day.

Researchers are increasingly recognizing the advantage of looking at dietary, physical activity, sedentary behavior, and sleep patterns and how they may interact with, and reinforce or constrain, healthy behaviors. Combining measures and methods may make it easier for researchers to explore multidimensional behavior patterns that influence obesity risk.

3. Develop recommendations for constructs for each developmental age to include in questionnaires.

Childhood is a period of rapid change, physically and cognitively. Specific developmental achievements affect a child's feeding, physical activity, and sleep patterns and abilities. New measures for infants, toddlers, and children should include constructs for each developmental age to reflect current and emerging knowledge about how a child's growth influence these abilities and practices. This is a particular priority for the Birth to 24 Month period, as this is an emerging area for dietary and physical activity guidelines. A guide for researchers, with definitions and information on physical changes at different developmental points in the Birth to 24 Month period, could be very helpful in this regard.

4. Define terms and core indicators or domains that can be measured.

It is commonly thought that "what can be measured can be changed." However, the first step in measurement is identifying and defining the terms and core indicators that will be measured. For example, two key aspects have been identified that define sedentary behavior: energy expenditure and postural behavior. Evidence links screen time to adiposity, perhaps because screen time is relatively easily recalled and that exposure to food ads increases snacking while sitting. Studies examining the mechanisms of sedentary behavior are needed to define other factors that may be relevant, such as studies that can disentangle sedentary activities, reveal whether some sedentary activities replace others, explain dose-response measures, describe long and short bouts of sedentary time, and describe transitions to and from sedentary behavior.

As researchers shift to assessing patterns of behavior, the need to define terms and indicators is becoming increasingly important. For example, when examining dietary patterns, it will be important to look at when any eating episodes occur throughout the day, rather than just asking about meals or snacks. This will require defining terms such as "meals," "snacks," and "other." When examining temporal sequences related to eating, attention to terms such as "dinner" or "supper" will help with discovery and also with how to translate findings to messages that will be clearly understood. Further, agreed-upon definitions are needed for concepts like dietary pattern, diet quality, diet variety, snacks, meals, usual food, and nutrient intake.

It might be advantageous to consider developing a core set of brief, standardized indicators that, together with supplemental tools, will allow researchers to compile a package of child-based factors relevant to healthy weight as an outcome. This would respond to the practical need to reduce the number of measures, especially for instruments used with young children.

Another aspect of this issue is the need to "future proof" terms and indicators. For example, in physical activity measurement and screen time, changes happen so rapidly that by the time a measure is in place it may be useless. For diet, it might be useful to anticipate changes in areas such as fortification, processing, or even immigration, that will affect the dynamics that influence measurement.

5. Examine the importance of family, social, and environmental contexts and how they evolve with age.

Increased attention is needed to develop measures that go beyond individual behavior to address the larger family, social, and environmental contexts in which those behaviors occur and how they may change as children age. For example, information about the family food dynamic could shed light on the specific characteristics of a child's dietary pattern. Applying a metric to assess the effects of context on physical activity, such as where or with whom the activity takes place, could improve understanding about the effects on factors such as aerobic fitness, strength, coordination, and balance. Some evidence suggests that for young children, being active with parents is a better-quality experience than doing the equivalent amount of activity alone. This understanding is critical to developing effective interventions. Having information about the level of resources that a family may have for housing and leisure time may provide essential context to results from surveys on time spent in sedentary behavior. Information about the specifics of how sedentary time (e.g., screen time, reading, quiet play, talking with family) occurs also can provide valuable contextual information. Given the heavy burden on children to be

self-regulating when surrounded by an obesogenic environment, especially as they grow and become more independent, considerations of the policy and environmental context becomes increasingly important. In addition to helping researchers, having measures of policy and environments would help when countries set national targets for changing policy or environments.

Taking a broader, contextual approach also allows researchers to consider the interactions between obesity-related behaviors. For example, a number of studies have examined the relationship between sleep duration and obesity risk in children. Drivers associated with increased obesity risk in shortened sleep include changes in appetite, changes in hormone levels, increased hunger, and increased opportunities to eat. Evidence also suggests that greater variability in sleep on weekdays versus weekends is associated with obesity risk, and that later bedtimes are associated with increased macronutrient intake. Questionnaires that include questions on demographic factors and dietary intake patterns as well as sleep habits may help researchers tease out these relationships and provide insights into the family's ability to shift certain behaviors.

Understanding the larger context in which specific behaviors occur also may assist in conceptualizing and researching overall behavior patterns, such as total dietary patterns rather than intake of specific food groups, or 24-hour activity patterns that incorporate sleep, sedentary time, and all levels of physical activity intensity rather than specific cut-points of physical activity intensity during specific activity. Findings from these approaches can contribute to the development of guidance and interventions focused on broad-based health-promoting behaviors.

6. Support efforts to assess the validity and reliability of measures.

The indicators now being developed by WHO for dietary assessment in the Birth to 24 Month age group will be valuable because of the similarities of obesity-related issues facing the U.S. and the global community. WHO prioritized the selection of survey questions for use around the world to be relatively simple and adaptable for local contexts. WHO also has developed a research agenda that includes validation of cross-country survey questions to further ensure the use of high-quality metrics.

Numerous factors must be taken into account when considering measurement needs to better assess obesity-related behavior patterns in young children. These factors include literacy and numeracy, the setting involved, and potential biases (e.g., social desirability, recall, and activity biases). Another factor to recognize is that an intervention itself can affect reporting and assessment, making it more likely that caregiver and child reporters could be influenced by social desirability and recall biases. These challenges should be addressed through improvements in analytical methods.

Establishing the reliability and validity of current and new measures is a priority, and some efforts in that direction already are underway. Developing equivalent measures of the same mechanism or phenomenon across settings and individuals can contribute to this effort. As the number of very young children in childcare settings increases, including this setting will also become increasingly important. This effort can complement the growing monitoring and regulation of childcare food environments at the state level. Integrating biomarkers or metabolomics also may help in the validation work on some indicators.

Next Steps

This white paper can be accessed on the NCCOR website at https://www.nccor.org/measurement-workshop-series/. White papers for the other two workshops also will be posted on the NCCOR website. In addition, NCCOR plans to publish a synthesis of findings and recommendations from the three workshops in the scientific literature. This publication will further detail the first actions that NCCOR plans to take in this area.

It is anticipated that recommendations from these workshops will advance the development of improved measures that can be used across a range of research, surveillance, and intervention activities related to childhood obesity. Some of the speakers from this workshop have already taken steps on a couple of the recommendations and future work related to this workshop will be available on the NCCOR website. Ultimately, by addressing the many levels of factors that influence childhood obesity and with focused work within high-risk groups, NCCOR hopes these efforts will ultimately help reduce childhood obesity.

Other Recommendations for Priority Actions to Advance Measurement of Individual Behaviors Related to Childhood Obesity

During the presentations and discussions, a number of priorities emerged for advancing measurement for individual behaviors related to diet, physical activity (PA), sedentary behavior (SB), and sleep. In addition, participants were asked to consider short- and medium-term action steps that would be top priorities for NCCOR to pursue. The previous section synthesized priorities and action steps common across all the domains. **The following priorities were identified for particular domains, as indicated by check marks. NCCOR noted that some of these priorities also are relevant for other domains, and these are indicated by open circles.**

PRIORITY	DOMAIN		
NEW MEASURES DEVELOPMENT	**DIET**	**PA/SB**	**SLEEP**
Define elements of diet quality.	✓		
Develop recommendations for constructs for each developmental age to include in questionnaires.	✓	○	○
Measure parents' early organization of child's sleep and association with later sleep trajectories; connect these indicators with early feeding practices.	✓		✓
Develop diet measures to bridge the gap between older infants and toddlers and children ages 2–5, while keeping in mind that children develop at their own pace. These measures must be standardized, yet flexible enough for use across specific age, sex, gender, income, education, and cultural subpopulations.	✓		
Develop measures that can reflect the variability in dietary patterns across subgroups by age, race/ethnicity, cultural feeding practices, household and maternal income, education, parental feeding experience, food security, and access to healthful foods.	✓		
Base measurements on bidirectional relations between children and caregivers.	✓	○	○
Develop a guide for researchers, with definitions and information on physical changes at different developmental points in the Birth to 24 Month period to aid in the creation of new measures.	✓	○	○
Use metabolomic biomarkers to test the extent to which dietary reporting methods accurately reflect actual intakes in different settings and population sub-groups in order to assess their role in generating evidence for policy and clinical nutrition advice.	✓		
Develop methods to assess both the energy expenditure and the postural components of sedentary behavior.		✓	
Develop methods to better understand physical activity patterns.		✓	
Consider issues of chronotypes and other constructs relevant to obesity and metabolic disorders.	○	○	✓
Measure parental understanding and skills in addressing sleep and other obesity-relevant behaviors.	○	○	✓
Consider how to evaluate sleep self-regulation. Include dyadic measurement and consider role of parental sensitivities to child cues.			✓
Develop new measures to further elucidate the relative role of enhancing sleep through nocturnal sleep periods versus naps. This may be particularly relevant, given challenges with assessing daytime naps.			✓
PROCESS, STUDY DESIGN, AND PRACTICE	**DIET**	**PA/SB**	**SLEEP**
Curate NCCOR Measures Registry around indicators similar to the SNAP-Ed Evaluation Framework.	✓		
Connect developmental milestones with feeding practices.	✓		
Pursue investigations of operational issues related to measuring feeding practices for Birth to 24 Months, such as sources of bias, needs of caregiver respondents, differences in data collected in large-scale surveys, revisions to the operational guidance.	✓		
Prioritize diet measures by evidence-based factors associated with childhood obesity, including variety in foods and food groups; limited consumption of high-sugar, high-fat foods; appropriate beverage types and amounts; appropriate snacking frequency and types of foods; and limited frequency of eating at fast food restaurants.	✓		

PRIORITY	DOMAIN		
PROCESS, STUDY DESIGN, AND PRACTICE CONTINUED	**DIET**	**PA/SB**	**SLEEP**
Use concurrent measures of diet behaviors, attitudes, practices, and food security.	✓		
Integrate principles of nutrition, child development, and structure into responsive feeding.	✓		
Agree on common measures of responsive feeding (0–2, 3–5 years).	✓		
Improve dietary intake assessment methods to improve data collection on dietary patterns of young children.	✓		
Promote progress in analytical methods and support efforts to automate collection of images using either active or passive methods.	✓	○	○
Revamp the NCCOR Measures Registry to make it more tool focused.	○	✓	○
Publish guidelines for accelerometry data and methods.		✓	
Support research that addresses social, environmental, and cultural factors related to physical activity assessment.		✓	
Conduct studies to disentangle the effects of specific sedentary behaviors versus total sedentary time on childhood obesity.		✓	
Develop guidance for specific measurement protocols and add sleep measures to the Measures Registry.			✓
Make use of multiple measurement systems to obtain a representative picture of child sleep, with a clear understanding of the strengths and weaknesses of each measure and the complementary data that each measure provides.			✓
Use concurrent measures of children's behavioral and social routines (i.e., eating, activity and sleep behaviors and routines) together with underlying circadian rhythms.	○	○	✓
Determine the relative benefits of self- or parent-report versus additional measures of sleep (e.g., actigraphy) and identify the contexts under which one measure may be preferable to another.			✓
ANALYSIS AND METHODS	**DIET**	**PA/SB**	**SLEEP**
Develop approaches to encourage better and more extensive use of NHANES dietary data. Some suggested approaches include: • Calibrate NHANES data against other dietary data sets • Correlate the detailed dietary data collected in NHANES with WHO's eight core Infant and Young Child Feeding indicators • Add WIC infant feeding study questions, such as those on how children are being fed, feeding practices, and developmental milestones, in other dietary data instruments, including within NHANES	✓		
Develop a plan to periodically update new national data on average portion sizes to reported food frequency data.	✓		
Improve methods for portion size estimation.	✓		
Develop improved methods to assess usual intake.	✓		
Examine dietary variance across high and low-income countries, race/ethnicity, and developmental stage.	✓		
Conduct longitudinal observational studies and intervention trials of responsive feeding.	✓		
Promote and emphasize importance of improving all methods as being equally valuable due to the benefits of having multiple methods to best match diverse populations.	✓		
Combine dietary assessment instruments (24-h dietary recall and FFQ) to enhance assessment.	✓		
Use technology-based methods, which hold promise for more independent capture of foods and beverages among children ages 6–12 years.	✓		
Use objective evidence of current intakes to develop policies aimed at changing people's diets. Biomarkers based on metabolomics profiling provide an opportunity to assess adherence to dietary guidelines through a simple and non-invasive test, applicable on a large scale in dietary surveys as well as in clinical settings.	✓		
Use large-scale population studies to systematically evaluate the impact of chemical and non-chemical stressors on childhood obesity in a systematic manner. Such studies can help to identify targets for prevention and intervention early in life, leading to better science-based regulation of environmental obesogenic exposures.	✓		
Develop methods to enable surveillance of energy expenditure and posture.		✓	

PRIORITY	DOMAIN		
ANALYSIS AND METHODS CONTINUED	DIET	PA/SB	SLEEP
Advance signal processing methods.	○	✓	○
Create an annotated accelerometry data repository and an accelerometry analysis wiki.		✓	
Support research on validity and reliability of methods.	○	✓	○
Compare device-based methods using various device attachment methods and harmonizing epoch and cut-points.		✓	
Establish data reduction and analytic procedures for longitudinal studies of physical activity in children from birth to adolescence.		✓	
Develop user-friendly methods to process and analyze data from device-based measures.		✓	
Conduct dose-response studies to understand the association of sedentary behaviors with childhood obesity.		✓	
Consider use of computer adaptive questionnaires administration for sleep questionnaires.			✓
Develop methods to better understand reliability and validity of capturing sleep and activity parameters through one device in order to streamline measurement of multiple movement related variables associated with obesity risk.			✓
Determine the sensitivity of current measures in capturing change within interventions for sleep.			✓
Identify consistent methodologies for using child and parent self-report to obtain data on bedtimes, wake times, and duration of sleep.			✓

ABBREVIATIONS

B–24	Birth to 24 Months
CDC	U.S. Centers for Disease Control and Prevention
CFQ	Comprehensive Feeding Practice Questionnaire
DHS	Demographic and Health Survey
FFQ	Food Frequency Questionnaire
FPSQ-28	Feeding Practices and Structure Questionnaire
HEI	Healthy Eating Index
HELIX	Human Early Exposome Project
HHS	U.S. Department of Health and Human Services
ISCOLE	International Study of Childhood Obesity, Lifestyle and the Environment
LAUNCH	Linking Activity, Nutrition, and Child Health
MICS	Multiple Indicator Cluster Surveys
NHANES	National Health and Nutrition Examination Survey
NCCOR	National Collaborative on Childhood Obesity Research
RWJF	Robert Wood Johnson Foundation
SNAP	Supplemental Nutrition Assistance Program
STOP	Science and Technology in Childhood Obesity Policy
TASST	Taxonomy of Self-reported Sedentary Behaviour Tools
USDA	U.S. Department of Agriculture
WHO	World Health Organization
YRBSS	Youth Risk Behavior Surveillance System

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DIET

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ADVANCING MEASUREMENT OF INDIVIDUAL BEHAVIORS RELATED TO CHILDHOOD OBESITY

AGENDA

May 20, 2019 12:00–4:30 p.m.
May 21, 2019 9:00 a.m.–4:00 p.m.

FHI 360 – Academy Hall & Vista
1825 Connecticut Ave NW, Washington, DC 20009

Remote participation: Call in number: 1-866-668 0721 Conference Code: 166-732-1196
Log-in information: https://fhi360smc.adobeconnect.com/NCCOR

Objective: To determine how NCCOR can contribute to better measurement and measurement practices in Research and Evaluation on the key behavioral determinants of childhood obesity

DAY 1 May 20, 2019

12:00–12:30	**Lunch is available**
12:30–12:45	**Welcome** – Elaine Arkin, *NCCOR Coordinating Center*
12:45–1:00	**Background and Workshop Goals** – Rachel Ballard, *NIH*
1:00–1:30	**Session 1: Measurement of feeding practices for children birth to 24 months (B–24)** • Overview of current measurements and challenges of assessment of feeding practices for B-24 at a global level – Chessa Lutter, *RTI International and the University of Maryland School of Public Health* • Assessment of dietary patterns for children birth to 24 months (B–24): Measures and challenges – Ronette Briefel, *Mathematica* • Overview of Responsive Feeding and Measurement – Maureen Black, *RTI International and University of Maryland School of Medicine*
1:30–2:00	**Discussion 1: What are the measurement needs for feeding practices for B–24 as they influence childhood obesity?** • Moderator – Heather Hamner, *CDC* • Discussant – Maureen Black, *RTI International and University of Maryland School of Medicine*
2:00–2:10	**Break**
2:10–2:30	**Session 2: Measurement needs to better assess dietary patterns** • Assessing diet patterns in young children (ages 2–5) – Dianne Ward, *University of North Carolina, Gillings School of Global Public Health* • Overview of current measurements and challenges of assessment (ages 6–12) – Carol J. Boushey, *University of Hawaii Cancer Center*
2:30–3:00	**Discussion 2: What are the measurement needs for dietary patterns as they influence childhood obesity?** • Moderator – Jill Reedy, *NIH* • Discussant – Sharon Kirkpatrick, *University of Waterloo*
3:00–3:25	**Novel measures of individual assessment on obesity related indicators from the STOP Project** – Lida Chatzi, *University of Southern California, Keck School of Medicine*
3:25–3:35	**Break**
3:35–4:15	**Preliminary discussion on measurement priorities** – TusaRebecca Pannucci, *USDA* and Elaine Arkin, *NCCOR Coordinating Center* **Discussion Questions (focus on short-term and medium-term actionable steps):** • What are the measurement needs related to research? Program evaluation? • Are there any issues related to diet that were not raised today? Are there key issues we have missed? • Are there specific measurement needs related to age groups? • Are there specific measurement needs related to other frames/lenses that we may have missed?
4:15–4:30	**Wrap Up** – Elaine Arkin, *NCCOR Coordinating Center*

DAY 2 May 21, 2019

8:30–9:00	**Breakfast**
9:00–9:30	**Welcome and Review of Day 1** – Elaine Arkin, *NCCOR Coordinating Center* and Mary Evans, *NIH*
9:30–10:00	**Session 3: Measurement of physical activity in children across development stages and settings** • Key activities to capture for physical activity and measurement challenges in children 0–5 years old – Mark Tremblay, *Healthy Active Living and Obesity Research Group* • Overview and challenges of device-based measurement of physical activity in children – Russell R. Pate, *University of South Carolina, Arnold School of Public Health* • Considerations for assessing physical activity in different settings and for different applications – Gregory Welk, *Iowa State University*
10:00–10:30	**Discussion 3: What are the physical activity measurement needs as they influence childhood obesity across developmental stages?** • Moderator – Deb Galuska, *CDC* • Discussant – Karin Pfeiffer, *Michigan State University*
10:30–10:40	**Break**
10:40–11:00	**Session 4: Measurement of sedentary behavior in children** • Overview of measurement of sedentary behavior in children for research, surveillance, and evaluation – Derek Hales, *University of North Carolina, Chapel Hill* • Challenges of measuring different activities during sedentary time – John Sirard, *University of Massachusetts, Amherst*
11:00–11:30	**Discussion 4: What are the measurement needs for sedentary behavior as it influences childhood obesity?** • Moderator – David Berrigan, *NIH* • Discussant – Peter Katzmarzyk, *Pennington Biomedical Research Center*
11:30–11:50	**Session 5: Measuring sleep and its interaction with childhood obesity** • Overview of measurements and challenges of assessing sleep in children – Douglas Teti, *Pennsylvania State University*
11:50–12:30	**Discussion 5: What are the measurement needs for sleep as it relates to childhood obesity?** • Moderator – Aaron Laposky, *NIH* • Discussant – Chantelle Hart, *Temple University, College of Public Health*
12:30–1:30	**Lunch**

1:30–2:30	**Small Group Discussions on Measurement Priorities**
	• **Diet**
	  • Room: Balcony D
	  • Call-in number: 1-866-668-0721 Conference Code: 703-686-2738
	• **Physical Activity and Sedentary Behavior**
	  • Room: Vista Room
	  • Call-in number: 1-866-668-0721 Conference Code: 166-732-1196
	• **Sleep**
	  • Room: Balcony E
	  • Call-in number: 1-866-668-0721 Conference Code: 592-774-8775
	Discussion Questions (focus on short-term and medium-term actionable steps):
	• What are the measurement needs related to research? Program evaluation?
	• Are there any issues related to diet, physical activity, sedentary behavior, or sleep that were not raised today? Are there key issues we have missed?
	• Are there specific measurement needs related to age groups?
	• Are there specific measurement needs related to other frames/lenses that we may have missed?

2:30–3:00	**Report Out**
3:00–3:30	**Break and Prioritizing Activity**
3:30–3:45	**Review of Top Priorities** – Elaine Arkin, *NCCOR Coordinating Center*
3:45–4:00	**Wrap Up and Next Steps** – Rachel Ballard, *NIH*