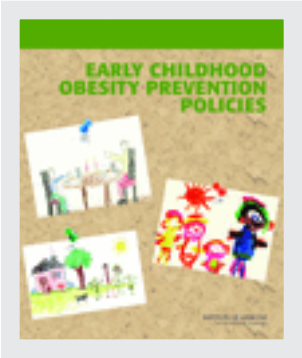

Early Childhood Obesity Prevention Policies

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EARLY CHILDHOOD OBESITY PREVENTION POLICIES

Early Childhood Obesity Prevention Policies

Committee on Obesity Prevention Policies for Young Children

Leann L. Birch, Lynn Parker, and Annina Burns, *Editors*

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Willing is not enough; we must do."
—Goethe

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This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

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Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the report's conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by **Neal A. Vanselow,** Professor Emeritus, Tulane University, and **Elena O. Nightingale**, Scholar-in-Residence, Institute of Medicine. Appointed by the National Research Council and Institute of Medicine, they were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

Preface

The obesity epidemic has not spared even the nation's youngest children; about 20 percent of children are already overweight or obese before they enter school, and rates are even higher among low-income children and among African American and Latino children. These statistics are of particular concern because, contrary to popular belief, children do not "grow out of" their "baby fat." Evidence indicates that excessive weight gain in the first years of life can alter developing neural, metabolic, and behavioral systems in ways that increase the risk for obesity and chronic disease later in life. Although few attempts have been made to prevent obesity during the first years of life, this period may represent the best opportunity for obesity prevention. During infancy and early childhood, lifestyle behaviors that promote obesity are just being learned, and it is easier to establish new behaviors than to change existing ones.

This report is one of a series of publications dedicated to providing succinct information on childhood obesity prevention specifically for policy makers. Funded by The Robert Wood Johnson Foundation, the report addresses some of the same themes as previous Institute of Medicine (IOM) reports on obesity (including *Local Government Actions to Prevent Childhood Obesity* and *Bridging the Evidence Gap in Obesity Prevention*), but focuses on young children from birth to age 5. A number of key factors influence the risk for obesity in an infant or young child, including prenatal influences, eating patterns, physical activity and sedentary behavior, sleep patterns, and marketing and screen time. Young children are dependent on parents, caregivers, and others to provide environments that can

help shape these factors in positive ways by, for example, supporting the development of lifestyle behaviors that promote growth and development, making healthy foods available in appropriate amounts, and providing safe places for active play. Moreover, all of these factors come into play in the policy environment that surrounds and influences parents and children and must be addressed in a coordinated manner if progress is to be made against the early onset of childhood obesity.

This report addresses all of these factors and offers policy recommendations that together form an action plan for addressing obesity in young children. It focuses on the environments in which young children spend their time and is directed at the adults who shape those environments. Parents play the primary role in shaping children's development and influencing their obesity risk through genetics and home environments. However, the focus of this report is on policies that are developed and implemented by policy makers and by caregivers who interact with parents and young children. Thus the report's recommendations are not made directly to parents but to these "intermediaries," to ensure that early childhood obesity prevention policies are implemented in a way that complements and supports parents' efforts to maintain healthy weight in their young children. In particular, it is the committee's hope that the report will find its way to federal, state, and local government policy makers who work in areas that impact young children in infancy and early childhood. The committee attempted to make the report user-friendly so that what we have learned about obesity prevention for young children can be put to good use in efforts to improve the present and future health of the nation's children.

I want to express my sincere appreciation to the other committee members for their commitment to our task and the countless volunteer hours they contributed to this study and the development of the report. I also want to thank our workshop speakers for their insight and perspectives on preventing obesity in the first years of life. In addition, many thanks to Rona Briere for her editing of the report. Finally, I want to express my gratitude to the dedicated IOM staff who worked with the committee on this project: Annina Catherine Burns, study director; Nicole Ferring Holovach, research associate; Gui Liu, senior program assistant; Sheila Moats, associate program officer; Lynn Parker, scholar; and Linda Meyers, director, Food and Nutrition Board.

Leann L. Birch, *Chair*
Committee on Obesity Prevention Policies for Young Children

Contents

Summary

Childhood obesity is a serious health problem that has adverse and long-lasting consequences for individuals, families, and communities. The magnitude of the problem has increased dramatically over the past three decades and, despite some indications of a plateau in this growth, the numbers remain stubbornly high. Efforts to prevent childhood obesity to date have focused largely on school-age children, with relatively little attention to children under age 5. However, there is a growing awareness that efforts to prevent childhood obesity must begin before children ever enter the school system.

The first years of life are important to health and well-being throughout the life span. Preventing obesity in infants and young children holds promise for enabling significant gains toward both reversing the epidemic of childhood obesity and reducing obesity in adulthood. According to data from the Centers for Disease Control and Prevention, the obesity epidemic has not spared the nation's youngest children: about 10 percent of infants and toddlers have high weight-for-length, and slightly more than 20 percent of children aged 2–5 are already overweight or obese. Contrary to the common notion that children will "grow out of it," childhood obesity tends to persist into later life and can increase the risk for obesity-related disease in adulthood.

Environmental factors can profoundly affect children's development and obesity risk in the first years of life, when patterns of eating, physical activity, and sleep are developing, patterns that continue to influence obesity, health, and well-being throughout life. Accordingly, this report offers policy recommendations

designed to prevent obesity in infancy and early childhood by promoting healthy early environments in settings outside the home where young children spend substantial time.[1]

STATEMENT OF TASK AND APPROACH

Given growing evidence on the importance of the early years for later health outcomes, the Institute of Medicine's (IOM's) Standing Committee on Childhood Obesity Prevention recommended a study to examine the evidence and provide guidance on obesity prevention policies for young children from birth to age 5. The Committee on Obesity Prevention Policies for Young Children was formed to conduct this study. See Box S-1 for the committee's full statement of task.

The committee formulated its recommendations using the best evidence available, including both direct and indirect evidence about the likely impact of a given policy on reducing childhood obesity. The committee reviewed the published literature; examined reports from organizations that work with young children; invited presentations from experts on a range of scientific, programmatic, and policy issues related to children from birth to age 5; and explored a variety of materials that have been developed for programs and practitioners. The committee gave strong observational studies serious consideration and was also receptive to evidence that a policy would be likely to affect a determinant of childhood obesity even if not yet studied for its direct influence on obesity. Thus, for example, the committee recommends policy changes that are expected to increase physical activity or promote more healthy eating in children because such intermediate outcomes are themselves associated with prevention of childhood obesity. The committee also drew on the extensive experience and expertise of its members in child development, obesity prevention, child health, nutrition, infant development, physical activity, pediatrics, child psychology and behavior, child care regulations and policy, food marketing and media, health disparities, family health, federal and state children's programs, and community health.

In addition to formulating policy recommendations, the committee identified potential actions that could be taken to implement those recommendations. These actions lie within the purview of relevant decision makers, were determined to be actionable based on a combination of precedent and committee members'

[1]In this report, the term "young children" refers to ages birth to 5 years.

Box S-1
Statement of Task

An ad hoc committee will review factors related to overweight and obesity in infants, toddlers, and preschool children (birth to 5 years), with a focus on nutrition, physical activity, and sedentary behavior; identify gaps in knowledge; and make recommendations on early childhood obesity prevention policies, taking into account the differences between children birth to 2 years old and 2 to 5 years old.

In conducting its task, this committee will:

- Draw on primary and secondary sources to assess evidence on the:
  - major factors affecting obesity risk in young children, including the relationship with caregivers, physical activity opportunities and barriers, access to healthy foods, social determinants, and other important factors;
  - major factors in the first 5 years that affect attitudes, preferences, and behaviors important to overweight and obesity; and
  - relationships between elevated weight status and excess weight gain in young children and their health and well-being during childhood and risk for obesity-related comorbidities, across the life course.
- Identify settings, existing programs, and policy opportunities for childhood obesity prevention efforts in the first 5 years;
- Consider the inclusion of illustrative case studies; and
- Make recommendations on early childhood obesity prevention policies across a range of settings and types of programs, taking into account potential distinctions between policy recommendations for the first 2 years (birth to 2 years) and those developed for the next 3 years (2 to 5 years).

The primary audience of the report includes decision makers and stakeholders who have the opportunity to influence the environments in which young children develop and grow.

judgment, and have the potential to make a positive contribution to the implementation of the committee's recommendations.

In developing its recommendations, the committee recognized that parents and families have the greatest influence on the development and behaviors that shape health outcomes in children from birth to age 5. Parents and families make decisions and take actions that determine their children's daily schedule and routines. They provide and coordinate their children's feeding, activity, and sleep and can determine their exposure to marketing and television. Making regular visits to

health care providers and acting on feedback regarding a child's health are usually the responsibility of parents and families.

The committee's task was to focus on policies that would promote and support obesity prevention among young children. The committee's recommendations target policies that influence the programs, institutions, settings, and environments that shape children's activities and behaviors. By definition, these policies are likely to be developed and implemented by individuals and institutions outside of the home setting. Thus the recommendations in this report target those who support parents and families in taking care of young children and those who can play a role in improving young children's environments outside of the home. These include state and local regulators of child care, child care providers, health care providers, and directors of federal and local child care and nutrition programs, as well as members of the broader community that influence the environments of young children. These policies can be an important part of the coordination of care and consistent messages about child health that are critical to success in helping families raise healthy children.

All young children share the need for healthy food, optimum physical activity, sufficient sleep, health care providers who monitor their growth for healthy patterns and advise and assist their parents in following through, and protection from the negative influences of too much sedentary behavior and marketing of unhealthy foods and beverages to children. Nonetheless, in developing obesity prevention recommendations and implementation strategies that will be effective for young children and their families, the committee recognized the potential impact of negative social and economic factors in some communities that can act as barriers to a recommendation's success. The committee therefore attempted to formulate recommendations to caregivers and policy makers that would be universal with respect to the optimal health of young children but also feasible through creative adaptation in many different settings with families at all socioeconomic levels.

CONTEXT FOR THE COMMITTEE'S RECOMMENDATIONS

This report and the committee's recommendations address the assessment of obesity risk through growth monitoring, as well as key factors that influence obesity risk in young children—physical activity, healthy eating, marketing and screen time, and sleep. Although the committee's charge was to focus on children from birth to age 5, the report also includes a discussion of prenatal influences to high-

light prior IOM recommendations and the fact that obesity prevention starts with the health of the mother.

The first set of recommendations in the report has to do with the importance of *assessing the risk for obesity in young children through growth monitoring*. Infants and young children are weighed and their length or height recorded as part of routine well-child visits to the pediatrician or other health care provider. These visits offer the earliest opportunity to track children who are at risk of overweight or obesity, and can provide the physician and the child's parents with an early opportunity to take preventive action.

Because energy expenditure through *physical activity* is one side of the energy balance equation that determines whether healthy weight can be developed and maintained, the committee identified it as an important area to explore. Society has changed in multiple ways that have reduced physical activity and increased sedentary activities, and these trends are evident even in the youngest children. The relationships among weight status, physical activity, and sedentary behavior are not fully understood in young children, but some evidence suggests that higher levels of physical activity are associated with a reduced risk of excessive weight gain over time in younger children, and similar evidence is extensive in older children and adults. The committee's recommendations in this area call for increasing young children's physical activity and decreasing their sedentary behavior in child care settings and call on health care providers and educators to counsel parents on how to accomplish these goals at home. Recommendations for infants are included in an effort to highlight the need to begin obesity prevention practices in early life. In a related recommendation, the committee stresses that the built environment in communities can promote physical activity for young children and suggests actions that can be taken to this end, including ensuring the availability of indoor and outdoor recreation areas that encourage all children, including infants and children with disabilities, to be physically active.

The committee's recommendations for *healthy eating* begin with the promotion of and support for breastfeeding. Although causality cannot be inferred, breastfeeding is associated with a reduction in obesity risk in childhood. The next set of recommendations has to do with the feeding of young children in child care settings, because at least half of children under age 5 receive out-of-home care while their parents work. Here the committee recommends that meal patterns consistent with the federal Child and Adult Care Food Program (CACFP) be required for these settings. The CACFP patterns are consistent with current dietary guidelines and nutrition recommendations for promoting health by reducing the preva-

lence of inadequate or excessive intake of food, nutrients, and calories. The committee also recommends that the practice of responsive feeding be required in child care settings. Evidence supports the presence of self-regulation abilities in young children, and the degree of responsiveness of caregivers to child feeding is associated with children's continuing ability to regulate their caloric intake. To encourage translation of these recommendations to home settings, training for health and education professionals in how to provide guidance to parents on healthy eating also is recommended.

The committee's recommendations call on government at all levels to support healthy eating among young children through guidelines and promotion efforts. For example, the Dietary Guidelines for Americans form the basis for nutrition recommendations for public and federal programs but do not include guidelines for children under 2 years of age. Such guidelines also are critical as a basis for national dietary intake studies. In addition, government agencies are called upon to promote access to affordable healthy foods for all families, especially those with low incomes. Federal nutrition programs are effective in providing appropriate amounts of nutritious foods, but not all of those who may need these programs are participating. In many neighborhoods, moreover, it is very difficult for families to find accessible and affordable healthy foods for their young children.

The lives of young children are permeated by media—television, videos, digital media, video games, mobile media, and the Internet. The committee recommends limitations on *screen time* for children 2 to 5 years old because of its potential for contributing to childhood obesity. There is strong evidence that exposure to television advertising is associated with adiposity in young children, and substantial screen time also is associated with obesity. For these reasons, the committee recommends that health care providers counsel parents and other caregivers of children not to permit television, computers, or other digital media devices in children's sleeping areas. Finally, a positive use of media is proposed—a sustained social marketing campaign to provide consistent messages to parents and caregivers of young children on obesity prevention strategies. Such campaigns can be effective for disseminating information and producing changes in behavior.

Finally, evidence suggests that a decrease in *sleep* duration in infancy, childhood, and adolescence has occurred over the past 20 years, with the most pronounced decreases seen among children less than 3 years of age. Epidemiologic evidence indicates that short sleep duration may be a risk factor for obesity among

young children. Thus, the committee calls on child care providers to adopt practices that promote age-appropriate sleep duration and advocates training for health and education professionals in how to counsel parents on this issue.

CONCLUSION

Obesity prevention requires the efforts of many sectors to improve relevant policies and practices. Interactions among institutions, programs, settings, and families can be effective in promoting and sustaining a healthy environment for young children. Infants, toddlers, and preschoolers are dependent upon the actions of the adults who care for them, and they should be cared for in a manner that promotes their healthy growth, development, and well-being throughout their day. The policies that influence young children's environments inside and outside their homes should make the healthy choices the easy choices for adults who care for them.

Finally, as new policies to prevent childhood obesity are implemented, it will be important to evaluate them to (1) support further action where success can be demonstrated, (2) reconsider policies when they fail to achieve the intended outcome, and (3) identify any unintended adverse consequences. As new evidence emerges, moreover, it will be important to examine the committee's recommendations and make needed revisions. It is important to act today based on what is known, while also undertaking the necessary research and policy evaluation to ensure better informed and effective actions in the future.

RECOMMENDATIONS AND POTENTIAL ACTIONS

GOAL: ASSESS, MONITOR, AND TRACK GROWTH FROM BIRTH TO AGE 5.

Recommendation 2-1[1]

Health care providers *should measure weight and length or height in a standardized way, plotted on World Health Organization growth charts (ages 0–23 months) or Centers for Disease Control and Prevention growth charts (ages 24-59 months), as part of every well-child visit.*

Recommendation 2-2

Health care professionals *should consider (1) children's attained weight-for-length or body mass index at or above the 85th percentile, (2) children's rate of weight gain, and (3) parental weight status as risk factors in assessing which young children are at highest risk of later obesity and its adverse consequences.*

GOAL: INCREASE PHYSICAL ACTIVITY IN YOUNG CHILDREN.

Recommendation 3-1

Child care regulatory agencies *should require child care providers and early childhood educators to provide infants, toddlers, and preschool children with opportunities to be physically active throughout the day.*

For infants, potential actions include

- providing daily opportunities for infants to move freely under adult supervision to explore their indoor and outdoor environments;
- engaging with infants on the ground each day to optimize adult–infant interactions; and
- providing daily "tummy time" (time in the prone position) for infants less than 6 months of age.

[1]The committee's recommendations are numbered according to the chapter in the main text of the report in which they appear. Thus, for example, recommendation 2-1 is the first recommendation in Chapter 2.

For toddlers and preschool children, potential actions include

- providing opportunities for light, moderate, and vigorous physical activity for at least 15 minutes per hour while children are in care;
- providing daily outdoor time for physical activity when possible;
- providing a combination of developmentally appropriate structured and unstructured physical activity experiences;
- joining children in physical activity;
- integrating physical activity into activities designed to promote children's cognitive and social development;
- providing an outdoor environment with a variety of portable play equipment, a secure perimeter, some shade, natural elements, an open grassy area, varying surfaces and terrain, and adequate space per child;
- providing an indoor environment with a variety of portable play equipment and adequate space per child;
- providing opportunities for children with disabilities to be physically active, including equipment that meets the current standards for accessible design under the Americans with Disabilities Act;
- avoiding punishing children for being physically active; and
- avoiding withholding physical activity as punishment.

Recommendation 3-2

***The community** and its built environment should promote physical activity for children from birth to age 5.*

Potential actions include

- ensuring that indoor and outdoor recreation areas encourage all children, including infants, to be physically active;
- allowing public access to indoor and outdoor recreation areas located in public education facilities; and
- ensuring that indoor and outdoor recreation areas provide opportunities for physical activity that meet current standards for accessible design under the Americans with Disabilities Act.

GOAL: DECREASE SEDENTARY BEHAVIOR IN YOUNG CHILDREN.

Recommendation 3-3

***Child care regulatory agencies** should require child care providers and early childhood educators to allow infants, toddlers, and preschoolers to move freely by limiting the use of equipment that restricts infants' movement and by*

implementing appropriate strategies to ensure that the amount of time toddlers and preschoolers spend sitting or standing still is limited.

Potential actions include

- using cribs, car seats, and high chairs for their primary purpose only—cribs for sleeping, car seats for vehicle travel, and high chairs for eating;
- limiting the use of equipment such as strollers, swings, and bouncer seats/chairs for holding infants while they are awake;
- implementing activities for toddlers and preschoolers that limit sitting or standing to no more than 30 minutes at a time; and
- using strollers for toddlers and preschoolers only when necessary.

GOAL: HELP ADULTS INCREASE PHYSICAL ACTIVITY AND DECREASE SEDENTARY BEHAVIOR IN YOUNG CHILDREN.

Recommendation 3-4

Health and education professionals *providing guidance to parents of young children and those working with young children should be trained in ways to increase children's physical activity and decrease their sedentary behavior, and in how to counsel parents about their children's physical activity.*

Potential actions include

- colleges and universities that offer degree programs in child development, early childhood education, nutrition, nursing, physical education, public health, and medicine requiring content within course-work on how to increase physical activity and decrease sedentary behavior in young children;
- child care regulatory agencies encouraging child care and early childhood education programs to seek consultation yearly from an expert in early childhood physical activity;
- child care regulatory agencies requiring child care providers and early childhood educators to be trained in ways to encourage physical activity and decrease sedentary behavior in young children through certification and continuing education; and
- national organizations that provide certification and continuing education for dietitians, physicians, nurses, and other health professionals (including the American Dietetic Association and the American Academy of Pediatrics) including content on how to counsel parents about children's physical activity and sedentary behaviors.

GOAL: PROMOTE THE CONSUMPTION OF A VARIETY OF NUTRITIOUS FOODS, AND ENCOURAGE AND SUPPORT BREASTFEEDING DURING INFANCY.

Recommendation 4-1

Adults who work with infants and their families *should promote and support exclusive breastfeeding for 6 months and continuation of breastfeeding in conjunction with complementary foods for 1 year or more.*

Potential actions include

- hospitals and other health care delivery settings improving access to and availability of lactation care and support by implementing the steps outlined in the Baby-Friendly Hospital Initiative and following American Academy of Pediatrics policy recommendations;
- hospitals enforcing the World Health Organization's International Code of Marketing of Breast Milk Substitute (This step includes ensuring that hospitals' informational materials show no pictures or text that idealizes the use of breast milk substitutes; that health professionals give no samples of formula to mothers [this can be complied with through the Baby-Friendly Hospital Initiative]; and that the Federal Communications Commission, the Department of Health and Human Services, hospital administrators [through the Baby-Friendly Hospital Initiative], health professionals, and grocery and other stores are required to follow Article 5, "The General Public and Mothers," which states that there should be no advertising or promotion to the general public of products within the scope of the code [i.e., infant formula]);
- the Special Supplemental Nutrition Program for Women, Infants, and Children, the Child and Adult Care Food Program, Early Head Start, other child care settings, and home visitation programs requiring program staff to support breastfeeding; and
- employers reducing the barriers to breastfeeding through the establishment of worksite policies that support lactation when mothers return to work.

Recommendation 4-2

To ensure that child care facilities provide a variety of healthy foods and age-appropriate portion sizes in an environment that encourages children and staff to consume a healthy diet, ***child care regulatory agencies*** *should require that all meals, snacks, and beverages served by early childhood programs be consistent with the Child and Adult Care Food Program meal patterns and that safe drinking water be available and accessible to the children.*

Recommendation 4-3

*The **Department of Health and Human Services** and the **U.S. Department of Agriculture** should establish dietary guidelines for children from birth to age 2 years in future releases of the Dietary Guidelines for Americans.*

GOAL: CREATE A HEALTHY EATING ENVIRONMENT THAT IS RESPONSIVE TO CHILDREN'S HUNGER AND FULLNESS CUES.

Recommendation 4-4

***State child care regulatory agencies** should require that child care providers and early childhood educators practice responsive feeding.*

Potential actions include

- for infants—holding infants in one's arms or sitting up on one's lap while feeding and not propping bottles, recognizing infant feeding cues (e.g., rooting, sucking), offering an age-appropriate volume of breast milk or formula to infants and allowing infants to self-regulate their intake, and introducing developmentally appropriate solid foods in age-appropriate portions and allowing all infants to self-regulate their intake; and
- for toddlers/preschoolers—providing meals and snacks as part of a daily routine, requiring adults to sit with and eat the same foods as the children, allowing children to serve themselves when serving from common bowls (family-style service), providing age-appropriate portions and allowing children to determine how much they eat when offering foods that are served in units (e.g., sandwiches), and reinforcing children's internal cues of hunger and fullness.

GOAL: ENSURE ACCESS TO AFFORDABLE HEALTHY FOODS FOR ALL CHILDREN.

Recommendation 4-5

***Government agencies** should promote access to affordable healthy foods for infants and young children from birth to age 5 in all neighborhoods, including those in low-income areas, by maximizing participation in federal nutrition assistance programs and increasing access to healthy foods at the community level.*

Potential actions include

- for children that qualify, the U.S. Department of Agriculture and state agencies maximizing participation in federal nutrition assistance programs serving children from birth to age 5, including the Special Supplemental Nutrition Program for Women, Infants, and Children, the Child and Adult Care Food Program, and the Supplemental Nutrition Assistance Program; and
- the federal government assisting state and local governments in increasing access to healthy foods.

GOAL: HELP ADULTS INCREASE CHILDREN'S HEALTHY EATING.

Recommendation 4-6

Health and education professionals *providing guidance to parents of young children and those working with young children should be trained and educated and have the right tools to increase children's healthy eating and counsel parents about their children's diet.*

GOAL: LIMIT YOUNG CHILDREN'S SCREEN TIME AND EXPOSURE TO FOOD AND BEVERAGE MARKETING.

Recommendation 5-1

Adults working with children *should limit screen time, including television, cell phones, or digital media, to less than 2 hours per day for children aged 2–5.*

Potential actions include

- child care settings limiting screen time, including television, cell phones, or digital media, for preschoolers (aged 2–5) to less than 30 minutes per day for children in half-day programs or less than 1 hour per day for those in full-day programs;
- health care providers counseling parents and children's caregivers to permit no more than a total of 2 hours per day of screen time, including television, cell phones, or digital media, for preschoolers, including time spent in child care settings and early childhood education programs;
- health care providers counseling parents to coordinate with child care providers and early childhood education programs to ensure that total screen time limits are not exceeded between at-home and child care or early education settings; and
- state and local government agencies providing training, tools, and technical assistance for child care providers, early childhood education program teachers and assistants, health care providers, and community service agency personnel in how to provide effective counseling of parents regarding the importance of reducing screen time for young children.

Recommendation 5-2

__Health care providers__ should counsel parents and children's caregivers not to permit televisions, computers, or other digital media devices in children's bedrooms or other sleeping areas.

Recommendation 5-3

The __Federal Trade Commission__, the __U.S. Department of Agriculture__, the __Centers for Disease Control and Prevention__, and the __Food and Drug Administration__ should continue their work to establish and monitor the implementation of uniform voluntary national nutrition and marketing standards for food and beverage products marketed to children.

GOAL: USE SOCIAL MARKETING TO PROVIDE CONSISTENT INFORMATION AND STRATEGIES FOR THE PREVENTION OF CHILDHOOD OBESITY IN INFANCY AND EARLY CHILDHOOD.

Recommendation 5-4

The __Secretary of Health and Human Services__, in cooperation with __state and local government agencies__ and __interested private entities__, should establish a sustained social marketing program to provide pregnant women and caregivers of children from birth to age 5 with consistent, practical information on the risk factors for obesity in young children and strategies for preventing overweight and obesity in this population.

GOAL: PROMOTE AGE-APPROPRIATE SLEEP DURATIONS AMONG YOUNG CHILDREN.

Recommendation 6-1

Child care regulatory agencies *should require child care providers to adopt practices that promote age-appropriate sleep durations among young children.*

Potential actions include

- creating environments that ensure restful sleep, such as no screen media in rooms where children sleep and low noise and light levels during napping;
- encouraging sleep-promoting behaviors and practices, such as calming nap routines;
- encouraging practices that promote child self-regulation of sleep, including putting infants to sleep drowsy but awake; and
- seeking consultation yearly from an expert on healthy sleep durations and practices.

Recommendation 6-2

Health and education professionals *should be trained in how to counsel parents about their children's age-appropriate sleep durations.*

1

Introduction

The topic of this report was recommended by the Institute of Medicine's (IOM's) Standing Committee on Childhood Obesity Prevention. The report grew out of a recognition that early childhood has emerged as a critical period for assessing the beginnings of obesity and instituting preventive measures. Given the evidence linking excessive weight gain in the first years of life to obesity and chronic disease in later years, the Standing Committee believed it was important to bring this issue to the attention of decision makers who influence children's early years and to recommend policies that can advance obesity prevention for young children. The Standing Committee recognized that prevention strategies focused on this early period, when intervention can affect rapidly developing metabolic and behavioral systems, have the potential to alter the risk for obesity and chronic disease in childhood and throughout the life span. The Standing Committee believed that addressing early childhood obesity offers an important pathway to reversing the childhood obesity epidemic and that, while much research and policy effort had focused on obesity prevention for school-age children and teens, there was a paucity of consistent and authoritative guidance on obesity prevention policy and practice for young children.

Accordingly, the IOM convened the Committee on Obesity Prevention Policies for Young Children. The committee was charged with reviewing the factors related to overweight and obesity in infants, toddlers, and preschool children (from birth to 5 years of age), with a focus on nutrition and physical activity and sedentary behavior, and with making recommendations for early childhood obesity

Box 1-1
Statement of Task

An ad hoc committee will review factors related to overweight and obesity in infants, toddlers, and preschool children (birth to 5 years), with a focus on nutrition, physical activity, and sedentary behavior; identify gaps in knowledge; and make recommendations on early childhood obesity prevention policies, taking into account the differences between children birth to 2 years old and 2 to 5 years old.

In conducting its task, this committee will:

- Draw on primary and secondary sources to assess evidence on the:
  - major factors affecting obesity risk in young children, including the relationship with caregivers, physical activity opportunities and barriers, access to healthy foods, social determinants, and other important factors;
  - major factors in the first 5 years that affect attitudes, preferences, and behaviors important to overweight and obesity; and
  - relationships between elevated weight status and excess weight gain in young children and their health and well-being during childhood and risk for obesity-related comorbidities, across the life course.
- Identify settings, existing programs, and policy opportunities for childhood obesity prevention efforts in the first 5 years;
- Consider the inclusion of illustrative case studies; and
- Make recommendations on early childhood obesity prevention policies across a range of settings and types of programs, taking into account potential distinctions between policy recommendations for the first 2 years (birth to 2 years) and those developed for the next 3 years (2 to 5 years).

The primary audience of the report includes decision makers and stakeholders who have the opportunity to influence the environments in which young children develop and grow.

prevention policies. The focus of the study was on settings, existing programs, and policy opportunities for childhood obesity prevention in the first 5 years of life and on the development of recommendations across a range of settings and types of programs. The primary audience for the report is policy makers and stakeholders who have opportunities to influence the environments in which young children develop and grow.[1] The committee's statement of task is presented in Box 1-1.

[1]In this report, the term "young children" refers to ages birth to 5 years.

OBESITY IN EARLY CHILDHOOD

Obesity takes time to develop and for symptoms to appear. Therefore, children may be at risk for childhood obesity at a very young age but not yet defined clinically as overweight or obese. When children begin to show, for example, excess weight-for-height, this should not be dismissed as something "the child will grow out of with time." The first years of life are critically important to a child's health, well-being, and development. Excess weight at a young age can hinder movement and normal levels of activity and ultimately compromise later health and development.

The data reveal that the problem of obesity in infancy and early childhood is pervasive and growing. Approximately 10 percent of children under age 2 years have high weight-for-length (at or above the 95th percentile) (Ogden et al., 2010). The problem persists among children over age 2. Fully 21 percent of children aged 2–5 are overweight or obese, and the proportions of overweight and obese children in this age group have doubled in 30 years (Ogden et al., 2008, 2010). These statistics are of particular concern because rapid weight gain and obesity during the first years of life increase the risk for later obesity (Freedman et al., 2005; Goodell et al., 2009; Ong et al., 2009; Stettler et al., 2003).

The prevalence of overweight and obesity has increased significantly over the past 25 years among all ethnic groups, but is higher in some groups than in others. Variations in the prevalence of overweight among different ethnic groups in the United States are measured regularly in the National Health and Nutrition Examination Survey (NHANES). The Centers for Disease Control and Prevention (CDC) has published the most recent national survey data, showing that Hispanic males and African American females have a higher prevalence of obesity than other groups, particularly in the teenage years (CDC, 2011) (see Figure 1-1).

Although school-based prevention is critical, it is not where awareness and action on childhood obesity should begin. The childhood obesity epidemic requires a sense of urgency and new avenues for prevention focused on the first 5 years of life. The first years of life are characterized by rapid growth and developmental change. The newborn's behavioral repertoire is limited to sleeping, feeding, crying, and a few reflexes, but over the next months and years, development proceeds rapidly. In these early years, children will learn to sleep through the night, drink from a cup, walk, and talk; in many cases, they also will learn to drink sugar-sweetened beverages (Fox et al., 2010; Siega-Riz et al., 2010) instead of milk or water, dislike and reject vegetables (except french fries), and watch too much

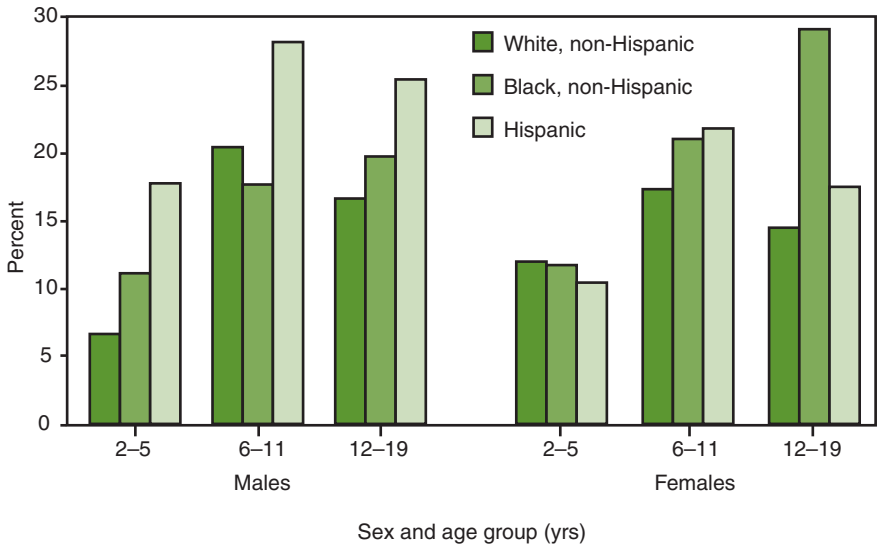

FIGURE 1-1 Prevalence of obesity among children and adolescents, by sex, age group, and race/ethnicity—United States, 2007–2008.
SOURCE: CDC, 2011.

television. By the time they reach ages 6 to 11, 35 percent will have become overweight or obese (Ogden et al., 2010).

Development is more rapid during these early years than at any other time after birth, and young children's early experiences are "built into their bodies," affecting neural, metabolic, and behavioral systems in ways that can influence obesity risk, health, and well-being throughout the life span (Birch and Anzman, 2010; Gluckman et al., 2008; NRC and IOM, 2000). Evidence now emerging reveals the potential of this early period for obesity prevention. In contrast to later stages of life, early development is a period when it is not necessary to change established dietary and activity patterns, but to promote the development of healthy patterns. Despite the critical role of early learning and development in shaping obesity risk, infancy and early childhood have not been a focus of obesity prevention efforts. Yet precisely because this early period is one of rapid development, it may afford the best opportunities for altering development in ways that can reduce obesity risk. It is during such periods of rapid change and instability that interventions can alter developmental pathways, and these alterations can

have long-term effects on the risk for obesity and related chronic disease decades later, in adulthood.

Unfortunately, many children learn lifestyles during the first years of life that contribute to excessive weight gain, the risk of obesity, and chronic disease later in life. Early in life, as children are being introduced to the adult diet, it is especially important that they have opportunities to learn to like and eat healthy foods. Recent survey data indicate that even the nation's youngest children are consuming diets that are too high in energy and added sugar, fat, and salt and that include too few fruits, vegetables, and complex carbohydrates (Reedy and Krebs-Smith, 2010). With respect to activity patterns, many young children are developing lifestyles that include too much screen time, too little sleep, and too little active play (Christakis and Garrison, 2009; Iglowstein et al., 2003; NASPE, 2009; Perrin et al., 2007).

Children learn lifestyles from the adults who care for them. These adults have a powerful impact on children's developing patterns of eating and activity; they structure their children's environments through the choices they make, both within the family and through the child care arrangements they select for out-of-home care. These environments can differ in opportunities they provide for activity, for television viewing, and for the consumption of some foods and not others. In addition, adult caregivers serve as models for children's developing eating and activity patterns. Infants and young children are dependent on their caregivers as well to create safe environments that can promote the development of healthy lifestyles.

Differences in caregivers' responsiveness also affect children's development. During the first years of life, both child and caregiver must learn to recognize and respond to the other's cues. Responsive caregiving has been identified as an effective tool that can foster children's social, emotional, cognitive, and physical growth, health, and development (Black and Aboud, 2011; Eshel et al., 2006). To be a responsive caregiver requires understanding infants' and children's early physical, cognitive, social, and motor development. Responsiveness is characterized by reciprocity between child and caregiver and includes promptly identifying the child's needs and responding contingently and in ways that are appropriate to the child's level of development. To be responsive to the child during periods of rapid development in early childhood, caregivers' responses must change as children are developing new behaviors and abilities. For example, offering a young infant breast milk or formula in response to hunger cues is appropriate, but offering pureed foods before about 6 months of age is not (AAP, 2005). For this reason,

the recommendations and potential implementing actions presented in Chapters 3 through 6 addressing children's eating, physical activity, media exposure, and sleep, respectively, differ according to the child's age and developmental level.

PURPOSE AND SCOPE OF THE REPORT

Childhood obesity prevention begins with the patterns and behaviors of those who care for infants and young children and in the environments where children grow and develop in their first years of life. A number of key factors influence the weight of an infant or young child, including prenatal influences, eating patterns, environments, physical activity levels, sleep patterns, food and beverage marketing, and screen time. All of these factors come into play in the policy environment that shapes the places where children spend their time and must be addressed in a coordinated manner if progress is to be made against the early onset of childhood obesity.

A wide range of institutions and settings influences young children's behaviors. The purpose of this report is to provide practical guidance for two primary audiences. The first is those who work with young children in settings where they spend their time outside the home. These comprise child care providers and early childhood educators, as well as others whose direct and indirect messages ultimately shape parents'[2] knowledge about health and obesity, including health care providers and those who work in home visiting programs such as the Special Supplemental Nutrition Program for Women, Children and Infants (WIC) and the U.S. Department of Agriculture's (USDA's) Cooperative Extension programs. Policies and practices developed by the institutions, programs, and professional organizations with which these individuals are affiliated influence the content and frequency of their communications with parents on a number of issues related to children's daily routines, including eating patterns, physical activity, and sleep. The second audience for the report is those who make and implement policies that directly affect children from birth to age 5.

Parents play the primary role in shaping children's development. However, the focus of this report is on policies that are developed and implemented by policy makers and by caregivers who interact with parents and young children. The report does not make recommendations directly to parents, but rather urges these "intermediaries" to ensure that policies are implemented in a way that comple-

[2]For purposes of this report, the term "parents" refers to those who have primary responsibility for a child's welfare in the home.

ments and supports parents' efforts to maintain healthy weight in their young children. In this model, parents are not "counseled"; rather, they are provided education, knowledge, and awareness. Caregivers and policy makers act as helpful partners in the endeavor to maintain healthy weight in young children.

It is important to remember that the role of intermediary requires what is often called "cultural competency," or the ability to work in cross-cultural situations. Culturally competent people can act sensitively and effectively in the context of beliefs, actions, and needs of a community different from their own. On its minority health website, the Department of Health and Human Services (HHS) defines culturally competent health care services as those that are "respectful of and responsive to the health beliefs, practices, and cultural and linguistic needs of diverse patients" and suggests that these types of services "can help bring about positive health outcomes" (HHS, 2011). If these beliefs, practices, and needs are not understood, or are ignored, the success of efforts to partner with parents in childhood obesity prevention will be compromised.

Parents also can play an important role beyond the direct role they play at home with their children. Working with other parents, for example, they can influence their children's child care food environment for the better, support child care staff in making healthy changes in foods and beverages provided in young children's educational settings, or join with their neighbors to direct local government attention to a neglected or unsafe neighborhood park.

This report briefly addresses the food and physical activity environments of the larger community in which children and families reside. However, its focus is on policy makers and caregivers of young children and their important roles in interacting with children and parents, as well as in helping to create environments and local and national policies specific to young children that can increase their chances of maintaining a healthy weight. A previous IOM publication, *Local Government Actions to Prevent Childhood Obesity* (IOM and NRC, 2009), addresses issues related to the food and physical activity environments of the broader community for all children and families in much greater detail. That report focuses on improving access to and consumption of healthy, safe, and affordable foods through changes in retail outlets, restaurants, community outlets, public programs, and worksites and encouraging physical activity through improvements in the built environment, initiation of programs for walking and biking, and promotion of increased recreational and routine physical activity.

Access to healthy, safe, and affordable food also is influenced by major food manufacturing decisions, as well as strategic choices made by food retailers and

restaurant industry leaders. In addition, agriculture policy and decisions made by farmers can make a difference in food availability. These decisions, processes, and policies influence the diets of all Americans to a greater or lesser extent. However, this report focuses on obesity prevention policies that are unique to children from birth to age 5 and that can be implemented through the assistance and involvement of caregivers and policy makers.

In addition, it should be noted that, although this report does not focus on pregnancy and prepregnancy, the committee decided to devote a significant portion of Chapter 2 to prenatal influences because what happens in utero may predispose young children to metabolic imbalances that lead them to gain excess weight as they grow and develop. In that chapter, the committee reaffirms prior IOM recommendations regarding healthy weight prepregnancy and healthy weight gain during pregnancy as important factors in the prevention of early childhood obesity. That chapter also comments on the need for further research in the area of prepregnancy and other influences on early childhood weight.

Finally, there is growing interest in the potential role of exogenous agents—including chemical pollutants, drugs, and microorganisms—that may disturb metabolism in a manner that promotes obesity in young children. These agents generally are thought to be potentially influential through prenatal exposure, but could also be associated with exposures in early childhood. These emerging issues in early childhood obesity prevention are covered briefly in Appendix B.

STUDY APPROACH

The committee's approach to this study encompassed gathering and assessing the evidence, formulating recommendations, and exploring child care standards.

Gathering and Assessing the Evidence

The formulation of policy recommendations calls for careful consideration of the evidence associated with one course of action or another. The committee carefully considered both direct and indirect evidence regarding the likely impact of a given policy on reducing childhood obesity, as well as evidence pertaining to the potential for unintended adverse effects. The committee did not carry out a comprehensive, systematic evidence review on each important policy-related question. However, its expertise and consideration of the most pertinent studies led to recommendations that are consistent with the evidence base. Evidence on obesity prevention for young children is limited, especially for those under 2 years of age. There are multiple reasons for this lack of data. First, it is difficult and expensive

to design studies that satisfy Institutional Review Board criteria for conducting research with young children and infants. Second, both federal and private funding for research has targeted primarily school-age children. Third, most policy and environmental interventions are expensive and time-consuming, while impact is often difficult to observe in a short time period, which is the norm for many research studies. Fourth, younger children are more difficult to reach and include in primary data studies than older children. Finally, childhood obesity prevention is a relatively new area for research funding, particularly research focused on policy.

Despite the scarcity of data, the urgency of the issue of obesity in young children demands that action be taken now with the best available evidence. As noted in a previous IOM report, obesity prevention actions "should be based on the best available evidence—as opposed to waiting for the best possible evidence" (IOM, 2005, p. 3). Therefore, in addition to reviewing the published literature, the committee examined reports from organizations that work with young children; invited presentations from experts on a range of scientific, programmatic, and policy issues related to children from birth to age 5; and explored a variety of materials that have been developed for programs and practitioners.

Experimental studies testing the impact of childhood obesity prevention policies are rare. The committee gave strong observational studies serious consideration and was also receptive to evidence that a policy would be likely to affect a determinant of childhood obesity even if not studied for its direct influence on obesity. Thus, for example, policy changes that are expected to increase physical activity or promote more healthy eating in children are recommended because such intermediate outcomes are themselves associated with prevention of childhood obesity.

In reviewing the available literature, the committee drew on the extensive experience and expertise of its members. The committee's 15 members brought to bear a broad array of knowledge and experience related to young children in the areas of

- child development,
- obesity prevention,
- child health,
- nutrition,
- infant development,
- physical activity,

- pediatrics,
- child psychology and behavior,
- child care regulations and policy,
- food marketing and media,
- health disparities,
- family health,
- federal and state child programs, and
- community health.

In areas in which the committee identified a need for additional information, outside experts were called upon at a public workshop held on June 2, 2010, in Washington, DC, titled "Emerging Issues, Programs, and Policy Needs in Early Childhood Obesity Prevention." These experts specialized in the areas of

- injury prevention,
- motor development,
- electronic media,
- sleep,
- introduction of solids and complementary feeding,
- WIC and Head Start, and
- child care practices and policy.

Appendix A provides greater detail on the study methods, while Appendix E contains the workshop agenda.

Formulating Recommendations

For young children, actions that promote healthy development often also support obesity prevention. In formulating its recommendations, therefore, the committee considered policies that would promote young children's health, with a focus on the key factors linked to obesity in early childhood, such as eating patterns, physical activity levels, television viewing, marketing, and sleep. The committee formulated policy recommendations and also identified potential actions that could be taken to implement those recommendations. These actions lie within the jurisdiction of relevant decision makers, were determined to be actionable based on a combination of precedent and committee members' judgment, and have the potential to make a positive contribution to the implementation of the recommendations.

To implement the committee's recommendations, health and child care providers often will need education and training, implementation tools they obtain from others or create, and limited or extensive technical assistance. Identifying specific tools was beyond the scope of this study, but each chapter does contain training recommendations for different audiences that are relevant to the topic at hand. Training can take a number of forms: in-service training and continuing education provided on the job, training that is part of college and associate degree programs, clinical training in health care providers' degree programs, and certification programs (which also require continuing education) offered by national professional organizations.

All young children share the need for healthy food, optimum physical activity, sufficient sleep, health care providers who monitor their growth for healthy patterns and who advise and assist their parents in following through, and protection from the negative influences of too much sedentary behavior and the marketing of unhealthy foods and beverages to children. Nonetheless, in developing obesity prevention recommendations and implementation strategies that will be effective for young children and their families, the committee recognized the importance of negative social and economic factors in some communities that can act as barriers to a recommendation's success.

It is widely recognized that many low-income neighborhoods have limited access to healthy foods because of a lack of nearby supermarkets (Morland et al., 2006; Powell et al., 2007; Zenk and Powell, 2008) and that places to be physically active in these communities are in short supply (Lovasi et al., 2009). At the same time, access to less healthy foods and advertising for these foods has been shown to be higher in lower-income neighborhoods (Baker et al., 2006; Black and Macinko, 2008; Kumanyika and Grier, 2006; Yancey et al., 2009). For example, fast-food restaurants and the relatively inexpensive calorie-dense foods they sell are more available in such neighborhoods (Baker et al., 2006; Larson et al., 2009). In these same neighborhoods, many stores where food is sold are small, with limited equipment and shelf space, and lack fruits and vegetables, whole grains, and low- and nonfat dairy products (IOM and NRC, 2009; Morland et al., 2002). Families with limited resources and time who must make their food purchases in these environments face difficult choices related to cost, availability, and quality.

Moreover, affordable child care providers in low-income neighborhoods may not have the resources to offer optimal opportunities for physical activity because of a lack of space or equipment (Copeland et al., 2011; Trost et al., 2010). Likewise, low-income parents and caregivers may have limited budgets

for providing nutritious meals to young children (Ding et al., in press; Kelly and Patterson, 2006; Omar et al., 2001; Slusser et al., 2011). Parents with several jobs or unusual working hours who are picking up their young children at child care centers or bringing their children to health care centers also may have very limited time to interact with their children's providers and learn what they have to offer. Mothers who of necessity return to work soon after giving birth may have workplaces that are not friendly to breastfeeding (Guendelman et al., 2009; Kimbro, 2006; Rojjanasrirat and Sousa, 2010).

In this context, the committee attempted to formulate recommendations to caregivers and policy makers that would be universal with respect to the optimal health of young children but also feasible in the short term through creative adaptation in many different settings with families at all socioeconomic levels.

As noted earlier, the committee's recommendations are aimed at policy makers at all levels, as well as professionals in a variety of settings where young children receive care. Given that childhood obesity is a multidimensional problem requiring a multidimensional solution, the committee believes it will be helpful for both of these groups to examine the full report as a broad base for specific actions. Obesity prevention efforts in early childhood require consistent and common policy, practices, and information across multiple settings; innovative thinking about implementation; effective communication among caregivers; and shared concerns for healthy development and obesity prevention in young children.

Exploring Child Care Standards

Throughout this report, the committee makes recommendations for the development of standards by state child care regulatory agencies. These standards have to do with physical activity, healthy eating, screen time, and sleep. They are based on a combination of the best evidence available on actions that can support obesity prevention in young children, best practices for child care settings founded on widely recommended practices, and the judgment of the committee.

Several overall strategies could be employed to foster adoption of these standards by child care providers. They include focused outreach campaigns to child care providers and parents of young children; criteria for program accreditation; the Quality Rating and Improvement System (QRIS); and state voluntary regulations and mandatory regulations developed by state regulatory agencies, often in response to specific state legislation. Focused outreach campaigns could be conducted by both private and public entities. Several national organizations offer accreditation programs for child care providers seeking to improve the quality of

care and compete better in the child care market. QRIS is not in effect in all states, but it is usually separate from state licensing standards. Typically, as with accreditation, meeting QRIS standards can make child care providers more attractive in the market, depending on their ratings, and in some cases the level of subsidies they may receive from the state to provide child care to individual children can be based on their QRIS rating. State voluntary standards often are tied to an incentive that benefits the child care program; if a program complies, for example, its licensing fee is reduced.

The focus of the committee's recommended strategy for child care settings is mandatory regulation. This decision was made for several reasons. All states already have child care regulations of some type; thus the impact of state regulations reaches all preschool children in licensed care in a state, regardless of their geographic location or socioeconomic status. These regulations have the force of law and the potential to reach young children in an efficient and timely manner (National Association for Regulatory Administration, 2011). The reach of voluntary standards, guidelines, and criteria, by their nature, will not be as broad or thorough.

There is currently a national thrust, including among national health and child care organizations and at HHS, toward encouraging state child care regulations that will contribute to obesity prevention in young children (AAP et al., 2010; National Resource Center for Health Safety in Child Care and Early Education, 2011). For example, in Healthy People 2020 (HHS, 2010), the physical activity objectives include "increase the number of states with licensing regulations for physical activity provided in child care," and under that objective are the subobjectives of requiring children to engage in vigorous or moderate physical activity and requiring a certain number of minutes of physical activity per day or length of time in care. In addition, the recently passed Healthy, Hunger-Free Kids Act of 2010 (Public Law 111-296 [December 13, 2010]), through which Congress reauthorized funding for federal school meal and child nutrition programs for the next 5 years and provided new funding for these programs over 10 years, includes a requirement for interagency coordination to promote health and wellness in child care licensing. The act requires the Secretary of Agriculture to "coordinate with the Secretary of Health and Human Services to encourage state licensing agencies to include nutrition and wellness standards within licensing standards that ensure, to the maximum extent practicable, that licensed child care centers and family or group day care homes provide to all children under their supervision daily opportunities for age-appropriate physical activity," "limit the use of electronic media

and the time spent in sedentary activity to an appropriate level," "serve meals and snacks that are consistent with the requirements of the Child and Adult Care Food Program," and "promote such other nutrition and wellness goals as the Secretaries determine to be necessary."

Over the past 2 years, a number of states, including Arizona, Delaware, Massachusetts, North Carolina, Tennessee, and Texas, as well as Washington, DC, have adopted mandatory regulations related to obesity prevention in child care settings related to breastfeeding, nutrition, physical activity and inactivity, and screen time. (These and other state standards can be found on the website of the National Resource Center for Health and Safety in Child Care and Early Education at http://www.nrckids.org.) The committee recognizes that a regulatory requirement may take time to implement in some states. In the interim, this report's recommendations could be used in developing and encouraging voluntary standards in those states.

ORGANIZATION OF THE REPORT

Chapter 2 addresses the importance of beginning growth monitoring at birth in order to gauge and respond to a child's risk of developing obesity, as well as the usefulness of understanding the major prenatal influences on early childhood weight. Chapters 3 through 6 are organized around the key factors that play a role in early childhood obesity development and prevention: physical activity (Chapter 3), eating patterns (Chapter 4), food and beverage marketing and screen time (Chapter 5), and sleep (Chapter 6). Each of these chapters begins with one or more goals that underlie the recommendations on that topic, which are then presented along with their rationale and potential actions for implementation.

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2
Assessing Risk for Obesity in Young Children

GOAL: Assess, monitor, and track growth from birth to age 5.

This chapter examines the importance of growth monitoring from birth to assess the risk for obesity in young children. It also reviews prenatal factors that may influence that risk.

GROWTH MONITORING

Infants and young children are weighed, and their length or height is recorded as part of routine well-child visits to the pediatrician or other health care provider. These visits offer the earliest opportunity to track children who are at risk of overweight or obesity and provide guidance to parents at an early stage of rapid weight gain so they can take preventive action. Weight-for-length or weight-for-height measurements need to be performed accurately, and updated guidelines should be used for the assessment. Updated guidelines from the Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics (AAP) include using the World Health Organization (WHO) growth charts for children from birth to age 23 months and the CDC growth charts for ages 2 to 5 years; the CDC growth charts can be used to calculate and plot body mass index (BMI). The focus of a child's visits to the health care provider should not be just

TABLE 2-1 Weight Statuses and Corresponding Percentiles

Age (years)	At Risk for Overweight	Overweight	Obese
0–2 (WHO charts)	84.1st to 97.7th percentile	>97.7th percentile	N/A
2–5 (CDC charts)	N/A	85th to 95th percentile	>95th percentile

NOTE: N/A = not applicable.

on healthy growth, but also on identifying excess weight-for-length or -height and monitoring the trajectory of change in weight-for-length, weight-for-height, or BMI-for-age. Health care providers should identify children less than 2 years of age as at risk for overweight if their growth measurements are between the 84.1st and 97.7th percentiles on the WHO charts, and as overweight if their measurements exceed the 97.7th percentile. Using the CDC charts, they should identify children aged 2–5 years as overweight if their measurements are between the 85th and 95th percentiles, and obese if their measurements exceed the 95th percentile (see Table 2-1).

Parents should be given appropriate information, suggestions, and referrals to identify behaviors putting the child at risk. In general, both health care practitioners and parents need to understand that "bigger is not always better."

The training of pediatricians, nurses, and others who work with children needs to include basic obesity prevention. In the end, preventing childhood obesity requires early intervention. The environments in which children spend their time and information provided to parents on nutrition, activity, and sleep are critical to ensuring children's well-being. When a child is at risk or already overweight or obese, the problem needs to be recognized in the early stages by all health care providers. Health care providers and programs that provide guidance to parents, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), are best positioned to inform parents about obesity prevention for young children.

The Role of Health Care Professionals

Parents view pediatricians, primary care physicians, and health care providers as having the most authority in offering advice about childrearing (McLearn et al., 1998; Moseley et al., 2011). Parents interact with pediatricians and other health care providers in the early stages of child growth more than with any other pro-

viders (McLearn et al., 1998), except perhaps their daily child care provider. They seek advice on feeding, sleep, activity, and other aspects of early childhood behavior from health care providers, which creates the opportunity to inform parents about a range of factors that impact excess weight gain in the early years of life.

Well-child visits are standard visits at which the health care provider assesses and monitors the child's health and growth. Usually eight visits occur at set intervals throughout the first 2 years of a child's life. During these visits, children often are measured for length and weight, and this information is plotted on growth charts. This measurement should occur at every well-child visit. And while emphasis has historically been placed on identifying undernutrition or a lack of growth, equal attention needs to be given to excess weight-for-length, which is the measure of overweight in the first 2 years of life. After 2 years of age, children routinely visit health care providers for continual assessment of their growth. Although height and weight are almost always recorded during health maintenance visits, BMI calculations after age 2 are performed less consistently (Klein et al., 2010). To assess weight gain accurately, health care providers should consistently calculate BMI values and plot them on CDC's gender-specific BMI-for-age charts.

In addition to monitoring the child's growth, health care providers are in a position to observe and ask about the family environment. Observations of parental weight, discussions of childhood activities and family eating patterns, and clinical assessments of weight-for-length or -height can provide valuable information on the child's health and the potential risk for later obesity.

Health care professionals and pediatricians are best positioned to identify excess weight in young children. The interaction between parents and health care providers gives parents an opportunity to become aware of their child's excess weight early on to allow time for intervention and prevention.

Misperceptions of Excess Weight

Because parents and other caregivers have complete control over their young children's food intake, it is important that parents understand the growth patterns and the significance of excessive weight gain during the first few years of life. However, studies show that many parents in fact do not understand the consequences of or are not concerned about early overweight or obesity in their children. In focus groups conducted with WIC mothers, some mothers expressed the belief that it was healthy for their babies to be overweight (Baughcum et al., 1998). The overweight mothers in the focus groups believed that their children were overweight because they were genetically prone to be so; therefore, the

extra weight was viewed as natural and not problematic (Baughcum et al., 1998). Mothers also tend to underestimate their children's weight status, even when they correctly recognize overweight in themselves (Baughcum et al., 2000). Studies in Mexico and Greece showed that mothers who underestimate their children's weight tend to have less income and education (Jimenez-Cruz et al., 2010; Manios et al., 2010); conversely, a similar study in The Netherlands revealed that this misperception exists regardless of mothers' education level (Jansen and Brug, 2006). Of interest, Huang and colleagues (2007) found that parents are less likely to correctly identify overweight in their own children than in children who are unrelated to them. The researchers hypothesized that parents judge the weight of their own children using a different standard (Huang et al., 2007). These misperceptions can be corrected with the objective input of a health care professional. By helping parents understand the growth charts, health care professionals can give parents a tool with which to compare their children's weight status and growth pattern objectively with those of a healthy reference population.

Updated Guidelines for Measuring Children

As noted above, the committee believes child growth and weight should be measured at every well-child visit. For this purpose, health care providers should use the updated CDC guidelines, which specify the WHO growth charts for the first 2 years of life and the CDC growth charts for ages 2–5. BMI should be calculated from the growth charts for children aged 2–5.

Recommendation 2-1: Health care providers should measure weight and length or height in a standardized way, plotted on World Health Organization growth charts (ages 0–23 months) or Centers for Disease Control and Prevention growth charts (ages 24–59 months), as part of every well-child visit.

Rationale

Until recently, growth data for children from birth to age 2, as well as for children over age 2, were plotted on 2000 CDC growth charts. The data used to generate the curves in CDC's growth charts for ages 0–2 were collected from secondary sources and included information on infants raised in various health environments in the United States (Grummer-Strawn et al., 2010). On the other hand, the data for the WHO growth charts were collected from a large cohort of children from birth to age 2 living in various cultures who were raised in an optimal health

environment. These infants were breastfed for at least 12 months, introduced to complementary food around 6 months of age, and raised by mothers who did not smoke and in households of adequate income (de Onis et al., 2004). In addition, a cohort was measured longitudinally from birth to age 2 years, and weight and length velocity,[1] along with weight, length, and BMI standard values, are available for this cohort (de Onis et al., 2004). Therefore, the WHO growth charts should be used for children aged 0–2.

On the other hand, the data collection for the growth curves for children over age 2 years was similar for both CDC and WHO. Therefore, the CDC growth charts should continue to be used for children 24-59 months of age (Grummer-Strawn et al., 2010). These standard or reference growth charts can be embedded in an electronic medical record and values of BMI (wt/ht^2, kg/m^2 [http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm]) and weight velocity calculated and plotted electronically along with the measured values. In addition to the growth charts that record weight-for-height data, children aged 2 and older should be assessed using the BMI calculator for children and teens. These data should be plotted on age- and gender-specific BMI charts to monitor growth.

A survey of primary care physicians and pediatricians conducted by the AAP found that while 99 percent of survey respondents measure and plot height and weight data for children during well-child visits, only 52 percent calculate BMI percentiles for children aged 2 years and older (Klein et al., 2010); only 45 percent calculate BMI percentiles at most or every well-child visit (Sesselberg et al., 2010). In a study of an academic pediatric practice, Hillman and colleagues (2009) found that only 59.7 percent of pediatric medical records contain CDC's BMI-for-age growth charts and that resident physicians are more likely than attending physicians to document and plot BMI data for their patients. These statistics emphasize the need for physicians to be trained to consistently calculate BMI percentiles and plot them on growth charts to monitor children's growth.

Major curves on the WHO charts are the 2.3rd, 15.9th, 50th, 84.1st, and 97.7th percentile curves. A child who is 2 years old or younger is considered overweight when he or she exceeds the 97.7th percentile on the WHO charts. The child should be identified as at risk of becoming overweight if his or her measurement crosses above the 84.1st percentile curve (Figure 2-1).

BMI calculations are not done for infants or children under the age of 2 years. In children aged 2 years and older, measurement of age- and gender-specific

[1]Defined as the rate of change in growth measurements over time.

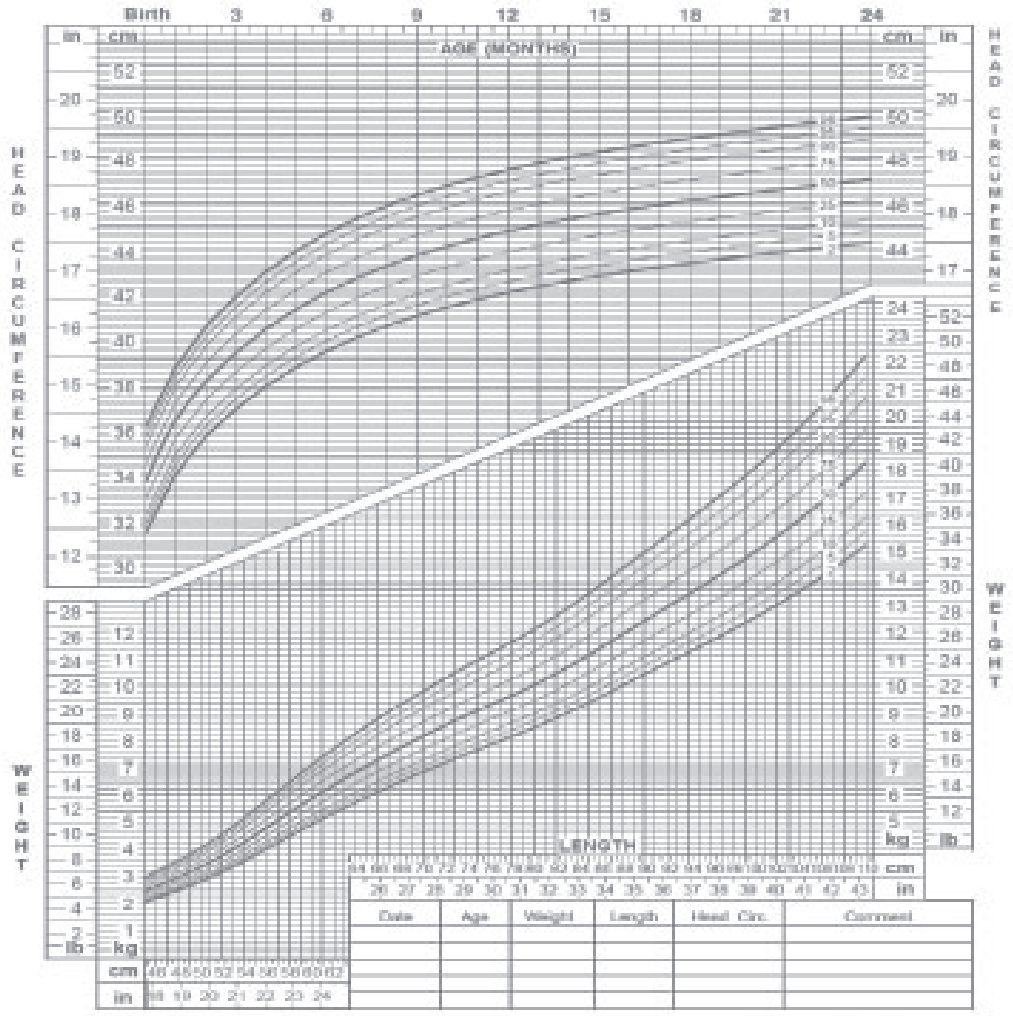

FIGURE 2-1 Weight-for-length growth chart for girls.
SOURCE: CDC, 2010.

BMI can provide an indication of overweight or obesity. As shown in an example of the color-coded BMI chart (Figure 2-2), children whose age- and gender-specific BMI measurements fall in the green zone, which is between the 5th and 85th percentiles, are considered to be of healthy weight. Those whose measurements exceed the 95th percentile or fall below the 5th percentile, both red zones, are obese or underweight, respectively. And children whose BMI falls in the yellow area, between the 85th and 95th percentiles, are consid-

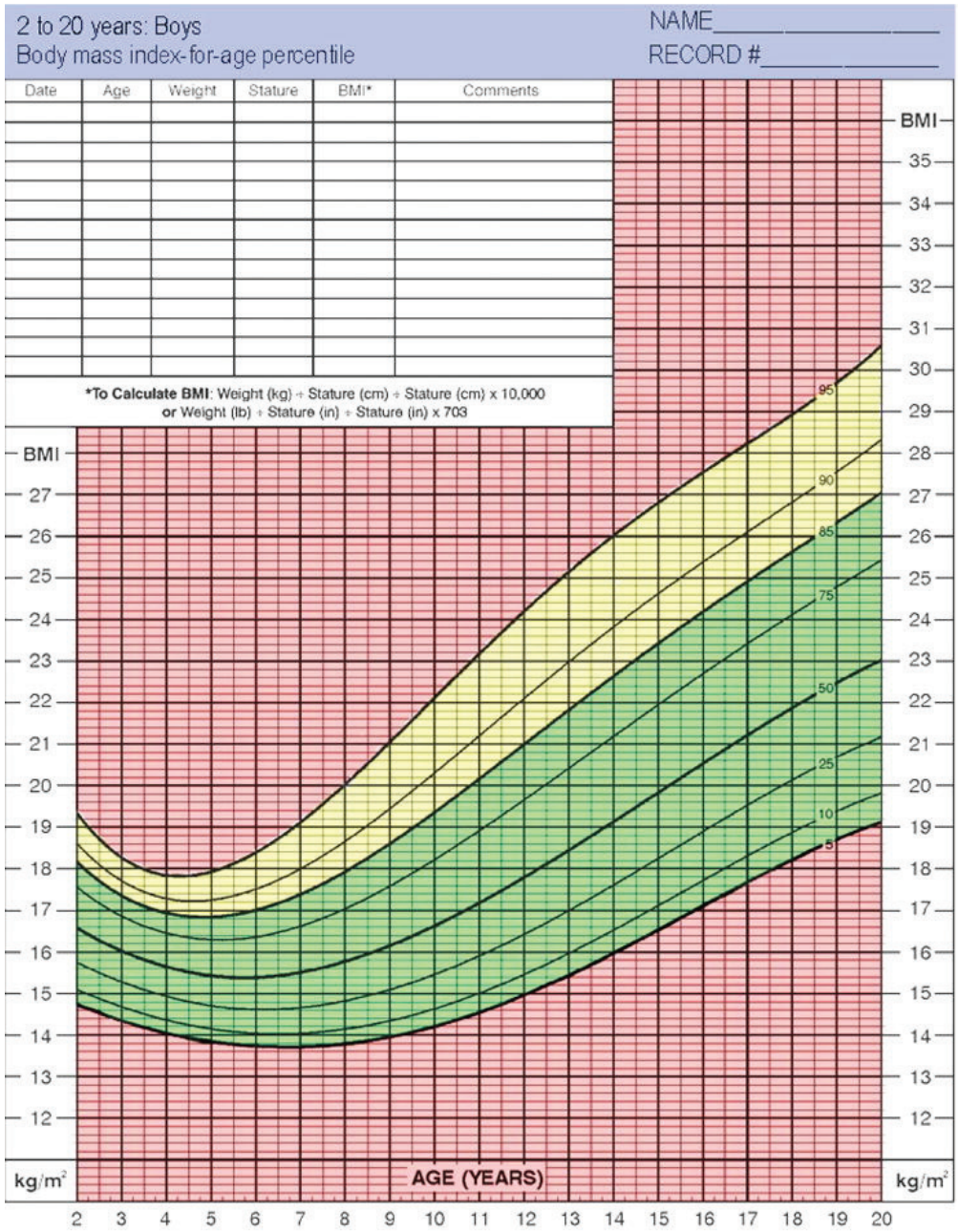

FIGURE 2-2 CDC color-coded BMI-for-age growth chart for boys.
SOURCE: CDC, 2010.

ered overweight. In all children, physicians and parents should begin preventive intervention when the growth measurements exceed the 84.1st or 85th percentile curve. This would require that physicians and parents understand and consistently use the growth charts.

Recommendation 2-2: Health care professionals should consider (1) children's attained weight-for-length or body mass index at or above the 85th percentile, (2) children's rate of weight gain, and (3) parental weight status as risk factors in assessing which young children are at highest risk of later obesity and its adverse consequences.

Rationale

Documenting and plotting BMI data on charts can help physicians see trends in children's growth and detect early signs of overweight and obesity, allowing intervention before children become overweight or obese. Use of growth charts to plot BMI data is especially important as physicians can correctly identify the weight status of children visually only about half of the time (Huang et al., 2009). However, although many children are routinely measured for weight and length or height, there is often no follow-through in identifying those who are at risk of overweight or obesity once that information has been collected. A review of children's medical records showed that even among those whose BMI categorized them as severely obese, only 76 percent were given this diagnosis by their physician; even fewer children were diagnosed if their BMI indicated that they were just overweight (10 percent) or obese (54 percent) (Benson et al., 2009). A review of outpatient preventive care visits by children with high BMIs likewise indicated that physicians severely underdiagnosed obesity in those patients (Patel et al., 2010). Although the lack of a diagnostic code is not necessarily the same as the lack of recognition and discussion of a condition, these studies indicate that physicians often miss the opportunity to identify children who are at risk of obesity before they become obese. Thus it is critical that physicians recognize the early signs of obesity. They should be trained to follow the guidelines of CDC and WHO, which indicate that children are overweight when their measurements exceed the two upper percentile curves on the growth charts. The committee believes it is important that the standard for risk be both a percentile and the amount of weight gain.

It can be argued that measurement and plotting of growth, and even a diagnosis of obesity, will not be sufficient if physicians fail to follow through on these results. In fact, a survey conducted by Jelalian and colleagues (2003) found that

one-fourth of physicians perceive themselves as being "not at all or only slightly competent" to treat obesity. Additionally, the collaborative community-based intervention and prevention programs that could be helpful to these physicians are not always available to primary care providers (Pomietto et al., 2009). Children grow rapidly in the early years of life. In the first year alone, most healthy infants triple their birth weight (Lightfoot et al., 2009). However, excessively rapid growth in weight-for-length or -height can indicate behaviors that put children at risk for obesity, even if the excess weight may not yet be apparent. Abundant epidemiologic evidence from the developed world now shows that more rapid weight gain during the first half of infancy predicts later obesity and cardio-metabolic risk (Gillman et al., 2008). Previous studies of both contemporary (Dennison et al., 2006; Hui et al., 2008; Taveras et al., 2009) and historical (Stettler et al., 2002) cohorts and two recent systematic reviews of infant growth and obesity (Baird et al., 2005; Monteiro and Victora, 2005) have concluded that infants at the highest end of the weight distribution and those who grow most rapidly (usually measured as weight gain) are more likely to be obese later in life. The review by Baird and colleagues (2005) found that infants who gain weight rapidly in the first year of life are 1.17 to 5.70 times more likely to develop later obesity than infants who do not gain weight rapidly.

Because health care professionals routinely document serial measures of weight and length and screen for abnormalities in weight status using published growth charts, practical tools based on the growth charts can be useful in assessing risky weight gain in infancy even before children reach the cutoffs for overweight or obesity.

In a study of height and weight data for more than 44,000 children from ages 1 to 24 months and at ages 5 and 10 years, Taveras and colleagues (in press) examined the association between upward crossing of major percentiles in weight-for-length in the first 2 years of life and prevalence of obesity at ages 5 and 10 years. "Major" percentile was defined as the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles on the CDC growth charts. The authors found that crossing upward of two or more major weight-for-length percentiles in the first 24 months of life was associated with later obesity. For example, the odds of obesity at age 5 were 2.08 (95 percent confidence interval [CI]: 1.84, 2.34) and at age 10 were 1.75 (95 percent CI: 1.53, 2.00) among children who had ever crossed upwards of two or more versus fewer than two major weight-for-length percentiles in the first 24 months of life. Additionally, upward crossing of two major weight-for-length percentiles in the first 6 months was associated with the highest prevalence of

obesity 5 and 10 years later. Thus, both total weight gain of 8.15 kg from 0 to 24 months and crossing upwards of two or more major weight-for-length percentiles in the first 24 months of life could be used to assess the risk of later obesity in pediatric primary care for infants and children under the age of 2 years.

Even if total weight gain or crossing of weight-for-length percentiles is used by health care professionals to identify excess weight gain in infancy, it is still necessary to identify modifiable determinants of excess gain in adiposity and determine what the proper response should be (Gillman, 2010). A robust literature has emerged regarding pre- and perinatal predictors of childhood adiposity (Oken et al., 2007, 2008; Taveras et al., 2006, 2008, 2009; Wright et al., 2009), but few studies have examined whether these factors also predict weight gain in early infancy. Furthermore, there is a need to examine trade-offs between more and less rapid weight gain for different outcomes. At least among infants born preterm, more rapid weight gain in early infancy predicts better neurocognitive outcomes in childhood (Casey et al., 2006; Ehrenkranz et al., 2006). Whether this holds true with term infants is less clear (Belfort et al., 2008). Thus, the amount of weight gain that optimizes both neurocognitive outcomes and obesity risk may differ by gestational age. Investigating these potential determinants of excess infant adiposity gain could lead to intervention strategies in clinical and public health settings to prevent childhood obesity and its consequences.

The family and physical environment in which children grow up can increase their obesity risk. Noting parental weight status can assist in assessing the risk of later obesity in children and should therefore be included in the routine health assessment of young children. Health care providers also can identify risk for obesity by asking about family history and assessing the immediate environment in which children spend their time.

Research shows that parental BMI is the strongest predictor of obesity in young adulthood (Maffeis et al., 1998; Whitaker et al., 1997). In children aged 1–5 years, having an obese mother increases the odds of developing obesity in their 20s by 3.6; having an obese father increases the odds by 2.9 (Whitaker et al., 1997). Having two obese parents increases the odds of later obesity by 13.6 in children aged 1–2 and by 15.3 in those aged 3–5 (Whitaker et al., 1997). Using multiple analyses, Maffeis and colleagues (1998) found that both mothers' and fathers' BMI status are the strongest predictor of obesity in their children. This finding has been confirmed by other studies on the influence of parental BMI on children's risk of adult obesity (Abu-Rmeileh et al., 2008; Williams, 2001).

PRENATAL INFLUENCES

A number of plausible biological pathways link a mother's prepregnancy and prenatal status to obesity in her offspring. Knowing more about a mother's prepregnancy weight, gestational weight gain (GWG), diabetes and metabolism during pregnancy, and smoking during pregnancy can, along with growth monitoring and well-child visits, provide important hints in assessing a child's risk of developing obesity. For each of these four factors, compelling health considerations other than their possible link to childhood obesity guide clinical recommendations and public health policy. And although uncertainty exists regarding the direct and independent causal influence of these factors on obesity in children, some varying level of evidence supports that possibility.

Prepregnancy Weight

Clear and consistent observational evidence indicates that women who are of higher weight at the onset of pregnancy have infants and children who are more likely to be obese (Oken, 2009; Whitaker, 2004; Whitaker and Dietz, 1998), with a strong dose-response gradient between the magnitude of the mother's excess weight and that of her child (Whitaker, 2004). In the papers reviewed for a meta-analysis by Oken (2009), the magnitude of the association varied, but it tended to be quite strong (relative risks of 4 or greater) for the more extreme measures of childhood obesity and somewhat weaker for less extreme levels of childhood overweight. Maternal obesity was predictive of childhood obesity in general, most strongly for the more extreme levels of childhood obesity. The association was apparent for children in the age range of relevance to this report, under age 5, as well as for older children, adolescents, and adult offspring. A recent report on 9-year-old children from the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort showed not just elevated BMI associated with elevated maternal weight prior to pregnancy, but also an array of indicators of elevated risk for cardiovascular disease, including changes in blood pressure, lipids, and inflammatory markers (Fraser et al., 2010).

To the committee's knowledge, there is no direct evidence that interventions to produce more favorable maternal weight at the beginning of pregnancy have the expected and desired impact of reducing the child's risk of overweight or obesity. Nonetheless, there are a number of possible reasons for the association between maternal prepregnancy obesity and childhood obesity, most but not all of which suggest that policies producing more favorable prepregnancy weight would reduce the risk of obesity in children. One pathway concerns the effect of mater-

nal obesity on the intrauterine environment, with the metabolic consequences of greater maternal weight potentially programming the fetus toward obesity (Levin, 2000; Vickers et al., 2007). This pathway is also considered below in the discussion of pathways linking maternal diabetes and related metabolic disorders to childhood obesity. A second possibility, not directly amenable to preventive interventions, is that the mother's weight indicates a genetic predisposition to obesity that is transmitted to the child. Better weight maintenance by the mother would not alter her child's genetic makeup, of course, but even under this scenario, the potential for the mother to manage her own weight despite her predisposition could well be beneficial in helping her better manage her infant's weight. (A third, nonprenatal pathway might involve maternal behavior, with the mother's own tendency toward an unfavorable balance of energy intake and expenditure being passed on to her infant and child through childrearing practices [Oliveria et al., 1992].)

As the prevalence of overweight and obesity has increased dramatically over the past few decades in the United States, so, too, has the proportion of women entering pregnancy above ideal weight (Chu et al., 2009; Yeh and Shelton, 2005). Mothers who are overweight or obese entering pregnancy (referred to in the remainder of this paragraph as "overweight") are at high risk for pregnancy complications and make greater use of health care services and incur higher costs (Catalano, 2007; Chu et al., 2008; Heslehurst et al., 2008). In addition, maternal overweight is the strongest identified predictor for glucose intolerance and gestational diabetes mellitus (GDM), which themselves predict increased risk for pregnancy complications, as well as subsequent development of type 2 diabetes mellitus (American Diabetes Association, 2004; Bo et al., 2001; Crowther et al., 2005; Dabelea et al., 2005; Radesky et al., 2008). Infants born to overweight mothers are more likely to be born large for gestational age, are less likely to be breastfed, and are at higher risk for overweight and type 2 diabetes mellitus in later life (Gunderson, 2007; Li et al., 2003; Stuebe et al., 2005). Maternal overweight may be feeding into an intergenerational cycle in which offspring of heavier mothers are themselves more likely to weigh more and have impaired glucose tolerance entering their own pregnancies. Overweight mothers are most likely to gain excessive weight during pregnancy and to experience substantial weight retention postpartum, doubly disadvantaging themselves and their children.

Although the association between maternal and child weight and obesity is clear, there are compelling reasons to undertake studies to determine why that link exists. This is not merely a matter of academic interest but an opportunity to

understand the determinants of childhood obesity more fully, with implications for a wide range of potential interventions. The association between maternal and childhood obesity is a strong signal, and the opportunity exists to draw out its implications more fully. To the extent that the association indicates some biologically based fetal programming, it has important implications for gestational influences that include maternal diabetes, as well as chemicals, drugs, and microorganisms that have metabolic consequences. To the extent that the association is behavioral, the potential exists to incorporate particular educational components into prenatal care, using the marker of maternal obesity as an indication that the child may benefit from intervention. Ultimately, studies are needed that can experimentally improve prepregnancy weight and examine the consequences for obesity in offspring.

Gestational Weight Gain

At the time of the recent Institute of Medicine (IOM) report on guidelines for GWG (IOM, 2009), a small number of studies had been published that directly addressed the question of whether higher levels of GWG were associated with an increased risk of obesity in childhood and beyond. The literature was summarized by Oken (2009), who reported on seven studies, all of which identified an increased risk of elevated weight in offspring (children or adult) associated with higher GWG. Additional studies published since the time of Oken's review have provided further support for the hypothesis that elevated GWG has an independent effect on the likelihood of obesity in children and adolescents (Oken, 2009).

Six recent studies examining the relationship of GWG to infant and childhood weight/obesity (Fraser et al., 2010; Margerison Zilko et al., 2010; Oken et al., 2009; Olson et al., 2009; Stuebe et al., 2009; Wrotniak et al., 2008) all provide supportive evidence for the hypothesis that elevated GWG leads to increased childhood weight or risk of obesity, although the degree of that support and specific results differ. Most directly relevant to the age range of interest for this report, Olson and colleagues (2009) considered the risk of overweight in children at age 3 and found that the risk was greater for children of mothers who gained more weight during pregnancy and that this association was stronger among overweight and obese mothers. Margerison Zilko and colleagues (2010) analyzed data from the National Longitudinal Survey of Youth and found that the children of women who gained more than the recommended amount during pregnancy had an increased risk of obesity at ages 2–20. Likewise, children born to mothers enrolled in the Collaborative Perinatal Project in the 1960s (Wrotniak et al.,

2008), when maternal obesity was rare, showed an association between GWG and odds of being overweight at age 7. The ALSPAC cohort in England was recently analyzed to address this question (Fraser et al., 2010). The analysis showed that 9-year-old children whose mothers exceeded the IOM recommendations for GWG had elevated BMIs, as well as increased waist size, fat mass, leptin, systolic blood pressure, and C-reactive protein and lower HDL (high-density lipoprotein) levels, all associated with cardiovascular disease in adults. Cumulatively, these results can be summarized as providing a preponderance of evidence supporting the association between GWG and an increase in average childhood weight, as well as an increase in the risk of children being classified as overweight or obese.

Some key methodological challenges in addressing this issue need to be noted. First, women who are overweight or obese prior to conception have a higher risk of having children who are obese and tend to have lower GWG than normal-weight or underweight women, an observation that calls for careful control of prepregnancy weight. Second, women who have higher GWG tend to have heavier babies (IOM, 2009), and infants who weigh more at birth are more likely to be obese as children and later in life (Freedman et al., 2005). However, controlling for birth weight is not necessarily appropriate insofar as birth weight is on the causal pathway linking elevated GWG to childhood obesity. There are other plausible pathways linking elevated GWG to childhood obesity, including a genetically shared maternal and infant tendency to gain weight, common dietary habits for the mother and her child, and a metabolic effect of maternal weight gain on infant appetite and glucose metabolism that supports weight gain. Regardless of the mechanism, however, the critical question is whether elevated GWG is causally related to childhood obesity such that improved compliance with GWG guidelines would reduce the occurrence of childhood obesity.

The guidelines for GWG recommended by the IOM were selected to balance and optimize maternal and infant health. Although there is legitimate debate regarding whether the levels are the precisely right ones, insufficient weight gain clearly is associated with adverse outcomes, notably fetal growth restriction and possibly preterm birth and its consequences, including infant mortality. There is also clear evidence that excessive GWG is associated with an increased risk of excessive weight retention and its sequelae in the mother following pregnancy, as well as with elevated infant weight and the resulting increased risk of Cesarean delivery. For the purposes of this discussion, the question is whether improved compliance with the GWG guidelines, particularly not exceeding the recommended weight gain, would have beneficial effects beyond the potential reduction in

obesity in young children. The answer is that it clearly would, reducing maternal obesity and infant macrosomia—both major health concerns—at a minimum.

The potential for negative effects of pushing more forcefully for compliance with the GWG recommendations also must be considered. Some health outcomes follow a continuum, so that lower GWG is predicted to increase the risk of small-for-gestational-age births (IOM, 2009; Viswanathan et al., 2008). The potential also exists for increasing maternal anxiety, given the substantial proportion of women who exceed the guidelines (IOM, 2009), with mothers becoming more fearful regarding the health of their child but not necessarily being able to take the actions necessary to address this concern.

Despite the consistent and growing observational data indicating that women with higher GWG have infants and children at greater risk of obesity, the question of causality remains unresolved. Research to determine directly the effect of GWG on childhood obesity is needed, notably randomized controlled trials (RCTs) of sufficient size to conclude whether more optimal GWG has the expected beneficial effect in reducing the risk of overweight and obesity in children.

The few published interventions to modify GWG have included relatively small numbers of participants and have had mixed results (Artal et al., 2007; Kinnunen et al., 2007; Olson et al., 2004; Polley et al., 2002; Wolff et al., 2008). A 2008 systematic review of diet and exercise interventions during and after pregnancy published in 1985–2007 identified only one high-quality prenatal intervention that included 120 women (Kuhlmann et al., 2008). Another systematic review of interventions to limit GWG among overweight and obese women similarly concluded that, given the limited information available, further evaluation through RCTs with adequate power is required (Dodd et al., 2008).

Maternal Diabetes During Pregnancy

As discussed in more detail below, evidence clearly shows that women who have insulin-dependent diabetes at the time of pregnancy have offspring at increased risk of obesity. However, the evidence regarding whether gestational diabetes, a far more common condition, has an independent effect on childhood obesity is much less certain. Furthermore, even when an association is observed, it is not clear whether that increased risk of childhood obesity is a by-product of the strong relationship between elevated prepregnancy BMI and risk of gestational diabetes, with the elevated maternal BMI rather than the gestational diabetes resulting in obesity in the offspring, or whether the association may reflect an independent effect of gestational diabetes. On the other hand, it is possible that at least part of

the effect of maternal obesity more generally is through the associated impaired glucose tolerance's biological effect on the fetus. Shared genetic risks for diabetes and impaired glucose tolerance may also contribute to the association between maternal diabetes and childhood obesity.

Several studies have found an increased risk of obesity in the offspring of mothers with gestational diabetes (Silverman et al., 1991, 1995; Vohr et al., 1980), but Whitaker and colleagues (1998) note that all of these studies included a mix of mothers with gestational diabetes and with preexisting insulin-dependent diabetes. A study by Dabelea and colleagues (2000) examined pregnancy outcomes of women before and after their diagnosis with type 2 diabetes. The study results clearly indicated that children born after diagnosis had a greater risk of being obese than those born before diagnosis, a clear demonstration that genetics alone do not account for the association.

Results for gestational diabetes and obesity in offspring are less consistent. Whitaker and colleagues (1998) found no support for an increased risk of obesity in children born to mothers with either gestational diabetes or evidence of impaired glucose tolerance based on pregnancy screening. Wright and colleagues (2009) found an association between gestational diabetes and increased adiposity in 3-year-old children based on skinfold measures of adiposity but not based on BMI. Gillman and colleagues (2003) found a small, independent association between maternal gestational diabetes and adolescent obesity, not mediated by birth weight or confounded by prepregnancy BMI. The metabolic disturbances of gestational diabetes may be so much less severe than those of diagnosed type 2 diabetes that the consequences for offspring are more subtle. However, the markedly greater prevalence of gestational diabetes as opposed to type 2 diabetes in women of reproductive age makes the potential impact of gestational diabetes of great public health importance.

Evidence clearly demonstrates adverse effects of gestational diabetes on the health of offspring. These effects include the risk of macrosomia and its consequences in the form of Cesarean delivery and dystocia and physiologic changes at the time of birth (Catalano, 2007; Crowther et al., 2005). Improved control of diabetes during pregnancy has been shown to mitigate these risks (Crowther et al., 2005), whether through behavioral change (diet and exercise) or through medication. Thus there is a clear basis for supporting actions to improve the detection and control of diabetes in pregnancy and no apparent risk of harm, and such policies may also help reduce the risk of obesity in young children.

As part of the spectrum of concerns related to maternal prepregnancy obesity and GWG, the relationship between the maternal metabolic environment and infant eating, activity, and future weight gain needs to be more fully understood. Such research would help identify interventions with the potential to mitigate the adverse effects of maternal obesity, excess GWG, and diabetes, as well as provide more fundamental information on prenatal influences on the risk of childhood obesity. Programming for obesity in utero is quite plausible and a phenomenon worthy of elucidation.

Smoking During Pregnancy

A number of studies have documented an association between maternal smoking during pregnancy and the risk of obesity in offspring (Oken et al., 2005; Power and Jefferis, 2002; Von Kries et al., 2002). The literature generally has found positive associations that were reduced but not eliminated with adjustment for confounding and a stronger association with heavier smoking.

Although a statistical association between maternal smoking and childhood obesity appears to exist, the exact reasons for this association are not straightforward. Among the possible bases for the association, only some would predict that reductions in smoking would reduce the risk of early childhood obesity. The association may simply reflect confounding by socioeconomic status, attempts at statistical adjustment notwithstanding, given the strong relationship of lower education and income with both smoking during pregnancy and obesity in children. A direct causal effect of smoking on childhood obesity is plausible, but the pathway by which it might operate is uncertain (Chen and Morris, 2007). One paradoxical aspect of the association is that smoking clearly causes reduced fetal growth, and smaller size at birth is generally predictive of reduced risk of obesity. However, the impaired fetal growth may be followed by catch-up growth in infancy that is associated with obesity in childhood and beyond (Oken et al., 2008). There may also be a direct programming effect on the infant's and child's tendencies toward obesity, affecting appetite, activity levels, or metabolism.

The evidence that smoking during pregnancy has adverse effects on fetal growth, placental abruption, stillbirth, and infant mortality is compelling (Salihu and Wilson, 2007) and provides a clear basis for taking all possible measures to curtail or ideally eliminate the behavior. The only outcome of pregnancy that appears to benefit from maternal smoking is preeclampsia, with consistent evidence of reduced risk among smokers (England and Zhang, 2007), but the nega-

tive consequences of smoking during pregnancy more than offset this potential benefit.

The policy recommendations regarding smoking are already quite clear, so that research is not needed at this point to guide interventions. The main argument for a closer examination of the association between smoking during pregnancy and childhood obesity is to better understand pathways that may be relevant to other exposures that affect fetal development and metabolism. Elucidating the causal pathways suggested by an adverse effect of smoking on obesity could be beneficial in identifying and reducing other, analogous influences.

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3

Physical Activity

GOALS:

- **Increase physical activity in young children.**
- **Decrease sedentary behavior in young children.**
- **Help adults increase physical activity and decrease sedentary behavior in young children.**

Over the past 20 years, society has changed in multiple ways that have reduced the demand for physical activity and increased the time spent in sedentary pursuits. These trends have been evident even in the youngest children. It is well documented that many children under age 5 fail to meet physical activity guidelines established by expert panels (NASPE, 2009). The relationships among weight status, physical activity, and sedentary behavior are not yet fully understood in young children, but the limited research on this issue is growing. Some evidence suggests that higher levels of physical activity are associated with a reduced risk of excessive weight gain over time in young children (Janz et al., 2005, 2009; Moore et al., 2003), and similar evidence is more extensive for older children and adults (Hankinson et al., 2010; Riddoch et al., 2009). Additional prevention-oriented research to study the relationship between physical activity and risk of excessive weight gain over time in children is important.

Increasing physical activity and reducing sedentary behavior are logical and accepted strategies for maintaining energy balance and preventing excessive weight gain. Recent evidence-based publications from government agencies, often developed using recommendations from scientific panels, affirm the importance of physical activity in reducing the risk of excessive weight gain. For example, the *Dietary Guidelines for Americans 2010* (USDA and HHS, 2010) counsels that for Americans 2 years of age and older, "Strong evidence supports that regular participation in physical activity also helps people maintain a healthy weight and prevent excess weight gain." *The Surgeon General's Vision for a Healthy and Fit Nation* (HHS, 2010) argues that "physical activity can help control weight, reduce risk for many diseases (heart disease and some cancers), strengthen your bones and muscles, improve your mental health, and increase your chances of living longer." The *2008 Physical Activity Guidelines for Americans* (HHS, 2008a), targeted to children over 6 years of age and adults, states, "Regular physical activity in children and adolescents promotes a healthy body weight and body composition."

This chapter thus presents policy and practice recommendations aimed at increasing physical activity and decreasing sedentary behavior in young children. Specifically, the recommendations in this chapter are intended to (1) increase young children's physical activity in child care and other settings, (2) decrease young children's sedentary behavior in child care and other settings, and (3) help adults adopt policies and practices that will increase physical activity and decrease sedentary behavior in young children. Each of these recommendations includes potential actions for its implementation. Recommendations for infants are included in an effort to highlight the need to begin obesity prevention practices in early life. The recommendations in this chapter target child care regulatory agencies, child care providers, early childhood educators, communities, colleges and universities, and national organizations for health and education professionals, urging them to collectively adopt policies and practices that will promote physical activity and limit sedentary behavior in young children.

GOAL: INCREASE PHYSICAL ACTIVITY IN YOUNG CHILDREN

Recommendation 3-1: Child care regulatory agencies should require child care providers and early childhood educators to provide infants, toddlers, and preschool children with opportunities to be physically active throughout the day.

For infants, potential actions include

- providing daily opportunities for infants to move freely under adult supervision to explore their indoor and outdoor environments;
- engaging with infants on the ground each day to optimize adult–infant interactions; and
- providing daily "tummy time" (time in the prone position) for infants less than 6 months of age.

For toddlers and preschool children, potential actions include

- providing opportunities for light, moderate, and vigorous physical activity for at least 15 minutes per hour while children are in care;
- providing daily outdoor time for physical activity when possible;
- providing a combination of developmentally appropriate structured and unstructured physical activity experiences;
- joining children in physical activity;
- integrating physical activity into activities designed to promote children's cognitive and social development;
- providing an outdoor environment with a variety of portable play equipment, a secure perimeter, some shade, natural elements, an open grassy area, varying surfaces and terrain, and adequate space per child;
- providing an indoor environment with a variety of portable play equipment and adequate space per child;
- providing opportunities for children with disabilities to be physically active, including equipment that meets the current standards for accessible design under the Americans with Disabilities Act;
- avoiding punishing children for being physically active; and
- avoiding withholding physical activity as punishment.

Rationale

With adequate supervision and a secure perimeter, infants should be provided time each day to move freely and explore their surroundings. Physical activity may facilitate the achievement of gross motor milestones (Slining et al., 2010) and provides opportunities to expend energy (Li et al., 1995; Wells et al., 1996a,b). Research examining physical activity in infants is scarce, and even defining physical activity for infants is challenging. Thus, based on limited information, promot-

ing opportunities for movement such as reaching, creeping, crawling, cruising, and walking may be the most effective way to increase energy expenditure in children less than 1 year of age.

Although evidence in this area is limited, physical activity in infancy may help control excessive weight gain and maximize infants' developmental potential. Obesity has been linked to lower levels of fitness and motor skills in older children (Cawley and Spiess, 2008; Frey and Chow, 2006; Graf et al., 2004; Mond et al., 2007; Okely et al., 2004; Shibli et al., 2008; Slining et al., 2010). Obesity in infancy in particular may delay the achievement of gross motor milestones (Shibli et al., 2008; Slining et al., 2010), and infants who attain motor milestones at later ages may be less physically active later in childhood (Slining et al., 2010).

Adults can help facilitate physical activity in infants by engaging with them on the floor or ground and encouraging exploration and free movement. Infants should spend some of this time in the prone position for supervised "tummy time" to help them attain motor milestones (Jennings et al., 2005; Kuo et al., 2008).

In designing indoor and outdoor spaces for children's physical activity, attention increasingly is being paid to the developmental needs of toddlers and preschoolers (Trost et al., 2010; Ward et al., 2010), but much less attention has been paid to infants. For example, research is emerging on what characteristics of the physical environment are associated with more movement in children over 36 months of age, but little is known on this subject for children under 36 months of age.

Adults are responsible for creating the spaces in which infants move. The characteristics of these spaces theoretically can affect energy expenditure and obesity risk by influencing infants' movements. However, data are lacking with which to link any physical characteristics of indoor or outdoor spaces to infant movement or body weight. Recommendations on the characteristics of spaces for infants that would prevent obesity are based on what is known about how to alter indoor environments to facilitate the achievement of gross motor milestones (Abbott and Bartlett, 2001; Bower et al., 2008). The magnitude or direction of the association among gross motor skills, movement, and body weight in infancy has not been elucidated. It is plausible, however, that the creation of indoor and outdoor spaces that support the achievement of motor milestones will facilitate movement and increase the possibility that infants can maintain a healthy body weight.

Infants are intrinsically motivated to explore their environments to obtain the visual, auditory, and tactile sensory input that fosters their cognitive and social development (Bushnell and Boudreau, 1993). Infants will generally approach and

interact with objects that elicit their attention. An infant's attention and interaction will often be sustained if the objects have sensory properties that produce positive reinforcement. To explore the environment that is beyond arm's reach, infants must develop the locomotor skills of rolling, creeping, crawling, or walking. The development of these skills can be enhanced by the sensory properties of surfaces on which infants are placed and by the presence of stable objects they can use for pulling up to a standing position or stepping with support (cruising) (Metcalfe and Clark, 2000). While infants are developing verbal language, they also rely on movement to communicate with others. Motor movement, therefore, is elicited in infants not just by the objects in their environments but also by their interactions with adults.

Broad consensus exists that young children should engage in substantial amounts of physical activity on a daily basis. In older children and adolescents, research has demonstrated a relationship between higher levels of physical activity and reduced risk for development of overweight and other physiologic indicators of elevated cardio-metabolic risk (HHS, 2008b). The *2008 Physical Activity Guidelines for Americans* includes the recommendation that school-age youth engage in at least 60 minutes of moderate to vigorous physical activity per day (HHS, 2008a).

Very little research has been conducted on the relationship between physical activity and health in infants. Some, but limited, research has been undertaken on the relationship between physical activity and body weight in toddlers and preschoolers. Nonetheless, the prevalence of overweight and obesity clearly has increased in these children (Ogden et al., 2010), and expert panels frequently have recommended that increased physical activity be targeted as one strategy for reducing the prevalence of obesity among children in these age groups (IOM, 2005; Strong et al., 2005). Some expert panels have recommended that 2- to 5-year-old children engage in 2 or more hours of physical activity per day (NASPE, 2009); however, these recommendations have not been based on dose-response studies of the effect of physical activity on health outcomes. A rationale for those guidelines is that toddlers and preschoolers need substantial amounts of physical activity to develop the fundamental motor patterns that underlie efficient and skilled human movement (Clark, 1994; Williams and Monsma, 2007).

Toddlers and preschoolers, as compared with older children, clearly tend to be highly physically active. Several studies have examined levels of light, moderate, and vigorous physical activity in young children using accelerometry as an objective measure. Differing accelerometer cut-points used by researchers to dis-

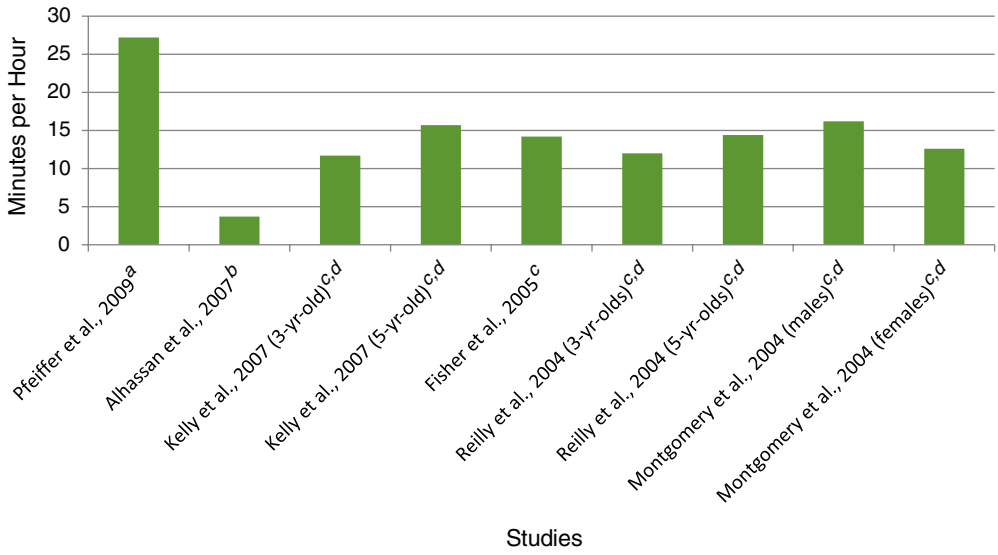

FIGURE 3-1 Synthesis of studies examining levels of total minutes of physical activity per hour (light, moderate, and vigorous) in awake children (3 to 5 years old).
NOTES:
[a]ActiGraph accelerometer, used cut-point from Pate (Pate et al., 2006).
[b]ActiGraph accelerometer, used cut-point from Sirard (Sirard et al., 2005).
[c]ActiGraph accelerometer, used cut-point from Reilly (Reilly et al., 2003).
[d]Median.

tinguish the threshold for light physical activity likely contribute to the different estimates of physical activity reported. Nonetheless, these studies demonstrate that children aged 3–5 are physically active (sum of light, moderate, and vigorous activity) for an average of about 15 minutes per hour of observation (Figure 3-1). This finding corresponds to approximately 3 hours of physical activity across a period of 12 waking hours. If this documented median is taken as a reasonable standard (e.g., those below the median should increase to that level), toddlers and preschoolers should be physically active for at least 3 hours per day. To adhere to that guideline, child care facilities should ensure that toddlers and preschoolers are active for at least one-quarter of the time they spend in the facility. For example, children spending 8 hours per day in care should be provided opportunities to be active for at least 2 hours.

Findings from physical activity interventions in the home and child care settings provide evidence of successful strategies to increase young children's physical activity levels. Three family-based interventions demonstrated positive effects

(Cottrell et al., 2005; Klohe-Lehman et al., 2007; Sääkslahti et al., 2004). Cottrell and colleagues (2005) conducted a 4-week family physical activity intervention that included pedometers (for parents and children) and information on physical activity. Children in the intervention group significantly increased their steps per day relative to children in the control group (Cottrell et al., 2005). The other two studies used parental reports of children's physical activity and found that young children had higher physical activity levels at the end of the intervention (Klohe-Lehman et al., 2007; Sääkslahti et al., 2004).

Some studies suggest that structured physical activity sessions implemented in child care settings can be effective in increasing physical activity levels among preschool-age children (Eliakim et al., 2007; Trost et al., 2008; Williams et al., 2009). Trost and colleagues (2008) conducted an RCT to test the effectiveness of an 8-week "move and learn" activity curriculum in the child care setting. This curriculum incorporated physical activity into 10-minute curriculum lessons in math, social studies, science, language arts, and nutrition education (Trost et al., 2008). During classroom time, children in the intervention group engaged in significantly more moderate to vigorous physical activity than children in the control group during weeks 5–8, and more vigorous physical activity during weeks 7 and 8 (Trost et al., 2008). When classroom and outdoor time were combined, levels of moderate to vigorous physical activity were similar between the two groups with the exception of weeks 7 and 8, when children in the intervention group had higher levels of moderate to vigorous physical activity (Trost et al., 2008). In the study by Williams and colleagues (2009), teachers in nine Head Start centers implemented a 10-week intervention consisting of 10-minute classroom physical activities (Animal Trackers). These activities effectively increased the amount of time children spent in structured physical activity, for a total of 47 minutes per week (Williams et al., 2009). Finally, Eliakim and colleagues (2007) conducted a group RCT that included a physical activity program for preschool children. The 14-week intervention included 45-minute sessions of circuit training and endurance activities 6 days per week. At the conclusion of the intervention, children in the intervention group had made significantly more overall steps per day, steps during school, and steps after school compared with children in the control group (Eliakim et al., 2007).

Two examples of environmental interventions in the child care setting had positive outcomes (Benjamin et al., 2007; Hannon and Brown, 2008). Hannon and Brown (2008) tested the effect of activity-friendly equipment on the playground, which was set up as an obstacle course. Children had significantly

increased the percentage of time spent in light (+3.5 percent), moderate (+7.8 percent), and vigorous (+4.7 percent) physical activity and significantly decreased the percentage of time spent in sedentary behavior (–16 percent) postintervention (Hannon and Brown, 2008). Benjamin and colleagues pilot-tested an environmental intervention in 19 child care centers. The intervention consisted of a director's self-assessment, action planning, continuing education workshops, technical assistance, and reassessment (Benjamin et al., 2007). At the conclusion of the 6-month intervention period, the intervention centers had improved by approximately 10 percent based on the director's self-assessment (Benjamin et al., 2007). In a larger trial involving 84 child care centers, however, a similar intervention had no significant impact on physical activity (Ward et al., 2008).

Young children should be provided with daily opportunities to be active outdoors when possible. Research has demonstrated that young children are more active outdoors than indoors (Brown et al., 2009; Klesges et al., 1990; Sallis et al., 1993). For example, Brown and colleagues (2009) found that only 1 percent of preschoolers' indoor time consisted of moderate to vigorous physical activity, as compared with 17 percent of their outdoor time (Brown et al., 2009). Yet although young children are more active when outside, the potential exists to increase preschoolers' physical activity levels further during outdoor play. Realizing this potential may require more training of adults in how to encourage children's movement. Some evidence suggests that allowing more outdoor time for unstructured play may alone be insufficient to increase young children's physical activity levels (Alhassan et al., 2007).

Several strategies have been identified to increase young children's physical activity levels in outdoor settings. First, large playgrounds, particularly those with open space, are significantly associated with increased physical activity levels (Boldemann et al., 2006; Brown et al., 2009; Cardon et al., 2008; Dowda et al., 2009). For example, Dowda and colleagues (2009) found that preschoolers engaged in more moderate to vigorous physical activity in preschools with larger playgrounds compared with children in preschools with smaller playgrounds (Dowda et al., 2009). Second, providing portable playground equipment, such as balls or wheeled toys, significantly increases young children's physical activity levels (Brown et al., 2009; Cardon et al., 2008; Dowda et al., 2009). Third, evidence indicates that young children are more active in outdoor spaces with less fixed equipment (Bower et al., 2008; Brown et al., 2009; Dowda et al., 2009). Finally, outdoor spaces with trees, shrubbery, and broken ground are positively associated with physical activity in young children (Boldemann et al., 2006). (In this study,

"broken ground" refers to spaces with clusters of trees present, rather than wide open spaces.)

Although the literature is limited with respect to how to increase moderate to vigorous physical activity while young children are indoors, doing so is important because children tend to be inactive while indoors. Bower and colleagues (2008) found that providing such opportunities was positively associated with moderate to vigorous physical activity ($r = 0.50$) and negatively associated with sedentary behavior ($r = -0.53$).

Physical activity also can be incorporated into activities designed to promote children's cognitive and social development. Indeed, active learning has been shown to promote cognitive development (Burdette and Whitaker, 2005; Bushnell and Boudreau, 1993). Therefore, including training on the benefits of physical activity and how to promote active play and provide a positive environment for such play is advisable for child care providers.

Recommendation 3-2: The community and its built environment should promote physical activity for children from birth to age 5.

Potential actions include

- ensuring that indoor and outdoor recreation areas encourage all children, including infants, to be physically active;
- allowing public access to indoor and outdoor recreation areas located in public education facilities; and
- ensuring that indoor and outdoor recreation areas provide opportunities for physical activity that meet current standards for accessible design under the Americans with Disabilities Act.

Rationale

Physical activity provides children with opportunities to expend energy. As discussed under the previous recommendation, although research on the relationship between physical activity and the control of excessive weight gain among young children is limited, evidence suggests that higher levels of physical activity are associated with a reduced risk of excessive weight gain. The importance of active play for children to promote their physical, cognitive, and emotional development is well established, and such play may help prevent overweight and obesity during early childhood and later in adult life (Berntsen et al., 2010;

Burdette and Whitaker, 2005; Dwyer et al., 2009; Ginsberg et al., 2007; Janz et al., 2002). Children at all ages need indoor and outdoor spaces that provide them with opportunities to play and be physically active. To promote physical activity, however, facilities need to be accessible, safe, and well designed to prevent serious injuries to young children. Adults and caregivers may limit young children's playing in outdoor spaces and recreational parks for fear that they will be injured if playground surfaces and equipment are not safe or developmentally appropriate.

The *Public Playground Safety Handbook* issued by the Consumer Product Safety Commission (CPSC, 2010) offers detailed guidelines for the design of playgrounds and the selection of equipment and surfacing materials to ensure the safety of children. The commission also has guidelines for separating play areas for children of different age groups to avoid injuries during play and for designing pathways to prevent older, more active children from running into younger children with slower movements and reactions. These guidelines form the basis for the National Health and Safety Performance Standards (AAP et al., 2002) for out-of-home child care, which include detailed standards for a number of outdoor play area features, including size and capacity, as well as specifications for playground equipment. State and local enforcement of national standards for outdoor playgrounds and recreational facilities is key to providing young children (infants, toddlers, and preschoolers), under the supervision of their caregivers, with increased opportunities to be physically active outside of their homes or child care settings.

Neighborhoods and communities can affect children's opportunities to be physically active through the provision of parks, open spaces, and playgrounds (AAP, 2009). In communities where these venues are limited, opportunities to use public school facilities can also be explored (IOM and NRC, 2009). Numerous reviews have examined the links between the built environment, including the availability of parks and playgrounds, and the physical activity of adults (Floriani and Kennedy, 2008; Kaczynskl and Henderson, 2008), and researchers have increasingly been interested in assessing the impact of the built environment on children's, including preschoolers', physical activity (Davison and Lawson, 2006). Thus, various surveys, assessment tools, and measurement approaches have been developed and used to evaluate the link between the quality of outdoor playgrounds for young children (under age 5) and their physical activity levels (Brown et al., 2006; Cosco et al., 2010; DeBord et al., 2005; Saelens et al., 2006). Behavioral mapping is one approach used to explore the relationship between a number of physical attributes, such as open areas, sand play, ground surface, play equipment, and pathways, and levels of physical activity (sedentary, light,

and moderate to vigorous physical activity) among children in a preschool setting (Cosco et al., 2010). Communities and local governments can benefit from the growing evidence and expertise in designing outdoor playgrounds and other areas to further help young children develop their gross motor skills and be physically active. Landscape architects and designers, environmental psychologists, and specialists can provide technical assistance and knowledge of how to design playgrounds using behavioral mapping methods and other science-based approaches to enhance the physical attributes of parks and playgrounds and attract young children to play and be active (see Box 3-1).

Among older children, those with disabilities appear to be at higher risk for developing obesity than those without disabilities (Chen et al., 2010; Rimmer et al., 2010). The cause of this increased risk is unclear, but lower levels of physical activity and higher levels of sedentary behavior may be one explanation, particularly for the subset of children with physical disabilities (Maher et al., 2007; Steele et al., 1996). To increase opportunities to be physically active for children with disabilities, both indoor and outdoor spaces for young children's physical activity

Box 3-1
Behavioral Mapping: A New Approach to Link Outdoor Design with Physical Activity Levels

Behavioral mapping is a method that combines direct observation of the physical attributes of a location, such as a playground, with measurement of the physical activity behaviors of individuals. This mapping approach is based on two concepts: behavior settings (ecological units that are composed of people, physical components, and behavior) and affordance (perceived properties of an environment). The approach was recently used to investigate the relationship between different layouts, designs, and equipment locations in preschool outdoor playgrounds and the perceptions and abilities of preschoolers with respect to playing and being physically active. Behavioral mapping is a promising method for assessing not only the physical characteristics of recreational areas and playgrounds but also the impact of climate and seasonality on the year-round physical activity of children, as well as possible differences based on race and ethnicity in children's perceptions and use of these behavior settings.

SOURCE: Cosco et al., 2010.

should be accessible to these children and contain equipment that meets their particular needs (Riley et al., 2008). This is true not only for child care and early childhood education programs but also for recreational facilities in the community. Meeting the standards for accessibility is most likely to be achieved by applying principles of universal design, which allow individuals of varying ages and abilities to be physically active with autonomy and safety (Preiser and Ostroff, 2001).

GOAL: DECREASE SEDENTARY BEHAVIOR IN YOUNG CHILDREN

Recommendation 3-3: Child care regulatory agencies should require child care providers and early childhood educators to allow infants, toddlers, and preschoolers to move freely by limiting the use of equipment that restricts infants' movement and by implementing appropriate strategies to ensure that the amount of time toddlers and preschoolers spend sitting or standing still is limited.

Potential actions include

- using cribs, car seats, and high chairs for their primary purpose only—cribs for sleeping, car seats for vehicle travel, and high chairs for eating;
- limiting the use of equipment such as strollers, swings, and bouncer seats/chairs for holding infants while they are awake;
- implementing activities for toddlers and preschoolers that limit sitting or standing to no more than 30 minutes at a time; and
- using strollers for toddlers and preschoolers only when necessary.

Rationale

Energy expenditure through physical activity is one side of the energy equation that determines whether healthy weight can be developed and maintained. Physical activity in child care settings provides children with important opportunities to expend energy. As discussed under the previous recommendation, although research on the relationship between physical activity and the control of excessive weight gain among young children is limited, evidence suggests that higher levels of physical activity are associated with a reduced risk of excessive weight gain.

Because of safety concerns, infants often are physically restrained from physical activity through the use of confining equipment, such as car seats, strollers, bouncer seats, swings, high chairs, cribs, and playpens. Although these

devices help protect infants (e.g., cribs provide safe sleeping environments, and car seats protect infants during vehicular travel), they should be limited to their intended purposes in the interests of allowing physical activity and thus energy expenditure. The long-term health implications of overusing these devices are still unknown; however, a handful of case studies suggest that infants need to engage in unrestricted movement throughout the day to promote energy expenditure and physical development (Garrett et al., 2002; Thein et al., 1997). Concern about the effects of restrictive devices was sufficient to lead Delaware in 2007 to require licensed child care centers to limit time spent, while awake, in any confining equipment, such as a crib, infant seat, swing, high chair, or playpen, to less than one-half hour (http://www.nrckids.org).

Recent reports suggest that overconfinement to cribs and playpens can result in infants' spending too much time on their back. Although supine sleeping is important because it helps prevent the occurrence of sudden infant death syndrome (SIDS), infants who spend too much time on their back are at risk for developing plagiocephaly, a deformation of the skull that may negatively affect cognitive and gross motor development later in infancy (Kordestani and Panchal, 2006; Robinson, 2010). Indeed, health practitioners have linked the increased incidence of plagiocephaly with national public campaigns to reduce SIDS (Bialocerkowski et al., 2008; Black, 2009; Cowan and Bennett, 2009; McKinney et al., 2009; Mildred et al., 1995). Thus while these important initiatives have reduced the incidence of SIDS, they may have unintended consequences associated with infants' supine sleep position. Parents and other caregivers can play an important role in averting these consequences by reducing the time infants spend in cribs and playpens when they are not sleeping and in general limiting the use of restrictive devices to their intended purpose.

Young children spend a large portion of their day engaged in sedentary behavior (Oliver et al., 2007). Several studies have used accelerometry for objectively measuring physical activity and sedentary behavior in young children. When accelerometer data are expressed as minutes per hour of observation, the amount of time young children spend in sedentary behavior ranges from 32.8 (Pfeiffer et al., 2009) to 56.3 (Alhassan et al., 2007) minutes per hour. The average across studies is approximately 45 minutes per hour of sedentary behavior (Alhassan et al., 2007; Cardon et al., 2008; Cliff et al., 2009; Fisher et al., 2005; Kelly et al., 2007; Montgomery et al., 2004; Pfeiffer et al., 2009; Reilly et al., 2004). Direct observation also has been used to measure physical activity and sedentary behavior in young children, and it provides contextual information, including the types,

locations, and social contexts of those behaviors. In a study of 476 3- to 5-year-old children from 24 child care centers, children spent approximately 89 percent of observed intervals in sedentary behavior: sitting, lying down, and standing (Brown et al., 2009).

Within the child care setting, several factors have been shown to either increase or decrease young children's sedentary behavior. One study found that young children in child care centers with high use of electronic media (e.g., televisions, movies, computers) had higher levels of sedentary behavior than young children in centers with low electronic media use (Dowda et al., 2009). Conversely, two studies (Bower et al., 2008; Dowda et al., 2004) found no association between use of electronic media in child care and children's sedentary behavior. The differences between these study findings have been attributed to differences in the measures of media use (Bower et al., 2008; Dowda et al., 2009). Higher-quality child care centers—defined as having an Early Childhood Environment Rating Scale-Revised (ECERS-R) score over 5 (Dowda et al., 2004, 2009) and higher scores on the physical activity environment and active opportunities scales of the Environment and Policy Assessment and Observation (EPAO) instrument (Bower et al., 2008)—are associated with less sedentary behavior in young children. Other factors associated with less sedentary behavior in child care include more portable and less fixed playground equipment (Bower et al., 2008; Dowda et al., 2009) and larger playgrounds (Dowda et al., 2009).

The potential health effects of sedentary behavior have not been studied in young children. Excessive exposure to television watching, a behavior that is usually sedentary, may be associated with increased weight gain in young children (Jackson et al., 2009; Jago et al., 2005; Janz et al., 2002; Proctor et al., 2003), an issue addressed in Chapter 5. In addition, there is concern that prolonged bouts of sedentary behavior may have negative health consequences. This issue has been studied in adults (Hamilton et al., 2007; Hu et al., 2003) but has not yet been studied in young children. Nonetheless, it appears to be appropriate for young children to avoid long periods of inactivity in order to increase their opportunities for energy expenditure.

GOAL: HELP ADULTS INCREASE PHYSICAL ACTIVITY AND DECREASE SEDENTARY BEHAVIOR IN YOUNG CHILDREN

Recommendation 3-4: Health and education professionals providing guidance to parents of young children and those working with young children should be trained in ways to increase children's physical activity and decrease

their sedentary behavior, and in how to counsel parents about their children's physical activity.

Potential actions include

- colleges and universities that offer degree programs in child development, early childhood education, nutrition, nursing, physical education, public health, and medicine requiring content within coursework on how to increase physical activity and decrease sedentary behavior in young children;
- child care regulatory agencies encouraging child care and early childhood education programs to seek consultation yearly from an expert in early childhood physical activity;
- child care regulatory agencies requiring child care providers and early childhood educators to be trained in ways to encourage physical activity and decrease sedentary behavior in young children through certification and continuing education; and
- national organizations that provide certification and continuing education for dietitians, physicians, nurses, and other health professionals (including the American Dietetic Association and the American Academy of Pediatrics) including content on how to counsel parents about children's physical activity and sedentary behaviors.

Rationale

Based on what is known about the impact of training for child care staff on children's physical activity and the need for more training opportunities expressed by child care providers, a recommendation on training for health and education professionals on ways to increase children's physical activity is appropriate. Millions of young children spend substantial amounts of time in child care and early childhood education programs. The social and physical environments provided by these programs have an important influence on children's physical activity and sedentary behavior. Those environments are established by the administrators, child care providers, and early childhood educators who design, manage, and deliver the programs. Research has shown that staff training influences children's physical activity in child care centers. More teacher education (Dowda et al., 2004) and training (Bower et al., 2008; Dowda et al., 2009) in physical activity are associated with higher levels of physical activity in children. For example, teacher training in physical activity was found to be positively associated with children's mean

activity level (r = 0.40) and the percentage of time children spent in moderate to vigorous physical activity (r = 0.35) and negatively associated with the percentage of time children spent in sedentary behavior (r = –0.35) (Bower et al., 2008). In addition, training in physical activity was positively associated with more teacher behavior supportive of physical activity (r = 0.48) (Bower et al., 2008).

A major examination of issues related to training of employees in child care and child development centers with regard to physical activity and nutrition was undertaken in the state of Delaware (Gabor et al., 2010). Training needs and recommendations for future training activities were studied through an extensive series of focus group discussions. Child care providers acknowledged the need for more training opportunities, technical assistance, and resources. Specifically, child care center directors stated that child care providers and early childhood educators needed more ideas and resources for structured physical activities, especially those that are linked to the development of gross motor skills. In addition, child care providers preferred a hands-on training approach for learning how to incorporate structured activities into the child care setting.

Several national organizations have made recommendations regarding training in the provision of physical activity programs for child care providers and early childhood educators (AAP et al., 2010; Benjamin, 2010; McWilliams et al., 2009). Training opportunities also should be provided for special education teachers who have specific responsibility, under the Individuals with Disabilities Education Act, for working with children with disabilities.

There are resources available to assist caregivers with ways to encourage physical activity in young children. Information can be found at the following websites, among others:

- National Association for Sport and Physical Education: http://www.naspeinfo.org
- National Association for the Education of Young Children: http://www.naeyc.org/

Adults control where and how children under age 5 spend their time. These decisions influence the variety, frequency, and intensity of children's movement experiences and thus their motor development, energy expenditure, and body weight. For example, whether an awake infant in the home is spending time constrained in a car seat or prone and moving freely on the floor may have implications for that infant's gross motor development, movement, and energy expendi-

ture. Whether a toddler or preschooler at home spends time watching television or playing outdoors may have similar implications. These decisions about allocation of time across activities also affect children's cognitive, social, and emotional development. Thus it is the cumulative impact of decisions made by adults that shapes the development of the bodies and minds of young children.

Of all the adults who make decisions about activities for infants, toddlers, and preschoolers, it is parents (or guardians) who have the greatest influence because children at this age still spend the majority of their time in their parents' care. This is true even for children in full-day child care or preschool. Therefore, how children spend the time they are with their parents and the nature of the physical environment in the home are two key leverage points for preventing obesity from birth to age 5. Parents establish the household policies and practices in these two areas. Therefore, for public policy to affect these areas, it must reach parents.

Parents seek advice in raising their children from those they trust. Outside of friends and family, the professionals they often trust include the following: health care providers; child care providers; early childhood educators; and those working in home visiting programs, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and U.S. Department of Agriculture (USDA) Cooperative Extension programs. These professionals function within institutions, programs, and professional organizations that can develop policies and practices that influence the content and frequency of professionals' communication with parents on a number of issues affecting children's physical activity.

The first two goals of this chapter involve recommendations designed to alter settings outside the home by changing physical environments and the ways adults in those settings interact with children and allocate children's time across activities. It would be ideal for parents to implement many of these same recommendations at home. Parents can be aided in this effort by the professionals from whom they already seek advice about parenting. For parents to be receptive to this advice, they must feel encouraged by these professionals rather than blamed, and the advice must be practical and compatible with the parents' values. Messages about physical activity and sedentary behavior also must be consistent across settings—from the pediatrician's office, to the WIC clinic, to the child care center.

Finally, professionals can empower parents to change children's environments and activities outside the home to encourage physical activity and decrease sedentary behavior. Parents need the support of professionals to advocate for these changes in their communities, especially in settings where their children receive

child care and early childhood education. Parents' expression of their opinions can change the indoor and outdoor environments in all these settings, the ways in which nonparental adults interact with their children, and the kinds of activities their children engage in while away from home.

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4

Healthy Eating

GOALS:

- **Promote the consumption of a variety of nutritious foods, and encourage and support breastfeeding during infancy.**
- **Create a healthy eating environment that is responsive to children's hunger and fullness cues.**
- **Ensure access to affordable healthy foods for all children.**
- **Help adults increase children's healthy eating.**

The majority of young children in the United States are not consuming nutritious diets (Fox et al., 2010; Fungwe et al., 2009; Siega-Riz et al., 2010). U.S. children of all ages are consuming diets that are too high in added sugar and fat and too low in fruits and vegetables, whole grains, and low-fat and nonfat dairy products (Reedy and Krebs-Smith, 2010; Williams, 2010). Taking action to ensure that children aged 0–5 have access to a variety of nutritious foods can contribute to healthy growth and a reduction in obesity risk.

A child develops food preferences by responding to what he or she is fed and observing adults; the availability of food in the immediate environment also plays a role. Because food offered to young children is determined by caregivers, they should make every effort to introduce children to healthy foods and lifestyle

habits from the beginning of infancy onward (Skinner et al., 2004). Children who have early experiences with eating healthy foods are more likely to prefer and consume those foods and to have dietary patterns that promote healthy growth and weight (Anzman et al., 2010; Mennella et al., 2008), patterns that may then persist in later childhood (Skinner et al., 2004). Given that more than half of children under the age of 5 receive care in out-of-home settings (HHS, 2011a), parents as well as other caregivers need information and guidance on how to foster the development of healthy eating patterns among young children. This chapter includes recommendations designed to improve nutrition through infancy to the consumption of solid foods.

GOAL: PROMOTE THE CONSUMPTION OF A VARIETY OF NUTRITIOUS FOODS, AND ENCOURAGE AND SUPPORT BREASTFEEDING DURING INFANCY

Recommendation 4-1: Adults who work with infants and their families should promote and support exclusive breastfeeding for 6 months and continuation of breastfeeding in conjunction with complementary foods for 1 year or more.

Potential actions include

- hospitals and other health care delivery settings improving access to and availability of lactation care and support by implementing the steps outlined in the Baby-Friendly Hospital Initiative and following American Academy of Pediatrics policy recommendations;
- hospitals enforcing the World Health Organization's International Code of Marketing of Breast Milk Substitute (This step includes ensuring that hospitals' informational materials show no pictures or text that idealizes the use of breast milk substitutes; that health professionals give no samples of formula to mothers [this can be complied with through the Baby-Friendly Hospital Initiative]; and that the Federal Communications Commission, the Department of Health and Human Services, hospital administrators [through the Baby-Friendly Hospital Initiative], health professionals, and grocery and other stores are required to follow Article 5, "The General Public and Mothers," which states that there should be no advertising or promotion to the general public of products within the scope of the code [i.e., infant formula]);

- the Special Supplemental Nutrition Program for Women, Infants, and Children, the Child and Adult Care Food Program, Early Head Start, other child care settings, and home visitation programs requiring program staff to support breastfeeding; and
- employers reducing the barriers to breastfeeding through the establishment of worksite policies that support lactation when mothers return to work.

Rationale

A number of systematic reviews on the relationship between breastfeeding and childhood obesity conclude that, while the nature of the study designs makes it difficult to infer causality, there is an association between breastfeeding and a reduction in obesity risk in childhood (Adair, 2009; Arenz et al., 2004; Harder et al., 2005; Monasta et al., 2010; Owen et al., 2005). Thus, in the committee's judgment, a recommendation on breastfeeding is warranted. The first Institute of Medicine (IOM) report on childhood obesity prevention takes a similar position (IOM, 2005).

There is a window of opportunity after birth during which breastfeeding can be initiated. However, many hospitals and health care providers do not provide information about and support for breastfeeding. The most recent data from the Centers for Disease Control and Prevention (CDC) indicate that 75 percent of women in the United States initiate breastfeeding at birth, and 43 percent are breastfeeding at 6 months after birth; however, only 13 percent of mothers are breastfeeding *exclusively* at 6 months (CDC, 2010), and only 22.4 percent are breastfeeding at 12 months (HHS, 2011b). The American Academy of Pediatrics (AAP) and many other health organizations recommend exclusive breastfeeding for approximately the first 6 months of life, with the addition of complementary foods at around 6 months and continued breastfeeding through the first year of life and beyond (AAP, 2005; ADA, 2005; WHO, 2001).

Although breastfeeding rates have improved over time, disparities exist by race and ethnicity and by socioeconomic status. Only 58 percent of black infants are ever breastfed, compared with 76 percent of white and 80.6 percent of Latino infants. Fully 88 percent of the infants of college graduates are ever breastfed, compared with only 66 percent of infants of high school graduates. These differences continue for breastfeeding at 6 and 12 months. *The Surgeon General's Call to Action to Support Breastfeeding* points out a number of barriers to breastfeeding in the United States, including lack of knowledge, social norms, poor family and social support, embarrassment, lactation problems, employment, child care,

and health services and health professionals that fail to promote or support the practice (HHS, 2011b).

The rapid attrition seen among mothers who breastfeed indicates that support, education, and public policy are inadequate to ensure that all women who want to breastfeed can do so. Support for breastfeeding initiation and maintenance needs to begin during prenatal care and continue at the hospital or other place of childbirth and into child care settings and workplaces.

Institutional support within hospitals is critical to help mothers learn to breastfeed. Hospitals have the potential to influence, educate, and support virtually all new mothers, especially those who have been shown to be less likely to ever breastfeed or sustain breastfeeding up to 6 months or a year. The Baby-Friendly Hospital Initiative is a global program designed to encourage and recognize hospitals and birthing centers that offer an optimal level of care for infant feeding (see Box 4-1). The initiative increases the duration of breastfeeding and the initiation of exclusive breastfeeding (Fairbank et al., 2000; Kramer et al., 2001). Mothers in the United States were 13 times more likely to stop breastfeeding before 6 weeks if they delivered in a hospital where none of the 10 steps of the Baby-Friendly Hospital Initiative were followed as compared with mothers who delivered at hospitals where at least 6 of the 10 steps were followed (DiGirolamo et al., 2008). Furthermore, following the steps decreased the disparities in initiation and duration rates of breastfeeding seen across different income, ethnic, and racial groups (Merewood et al., 2005). Although more than 18,000 hospitals worldwide are designated as Baby-Friendly, only 3 percent of maternity hospitals in the United States are so designated (Baby-Friendly USA, 2011; CDC, 2008).

Although employment outside the home is one of the biggest reasons for discontinuing breastfeeding (Mandal et al., 2010) workplace lactation programs can increase the duration of breastfeeding (Abdulwadud and Snow, 2007). Not only do workplace lactation programs increase breastfeeding duration, but they also confer advantages on the employer, such as decreased absenteeism (Cohen and Mrtek, 1994; Mills, 2009; Wyatt, 2002). Twenty-four states have laws related to breastfeeding at the workplace, and the Patient Protection and Affordable Care Act of 2010 and the Reconciliation Act of 2010, which amends the Fair Labor Standards Act of 1938 (29 U.S. Code 207), require an employer to provide reasonable break time for an employee to express breast milk for her nursing child for 1 year after the child's birth (National Conference of State Legislatures, 2011). However, many women still

Box 4-1
Baby-Friendly Hospital Initiative

The Baby-Friendly Hospital Initiative (BFHI) is a global program sponsored by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) to encourage and recognize hospitals and birthing centers that offer an optimal level of care for infant feeding. The BFHI assists hospitals in helping mothers initiate and continue breastfeeding, and gives special recognition to hospitals that have done so. The BFHI promotes breastfeeding through the Ten Steps to Successful Breastfeeding for Hospitals. The steps for the United States are:

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within one hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation, even if they are separated from their infants.
6. Give newborn infants no food or drink other than breastmilk, unless medically indicated.
7. Practice "rooming in"—allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no pacifiers or artificial nipples to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

SOURCE: http://www.babyfriendlyusa.org.

struggle to breastfeed when they go back to work because of a lack of enforcement of the law (74 percent of employers do not offer lactation rooms or accommodations for breastfeeding, and some employers see little value to breastfeeding in the workplace) (Grummer-Strawn and Shealy, 2009; Libbus and Bullock, 2002).

In addition to workplace lactation programs, breastfeeding duration is affected by the degree of control a woman has over her job, including the flexibility she is allowed; whether she works full time; and the length of maternity leave (Abdulwadud and Snow, 2007; Hawkins et al., 2007; Mandal et al., 2010). These factors are highly relevant for breastfeeding mothers, because the Family and Medical Leave Act covers only 56 percent of women with children younger than 18 months of age (Mandal et al., 2010).

Providers in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), child care settings, Early Head Start, and home visitation programs also have many opportunities to support breastfeeding, especially among low-income women (Shealy et al., 2005). The WIC program, for example, serves almost half of the babies born in the United States (IOM, 2006). One-to-one health education and peer counseling in the prenatal and postnatal periods have been found to be highly effective in increasing the initiation and duration of breastfeeding (Fairbank et al., 2000; Gross et al., 2009). Home visitation has been used successfully to provide instruction, guidance, and support to mothers who are learning to breastfeed and continuing to do so throughout the baby's first year. Moreover, as the current work environment often is not conducive to supporting women who breastfeed, the support of health care providers can be integral in overcoming the isolation and other obstacles mothers often face while balancing work and breastfeeding an infant.

Child care centers that provide lactation rooms or other space for breastfeeding mothers and optimally support working mothers, including their staff, who want to breastfeed their infant could be labeled as Breastfeeding-Friendly (Box 4-2). This label could be similar to the Baby-Friendly Hospital designation, indicating child care centers that follow basic guidelines to support breastfeeding schedules. Breastfeeding-Friendly space would allow women to continue breastfeeding even after returning to work, a key factor in increasing breastfeeding rates. Multiple stakeholders should explore incentives and actions such as these for encouraging and supporting breastfeeding at the worksite, as suggested by the Surgeon General (HHS, 2011b) and by the IOM in *Local Government Actions to Prevent Childhood Obesity* (IOM and NRC, 2009).

Bottle Feeding

Breastfeeding is the best way to support the growth and development of a young infant. However, the committee realizes that some women will formula feed their infant and not breastfeed, and that many women who breastfeed may use a bottle to feed their infant breast milk or formula on some occasions, often because of one or more of the barriers to breastfeeding described above. These women also need the advice and support of their health care providers, especially because there is a greater risk that a bottle-fed infant can be overfed or encouraged to "finish the bottle," in turn increasing the risk for obesity. The literature suggests the following guidelines on bottle feeding:

Box 4-2
Ten Steps to Breastfeeding-Friendly Child Care Centers

1. Designate an individual or group who is responsible for development and implementation of the ten steps.
2. Establish a supportive breastfeeding policy and require all staff be aware of and follow the policy.
3. Establish a supportive worksite policy for staff members who are breastfeeding.
4. Train all staff so that they are able to carry out breastfeeding promotion and support activities.
5. Create a culturally appropriate breastfeeding-friendly environment.
6. Inform expectant and new families and visitors about your center's breastfeeding-friendly policies.
7. Stimulate participatory learning experiences with the children, related to breastfeeding.
8. Provide a comfortable place for mothers to breastfeed or pump their milk in privacy, if desired.
9. Educate families and staff that a mother may breastfeed her child wherever they have a legal right to be. Establish and maintain connections with local breastfeeding coalition or community breastfeeding resources.
10. Maintain an updated resource file of community breastfeeding services and resources kept in an accessible area for families

SOURCE: Wisconsin Department of Health Services, http://www.dhs.wisconsin.gov/health/physicalactivity/pdf_files/BreastfeedingFriendlyChildCareCenters.pdf.

- Only breast milk or infant formula should go in the bottle (USDA, 2009). Juice, soda, and sweetened or carbonated beverages should not be put in the bottle. Cow's milk should not be introduced until at least 1 year of age (AAP, 2008).
- Based on the average intake of 2–4 ounces of breast milk or formula by an infant from birth to 4 months of age (Hagan et al., 2008), a 4-ounce bottle should be used to feed an infant. If the infant shows signs of hunger after finishing a 4-ounce bottle, it may be time to transition to a larger bottle size.
- The bottle should be held by an adult caregiver. It should not be propped, which prevents the infant from being able to stop feeding. An adult should feed the infant to watch for cues of satiety (Shelov, 2009).
- Feeding should not be initiated automatically any time the infant cries. Infant hunger cues should be appreciated (see Table 4-1). A bottle should not be used as a quieting device. Alternative soothing strategies, such as

holding or swaddling the infant, should be tried first (AAP, 2008; Hagan et al., 2008; Shelov, 2009).

- Infants should not be forced to finish the bottle (Hagan et al., 2008; Li et al., 2010).
- Infants should be "off the bottle" and drinking from a cup around 1 year of age, but no older than 18 months of age (Shelov, 2009).

Complementary Feeding

Complementary solid foods should be introduced at around 6 months of age (AAP, 2005). However, a substantial percentage of mothers introduce solid foods before their infant is 4 months of age (Fein et al., 2008), particularly if they perceive the infant to be "fussy" (Wasser et al., 2011). Mothers may also add cereal to the bottle in the belief that doing so will help the infant sleep longer (Kavanagh

TABLE 4-1 Infant Feeding Cues

Age	Hunger Cues	Fullness Cues
Birth through 5 months	• Wakes and tosses • Sucks on fist • Cries or fusses • Opens mouth while feeding to indicate wanting more	• Seals lips together • Turns head away • Decreases or stops sucking • Spits out the nipple or falls asleep when full
4 months through 6 months	• Cries or fusses • Smiles, gazes at caregiver, or coos during feeding to indicate wanting more • Moves head toward spoon or tries to swipe food toward mouth	• Decreases rate of sucking or stops sucking when full • Spits out nipple • Turns head away • May be distracted or pay more attention to surroundings
5 months through 9 months	• Reaches for spoon or food • Points to food	• Starts eating more slowly • Pushes food away
8 months through 11 months	• Reaches for food • Points to food • Gets excited when food is presented	• Starts eating more slowly • Clenches mouth shut or pushes food away
10 months through 12 months	• Expresses desire for specific food with words or sounds	• Shakes head to say "no more"

SOURCE: USDA, 2009.

et al., 2010). Yet complementary foods introduced too early do not benefit the infant and may even be harmful because of the possibility of the infant's choking (since the infant may not have the neuromuscular mechanisms needed for swallowing), developing food allergies, or consuming less than the appropriate amount of breast milk or infant formula (Fiocchi et al., 2006; Grummer-Strawn et al., 2008; Walker et al., 1996). Additionally, an infant's gut is not sufficiently mature for solid food prior to 4 months of age (USDA, 2001). Research on the effects of early introduction of complementary foods and obesity risk is inconsistent, with some studies reporting a possible association (Huh et al., 2011) and others reporting no clear association (Moorcroft et al., 2011).

The foods and beverages offered to infants during the transition to solid foods are important in setting the foundation for eating patterns later in life; those that become familiar early in life will tend to be preferred to those that are unfamiliar. A preponderance of energy-dense foods, high in sugar, fat, and salt, provides an eating environment that can foster preferences for these foods, resulting in diets that are inconsistent with the Dietary Guidelines for Americans (DGA) (Birch, 1999). Children are predisposed to like sweet and salty foods but must learn to like those that are not (Cowart et al., 2004; IOM, 2010). Healthy foods such as vegetables will be accepted if they become familiar and if children see others eating and enjoying them (Addessi et al., 2005; Harper and Sanders, 1975). As children are being introduced to the adult diet, all foods are new. They will tend to reject new foods initially, but with frequent opportunities to try these foods, will accept many of them. At home and in child care settings, therefore, young children should be introduced to healthy foods and given frequent opportunities to try them. It is important to note that, according to recent evidence, children attending child care programs that participate in the Child and Adult Care Food Program (CACFP) consume diets of better nutritional quality than children not attending such programs (Bruening et al., 1999; Crepinsek and Burstein, 2004; Whaley et al., 2008).

Recommendation 4-2: To ensure that child care facilities provide a variety of healthy foods and age-appropriate portion sizes in an environment that encourages children and staff to consume a healthy diet, child care regulatory agencies should require that all meals, snacks, and beverages served by early childhood programs be consistent with the Child and Adult Care Food Program meal patterns and that safe drinking water be available and accessible to the children.

Rationale

Children who consume a diet rich in nutrient-dense whole grains, fruits, vegetables, and low-fat or nonfat milk and other dairy products and low in energy-dense, nutrient-poor foods are less likely to be overweight or obese (Bradlee et al., 2010; Frank, 2008). As noted in Chapter 1, overweight and obese children are more likely to become obese adolescents and adults (Taveras et al., 2009; Whitaker et al., 1997) and more likely to suffer from the chronic diseases associated with excess weight. Some of these diseases that are associated with obesity and that may be present during childhood include type 2 diabetes, hypertension, hyperlipidemia, dyslipidemia, hepatic steatosis, obstructive sleep apnea, gallbladder disease, and musculoskeletal and psychosocial disorders (Daniels et al., 2009; Freedman et al., 2007). Overweight and obese adults are more likely to develop cardiovascular diseases, type 2 diabetes, stroke, certain types of cancer, and osteoarthritis (Pi-Sunyer, 2009).

The DGA provide guidance on what constitutes a healthy diet for children 2 years of age and older (USDA and HHS, 2010). In the absence of governmental science-based national dietary recommendations for children younger than 2 years of age, AAP guidelines are used for this age group. For the purposes of this report and to be consistent with the DGA, *nutritious foods* and *healthy foods* are defined as lean and low-fat protein foods; whole-grain products; fruits and vegetables prepared with little or no added sugar, salt, or fat; and low-fat or nonfat milk and other dairy products. At the request of the U.S. Department of Agriculture (USDA), the IOM has made recommendations for updating meal patterns served through the CACFP in child care settings (see Box 4-3). The final regulations may vary once the USDA rulemaking process is complete.

Children in the United States are not meeting these nutritional guidelines. Their diets are low in whole fruits, dark green and orange vegetables and legumes, and whole grains, key sources of nutrients. Although children aged 2–5 meet the DGA recommendations for total fruit and milk, their diets are high in saturated fat, sodium, added sugar, and calories (Fungwe et al., 2009; Guenther et al., 2008). Indeed, many young children consume discretionary calories from added sugars or fat every day (Fox et al., 2010). These are considered energy-dense, nutrient-poor foods, which provide many calories in a small volume with few essential nutrients. In layman's terms, these are "junk foods" and "fatty foods." Preventing obesity early in life is easier than treating it. Thus, it is critical that health care providers, researchers, and policy makers explore ways to limit access to energy-dense, nutrient-poor foods for even young children. Whole grains, fruits,

Box 4-3
Recommended Daily Meal Patterns for CACFP Breakfast, Lunch/Supper, and Snacks: Number of Servings and Range of Serving Sizes[a]

Food Group	Number of Servings	Range of Serving Size
	Breakfast	
Fruits or nonstarchy vegetables	1	1/4 to 1/2 cup
Grains/breads	1	1/2 to 2 1/2 ounce equivalent
Lean meats/meat alternatives (3 times weekly)	1	1/2 to 1 ounce equivalent
Milk	1	1/2 to 3/4 cup
	Lunch/Supper	
Fruits	1	1/4 to 1/2 cup
Vegetables	2	1/4 to 1 cup
Grains/breads	1	1/2 to 2 ounce equivalent
Lean meats/meat alternatives	1	1/2 to 2 ounce equivalent
Milk	1	1/2 to 1 cup
	Snacks (Choose two food groups per snack)	
Fruits	2 per week	1/2 to 1 cup
Vegetables	2 per week	1/8 to 1 cup
Grains/breads	2 per week	1/2 to 2 ounce equivalent
Lean meats/meat alternatives	2 per week	1/2 to 1 ounce equivalent
Milk	2 per week	1/2 cup

[a]Serving sizes vary by age group.

SOURCE: Adapted from IOM, 2011a.

and vegetables are excellent sources of complex carbohydrates, fiber, vitamins, and minerals, and because they tend to have higher water and fiber content, they are relatively low in energy density and can help children feel fuller longer. If energy density is reduced in the diet through an increase in consumption of vegetables instead of a total reduction in meal size, children are likely to consume fewer calories and more vegetables (Leahy et al., 2008). Establishing preferences for foods with lower energy density and higher nutritional content, such as fruits and vegetables, not only increases the intake of important nutrients at the time of consumption but also may reduce caloric intake, in turn reducing the risk for obesity and chronic disease in the future.

Sugar-sweetened beverages are an energy-dense, nutrient-poor food commonly consumed by children. Defined as beverages that contain caloric sweeteners, they include carbonated beverages, fruit drinks, sweetened bottled waters, sports drinks, and energy drinks. More than half of toddlers and preschoolers consume one or more servings of such beverages per day (Fox et al., 2010). Sugar-sweetened beverages are the primary source of added sugar in the American diet (Hu and Malik, 2010). They account for a significant number of discretionary calories in the diets of young children—60 kcal per day at 2–3 years of age and 121 kcal per day at 4–8 years of age (Reedy and Krebs-Smith, 2010). It is not surprising, then, that strong evidence links the consumption of sugar-sweetened beverages and excess weight gain in children, including young children (Hu and Malik, 2010; Vartanian et al., 2007; Wang et al., 2009). One study found, for example, that 5-year-old girls who consume more than two servings of sugar-sweetened beverages per day have a higher body fat percentage through age 15 than girls with lower intake of such beverages (Fiorito et al., 2009).

There are other reasons to limit the intake of sugar-sweetened beverages among young children. Those who drink such beverages consume more sugars and fewer whole grains, fruits, vegetables, and low- or nonfat dairy products than their peers who do not consume these beverages (Fiorito et al., 2010; Kranz et al., 2005). Moreover, because infants are born with a preference for sweet tastes, intake of sugar-sweetened beverages in early childhood may result in a preference for sweet beverages later in life (Birch, 1999), an issue discussed further below. High intake of these beverages in adolescence also may directly increase the risk of type 2 diabetes, independently of the risk from excessive caloric intake.

Clear and undisputed evidence shows that children benefit from consuming a diet rich in low- or nonfat milk and other dairy products. Flavored milk should be avoided as it contains added calories in the form of high fructose corn syrup

or sucrose, which may contribute to excess energy in the diet. Evidence shows that young children who drink flavored milk consume more total calories and more added sugars than children who drink only plain milk (Murphy et al., 2008; Wilson, 2000).

The second-largest source of energy in the diet of 2- to 3-year-old children is 100 percent fruit juice, contributing nearly 100 calories per day to their intake (Reedy and Krebs-Smith, 2010). Although no association was found between overweight and intake of 100 percent fruit juice (Nicklas et al., 2008), children who consumed such juices had higher energy intakes. Therefore, 100 percent fruit juice should be limited to no more than one serving per day, from a cup rather than a bottle, for toddlers and preschoolers. This recommendation is consistent with the AAP guideline issued in 2001 (Baker et al., 2001).

Providing drinking water as an alternative to sugar-sweetened beverages and fruit juice helps reduce discretionary energy intake and resultant obesity risk. Replacing these beverages with water reduces children's total calorie intake (Wang et al., 2009), and the availability of drinking water has been found to increase water intake and decrease overweight among early elementary students (Muckelbauer et al., 2009). Drinking water not only improves hydration but also may reduce the risk for the development of early dental caries (Kleinman, 2009). Children are well served by developing the habit of seeking water to quench their thirst. Drinking water should be available and accessible to young children throughout the day.

As alluded to earlier, the foods to which infants and young children are exposed help develop their food and flavor preferences, and these preferences tend to persist throughout life (Birch, 1999). Recent evidence indicates that the first months of life may be a particularly sensitive period for learning flavors (Mennella et al., 2009), and flavor preferences developed as early as infancy can influence food selection during childhood and later in life (Mennella et al., 2008). While infants are born with a genetic predisposition to prefer sweet tastes (Birch, 1999; Steiner and Glaser, 1995), then, childhood food exposures can either increase (Beauchamp and Moran, 1984; Benton, 2004) or decrease (Sullivan and Birch, 1990) these preferences.

Recommendation 4-3: The Department of Health and Human Services and the U.S. Department of Agriculture should establish dietary guidelines for children from birth to age 2 years in future releases of the Dietary Guidelines for Americans.

Rationale

The DGA provide evidence-based nutrition recommendations intended to promote health and reduce the risk of obesity and chronic disease for Americans aged 2 years and older (USDA and HHS, 2010). These guidelines are updated every 5 years and form the basis for nutrition recommendations for the public and for federal nutrition assistance programs. As noted above, no governmental science-based national dietary recommendations are available for children under the age of 2 years. Such recommendations are critical as the basis for national dietary intake studies, and in their absence, no standard for comparison exists. In 2010 the DGA committee recommended that starting in 2015, guidelines be issued for children from birth to 2 years of age (Van Horn, 2010). Including children in this age group in future updates of the DGA would provide specific, actionable dietary recommendations for all of America's children, including the youngest. These recommendations could help inform effective obesity prevention efforts.

GOAL: CREATE A HEALTHY EATING ENVIRONMENT THAT IS REPONSIVE TO CHILDREN'S HUNGER AND FULLNESS CUES

Recommendation 4-4: State child care regulatory agencies should require that child care providers and early childhood educators practice responsive feeding.

Potential actions include

- for infants—holding infants in one's arms or sitting up on one's lap while feeding and not propping bottles, recognizing infant feeding cues (e.g., rooting, sucking), offering an age-appropriate volume of breast milk or formula to infants and allowing infants to self-regulate their intake, and introducing developmentally appropriate solid foods in age-appropriate portions and allowing all infants to self-regulate their intake; and
- for toddlers/preschoolers—providing meals and snacks as part of a daily routine, requiring adults to sit with and eat the same foods as the children, allowing children to serve themselves when serving from common bowls (family-style service), providing age-appropriate portions and allowing children to determine how much they eat when offering foods that are served in units (e.g., sandwiches), and reinforcing children's internal cues of hunger and fullness.

Rationale

Research indicates that young children have some ability to regulate their food intake, a potential that should be tapped through responsive feeding (described in detail in Box 4-4). This ability appears to be present as early as infancy, as demonstrated by infants consuming larger amounts of formula or food when the caloric density of their diet was low and smaller amounts when the caloric density was high (Fomon et al., 1969; Fox et al., 2006). Young children's caloric intake may vary from meal to meal, but their intake over 24-hour periods is more consistent (Birch et al., 1991), a finding that provides additional evidence for self-regulation.

Caregivers' approach to feeding practices can either promote or interfere with children's ability to learn to self-regulate their food intake. Adults' control of feeding practices by making all decisions about children's food consumption, including the amount eaten, is associated with a decreased ability to regulate energy consumption (Faith et al., 2004; Johnson and Birch, 1994) and an increased risk of overweight in preschoolers (Baughcum et al., 1998; Carper et al., 2000; Fisher and Birch, 1999; Rhee et al., 2006). Adults concerned about overeating in children may respond by strictly limiting access to high-fat, energy-dense foods (Birch and Fisher, 1998); however, this can paradoxically exacerbate the problem by promoting increased intake of those foods when they are available and discouraging self-regulation of caloric intake (Bante et al., 2008; Birch and Fisher, 1998; Birch et al., 2003; Fisher and Birch, 1999; Johnson, 2000). Conversely, adults who think children will not eat enough may force them to eat everything on their plate or use rewards as a means to get them to eat more than they want. This practice may diminish children's preference for foods they are forced to eat and reduce their responsiveness to hunger and fullness cues (Birch et al., 1987). Additional controlling feeding practices that can impair children's self-regulation include using palatable foods as rewards or bribes to control children's behavior (Birch et al., 1987, 1991; Branen and Fletcher, 1999); using external cues, such as "clean your plate" (Ramsay et al., 2010); and rewarding children for eating certain foods (Birch et al., 1987, 1991). Offering large portions of palatable foods also can impact children's self-regulation; larger portions promote greater intake, causing young children to eat more (Fisher et al., 2007). When a variety of healthy foods are offered in appropriate portions, and an adult is available to support children and give appropriate cues, children can determine how much they eat.

In addition, adults should sit with children and eat the same foods. In so doing, adults can model the consumption of healthy foods (Nicklas et al.,

Box 4-4
What Is Responsive Feeding?

In feeding, adults provide healthy foods to children and allow children to control the amount they eat. Responsive feeding practices help reinforce children's eating according to their internal hunger and fullness cues (Black and Aboud, 2011; Engle and Pelto, 2011). Examples of responsive feeding include the following:

- Adults sit with and eat with children so they can observe the children's eating and remind them of their hunger and fullness cues. Adults can observe when children are eating for nonhunger reasons, such as because they want to delay going on to the next activity or because they enjoy the taste of the food, and can redirect them to their hunger and fullness cues.
- Letting children serve themselves allows them to take the amount of food they need to satisfy their hunger.
  - —This works best if adults sit at the table and give guidance as to how much food the children can take at one time. Statements such as "You can take one spoonful, and then you can have more if you are still hungry" help children take appropriate amounts of food and reassure them that they will be able to satisfy their hunger.
  - —Adults should teach children to serve themselves, model self-serving, and give appropriate verbal or physical assistance when needed.
  - —Adults should provide serving utensils that help children serve themselves child-sized portions.
- Providing food on a regular schedule helps children self-regulate their food intake. Young children may need food every 2.5 to 3 hours. These can be considered minimeals, each consisting of healthy foods. Offering food on a regular schedule prevents children from becoming overly hungry, which can lead to overeating.
- Adults should offer child-sized unit foods, such as sandwiches. Foods such as minibagels, sandwiches cut in quarters, and minimuffins help children eat according to their internal cues.
- Child-sized plates and utensils also help support children in self-regulating their food intake.
- Adults can encourage, but not force, children to try healthy foods.

SOURCE: Connecticut State Department of Education, 2010; Fletcher et al., 2005.

2001), which in turn can promote children's willingness to try and eat such foods (Addessi et al., 2005).

Adults also can help children learn the skills needed for "family-style" meals, including taking turns, passing foods, and serving themselves (Fletcher and Branen, 2004). Family-style service, where children serve themselves from common serving bowls, has been recommended as a way of helping children eat according to their own hunger and fullness cues (Branen et al., 1997). This eating style, which is supported by the CACFP and Head Start (Connecticut State Department of Education, 2010; ECLKC, 2011), enhances children's understanding of their internal hunger and satiety cues.

Taken together, the available research indicates that parents' and care providers' feeding practices can play an important role in preventing early childhood obesity. Consistent messages about the positive effect of responsive feeding practices, as opposed to nonresponsive, controlling practices, are necessary for young children to achieve competence in self-regulating energy intake (see Box 4-5). Evidence supports the presence of self-regulation abilities in young children as early as infancy. The degree of responsiveness of caregivers' approaches to child feeding is associated with children's continuing ability to self-regulate caloric intake and the risk of overweight in preschoolers. In addition, a number of states have licensing standards related to responsive feeding practices. In Delaware, for example, licensed centers must hold an infant while bottle feeding and serve food on demand. In Tennessee the regulations require that the feeding schedule for infants be in accordance with the child's needs rather than the hour of day (http://www.nrckids.org). Therefore, in the committee's judgment, a recommendation in support of responsive feeding in child care settings is appropriate.

GOAL: ENSURE ACCESS TO AFFORDABLE HEALTHY FOODS FOR ALL CHILDREN

Recommendation 4-5: Government agencies should promote access to affordable healthy foods for infants and young children from birth to age 5 in all neighborhoods, including those in low-income areas, by maximizing participation in federal nutrition assistance programs and increasing access to healthy foods at the community level.

Box 4-5
Translating Responsive Feeding Ideas for Parents

Childcare Mealtime and Active Play Partnerships (ChildcareMAPP, http://www/childcaremapp.org) is a joint effort of the University of Colorado Anschutz Medical Campus, the University of Idaho, Washington State University, and the U.S. Department of Agriculture to provide information and educational resources regarding healthy eating and physical activity in child care settings and in children's homes. Although the main target audience is child care providers and educators, parents can freely access the resources available on ChildcareMAPP's website. Child care providers are encouraged to share with parents information and resources, such as best practices in child care settings, that can be translated into homes.

Below is a list of strategies ChildCareMAPP developed for use by child care providers in communicating with parents about helping their children develop healthy eating habits:

- Teach the family to recognize their child's eating behaviors and help them determine what to look for when a child is eating according to his or her own feelings of hunger and fullness.
- Ask about a family's dreams for their child's health. Listen to their dreams for their child's short-term health and long-term health.
- Talk with families about the closeness of families and its impact on children in early childhood. Discuss the child's most supportive family member and how he or she can allow a child to listen to internal cues of hunger and fullness.
- Explain to families why you set out specific foods and utensils and what you expect the children to do with the foods or utensils. Explain your center's strategies for helping children to stay in touch with their feelings of hunger and fullness.
- Take notes on what happens with children's eating and mealtime skills in your program. Include the child's preferences, attempts at trying new foods or serving skills, and progress over time. Share what you learn with families often. Also, document the child's eating skills, which include judging amounts to serve themselves, recognizing hunger and fullness cues, pouring from pitchers, choosing how much to put in their mouths so they can chew and swallow comfortably and without choking, using utensils, choosing what to eat, trying unfamiliar foods, and eating a variety of foods.

SOURCE: http://www.cals.uidaho.edu/feeding/fortrainers/handouts/pdf/PWP1_Talking_with_Families_about_ Healthy_ Weight.pdf (accessed May 9, 2011).

Potential actions include

- for children that qualify, the U.S. Department of Agriculture and state agencies maximizing participation in federal nutrition assistance programs serving children from birth to age 5, including the Special Supplemental Nutrition Program for Women, Infants, and Children, the Child and Adult Care Food Program, and the Supplemental Nutrition Assistance Program; and
- the federal government assisting state and local governments in increasing access to healthy foods.

Rationale

Federal nutrition assistance programs provide an existing infrastructure for supporting food access for low-income families, who are at greatest risk for food insecurity. The federal government funds several nutrition assistance programs that aim to prevent hunger and improve dietary quality among families with young children (Box 4-6). In 2008, the last year for which the data are available, the federal government spent $53 billion supporting federal nutrition assistance programs, including the Supplemental Nutrition Assistance Program (SNAP), WIC, and other child nutrition programs (Kimbro and Rigby, 2010). It is possible that participating in programs that subsidize nutritious foods and meals may reduce obesity risk among young children (Kimbro and Rigby, 2010), although these results have not been replicated. Yet while the link between food insecurity and obesity risk in children is unclear (IOM, 2011b), evidence of the numerous impacts of food insecurity on other aspects of cognitive and behavioral development are sufficient to support these efforts. Many who are eligible for these benefits do not receive them: more than one-third of those eligible for SNAP and 40 percent of those eligible for WIC do not participate (White House Task Force on Childhood Obesity, 2010). Increasing the participation of all eligible families in these programs is essential to maximize the accessibility of nutritious foods and improve dietary quality, especially among low-income and minority families.

Participation in federal nutrition assistance programs benefits the diets and health of young children (Bitler et al., 2003; Stang and Bayerl, 2010; VerPloeg et al., 2009). Children whose families participate in SNAP consume diets that align more closely with the diets of the general U.S. population than do those of nonparticipating low-income children (Cole and Fox, 2008). Likewise, children attending child care centers that participate in the CACFP consume a more nutri-

Box 4-6
U.S. Nutrition Programs That Can Promote Healthier Eating

The U.S. Department of Agriculture's Food and Nutrition Service oversees nutrition programs. They include the following:

- The **Supplemental Nutrition Assistance Program** (SNAP, formerly the Food Stamp Program) provides funds via an EBT (electronic benefit transfer) card that can be used to purchase food at most grocery stores and some other food stores and markets.
- The **Special Supplemental Nutrition Program for Women, Infants, and Children,** better known as the WIC Program, provides assistance to low-income women, infants, and children up to age 5 who are at nutritional risk by supplying vouchers for the purchase of nutritious foods to supplement their diets, information on healthy eating, and referrals to health care.
- The **National School Lunch Program** provides cash subsidies and donated commodities to school districts and independent schools that choose to take part in the program. In return, they must serve lunches that meet federal requirements, and they must offer free or reduced-price lunches to eligible children.
- The **School Breakfast Program** operates in the same manner as the National School Lunch Program.
- The **Fresh Fruit and Vegetable Program** provides free fresh fruits and vegetables in selected low-income elementary schools nationwide.
- The **Summer Food Service Program** provides free, nutritious meals and snacks to help children in low-income areas get the nutrition they need throughout the summer months when they are out of school.
- The **Child and Adult Care Food Program** is a nutrition education and meal reimbursement program helping providers serve nutritious and safely prepared meals and snacks to children and adults in day care settings.
- The **Farmers' Market Nutrition Program** provides fresh fruits and vegetables from local, certified farmers' markets to WIC recipients.
- The **Emergency Food Assistance Program** makes commodity foods available to states. States provide the food to local agencies, usually food banks, which in turn distribute it to soup kitchens and food pantries that directly serve the public.

SOURCE: USDA, 2011.

tious diet than children in non-CACFP centers and low-income children who bring meals from home (Bruening et al., 1999; Whitaker et al., 2009). Because many young children routinely spend time in out-of-home care, they consume a substantial proportion of their meals and snacks in child care settings. The CACFP allows child care providers to serve healthy foods and give children opportunities to learn positive food behaviors, which are an important part of their development in this environment. Young children need opportunities to explore and try healthy foods (Birch and Marlin, 1982; Birch et al., 1998; Sullivan and Birch, 1994). Learning about different foods and seeing others eat them are conducive to children's willingness to try and accept new foods, an important part of their early exploratory development.

Community efforts to enhance access to affordable nutritious foods, specifically fruits and vegetables, also should be supported. Low-income families spend significantly less on fruits and vegetables relative to higher-income families, and are more likely to purchase no fruits or vegetables in a given week (Blisard et al., 2004; Sturm and Datar, 2005). Low-income families also eat fewer total vegetables, dark green and orange vegetables, legumes, and whole grains than higher-income families (Guenther et al., 2008). Whether this differential is related to the lack of access in their neighborhoods or to the relatively high cost of fruits and vegetables has not been established (Lovasi et al., 2009). It is known, however, that disparities exist in access to fruits and vegetables in low-income communities as compared with middle- and high-income communities. Many low-income families live in neighborhoods in which nutritious foods are not easily available. If local markets do sell whole grains, fruits, vegetables, and low- or nonfat milk and other dairy products, their cost often puts these products out of reach for a family of limited means. These "food deserts" in low-income communities (Ver Ploeg et al., 2009) are associated with higher rates of obesity (Lovasi et al., 2009).

Establishing supermarkets and grocery stores in low-income neighborhoods increases access to healthy foods, including fresh fruits and vegetables, at lower cost (Story et al., 2008). Farmers' markets and mobile fruit stands also can increase access to fruits and vegetables in low-income communities. Box 4-7 describes an effort undertaken by New York City to increase access in underserved communities by licensing 1,000 Green Carts to sell reasonably priced fresh fruits and vegetables in its poorest neighborhoods.

Box 4-7
Green Carts: Increasing Access to Fresh Fruits and Vegetables in Low-Income Urban Neighborhoods

The New York City Department of Health and Mental Hygiene (NYCDOHMH) launched a Green Cart initiative in 2007. The purpose of this project was to increase access to affordable fresh fruits and vegetables in high-risk neighborhoods in New York City. These neighborhoods have high child and adult obesity rates and have limited access to stores that sell a variety of fresh produce.

Green Carts, which are easily recognized with their colorful umbrellas, are mobile food carts that sell only fresh produce. The fruits and vegetables must be sold raw, and only whole fruits and vegetables may be sold. Frozen and processed produce cannot be sold at Green Carts.

NYCDOHMH made provisions to approve 1,000 permits for Green Carts. Cart owners must register for, and be granted, a permit to operate a Green Cart. This permit identifies a neighborhood in which the Green Cart can sell produce; the exact location of the cart and its hours of service are determined by the operator. New York City received a grant from a private foundation that allows vendors to apply for reduced-interest loans to cover startup costs and receive free technical assistance on setting up a Green Cart business. Many neighborhood businesses and organizations have offered assistance as well, such as by providing a site in which a vendor can set up his or her Green Cart, assistance with cart storage and cleaning, referrals of clients, healthy recipes to offer customers, connections to local farmers and fruit and vegetable vendors, and facilities for produce storage.

NYCDOHMH is conducting a multiyear evaluation of the Green Cart initiative. Thus far, data have been collected at baseline and 1 year after the start of the program. Fewer than 200 of an eventual 1,000 carts had been permitted before year 1 data were collected. Nonetheless, those data documented increases in fruit and vegetable availability in both Green Cart and comparison neighborhoods. Future data will be needed to truly understand the impact of the Green Cart program on fruit and vegetable availability in low-income New York City neighborhoods.

SOURCE: NYCDOHMH Green Carts, http://www.nyc.gov/html/doh/html/cdp/cdp_pan_green_carts.shtml (accessed June 13, 2011).

GOAL: HELP ADULTS INCREASE CHILDREN'S HEALTHY EATING

Recommendation 4-6: Health and education professionals providing guidance to parents of young children and those working with young children should be trained and educated and have the right tools to increase children's healthy eating and counsel parents about their children's diet.

Rationale

As discussed previously, millions of young children spend substantial amounts of time in child care and early childhood education programs. The social and physical environments provided by these programs exert an important influence on children's diets. Those environments are established by the administrators, child care providers, and early childhood educators who design, manage, and deliver the programs. Thus, opportunities may exist for enhanced health promotion in these settings. Collaboration between pediatricians and early child care and education professionals has the potential to improve the breadth and effectiveness of such health promotion education (Gupta et al., 2005).

A survey of child care staff in five western states revealed that fewer than half of the responding centers allowed children to serve themselves (Sigman-Grant et al., 2008), although, as discussed earlier, this is recommended practice. The use of inappropriate feeding practices may be due to the fact that training in feeding young children for child care staff is limited, particularly in programs that do not participate in the CACFP. Child care health consultants who serve these centers receive little training in the basic nutrition and physical activity principles important to the promotion of healthy weight in children (Benjamin et al., 2008).

This recommendation is intended to ensure that health and education professionals are able to implement the recommendations on healthy eating in this report. Such training can take different forms. For example, degree programs in early childhood education and child development could include content on feeding young children. Ongoing staff development in child care settings could include training on planning healthy meals, serving as a role model for healthy eating, creating a healthy mealtime environment, and leading nutrition education activities for children. The IOM report on standards for the CACFP also recognizes the need for training and technical support for providers and suggests paths for developing their competencies and skills (IOM, 2011a).

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5
Marketing and Screen Time

GOALS:

- **Limit young children's screen time and exposure to food and beverage marketing.**
- **Use social marketing to provide consistent information and strategies for the prevention of childhood obesity in infancy and early childhood.**

The lives of young children are permeated by media (e.g., television, video games, mobile media, the Internet) (Harris et al., 2009a; IOM, 2006; Story et al., 2008; Vandewater et al., 2006, 2007). Preschool-age children, for example, watch 1 to 3 hours of television per day (Christakis and Garrison, 2009). For young children, decades of research provides strong evidence that "marketing works" to establish their food preferences, purchase requests, and (at least) short-term consumption (IOM, 2006). Substantial exposure to television (including any advertising) is associated with greater risk of overweight and later obesity, inactivity, decreased metabolic rate, and increased snacking (IOM, 2006; Jago et al., 2005; Kaphingst and Story, 2009; Story et al., 2008; Thompson et al., 2008). Limiting total screen time and improving content across the multiple environments where young children spend their time will reduce both their exposure to food

and beverage marketing and their risk of early childhood obesity (Moore, 2006; Pempek and Calvert, 2009; Swinburn and Shelly, 2008).

Accordingly, this chapter is focused on two goals. The first is to limit the exposure of young children to media and food marketing, as well as to improve voluntary standards for marketing foods and beverages to young children. The second is to provide consistent information and strategies to parents and other caregivers on how to prevent childhood obesity and promote healthy child development through a long-term, robust program of social marketing. In 2001, the American Academy of Pediatrics (AAP) issued a statement regarding media use and children, as well as a guideline recommending no television viewing for children under 2 years of age (AAP, 2001). This age recommendation is consistent with neurodevelopmental research showing that significant brain development is completed in response to environmental stimuli over the first 18–24 months of life (Christakis, 2009). Yet despite these recommendations, there has been an explosion of television programming geared specifically toward infants and preschoolers, generating sales of nearly $100 million in 2004 (Anderson and Pempek, 2005; Khermouch, 2004; Mendelsohn et al., 2008; Wartella et al., 2005). In fact, a recent Kaiser Family Foundation report showed that 61 percent of children younger than 2 years of age are exposed to television and spend approximately 1 hour 20 minutes daily in this activity (Rideout and Hamel, 2006). Further, a reported 30 percent of children aged 0–3 and 43 percent of those aged 4–6 have a television in their bedroom (Kaiser Family Foundation, 2005).

Research is limited on the impact of media exposure on very young children. Several factors account for the dearth of research, including methodological challenges specific to this age group, a lack of federal funding priority, and difficulty in defining and assessing attention to content (Anderson and Pempek, 2005; Christakis et al., 2004; Kaiser Family Foundation, 2005). Evidence is limited in particular for children aged 0–2 and for "new" media, such as social networking media and the Internet.

GOAL: LIMIT YOUNG CHILDREN'S SCREEN TIME AND EXPOSURE TO FOOD AND BEVERAGE MARKETING

Recommendation 5-1: Adults working with children should limit screen time, including television, cell phones, or digital media, to less than 2 hours per day for children aged 2–5.

Potential actions include

- child care settings limiting screen time, including television, cell phones, or digital media, for preschoolers (aged 2–5) to less than 30 minutes per day for children in half-day programs or less than 1 hour per day for those in full-day programs;
- health care providers counseling parents and children's caregivers to permit no more than a total of 2 hours per day of screen time, including television, cell phones, or digital media, for preschoolers, including time spent in child care settings and early childhood education programs;
- health care providers counseling parents to coordinate with child care providers and early childhood education programs to ensure that total screen time limits are not exceeded between at-home and child care or early education settings; and
- state and local government agencies providing training, tools, and technical assistance for child care providers, early childhood education program teachers and assistants, health care providers, and community service agency personnel in how to provide effective counseling of parents regarding the importance of reducing screen time for young children.

Rationale

The recommended limitation on screen time for children aged 2–5 is related to two different factors, both of which have the potential to contribute to childhood obesity: the food and beverage marketing the child may experience when watching television or interacting with other media, and the amount of screen time to which a child is exposed. Young children are exposed to high levels of food marketing and advertising designed to foster brand loyalty and influence purchasing behavior (Elliott, 2008; Harris et al., 2009a,b; IOM, 2006; Kovacic et al., 2008). Television advertising influences children to prefer and request high-calorie and low-nutrient foods and beverages (IOM, 2006). Conservative estimates suggest that U.S. expenditures for food marketing to children aged 2–17 through television, the Internet, radio, packaging, in-store promotions, video games, and text messages reach $1.6 billion per year (Kovacic et al., 2008). According to a Federal Trade Commission (FTC) Bureau of Economics Report, children aged 2–5 are exposed to approximately 25,000 advertisements annually, about 5,400 of which are for food (FTC, 2007).

There have been industry efforts to address this issue. A self-regulatory advertising initiative by 17 major food and beverage companies has set company-specific standards for products marketed to children younger than age 12 (CBBB, 2010). Their reports show good compliance with individual company standards, significant product reformulation (e.g., less sugar added to cereals), and a reduction in initiativewide food advertising to children since 2006 (CBBB, 2008, 2009). At the same time, other researchers, using common nutrition standards for all foods, report that overall food marketing on television continues to be mainly for products high in calories, added sugars, and fat (Kunkel, 2009; Yale Rudd Center for Food Policy and Obesity, 2010).

Children below the age of 5 and probably up to age 8 do not recognize the persuasive intent of commercial advertising or even understand what advertising is; they tend to interpret advertising claims as accurate (Harris et al., 2009b). They also are attracted to brands they associate with media characters, products, and brand logos (Elliott, 2008; Schor and Ford, 2007; Stitt and Kunkel, 2008). Marketing on television influences their food beliefs and preferences, purchase requests to parents, short-term consumption, and usual dietary intake (IOM, 2006; Story et al., 2008). Moreover, according to the Institute of Medicine (IOM) report *Food Marketing to Children and Youth: Threat or Opportunity* (IOM, 2006), there is strong evidence that exposure to television advertising is associated with adiposity in children aged 2–11. Young children spend a large portion of their day in child care settings, and their environment should not promote television viewing or marketing of calorie-dense, nutrient-poor foods, beverages, and brands.

The amount of time young children are exposed to media also is important. Children experience the cumulative effects of various forms of screen time across settings of care (Kaiser Family Foundation, 2003; Miller et al., 2008; Swinburn and Shelly, 2008; Viner and Cole, 2005; Zimmerman et al., 2007). In the typical American home, the television is on approximately 6 hours per day (Vandewater et al., 2005). Moreover, Christakis and Garrison (2009) found that children in home-based child care settings are exposed to 1.84 more hours of television than those in center-based programs (infants: 0.2 versus 0 hours; toddlers: 1.6 versus 0.1 hours) (Christakis and Garrison, 2009). Young children's screen time exposure may be underestimated across settings of care (Lee et al., 2009; Vandewater et al., 2006, 2007). Accordingly, child care providers should include the amount of screen time to which a child was exposed during the day in their daily activity reports to the child's parents.

Substantial television viewing (more than 2 hours per day) has been shown to be significantly associated with increased body mass index (BMI) (Jago et al., 2005; Proctor et al., 2003) and body fatness (Jackson et al., 2009; Janz et al., 2002; Proctor et al., 2003) in young children. Research has found that children aged 2–5 who watch more than 2 hours per day of television/videos are significantly more likely to be overweight or obese than those who do not (Mendoza et al., 2007).

Likewise, in a longitudinal study of preschool-age children who were followed for 8 years, Proctor and colleagues (2003) found that young children who watched television 3 or more hours per day had significantly higher BMI, triceps skinfold, and sum of five skinfolds than children who watched television less than 1.75 hours per day. Jackson and colleagues (2009) found that each extra hour of television viewing was associated with an extra 1 kg of body fat.

Major federal government initiatives have concluded that screen time is related to weight outcomes and to adequacy of physical activity, but their definition of screen time is not limited to media that contain food advertising. The Centers for Disease Control and Prevention's (CDC's) Task Force on Community Preventive Services recommends behavioral interventions aimed at reducing screen time based on "sufficient evidence of effectiveness for reducing measured screen time and improving weight-related outcomes." Screen time is defined as "time spent watching TV, videotapes, or DVDs; playing video or computer games; and surfing the internet." In identifying research gaps, the task force points out that important research issues remain, including that "additional research is needed to identify how screen time affects health outcomes." One of the task force's research questions is: "What is the mechanism for screen time being associated with weight-related outcomes?" (Community Guide, 2010).

Healthy People 2020 (HHS, 2010) positions screen time as a direct competitor with adequate physical activity in children from birth to 12th grade. Key physical activity objectives recommended by Healthy People 2020 include increasing the proportion of children aged 0 to 2 years who view no television or videos on an average weekday; increasing the proportion of children and adolescents aged 2 through 12th grade who view television and videos or play videogames for less than 2 hours a day; and increasing the proportion of children and adolescents aged 2 through 12th grade who use a computer or play computer games outside of school (or for nonschool work) for less than 2 hours a day,

The AAP (2001) recommends limiting children's total media time to no more than 1 to 2 hours of quality programming per day and discouraging television viewing for children younger than 2 years of age. Yet a recent study suggests

that more than a third of health care providers fail to discuss television guidelines with parents (Spivack et al., 2010). Health care providers are important sources of information for parents. They should consistently recommend limitations on young children's screen time exposure and encourage parents to ask child care providers about the amount of screen time that occurred during the day for their child.

Although the committee thought it reasonable to assume that the relationship between screen time and obesity among children aged 2–5 is similar to that among children aged 0–2, the evidence about this relationship was insufficient for the committee to make an obesity prevention recommendation for the latter age group. The committee notes, however, that evidence unrelated to obesity (e.g., about cognitive development) has led others to raise concern about any screen time in this age group. Thus the committee believes that discouraging screen time in this age group may be important for other reasons, as noted by the AAP (2001).

Recommendation 5-2: Health care providers should counsel parents and children's caregivers not to permit televisions, computers, or other digital media devices in children's bedrooms or other sleeping areas.

Rationale

The presence of a television in a child's bedroom that is on for more than 2 hours per day is a risk factor for becoming overweight by age 3 (Swinburn and Shelly, 2008). As noted earlier, televisions in the bedrooms of young children are common. Parents should receive consistent counseling regarding the impact of screen time on their children's sedentary behavior, dietary intake, and risk for obesity and the pediatric media recommendations of the AAP (Gentile et al., 2004; Taveras et al., 2010).

Among one diverse sample, 67 percent of all children had a television in the room where they slept, including 70 percent of black, 74 percent of Hispanic, and 22 percent of white children. Parents place a television in their child's bedroom to keep the child occupied, to help the child sleep, and to free up other televisions for use by family members (Taveras et al., 2009). Young children with a television in their bedroom are more likely to experience higher levels of television viewing with an increased risk of unsupervised screen time (Kumanyika and Grier, 2006; Swinburn and Shelly, 2008). As discussed under the previous recommendation, substantial television viewing is associated with increased BMI in young children.

Recommendation 5-3: The Federal Trade Commission, the U.S. Department of Agriculture, the Centers for Disease Control and Prevention, and the Food and Drug Administration should continue their work to establish and monitor the implementation of uniform voluntary national nutrition and marketing standards for food and beverage products marketed to children.

Rationale

As previously discussed in this chapter, television advertising has been shown to influence children to prefer and request high-calorie and low-nutrient foods and beverages, and there is strong evidence that exposure to television advertising is associated with adiposity in children aged 2–11.

The food and beverage industry at best has used a variety of differing nutrition standards in marketing products and brands targeting children, including current self-regulatory systems (CBBB, 2010). Such varying standards, or the absence of any marketing standards, create a confusing food marketing environment for parents and children and make it difficult for parents to rely on marketing claims or make healthy product choices for their children, even with some improvements in product formulation (CBBB, 2010; Kunkel, 2009; Yale Rudd Center for Food Policy and Obesity, 2010). Because "marketing works" to impact the food preferences, purchase requests, and consumption of parents and children (IOM, 2006), uniform voluntary standards for nutrition and marketing of products targeting children could help them make better choices.

An evaluation of stakeholders' progress in achieving the recommendations in the IOM report *Food Marketing to Children and Youth: Threat or Opportunity* (IOM, 2006), however, shows little progress (Wartella, 2011). The Interagency Working Group on Food Marketed to Children (2011), which includes representatives from the FTC, CDC, the Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA), has released "Preliminary Proposed Nutrition Principles to Guide Industry Self-Regulatory Efforts" and requested public comment from stakeholders. Such standards will provide clear guidance for industry and consumers about foods and beverages marketed to children. In addition, once the voluntary standards have been established, the FTC should launch an ongoing annual monitoring program to assess voluntary and uniform compliance with the standards and their effectiveness in improving food and beverage marketing to children. Embedded in this recommendation is the committee's expectation that the food industry will adopt the voluntary standards quickly and uniformly.

GOAL: USE SOCIAL MARKETING TO PROVIDE CONSISTENT INFORMATION AND STRATEGIES FOR THE PREVENTION OF CHILDHOOD OBESITY IN INFANCY AND EARLY CHILDHOOD

Recommendation 5-4: The Secretary of Health and Human Services, in cooperation with state and local government agencies and interested private entities, should establish a sustained social marketing program to provide pregnant women and caregivers of children from birth to age 5 with consistent, practical information on the risk factors for obesity in young children and strategies for preventing overweight and obesity in this population.

Rationale

Parents' and other caregivers' work is hard and constant—never more so than during pregnancy and children's early years. A large-scale social marketing program, sustained over time and offering consistent and practical guidance, could help parents undertake actions, behaviors, and ongoing parenting practices that can help prevent obesity and support healthy development in their children. Such a program also could direct parents to complementary and reinforcing information and guidance provided in health care settings and community service agencies (Asbury et al., 2008; IOM, 2006). Some examples of potential core messages for such a campaign are listed in Box 5-1.

Social marketing is defined as using commercial marketing principles (such as the four "Ps" of place, price, product, and promotion) to benefit society and the target audience (Evans et al., 2010). Effective social marketing includes sequenced action steps that demonstrate benefits and reduce barriers for specific audiences through consumer decision making, leading to increased societal benefit (Smith, 2006). Social marketing interventions may be able to impact a variety of health and risk behaviors through one campaign; for example, a campaign may target increasing fruit and vegetable consumption at the same time that it targets behaviors to decrease fat intake (Stead et al., 2007).

Social marketing interventions can produce changes across a relatively broad spectrum of behaviors. Successful social marketing programs include those targeting oral health, reduced alcohol use, smoking cessation, and seat belt use (Smith, 2006; Snyder et al., 2004). Key elements of the most successful campaigns include specific behavioral goals of the intervention, target populations, communication activities and channels, message content and presentation, and techniques for feedback and evaluation (Smith, 2006).

Box 5-1
Examples of Potential Core Messages for a Social Marketing Program on Preventing Obesity in Young Children

- Set healthy routines for your family (offer healthy foods and diet, eat together, promote physical activity, set regular sleep times, limit screen time).
- Establish healthy places for your child at home or away (make healthy food and physical activity choices the easy choices in these environments).
- Move with your child (encourage, model, and join in physical activity).
- Eat with your child (model healthy eating, and encourage the child to respond to hunger and fullness cues).
- Get everybody on the same page (talk to your family members, child care provider, health care provider, early childhood education program, and community service agencies about how to prevent childhood obesity).

Because overweight and obesity are now prevalent throughout society and because concern about overweight status can be culturally counterintuitive, an effective social marketing program should be long term as well as robust and accessible. Examples of long-term social marketing campaigns aimed at adults that have proven effective over time include smoking cessation and seat belt use (Smith, 2006). Of course, unlike tobacco and seat belt use, obesity presents the additional challenge of maintaining balance between the need to eat and overeating.

Costs associated with an effective long-term social marketing program will be significant. As an example, CDC's VERB campaign[1] had average annual funding of about $60 million, starting with $125 million the first year and decreasing each year thereafter. The VERB campaign provided evidence that the development of a national media campaign with social marketing messages for children can have a demonstrable impact on physical activity (Asbury et al., 2008; Banspach, 2008; Huhman et al., 2010). VERB was successful in part because resources were

[1]See http://www.cdc.gov/youthcampaign/index.htm.

allocated up front for planning a successful campaign by developing a brand that resonated with the target market, children aged 9–13. Although less money was available the following years, the campaign was able to continue being effective because it was built on what had been done in the first year (Wong, 2011). Moreover, when trying to reach large numbers of people, media campaigns are more cost-effective than interpersonal communication methods, such as clinic-based education (Snyder, 2007; Snyder et al., 2004).

The use of lower-cost digital media as an important part of the program can help limit costs and make the program more effective and responsive to individual parental requests for information. Coordination of the social marketing efforts with health care providers and community service agencies can add substantially to cost-effectiveness (Snyder et al., 2004). It is important to emphasize that the cost of a successful social marketing campaign may represent only a small fraction of the increasing health care costs associated with obesity each year. The value in human terms of preventing overweight and obesity in childhood is incalculable.

Social marketing programs can be effective for disseminating information that can help parents and caregivers who directly influence the health of young children (Grier and Kumanyika, 2010; Kumanyika and Grier, 2006). Yet research conducted over the past two decades indicates that today's health information is not presented in a usable, understandable format for most people (White House Task Force on Childhood Obesity, 2010). Caregivers in particular lack accurate information about nutrition and physical activity for young children that is communicated consistently in a clear and actionable way (HHS, 2010).

The 1% Or Less Milk campaign (Reger et al., 1998), CDC's VERB campaign, and the 5-4-3-2-1 Go! campaign[2] in Chicago are examples of social marketing programs that have been used to promote good nutrition and increased physical activity levels. These programs targeted parents, in addition to children, to encourage them to have a healthier family and home environment. Programs such as these often use a combination of approaches involving community outreach and mass media (Evans et al., 2010). Messages aimed at parents can address risk factors such as television watching, interactions with children that can alter preferences, and patterns of behavior consistent with healthy child development (Evans et al., 2008, 2010). Caregivers also can be reached with targeted social marketing messages about food preferences and choices, exercise, and healthy weight.

[2]See http://www.clocc.net/partners/54321Go/index.html.

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6

Sleep

GOAL: Promote age-appropriate sleep durations among young children.

The obesity epidemic has been paralleled by a similar epidemic of sleep deprivation. Over the past 40 years, daily sleep duration among adults has decreased by 1–2 hours, and the proportion of adults getting less than 7 hours of sleep has more than doubled, from 15 percent to 39 percent (NSF, 2008). Evidence also suggests a decrease in sleep duration across infancy, childhood, and adolescence ranging from 30 to 60 minutes over the past 20 years, due largely to later bedtimes, with the most pronounced decreases seen among children under 3 years of age (Dollman et al., 2007; Iglowstein et al., 2003). Recent studies also suggest that the quality of sleep among young children is too often compromised (NSF, 2008) and that pediatric sleep disturbances frequently become chronic, with few children outgrowing the problem (Kataria et al., 1987; Pollock, 1994). As with obesity, racial/ethnic minority populations in particular experience insufficient sleep across their life span, starting in infancy (Nevarez et al., 2010) and continuing into childhood (Spilsbury et al., 2004) and adulthood (CDC, 2009; Lauderdale et al., 2006).

Mounting epidemiologic evidence indicates that short duration of sleep is a risk factor for obesity, type 2 diabetes, coronary heart disease, hyperten-

sion, and all-cause mortality in adults independently of other measured risk factors (Ayas et al., 2003; Gangwisch et al., 2006; King et al., 2008; Patel and Hu, 2008; Williams et al., 2007). A similar inverse association between sleep duration and obesity has been observed in cross-sectional studies of older children and adolescents (Chaput et al., 2006; Eisenmann et al., 2006; Kagamimori et al., 1999; Sekine et al., 2002; von Kries et al., 2002) and increasingly in longitudinal studies, including those of infants and children under age 5 (Agras et al., 2004; Bell and Zimmerman, 2010; Landhuis et al., 2008; Reilly et al., 2005; Snell et al., 2007; Taveras et al., 2008). Nonetheless, several aspects of the relationship between sleep and obesity are not yet sufficiently understood to inform clear policy recommendations beyond those that support the promotion of age-appropriate sleep durations. This chapter summarizes the evidence linking insufficient sleep to childhood obesity and provides recommendations to support the goal of promoting age-appropriate sleep durations for young children. To support and complement the first recommendation on requiring child care providers to adopt practices that promote age-appropriate sleep durations, the second recommendation addresses training for health and education professionals on how to counsel parents about this issue.

Recommendation 6-1: Child care regulatory agencies should require child care providers to adopt practices that promote age-appropriate sleep durations among young children.

Potential actions include

- creating environments that ensure restful sleep, such as no screen media in rooms where children sleep and low noise and light levels during napping;
- encouraging sleep-promoting behaviors and practices, such as calming nap routines;
- encouraging practices that promote child self-regulation of sleep, including putting infants to sleep drowsy but awake; and
- seeking consultation yearly from an expert on healthy sleep durations and practices.

Recommendation 6-2: Health and education professionals should be trained in how to counsel parents about their children's age-appropriate sleep durations.

Rationale

Evidence suggests that among children under 2 years of age, 12 or more hours of sleep in a 24-hour period is protective of obesity at age 3. Among children aged 2–5, 11 or more hours of sleep has been found to be associated with lower obesity risk. Age-appropriate sleep durations from the National Sleep Foundation include (NSF, 2011)

- newborns, less than 3 months: 10.5–18 hours in a 24-hour period;
- infants, 3 months to <12 months: 9–12 hours during the night and 30-minute to 2 hour naps one to four times a day;
- toddlers, 1 year to <3 years: 12–14 hours in a 24-hour period; and
- preschoolers, 3 years to <5 years: 11–13 hours in a 24-hour period.

Evidence suggests an inverse association between sleep duration and obesity in children (Agras et al., 2004; Bell and Zimmerman, 2010; Landhuis et al., 2008; Reilly et al., 2005; Taveras et al., 2008). All published studies have reported an association between shorter sleep duration and increased obesity risk in children across the pediatric age range (Cappuccio et al., 2008; Chen et al., 2008; Patel and Hu, 2008).

One of the largest studies involved a Japanese birth cohort of 8,274 children. At ages 6 to 7, the odds ratios for obesity were 1.49, 1.89, and 2.87 for those sleeping 9–10, 8–9, and less than 8 hours, respectively, compared with those obtaining at least 10 hours of sleep and after adjusting for sex, parental obesity, and other lifestyle factors (Sekine et al., 2002). Similar findings have been reported from Portugal (Padez et al., 2005), Spain (Vioque et al., 2000), France (Locard et al., 1992), and Germany (von Kries et al., 2002). Prospectively, a UK study of 8,234 children showed that sleep duration at age 38 months predicted obesity at age 7, with odds ratios of 1.45, 1.35, and 1.04 for children sleeping less than 10.5, 10.5–10.9, and 11.0–11.9 hours, respectively, compared with those sleeping at least 12 hours (Reilly et al., 2005). In another study, 4-year-old children who slept less than 10.5 hours per weekday night had elevated odds of obesity compared with children who slept at least 10.5 hours (Anderson and Whitaker, 2010). Short sleep duration has been associated with increased television viewing and reduced participation in organized sports (Locard et al., 1992; Taveras et al., 2008; von Kries et al., 2002).

Poor sleep routines have also been associated with obesity in children. In one study, irregular sleeping habits between 2 and 4 years of age were associated

with elevated body mass index (BMI) and prevalence of obesity at age 21 (Mamun et al., 2007).

Three longitudinal studies have examined the relationship between insufficient sleep during infancy and early childhood and later weight gain. In a study of 915 children aged 0–3, infant sleep of less than 12 hours per day was associated with higher BMI Z-score, higher adiposity, and increased odds of obesity (Taveras et al., 2008). In a second study, parental reports of sleep duration were negatively correlated with weight for length at age 6 months (Tikotzky et al., 2010). Finally, Bell and Zimmerman (2010) found that for children younger than age 4 at baseline, short duration of nighttime sleep was strongly associated with increased risk of overweight or obesity at follow-up. Daytime napping was not a substitute for nighttime sleep and had little effect on obesity risk. Bell and Zimmerman also found that sleep duration was not associated with subsequent weight status among children who were older at baseline (e.g., aged 5–13). These studies among young children suggest that early childhood is a developmental period when sleep behaviors may particularly influence obesity risk.

Insufficient sleep may affect obesity and metabolic dysfunction through a variety of pathways. Short-term experimental studies in adults show that sleep restriction is associated with physiologic mechanisms that may increase the risk of adiposity and cardio-metabolic disorders (Patel and Hu, 2008). Basic laboratory studies of experimental sleep restriction have shown effects that include increases in hunger and appetite scores, increased snacking, reduced leptin, and insulin resistance (Nedeltcheva et al., 2009; Spiegel et al., 2004a,b). Sleep restriction also has been associated with elevated sympathovagal balance; hypercortisolemia (Spiegel et al., 2004a); elevated C-reactive protein; and increased secretion of pro-inflammatory cytokines (Vgontzas et al., 2004), which may relate to the association between short sleep duration and adverse cardio-metabolic outcomes, including hypertension (Gottlieb et al., 2006) and insulin resistance.

A few studies suggest that sleep curtailment may increase energy intake through influences on eating behavior and diet. In one study of normal-weight adults, for example, short sleep duration was found to be associated with increased hunger and greater desire to eat calorie-dense foods with high carbohydrate content (Spiegel et al., 2004b). Sleep restriction also may lead to increased time spent in sedentary activities, such as television viewing, when snacking is common (Sivak, 2006). In addition, chronic sleep deprivation can lead to feelings of fatigue, which may lead to reduced physical activity (Patel and Hu, 2008). Studies in humans suggest further that circadian misalignment can contribute to

metabolic dysfunction (Scheer et al., 2009). Molecular circadian clocks exist in almost all tissues and contribute to the coordination of gene transcription involved in a range of metabolic processes (Ko and Takahashi, 2006). Studies show that central and peripheral circadian molecular clocks interact to achieve appropriate internal alignment of metabolic signaling, as well as external alignment of cellular processes with the environment.

The existing literature on this subject has important limitations. Most of the studies examining mechanisms relating sleep and adverse outcomes have been conducted among adults, and most but not all (Chaput et al., 2008; Taheri et al., 2004) of them rely on short-term experimental work.

The early childhood period is a time when sleep problems are highly prevalent (Sadeh and Sivan, 2009), and are associated with multiple adverse outcomes for the child, including obesity (Taveras et al., 2008; Thunstrom, 1999, 2002), and with maternal depression and parenting stress (Wake et al., 2006). While much is known about the role of parental behavior and cognition in influencing infant sleep, less is known about the social and environmental context (Sadeh et al., 2010; Tikotzky and Sadeh, 2009). Poor sleep among children may be due to primary sleep disorders such as sleep apnea. Most commonly, however, poor sleep is due to a host of behavioral and environmental factors, collectively referred to as "poor sleep hygiene" (Mindell et al., 2009). These include sleep habits that reduce sleep quality and impair sleep duration, such as irregular bed and wake times, use of caffeine or other stimulating substances before bedtime, inappropriate napping habits, engagement in stimulating or stressful activities close to bedtime, and sleep environments that are uncomfortable or disruptive. Reduced childhood sleep also reflects differences in parental behavior (Acebo et al., 2005; Sadeh et al., 2007, 2009; Tikotzky and Sadeh, 2009) and environmental exposures, including the presence of a television in the bedroom (Mindell et al., 2009).

In addition to obesity, insufficient sleep and secondary daytime sleepiness may impact neurocognitive functioning; increase behavioral problems, including aggression; and affect mood (Cao and Guilleminault, 2008; Gregory et al., 2008). During the past 15 years, sleep researchers have shown that sleep disorders can lead to a clinical presentation that mimics attention-deficit/hyperactivity disorder (Chervin et al., 1997, 2003). In addition, Gregory and colleagues (2008) observed more than 2,000 children aged 4–16 and later at ages 18–32 and found a strong link between sleep problems and the development of behavioral difficulties later in life.

Box 6-1
Case Study: Sleeping and Intake Methods Taught to Infants and Mothers Early in Life (SLIMTIME)

SLIMTIME was a pilot study of 160 mother–infant dyads. With a 2 x 2 design, 160 dyads were randomized into one of four treatment cells to receive two, one, or no interventions delivered during two nurse home visits. The first intervention ("Soothe/Sleep") was delivered by a research nurse at the first home visit, which occurred between 2 and 3 weeks after birth. Parents randomized to receive the "Soothe/Sleep" intervention were taught alternatives to feeding as an indiscriminate first response to infant distress. The use of alternative soothing techniques afforded nonhungry infants opportunities to experience being soothed without being fed and to learn to self-soothe and return to sleep without a feeding. In addition to one-on-one instruction, participating mothers were given an instructional handout and a commercially produced video, "The Happiest Baby on the Block." The video details a process to help calm and soothe infants with strategies that can be applied during the day and at night when it is time for sleep. Briefly, the process includes instructions and demonstrations using five soothing techniques: (1) swaddling, (2) side or stomach position while awake, (3) shushing, (4) swinging, and (5) sucking. Other instructions included in the "Soothe/Sleep" intervention taught parents to emphasize day/night environmental differences and to respond to nocturnal awakenings with other soothing and care-taking responses, such as diaper changing before feeding. All study participants received a standard infant parenting book that included traditional advice on handling night awakenings, including feeding, rocking, and checking for a dirty diaper.

At 1 year, a significant effect of the intervention was seen on nocturnal sleep for predominantly breastfed infants, with breastfed dyads in the "Soothe/Sleep" groups showing significantly more sleep than controls ($P = 0.04$; see the figure on the next page). At 1 year, infants who had received both interventions had lower weight-for-length percentiles ($P = 0.009$) than the control group. This study suggests that a multicomponent behavioral intervention that includes sleep improvement may hold promise for long-term obesity prevention.

Despite the increasing evidence relating sleep duration and obesity, the urgent need to decrease the prevalence of childhood obesity, and the availability of efficacious behavioral interventions to prevent and treat childhood sleep problems (Mindell et al., 2006), few interventions have been undertaken to improve early childhood sleep to prevent obesity (Paul et al., 2011; Taveras

Box 6-1
Continued

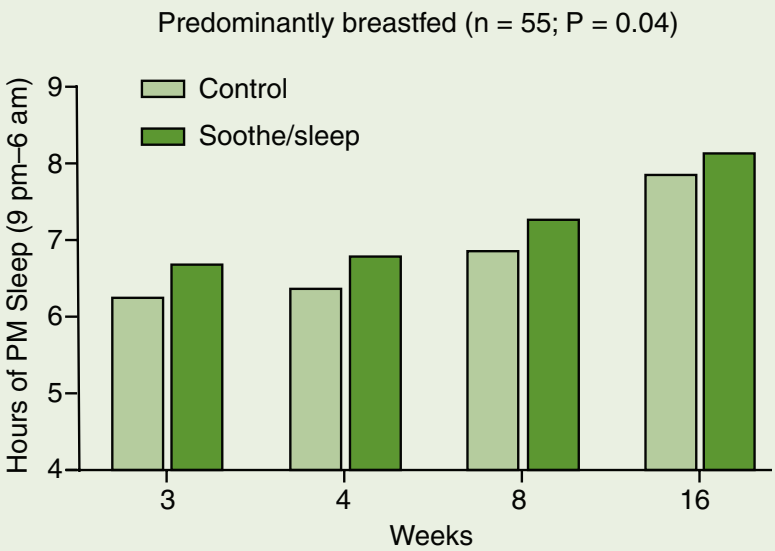

FIGURE 6-1 Effect of "Soothe/Sleep" intervention on nocturnal sleep duration among breastfed infants.
SOURCE: Paul et al., 2010.

et al., 2010). One study reviewed 52 behavioral treatment programs for bedtime problems and night waking. Mindell and colleagues (2006) found that behavioral therapies and preventive parental education on healthy sleep habits for children were efficacious in demonstrating clinically significant improvements in child sleep. The authors also call for more research to examine various delivery methods for treatment, develop objective measures of sleep duration, and establish the long-term efficacy of existing interventions. Two recent pilot interventions among mother–infant dyads in the first year of life have attempted to improve early childhood sleep to promote healthy infant growth and prevent overweight (Paul et al., 2011; Taveras et al., 2010). These two interventions are described in Boxes 6-1 and 6-2.

Box 6-2
Case Study: First Steps for Mommy and Me: A Pilot Intervention to Improve Sleep Behaviors of Postpartum Mothers and Their Infants

First Steps for Mommy and Me was a pilot intervention to assess the feasibility of a pediatric primary care–based intervention aimed at promoting healthy sleep behaviors among infants aged 0–6 months and their mothers. Sixty mother–infant pairs were assigned to the intervention groups and 24 to the control group. Mothers in the intervention groups received (1) brief focused negotiation by pediatricians, (2) motivational counseling by a health educator, and (3) group parenting workshops. They received developmentally appropriate counseling from their pediatrician and the health educator on ways to promote infant self-regulation of sleep, including avoiding sleep associations (e.g., putting infants in their crib drowsy but awake, avoiding relying on an external cue such as nursing for the infant to fall asleep); using alternative soothing methods for crying infants; and implementing healthy sleep habits, such as a calming bedtime routine.

At 6 months, compared with control infants, intervention infants had greater increases in their nocturnal sleep duration from baseline to follow-up (mean increase 1.9 versus 1.3 hours/day; $p = 0.05$); greater reductions in settling time (mean reduction –0.70 versus –0.10 hours/day; $p = 0.02$); and greater reductions in hours/day of nighttime wakefulness (mean reduction –2.9 versus –1.5 hours/day; $p = 0.08$). In addition, fewer intervention infants were in the highest quartile of weight-for-length Z-score at age 6 months (22 percent versus 42 percent; $p = 0.06$). The study findings suggest that the program of brief focused negotiation by pediatricians, individual coaching by a health educator using motivational interviewing, and group parenting workshops tended to improve infant sleep behaviors and that such a program may prevent excess infant weight gain.

SOURCE: Taveras et al., 2010.

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A

Methods

Formulation of policy recommendations calls for careful consideration of the evidence associated with one course of action or another. The Committee on Obesity Prevention Policies for Young Children carefully considered both direct and indirect evidence regarding the likely impact of a given policy on reducing childhood obesity. We also considered evidence pertaining to the potential for unintended adverse effects. Although we did not conduct a comprehensive, systematic evidence review on each important policy-related question, our collective expertise and consideration of the most pertinent studies yielded recommendations that are consistent with the evidence base. In areas in which the committee identified a need for additional information, outside experts were called upon at a public workshop held on June 2, 2010, in Washington, DC, titled "Emerging Issues, Programs, and Policy Needs in Early Childhood Obesity Prevention."

The ideal evidence to support policy recommendations would be a series of experimental studies testing the impact of various policies on childhood obesity in representative settings. Given the rarity of such studies and the urgent need to address the enormous health impacts of obesity, however, we could not restrict ourselves to making recommendations in the few areas in which such firm evidence exists. Observational studies are easier to conduct and thus far more common, and we gave strong studies of this type serious consideration. Although we recognize that conclusions regarding causality that can be drawn from such studies are less firm, we believe that evidence from

repeated, well-conducted observational studies can provide sufficient support for policy recommendations. We also were receptive to evidence that a policy would be likely to affect a determinant of childhood obesity even if not studied for its direct influence on obesity. That is, we recommend policy changes expected to increase physical activity or promote more healthy eating in children because such intermediate outcomes are themselves associated with prevention of childhood obesity.

Our recommendations are predicated on the belief, supported by evidence, that a change in the target of a policy will produce the desired change in obesity or its behavioral risk factors (e.g., a policy resulting in reduced consumption of soft drinks would contribute to obesity prevention). This belief reflects an informed judgment that considers the quality of the studies and the results they generate.

Another important consideration is the possibility that a policy intended to reduce childhood obesity could have unintended adverse consequences. For example, policies to promote physical activity among children must take into account the potential for increased risk of injury. Because many important developmental processes occur during gestation and early childhood, it is essential to be as certain as possible that none of the recommended policy changes could have irreversible adverse effects during these critical periods. Lacking direct evidence in most cases, we relied on more subjective consideration of the plausibility of such consequences. We also considered ways to mitigate potential adverse consequences, such as environmental design to reduce playground injuries among young children.

In the report we note the current state of the scientific evidence pertinent to the recommended policies, including both uncertainties and areas in which research is needed. Ultimately, our recommendations take full account of the scientific data but also reflect our collective best judgment. We have attempted to be consistent in our approach to combining scientific evidence and expert judgment, holding policy options to the same standards. The urgency of addressing obesity in young children requires taking action rather than waiting for more conclusive research—applying the "best available" rather than the "best possible" evidence. Research in this context includes studies of more effective means of implementing or enforcing policy changes to reduce childhood obesity. Some of our policy recommendations (or our unwillingness to make recommendations) fall on the cusp of the scientific evidence, barely or almost sufficient, and those are issues for which more research could well tip the balance in one direction or another.

As new policies to prevent childhood obesity are implemented, it is important that those policies be evaluated to (1) support further action where success can be demonstrated; (2) ensure that policies that fail to act in the intended manner are reconsidered; and particularly (3) assess any unintended adverse consequences. As new evidence emerges, it will be important to reexamine our policy recommendations and make any necessary revisions. Thus it is essential to act aggressively based on what is known now while putting in place the necessary processes for research and policy evaluation to ensure that action can be taken even more wisely and effectively in the future.

B
Emerging Issues in Early Childhood Obesity Prevention

There is growing interest in the potential role of exogenous agents—including chemical pollutants, drugs, and microorganisms—that may disturb metabolism in a manner that promotes obesity in young children. These agents are generally thought to be potentially influential through prenatal exposures, but could also be associated with exposures to the child. The committee does not view the evidence linking these agents to childhood obesity as sufficient to influence policy, but it is important to monitor the evidence in this area and promote research whose results could indicate that curtailing these exposures would reduce the risk of early childhood obesity.

Endocrine-disrupting chemicals in the environment have been hypothesized to increase the risk of obesity (Heindel and vom Saal, 2009; Newbold et al., 2008). This hypothesis suggests that these chemicals cause biologic changes in the systems that control adipose tissue development, ultimately causing offspring to be of higher body weight. The mechanisms, though poorly understood, are thought to be parallel to the pathways by which maternal metabolism during pregnancy and tobacco smoke are believed to program the fetus toward having a higher risk of obesity.

A range of drugs have been used in the livestock industry to enhance growth of farm animals (Heindel and vom Saal, 2009). The list of contenders for chemical "obesogens" is extensive, including drugs such as diethylstilbestrol and antithyroid medications and pollutants such as bisphenol A (BPA), phthalates, organophosphates, carbamates, PCBs (polychlorinated biphenyls),

DDT (dichlorodiphenyltrichloroethane), cadmium, and lead (Heindel and vom Saal, 2009; Newbold et al., 2008). Pollutants that act as endocrine disruptors include agents that are known to alter metabolism in experimental settings and may have analogous effects in adult humans, although there is no direct evidence of effects on infants or children. In one study of participants in the National Health and Nutrition Examination Survey, evidence was found linking levels of phthalates in blood to waist circumference and levels of insulin resistance in adults (Stahlhut et al., 2007). An analogous study in the National Health and Nutrition Examination Survey of polyfluoroalkyls did not find an association of blood levels with body mass index (BMI) or insulin resistance (Nelson et al., 2010).

In 2006, a paper published in *Nature* reported that microbial populations in the gut differ between obese and lean people, and that when obese people lost weight, the state of their microflora reverted back to that observed in a lean person, suggesting that obesity may have a microbial component (Turnbaugh et al., 2006). In a more recent study, Turnbaugh showed that the microbiota in the human gut can be transferred successfully to germ-free mice; that in germ-free mice transplanted with human fecal microbiota, a high-fat, high-sugar diet durably changes the transplanted microbiome; and that this diet-altered microbiome promotes obesity (Turnbaugh et al., 2009).

The chemicals of concern have a range of endocrine effects and are therefore of health concern independently of whether they influence obesity in children in particular. Regulation needs to take into account the full array of health concerns and target the most sensitive endpoints as the limiting factor in defining acceptable exposure levels. Reducing human exposure to these agents would have no known detrimental effects on health.

Enhanced efforts are warranted to determine whether such agents make a contribution to the marked changes seen in the occurrence of childhood obesity. Such efforts include further mechanistic research, as well as observational studies, to determine whether such exposures during gestation and early childhood are related to increased weight and elevated risk of obesity.

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C

Glossary

Active play: Play that involves physical effort and action.

Adiposity: The state of an excess of body fat.

Artificial sweeteners: Substitutes for sugar that generally are not naturally occurring.

Baby-Friendly Hospital Initiative: The "Ten Steps to Successful Breastfeeding" are set out in the joint World Health Organization (WHO)/United Nations Children's Fund (UNICEF) statement, "Protecting, promoting and supporting breastfeeding: the special role of maternity services." The WHO/UNICEF Baby-Friendly Hospital Initiative was developed to ensure that every facility providing maternity services would fully practice all 10 steps to successful breastfeeding and to help effect the principles and aim of all Articles of the International Code of Marketing of Breast Milk Substitutes.

BMI Z-score: Measure of standard deviations from BMI.

Body mass index (BMI): One of the most commonly used measures for defining overweight and obesity, calculated as weight in kilograms divided by height in meters squared.

Calorie-dense, nutrient-poor foods: Foods and beverages that contribute few vitamins and minerals to the diet but contain substantial amounts of fat and/or sugar and are high in calories. Consumption of these foods, such as sugar-sweetened beverages, candy, and chips, may contribute to excess caloric intake and unwanted weight gain in children.

Caries: Decay of a tooth.

Child care: Supervising or providing nurturing to a child, especially by someone other than the child's primary caretaker.

Community providers: Include child care providers, faith-based organizations, librarians, and schools and teachers.

Developmentally appropriate sleep durations: According to the National Sleep Foundation, developmentally appropriate sleep durations are as follows:

- newborns, birth to <3 months: 10.5–18 hours in a 24-hour period;
- infants, 3 months to <12 months: 9–12 hours during the night and 30-minute to 2-hour naps one to four times a day;
- toddlers, 1 year to <3 years: 12–14 hours in a 24-hour period; and
- preschoolers, 3 years to <5 years: 11–13 hours in a 24-hour period.

Dietary Guidelines for Americans: The Dietary Guidelines for Americans have been published jointly every 5 years since 1980 by the Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA). The guidelines provide authoritative advice for those aged 2 years and older on how good dietary habits can promote health and reduce risk for major chronic diseases. They serve as the basis for federal nutrition assistance and nutrition education programs.

Discretionary calories: The balance of calories, mainly from solid fat and added sugars, remaining in a child's energy allowance after meeting nutritional requirements from the intake of foods low in fat or with no added sugar.

Dyslipidemia: A condition characterized by abnormal lipid and lipoprotein levels in the blood.

Dystocia: Childbirth that is difficult or abnormal.

Energy-dense foods: Foods that are high in calories.

Explicit marketing: Discrete, commercial messages, set off from program content, designed to promote products and brands, such as television advertisements, Internet banner advertisements, and billboards.

Federal poverty level: The threshold of income used to determine eligibility for government assistance programs.

Food access: The extent to which a community can supply people with the food needed for health. Communities with poor food access lack the resources necessary to supply people with the food needed for a healthy lifestyle. The availability of high-quality, affordable food and close proximity to food stores increase food access.

Food (and beverage) marketing: Promotion of the awareness, appeal, and sale of commercial food and beverage products and brands in media, retail stores, and vending machines and on billboards.

Food security: Consistent, dependable access to enough food for active, healthy living.

Food insecurity: A household-level economic and social condition of limited or uncertain access to adequate food.

Healthy foods: Refers to foods of high nutritional quality, such as fruits and vegetables, with minimal or no added sugar, fat, and salt; low-fat or nonfat dairy products; whole grains; and lean meats.

Infant: A child from birth to 12 months of age.

Light physical activity: Muscle-powered movement at a slow, easy pace; examples are slow walking, crawling, and limb or trunk motion while seated. Energy expenditure is at a rate of 1.1 to 3.9 metabolic equivalent of task.

Macrosomia: The condition of an infant with an excessive birth weight.

Maternal and infant care practitioners: Include early Head Start educators, Healthy Start providers, Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) providers, maternal hospital administrators and staff, physicians, nurses, dentists, and dietitians.

Media: Include traditional print and television media and the emerging media of the Internet.

Mixed feeding (los dos): Both breastfeeding and formula feeding during infancy.

Moderate physical activity: Muscle-powered movement at a modest pace; examples are brisk walking, hopping, jumping, and climbing. Energy expenditure is at a rate of 4.0 to 6.9 metabolic equivalent of task.

Nonnutritive sweeteners: Sweeteners containing no calories or other nutrients.

Nutrient-dense foods: Foods that contain substantial amounts of vitamins, minerals, and other health-promoting components, such as fiber, and relatively few calories. Foods that are low in nutrient density supply calories but no or small amounts of vitamins, minerals, and health-promoting components.

Obesity and overweight: Children and adolescents are defined as obese if they have a body mass index (BMI) above the 95th percentile for their age and sex and as overweight if they have a BMI between the 85th and 95th percentiles for their age and sex according to growth charts (http://www.cdc.gov/growthcharts).

Obesity prevention: Steps that can be taken to reduce the incidence of obesity.

Obesogenic environment: A set of circumstances that leads individuals to consume more calories than they expend, causing them to become obese.

Peer support: In the context of breastfeeding, provided by mothers who are currently breastfeeding or who have done so in the past; includes individual counseling and mother-to-mother support groups. Women who provide peer support undergo specific training and may work in an informal group or one-to-one

through telephone calls or visits in the home, clinic, or hospital. Peer support includes psychoemotional support, encouragement, education about breastfeeding, and help with solving problems.

Physical activity: Body movement produced by the contraction of muscle that increases energy expenditure above the resting level.

Policy maker: In this report, refers to a decision maker who has the authority to pass legislation affecting obesity prevention or other public health problems. Examples of policy makers are federal or state legislators, governors, and mayors.

Poor sleep hygiene: Sleep habits that reduce sleep quality and impair sleep duration, such as irregular bedtimes and wake times, use of caffeine or other stimulating substances before bedtime, inappropriate napping habits, engagement in stimulating or stressful activities close to bedtime, and sleep environments that are uncomfortable or disruptive.

Preschool-age child: A child from age 3 until the time of enrollment in kindergarten.

Product placement: Display of commercial food or beverage products within programming or interactive activities (usually in return for payment) in an appealing manner, or simply to reinforce recognition.

Professional education: In the context of breastfeeding, includes any program designed to improve the knowledge, skills, attitudes, or behaviors of health care providers on the importance of breastfeeding, the physiology and management of lactation, or counseling related to breastfeeding. Health care providers are defined here as physicians; nurse midwives, nurse practitioners, and other nurses; nutritionists; lactation consultants; and other members of the health care team, such as pharmacists, social workers, speech/language pathologists, physical therapists, and occupational therapists.

Responsive feeding: Feeding in which the adult interprets signals of hunger and fullness from the child and responds quickly to those signals.

Screen time: Minutes or hours of individual exposure to television, DVD, or streaming video programming; videogames; Internet sites; enhanced cell phones; and other digital media.

Structured physical activity: Activity that is developmentally appropriate and fun. Structured physical activity should include

- daily planned physical activity that supports the development of age-appropriate motor skills, is engaging, and involves all children with minimal or no waiting; and
- daily, fun physical activity that is vigorous (gets children "breathless" or breathing more deeply and more rapidly than during typical activities) for short bouts of time.

Sugar-sweetened beverages: Beverages to which sugar, typically high fructose corn syrup or sucrose (table sugar), has been added, including soft drinks, fruit drinks, sports drinks, tea and coffee drinks, energy drinks, and sweetened milk or milk alternatives.

Toddler: A child from 12 months up to 36 months of age.

Unstructured physical activity: Child-initiated physical activity that occurs as the child explores his or her environment. Unstructured activity should include

- activities that respect and encourage children's individual abilities and interests; and
- teacher engagement with children, support for extending play, and gentle prompts and encouragement by teachers (when appropriate) to stay physically active.

Vigorous physical activity: Muscle-powered movement at a fast pace; examples are running, stair climbing, and cycling at a fast pace. Energy expenditure is at a rate of 7.0 metabolic equivalent of task or above.

D

Acronyms

AAP	American Academy of Pediatrics
ADA	American Dietetic Association
ALSPAC	Avon Longitudinal Study of Parents and Children
BFHI	Baby-Friendly Hospital Initiative
BMI	body mass index
CACFP	Child and Adult Care Food Program
CDC	Centers for Disease Control and Prevention
DGA	Dietary Guidelines for Americans
EPAO	Environment and Policy Assessment and Observation instrument
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FTC	Federal Trade Commission
GDM	gestational diabetes mellitus
GWG	gestational weight gain

HHS	U.S. Department of Health and Human Services
IOM	Institute of Medicine
NHANES	National Health and Nutrition Examination Survey
NRC	National Research Council
NYCDOHMH	New York City Department of Health and Mental Hygiene
QRIS	Quality Rating and Improvement System
RCT	randomized controlled trial
SIDS	sudden infant death syndrome
SNAP	Supplemental Nutrition Assistance Program
USDA	U.S. Department of Agriculture
WHO	World Health Organization
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

E
Workshop Agenda and Speaker Biographical Sketches

June 7–8, 2010
Keck Center of the National Academies
500 Fifth Street, N.W., Room 201
Washington, DC

1:00 p.m. Welcome and introduction
Leann Birch

SESSION 1: FILLING THE GAPS

1:10 Injury prevention
Keshia Pollack, Johns Hopkins Bloomberg School of Public Health (by phone)

Presentation on early FITS data findings
Ronette Briefel, Mathematica Policy Research, Inc.

Motor development
Jane Clark, University of Maryland

Electronic media
Elizabeth Vandewater, RTI International

Sleep
Judith Owens, Brown University

Factors affecting growth
Nancy Krebs, University of Colorado Health Sciences Center

3:00 Break

SESSION 2: PROGRAMS

3:15 WIC
Laurie True, California WIC Association

Head Start
Everludis Lopez, Head Start, Fairfax, Virginia

Child Care
Doris Fredericks, Choices 4 Children, San Jose, California

SESSION 3: POLICY NEEDS

4:15 Policy needs
Gabrielle Serra, Education and Nutrition Policy Advisor, House Committee on Education and Labor

Dan Christensen, Professional Staff, Senate Committee on Agriculture, Nutrition and Forestry

5:00 Adjourn

BIOGRAPHICAL SKETCHES OF WORKSHOP SPEAKERS

RONETTE R. BRIEFEL, Dr.P.H., R.D., a senior fellow at Mathematica Policy Research in Washington, DC, is the project director and principal investigator for the 2008 Feeding Infants and Toddlers Study (FITS) and was the co-principal investigator for the 2002 FITS. Dr. Briefel's research includes evaluations of nutrition programs, population-based studies of the diets and health status of children and high-risk populations, and investigations of the home and school food environments and children's diet and obesity. She has authored more than 100 publications in peer-reviewed journals on topics including infant feeding patterns, dietary intake, food security, obesity, and cardiovascular risk factors of children and disadvantaged populations. Dr. Briefel served on the Institute of Medicine's Committee on Dietary Risk Assessment in the WIC Program and Committee on Strategies to Reduce Sodium Intake in the United States. She received her B.S. in nutrition from Pennsylvania State University, and her M.P.H. in maternal and child health and Dr.P.H. in chronic disease epidemiology from the University of Pittsburgh. Dr. Briefel is a member of the American Society for Nutrition and the American Dietetic Association and is a registered dietitian.

JANE E. CLARK, Ph.D., is professor and chair of the Department of Kinesiology and professor in the Neuroscience and Cognitive Sciences program at the University of Maryland, College Park. Currently, her research focuses on the development of motor control and coordination in typically developing infants and children and those children with developmental coordination disorder (DCD). The National Science Foundation has funded her research on infant motor development, and the National Institutes of Health (NIH) continues to support her work on children with DCD. She has co-edited 7 texts on motor development and authored 24 book chapters and more than 60 refereed journal publications. She has presented more than 200 scientific papers at national and international conferences and been invited to speak at universities in 10 countries. In addition to her scientific contributions, Dr. Clark has served as the elected leader of three national organizations in the field of kinesiology. She received her Ph.D. in kinesiology from the University of Wisconsin with a major emphasis on the motor skill development of infants and children, an area in which she has made her scientific contributions for more than 30 years.

DORIS C. FREDERICKS, M.Ed., R.D., is executive director of Choices for Children, an organization that provides a variety of family and provider services.

Ms. Fredericks is past president of the California Dietetics Association. She has experience in child care resources and referrals, parent and provider education, and child care and nutrition subsidies. In her current position, she oversees the Child Care Subsidy Program, which utilizes state and federal funds to provide financial assistance for child care services for families and referrals to potential child care centers and home providers who may meet family schedules and needs. Ms. Fredericks also works with the nutrition teams in all regions providing technical assistance for the Child Care Food Program operation, as well as nutrition education for child caregivers, children, and families. Ms. Fredericks received her M.Ed. in nutrition education from the University of Cincinnati and her B.A. in dietetics from Ohio Wesleyan University.

NANCY F. KREBS, M.D., M.S., is professor of pediatrics in the Department of Pediatrics at the University of Colorado, Denver (UCD), and is head of the Section of Nutrition in the Department of Pediatrics. She has extensive research experience in trace mineral nutrition in breastfeeding infants and their mothers, including in international settings. Her current research is testing effects of different complementary feeding regimens to meet micronutrient requirements for breastfed infants. Through the NIH/National Institute of Child Health and Human Development (NICHD) Global Network for Women's and Children's Research, she leads an ongoing multicountry efficacy trial of complementary feeding and growth and development. As a secondary area of research interest, Dr. Krebs is a co-investigator in research related to childhood obesity, both prevention and treatment studies. Her clinical activities include directing two pediatric nutrition clinics—one for children with undernutrition and feeding problems and the other for overweight infants and children. She served as chair of the Committee on Nutrition for the American Academy of Pediatrics (AAP) for 4 years and as co-chair of the AAP Task Force on Obesity. From 2003 to 2007, she served as a member of the Food and Nutrition Board with the Institute of Medicine. After graduating from the UCD School of Medicine, she completed a pediatric internship and residency and a 3-year fellowship in pediatric gastroenterology and nutrition at UCD. She is board certified in general pediatrics, clinical nutrition, and pediatric gastroenterology.

EVERLUDIS LÓPEZ, R.D., manages the Nutrition Services Area for Fairfax County Early Head Start and Head Start programs. She has more than 30 years of experience working with children and pregnant women. Ms. López earned

her bachelor's degree in home economics with a concentration in nutrition and dietetics from the University of Puerto Rico. Her area of expertise is working with children and pregnant women from low-income families. Other areas of expertise include speaking and writing fluently in Spanish, providing technical assistance to staff and families on ways to improve dietary and healthy eating habits, and providing training on nutrition issues. Ms. López spoke at the Institute of Medicine's Committee to Review Adult and Child Care Feeding Programs workshop in February 2010.

JUDITH OWENS, M.D., is associate professor of pediatrics at the Brown Medical School. She is board certified in developmental/behavioral pediatrics and sleep medicine. Her particular research interests are in the neurobehavioral and health consequences of sleep problems in children, pharmacologic treatment of pediatric sleep disorders, sleep health education, and cultural and psychosocial issues impacting sleep. As a recipient of a 5-year NIH grant in sleep education, the Sleep Academic Award, she has developed educational materials for the Brown Medical School, as well as the American Academy of Sleep Medicine (AASM). Dr. Owens received the AASM 2006 Excellence in Education Award and recently completed a four-year term as chair of the AASM Section on Childhood Sleep Disorders and Development. She is director of the Pediatric Sleep Disorders Clinic at Hasbro Children's Hospital and the Learning, Attention, and Behavior Program at Rhode Island Hospital. Dr. Owens received her undergraduate and medical degrees from Brown and a master's degree in maternal and child health from the University of Minnesota. She completed pediatric residency training at Children's Hospital of Philadelphia and fellowships in behavioral pediatrics at Minneapolis Children's Medical Center and in child psychiatry at Brown University.

KESHIA M. POLLACK, Ph.D., M.P.H., is assistant professor and director of the Occupational Injury Epidemiology and Prevention Training Program at Johns Hopkins Bloomberg School of Public Health. She is a member of the core faculty of the Center for Injury Research and Policy, the Education and Research Center for Occupational Safety and Health, and the Center for Health Disparities Solutions. Her research interest is in preventing injuries related to occupation, obesity, sports/physical activity, and the built environment and understanding how such injuries disproportionately affect vulnerable populations. Dr. Pollack also is interested in the role of epidemiology in the policy making process, especially the use of research by legislators and the use of tools such as health impact assessment

in the policy making process. She works for Delegate Dan Morhaim, a member of the Maryland General Assembly. She also is an advisor to a community coalition of the Associated Black Charities seeking to alleviate the burden of childhood obesity in Baltimore. Prior to joining the Johns Hopkins faculty, Dr. Pollack completed a postdoctoral fellowship in evaluation sponsored jointly by the University of Pennsylvania Campbell Collaboration and The Robert Wood Johnson Foundation. There, she worked on research, evaluations, and programming for childhood obesity and health issues affecting vulnerable populations. Dr. Pollack received her B.A. from Tufts University, her M.P.H. from Yale University, and her Ph.D. from The Johns Hopkins University.

GABRIELLE SERRA, M.S., is a policy advisor for Chairman George Miller of the Committee on Education and Labor of the U.S. House of Representatives. She joined the committee in June 2009. She is responsible primarily for advising on food and nutrition policy issues. Prior to her work on the committee, she had served with the U.S. Department of Agriculture's (USDA's) Food and Nutrition Services since 2003, working mainly in the area of policy and program development for the school meal programs. Ms. Serra also served on detail assignment in 2008 as policy advisor in the Office of the Under Secretary of the Food, Nutrition, and Consumer Services of USDA, which is the administering agency for the domestic nutrition assistance programs. Ms. Serra received an M.S. in food policy and applied nutrition, with an emphasis in food policy and economics, from the Friedman School of Nutrition Science and Policy at Tufts University. She received her B.S. in public health in 2003 from the College of Health and Human Sciences of Oregon State University. Ms. Serra is a 2003 recipient of the USDA Public Service Leaders Scholars Fellowship.

LAURIE TRUE, M.P.H., R.D., is executive director at the California WIC Association in Sacramento. Previously, she was research and policy director at California Food Policy Advocates in San Francisco. She is a public health nutritionist with many years of experience in research, community organizing, and legislative advocacy. Ms. True consults widely with federal, state, and local decision makers, academics, and community-based organizations on WIC, nutrition, and health policy. She was involved in the founding of many of California's current health advocacy organizations and coalitions, including the California Food Policy Advocates, the California WIC Association, and the Strategic Alliance for Healthy Food and Activity Environments. Ms. True has overseen numerous community-

based applied research and evaluation projects on federal nutrition policy, including a hunger survey of children in California's Central Valley. She has advocated successfully on many bills and issues impacting the health and nutrition of the state's most vulnerable populations. She serves on many statewide advisory boards and was a reviewer of the Institute of Medicine's report *WIC Food Packages: Time for a Change*. In 2005, she was an Atlantic Public Policy Fellow and worked for the government of Scotland, advising on obesity prevention and child nutrition reforms. In 2008, she received the Excellence in Dietary Guidance Award from the American Public Health Association. Ms. True received her B.S. in nutrition science from Barnard College and Simmons College (Boston) and her M.P.H. and registered dietitian credential from the University of California, Berkeley.

ELIZABETH A. VANDEWATER, Ph.D., is senior research scientist at RTI International. Between 1998 and 2007, she was on the faculty at the University of Texas at Austin, where she received tenure and served as associate director of the Population Research Center and as director of the Center for Research on Interactive Technology, Television and Children. Dr. Vandewater's research focuses on children's health behaviors and health outcomes. Her current research projects focus on two issues central to children's health and well-being: (1) the development of pediatric obesity, and (2) the effect of media on very young children. Her research has been funded by NICHD, the National Science Foundation, the Department of Education, the Kaiser Family Foundation, the Fisher-Price Corporation, and the Brainy Baby Corporation. She is a founding investigator of the Children's Digital Media Center, a research collaborative funded by the National Science Foundation that focuses on the impact of new technologies on children, now in its ninth year of funding. Dr. Vandewater currently serves on the board of *PBS Kids Next Generation Media* and the Social Sciences and Population Studies review panel at NIH. She received her Ph.D. in psychology from the University of Michigan and completed a postdoctoral fellowship in life course development at the Institute for Social Research.

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Biographical Sketches of Committee Members

LEANN L. BIRCH, Ph.D. (*Chair*), is distinguished professor of human development and nutritional sciences and director of the Center for Childhood Obesity Research at The Pennsylvania State University. She also holds an appointment in the university's Department of Pediatrics. Dr. Birch's research interests include developing controls of food intake during infancy, childhood, and adolescence; the development of disordered eating; and risk and protective factors for childhood obesity. She is internationally recognized for her work in this area and is the author of more than 170 publications. She has served on the Council of Scientific Advisors to the U.S. Department of Agriculture (USDA)/Agricultural Research Service (ARS) Children's Nutrition Research Center. Dr. Birch served as a member of the Institute of Medicine (IOM) Committee on Prevention of Obesity in Children and Youth and is a current member of the IOM's Standing Committee on Childhood Obesity Prevention. She has received the Lederle Award for Human Nutrition from the American Society for Nutrition. She has also been awarded the Faculty Scholar Medal for Outstanding Achievement in Social and Behavioral Sciences and the Pauline Schmitt Russell Distinguished Research Career Award from The Pennsylvania State University. Dr. Birch received her Ph.D. in psychology from the University of Michigan, Ann Arbor.

ALICE AMMERMAN, Dr.P.H., R.D., is director of the Center for Health Promotion and Disease Prevention and professor in the Department of Nutrition, Schools of Public Health and Medicine, at the University of North Carolina

(UNC), Chapel Hill. Her research involves the design and testing of innovative clinical and community-based nutrition and physical activity intervention approaches for chronic disease risk reduction in primarily low-income and minority populations. Her most recent research interests focus on school nutrition policy associated with childhood obesity, sustainable agriculture as it relates to improved nutrition, and social entrepreneurship as a sustainable approach to addressing health disparities. Dr. Ammerman is engaged in research and practice collaborations across North Carolina addressing childhood obesity and has served on several statewide advisory boards regarding childhood obesity and sustainable local food systems. Dr. Ammerman is principal investigator for 1 of 10 National Institutes of Health (NIH)-funded Health Disparities Centers, with a focus on cardiovascular disease. She is co-principal investigator of the Centers for Disease Control and Prevention (CDC)-funded Center of Excellence for Training and Research Translation at UNC, charged with the identification, translation, and dissemination of evidence-based interventions for the control and prevention of obesity and cardiovascular disease. In 2000, Dr. Ammerman received the Greenberg Award for excellence in public health research, service, and practice, and in 2011 the Ned Brooks Award for Public Service. She received her doctoral degree in nutrition from UNC, Chapel Hill.

BETTINA M. BEECH, Dr.P.H., M.P.H., is professor of public health sciences, pediatrics, and internal medicine at Wake Forest University School of Medicine and co-director of the Maya Angelou Center for Health Equity. Dr. Beech's research focuses on the role of nutritional factors in the primary and secondary prevention of chronic diseases, with a particular focus on childhood obesity and related problems such as diabetes and metabolic syndrome. Her current studies involve the development and evaluation of interventions to prevent or treat childhood obesity in family- and community-based settings, particularly among African Americans. Dr. Beech has been an active member of the American Public Health Association and the Obesity Society and currently serves on two national advisory councils focused on the clinical management of childhood obesity. She served as an external reviewer for the IOM report *WIC Food Packages: Time for a Change*; is a member of the African American Collaborative Obesity Research Network (AACORN); and is lead editor of *Race and Research in Focus: Perspectives on Minority Participation in Health Studies*, published by the American Public Health Association. Dr. Beech has served as a member of the board of directors for the Memphis Chapter of the American Diabetes Association and recently

served as chair of the Child Health and Wellness Advisory Council for the State of Tennessee. She holds a B.A. from Temple University, an M.P.H. from Temple University, and a Dr.P.H. in community health from the University of Texas Health Science Center, School of Public Health. She also completed a postdoctoral fellowship in behavioral science at the M.D. Anderson Cancer Center.

SARA BENJAMIN NEELON, Ph.D., M.P.H., R.D., is assistant professor in the Department of Community and Family Medicine at Duke University Medical Center and the Duke Global Health Institute. Previously, she was a postdoctoral research fellow for the Obesity Prevention Program in the Department of Population Medicine at Harvard Medical School. Dr. Benjamin Neelon's research focuses on nutrition and physical activity interventions for children from birth to 5 years of age, evaluation of the nutrition and physical activity environment in child care settings, early childhood predictors of obesity, feeding practices as predictors of later obesity, and nutrition policy and regulation in child care. She has published a book on nutrition for children in child care: *Making Food Healthy and Safe for Children: How to Meet the National Health and Safety Performance Standards—Guidelines for Out-of-Home Child Care Programs*. Dr. Benjamin Neelon received both her M.P.H. and Ph.D. in nutrition from UNC, Chapel Hill.

LAUREL J. BRANEN, Ph.D., R.D., L.D., is professor of family and consumer sciences in the School of Family and Consumer Sciences at the University of Idaho. Dr. Branen is a nationally recognized expert on issues associated with feeding young children in group settings, and lectures at workshops and seminars across the country. She co-developed Feeding Young Children in Group Settings, an educational program designed for child care professionals, educators, food service workers, and others who train staff or parents on issues related to feeding. She also co-developed Mealtime and Active Play Partnerships, a website that includes childhood obesity prevention training materials. She received her B.S. in food science and technology from the University of Wisconsin, Madison; her M.S. in home economics (nutrition education) from Washington State University, Pullman; and her Ph.D. in education, cognate in counseling, from the University of Idaho, Moscow.

DAVID V. B. BRITT, M.P.A., is past president and chief executive officer of Sesame Workshop. Mr. Britt's earlier professional experience includes executive positions with the U.S. Agency for International Development, the Equal

Employment Opportunity Commission, and the Overseas Private Investment Corporation. He has presented to various congressional committees and the Federal Trade Commission on children's education, obesity, and media issues. Since his retirement, Mr. Britt has consulted on food marketing issues for The Robert Wood Johnson Foundation and on leadership development for nonprofit organizations. He is currently board chair of The Education Trust, a nonprofit organization working for quality education for all, pre-K–16, and is a board member of INMED Partnerships for Children, a nonprofit organization working to promote children's health, education, and well-being. Mr. Britt is a member of the Advisory Committee of the Initiative for Social Enterprise at Harvard Business School and a member of the Council on Foreign Relations. He is a former member of the Board on Children, Youth, and Families of the National Academies. He served on the IOM Committee on Food Marketing and the Diets of Children and Youth and is currently serving on the Committee on Accelerating Progress in Obesity Prevention. He received a B.A. from Wesleyan University and an M.P.A. from the John F. Kennedy School of Government at Harvard University.

DEBRA HAIRE-JOSHU, Ph.D., is professor of public health and medicine and associate dean for research at Washington University in St. Louis. Dr. Haire-Joshu directs the Center for Obesity Prevention and Policy Research and also serves as associate director of the Diabetes Research and Training Center. Her current research on obesity prevention and policy interventions among underserved populations in early childhood and youth has been supported by a number of NIH agencies, including the National Cancer Institute, the National Institute of Diabetes and Digestive and Kidney Diseases, and the CDC, as well as the Missouri Foundation for Health. Dr. Haire-Joshu served as a health policy fellow in the office of former Senator Barack Obama and as a Robert Wood Johnson health policy fellow for the Health, Education, Labor and Pensions Committee of Senator Edward Kennedy. Her work as chair of the Health Policy Committee led to her appointment as a distinguished fellow of the Society of Behavioral Medicine. She is also a member of Delta Omega, the honorary society for public health. She completed her Ph.D. at Saint Louis University.

RONALD E. KLEINMAN, M.D., is physician in chief of Massachusetts General Hospital for Children, chief of the Pediatric Gastroenterology and Nutrition Unit at Massachusetts General Hospital, and Charles Wilder professor of pediatrics at Harvard Medical School. His major areas of research interest include gastro-

intestinal immunology, nutritional support of infants and children, and nutrition and public health policy. He has been a member of the Medical Advisory Group on Diet and Nutrition Guidelines in Cancer for the American Cancer Society and the National Cholesterol Advisory Committee (National Institute of Child Health and Human Development), and a member of the board of trustees for the International Child Health Foundation, the Global Child Nutrition Foundation, the Massachusetts General Hospital Physicians Organization, and Project Bread. Dr. Kleinman served as chair of the Committee on Nutrition for the American Academy of Pediatrics and is editor of the fourth, fifth, sixth, and seventh editions of the Academy's *Pediatric Nutrition Handbook*. He served on the National Research Council (NRC)/IOM Committee on the Impact of Pregnancy Weight on Maternal and Child Health and the IOM Committee on Nutrition Standards for National School Lunch and Breakfast Programs. A graduate of Trinity College in Hartford, Connecticut, Dr. Kleinman earned his M.D. from New York Medical College, completed his residency and a postgraduate fellowship in molecular biology at the Albert Einstein Medical Center in New York, and completed a fellowship in pediatric gastroenterology and nutrition at the Massachusetts General Hospital and Harvard Medical School.

SUSAN LANDRY, Ph.D., is Albert and Margaret Alkek Chair in Early Childhood and Michael Matthew Knight professor in the Department of Pediatrics at the University of Texas Health Science Center, Houston. She is director and founder of the Children's Learning Institute at the University of Texas, which includes the Texas State Center for Early Childhood Development (SCECD) among its many programs. The SCECD works with early childhood educators across the state and the nation. Dr. Landry served on the Shaping a Healthier Generation Advisory Council of the National Governors Association Centers for Best Practices. She is past chair of the Head Start National Reporting System Advisory Panel, 2005–2006, an appointment made by the secretary of the U.S. Department of Health and Human Services, and was a member of the National Early Literacy Panel. Dr. Landry's research targets parent–child and early childhood classroom intervention studies. She has published more than 100 peer-reviewed publications; 19 book chapters; and a monograph, *Effective Early Childhood Programs: Turning Knowledge into Action,* that describes the findings of these research studies. She holds a Ph.D. in applied developmental psychology from the University of Houston.

LYNNE OUDEKERK, M.A., R.D., C.D.N., is director of the Child and Adult Care Food Program (CACFP) at the New York State Department of Health. Ms. Oudekerk also serves as principal investigator for USDA-funded Team Nutrition Training Grants, which provide funding for innovative obesity prevention programming for youth attending child care centers and organized after-school programs. As part of her current position, she directs the Supplemental Nutrition Assistance Program/U.S. Department of Education–funded Eat Well Play Hard in Child Care Settings (EWPHCCS) initiative. EWPHCCS provides funding to government and nonprofit agencies in the state for the implementation of nutrition education and physical activity interventions in low-income child care centers targeting preschool children, their families, and their caregivers with obesity prevention messages. Ms. Oudekerk oversees program evaluation activities for CACFP obesity prevention projects by collecting, analyzing, and disseminating data and reports on the success of nutrition and physical activity interventions in New York communities. She also directs outreach activities designed to increase the participation of underserved day care centers and family day care homes. Ms. Oudekerk is president of the CACFP National Professional Association. She received a B.S. in nutritional sciences from Cornell University and an M.A. in human nutrition from Syracuse University.

RUSSELL R. PATE, Ph.D., is professor of exercise science at the Norman J. Arnold School of Public Health, University of South Carolina, Columbia. Dr. Pate's research interests and expertise focus on physical activity measurement, determinants, and promotion in children and youth. He also directs a national postgraduate course aimed at developing research competencies related to physical activity and public health. Dr. Pate is involved in the CDC-funded Prevention Research Center at the University of South Carolina. His research includes studies on preschoolers' physical activity levels and how schools can influence these levels, as well as multicenter trials on the promotion of physical activity among middle and high school–age girls. Dr. Pate was a member of the Physical Activity Guidelines Advisory Committee and served on the 2005 Dietary Guidelines Advisory Committee. He is a past president of both the American College of Sports Medicine and the National Coalition on Promoting Physical Activity. Dr. Pate served as a member of the IOM Committee on Prevention of Obesity in Children and Youth and Committee on Accelerating Progress in Preventing Obesity in Children and Youth, and is a current member of the Standing Committee on Childhood Obesity Prevention. He received a B.S. in physical edu-

cation from Springfield College and an M.S. and Ph.D. in exercise physiology from the University of Oregon.

DAVID A. SAVITZ, Ph.D., is professor of community health (epidemiology) and obstetrics and gynecology at Brown University. He served as Carey C. Boshamer distinguished professor and chair of the Department of Epidemiology at the University of North Carolina School of Public Health until the end of 2005 and was Charles Bluhdorn professor of preventive medicine at Mount Sinai School of Medicine, 2006–2010. Dr. Savitz's teaching is focused on epidemiologic methods, and he authored a book entitled *Interpreting Epidemiologic Evidence*. He has served as editor of the *American Journal of Epidemiology* and as a member of the Epidemiology and Disease Control-1 study section of NIH, and currently is an editor of *Epidemiology*. He was president of the Society for Epidemiologic Research and the Society for Pediatric and Perinatal Epidemiologic Research, and North American regional councilor for the International Epidemiological Association. Dr. Savitz's primary research activities and interests are in reproductive, environmental, and cancer epidemiology. He has served on seven IOM or NRC committees, most recently on the Committee on Contaminated Drinking Water at Camp Lejeune and the Committee to Reexamine IOM Pregnancy Weight Guidelines. He is a member of the IOM. Dr. Savitz received his undergraduate training in psychology at Brandeis University, a master's degree in preventive medicine at Ohio State University, and his Ph.D. in epidemiology from the University of Pittsburgh Graduate School of Public Health.

WENDELIN SLUSSER, M.D., M.S., FAAP, is associate clinical professor of pediatrics at the University of California, Los Angeles (UCLA) Schools of Medicine and Public Health, co-founder and medical director of the Mattel Children's Hospital UCLA Fit for Healthy Weight program, founder and co-director of the Community Health and Advocacy Pediatric Residency Training Program, and founder and director of the UCLA Breastfeeding Resource Program. She worked on the conception and implementation of the National Breastfeeding Policy Conference, which brought together more than 100 national leaders from different sectors and formulated a series of breastfeeding policy recommendations. This policy conference triggered the preparation of the Surgeon General's "HHS Blue Print for Action on Breastfeeding" and provided the framework for the U.S. National Breastfeeding Committee's Strategic Plan. Dr. Slusser has also provided technical assistance at the local, national, and international levels. She is board certified in

pediatrics; is a fellow of the American Academy of Pediatrics; and practices and teaches general pediatrics and health promotion at the Venice Family Clinic, the largest free clinic in the United States. She was honored with the Beverllee Myers Award of Excellence in 2008 and the Robert F. Allen Symbol of H.O.P.E. (Helping Other People through Empowerment) Award in 2010. Dr. Slusser graduated cum laude from Princeton University, and received her medical degree from the College of Physicians and Surgeons at Columbia University and her master's of science degree from the Institute of Human Nutrition at Columbia University. She completed her internship and residency in Pediatrics at Babies Hospital, Columbia Presbyterian Hospital, in New York City.

ELSIE M. TAVERAS, M.D., M.P.H., is assistant professor of both population medicine and pediatrics at Harvard Medical School's Department of Population Medicine (DPM). She works with DPM's Center for Child Health Care Studies and co-directs DPM's Obesity Prevention Program. She is also director of the One Step Ahead clinic, a multidisciplinary childhood overweight prevention and early management program at Children's Hospital Boston. Her research interests include nutrition and physical activity as they affect child health and childhood obesity prevention. Dr. Taveras was selected for the Physician Faculty Scholars Program of The Robert Wood Johnson Foundation to examine opportunities for childhood obesity prevention among underserved populations. She trained in pediatrics at Children's Hospital Boston and Boston Medical Center and received her M.P.H. from the Harvard School of Public Health.

ROBERT C. WHITAKER, M.D., M.P.H., is professor of public health and pediatrics at Temple University. Prior to joining the Temple faculty, he was a senior fellow at Mathematica Policy Research, Inc. in Princeton, New Jersey, and a visiting senior research scholar at the Center for Health and Wellbeing at the Woodrow Wilson School of Public and International Affairs at Princeton University. His research has focused on the childhood antecedents of adult chronic disease and has included studies on school nutrition, obesity prevention strategies in preschool children, parent–child feeding interaction, the epidemiology of childhood obesity, and the determinants of social and emotional well-being in children. Dr. Whitaker served on the IOM Committee on Dietary Risk Assessment in the WIC Program and the Committee on Prevention of Obesity in Children and Youth. He received a B.A. in chemistry from Williams College, an M.D. from The Johns Hopkins

University School of Medicine, and an M.P.H. from the University of Washington School of Public Health and Community Medicine. Dr. Whitaker completed his residency and fellowship in pediatrics at the University of Washington School of Medicine, and he received postdoctoral training as a Robert Wood Johnson clinical scholar.

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