

American Heart Association Childhood Obesity Research Summit Report

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Over the past 3 decades, the prevalence of obesity has increased among children of all ages. Today, one third of American children and adolescents are obese or overweight. Childhood obesity is one of the most pressing health threats facing the United States.

I. The Problem: Childhood Obesity—A Burgeoning Epidemic

Over the past 30 years, the prevalence of obesity has nearly tripled for children 2 to 5 years of age and youth 12 to 19 years of age, and it has quadrupled for children 6 to 11 years old.¹ Data from 2 National Health and Nutrition Examination Surveys (1976 to 1980 and 2003 to 2004) show that for children 2 to 5 years of age, the prevalence of overweight increased from 5% to 13.9%; for those 6 to 11 years of age, prevalence increased from 6.5% to 18.8%; and for those 12 to 19 years of age, prevalence increased from 5.0% to 17.4%.²

Overweight children and adolescents are at risk for significant health problems both during their youth and as adults. For example, during their youth, overweight children and adolescents are more likely than other children and adolescents to have risk factors associated with cardiovascular disease (eg, high blood pressure, high cholesterol, and type 2 diabetes mellitus).³ Overweight children and adolescents are also more likely to become obese as adults.^{4,5} For example, 1 study found that approximately 80% of children who were overweight at 10 to 15 years of age were obese adults at 25 years of age.⁴ Another study found that 25% of obese adults were overweight as children.³ The latter study also found that if overweight begins before 8 years of age, obesity in adulthood is likely to be more severe. Studies have also documented the link between obesity and poor school performance and unhealthy or risky behaviors such as alcohol use, tobacco use, premature sexual behavior, inappropriate dieting practices, and physical inactivity.^{6,7}

Overweight children and adolescents may experience other health conditions associated with increased weight, which include asthma, hepatic steatosis, sleep apnea, and type 2 diabetes mellitus. Obesity also puts children at long-term higher risk for other debilitating chronic conditions such as stroke; breast, colon, and kidney cancers; musculoskeletal disorders; and gall bladder disease.

Obesity-associated annual hospital costs for children and youth have more than tripled over 2 decades, rising from \$35 million in 1979 to 1981 to \$127 million in 1997 to 1999. After adjustment for inflation and conversion to 2004 dollars, the national healthcare expenditures related to obesity and overweight in adults alone range from \$98 billion to \$129 billion annually.⁸ The obesity crisis and the public health threat it represents mandate immediate action from the healthcare community to provide clinical intervention and to serve as advocates for the development of community programs that help teach and support healthy behaviors.

II. Childhood Obesity Research Summit

As part of its strategic focus on childhood obesity, and particularly the prevention of childhood obesity, the American Heart Association convened a Childhood Obesity Research Summit to examine research opportunities where the

obesity epidemic intersects with the healthcare system. The outcomes of the conference help inform the American Heart Association and the Alliance for a Healthy Generation broadly in terms that help to focus ongoing research and public policy initiatives.

III. Pathophysiology and Morbidity of Childhood Obesity

A. Pathophysiology of Obesity

The pathophysiology of obesity in childhood can be viewed from 3 perspectives: a homeostatic or energy-balance perspective, an epidemiological perspective, and a pathological perspective examining the consequences of excess fat on risk for future disease. The fundamental cause of obesity is a greater imbalance between energy intake and expenditure than is expected for normal growth and development. Usually, this occurs over a period of time and in the setting of a susceptible genetic background and environmental factors. Epigenetic factors, defined as the changes in gene function that do not relate to changes in DNA sequence, begin in utero (or in some cases in previous generations) and also contribute.⁹ Infants of diabetic mothers and of mothers who smoke during pregnancy have increased risk of subsequent obesity. Infant feeding practices may also play a role, particularly a shortened period of breast-feeding. A reduced amount of sleep during infancy is another potential risk factor for obesity. Some medications have been clearly demonstrated to cause excess weight gain.

B. Medical Consequences of Childhood Obesity

The increasing prevalence and severity of obesity in children and adolescents have resulted in a higher prevalence of comorbid conditions, including high blood pressure, early development of atherosclerosis, type 2 diabetes mellitus, nonalcoholic fatty liver disease, polycystic ovary disorder, and disordered breathing during sleep.¹⁰ These complications can occur both in the short-term and in the long-term. Some complications, such as type 2 diabetes mellitus, previously thought to only occur in adulthood have now been shown to occur in children and adolescents. This has raised concerns about whether the obesity epidemic might shorten the lifespan of the current generation of children.

Olshansky et al¹¹ evaluated the potential effect of childhood obesity on lifespan. Their analysis predicts a shorter lifespan for the current generation of children, in large part because of obesity and its related comorbidities, including cardiovascular disease and metabolic, gastrointestinal, pulmonary, orthopedic, neurological, psychological, and social disorders. However, others have speculated that improved medical care will ameliorate these effects.

There is still much to be learned about the mechanisms for obesity development and the related comorbid conditions. Translational research perhaps will lead to information that will help to identify children at higher risk for excessive weight gain and for the development of specific adverse outcomes due to obesity. This type of mechanistic research could also inform more specific strategies for treatment of

comorbidities when weight management cannot be accomplished or is less than adequate.

Selected Unanswered Questions Related to the Medical Consequences of Childhood Obesity

- Who is at risk for development of the medical consequences of childhood obesity?
- How soon should surveillance of children begin to identify obesity-related comorbidities?
- When weight loss is inadequate or fails to modify the medical consequences of obesity, how aggressive should healthcare providers be in the institution of pharmaceutical agents to treat these consequences?
- Under what conditions should children with obesity-related comorbidities be evaluated or managed by subspecialists?

C. Psychosocial and Societal Consequences of Childhood Obesity

Historically, studies to evaluate the psychosocial consequences of pediatric overweight have focused primarily on comparing the functioning of overweight children and adolescents with that of nonoverweight peers on dimensions of health-related quality of life, self-concept, body image, depressive symptomology, and peer relationships. Cross-sectional studies comparing either clinical or community samples of overweight children and adolescents with non-overweight comparison samples demonstrate fairly consistent support for decreased health-related quality of life associated with increasing weight, with those with the highest weight demonstrating the greatest impairment in health-related quality of life. There is also evidence indicating lower body satisfaction and physical appearance-related self-concept in overweight children and adolescents.¹² Longitudinal studies suggest decreases in self-esteem from childhood to early adolescence among overweight children,¹³ and there is some evidence from prospective studies indicating increased risk for development of obesity among depressed adolescents.¹⁴ Overweight children experience more teasing and both overt and relational victimization than normal-weight peers. Longitudinal research suggests that weight status is predictive of vulnerability to bullying in peer relationships.^{15,16} Finally, some studies document a relationship between overweight status and decreased probability of employment and less financial support for college among women, as well as lower household incomes for both men and women. Findings from other domains of psychosocial function, including depressive symptomatology, externalizing behaviors, and self-concept, are more heterogeneous, and even when samples of overweight children and adolescents yield lower scores, they are often still in the clinically normal range.

More recent studies have focused on understanding the variability in outcomes among overweight children and adolescents, with the potential for identifying risk and protective factors. Social stigma and weight-based teasing have been identified as key dimensions that may increase risk for negative psychosocial outcomes among overweight pediatric populations.¹⁷ Cross-sectional and longitudinal studies have demonstrated a relationship between weight-based teasing and a number of negative psychosocial outcomes, including

unhealthy weight-control behaviors, decreased body satisfaction, decreased self-concept, and depressive symptoms. Body dissatisfaction and weight/shape concerns have also been associated with lower self-esteem, as well as higher depression and anxiety scores. A final set of findings with regard to psychosocial consequences relates to changes observed through participation in weight-control interventions. Improvements in psychosocial functioning have been observed in children and adolescents participating in weight-control treatments. These changes are typically independent of weight-loss outcomes.

Selected Unanswered Questions Related to Psychosocial and Societal Consequences of Childhood Obesity

- With regard to severely overweight youth, to what extent do negative psychosocial outcomes, such as depressive symptoms and disordered eating behaviors, relate to degree of overweight, and to what extent do these dimensions improve as a result of intensive weight-control interventions?
- What role do moderators such as age, gender, ethnicity, and socioeconomic status play in the relationship between overweight and psychosocial outcomes?
- To what extent do cultural norms regarding weight status and the associated stigma of overweight impact psychosocial outcomes such as self-esteem and body satisfaction?
- What protective factors, such as degree of family connectedness and family behaviors, buffer the potential negative psychosocial consequences of pediatric overweight?
- To what extent can protective factors be enhanced through intervention?
- What impact do psychosocial outcomes, such as social stigma, have on weight status, risk behaviors, and health outcomes?

Recommendations

- **Education:** Given the heterogeneity of outcomes for overweight youth, it is important for professionals to objectively evaluate psychological and social correlates and not assume maladjustment in these patients. A second potential area for professional education relates to the importance of efforts to decrease weight-related teasing and stigma and enhance self-concept in overweight children and adolescents.
- **Public policy/advocacy:** Policies to decrease tolerance for teasing and stigma in schools may improve the emotional climate for overweight children and adolescents. Education of the public regarding physiological aspects of overweight may enhance these efforts.
- **Research:** (1) The focus should be on severely obese youth, with attention to documentation of emotional and social functioning, as well as change in psychosocial correlates with decreases in obesity. (2) Moderators including gender, race, ethnicity, and socioeconomic status should be examined in the relationship between weight status and psychosocial outcomes. (3) Longitudinal studies to examine relationships among weight status, psychosocial correlates, and other health risk behaviors would be informative in eluci-

dating temporal relationships and identifying intervention targets. (4) A research agenda concerning weight stigma as it relates to psychosocial, academic, and physical health outcomes should be pursued.

IV. Current Healthcare Practices in Childhood Obesity Prevention and Treatment

A. Lifestyle Assessment: Diet and Physical Activity

Limited data have been published to assess the specific goals that pediatric primary care providers hope to accomplish when performing lifestyle assessment of diet and physical activity; however, routine care and anecdotal reports suggest that diet and physical activity assessments are usually the first step in counseling in the primary care setting. In routine care, assessment questions are intended to bring up the issue and give families an opportunity to ask questions or raise concerns. Lifestyle assessment is also an opportunity to identify potential targets for prevention and increase families' self-awareness of current behaviors. The situation may differ between routine well-child care visits and visits aimed at addressing a specific health issue, with childhood obesity lifestyle assessment requiring specific and more in-depth questions. In preparing for diet and physical activity counseling, it is helpful to assess the current situation to determine whether the patient meets recommendations, not only in areas of obesity prevention or treatment but also in other areas of pediatric nutrition.

Some published data address how frequently lifestyle assessment is performed in the pediatric primary care setting. In response to a mailed questionnaire, in a random sample of pediatricians, nurse practitioners, and dietitians, more than 90% reported routine assessment of diet history, and more than 95% reported assessment of physical activity.¹⁸ In a separate study, 56% of family practice physicians and 71% of pediatricians reported routinely performing diet recall; 54% and 79%, respectively, reported assessing sedentary activities; and 88% and 98%, respectively, reported assessing exercise and sports.¹⁹ The main limitations of these and similar studies include the usual low response rate achieved in questionnaires of healthcare professionals and, even more concerning, the likely bias that results because providers who perform lifestyle assessments are more likely to respond, thus overestimating how frequently such assessment actually occurs.

Even more important than how frequently assessment is performed is how it is actually conducted. One study reports that pediatricians assess diet using questions about usual or typical food intake (33.5%), diet diaries (31.2%), 1-day diet recall (15.3%), or eating practices and patterns (14.1%). They assess physical activity using questions about organized physical activity (97.4%), sedentary activities (93.6%), or unstructured physical activities (91.6%).¹⁴ Because dietary or physical activity assessments are not typically taught in medical or other health-profession schools, a wide variability exists in how they are performed in primary care. Most assessment methods are not standardized, and it remains unclear how often standardized assessment methods are used.

Several tools have been developed in the research setting to assess dietary intake that could potentially be used in the primary care setting. These include weighted food records, semiquantitative food records, and standardized diet history, all of which are reliable but likely unfeasible in the primary care setting. Less reliable but likely more feasible methods include informal diet history and standardized or informal food-frequency questionnaires. For physical activity research, methods of assessment include doubly labeled water and calorimetry, heart rate monitors, and accelerometers. Perhaps more feasible in the primary care setting are pedometers, physical and sedentary activity diaries, and formal validated or informal physical activity questionnaires. Feasibility issues in the primary care setting include time constraints, cost, training, and expertise in the use of these methods. Emerging technologies may provide novel methods of diet and physical activity assessment that potentially may be helpful in the primary care setting. These include Internet-based diet and physical activity assessment; PDA (personal digital assistant) or cell phone-based dietary assessment; accelerometers or motion sensors in cell phones, clothing, or shoes; and use of a GPS (global positioning system) to assess physical activity. Another interesting concept is the placement of risk-assessment (including diet and physical activity) kiosks in the waiting rooms of primary care practices to allow families to provide important and standardized information that can be analyzed and used by the clinician in the visit after the assessment.

Selected Unanswered Questions Related to Lifestyle Assessment: Diet and Physical Activity

- Which goals in lifestyle assessment should be prioritized in the pediatric primary care setting? This question should be addressed by assessing the feasibility of each method in terms of time, cost, and expertise, as well as by assessing the expected benefits in terms of quality and usefulness of the information collected and its utility as a first step in counseling.
- How is lifestyle assessment currently conducted in the pediatric primary care setting? Because of the issues related to response rate and bias, as well as issues of social desirability in responses, methods other than questionnaires should be considered, including direct observation or patient interviews.
- What are the feasibility and the validity of tools currently used in research settings in the office setting? More promising tools for the clinical setting include targeted food-frequency questionnaires, brief physical activity questionnaires, and pedometers.
- How can emerging technologies be used in the primary care setting to assess diet and physical activity?
- Can lifestyle assessment without effective counseling have a potentially negative impact?

Recommendations

- *Education:* Pediatric primary care providers should be trained in brief, validated methods of diet and physical activity assessment.

- *Public policy/advocacy*: Reimbursement of diet and physical assessments in the pediatric primary care setting should be promoted and supported.
- *Research*: More research is needed in the areas of clinical and psychosocial/behavioral assessment. The clinical effectiveness and cost-effectiveness of physicians versus dietitians, nutritionists, and certified diabetes educators in lifestyle assessment should be examined.
- *Prevention in office-based settings*: Effective prevention and treatment options related to diet, exercise, sedentary behaviors, and family and behavioral approaches should be implemented, as well as management of obesity and morbid obesity and behavioral, medical, pharmacological, and surgical management.

B. Clinical Assessment

Evaluation of obesity begins with calculation of body mass index (BMI), which has clinical validity because it correlates with adiposity,²⁰ adult adiposity,²¹ cardiovascular risk factors,²² and long-term mortality.²³ Unfortunately, there is no perfect cut point for BMI that identifies all children with elevated body fat. BMI correlates with total fat; however, there may be as yet unidentified or unquantified race and gender differences that need to be considered.

Because BMI norms change with age and differ between boys and girls, absolute BMI is not an appropriate screen in children. Practitioners need to plot BMI on the Centers for Disease Control and Prevention (CDC) percentile curves to identify the BMI percentile category (www.cdc.gov/growthcharts). The BMI z score is an appropriate alternative but requires further calculation, which is cumbersome for busy pediatricians to perform. Skinfold-thickness measurement to confirm increased body fat is not currently recommended, because accurate, reproducible measures are technically difficult to perform. Waist circumference is also not recommended until research establishes how this measure adds information about risk to that already provided by BMI.

Clinicians should assess obesity risk in all children, integrating information about the patient's BMI, medical risk, and current eating and physical activity behaviors and attitudes. This assessment should guide initiation of preventive or treatment strategies. Current definitions use the 85th percentile to define overweight and the 95th percentile to define obesity.^{23a}

Selected Unanswered Questions Related to Clinical Assessment

- Evaluation of current recommendations implementation is needed. This evaluation should determine which recommendations (eg, National Heart, Lung, and Blood Institute [NHLBI] and the American Academy of Pediatrics) are being implemented, the barriers to implementation, and the costs and benefits of implementing screening practices.
- Should screening and management differ by level of obesity? In the patient with mild BMI elevation, how should clinical information affect management, and what additional measures would help delineate risk (such as

visceral adiposity assessment)? Is early treatment more successful? When should intervention take place?

- For patients with BMI >99th percentile, should the evaluation be modified?

Recommendations

- *Education*: Primary care providers and third-party payers should be educated about existing guidelines, as well as about the costs and benefits of screening.
- *Public policy/advocacy*: Systems to coordinate screening efforts among various healthcare providers, such as obstetricians, pediatric physicians, and adult physicians, should be developed to promote BMI screening across the lifetime of individuals.
- *Research*: (1) Barriers to implementation of screening guidelines should be studied. (2) Screening guidelines should be evaluated on the basis of severity. (3) Research to collect more epidemiological data on anthropometrics early in life (normative data on length for weight) should be funded. (4) More epidemiological data are needed on early childhood obesity, including normative data on high weight-for-length and risk for persistence and poor health outcomes. (5) More data are needed on the success of various management strategies.
- *General*: A network of obesity researchers, educators, clinicians, and policy makers should be developed to increase communication and the sharing of tools and techniques for performing research.

C. Psychosocial/Behavioral Assessment

Current practices for psychosocial screening assessments include quality-of-life assessments, readiness assessments, and family-context assessments. From studies of psychosocial assessment, it is known that the prevalence of clinical-range depression symptoms is low, although there is a substantial prevalence of a subclinical range of depressive symptoms; there is a low prevalence of comorbid eating disorders; and impairments such as poor health-related quality of life, social isolation and stigmatization, adolescent low self-esteem and poor body image, and maternal distress are prevalent.

The available data indicate that greater depressive symptoms at baseline are associated with higher dropout rates in a clinical program,²⁴ and greater parent distress and child social problems at baseline are associated with poorer weight-loss outcomes.²⁵ The existence of fewer social problems at baseline predicted better long-term maintenance of weight loss at 2 years,²⁶ and improvements in weight status were shown to be associated with improvements in the child's social problems and psychological adjustment, with reduction in maternal distress.²⁷ In addition, participation in intervention alone has a positive effect on self-esteem.²⁸

To help clinicians tailor treatment approaches, randomized clinical trials are needed on the appropriateness of psychological treatment before clinical treatment, referral for concurrent psychological and clinical treatment, or treatment of psychosocial issues within a weight-management model. In

addition, an understanding of the readiness to change in a family can be useful. This can be accomplished in the framework of “stages of change,” with assessment of where the parent and child are on a continuum of readiness to make lifestyle changes. Motivational interviewing techniques may be helpful to move patients and families toward greater readiness. Parents need to be better educated about the definition and health consequences of obesity. Currently, there are no well-validated measures in widespread use to evaluate readiness to change. Studies of the potential for harm from intervention in a family that is not ready for an intervention are also needed.

The final area that requires evaluation is the family structure. A family assessment is recommended to determine who will do what in providing/monitoring care, what the favored parenting style is, and how the family functions. The existing literature suggests that higher family conflict/lower cohesion, ineffective parenting style, and maternal distress are more prevalent in families of children who present for specialized obesity treatment. An improved understanding is needed in relation to how family/parenting factors bring about lifestyle change, whether family/parenting factors lead to obesity development, and the best methods to assess and monitor patients in a clinical setting.

Selected Unanswered Questions Related to Psychosocial/Behavioral Assessment

- How should psychosocial assessment be performed? Should patients be referred for psychological treatment first or be referred for concurrent psychological treatment after BMI has been measured and interpreted, or should psychosocial issues be treated within a weight-management model?
- How does psychosocial impairment pose barriers to adherence to a weight-management prescription?
- Can obesity-specific instruments to assess child/adolescent lifestyle behavior and the psychometrics of these psychosocial instruments be developed and evaluated?

Recommendations

- **Education:** Primary care providers should be taught about the high prevalence of psychosocial dysfunction in obese patients and their families. The interactions between obesity and psychosocial stress should be emphasized.
- **Public policy/advocacy:** Access to psychological evaluations and treatment in settings other than the primary care providers' offices, such as schools or community centers, should be increased.
- **Research:** (1) Obesity-specific instruments for evaluation of psychosocial health should be developed and validated. (2) Measures to assess family readiness to change must be validated; whether readiness has predictive validity for treatment outcomes must be determined; whether readiness assessment varies by setting and intervention must be understood; and a determination must be made regarding whether intervention in a family that is not ready for it can result in harm. (3) A better understanding is needed

regarding which family/parenting factors bring about lifestyle change, what family/parenting factors lead to obesity development, and what the best methods are to assess and monitor these factors in a clinical setting. Obesity-specific tools that specifically relate to family functioning and parenting skills are needed for the development of more context-specific family-based behavioral therapies to overcome barriers that prevent adherence to lifestyle-change prescriptions. (4) Pediatric disease models such as diabetes mellitus and cystic fibrosis that have successful assessment and treatment methods should be evaluated to determine the possibility of generalizing effective approaches that could be adapted to other conditions. (5) An understanding of psychological adjustment within the context of how it impacts behavior (versus weight gain/loss) is needed. (6) A determination must be made as to how often to assess behavioral and psychosocial functioning.

D. Implementing Effective Prevention and Treatment Options: Diet

Excessive adiposity stems from an energy imbalance. Several factors can promote excess energy consumption. These include appetite stimulation, consumption of excess quantities of food, and consumption of excess calorie-dense foods. Prevention and treatment of obesity usually require a decrease in energy consumption and an increase in energy expenditure to improve energy balance. Dietary interventions that may help reduce or prevent childhood obesity include breast-feeding for infants, a high-fiber diet, and calcium intake.

Studies show dose-dependent reductions in obesity among breast-fed infants.²⁹ Some studies also show increased fat mass in formula-fed infants.³⁰ Lower fat mass in breast-fed babies may be related to the production and excretion of leptin by human mammary epithelial cells, as well as storage of leptin in breast milk fat globules. Leptin supplementation during weaning lowers adult body weight and energy in animal models. Breast-fed infants are protected against fat accumulation and are more sensitive to long- and short-term self-regulation of food intake. Leptin concentrations are highest in the first month of life. Paradoxically, high levels of adiponectin in maternal milk have been proposed as a risk factor for childhood overweight.²⁸ Studies have also shown experimental evidence for the long-term benefits of breast-feeding on the risk of atherosclerosis.³¹

A high-fiber, low-fat diet has been shown to reduce overweight/obesity in women. High-fiber diets can reduce low-density lipoprotein cholesterol, increase postmeal satiety, and decrease subsequent hunger.^{32,33} The American Heart Association dietary guidelines for children recommend the inclusion of fiber-rich foods, including fruits, vegetables, whole grains, and legumes. An increase in fruits and vegetables can help reduce consumption of energy-dense foods.³⁴

Dietary factors that promote obesity include high-calorie beverages (sugared soft drinks or fruit juice), energy-dense foods (fast foods, snack foods), excess refined carbohydrates, excess dietary fat, and large portion sizes.³⁵ The increase in the prevalence of obesity has coincided with an increase in

portion sizes of foods both inside and outside the home, which suggests that larger portions may play a role in the obesity epidemic. Nutritional factors inherent in fast food, such as low levels of dietary fiber, high palatability, high energy density, high fat content, high glycemic load, and high content of sugar in liquid form, may promote excess energy intake.³⁶

To outline a dietary treatment plan and to provide adequate education, counseling by a health professional with expertise in dietary management is often required. Physicians usually do not have adequate time to devote to dietary management, and they may not have the expertise required. The use of a qualified and experienced health professional, preferably a registered dietitian, for dietary counseling and to implement an optimal dietary plan for achieving and maintaining a healthy body weight is recommended.

Selected Unanswered Questions Related to Diet

- What are the best tools for clinicians to help families alter food intake to prevent and treat childhood obesity?

Recommendations

- *Education:* Issues related to health literacy, parenting skills, and cultural competency need to be addressed with clinicians and with parents, and models for delivering dietary information must be provided.
- *Public policy/advocacy:* (1) Communities need to be responsible for providing access to affordable healthy food and exercise. (2) Capacity has to be built within the healthcare system to take care of obese children and children at risk for obesity.
- *Research:* (1) Dietary factors that should be studied include macronutrients, probiotics (dietary supplements containing potentially beneficial bacteria or yeasts), and fasting. (2) The importance of the incretin axis in the control of body weight and predicting responsiveness to agonists and antagonists requires further study in children. (3) Studies are needed regarding whether insulin resistance is a cause of obesity or prevents excessive weight gain during growth and development. (4) Longitudinal studies are necessary to clarify whether adipokines within the intrauterine and neonatal environment play an important role in fetal and neonatal programming of obesity and comorbid conditions such as diabetes mellitus, hypertension, and coronary heart disease.

E. Implementing Effective Prevention and Treatment Options: Exercise and Sedentary Behaviors

The clinical management of overweight children continues to be a frustrating experience for most families and pediatric healthcare professionals. Professional medical organizations often have not provided specific recommendations for intensity, duration, frequency, or modality of exercise for the management of pediatric obesity. Even with specific recommendations, implementation may be difficult.

Yet there is sufficient evidence to recommend exercise in conjunction with nutritional and behavioral counseling to overweight children. A recent literature survey that included exercise interventions within individual- and family-based programs found a total of 47 studies that evaluated exercise interventions in overweight children. Twenty-four of these studies were randomized, controlled trials, and 10 examined the independent contribution of exercise. All but 2 of these trials demonstrated significant reductions in adiposity independent of other factors.³⁷

The benefits of exercise in the management of pediatric obesity are cumulative. Over time, consistent exercise will result in a multitude of metabolic and physiological benefits by promoting weight loss through increased energy expenditure and possibly through inhibition of food intake.³⁸ Physical activity also helps maintain a desirable weight and helps reduce risk factors for cardiovascular disease, as shown in recent studies in children.³⁹ Frequent vigorous exercise periods have been shown to be associated with decreased abdominal fat in youth.⁴⁰ Recently, strength training was shown to be an independent predictor of lower insulin resistance in children.⁴¹ Unfortunately, the positive effects of exercise training will only be realized if the overweight child complies with the prescribed physical activities. Therefore, it is imperative that careful consideration be given to selecting the most appropriate intensity, frequency, duration, and modality of exercise for each overweight child.

Obesity in children is associated with low levels of physical fitness and reduced speed and agility. Reports show that it is difficult to encourage overweight children to adhere to exercise programs because of the greater cardiopulmonary and biomechanical strain associated with primarily weight-bearing activity.⁴² The discomfort associated with transporting an overweight body may result in pain in the lower extremities, breathing difficulty, and premature fatigue. In addition, childhood obesity may impair fundamental motor skills. This, combined with a higher energy cost of locomotion, may alter the overweight child's perception of exercise difficulty. Therefore, overweight children may experience negative consequences of participation in activities considered appropriate for normal-weight children. When exercise programs for overweight children are designed, activities that are easily mastered should be considered. Recommendations based on clear, attainable goals that gradually increase in volume and intensity over time should be established. Such activities will help ensure that overweight children experience initial success.⁴³ Because overweight children will expend more energy performing exercise of the same intensity as normal-weight children, they should not be prescribed running activities in which they must compete with normal-weight youth. Any resistive weight-lifting type of exercise activity should be performed under the close supervision of trained personnel.

Clinical treatment intervention programs designed to promote exercise should contain activities structured to the specific physical, emotional, and cognitive needs of the participants. Exercise for overweight children should be appropriate to their specific physiological and metabolic condition.

Selected Unanswered Questions Related to Exercise and Physical Activity

- Are instructional and activity-promoting video games and DVDs effective in increasing physical activity and reducing obesity?
- Do family activities such as family bike rides and tag games have an impact on adoption of increased activity and weight reduction?
- Is mainstreaming of overweight/obese children with normal-weight children in sports activities helpful or harmful? Does this differ by age and sex?
- What are the potential health and weight benefits of resistance training for children?
- What is the optimum dose of exercise (intensity, duration, frequency, or modality) for the prevention or management of pediatric obesity?

Recommendations

- *Education:* (1) Parents need education in what activities are appropriate on the basis of a child's age, development, and emotional makeup. (2) Parents need skills to teach their children how to play sports. (3) Overweight children need to learn pacing skills to exercise at an appropriate level without injury. (4) Activity-friendly classrooms that increase nonexercise activities should be encouraged. (5) School administrators need to better understand the relationship between fit kids and academic achievement.
- *Research:* More research is needed to evaluate the benefits of commonly recommended reductions in sedentary behavior for weight loss and maintenance and to understand the optimum types of physical activity to prevent abnormal weight gain.

F. Implementing Effective Prevention and Treatment Options: Family and Behavioral Approaches

Given the importance placed on family influence of children's weight-related behaviors, it is not surprising that family involvement is an important part of childhood overweight-prevention programs. A recent Cochrane review on preventing obesity in childhood reports on evidence from 22 studies evaluating the efficacy of programs that lasted at least 12 weeks.⁴⁴ Approximately one third of these prevention programs reported the inclusion of some aspect of family or parental involvement. A common focus was the peripheral inclusion of parents in school- or community-based programs, usually in the form of newsletters or postcards sent to parents and occasional family-based events at school or in the community. Conclusions about the importance of parental or family involvement in childhood overweight-prevention programs are made difficult by the relatively low prevalence of the inclusion of parent/family components in these programs. The overall weak effects of such prevention programs and the lack of direct comparisons between prevention programs that vary the amount or type of parental/family involvement are also concerns. Reasons for not including the family in these studies include the following: (1) The common delivery

settings (eg, schools) are not optimal for parental/family involvement; (2) there is a lack of perceived risk or benefit on the part of the parents; or (3) there is an assumption that small changes necessary for prevention can be achieved by working in other areas.

In contrast to childhood overweight-prevention programs, childhood overweight treatment often takes the form of a family-based behavioral intervention in which parents are intricately involved in treatment.^{43,45} Family-based behavioral interventions are the most widely studied types of intervention, with evidence of long-term success among 8- to 12-year-old children.⁴⁶ Such interventions are more consistently successful than no treatment or education-only interventions.⁴⁷ The core behavioral skills of these intervention programs, including monitoring, contingency management, and environmental control to help already overweight children make eating and activity changes, are highly dependent on caregivers' implementation. Recent well-designed randomized trials document outcomes associated with involving parents as active treatment partners in such interventions^{26,48} with initial success but some relapse after treatment cessation. Anecdotally, parents appear to drive the majority of their children's success in such skills-based interventions. It is not clear whether alternatives to such skills-based approaches that include parents could also have efficacy, particularly for families that are not responsive to existing approaches.

Selected Unanswered Questions Related to Implementing Effective Prevention and Treatment Options: Family and Behavioral Approaches

- What is the level of family involvement that is most related to prevention efficacy? If greater family involvement is required, what form should it take, and how should families be engaged?
- What factors (intervention, family, or other) moderate the efficacy of prevention efforts?
- What improvement can be gained through family involvement in school-based prevention interventions?
- How can more families adopt evidenced-based obesity prevention and treatment strategies?
- How can the current healthcare models be changed to integrate family-based behavioral treatment?
- What is needed to sustain the initial effects of family-based behavioral interventions for pediatric overweight?

Recommendations

- *Education:* Existing family-based treatment programs should be linked with primary and tertiary care providers and provider networks.
- *Public policy/advocacy:* Family involvement should be advocated not only in medical care but in other institutions and organizations that impact children's eating and activity behaviors (eg, schools).
- *Research:* (1) The empirical gaps cited above with regard to family involvement in childhood overweight prevention and treatment should be addressed. (2) Evaluation of intervention and treatment programs should be encouraged.

G. Behavioral Management

Several behavioral strategies have been used successfully in interventions with overweight children that have produced sustained weight loss over time and received considerable empirical support. These include goal-setting, self-monitoring, stimulus control, contingency management, stress management, modeling, and social (including family) support. Although these strategies have helped achieve weight loss in children, they have not been shown to lead to long-term weight maintenance.

The Family Lifestyle Overweight Prevention Study has suggested that a school-based treatment of sufficient intensity can be an effective means for promoting initial weight loss; however, further efforts are needed to evaluate maintenance of the lifestyle changes and resulting weight management. The study findings indicate that the nutrition elements of such programs should be simple and easily integrated into lifestyle, and the physical activity components should focus on fun activities.⁴⁹

Some of the most promising studies in the area of childhood overweight management were performed with homogeneous samples. There are few data on the use of behavioral management in minorities, children from low-income families, or significantly overweight children. Given the increased rates of overweight in minority and low-income children and the increased health and emotional problems for overweight adolescents, methods and strategies that are effective with these groups must be developed. Modification of behavioral strategies to address the specific needs of these patients and families has yet to be undertaken. Recruitment, adherence, and retention need to be better understood to increase the efficacy of behavioral interventions in diverse populations. Culturally and economically appropriate behavior-based interventions are also necessary to meet the unique needs of various populations.

Selected Unanswered Questions Related to Behavioral Management

- How intense do interventions have to be in order to be effective? What works best in short-term intervention? Is that different from longer-term intervention and maintenance?
- Can clinical findings be generalized to broader populations?
- What is the long-term impact of behavioral management on physical and psychosocial factors?

Recommendations

- *Research:* (1) Long-term maintenance strategies need to be evaluated. (2) Culturally and economically appropriate interventions with minority groups and with low-income populations need to be studied further. (3) Interventions with significantly overweight children need to be studied. (4) Improvements need to be made in recruitment and retention strategies.

H. Medical and Pharmacological Management

Behavioral and pharmacological treatments for obesity appear to be additive in adult studies. Behavioral treatment

helps the overweight person develop skills to cope with an environment that promotes overeating and physical inactivity. Pharmacological treatment may help to minimize the effects of biological factors that relate to weight gain.⁵⁰

Recommendations from the NHLBI for adults emphasize that the addition of antiobesity drugs to a regimen of lifestyle modification can produce more weight loss than lifestyle modification alone. According to the NHLBI, antiobesity agents may be considered for adult patients with BMIs of ≥ 30 kg/m², or ≥ 27 kg/m² if the patient has an obesity-related comorbidity or risk factor.⁵¹ The NHLBI guidelines note that antiobesity drugs should only be given as part of a comprehensive program of lifestyle modification, and different antiobesity agents should not be combined. Risk associated with long-term pharmacotherapy must be balanced by the increasing risks of continued weight gain.

The available pharmacological agents for weight loss include orlistat and sibutramine. A 1-year controlled trial of the use of orlistat for adolescents showed greater reductions in BMI than with placebo. The study trial did not find significant between-group differences in glucose, insulin, or lipid levels. Gastrointestinal tract adverse events were more common in the orlistat group and included fatty/oily stool, oily spotting, abdominal pain, and fecal urgency.⁵²

Both 6-month and 1-year controlled studies of sibutramine found significant weight loss compared with placebo. Parameters of glycemic control and lipid metabolism were also improved in the sibutramine versus placebo groups. The effect of behavioral treatment was analyzed separately from the sibutramine effect in the 12-month trial. It was shown that sibutramine and behavioral therapy had a similar magnitude of BMI-lowering effects of approximately 4% and were additive. These 6- and 12-month studies in overweight adolescents were not designed to provide information on weight maintenance. It is not possible to determine whether these adolescents will require chronic treatment with weight-loss medications into adulthood and beyond or whether weight loss over a 12-month period will be sufficient to result in consistent behavior change over time. All of these studies tested orlistat or sibutramine as adjunctive therapy to the well-known effects of behavior modification. All patients received dietary, exercise, and lifestyle modification instructions and counseling.⁵³

Selected Unanswered Questions Related to Pharmacological Management

- Is pharmacological treatment more useful for some patients? How can those patients be identified?
- Is short-term pharmacological treatment useful, or must it be of longer duration?
- What new agents might be more useful in a pediatric or adolescent patient?
- How is pharmacological management best combined with behavioral management?

Recommendations

- *Research:* Pediatric studies of pharmacological approaches to weight loss are needed. New agents to assist in weight-

management efforts, specifically in children and adolescents, are needed. Studies of pharmacological agents must also include evaluation of the optimum behavioral strategies to complement the use of medication.

I. Surgical Management

Most modern gastrointestinal procedures for obesity achieve long-term weight loss and favor maintenance of weight loss. Operations are not without risk, and thoughtful use of revised guidelines should optimize benefits and minimize risks of adolescent bariatric surgery.⁵⁴ Importantly, surgery reduces mortality by 30% in as few as 10 years.⁵⁵

The 40-year evidence base for bariatric surgery in adolescents is small. Research methodology and quality of studies vary, and few studies provide more than 3 years of follow-up data. Outcomes clearly demonstrate weight-loss effectiveness compared with the weight loss achieved with intensive dietary/behavioral interventions for severe pediatric obesity.^{56,57}

Limited data suggest that important comorbidities improve after bariatric surgery in adolescents, perhaps more so in youth than in adults, given that most pediatric comorbidities are of shorter duration. Analysis of perioperative complications indicates that bariatric surgical procedures are generally safe, with complications that are similar to those seen in adults. No perioperative mortality has been detected in pediatric age groups.⁵⁸ There are insufficient data to permit assessment of long-term risks or recidivism in young patients.

Several unique concerns have been raised about bariatric surgery in pediatric populations, including questions about timing of intervention, costs, informed consent, risk-taking behaviors after successful weight loss, compliance, and durability of weight loss and comorbidity resolution.⁵⁹ It has not yet been determined which obesity comorbidities are more reversible with weight loss and which may already be more fixed. These questions point to the importance of well-designed, prospective research efforts to better inform important decisions. Toward this goal, 2 federally funded studies, the Longitudinal Assessment of Bariatric Surgery (LABS) and Teen-LABS, are under way to compare baseline health and surgical risks and benefits between older and younger patients undergoing surgical weight loss. In addition, a randomized, controlled study of gastric banding in adolescents is being conducted in Australia. With these and other studies, refinements in the understanding of extreme obesity in diverse pediatric populations and its response to surgical therapy can be addressed.

Selected Unanswered Questions Related to Surgical Management

- Given that surgery dramatically reduces weight, are there factors that influence the durability of response?
- Are existing cardiovascular pathologies (eg, hypertension, left ventricular hypertrophy, or atherosclerosis) or risk factors for later cardiovascular disease (lipids, insulin, glucose, novel markers of cardiovascular risk) controlled in obese children after surgical weight loss?

- If cardiovascular pathology and risk factors are controlled after surgery, is the control better than with alternative therapies?
- What are the relative risks of modern bariatric surgery (short- and long-term) compared with the risks of alternative therapies, including risk of inadequate control?
- Can operations provide model systems to better understand factors (eg, metabolic, behavioral) underlying extreme obesity?
- Does the mechanism of weight loss differ from the mechanisms of comorbidity resolution?
- Can mechanisms of action of surgery to treat obesity inform other behavioral or psychological treatment strategies?
- How can well-characterized adolescent bariatric surgical cohorts be used to better understand behavioral, environmental, and physiological predictors of abnormal weight gain, surgical weight loss, and risks for regain after weight loss?

Recommendations

- *Public policy:* Methods should be developed to identify adolescent patients who require bariatric surgery to treat extreme obesity and ensure that third-party payers support the costs of surgery.
- *Research:* (1) Long-term cohort studies are needed to evaluate bariatric surgery from both a safety and efficacy standpoint. (2) Clinical trials comparing different approaches to weight management will be important. (3) It will be necessary to study behavioral approaches to optimize the short- and long-term impact of bariatric surgery. (4) Mechanistic components should be incorporated into studies of bariatric surgery to better understand the physiology of both weight loss and resolution of comorbid conditions.

V. Barriers to Optimum Care

A. Healthcare System Factors

1. Preparedness of Providers

In spite of the identification of specific risk behaviors related to overweight, primary care systems have often been ineffective at developing methods to implement guidelines for assessing children and adolescents who are overweight or obese.⁶⁰ Health systems have been more effective at orchestrating preventive screening focused on sexual behavior, substance use, and injury-related behavior versus screening for dietary or exercise behaviors.⁶¹ Some of the reluctance to fully implement screening measures may be due to the lack of well-defined, validated preventive and therapeutic interventions that could be given to children adolescents and their families.

Given that a series of studies now demonstrate the effectiveness of screening for health risk behaviors initiated during adolescence, it is incumbent on healthcare systems to learn from the decade of preventive interventions that embraced screening measures in clinical practice. A first step to engaging healthcare systems in augmenting services for

adolescents who are either overweight or obese may be to develop screening questions that target specific eating and inactivity behaviors and to facilitate BMI measurement at every clinical encounter. Full implementation can be achieved through skills-based clinician training, development of key messages that empower and motivate adolescents and their families to incorporate healthy practices into their lives, and tools to aid clinicians in clinical practice.

Behavioral modification is the cornerstone of treatment of pediatric overweight. Current guidelines call for evaluation of BMI, as well as screening and counseling for nutrition and physical activity behaviors³⁸; however, primary care clinicians are not implementing the current guidelines, even when they identify a child or adolescent as overweight. Furthermore, there is inadequate evidence that implementation of these guidelines would prevent or reduce overweight in pediatric populations. Although this lack of evidence is recognized as a major shortcoming of the current recommendations, there is good reason to believe that treatment and prevention of child and adolescent obesity can be integrated into primary care while such an evidence base is developed. At least 1 program has demonstrated success in obese adults, in which primary care providers were trained to screen and counsel their patients, and the BMI of motivated patients was reduced significantly.⁶² In adolescents, computer-assisted screening and provider-implemented counseling have been shown to change nutrition and activity behaviors but have not had an impact on BMI.

None of these measures guarantee reimbursement for interventions for overweight or obese adolescents in need of further intervention. These efforts need to be coordinated through public policy interventions that target reimbursement practices at the public and private level.

Selected Unanswered Questions Related to Preparedness of Providers

- What strategies are effective in achieving a behavior change in clinicians to measure, plot, and track BMI and to screen and counsel patients regarding nutrition, physical inactivity, and sedentary pursuits?
- If changes in clinician behavior can be achieved, will they be effective in preventing overweight and obesity, and will this improve the overweight status of the child or adolescent?

Recommendations

- *Education:* Educational strategies should be developed that are aimed at facilitating implementation of guidelines regarding screening and management of childhood overweight and obesity.
- *Public policy/advocacy:* Insurance coverage for ongoing screening and counseling must be increased.
- *Research:* (1) Implementation studies aimed at training providers to screen and counsel patients should be performed. (2) Intervention studies using BMI, lipids, and other cardiovascular disease risk factors as primary outcomes should be undertaken.

2. Models of Coverage and Care

Important gaps exist between what is being done to prevent and treat childhood obesity and what is covered by health insurance. This is especially true in light of the guidelines published by the CDC and the American Heart Association (see <http://www.americanheart.org/presenter.jhtml?identifier=3054245>).

Healthcare organizations should be able to promote continuity coordination, encourage quality through leadership and incentives, organize and equip multidisciplinary teams, use information systems, and support self-management and prevention of overweight and obesity. Community organizations need to focus on raising awareness and mobilizing resources. Policy plays a role in these types of activities by creating and supporting environments in which leadership and advocacy for childhood obesity are provided and cross-sector partnerships (eg, between health care, schools, and transportation networks) are developed and sustained. As policy support is developed and implemented, monitoring, benchmarking, and reporting of progress are needed.

Challenges and barriers to be addressed include program recruitment and retention, financing, apathy at the policy level, and clinical apathy. In addition, healthcare stakeholder organizations vary in terms of the priority they place on childhood obesity.

Some state governments are providing leadership in the development of systematic interventions and policies to address obesity. States can continue to provide leadership, establish task forces, develop and implement regulation standards, develop partnerships, address Medicare/Medicaid issues related to obesity coverage and treatment, and work collaboratively with schools, health organizations, and community organizations.⁶³ Healthcare professionals can play a critical role by serving as advocates and as a resource for state-based activity. Coverage and care policy at the federal level could be enhanced through effective coordination among organizations and stakeholders.

Selected Unanswered Questions Related to Models of Coverage and Care

- What interventions are states now performing? How effective are those interventions, and for which population segments? What is the distributional impact of how effective the current interventions are and under what conditions?
- If there is no enforcement of standards for mandatory physical education in schools, how effective are those standards?
- What are the costs of various interventions?
- How much will services for obesity prevention and treatment be used, how much will it cost to supply them, what difference will they make, and are they worth the investment?
- What is the impact of policy actions that have been taken on diverse overweight populations?

Recommendations

- *Education:* Assistance should be given to healthcare professionals to learn how to become engaged with policy

issues related to obesity, including coverage of services by third-party payers.

- *Public policy/advocacy*: (1) Evidence-based clinical and prevention recommendations should be adopted and implemented. (2) Healthcare organizations and professionals should model and support health-related issues at all levels. (3) The involvement of healthcare professionals in the policy arena (both public and private) should be enhanced. (4) Information and resources should be shared among states and among private insurers. (5) Policy interventions to address the obesity challenge should be designed, evaluated, and disseminated, and tools and technical assistance should be developed. (6) Health disparities related to obesity and its comorbid conditions should be addressed.
- *Research*: (1) There is a continued need for evidence-based measures and data. (2) There is a need to learn and build the evidence base with regard to the effectiveness of clinical interventions.

3. Uninsurance and Underinsurance Among Children and Families

Employer-sponsored health coverage remains the mainstay of coverage for children in the United States; however, over the past 10 to 20 years, coverage under Medicaid and the State Children's Health Insurance Program (SCHIP) has become increasingly important. Currently, more than 1 of 5 children rely on Medicaid or SCHIP for coverage, with these numbers higher among children from low-income families.⁶⁴

Although approximately 12% of children lack healthcare coverage, in the last decade there has been a decline in the prevalence of uninsured children. This was driven by the eligibility expansion of SCHIP, substantial investments in outreach, and enrollment simplification. However, in the past 2 years, there has been an erosion of this progress. More children have been added to the ranks of the uninsured, with a concentration of children from low-income families.⁶⁵

Most of the uninsured children are eligible for Medicaid or SCHIP, but they are not getting enrolled. Despite a 10-year focus on outreach and enrollment simplification, barriers persist in terms of awareness, eligibility levels, and parental ability to navigate the administration processes for enrollment.⁶⁶

Although 85% of low-income parents say they would enroll their children if told their child was eligible, fewer than half of those who would be eligible are aware of that fact, despite all but 8 states having set eligibility at 200% of federal poverty levels. Some parents indicate concerns that the Medicaid, and to an extent the SCHIP, enrollment processes are difficult. This is more prevalent in families in which Spanish is the first language and among families in which the parents have not completed high school.

Employer-sponsored coverage is the predominant form of healthcare coverage for children in United States.⁶⁷ As fewer parents obtain such coverage from employers, coverage diminishes for their children. Continued erosion of employer-sponsored coverage is expected, especially among low- and moderate-income families. Progress in enrolling more children in Medicaid and SCHIP depends on SCHIP reauthori-

zation, and state and federal healthcare reform efforts will impact children's coverage.

Selected Unanswered Questions Related to Uninsurance and Underinsurance Among Children and Families

- What is going to happen with reauthorization of SCHIP? How many federal resources are going to be made available to states for healthcare coverage for children?
- Will the federal resources support state programs for SCHIP and also support tools that would provide states with incentives to enroll eligible children?
- Would states have access to new policy tools that would make it easier for families to be aware of their eligibility status and to enroll?
- What are the barriers to accessing current resources for families without insurance or those who are underinsured?

Recommendations

- *Education*: Policy makers should be educated with regard to the health and societal implications of uninsurance and underinsurance that are relevant to childhood obesity.
- *Public policy/advocacy*: (1) New HEDIS (Healthcare Effectiveness Data and Information Set) measures for child and adolescent overweight/obesity should be developed. (2) Insurance coverage for ongoing screening, counseling, and interventions should be increased. (3) Improvements should be made to educate people about available programs and how to access those programs.
- *Research*: (1) The influence of coverage for health care and of socioeconomic and cultural factors on health beliefs and behaviors relevant to childhood obesity must be understood. (2) The multilevel factors that influence policy regarding healthcare coverage must be understood. (3) Data should be collected regarding trends and outcomes of uninsurance and underinsurance specific to childhood obesity and lifestyle risk factors.

4. Healthcare Providers and Settings as Role Models

Healthcare providers are doing a poor job of identifying and managing childhood obesity. One study of pediatricians, pediatric nurse practitioners, and registered dietitians documented that there was a low prevalence of the use of BMI and other measures of adiposity and a greater reliance on clinical impression and weight measures. Clinicians appear to be selective about the morbidities that receive focus when medical history is taken and physical examination is performed.

One study of pediatricians showed that only 27% of overweight pediatric patients were identified as such, whereas 86% of obese children were identified as such.⁶⁸ Identification of overweight and obesity was higher in adolescents than in younger children. Growth charts were current in only 41% of the visits audited, and BMI was plotted in only 6% of the cases. Yet, if overweight and obesity were identified, growth charts kept current, and BMI plotted, these activities would lead to increased odds that the patients would receive counseling for diet and physical activity.

Another study that included both community- and hospital-based clinics identified 40% of children as overweight and 15% as obese,⁶⁹ yet BMI was only documented in an extremely small number of records. Advice given to patients/parents generally addressed diet but did not focus on physical activity.

In another survey, 28% of parents of obese children recalled being told that their child was obese. Of that group, only 27% were referred to weight management. However, the children identified as obese did have a greater incidence of screening for comorbidities.⁷⁰ Obesity was identified less often in children who were very young. The greater the level of obesity was, the greater the identification rate. Obese children who were not identified as such had a lower prevalence of weight evaluation and management. Obese children did not necessarily receive all the components of evaluation and advice. Children who were older at the time of their first clinical visit were more likely to receive counseling about physical activity and diet. Female physicians were more likely to identify and counsel obese patients; this counseling tended to focus on nutrition and physical activity but did not address the required balance between the 2 components.

Healthcare providers perceive a number of barriers that impact obesity identification and treatment. On the basis of primarily self-reported data, most practitioners indicated a feeling that although childhood and adolescent obesity treatment is needed, treatment is probably ineffective. Factors related to this outlook included patient motivation; degree of parental involvement; pessimism regarding effectiveness of counseling; lack of support services; and low proficiency among physicians related to behavioral management, management of parental conflict, and parenting skills.⁷¹

Another issue that may impact the engagement of healthcare providers is that in many instances, healthcare providers may only be minimally healthier than their patients. The Physicians Health Study noted that 38% of male physicians in the study had BMI >25 kg/m², and 6% had BMI >30 kg/m².⁷² The Nurses Health Study had similar findings for females. Among female participants in the Nurses Health Study, 23% had BMI >25 kg/m², and 5% had BMI >30 kg/m².⁷³ Studies have shown that a physician's personal weight status and health habits influence their counseling practices and how their patients perceive that counseling.⁷⁴

Healthcare institutions are subject to the same market forces that are driving the obesity epidemic, and this leads to these institutions being poor role models. A telephone survey of US and Canadian pediatric hospitals with residency programs found that of 101 hospitals surveyed, there were 29 fast food franchises in 24 hospitals, and vending machines were located in all but 4 of the hospitals. Cafeterias were externally operated in 54%, and nearly all the cafeterias offered sugared soft drinks, chocolate bars, candy, potato chips, burgers, fries, and meat pizza. Only 35% offered low-fat desserts. Only 50% of the US hospitals and 27% of the Canadian hospitals had pediatric obesity programs. Only 45% of the US hospitals and 64% of the Canadian hospitals had exercise programs aimed at staff.⁷⁵

Selected Unanswered Questions Related to Healthcare Providers and Settings as Role Models

- Can alterations of the healthcare environment itself improve the institution's commitment to services, staff health, the prevalence and effectiveness of counseling patients, and the perception of the institution as a healthy environment?
- What interventions are effective in addressing a healthy lifestyle for healthcare providers?
- What interventions are effective in improving adiposity for healthcare providers?
- Do changes in healthy lifestyle for healthcare providers impact the prevalence and effectiveness of counseling of patients?

Recommendations

- *Education:* (1) Work to create awareness of healthcare provider personal health and its impact on prevention practices and effectiveness. (2) Create physician personal health programs and incentives.
- *Public policy/advocacy:* (1) The AHA, through its partnership with the Clinton Foundation, the Alliance for a Healthier Generation (<http://www.healthiergeneration.org>), should work with national organizations to create voluntary agreements with fast food franchise outlets in hospitals; *trans* fat, saturated fat, cholesterol, and sodium in healthcare facility foods; beverages; childhood obesity programs; and staff health promotion, support, and treatment programs. (2) Lobby for effective changes in healthcare environments to promote a healthy lifestyle by restricting unhealthful options and increasing healthy alternatives.
- *Research:* (1) Conduct clinical studies to develop and evaluate effective strategies for getting pediatric care providers to calculate, plot, and track adiposity indicators and to initiate discussions regarding treatment for overweight children and their families. (2) Develop and evaluate effective strategies for dissemination and implementation of evidence-based overweight treatments (guidelines) into pediatric care practices. (3) Develop and evaluate effective counseling strategies for use by pediatric care providers when implementing treatment recommendations for overweight children and their families. (4) Identify and evaluate resources, services, and care strategies that are effective as adjuncts to healthy lifestyle counseling and medical/surgical therapy within pediatric care settings for overweight children and their families.

B. The Challenge of Behavior Change

1. Motivational Interviewing for Pediatric Obesity

Much of the counseling regarding behavior change that occurs in practice is didactic and prescriptive, with limited results in achieving behavior change. Motivational interviewing is a client-centered, directive method for enhancing intrinsic motivation to change behaviors by exploring and resolving ambivalence. It has been applied successfully to obesity management.⁷⁶ The goal of motivational interviewing is to facilitate fully informed, deeply contemplated, and

internally motivated choices.⁷⁷ The technique involves active listening, advising, informing, and asking. In conducting motivational interviewing, clinicians reflect about what they have heard from the patient before they provide information or advice. It is important to get the patient's understanding, to ask permission before providing information, to emphasize patient and parent choices, and to try to give options for change. The focus should be on the outcome and not on the process. Barriers to motivational interviewing from the clinician's perspective are a combination of time limitation, a sense of treatment futility (the belief that patients and their parents won't listen), and concerns about efficacy (a belief that it will really work).¹⁹

Selected Unanswered Questions Related to Motivational Interviewing

- When is the optimal time to train healthcare professionals in motivational interviewing techniques?
- Can motivational interviewing concepts be applied in group settings, or are they only appropriate for individual counseling?
- How can motivational interviewing be specifically adapted to address the types of behavior changes specific to overweight/obesity, as well as to children and adolescents?
- How can motivational interviewing be applied in the context of the family, school, and other environmental milieu in which children live?
- What is the effectiveness of motivational interviewing when applied in the context of the busy clinical practice?
- How can motivational interviewing be applied to achieve long-term behavioral change?

Recommendations

- *Education:* Physicians, nurses, and allied healthcare providers should be trained in motivational interviewing techniques.
- *Public policy/advocacy:* Time and support should be provided for motivational interviewing to be applied in busy clinical settings.
- *Research:* (1) Issues of broad application of motivational interviewing techniques should be addressed. (2) Feasibility within busy clinical practices should be assessed, and alternative venues or opportunities should be developed. (3) The efficacy of motivational interviewing in achieving behavior change in children and adolescents with regard to outcomes specific to overweight/obesity should be evaluated.

2. Psychosocial Factors Influencing Behavior Change

Recent research suggests that there are 3 psychosocial variables that may negatively influence the quality of life of obese children and that can also be barriers to the adoption of a healthier diet and physical activity patterns. These issues can coexist in the daily life of certain obese children, although they may be reluctant to discuss them with parents or healthcare providers:

1. **Weight-related teasing:** There is evidence that obese children and adults who are teased about their body size experience greater psychological distress, including poorer self-esteem, poorer body image, and greater depression.⁷⁸ Longitudinal research with college students confirms that being obese elicits weight teasing from peers, which in turn results in poorer body image and greater feelings of depression.⁷⁹ Weight teasing is associated with poorer quality of life among obese youth.⁸⁰ Weight teasing by peer and/or family members was associated with greater suicidal ideation and attempts in a sample of more than 2000 adolescent females.⁸¹ In addition to the psychological consequences, there is correlational evidence that exposure to weight teasing is associated with greater binge-eating tendencies in obese youth⁸²; moreover, weight teasing during sports at school is associated with reduced liking for physical activity and reduced physical activity compared with peers.⁸³ Thus, weight teasing may worsen weight-control efforts by promoting or perpetuating overeating and/or lowering physical inactivity.
2. **Social isolation:** With respect to social isolation, obese children appear to have a less extensive peer network than nonobese children. In an analysis of more than 90 000 13- to 18-year-old youth from the National Longitudinal Study of Adolescent Health, overweight adolescents received significantly fewer friendship nominations than normal-weight adolescents and were more likely to receive no friendship nominations.⁸⁴ More recently, Christakis et al⁸⁵ found that obese individuals were more likely to be clustered within social networks with other obese peers than nonobese peers. Greater isolation from peers in general and from nonobese peers in particular may result in reduced opportunities for physical activity, greater inactivity, and greater overconsumption of food by obese children.⁸⁶
3. **Depression:** There is evidence from prospective studies that depression during childhood or adolescence is a risk factor for excess weight gain or obesity.⁸⁷⁻⁸⁹ The mechanisms by which this occurs are not completely understood. Moreover, given the psychosocial prejudices confronting the obese, it is likely that being overweight contributes to feelings of depression for a subpopulation of obese youth.

Selected Unanswered Questions Related to Psychosocial Factors Influencing Behavior Change

- What is the role of coping mechanisms for dealing with weight teasing, and how can this improve quality of life and weight-control efforts?
- How do peer and nonfamilial social influences affect behavior change?
- What are the causal pathways regarding the extent to which depression is a barrier to healthy eating and physical activity, and can weight control be achieved in obese youth who experience depression?

Recommendations

- *Education:* (1) Awareness by healthcare providers of psychosocial issues in overweight/obese children and adolescents should be increased. (2) Healthcare providers should

be educated in the assessment and management of these psychosocial issues.

- *Public policy/advocacy*: (1) Awareness should be increased within the child's environmental milieu regarding psychosocial issues in overweight/obese children and adolescents. (2) Policy should be developed to address issues of weight teasing. (3) Resources for managing depression should be developed. (4) Programs should be developed to address issues of social isolation.
- *Research*: The ways in which weight-related teasing, social isolation, depression, and other psychosocial factors serve as barriers to behavior change in obese youth should be determined, to help them better achieve healthy lifestyle goals prescribed by the American Heart Association and to promote quality of life.

3. Environmental Factors Influencing Behavioral Change

Several changes have occurred related to food, eating, physical activity, and built environments over the past decades. These changes have been driven by technological advances and social, lifestyle, urbanization, and economic issues. Food is now readily available and accessible in multiple settings throughout the day. More processed and convenient foods are available, in larger portion sizes and at relatively low prices. There are fewer family meals and more meals that are eaten out, often at quick-service restaurants. The school food and physical activity environment is remarkably different from 30 years ago, with a proliferation of high-calorie, low-nutrition foods sold outside of school meals and less daily physical activity. Food marketing aimed at children has increased drastically over the years. At the same time, regular physical activity has been engineered out of children's daily routines. Collectively, these environmental changes have impacted children's eating and physical activity behaviors. An understanding of these issues and how they may facilitate or impede a move toward healthier eating and physical activity and modification of the environment is essential for reducing childhood obesity. Individual behavior change can only occur in a supportive environment with accessible and affordable healthy food and opportunities for regular physical activity.

It is critical to understand the major environmental determinants of healthy eating and physical activity and the most effective intervention points to improve these behaviors among children. An ecological framework is well suited for understanding behaviors and developing public health interventions and policies to improve healthy eating and physical activity among children. Four broad levels of influence—individual, social environment, physical environment, and macrolevel environments—all interact, both directly and indirectly, to impact eating and physical activity behaviors. The research on determinants of eating and physical activity behaviors in children and adolescents has focused predominantly on individual-level determinants of these behaviors (for example, attitudes, preferences, intentions and self-efficacy). Recently, there has been a shift in attention to environmental determinants of eating behavior and the built environment, but the empirical evidence on environmental factors is scant, especially for the food environment.

Selected Unanswered Questions Related to Environmental Factors Influencing Behavioral Change

- What aspects of the food, physical activity, and built environments are more influential than others and most amenable to change?
- What are the most feasible and effective environmental interventions and policies that will have the biggest impact on changing eating and physical activity behaviors to reduce childhood obesity?
- Can the modest effects of behavioral obesity-prevention programs be amplified by the addition of components to foster behavioral-environmental synergy?
- What is the intersection between the physical and social environment, perceptions of the environment, and individual behavior?

Recommendations

- *Education*: Healthcare providers should be trained to assess and consider environmental factors that may either enhance or impede behavior change related to overweight/obesity in families.
- *Public policy/advocacy*: (1) More interventions are needed to change the environment to enable children and families to more easily eat a healthy diet and be more physically active. (2) Practical and simplified environmental measures are needed that community advocates and members could use.
- *Research*: (1) The study of environmental influences on food and physical activity behaviors in children and how they impact weight status is a relatively new science, and the systematic development of conceptual models and theories is lacking. Strong theoretical models for testing the interactions among personal, social, and environmental factors and the mechanisms and causal pathways by which specific environmental influences might interact with individual factors to influence health behaviors and obesity are needed. (2) Improvements are needed in the quality of environmental-level measures, and more attention must be given to discriminate, predictive, and external validity. (3) More testing of environmental measures is needed that considers age, ethnicity, behavioral settings (eg, schools, home, and communities), and geographic settings (eg, rural). (4) More studies are needed of populations at the highest risk of obesity. (5) Environmental variables as mediators and moderators of individual and health-related outcomes must be examined. (6) Stronger study designs are needed that begin to address causality. (7) Geographic Information Systems (GIS) databases that describe physical activity environments need to be developed according to more standardized and consistent protocols.

VI. Practice-Based Resources for Prevention and Management

A. Models From Other Disciplines

1. Adult Chronic Care Model

Multiple physician and patient surveys have demonstrated low rates of identification and treatment of adult obesity

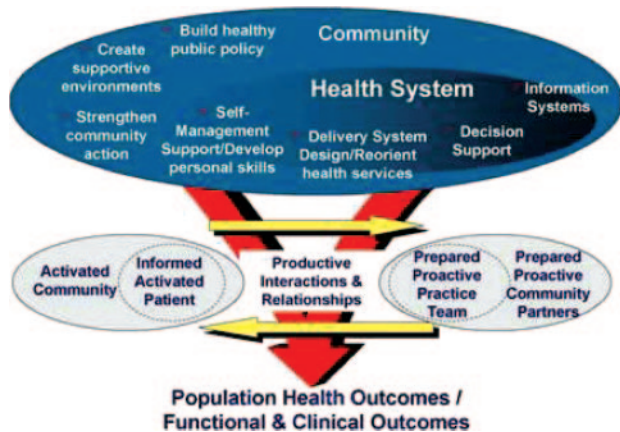


Figure. Population health outcomes/functional and clinical outcomes. Reprinted with permission from the American College of Physicians from Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? *Eff Clin Pract.* 1998;1:2–4.

within the office setting. This is likely due to several factors, including lack of training in obesity assessment and management, low confidence in ability to treat obesity and change relevant behaviors, limited time during office visits, competing demands, and inadequate reimbursement.^{90–92} The Institute of Medicine's 2001 report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, notes that these barriers are representative of the overall problem of trying to care for patients with chronic illness within an acute care setting. The focus on the system comes from organizational theories that promote change by altering the system of care.^{93,94}

Improving Chronic Illness Care, a national program of the Robert Wood Johnson Foundation (RWJF), presents the chronic care model as a framework for management of conditions such as obesity.⁹⁵ The Improving Chronic Illness Care program is supported by the RWJF, with direction and technical assistance provided by Group Health's MacColl Institute for Healthcare Innovation (www.improvingchroniccare.org).

The chronic care model identifies the essential elements of a healthcare system that encourage high-quality chronic disease care (Figure). These elements are the community, the health system, self-management support, delivery-system design, decision support, and clinical information systems. Evidence-based change concepts under each element, in combination, foster productive interactions between informed patients who take an active part in their care and providers with resources and expertise.⁹⁶ The chronic care model can be applied to a variety of chronic illnesses, healthcare settings, and target populations to produce healthier patients, more satisfied providers, and cost savings. The chronic care model has been evaluated for diabetes mellitus, asthma, congestive heart failure, and depression with mixed results; however, application of the chronic care model to the provision of obesity care remains untested.

Primary care for children and adolescents has traditionally dealt mostly with well-child visits and acute illness. The changing face of primary care for children and adolescents is beginning to address more chronic care conditions, and

chronic care models are beginning to be used. There is currently a low rate of obesity diagnosis and management in the pediatric office setting.⁹⁷ The National Initiative for Children's Healthcare Quality (<http://www.nichq.org>) uses the chronic care model with their learning collaborative for childhood obesity.

In order for child healthcare providers to develop best practices in the prevention of abnormal weight gain and treatment of obesity in children and adolescents, it is necessary to use knowledge gained in other areas of medicine, including care for adults with chronic illness. Particularly important examples include the treatment of heart failure and type 2 diabetes mellitus in adults. These are examples of situations in which systems of chronic care have proved useful in producing improved outcomes in areas in which care is complex and often requires behavior modification. An example of success in the pediatric population is the development of systems of care to support patients with asthma and their families. This section presents salient points learned from these disparate settings that could prove useful in developing better care for pediatric patients with obesity and obesity-related complications.

2. Treatment of Heart Failure

The most successful heart failure management interventions involve multidisciplinary teams that incorporate the social network of the patient and provide positive feedback to support complicated lifestyle changes and medical regimens. Consideration of comorbidities and mental health issues is critical in helping patients self-manage their heart failure. Many studies indicate that multidisciplinary teams that incorporate disease management strategies can lead to improved outcomes for heart failure and thus fewer hospitalizations, improved adherence to medications, improved adherence to lifestyle changes, improved mortality, more likely treatment of depression, and a greater likelihood of overcoming barriers.

3. Treatment of Type 2 Diabetes Mellitus

Substantial research in diabetes, smoking, and other areas of health promotion indicates that healthy behavior does not persist on its own; health behaviors must be provided ongoing and varied support and facilitation in order to persist. Research shows that diabetes self-management is effective in improving metabolic control and quality of life in diabetes.^{98,99} However, most of this research was conducted in university medical centers and similar settings. The Diabetes Initiative of the RWJF sought to show that diabetes self-management could be implemented successfully in settings such as neighborhood health centers and community organizations.¹⁰⁰ Lessons learned from the initiative include the following¹⁰¹:

- Self-management is central to diabetes care, not an add-on as time and resources permit.
- Community health workers can make substantial contributions to self-management programs.
- Ongoing follow-up and support for diabetes is important, and without it, self-management benefits will not be sustained.

- Attention to depression and negative emotions and the promotion of healthy coping are key components of self-management and are feasible in primary care and community programs.
- Attention needs to be given to organizational structure and support for self-management programs.¹⁰²
- Community clinic participants can be effective in promoting and supporting self-management.
- Given the limited reach of current programs and the variation in different groups' preferences and needs, development of self-management programs should focus on the identification and incorporation of many good practices rather than a few best practices.

A challenge faced by the Diabetes Initiative was how to develop a common program model that could be implemented in and tailored to the varied needs of the program's grantees. Six evidence-based resources and supports for self-management were identified: Individualized assessment; collaborative goal setting; the opportunity to learn and master skills for diabetes management; community resources, such as for healthy eating and physical activity; ongoing follow-up and support; and continuity of quality clinical care.

A similar challenge of dissemination of a core program in diverse settings is faced by Peers for Progress, a program of the American Academy of Family Physicians Foundation and the Eli Lilly and Company Foundation. The program was designed to validate and promote peer support for diabetes management. Preliminary development of this program identified a tentative list of key characteristics of peer support for diabetes management: (1) It must have its basis in a personal relationship; (2) it must offer assistance in finding ways to implement self-management plans in family, community, workplace, and other settings of daily life; (3) it should encourage the use of skills and problem solving; (4) it should provide social and emotional support in general and for maintaining diabetes management routines in daily life; (5) it should be a complement to, not a substitute for, diabetes patient education; (6) it should enable monitoring of problems in diabetes management; (7) it should provide linkage to clinical care; and (8) it should be implemented by volunteers.

The implications for approaches to childhood obesity, based on what has been learned from the Diabetes Initiative and Peers for Progress, are as follows:

- Self-management works in real-world settings; sustained behavior change requires varied intervention modes and ongoing support.
- Choice is key for reaching audiences and engaging those with diverse needs and preferences; program planning should identify and implement many good practices rather than obsess over identifying and limiting offerings to a few best practices.
- Identification of key program ingredients and approaches provides a base from which individual programs can be flexibly developed to ensure the best fit to settings, organizational and community strengths, and population needs and perspectives.

4. Treatment of Childhood Asthma

The prevalence of asthma has increased dramatically over the past 20 to 30 years. The explanation for this increase is not yet clear, but obesity is a likely contributor. The relationship between obesity and asthma was first suggested by a cross-sectional study of children in the late 1990s. Prospective cohort studies have clearly demonstrated a strong, positive association between BMI and risk of asthma across all ages. Moreover, weight-loss experiments, although limited, suggest that weight loss improves asthma.

The National Asthma Education and Prevention Program released the first US asthma guidelines in 1991. These guidelines were revised in 1997, and a brief update was released in 2002. The 2007 National Institutes of Health guidelines, or the Third Expert Panel Report, emphasize the importance of asthma control and of assessing both its severity and control across 2 domains: impairment and risk.

Many different initiatives have been undertaken to improve childhood asthma outcomes, including the RAND report on improving childhood asthma outcomes,¹⁰³ the National Asthma Education and Prevention Program report on key clinical activities,¹⁰⁴ and the Expert Panel Report 3 Guidelines Implementation Panel (ongoing). These 3 documents demonstrate the importance of distilling information from detailed documents to the activities or messages most likely to produce a significant impact on asthma care processes and outcomes. A related ongoing project, the ASTHMA IQ Project, demonstrates a more technological approach to improving asthma care in the specialist's office.

Selected Unanswered Questions Regarding the Chronic Care Approach to Obesity Management

- How can lessons learned from management of adult and pediatric chronic illnesses best be applied to management of pediatric obesity?
- How can studies be developed to evaluate the application of components of the chronic care model to address childhood obesity?
- Can methods that have been successful in the management of adult chronic illness be applied to pediatric patients?
- How can child healthcare providers develop the kind of medical home that will improve management of chronic illness?

Recommendations

- **Education:** Provide skill-oriented interactive training programs on self-management, behavioral change theories and methods, interdisciplinary care teamwork, and information systems to pediatric primary care.
- **Public policy/advocacy:** (1) The chronic care model will require reengineering of the health-delivery system, including addressing reimbursement issues, organization of health care, emphasis on prevention, and development of community resources. (2) Promote concepts proposed in the reports from RAND, the National Asthma Education and Prevention Program, and the Expert Panel Report 3

Guideline Implementation. (3) Promote specifically tailored technological solutions.

- *Research:* Quality improvement, health outcomes, and health economics will need to be evaluated for delivery of obesity care with the chronic care model versus usual care for childhood obesity.

B. Public Health Measures for Childhood Obesity

There have been notable public health successes with respect to certain threats to health. Questions have arisen regarding whether public health efforts to control tobacco might provide insight into how to prevent childhood obesity.

1. Tobacco Control: Implications for Childhood Obesity

Tobacco control has aspects both similar to and different from obesity as a public health problem:

- Both problems have guidelines for clinical care and policy interventions.
- For both, the evidence base for interventions is less robust for children and youth than for adults, and interventions for adolescence and adulthood are poorly defined.
- Progress in tobacco control required, and still requires, sustained advocacy and political leadership. Progress in addressing obesity will require the same.

There are also some important differences. Nicotine is highly addictive, and there is no safe level of use or exposure, whereas food is not a deadly product and people need to eat every day. This is one reason why the public health response to overnutrition has focused on strategies that rely on the need for individuals to change behavior. However, this approach may be ineffective, because companies spend substantial resources on advertising to influence what is eaten, and the food industry is often resistant to public health attempts to change current practices. Thus, a more comprehensive response may be needed, similar to that used against the tobacco industry.

Consideration needs to be given to the differences and similarities between tobacco use and obesity, including the nature of evidence-based guidelines and best practices for adults, adolescents, and children; the differences between benefits and harms, including whether children are affected before they are capable of making decisions; addiction and how risk affects nonusers; and how counseling, public health adjuncts, school, community, health systems, and regulatory and legislative policy influence use, price, and availability. Effective evidence-based practices related to anti-tobacco activities include increases in the price of tobacco, smoking bans and restrictions, cessation counseling (the 5A's [ask, assess, advise, assist, and arrange]) for adult cessation, availability of treatment for addiction, reduced patient costs for treatment, provider reminder systems, telephone/Web counseling and support, and mass media campaigns.

Lessons have been learned from addressing tobacco in managed care.¹⁰⁵ These include the knowledge that the use of an electronic medical records document can facilitate intervention delivery; dental practices can foster tobacco interventions; patient satisfaction can be improved via the provision

of tobacco-dependence treatments; systems innovations can increase the provision of evidence-based treatment to underserved or disadvantaged populations; and managed care organizations can achieve replicable improvements in delivery of tobacco-dependence treatment.

Tobacco remains a major health threat despite a decline in media attention. Unfortunately, some food industry tactics appear similar to those used by tobacco,¹⁰⁶ including the use of misinformation, the use of supposedly conflicting evidence, and the hiding of negative data. For both issues, individual responsibility and collective/environmental action need to be addressed. Support is needed for policies for children, because they cannot distinguish advertising from program content or make fully informed decisions about behaviors that affect their health. Better evidence is needed, but decisions to act to protect the common good, such as restrictions on advertising, pricing interventions, and community projects, can be effective at changing some behaviors.

The experience with tobacco control suggests that broad, well-networked coalitions, along with strong leadership, are needed to help develop and sustain the range of strategies needed to address obesity as a public health problem.

Selected Unanswered Questions Regarding a Public Health Approach to Obesity Management

- How can a public health approach aimed at reducing or eliminating harm be applied to childhood obesity?
- What factors driving the childhood obesity epidemic are amenable to strategies aimed at reducing harm?
- How effective are public health strategies in preventing or reducing childhood obesity or in enhancing interventions? Is there a growing evidence base?

Recommendations

- *Education:* Awareness of the negative consequences of the provision and promotion of those factors known to promote childhood obesity must be increased.
- *Public policy/advocacy:* (1) Controls on the advertising and marketing of less healthy nutritional items and sedentary pursuits directly to children must be advocated. (2) Action must be taken to ensure that the school environment removes or limits access to less healthy nutritional items. (3) Action must be taken to ensure that school programs limit sedentariness and promote physical activity. (4) The adoption of coordinated school health programs should be promoted in all schools. (5) The availability and affordability of healthy food and safe recreation should be assessed by neighborhood.
- *Research:* Assessments and strategies aimed at identifying and neutralizing factors that promote childhood obesity in the social and environmental realm should be developed.

C. Specific Research Issues

1. Specifying Priorities in the Context of a Complex, Multifactorial Problem

Patients often receive comorbidity-specific medical care; comprehensive care and understanding may be limited by lack of coordination. As a result, all patient needs may not be

identified and treated. This may affect care planning, staffing, and reimbursement. In addition, the interrelationship among comorbidities may not be addressed clinically. Thus, interventions often are not designed or assessed for their impact on all health risk factors.

Another issue to consider is that children of obese parents are at high risk for obesity, yet affected family members are treated separately. As a result, obese family members may not be identified or receive treatment or counseling in a timely manner. Also, there is a chance some family members will sabotage efforts of other family members to reduce weight.

Finally, it must be recognized that children live in communities. Community programs can help address patient needs at the local level, but clinicians are often not familiar with those programs.

Selected Unanswered Questions Related to Specifying Priorities in the Context of a Complex, Multifactorial Problem

- What are the food and activity environments at the community level?
- What obstacles and opportunities are there for families?
- Are there greater obstacles to obesity care for some children and some families?
- What is the best way to link patients/families to community program resources?
- How effective is such linkage based in practice settings?
- Does effective linkage improve diet, activity, and/or BMI?
- Do some approaches help some individuals/families more than others?
- Are there negative effects on other family members?

Recommendations

- *Research:* (1) Multigenerational assessments should be conducted to obtain information on children and adults, as well as family perceptions, in families that are being treated for obesity. (2) The care of all affected family members should be described, including identification of synergies and conflicts. (3) Trials of integrated care across family members should be conducted that assess outcome impacts on multiple family members and multiple comorbidities. (4) Trials of interventions should be conducted that are integrated in the contexts of family, school, and community.

2. Taking a Developmental Approach

A developmental approach to obesity prevention considers the extent to which the events that occur during early human development affect obesity-related consequences over a lifetime. It follows the developmental timeline of obesity to better understand differences at different development stages and examines what can be done to alter these events in a developmentally appropriate manner. The prenatal and early childhood periods are important periods for prevention of chronic disease throughout life, because both behaviors and physiology may be patterned and programmed early in life.

A number of developmental factors can predict childhood obesity. Some studies suggest an interaction between lower

birth weight and higher BMI in adulthood.¹⁰⁷ Studies on childhood growth show that steeper BMI trajectories in the early stages of life can indicate reduced glucose tolerance in young adulthood, and data show that children who are born small and have rapid weight gain early in life have a higher risk of metabolic disease in adulthood. Those who have the highest weight gain in the first 4 months of life have elevated risk of disease in adulthood. Those who gain the most weight in the first 6 months of life have the highest blood pressures, especially if they were born small.¹⁰⁸

Appropriate interventions have not been studied in detail within a developmental framework. A number of prebirth cohort studies exist that could help to evaluate the prenatal period. Key things to consider are fetal nutrition or the entire embryonic supply line, including maternal diet and physical activity; fetal metabolism; maternal periconception health; maternal gestational weight gain; breast-feeding; and sleep during infancy.

Interventions to prevent pediatric obesity may need to start before pregnancy and continue throughout gestation and the postpartum period for both the mother and child. Pregnancy may be an optimal time to start, because women may be more willing to change their behavior at that time. In addition, pregnant women receive frequent clinical care.

Selected Unanswered Questions

- How do maternal and family lifestyle factors before and during pregnancy influence the subsequent development of overweight/obesity during childhood and adolescence, and what is the relationship with metabolic factors?
- Can behavior change introduced during pregnancy be maintained after delivery?
- Can maternal behavior change influence the risk and development of overweight/obesity in the child?
- How can knowledge of child development influence the design and effectiveness of preventive and treatment interventions?

Recommendations

- *Research:* (1) Prevention studies in pregnant women should be taken advantage of to prevent childhood obesity. (2) The risk/benefit of weight gain in infancy should be examined. (3) What is meant by *developmentally appropriate* in the design and evaluation of preventive and treatment interventions should be determined.

3. Engaging Stakeholders

The origin of childhood obesity involves diverse factors from both a biological and an environmental perspective. Therefore, health promotion and obesity prevention in the community are shared responsibilities between many entities, organizations, and interests, including health-delivery organizations, public health agencies, other public and private entities, and the people of the community. The Institute of Medicine has recommended an ecological model for public health interventions wherein the individual is viewed within the larger context of family, community, and society. The obesity epidemic and the public health threat it represents

mandate application of this social ecological model in which the healthcare community plays an integral role in the clinical setting and members serve as advocates for programs in communities that help teach and support healthy behaviors.¹⁰⁹

Stakeholders include those who are involved with implementing the initiatives, those who are impacted by the initiatives, those with inherent interest in the issue, and necessary partners, including funders.¹¹⁰ Engagement of all relevant stakeholders optimizes the evaluation process, improves sustainability, increases feasibility and relevance, maximizes communication, and facilitates optimal implementation. In the end, addressing childhood obesity across sectors among many stakeholders can create the kinds of changes that are more effective, sustainable, and efficient than might be accomplished by acting alone.¹¹¹

All interventions require an investment of resources. Evaluation is a key component of any intervention with engaged stakeholders, and it is important to include stakeholders in evaluation planning. Opening the evaluation to opposing perspectives and enlisting the help or input of potential opponents can strengthen the evaluation's credibility.¹¹² Ultimately, it is this evaluation of impact that will inform whether the intervention and the resources it requires should be continued. The stakeholders can change over time as programs and policies are developed and implemented. Partnerships can be formed horizontally across sectors and vertically from practitioners to decision makers.⁹⁷

There are currently only a few models that target multi-level, multisector change around childhood obesity that include involvement from the healthcare sector. The "Shape Up Somerville" initiative in Massachusetts and the state-level work in Pennsylvania concerning childhood obesity prevention are 2 examples. In Somerville, multiple stakeholders were engaged, including children, parents, teachers, school food service providers, city departments, policy makers, healthcare providers, before- and after-school programs, restaurants, and the media. They addressed childhood obesity in a comprehensive way and demonstrated that a community-based environmental intervention decreased BMI *z* score in children at high risk for obesity.¹¹³ In Pennsylvania, the Pennsylvania Medical Society, Department of Public Welfare, and a statewide coalition addressing obesity collaborated to develop toolkits and database resources for practitioners centered around the commonwealth's requirement to assess children's BMI. Data from the assessment are forthcoming.

In these types of interventions, providers leverage their expertise by working as advocates to form alliances and lobby for policy change to maximize health in families, schools, and communities.¹¹⁴ Providers can serve as effective change agents for both the family and community. Healthcare providers can explore with families the use of local physical activity options, provide health and wellness information in their offices, and advocate for strong school wellness policies or healthy food offerings in their hospital system or local restaurants. Healthcare professionals are central to reversing the epidemic trends of obesity, not only in the clinical environment but also as change agents who engage stakeholders, or serve as stakeholders themselves, in multisector initiatives at the local, state, or federal level that address

healthier lifestyles systematically across communities and environments.

Selected Unanswered Questions

- How does the nature of stakeholder involvement in the design, implementation, and evaluation of interventions influence their effectiveness?
- What are effective strategies to engage and utilize stakeholders?

Recommendations

- *Research:* (1) The impact of stakeholder input on the effectiveness of interventions should be determined. (2) The nature of stakeholder involvement should be optimized.

4. Targeting the Appropriate Outcome

There has been relatively little research on interventions to address pediatric obesity compared with trials in adults. There are also few prospective data regarding the consequences of obesity when it begins in childhood. One key assumption is that the current patterns seen in adults will be similar for obese children. At the population level, increasing drug treatment of hyperlipidemia and hypertension, which are important comorbid conditions, may modify the impact of overweight and obesity in the future.¹¹⁵

The most common outcome for intervention studies in the field of overweight/obesity in adults is weight change. For adult participants in short- to medium-term (weeks/months) studies, even if BMI is used to select participants, the change in BMI in percentage terms is the same as the percent weight loss.

One standard for classifying childhood obesity is based on sex- and age-specific cut points for BMI, which correspond to BMI of 25 and 30 kg/m² at 18 years of age.¹¹⁶ It is possible to use simple weight change in pediatric studies; however the change in height over time complicates interpretation of change in weight over time. For example, weight may go up modestly while BMI decreases over a relatively short time interval. One consequence of different standards for assessing improvement in the degree of obesity is that it is difficult to compare the results of different trials.

Perhaps of greater importance in both adults and children is whether modifying obesity improves other health outcomes. Thus, the next sets of outcomes to consider are the physiological and metabolic responses to obesity, including blood pressure, dyslipidemia, and glucose metabolism. The Diabetes Prevention Program demonstrated that an intensive lifestyle program (including caloric restriction and increased physical activity) that reduced weight by 7% delayed or prevented the development of type 2 diabetes mellitus by 59% compared with control subjects among adults with impaired glucose tolerance.¹¹⁷ There are no equivalent long-term trials in children. There are sufficient studies demonstrating a beneficial effect of modest weight loss on blood pressure in adults to have weight loss be recommended as part of the lifestyle changes by the recent Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure hyperten-

sion guideline.¹¹⁸ The WOMAN (Women On the Move through Activity and Nutrition) study, focusing on postmenopausal women, evaluated a lifestyle intervention (dietary and physical activity changes) compared with health education with respect to a variety of metabolic parameters. The intervention produced a significant, 13-lb net weight loss at 18 months. There was a net reduction of 6 cm in waist circumference and small but positive changes in low-density lipoprotein cholesterol, insulin, glucose, large low-density lipoprotein, and low-density lipoprotein particles between the 2 groups.¹¹⁹

Cardiovascular risk factors and subclinical atherosclerosis measures may be considered intermediate/surrogate markers for the usual end points that are clearly of greatest interest for obesity intervention studies, including myocardial infarction, stroke, and other clinical cardiovascular and metabolic outcomes. There are no prospective long-term studies of lifestyle-intervention-induced weight loss in children and adolescents that demonstrate a beneficial effect on cardiovascular disease outcomes.

There is considerable debate regarding the effects of overweight/obesity on mortality, in part because of the suggestion that overweight (adult BMI 25 to 29.9 kg/m²) is not associated with excess deaths.¹⁰² There have been very limited prospective data regarding intentional weight loss and mortality.

The potential outcomes to consider for trials in overweight/obese youth are weight change, with special consideration of reduction in percent overweight or BMI z score and consideration of fat mass lost; intermediate physiological/metabolic measures; subclinical atherosclerosis measurements; and outcomes that include incidence of diabetes mellitus, cardiovascular disease events, and mortality. The selection of which outcome(s) should be applied to a particular study should be guided by the research question.

Selected Unanswered Questions Related to Targeting the Appropriate Outcome

- Are intervention studies in youth aimed at reducing disease outcomes (diabetes, heart disease, and stroke) or mortality feasible from a practical perspective?
- How do different outcome measures relate to one another in a causal or physiological manner?
- Do interventions aimed at adiposity or metabolic measures influence atherosclerosis, cardiovascular disease, or other obesity-related morbidities?

Recommendations

- *Education:* (1) Awareness of the full spectrum of outcomes available for assessment in intervention studies should be increased. (2) Standardization for assessments should be developed, together with normative data for outcome measures.
- *Public policy/advocacy:* (1) Resources to allow incorporation of novel outcome measures into intervention studies should be increased. (2) Awareness of the challenge of making links between different outcome measures should be increased.

- *Research:* (1) Specific outcome measures should be developed that can be applied in a valid and reliable manner in children and adolescents. (2) Interrelationships between various outcome measures should be determined, as well as how those interrelationships are influenced by interventions.

VII. Research Challenges

A. Research in the Busy Practice

To stimulate change in practice, focus must be placed on changing provider behaviors within the context of a comprehensive understanding of the clinical office as a complex system with competing demands. Insufficient understanding limits the effectiveness of attempts to change practice behaviors. Factors to examine include physician philosophy and style; characteristics of the practice organization, such as office efficiency, diversity, and clarity of staff roles; and communication patterns among physicians and staff.

Practice interventions that use a single intervention strategy have limited influence on changing physician performance. Successful interventions are multifaceted and include combinations of audit and feedback, reminders, local consensus processes, and marketing.

The model of practice change discussed here is adapted from an understanding of a complexity model of practice organization and has 4 interdependent elements for understanding and guiding practice change. These elements are (1) motivation of key stakeholders to achieve the target for change; (2) instrumental, personal, and interactive resources for change; (3) motivators outside the practice, including the larger healthcare environment and community; and (4) opportunities for change, that is, how key stakeholders understand the change options. Change is influenced by the complex interaction of factors inside and outside the practice. Interventions that are based on understanding the 4 key elements and their interrelationships can yield sustainable quality improvements in primary care practice.¹²⁰

Selected Unanswered Questions Related to Research in the Busy Practice

- How can interventions that are developed be tested in a true practice setting?
- What types of research will work best in busy practices?
- Where will the available resources come from to conduct practice-based research and provide interventions?

Recommendations

- *Research:* Scientific reviewers need a better understanding about practice-based research challenges.

B. Bring Research Into Practices: Web-Based Assessment for the Pediatric Obesity Clinic

E-health is an emerging field in the intersection of medical informatics, public health, and business; it refers to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development but also a state of mind, a way of thinking, an attitude, and a commit-

ment for networked, global thinking to improve health care locally, regionally, and worldwide by use of information and communication technology.¹²¹

E-health can enter clinical practice in many ways, through online electronic medical records, health passports, and e-mail/blogs between patients and providers. Physicians can use e-health to access clinical reference material, submit billing, and process prescriptions. Clinical researchers need to capitalize on emerging technologies to adapt Internet solutions to their needs.

The benefits of e-health include more complete and accurate data with fewer errors, cost-effectiveness, the ability to use online assessment tools, ease of sharing data, more security, elimination of the need to store paper documents, and shorter time for analysis. Disadvantages include the learning curve for investigators; developer availability; intellectual property concerns; logistics (computers/Internet on site); language or translation issues; compatibility with institutional charting; computer literacy of staff, patients, and others involved in the study; and the potential of higher cost.

There is a suggested superiority of computer versus paper/pencil in that it is faster, better tolerated, and more accurate, but this has only been shown in some nonnutrition areas.¹²² There is limited availability of public-use validated instruments for diet, physical activity, and mental health screening and very few computerized solutions,¹²³ as well as uncertain feasibility due to cost, investigator learning curve, developer availability, and language/cultural barriers.¹²⁴

Selected Unanswered Questions Regarding Web-Based Assessment for the Pediatric Obesity Clinic

- What is the lasting benefit of weight loss/maintenance using e-health?
- Is e-health feasible for a wide range of partners/practitioners?

Recommendations

- *Research:* (1) Standard measures should be developed to facilitate data sharing across sites; validated instruments should be reviewed, existing tools adapted, and collaboration and sharing of instruments encouraged. (2) Automated collection techniques should be developed and evaluated, with comparison of data quality for paper/pencil versus an automated technique for diet/physical activity. (3) Automated assessment tools must be pilot tested to establish their feasibility and validity. (4) More e-health interventions should be encouraged within clinical settings. (5) Focus groups should be conducted among primary care physicians, weight-management clinics, and patients to assess the acceptability of e-health obesity interventions. (6) E-health obesity interventions should be designed, implemented, and evaluated. (7) Existing efforts to share resources and/or assessment tools across institutions to further research efforts should be enhanced. Consideration should be given to establishing clinical data sharing through a national database. (8) Efforts to share resources by establishing a national pediatric weight-management clinic directory should be formalized, and providers should be allowed to upload resources for assessment.

C. Research Agenda: NHLBI and the Pediatric Heart Network

The NHLBI recently developed a strategic plan to guide its scientific mission in basic, translational, and clinical research. One of the NHLBI's main approaches to pediatric research involves the Pediatric Heart Network, a collaboration of clinical sites and a data coordinating center that conducts research studies in children with congenital or acquired heart disease. The network approach attempts to offer an effective, flexible way to study adequate numbers of patients with uncommon diseases through a common infrastructure for recruiting, monitoring, and following up patients whose conditions will be characterized in a standard fashion. The collaborative effort of the Pediatric Heart Network is a scientifically sound and cost-effective way to provide the information needed to bring evidence-based medicine to bear on children with heart disease. The Pediatric Heart Network also provides a platform to train junior investigators in pediatric clinical research and serves as a vehicle for rapid and widespread dissemination of findings. To date, the Pediatric Heart Network has not been used for the study of childhood obesity.

Two NHLBI programs in the area of pediatric obesity are We Can! and Girls Health Enrichment Multi-site Studies (GEMS). We Can! is a turnkey obesity-prevention program designed to engage the entire community. We Can! provides a curriculum and materials focused on parents and primary caregivers, together with science-based curricula for youth and a community toolkit to help local organizations garner media attention and involve key partners in their efforts. Collaboration is fostered through materials that draw community stakeholders together. The Girls Health Enrichment Multi-site Studies program is a family-based intervention that emphasizes improved dietary intake and increased physical activity. Four centers developed and tested interventions to prevent excess weight gain in black girls 8 to 10 years of age. The interventions were shown to reduce weight gain compared with a control group.

D. Research Agenda: The Children's Oncology Group

The Children's Oncology Group (COG), the world's largest cooperative cancer research organization, encompasses more than 200 pediatric cancer programs in North America, Australia, New Zealand, Switzerland, and the Netherlands. COG engages in multidisciplinary research enterprises. Members of COG's Cancer Control Committee are interested in examining problems identified as national priorities, including obesity. As obesity increases in children and adolescents, COG has observed that obese children over 10 years of age are at increased risk of cancer recurrence. Underweight and overweight children with acute myeloid leukemia experience more life-threatening or fatal complications of treatment than children of normal weight. The organization is undertaking a study to examine drug levels according to height and weight (BMI) in children with acute lymphoblastic leukemia. They are also participating in pilot studies on nutrition and exercise that may prevent the obesity that occurs during and after treatment for childhood cancer.

Older children, adolescents, and young adults treated for acute lymphoblastic leukemia can experience joint destruction due to loss of blood supply to the bone (avascular necrosis); exercise and nutrition also contribute to the strength of bones and joints. COG's Behavioral Science Committee focuses on behavioral studies that might answer critical questions about a child's cognitive, learning, emotional, and behavioral functioning under a variety of treatment options and can help define acceptable quality-of-life outcomes associated with those treatments.

In considering building a collaborative approach to research and funding that crosses traditional boundaries, COG provides the following suggestions based on experience: Begin with large, committed institutions with existing infrastructure. Expansion should be determined by accrual needs. Centralized data management and analysis is needed. The initiative should critically evaluate the need for the data requested, adequately support the need for the data requested, develop a simple and participative governance structure, assure robust scientific review, consider scientific integrity (group and individuals), and appropriately manage conflicts of interest.

E. Research Agenda: CDC

To identify research areas that should be addressed by the CDC and its partners in response to current and future public health needs and events, the CDC engaged in a priority-setting process with multiple stakeholders. The results of this process were published in 2006 in the document, *Advancing the Nation's Health: A Guide to Public Health Research Needs, 2006–2015* (<http://www.cdc.gov/od/science/PHResearch/cdcra/AdvancingTheNationsHealth.pdf>). This document is organized by 7 broad research categories, with 138 priority research themes identified across the 7 categories. Themes related to obesity research appear in 3 of the 7 categories: (1) Promote health to reduce chronic diseases and disability; (2) manage and market health information; and (3) promote cross-cutting public health research (which includes the social determinants of health, as well as the physical environment and health).

The CDC's Division of Nutrition, Physical Activity, and Obesity has a goal to decrease the prevalence of obesity through the prevention of excess weight gain and maintenance of healthy weight loss (<http://www.cdc.gov/nccdphp/publications/aag/dnpa.htm>). The Division of Nutrition, Physical Activity, and Obesity is currently engaged in a strategic planning process to identify focus areas for obesity and obesity research. Among criteria that guide the selection of priorities are the potential for impact, the needs of the funded state program, the recommendations of others, and the division's resources and capacity. Current and proposed research themes for the division include the following: Surveillance, which includes monitoring patterns in overweight and related behaviors, as well as the identification of new measures for surveillance, with a particular focus on environment and policy supports for healthful diets and physical activity; assessment to identify the measures of adiposity that best characterize children and adults with increased risk of adverse health outcomes; identification of effective and promising interventions for obesity prevention and control (this

research area includes the synthesis of findings from the scientific literature, extramural funding of pilot interventions, the evaluation of interventions conducted in the field, and the identification of common evaluation measures); translation research to determine the best strategies for disseminating scientific information so that it can be used effectively by practitioners and consumers; and disparities research, which increases the understanding of why differences in obesity and related behaviors within subgroups of the population exist and the most effective strategies for reducing these differences.

F. Research Agenda: Foundations

A number of national foundations support efforts related to childhood obesity issues. The RWJF has developed 3 integrated strategies to reverse the childhood obesity epidemic: Evidence, action, and advocacy.

Evidence involves investments in building the evidence base, which will help ensure that the most promising efforts are replicated throughout the nation. The foundation's major research efforts in this area—Active Living Research, Healthy Eating Research, and Bridging the Gap—are contributing to the nation's collective knowledge about the changes to policies and to community and school environments that are most effective in increasing physical activity and improving nutrition for kids. RWJF's action strategy for communities and schools focuses on engaging partners at the local level, building coalitions, and promoting the most promising approaches. RWJF is working with The Food Trust, a Philadelphia-based advocacy organization whose mission is to ensure that everyone has access to affordable, nutritious food. The foundation is also working closely with the Alliance for a Healthier Generation (a partnership of the American Heart Association and the William J. Clinton Foundation) to support efforts to improve nutrition, physical activity, and staff wellness in schools nationwide. As RWJF learns from its evidence and action strategies, results are shared by educating leaders and investing in advocacy, building a broad national constituency for childhood obesity prevention.

The W.K. Kellogg Foundation Food & Fitness Initiative is working to create vibrant communities that support access to locally grown, healthy, affordable food, as well as safe and convenient places for physical activity and play for everyone. To achieve this, the foundation is working with 9 communities nationwide. Each is facilitating collaboration across multiple sectors and communities, from transportation to public health, from agriculture to education, from youth to the faith community.

The California Endowment, a private statewide health foundation created as a result of Blue Cross of California's creation of WellPoint Health Networks, a for-profit corporation, has supported policy and advocacy organizations such as the Public Health Institute, the California Center for Public Health Advocacy, and California Project LEAN to initiate and implement efforts to inform key policy makers and community leaders about this crisis and the factors that contribute to its escalation. Nutrition and obesity-prevention programs are funded through initiatives aimed at community

health and reduction of disparities. By focusing on social and physical environments, the California Endowment aims to prevent disease and injury and eliminate conditions that lead to health disparities. The focus is to change policies and systems to support health-promoting environments.

Selected Unanswered Questions Related to Research Challenges

- What are the environmental and policy supports that are most effective for changing individual diet and physical activity? How are these supports best measured?
- What are the most effective strategies for translating scientific information for end-users?
- Why do disparities in obesity and its related behaviors exist? What are the most effective strategies or interventions to reduce these disparities?

Recommendations

- *Research:* (1) Gaps in research that are not being sufficiently met by funding from other research organizations should be identified. (2) The American Heart Association's research priorities should be communicated to other research organizations to avoid duplication and to facilitate potential collaboration. (3) Findings from American Heart Association research should be communicated to relevant stakeholders and audiences.

VIII. Research and Policy: Knowledge Translation

A. From Practice to Policy to Practice

It is important that healthcare providers recognize the relationship between practice and the development of evidence-based policy. When conceptualized as a continuum, the phases that exist for translating evidence to policy are more clearly articulated. One such continuum is based on and modified from work presented at the 2004 National Institute of Diabetes and Digestive and Kidney Diseases conference, "From Clinical Trials to Communities: The Science of Translating Diabetes and Obesity Research" (<http://www.niddk.nih.gov/fund/other/Diabetes-Translation/conf-publication.pdf>). This continuum comprises basic scientific research that creates knowledge, adaptation of relevant research to real-life settings, widespread dissemination of science to benefit populations, and incorporation of evidence into policies designed to promote and sustain population health. This approach serves as the basis for understanding the role that practice plays in policy development, which in simple terms occurs across 4 critical steps: Adequate scientific evidence, social will, political will, and expected outcomes.

Evidence summarized in several key reports, including the Institute of Medicine's report on *Preventing Childhood Obesity* (2004), the companion Institute of Medicine report evaluating *Progress in Preventing Childhood Obesity* (2006), and the report from Trust for America's Health that evaluates the impact of obesity policies in America (2007), provides the basis for the development of policies designed to enhance normal child development and weight. These reports also serve a critical role in drawing public attention to the problem

of childhood obesity. This in turn promotes social will to deal with this health epidemic. Recent national surveys also show growing public opinion in support of government intervention to address childhood obesity. This supportive social will is a key and necessary ingredient to implementing policy initiatives designed to prevent childhood obesity.

Evidence to guide intervention and social will to promote action are key to building the political capital or will needed to initiate policy development and change. Substantive data suggest that states have moved at more rapid rates than the federal government to address issues related to childhood obesity.^{125,126} Data suggest that legislative initiatives by the states do reflect evidence presented in key scientific reports. It also appears that policy interventions are most likely to be focused on healthy eating in schools.¹²⁷ The following is needed to ensure the development of evidence-based policies to prevent childhood obesity: Evaluation of policy impact on childhood obesity; advocacy for evidence-based policies to prevent childhood obesity; and involvement of policy makers with members of research teams.

Selected Unanswered Questions

- What is the impact of current obesity policies on the development of childhood obesity?
- What are the current priority policy issues in childhood obesity?
- What do policy makers identify as priority issues related to childhood obesity?

Recommendations

- *Education:* (1) Systematic communication designed to inform professional members of advocacy efforts related to childhood obesity should be provided. (2) Member involvement in the development and activities of health policy initiatives should be encouraged. (3) Workshops designed to develop advocacy skills should be offered to professional members.
- *Public policy/advocacy:* Current pending federal legislation designed to improve school-based nutrition and physical activity should be identified and supported.
- *Research:* (1) There is a need for studies to evaluate the impact of obesity-related policies on childhood obesity prevalence. (2) There is a need for studies that involve policy makers as key research team members in developing key evidence to inform childhood obesity policy.

IX. Concluding Remarks

Childhood obesity is a significant threat to the long-term health and well-being of American children. Obesity contributes to a significant burden in terms of chronic diseases, rising healthcare costs, and, most importantly, disability and premature death. It appears that this burden will increase in the future.

Because obesity is usually the result of a complex, interdependent constellation of factors, the goal of reducing childhood obesity can only be achieved through a comprehensive and coordinated effort that incorporates a range of multidisciplinary strategies. For that reason, it makes sense

that a national effort to address childhood obesity must be integrated and coordinated across multiple professional disciplines, and it must be inclusive of key research, health, advocacy, education, media, and consumer organizations. This need for collaboration cannot be overstated. Some excellent foundation-laying research has already been done in relation to childhood obesity, and there are several excellent programs and resources available. However, ongoing research and continued program development must be further supported and more widely disseminated, or the likelihood of widespread replication will be diminished. It is hoped that the Childhood Obesity Research Summit will serve as a tool to help inform collaborative efforts across multiple stakeholders to develop and test new strategies for prevention and treatment of childhood obesity.

Appendix A: Childhood Obesity Research Summit Planning Committee

The Childhood Obesity Research Summit was sponsored by the American Heart Association Council on Cardiovascular Disease in the Young. The program committee was cochaired by Stephen R. Daniels, MD, PhD, University of Colorado Denver School of Medicine; Marc S. Jacobson, MD, Schneider Children's Hospital; and Brian W. McCrindle, MD, MPH, The Hospital for Sick Children.

Committee members included Prabhakaran Balagopal, PhD, Nemours Children's Clinic/Mayo Clinic College of Medicine; Lora Burke, RN, PhD, MPH, University of Pittsburg; Stephen Cook, MD, MPH, University of Rochester Medical Center; Sarah D. de Ferranti, MD, MPH, Children's Hospital Boston; Robert H. Eckel, MD, University of Colorado Denver School of Medicine; David P. Faxon, MD, Brigham and Women's Hospital; Laura L. Hayman, RN, PhD, University of Massachusetts Boston; Rae-Ellen W. Kavey, MD, MPH, National Heart, Lung, and Blood Institute; Michele Mietus-Snyder, MD, University of California, San Francisco Center for Health and Community; Paul Poirier, MD, PhD, University Laval; Julie Steinberger, MD, MS, University of Minnesota; Elaine M. Urbina, MD, Preventive Cardiology; Linda Van Horn, PhD, RD, Northwestern University.

Appendix B: Childhood Obesity Research Summit Presenters

Prabhakaran Balagopal, PhD, Nemours Children's Clinic/Mayo Clinic College of Medicine, Moderator; Sarah Barlow, MD, MPH, Baylor College of Medicine—Clinical Assessment; Alain Bertoni, MD, MHP, Wake Forest University School of Medicine—Targeting the Appropriate Outcome; Helen Binns, Northwestern University, Feinberg School of Medicine—Research in the Busy Practice; George Bray, MD, Pennington Center, Louisiana State University—Pathophysiology of Obesity; Lora Burke, RN, PhD, MPH, University of Pittsburg, Moderator; Carlos Camargo, MD, PhD, Massachusetts General Hospital—Treatment of Childhood Asthma; Katherine Kaufer Christoffell, MD, MPH, Northwestern University, Feinberg School of Medicine—Specifying Priorities in the Context of a Complex, Multifactorial Problem; Stephen Cook, MD, MPH, University of Rochester Medical Center, Moderator; Stephen R. Daniels, MD, PhD, University of Colorado School of Medicine, The Children's Hospital, Moderator—Medical Consequences of Childhood Obesity; Sarah D. de Ferranti, MD, MPH, Children's Hospital Boston, Moderator; Robert H. Eckel, MD, University of Colorado at Denver and Health Sciences Center, Moderator; Myles Faith, PhD, University of Pennsylvania School of Medicine—Psychosocial Factors Influencing Behavior Change; David P. Faxon, MD, Brigham and Women's Hospital, Moderator; Edwin Fisher, PhD, The University of North Carolina at Chapel Hill—Treatment of Type II Diabetes Mellitus; John Foreyt, PhD, Baylor College of Medicine—Behavioral Management; Deborah Galuska, PhD, MPH, Centers for

Disease Control and Prevention—Research Agenda: CDC; Matthew Gillman, SM, Harvard Medical School/Harvard Pilgrim Health Care—Taking a Developmental Approach; Lee Goldberg, MD, MPH, University of Pennsylvania—Treatment of Heart Failure; Debra Haire-Joshu, PhD, MPH, Saint Louis University School of Public Health—From Practice to Policy to Practice; Sandra Hassink, MD, Alfred I du Pont Hospital for Children—Implementing Effective Prevention and Treatment Options: Diet; Laura L. Hayman, RN, PhD, University of Massachusetts Boston, Moderator; Charles Homer, PM, MPH, National Initiative for Children's Healthcare Quality—Evaluation of Toolkits Available in the Marketplace; Thomas Inge, MD, PhD, Cincinnati Children's Hospital Medical Center—Surgical Management; Charles Irwin, Jr, MD, University of California, San Francisco—Preparedness of Providers; Marc S. Jacobson, MD, Schneider Children's Hospital, Moderator—Medical and Pharmacological Management; Carolyn Jasik, MD, University of California San Francisco—Bridging Research Into Practice: Web-Based Assessment for the Pediatric Obesity Clinic; Elissa Jelalian, PhD, Brown Medical School—Psychosocial and Societal Consequences of Childhood Obesity; Rae-Ellen W. Kavey, MD, MPH, National Heart, Lung, and Blood Institute, Moderator; Genevieve Kenney, The Urban Institute—Uninsurance and Underinsurance Among Children and Families; Jonathan Klein, MD, MPH, University of Rochester—Tobacco Control: Implications for Childhood Obesity; Robert Kushner, MD, Northwestern University Feinberg School of Medicine—Adult Chronic Care Model; Laura Leviton, PhD, The Robert Wood Johnson Foundation—Research Agenda: Foundations; Brian W. McCrindle, MD, MPH, Hospital for Sick Children, Moderator—Healthcare Providers and Settings as Role Models; Michele Mietus-Snyder, MD, University of California, San Francisco Center for Health and Community, Moderator; William Neal, MD, West Virginia School of Medicine, Moderator—Intersection of Health Care with Other Environments: A Multilevel Approach: Family, School, Community, Government; Kevin Oeffinger, MD, Memorial Sloan-Kettering Cancer Center—Research Agenda: The Children's Oncology Group; Gail Pearson, MD, ScD, National Heart, Lung, and Blood Institute—Research Agenda: NHLBI and the Pediatric Heart Network; Paul Poirier, MD, PhD, University Laval, Moderator; Ken Resnicow, PhD, University of Michigan—Motivational Interviewing for Pediatric Obesity; Brian Saelens, PhD, University of Washington-Child Health Institute—Implementing Effective Prevention and Treatment Options: Family and Behavioral Approaches; Randy Seeley, PhD, University of Cincinnati—Neurobiological Aspects of Obesity; Lisa Simpson, MB, BCh, MPH, Cincinnati Children's Hospital Medical Center—Models of Coverage and Care; Melinda Southern, PhD, Louisiana State University Health Sciences Center—Implementing Effective Prevention and Treatment Options: Exercise and Sedentary Behaviors; Julie Steinberger, MD, MS, University of Minnesota, Moderator; Nicolas Stettler, MD, MSCE, The Children's Hospital of Philadelphia—Lifestyle Assessment: Diet and Physical Activity; Mary Story, PhD, RD, MPH, University of Minnesota—Environmental Factors Influencing Behavior Change; Elaine M. Urbina, MD, Preventive Cardiology, Moderator; Linda Van Horn, PhD, RD, Northwestern University, Moderator; Reginald Washington, MD, Rocky Mountain Pediatric Cardiology—Special Lecture: Current Protocol: CDC/AMA Guidelines; Laurie Whitsel, PhD, American Heart Association—Engaging Stakeholders; and Meg Zeller, PhD, Cincinnati Children's Hospital Medical Center—Psychosocial/Behavioral Assessment.

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Writing Group Disclosures

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Stephen R. Daniels	University of Colorado Denver School of Medicine	None	None	None	None	None	Abbott Laboratories*; Merck, Schering-Plough*	None
Robert H. Eckel	University of Colorado Denver School of Medicine	Sanofi-Aventis†	None	Cardiometabolic Health Congress†; Merck*; Sanofi-Aventis*	None	None	None	None
Marc S. Jacobson	Schneider Children's Hospital	Sankyo/ Medpace†	None	None	None	None	None	None
Brian W. McCrindle	The Hospital for Sick Children	None	None	None	None	None	Abbott*; Roche*	None
Brigid McHugh Sanner	Sanner & Company	None	None	None	None	None	American Heart Association†	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (1) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income, or (2) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

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