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Contact Hours: **6**

Childhood Obesity

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COURSE OBJECTIVE: The purpose of this course is to prepare healthcare professionals to understand childhood obesity, including its prevalence, consequences, contributing factors, interventions, and approaches to prevention and treatment.

LEARNING OBJECTIVES
Upon completion of this course, you will be able to:

- Describe the prevalence of overweight and obesity in U.S. children.
- Discuss the short- and long-term consequences of childhood obesity.
- Discuss factors contributing to childhood overweight and obesity.
- Describe components of an assessment for childhood overweight or obesity.
- Identify strategies for the prevention of childhood overweight and obesity.
- Explain interventions to treat overweight and obesity in children and adolescents.
- Discuss the ethical issues concerning overweight and obesity in children and adolescents.

INTRODUCTION

Obesity is the most prevalent nutritional disorder among children and adolescents in the United States and is considered a major health concern of the developed world. While adult obesity rates have doubled since 1980, childhood obesity rates have nearly tripled during that time (Ogden et al., 2014).

Over the past several decades, what, how, when, and where we eat and where and how families live, work, and play have undergone enormous change. Aggressive marketing of inexpensive high-fat, high-sugar foods, particularly to children; the fast-food invasion of school cafeterias; extensive time in front of a television, computer screen, or other digital devices; and decreased

physical activity have together widened the waistlines of children and narrowed their chances for a healthy future.

Other causes and risk factors for the development of overweight and obesity in children and adolescents include genetics, environmental effects (both prenatal and postnatal), and maternal behaviors and exposures.

Life-threatening health problems once diagnosed in adulthood—type 2 diabetes, high blood pressure, and high cholesterol—are often linked to obesity and are increasing among children and adolescents. These conditions threaten to decrease the life expectancy of today's children, and we are facing for the first time the chance that the current generation may have a shorter lifespan than their parents or their grandparents because of this issue (RWJF, 2015).

All the news is not negative, however. In 2015, the Robert Wood Johnson Foundation reported that more school districts, cities, counties and states reported declines during the previous year in their childhood obesity rates, which peaked in the early 2000s.

Defining Overweight and Obesity

The term *overweight* refers to increased body weight from fat, muscle, bone, water, or a combination of these factors in relation to height, which is then compared to a standard of acceptable weight. *Obesity* is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass. Overweight and obesity are the result of various genetic, behavioral, and environmental factors (RWJF, 2015).

Overweight and obesity are measured according to body-mass index (BMI). BMI is a common measure that expresses the relationship (or ratio) of weight to height, and is calculated as:

$$\text{BMI} = (\text{weight in pounds} \div \text{height in inches}^2) \times 703$$

BMI of adults remains relatively constant unless they gain or lose a lot of weight. The assessment of BMI in children, however, is more complicated because children's BMI changes as they grow and mature. Also, these patterns of growth are different for boys and for girls. As children's BMI changes considerably between birth and adulthood, fixed thresholds such as those for adults cannot be applied to children. Instead, children's BMI is classified by using thresholds that take into account the child's age and sex (RWJF, 2015).

After BMI is calculated for children and teens, it is expressed as a percentile. The percentile can be obtained from either a graph or a percentile calculator, which express a child's BMI relative to children in the United States of the same age and sex. BMI-for-age percentile growth charts are the most commonly used indicator to measure the size and growth patterns of children and teens in the United States (CDC, 2015a).

- ***Overweight*** is having a BMI ≥85th percentile for age and sex.
- ***Obesity*** is having a BMI ≥95th percentile for age and sex.

- ***Severe obesity*** is defined as having a BMI >120% of the 95th percentile for age and sex or a BMI ≥35, whichever is lower.
  (Skinner & Skelton, 2014)

Incidence and Prevalence

According to the latest figures from 2011 to 2012, approximately 17% of children and teenagers ages 2 to 19 years fell into the category *obese,* and 31.8% were either overweight or obese. In early childhood, more than 1 in 12 children were obese, and by ages 12 to 19, 20.5% of children and adolescents were obese (Ogden et al., 2014).

Among young children more than 2% fell into the category *severely obese,* 5% of 6- to 11-year-olds were severely obese, and 6.5% of 12- to 19-year-olds were severely obese (Skinner & Skelton, 2014).

Although obesity rates have tripled in the past 30 years for children, for very young children, there may be signs of progress. The National Health and Nutrition Examination Survey (NHANES) and the CDC released data in 2013 that showed an apparent decline in obesity prevalence in children ages 2 to 5 years from a high in 2004 of 14% to a little more than 8% in 2012 (NCSL, 2016).

Obesity experts, however, are questioning the validity of the decline due to a suspected error in the 2003 data. Following the CDC announcement, a study disputing this decline was done stating that overall childhood obesity rates increased from 14.5% to 17.3% and suggested that the results be evaluated over the next few years to determine if this is a sustained and a true decline (Skinner & Skelton, 2014).

RACIAL/ETHNIC DISPARITIES

There are significant racial and ethnic disparities in obesity prevalence among U.S. children and adolescents.

- Overweight and obesity prevalence rates for children ages 2 to 19:
  - Asian American: 19.5%
  - White: 28.5%
  - Black: 35.2%
  - Hispanic/Latino: 38.5%
- Severe obesity rates among children ages 2 to 19:
  - White: 4.8%
  - Hispanic/Latino: 6.6%
  - Black: 8.5%

- Overweight and obesity rates are higher, start at an earlier age, and increase more quickly among black and Hispanic/Latino children than among white children.
- Rates of obesity among low-income preschoolers remain high, with the highest among American Indians/Alaska Natives (21.1%), Hispanic/Latinos (18.7%), followed by whites (12.7%), blacks (11.8%), and Asian/Pacific Islanders (11.6%).
- Among children ages 6 to 11, Latino and black obesity rates are higher than white obesity rates, and these same rates are present among Hispanic/Latino and non-Hispanic/Latino black teens ages 12 to 19.
- Overweight and severe obesity are increasing significantly among Hispanic girls and non-Hispanic black boys.

  (Ogden et al., 2014; Fryar et al., 2012)

REGIONAL DISPARITIES

Regional differences in the United States as reported by NHANES shows the U.S. states with the highest childhood obesity rates are:

- Mississippi: 21.7%
- South Carolina: 21.5%
- District of Columbia: 21.4%
- Louisiana 21.1%
- Tennessee: 20.5%
- Arkansas 20%
- Arizona 19.8%
- Kentucky: 19.7%

The states with the lowest rates of childhood obesity include:

- Oregon: 9.9%
- New Jersey 10.0%
- Hawaii: 10.6%
- Wyoming: 10.7%

  (Ogden et al., 2014; NCSL, 2016)

CONSEQUENCES OF CHILDHOOD OBESITY

Being overweight or obese has serious short- and long-term consequences. Its chronic effects can reduce an individual's overall quality of life, both as a child and later as an adult, as well as result in premature death. Childhood overweight and obesity also impacts society.

Immediate Health Effects of Obesity

Childhood obesity increases the potential for early onset of **cardiovascular disease** as a result of **metabolic syndrome,** a name for a group of factors that raise the risk for heart disease and other health problems. There are five factors that make up metabolic syndrome, and they tend to occur together. These include:

- Excess fat in the abdomen
- High triglyceride level
- Low HDL cholesterol level
- High blood pressure
- High fasting blood sugar

Adipose tissue is proinflammatory, and inflammation is implicit in the development of metabolic syndrome (Magrone & Jirillo, 2015). Chronic inflammation in the body and blood vessels occurs in children who are obese. This causes roughening of the vessel walls, which leads to entrapment and accumulation of cholesterol. Chronic inflammation is in part due to an overload of simple, highly processed carbohydrates and the excess consumption of certain types of vegetable oils found in many processed foods (Lundell & Nordstrom, 2012).

In addition to metabolic syndrome, a factor that also increases the risk for cardiovascular disease and stroke is **nonalcoholic fatty liver** (NAFL), which causes fatty infiltration and inflammation of the liver. NAFL can cause hypertrophy of the left ventricular and early left ventricular diastolic and systolic dysfunction as well as blood vessel endothelial dysfunction and greater carotid intima-media thickness (Alterio et al., 2014).

Childhood obesity and **asthma** have repeatedly been shown to be associated in studies, and a genetic variant appears to increase the tendency for the development of both. Obesity parallels an increase in the incidence of allergic disease in early life, such as food allergies, as well as asthma, and there appears to be a stronger association between BMI and asthma among girls than boys. Increased BMI directly affects the mechanical effects of the respiratory system, leading to a reduced functional residual capacity and expiratory reserve volume as well as abnormalities in the lipid and/or glucose metabolism that contribute to the pathogenesis of asthma.

Inflammation is a characteristic that both obesity and asthma share. The presence of obesity-related hormones, known as adipokines, can penetrate the lungs and cause inflammation in the airways. Obese children with asthma also tend to present with more and severe respiratory symptoms and have poorly controlled asthma, though they use more medications. Recovery from acute exacerbations is also slower than in children of normal weight with asthma (Grasemann, 2015; Hampton, 2014).

Obese adolescents are more likely to have **prediabetes,** a condition in which blood glucose levels indicate a high risk for development of diabetes. Analysis found that the prediabetes rate of overweight adolescents in the United States was 2.6 times higher than those with normal

weight, and the risk increases among obese children with a family history of diabetes (Pinhas-Hamiel & Zeitler, 2013).

Obesity is a risk factor for **obstructive sleep apnea** (OSA) in children as well as adults. The likelihood of a child who is obese developing OSA is 4 to 5 times greater than in a child of normal weight. This increased risk is due to fat deposits around the neck and throat, which can narrow the airway. During periods of sleep apnea, oxygen saturation levels can drop below 85%. OSA is a serious cause of metabolic, cardiovascular, and neurocognitive morbidity in children (Newson, 2015).

The increasing incidence of childhood obesity has given rise to an increase in pediatric **gallbladder disease**, which causes abdominal pain that can be incapacitating. Although gallstones are unusual in childhood, nearly half of all cases of cholecystitis in adolescents are associated with obesity (Schwarz, 2015).

There are a number of **orthopedic complications** that can arise in association with obesity in childhood or adolescence. Excess weight can cause vitamin deficiencies, hormonal imbalances, and increased stress and tension that can damage the growth plates, which regulate and help determine length and shape of bones at maturity. Too much weight places excessive stress on the growth plates, which can lead to early arthritis, a greater risk for broken bones, and other serious orthopedic conditions such as:

- **Spinal problems.** A variety of spinal problems may arise due to factors such as the inability of mineral content of spinal bones to adequately compensate for excessive weight and the comparatively vulnerable anatomical location of vertebral growth plates.
- **Slipped capital femoral epiphysis.** A disruption occurs at the femoral epiphyseal plate, shifting the alignment between the femoral head, neck, and shaft. This may occur due to increased load from heavier body mass or from an excessively abducted gait pattern common in those with obesity, both of which increase shear forces at the capital femoral growth plate.
- **Blount disease.** This is a skeletal disorder characterized by a varus deformity of the tibia resulting from unequal weight-bearing stress on the medial tibial condyle during childhood skeletal development. This disorder can occur in infancy (characterized by bowlegged appearance) or adolescence. In adolescents, Blount disease can lead to gait deviations, including dynamic stance-limb knee varus, increased stance-limb knee rotation, and swing-limb circumduction as well as significant and potentially damaging compressive forces at the medial knee compartment.
- **Fracture risk.** Obese children are at increased risk of fractures, as bone development is not always able to compensate for excess weight. This imbalance can put undue stress on developing bones, increasing risk for joint damage or osteoarthritis in adulthood. Overweight, moderately obese, and extremely obese children all have an increased incidence of painful flat feet and fractures of the foot, along with the ankle, knee, and leg. Additionally, children who are overweight may fall with more frequency and/or force than children of typical weight. Overweight children may be less prone to participate in

physical activities or exercise, further compromising their bone density and increasing fracture risk.

Children who are obese may develop impaired coordination, called **developmental coordination disorder** (DCD), which causes clumsiness and problems with gross motor, visual, and fine motor coordination, such as writing, using scissors, tying shoelaces, or tapping one finger to another (AAOS, 2015).

Recent studies have shown that obesity in adolescence is associated with an increased risk of **multiple sclerosis** (MS) or its precursor, **clinically isolated syndrome** (CIS) (which is the first episode of neurologic symptoms isolated in time and compatible with possible future development of MS). Studies have shown that, compared to girls of normal weight, the risk is more than 1.5 times higher for overweight girls and nearly 1.8 times higher for moderately obese girls. For extremely obese girls, the risk of developing MS/CSI was nearly 4 times higher. No such associations were found for boys (Correale et al., 2014; Langer-Gould et al., 2013).

Long-Term Health Effects

In the long term, overweight children are more likely to become obese adults with serious, even life-threatening, chronic conditions. Among the immediate effects described above, children and adolescents who are obese are also more at risk when becoming adults for health problems such as **heart disease, type 2 diabetes, stroke,** and **osteoarthritis** (CDC, 2015a).

Overweight and obesity has been found to increase the risk of developing certain types of **cancers**. The CDC reports an increased risk for cancer of the breast, colon, endometrium, esophagus, kidney, pancreas, gallbladder, thyroid, ovary, cervix, and prostate as well as multiple myeloma and Hodgkin's lymphoma (CDC, 2015b).

Cognitive Effects

Cognitive impairment is a hidden consequence of childhood obesity. The more overweight youth are, the greater the difficulties they have in all areas of cognitive function.

Researchers have found that there are certain physiological differences between the brain activity of obese and healthy-weight children. Magnetic resonance imaging (MRI) scans of children who are obese but otherwise healthy have found they have different regional gray and white matter development in the brain and differences in white matter microstructures compared with children of normal weight that have been associated with cognitive impairment (Ou et al., 2015).

MRI studies among teenage females showed that weight gain was related to low gray matter volume in regions critical for the control of behavioral inhibition. BMI was also inversely correlated with general mental ability even after controlling for demographics, lifestyle factors, and lipid profiles (Wenk, 2015).

Childhood obesity is related to deficits in executive function, attention, mental rotation, mathematics, and reading achievement. Adolescents who are obese have deficits in a range of cognitive functions, such as attention and executive functions (Wang et al., 2016).

Psychosocial Effects

The psychosocial effects of childhood obesity are of great importance. Because our society idealizes thinness and stigmatizes fatness, weight issues have become an obsessive concern for both girls and boys of all ages and of every racial and ethnic heritage. Children learn that only thin people deserve love, attention, and success, and the media has presented the ideal body type as thinner and thinner each year. (The year 2015 brought an increase in positive body messages in the form of new Barbie dolls, plus-size models, and multiple Internet sites exposing the digital manipulation of images of women portrayed in the media.)

As a result, children have developed **dysfunctional** or **disordered eating habits.** This includes dieting, fasting, bingeing, purging, skipping meals, or consistently eating much more or much less than the body wants or needs. Dysfunctional eating is separated from the normal function of satisfying hunger and providing energy for health, growth, and well-being and instead seeks to reshape the body or relieve stress. This increases the risk for eating disorders (such as bulimia and anorexia nervosa), poor nutrition, growth impairments, and emotional problems. For example, girls who are overweight are more concerned about their weight, more dissatisfied with their bodies, and more likely to diet than their peers who are normal weight (USDHHS, n.d.).

As a general rule, the social stigma for overweight children in a society that puts a premium on thinness results in children who are obese having low self-esteem, lacking self-confidence, and becoming clinically depressed. They are also at risk for being bullied and teased.

Childhood obesity is the most common reason that children and adolescents are bullied. Weight-based victimization occurs in school more often than victimization related to race/ethnicity, sexual orientation, religion, or disability. **Verbal teasing** is the most frequent type of victimization reported by adolescents, followed by relational aggression (damaging one's relationships or social status), cyberbullying, and physical aggression (Puhl et al., 2015).

Girls who are 6 years old and older with a higher BMI are more likely to be victims, but the same does not appear to be true for boys. Girls who experience bullying were found to be more likely to gain even more weight over time, which then leads to more bullying. Males who are severely obese have been found to be more involved in the double role of bully and victim (Cote-Lussier et al., 2015).

The American Academy of Pediatrics states that some children who are overweight might seek emotional comfort in eating, which compounds the problem of obesity. In addition, it is noted there are repercussions that continue well into adolescence and beyond in discrimination in admission to prestigious universities and reduced job opportunities. Also, people who are overweight tend to earn less money and marry less often than their peers of average weight (AAP, 2015a).

Economic Impact

When compared to children of normal weight who maintain normal weight throughout adulthood, childhood obesity is estimated to cost $19,000 per child in medical costs. Multiplying this dollar amount by the number of 10-year-old children in the United States who are obese, lifetime medical costs for this age alone is nearly $14 billion. These figures represent the direct medical costs for obesity, including physician visits and medication, and do not take into account the indirect costs related to absenteeism and lost work productivity in adults (Finkelstein et al., 2014).

Children covered by Medicaid are almost 6 times more likely to be treated for a diagnosis of obesity than children covered by private insurance. Annual health costs for childhood obesity and related conditions among Medicaid beneficiaries are about 80% higher than the costs for privately insured children (Chazin & Maul, 2015).

CAUSES AND RISK FACTORS

Research has not yet led to a complete explanation as to why obesity occurs, although it has identified a large number of factors that increase the risk for childhood and adolescent overweight and obesity.

The prevailing belief—that obesity is caused by individual choices about food and exercise, lack of will power, and inability to discipline eating and lifestyle behaviors—is being disrupted. It is increasingly being understood that attributing obesity to personal responsibility is very simplistic and that there are many factors involved in the widespread obesity epidemic occurring around the globe.

Obesity likely involves a complex interaction between genetic predisposition and environmental and behavioral factors. Emerging theories also associate overweight/obesity with gene expression changes in tissues throughout the body, chemicals that affect fat cell production and storage, and pathogen invasion.

More than 90% of the cases of obesity population-wide are self-originating or **without known cause**, and less than 10% are associated with hormonal or genetic causes (Schwarz, 2015).

Genetic Factors

Along with other factors, genetics plays an important role in the pathogenesis of obesity. Studies have shown that obesity runs in families, and twin studies indicate it is largely due to genetic factors, with heritability exceeding 50%. Researchers have found that additive effects of multiple genes account for 30% of individual differences in childhood body weight. This suggests there are hundreds of other genetic variants influencing body weight that are yet to be discovered. Current findings support the thinking that children of obese parents are more at risk of becoming obese (Llewellyn et al., 2013).

At least one study has identified a possible genetic root to the insatiable appetite and slow metabolism of some obese patients. The discovery of a new obesity gene, KSR2, demonstrates that genes can contribute to obesity. Obese children carrying mutations in the KSR2 gene showed increased appetite, lower heart rate, slowed metabolism, and severe insulin resistance (Pearce et al., 2013).

A genetic component can also be seen due to differences in the prevalence of obesity between racial groups, from 5% or less in Caucasian and Asian populations to 50% or more among Pima Indians and South Sea Island populations.

However, genetics are unlikely to account fully for the prevalence of obesity. Declining rates of physical activity and an increase in consumption of energy-dense foods are also significant factors in the increase in obesity (Zhao & Grant, 2011; Graham et al., 2015).

EPIGENETICS

Epigenetics is the study of gene expression, the switching on and off of gene action without causing a mutation (a change in the genetic code, or DNA). Gene expression signals the cells in the body on how and when to differentiate. When gene expression is altered—for example, by exposure to certain chemicals, radiation, or dietary nutrients—abnormal development of cells, organs, and systems can occur. Environmental epigenetics looks at how chemicals or other environmental exposures can interfere with gene expression and thereby disrupt development. These epigenetic changes can increase susceptibility to obesity and other serious health problems, and the changes can be inherited by successive generations.

Obesity pathophysiology is very complex. As of yet, the epigenetic contribution to common forms of obesity is still largely unknown, but animal studies have shown that it is likely that both genetic and environmental effects on epigenetics will turn out to be associated with obesity. There has been progress made in identifying epigenetic changes induced by (or inducing) obesity, which will increase our understanding of the inheritance, development, and treatment of obesity (Youngson & Morris, 2013).

OBESOGENS

Obesogens are classified as **endocrine disruptors**. They are chemicals that increase either the number of fat cells in an organism or the amount of fat stored in those cells. Obesogens act indirectly on obesity by modulating appetite, satiety, or metabolism. They contribute to insulin resistance, cause inflammation in the body, and harm the mitochondria of cells.

OBESOGENS	
Examples and Sources	**Effects**
Hormones: recombinant bovine growth hormone (rBGH), estrogens in meat and milk	Controversy exists about effects; may pose cancer risks as well as affect endocrine developmental and immunologic and neurobiologic functions, especially for children
Methyl mercury in seafood	Interferes with fat and glucose metabolism; negatively affects thyroid hormones responsible for metabolism
Pesticides sprayed on crops, which seep into groundwater and enter tap water	Estrogen mimickers and thyroid disruptors that promote weight gain
Herbicides containing altrazine sprayed on crops to control weeds, which seep into ground water and enter tap water	Slow down thyroid hormone metabolism
Fungicides containing tribyline	Stimulate fat production
High-fructose corn syrup in processed foods	Increases insulin and leptin in the body, causing increased appetite and fat production
Perfluorooctanoic acid (PFOA) in microwave popcorn bags, nonstick pots and pans, stain-resistant fabrics	Increases insulin and leptin in the body, causing increased appetite and fat production
Phythalates in soft plastics and scores of other items (ubiquitous and nearly impossible to avoid)	May increase rate of adipocyte differentiation, making fat cells more efficient at storing fat; mimic and displace hormones; interrupt hormone production; may result in abnormal sexual development
Bisphenol A (BPA) in hard plastics, food can linings, cosmetics, soaps, lotions, food packaging, water bottles, toys	Mimics estrogen in the body; linked to greater weight gain
Flame retardants found in furniture, carpet padding, and electronics	Alter thyroid function; increase rate of fat cell production
Smog, dust, and other particulate matter in the air	Increase visceral obesity
Sources: Merkl, 2015; Song et al., 2014; Heart MD Institute, 2015; Heindel et al., 2015; Limaye & Salvi, 2014.	

Evidence exists that pets, laboratory animals, primates, and feral cats living in industrialized human societies are also showing a rise in obesity, which suggests that environmental obesogens and/or viral infections may be playing a role (Ponterio & Gnessi, 2015).

OPPORTUNISTIC PATHOGENS

Normal **gut bacteria** play an important role in diet-induced obesity. Some of the most innovative research being done into the causes for overweight and obesity has focused on the role of gut bacteria and their effect on fat generation and consumption. A study conducted on a group of Old Order Amish in Pennsylvania identified 26 species of bacteria in the human gut that appear to be linked to obesity and metabolic syndrome as well as inflammation. Researchers also analyzed people's gut bacteria by their occupation, and findings suggest that environmental exposure may play a role in determining the composition of the gut microbiota in humans (Zupancic et al., 2012).

Enterobacter cloacae is a common species of bacteria found normally in the human digestive system. It is excreted in both human and animal feces and can be found in dairy products, sewage, soil, and water. A bacterial product from *E. cloacae* known as lipopolysaccharide endotoxin has been shown to induce obesity and insulin resistance in its host. One study revealed that one endotoxin-producing bacterium isolated from a morbidly obese human's gut induced obesity and insulin-resistance in germfree mice, suggesting that it may contribute to the development of obesity in its human host. A slightly increased endotoxin load can cause a low-grade, chronic inflammation, which is the driving force for insulin resistance and altered fat metabolism in mice. The endotoxin is believed to activate a gene that helps generate fat and also deactivate a gene that consumes fat (Fei & Zhao, 2013; Zhang et al., 2015).

Evidence over the past two decades supports the hypothesis that **viral infections** may be associated with obesity in both animals and humans. The adenovirus 36 (Adv36), a common "cold" virus that is easily caught from an infected person who is coughing or sneezing, causes obesity in animals and is associated with obesity both in adults and children. The prevalence of Adv36 increases in relation to BMI (Ponterio & Gnessi, 2015).

Prenatal and Early Childhood Factors

The intrauterine environment and early-life influences are also important factors in the process of weight gain and body fatness throughout the course of life.

MATERNAL WEIGHT

Maternal obesity is one of the strongest and most reliable predictors of later obesity in children. Infants born to mothers who were obese prior to pregnancy are three times more likely to be overweight or obese when compared with children born to mothers with a normal BMI. Likewise, when a fetus is exposed to maternal high blood glucose and gestational diabetes mellitus, there is greater adiposity in children at birth and in childhood. There are no associations with a diagnosis of paternal diabetes, thereby highlighting the importance of the intrauterine environment, rather than genetics, on the postnatal body composition (Hollis & Robinson, 2015).

Excessive pregnancy weight gain is associated with greater overall and abdominal body fat in children and obesity at age 7. A study done among an urban multiethnic population showed

excessive weight gain in pregnancy was associated with an increased risk of childhood obesity of approximately 300% (Widen et al., 2015).

PRENATAL OBESOGEN EXPOSURE

Obesogens have been implicated as another prenatal contributor to obesity. The obesogen model proposes that chemical exposure during critical stages in development can influence subsequent adipogenesis, lipid balance, and obesity. These chemicals invade and persist in women's bodies, cross the placenta, and result in epigenetic changes that can continue across generations (Janesick et al., 2014).

Certain chemicals may copy or block the actions of specific hormones involved in the development of fat tissue and energy homeostasis. Prenatal obesogen exposure alters stem cells in the body to favor the development of fat cells at the expense of other cell types. Some have been shown to act through the peroxisdome proliferator activated receptor gamma (PPARg), the master regulator of adipogenesis. Others act in pathways that have not as yet been identified (Konkel, 2015).

Some chemicals—such as DDE (dichlorodiphenyldichloroethene), HCB (hexachlorobenzene) used in pesticides, and PCB (polychlorinated biphenyl) used in many industrial processes—have been banned for decades in developed countries, but the chemicals remain in the environment and bioaccumulate in the bodies of animals and humans, continuing to have an effect prenatally. For example, a ten-fold increase in the HCB concentration in the mother's blood is associated with higher risks of childhood obesity (Konkel, 2015).

Another recent study reports that pregnant women exposed to higher concentrations of polycyclic aromatic hydrocarbons (PAHs) were more than twice as likely to have children who were obese by age 7 than women with lower levels of exposure. PAHs are a common urban air pollutant, and this study offers evidence that prenatal exposure to this pollutant can influence childhood obesity (Rundle et al., 2012).

MATERNAL SMOKING

Maternal smoking is associated with a slow rate of fetal growth, low birth weight, higher weight gain during the first year, and increasing overweight and obesity after infancy. In a meta-analysis of 14 studies, maternal smoking during pregnancy was associated with a 50%-higher risk of childhood obesity (HSPH, 2016; Timmermans et al., 2014).

Prenatal exposure to maternal cigarette smoking is a well-established risk factor for obesity, but the underlying mechanisms are unknown. Preference for fatty foods, regulated in part by the brain reward system, may contribute to the development of obesity. One study concluded that prenatal exposure to maternal cigarette smoking may promote obesity by enhancing dietary preference for fat, and this effect may be mediated in part through subtle structural variations in the amygdala (Haghighi et al., 2013).

MATERNAL STRESS

In addition to chemicals in the environment, studies are being done to determine other environmental effects on the development of childhood obesity. Recent evidence indicates that severe maternal stress during pregnancy may impact the developing fetus and produce an increased susceptibility for childhood and adult obesity, as well as alterations in metabolic function (Entringer, 2013).

EARLY CHILDHOOD FEEDING

Studies suggest a link between breastfeeding and lower obesity risk. However, the relationship between breastfeeding and childhood obesity is controversial. There are many studies demonstrating that breastfeeding decreases childhood obesity, but others fail to confirm the relationship. The conclusion from a recent study shows that infants at the highest risk for rising weight patterns appear to benefit the most from longer breastfeeding duration (Carling et al., 2015).

Some studies indicate the risk of obesity is decreased in breastfed children due to better self-regulation of energy intake allowing for proper development of hunger/satiety signals, which may prevent some of the behaviors that lead to overweight and obesity. Microscopic properties of human milk regulate metabolism and reduce risk of obesity. As few as two months of exclusive breastfeeding, directly or by expressed milk, showed decrease obesity risk (Brownell et al., 2015).

MODERN HISTORY OF BREASTFEEDING

Historically, breastfeeding in America has been heavily influenced by culture and the manufacture of formulas, which began at the turn of the century. Manufacturers promoted baby formulas and suggested that their use was an improved, modern way to feed babies. This commercialization and the medicalization of infant care established an environment that encouraged bottle-feeding as the best and most necessary way to feed infants. By 1950 more than half of the babies in the United States were fed some form of baby formula (Apple, 1987).

By the 1970s, however, years of research showed that breast milk was best, and the pendulum began to swing back toward breastfeeding. The CDC (2014a) reported that nationwide in 2011, 79% of newborn infants started breastfeeding, 49% were breastfeeding at 6 months, and 27% were breastfeeding at 12 months. The Healthy People 2020 Initiative states that the national goal is to increase the proportion of mothers who breastfeed babies in the early postpartum period to 81.9% by the year 2020. In the United States, the Surgeon General and the U.S. Department of Health and Human services responded by providing 20 actions that are recommended to support breastfeeding across the country. *(See "Resources" at the end of this course.)*

CASE

DENISE, AGE 2 MONTHS

Samantha has brought her baby, Denise, in for a well-baby visit. Samantha is a 19-year-old African American single parent who has been obese most of her life. Both of her parents were obese. Her mother has type 2 diabetes mellitus, and her father died of a heart attack at age 43. Samantha's current weight is 240 pounds, and her pre-pregnancy weight was 222 pounds.

At birth Denise weighed 7 pounds, 4 ounces, and was 19 inches long. Today Denise's weight is 12.5 pounds, and she is 22 inches long. She is in the 75th percentile for her weight and the 50th percentile for length.

Samantha is breastfeeding Denise and reports she feeds "at least 10 times a day." Samantha says she feels exhausted and has taken to supplementing Denise's diet with formula before putting her to sleep at night because she needs to catch up on her own sleep. Occasionally Samantha's own mother gets up during the night and gives Denise a bottle.

The care plan for Samantha and Denise calls for education about the health, nutritional, economic, and emotional benefits of breastfeeding for both mother and baby. This includes a discussion about the benefits of breastfeeding for the possible prevention of childhood obesity. The nurse encourages Samantha to breastfeed Denise as long as possible and tells her that children who are breastfed as babies are better able to respond to hunger cues and to stop eating when they're full.

She counsels Samantha that many breastfeeding mothers think their milk supply is inadequate. During growth spurts, the infant may be more irritable and may demand to feed more often. By explaining growth spurts to Samantha, undue stress or interruptions in breastfeeding may be prevented. The nurse also explains that stress and fatigue may have an impact on Samantha's milk production and that her supply of milk depends on Denise's demand for it. The less frequently Denise nurses, the less milk her breasts will produce. If she starts supplementing with formula regularly, even for just one feeding a day, her milk supply will decrease.

Samantha reports that she is involved with the WIC program, and the nurse suggests that she obtain a free breast pump to help support the continuation of her breastfeeding. By collecting breast milk, supplemental feedings during the night will not require formula. She asks Samantha if she would like to consider a referral to a breastfeeding support group such as La Leche League, where she can learn creative skills and coping mechanisms as well as receive the needed peer support that will help her to continue breastfeeding.

The nurse also talks with Samantha about experimenting with various ways to soothe Denise when she cries and not to automatically turn to breast milk or formula to quiet her. Sometimes a new position, a calmer environment, or a gentle touch is all that is needed.

Formula Feeding and Childhood Obesity

Controversy exists regarding whether or not formula feeding actually causes later obesity. There are probably several mechanisms involved that are as yet not fully understood and that may lead an infant to passivity in feeding, increasing the risk of overconsumption. In one study even breast milk was overconsumed when fed by bottle (Stewart & Thompson, 2015).

A report in the *Journal of Obesity* states that the increased protein supply of cow-milk-based infant formula in comparison to the lower protein content of human milk is a recognized major risk factor for childhood obesity. There is evidence that breastfeeding in comparison to cow-milk-based formulas supplies much lower amounts of leucine to the infant. Leucine is an essential amino acid that helps to regulate blood sugar. Infant formula feeding in comparison to breastfeeding results in excessive serum levels of leucine, insulin, and insulin-like growth factor 1, explaining exaggerated early fat-producing programming, the promoting mechanism for early onset of childhood obesity (Melnik, 2012).

A recent randomized trial showed that feeding a lower protein-content infant formula reduces BMI and obesity risk in school-aged children (Weber et al., 2014).

A further concern about the adipogenic impact of formula feeding is that mothers often use higher-than-recommended amounts of formula powder in preparing infant meals. It is also not uncommon for parents to switch to a high-protein formula to keep their infants asleep during the night. Additionally, the total daily volume of formula given to the infant is not naturally restricted in comparison to daily limitations of milk volume by breastfeeding (Melnik, 2012).

Solid Food Introduction

A limited amount of research has shown that early introduction of solid foods before four months is associated with higher childhood BMI, but more evidence is needed before any firm conclusion can be made. The American Academy of Pediatrics and World Health Organization both currently recommend that solid foods be introduced at approximately six months of age (Pearce et al., 2013).

Behavioral Factors

Behavioral factors related to the development of overweight and obesity include what we choose to eat, how much we eat, how much physical activity we incorporate into our daily lives, and how much sleep we get each night. All of these factors involve responses to a specific set of conditions and are driven by both biology and the environment.

PROCESSED FOOD AND ADDICTIVE INGREDIENTS

Processed and "fast" foods have been available in America throughout the twentieth century; however, as more women entered the workforce during the 1970s and 1980s, the food industry responded with "convenience foods"— highly processed snacks and frozen dinners that could be heated in the oven or microwaved in minutes. Eating on the run and/or in front of the TV—dad on one schedule, kids on another, and mom on a third—replaced home-cooked family meals around the table. In the 1970s American families spent one third of their food money on meals eaten outside the home, but today highly processed food purchases are the dominant part of U.S. household purchases and almost half of food money is spent on eating away from home (Poti et al., 2015).

Human bodies are biologically "wired" to seek out high-fat, high-salt, and high-sugar foods. Sugar, salt, and fat have been so important in human evolution that brains respond to these nutrients by "rewarding" us with the release of endorphins and an increased desire for more. In combination, these nutrients act synergistically and are far more addictive than any one alone.

Salt

The importance of salt to overall health may explain why salty foods are so tasty and "you can't eat just one." Studies have shown that sodium appetite is driven by hypothalamic gene-regulatory programs that have previously been linked to addiction and reward. The reward results in craving more salt, resulting in the response of overeating (Liedtke, 2014).

Vegetable Oil

Plant-based vegetable oils, especially soybean oil, are heavily used in processed foods, margarines, salad dressings, and snack foods. Soybean oil is the oil of choice for many restaurants and fast-food establishments. Vegetable oils are known to induce diabetes, glucose intolerance, insulin resistance, and increase the accumulation of fatty acid metabolites in the liver. Of all the vegetable oils, soybean oil produces the most negative metabolic effects (Røyneberg Alvheim et al., 2014).

Research has shown that the body utilizes a major constituent in most vegetable oils to manufacture endocannabinoids, the same psychoactive compounds found in marijuana. Endocannabinoids play a key role in memory, mood, brain reward systems, drug addiction, and metabolic processes, such as the breakdown of fats into fatty acids and glycerol, glucose metabolism, and energy balance. Endocannabinoid receptor activation increases food intake and also increases food odor detection in the olfactory bulb, which increases appetite. Consuming vegetable oils can lead to overproduction of these compounds, boosting hunger, causing excess calorie intake, and resulting in overweight and obesity (Griffling, 2015).

Sucrose and High-Fructose Corn Syrup

Sucrose, broadly known as granulated sugar, comes from cane or beets. It is made up of two molecules: glucose and fructose. The glucose molecule provides fuel and suppresses the hunger hormone **ghrelin,** which stimulates **leptin** production. Leptin tells the brain that we are full and decreases appetite. Fructose is a sugar found naturally in fruit, honey, and fruit juice. Unlike sugar, fructose does not trigger satiating hormones. The fructose molecule is only metabolized by the liver and is converted to free fatty acids and triglycerides. It has no effect on the hunger hormone and can interfere with leptin levels, leading to overeating.

High-fructose corn syrup (HFCS) is a highly processed syrup sweetener derived from cornstarch, usually a combination of 55% fructose and 45% sucrose. The syrup is widely added to many kinds of processed foods, including soft drinks, breads and cereals, processed meats, dairy products, condiments and sauces, processed fruits and vegetables, crackers, candy, jam, jellies, syrups, and even infant formulas and baby food.

HFCS increases appetite, promotes obesity, and contributes to diabetes and inflammation. It is also more addictive than cocaine. When sugar and HFCS are consumed to a specific threshold, the brain's neurochemistry is altered and an intense release of dopamine occurs. Withdrawal symptoms develop following depletion of the dopamine. Fructose goes straight to the liver, triggers lipogenesis, and contributes to the development and severity of nonalcoholic fatty liver disease. According to the U.S. Department of Agriculture (2015), in 2014 Americans consumed 26.8 pounds of HFCS and 40.2 pounds of refined cane and beet sugar per capita.

Fructose causes liver insulin resistance specifically because of the way it is metabolized. Insulin induces satiety, and when the body resists insulin, the ingested sugars lead to fat storage and make the brain think it is hungry, which then increases consumption. The accumulation of body fat enhances the expression of enzymes involved in lipogenesis, resulting in even more fat accumulation.

Casein

Casein is a protein naturally found in milk and used in producing fast-food items. Over the last 30 years, casein has been used in foods to enhance physical properties such as whipping and thickening and to enhance nutritional value. Casein contains opiates, and as it is digested, it breaks apart to release tiny opiate molecules called casomorphins. One of these compounds has about one tenth the opiate strength of morphine. The addicting power of cheese, for example, may be caused by the removal of water, lactose, and whey products, which then concentrates casein (PCRM, 2015). Because of the reward (casomorphins) received from eating products containing casein, overconsumption is encouraged, leading to an energy intake and use imbalance that contributes to overweight and obesity.

Caffeine

Every exposure to caffeine can produce cerebral stimulation. Caffeine blocks a chemical responsible for calming the brain. When this chemical is blocked, stress hormones increase. When there is a high stress response, insulin resistance and fat storage can increase. Sweetened soft drinks that contain caffeine (e.g., Coke, Pepsi, Mountain Dew, and Dr. Pepper) reinforce our innate preference for sweetness but also "hook" children on caffeine, known to be habit-forming. Caffeine also interferes with the absorption of calcium from foods, a major concern because childhood and adolescence are the most important times for establishing strong, healthy bones (Hobar, 2015).

Energy drinks (e.g., Red Bull and Monster) contain large doses of caffeine. The amount of caffeine in an energy drink ranges from 75 milligrams to over 200 milligrams per serving. This compares to 35 milligrams in Coke and 54 milligrams in Mountain Dew (Cready & Kyle, 2016). These energy drinks also contain other legal stimulants like guarana, kola nut, yerba mate, cocoa, ginseng, and taurine, which increase the caffeine boost (Fryhofer, 2013).

The combination of sugar and caffeine in beverages raises the risk of being overweight. Children who drink one or more 12-ounce sweetened soft drinks daily have a 60% higher chance of becoming obese (Nemours Foundation, 2016).

DECREASED PHYSICAL ACTIVITY

Regular physical activity is a vital necessity for good health. Physical activity helps to reduce blood pressure; reduce risk for type 2 diabetes, heart attack, and stroke; relieve symptoms of depression and anxiety; and maintain a healthy weight. Children and adolescents currently are involved in a more sedentary lifestyle that contributes to an energy intake and utilization imbalance, eventually resulting in overweight and obesity.

For instance, many school districts have eliminated recess in order to increase classroom instruction time. This means that students can lose on average 30 minutes of physical activity per day, eliminating 2-1/2 hours of physical activity every week. Likewise, in a national survey on children's physical activity levels, 27.1% of high school students had participated in at least 60 minutes per day of physical activity on all seven days before the survey, and only 29% attended physical education class daily. The survey found that 15.2% of high school students had not participated in 60 minutes or more of **any** kind of physical activity on **any** day during the seven days before the survey (CDC, 2015b).

"Screen Time"

Only 1 in 3 children is physically active every day. Children now spend more than 7-1/2 hours a day in front of a screen (e.g., TV, video games, computer). Nearly one third of high school students play video or computer games for three or more hours on an average school day. Only six states (Illinois, Hawaii, Massachusetts, Mississippi, New York, and Vermont) require physical education in every grade, K–12 (PCFSN, 2016).

The American Academy of Pediatrics research shows that U.S. kindergarteners watch an average of 3.3 hours of television a day, and that kindergarteners and first-graders who watched as little as 60 minutes of television a day were more likely to have significantly higher BMI compared to children who watched for less than 60 minutes each day, even after adjusting for socioeconomic status, race-ethnicity, and computer use (AAP, 2015b).

Built Environment

Many aspects of today's built environment—housing, roads, walkways, density, transportation, shops, parks, and public spaces—do not encourage walking, biking, or other physical activities. Many communities are built in ways that make it difficult or unsafe to be physically active. It may be hard for families to get to parks and recreation centers, and public transportation may not be available. For many children, safe routes for walking or biking to school or play may not exist (Shuval et al., 2013). Seventy percent of African American neighborhoods and 81% of Latino neighborhoods lack recreational facilities and have the lowest per-capita spending on parks and recreation (Kann et al., 2014).

LACK OF SLEEP

Sleep duration has been studied in relation to health outcomes such as cognitive and emotional functioning and body weight. The American lifestyle has led to substantial reductions in sleep duration for both adults and children over the last few decades. The National Institutes of Health and other health groups recommend the average child get between 9 and 10 hours of sleep a night, but a recent study shows that children sleep only about 8 hours a night during the week.

The majority of studies support the inverse association between sleep duration and risk of overweight/obesity. Short sleep duration at around 5 to 6 years of age has been found to be associated with being overweight at age 15 years (Bonuck et al., 2015). When children with the shortest sleep duration (10 hours) were compared to children having the longest sleep duration (12 hours), they were 76% more likely to be overweight or obese. With every one hour per day increment in sleep duration, the risk of overweight/obesity was reduced by 21% (Ruan et al., (2015).

Studies have been done linking sleep deprivation to the hunger and appetite hormones leptin and ghrelin. Research suggests that when the body craves sleep, it interprets it as hunger, causing leptin levels to crash and ghrelin levels to spike. High ghrelin levels and low leptin levels are known to stimulate appetite, increase the desire for high-calorie foods, and increase fat storage (Hagen et al., 2015).

Environmental Risk Factors

INCOME, EDUCATION, AND FOOD ACCESS

Much research has been done relating to income, education, and food access as factors in the problem of childhood overweight/obesity. The CDC (2015c) reports that obesity prevalence is the highest among children in families with household income that is at or below the poverty threshold.

A recent study found that the higher the education level of a U.S. household, the healthier the foods that are purchased. Education levels, and not income levels or access to supermarkets, determine food preferences. This extensive study found that householders with higher income or education are purchasing food products that are about 40% closer to the USDA recommendations compared to householders with lower education or income. This has been shown to be true for householders that live in the same location with the same retail access to the same foods.

There are two hypothesis put forward to explain these disparities. One is that low socioeconomic status households do not have enough money to spend on healthful food products. Another is that these different households have different food preferences based on past experiences and continue making unhealthy choices despite access to healthful foods (Wharton University, 2015).

Overall, obesity prevalence among children with college-educated heads of household was approximately one half that of those children whose heads of household did not complete high school. Among non-Hispanic white children, the lowest prevalence of obesity was observed among those with heads of household who completed college. However, this was not true for non-Hispanic black children. Over time, the prevalence of obesity among girls with heads of household who did not finish high school has increased, but it has decreased for girls whose heads of household completed college. There was no similar finding among boys (CDC, 2015b).

CULTURE AND ETHNICITY

Parents hold specific cultural beliefs and practices regarding their children's health and care. This can influence how parents view and respond to a child's body size. In a study done among a diverse ethnic and cultural population, parents were found to underestimate their child's weight if they were black or South Asian (versus white), if they were from deprived backgrounds, if their child was male, or if the child was older (age 10–11 years versus 4–5 years). The study showed that 41% of parents underestimated where their child's BMI sat on government obesity scales and that there was an 80% chance the parent would classify their child as at a healthy weight (Black et al., 2015).

Types of foods eaten by children can be influenced by the cultural traditions of their families. Traditional foods may lower the risk of obesity in some children (e.g., Asians) and increase the risk of obesity in other children (e.g., blacks). Modern-day American culture includes processed

food, food-related advertising, reduced physical activity, and television viewing, all of which are contributing factors to childhood obesity (McIntosh, 2015).

PARENTAL STRESS

In a recent study it was found that the number of stressors parents have is directly related to obesity in their children. Parent-perceived stress was related to their child's increased fast-food consumption, an important behavioral indicator of obesity risk. Among the parental stressors were poor physical and mental health, financial issues, and being a single parent. Single-parent households had the strongest relationship to child obesity, while financial stress had the strongest relationship to a child who is not physically active (Parks et al., 2012).

Being raised by a single parent is a big risk factor for obesity, and experts say it is because of low incomes, which impacts the ability to pay for participation in organized sports and for healthy food. Eating healthy foods costs up to 30% more than eating a diet high in carbohydrates, sugar, and fat. Single parents provide fewer fruits and vegetables, and children who live with a single parent also report watching more television. Working single parents have the burden of having to ensure adequate finances, planning meals, shopping for nutritious food, and finding time to properly feed their children every day. Many single parents substitute fast and convenient foods for home-cooked meals to ease this pressure (McIntosh, 2015).

Households headed by single mothers are more likely to be poor. More than half of single mothers live in extreme poverty, with incomes below half the federal poverty level. Among homeless families nationwide, over three quarters are headed by single women with children (Shaefer & Edin, 2014).

PARENTAL FEEDING BEHAVIORS

Children naturally regulate their food intake, but parents' feeding behaviors may override a child's internal appetite signals. When a parent does not respond to their child's cues of hunger and/or feeling full and demands or controls the child's energy intake, it results in the underdevelopment of the ability to self-regulate energy intake. These children may be more likely to overindulge when given the opportunity (Kakinami et al., 2015).

ADOLESCENT VULNERABILITIES

The onset of adolescence begins a time of increased vulnerability for a wide range of behavioral and emotional health problems, including depression and eating disorders, among many others. Teens are greatly affected by peer pressure. Older adolescents have access to foods outside the home and school and have a greater ability and responsibility to make food choices. Their food choices, however, can often be influenced by friends and peers and may hinder weight control. The greatest concern adolescents report is the pressure they feel from peers to eat unhealthy foods. Peer relationships have been shown to be a barrier to healthy eating, and peer interactions were found to increase social pressure to eat unhealthy foods (Trieu, 2015).

MARKETING

The food industry spends $1.8 billion each year on ads to promote food and drinks to children. Food marketing targeted to children almost exclusively promotes calorie-dense, nutrient-poor foods and takes advantage of children's vulnerability to persuasive messages. Food advertising is very pervasive and effective in manipulating choices in children. There are potentially profound effects of food marketing on children's lifelong eating behaviors and health.

Children are regularly exposed to the marketing of unhealthy foods through television, the Internet, magazines, schools, product placements, video games, cell phones, as well as celebrity endorsement practices and purchasing incentives. An estimated 71% of 8- to 18-year-olds in the United States have televisions in their rooms. The average child views 13 television food advertisements daily. This figures increases to 14 for adolescents. The food industry knows that children and adolescents have significant discretionary incomes and are a powerful consumer segment, spending $180 million each year and influencing their parents' spending for another $200 billion (AHA, 2015; Gilbert-Diamond et al., 2014).

ASSESSING FOR OVERWEIGHT AND OBESITY

Nurse practitioners, office and clinic nurses, school nurses, hospital nurses, physical therapists, and occupational therapists, among others, all play a role in the assessment and treatment of children and adolescents for overweight or obesity. All assessment guidelines include the same elements.

- Calculating/plotting BMI
- Taking a family history
- Reviewing systems
- Completing a physical examination
- Testing for comorbidities
- Assessing behaviors and attitudes

Body-Mass Index

BMI is considered a reliable indicator of body fatness for most children and teens. The American Academy of Pediatrics recommends that BMI be calculated on a yearly basis for children 2 years and older. Assessment begins by obtaining accurate height and weight, followed by BMI calculation using the mathematical formula (see box), using a BMI wheel calculator, or by using an online BMI calculator *(see "Resources" at the end of this course)*.

BMI CALCULATION

BMI = (weight in pounds ÷ height in inches^2) x 703

or

BMI = (weight in kilograms ÷ height in meters^2)

For example, the BMI for a 13-year-old boy who weighs 190 pounds and is 5-feet, 5-inches tall would be calculated as:

$$BMI = 190 \div 65^2 \times 703 = 31.6$$

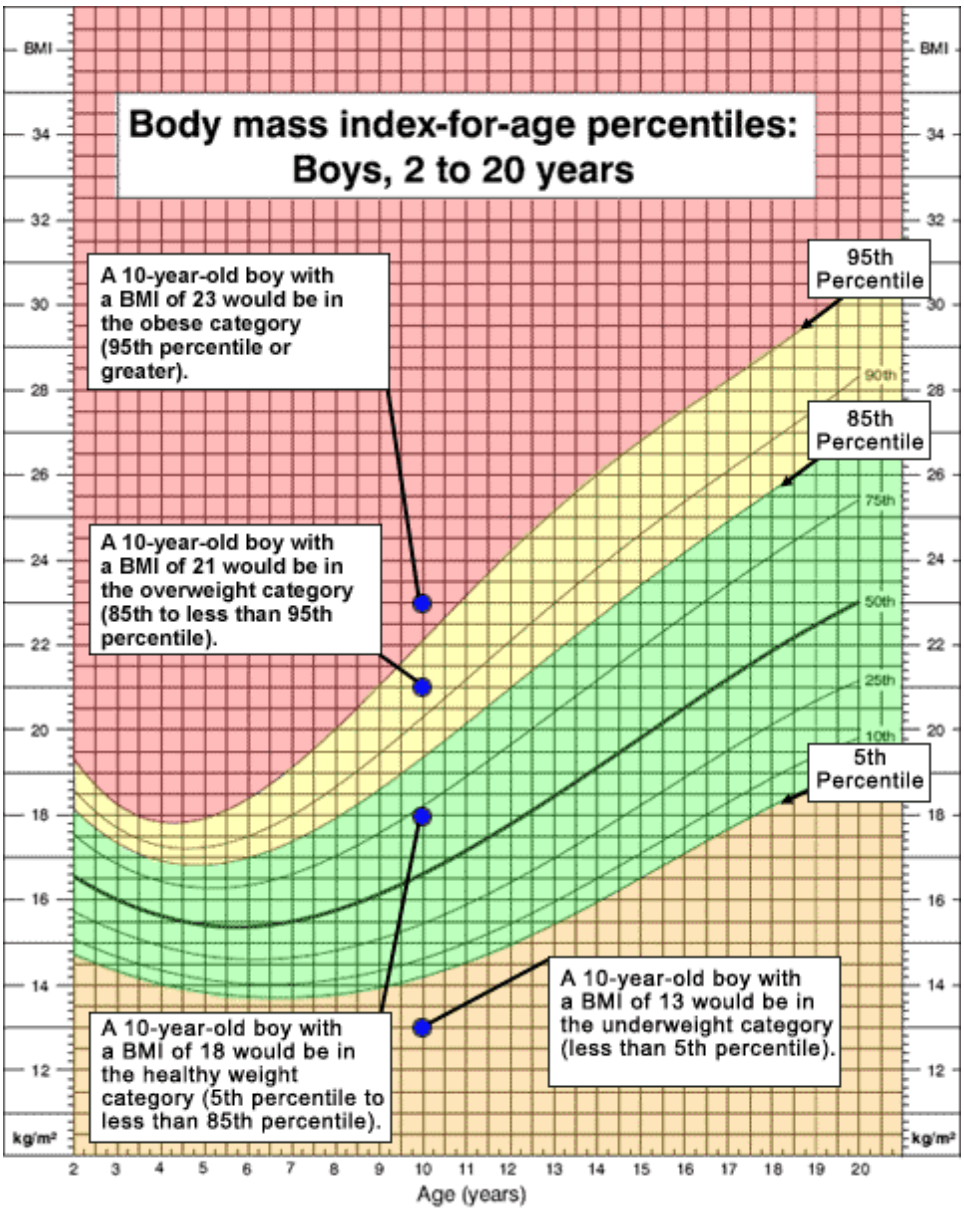
PLOTTING BMI

After BMI is calculated for children and teens, the BMI number is plotted on the CDC's BMI-for-age growth charts (for either girls or boys) to obtain a **percentile ranking**. *(See also "Resources" at the end of this course.)* Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children in the United States. The percentile indicates the relative position of the child's BMI number among children of the same sex and age. The growth charts show the weight-status categories used with children and teens (underweight, healthy weight, overweight, and obese).

DETERMINING WEIGHT CATEGORY

Once the BMI percentile has been determined, a weight category designation can be applied. A child is considered underweight if BMI is less than the 5th percentile, healthy weight if BMI is between the 5th and 84th percentiles, overweight if BMI is between the 85th and 94th percentiles, obese if between the 95th and 98th percentiles, and severely obese if greater than the 99th percentile. A child or adolescent with a BMI of 40 or higher is considered morbidly obese.

BODY-MASS INDEX FOR AGE GROWTH	
Weight Status Category	**Percentile Range**
Underweight	<5th percentile
Healthy weight	5th–84th percentile
Overweight	85th–94th percentile
Obese	≥95th percentile
Severely obese	≥99th percentile
Morbidly obese	BMI ≥40 kg/m^2



CDC BMI-for-age growth chart. (Source: CDC.)

CDC growth charts can be used as visual aids to educate parents about their children's growth. English, French, and Spanish versions of growth charts are available. When explaining BMI levels to parents, particularly those with limited English skills or limited health literacy/numeracy, the color-coded charts can increase understanding.

It is important to remember that although BMI correlates with the amount of body fat, BMI does not directly measure body fat. As a result, some people, such as athletes, may have a BMI that identifies them as overweight even though they do not have excess body fat. There are several methods used to determine body composition, such as hydrostatic (underwater) weighing, bioelectric impedance, and MRI. Although these methods are much more accurate, they are not commonly done in a routine clinical setting due to issues of cost, insurance coverage, and

availability. In order to determine if excess fat is a problem, a healthcare provider must perform further assessments, evaluations of diet and physical activity, a family history, and other appropriate health screenings (CDC, 2015a).

Family History

A family history should be obtained, focusing on obesity, type 2 diabetes, cardiovascular disease (hypertension, elevated cholesterol), and early deaths from heart disease or stroke. The risk for obesity and obesity-related health problems increases if there is a positive family history of obesity. A family history reflects genetic susceptibility and an environmental exposure shared by close relatives, which helps to identify people at high risk for obesity-related health problems.

Review of Body Systems

Using a clinical documentation tool, a focused review of systems should be obtained, asking for the following symptoms related to overweight and obesity:

- Anxiety, school avoidance, and social isolation (signs of depression)
- Polyuria, polydipsia, polyphagia, weight loss (type 2 diabetes mellitus)
- Headaches (pseudotumor cerebri)
- Night breathing difficulties (sleep apnea, hypoventilation syndrome, depression)
- Abdominal pain (gastroesophageal reflux, gallbladder disease, constipation)
- Foot, hip, or knee pain (orthopedic issues, slipped capital femoral epiphysis)
- Oligomenorrhea or amenorrhea (polycystic ovary syndrome, which is associated with obesity and insulin resistance and greatly increases a girl's risk of developing metabolic syndrome and type 2 diabetes mellitus)

  (Anderson et al., 2014)

Along with the review of systems, inquiry should be made into any allergies the child may have and any medications the child is taking. Certain steroids and antiseizure and antidepressant medications can increase a child's appetite and/or alter metabolism. Over time this increases the risk for obesity.

Physical Examination

Physical examination should include obtaining vital signs, height, weight, and BMI. Observing for the presence of **truncal obesity** should be done, as this increases the risk of cardiovascular disease. Although body composition is not routinely measured, a general overview of the child's body should be done to address the presence of muscle versus fat. A large-boned or very muscular child can have a higher BMI.

When assessing obesity in a child or adolescent, it is important to rule out any medical conditions that can be the cause of obesity and to assess for comorbid conditions. It must not be assumed that a child or adolescent is overweight or obese due only to behavioral factors. Assessing a child for obesity involves looking for the following signs and symptoms:

- Poor linear growth, which may be due to hypothyroidism, Cushing's syndrome related to high levels of cortisol, or Prader-Willi syndrome (a rare disorder present at birth whose key feature is a constant sense of hunger that usually begins after the first year of life)
- Malformed or misshapen body parts (which may be due to genetic disorders including Prader-Willi syndrome)
- Acanthosis nigricans, an eruption of velvety wart-like growths accompanied by hyperpigmentation in the skin of the armpits, neck, anogenital area, and groin, which is an important predictor of insulin resistance in childhood obesity (Miller, 2015)
- Hirsutism (excessive growth of hair or the presence of hair in unusual places, especially in women) and excessive acne, which may be related to polycystic ovary syndrome
- Purple striae on the abdomen, lower flank, breasts, hips, buttocks, shoulders, upper thighs, upper arms, and axillae, which is caused by rapid weight gain due to Cushing's syndrome
- Papilledema, an optic disc swelling secondary to elevated intracranial pressure seen in patients with pseudotumor cerebri
- Tonsilar enlargement secondary to sleep apnea
- Abdominal tenderness, which may be related to gallbladder disease, GERD, or nonalcoholic fatty liver disease
- Hepatomegaly due to nonalcoholic fatty liver disease
- Undescended testicle, which can occur in children with Prader-Willi syndrome
- Limited hip range of motion, which could suggest a slipped capital femoral epiphysis
- Lower-leg bowing caused by Blount disease, in which the medial side of the tibia, immediately distal to the knee joint, fails to develop normally

Laboratory Studies

Laboratory studies are drawn when indicated to identify any disorder that may be an underlying cause of obesity in a child.

- Thyroid function tests (recognizing that TSH is commonly elevated in patients with obesity)
- Serum leptin level (recognizing that a genetic mutation lowers leptin level leading to decreased satiety)

- Adrenal function tests (recognizing that cortisol levels are commonly elevated in patients with obesity)
- Karyotype for Prader-Willi
- Growth hormone secretion and function tests
- Assessment of reproductive hormones including prolactin
- Serum calcium, phosphorus and parathyroid hormones
- Insulin-like growth factor 1
  (Schwarz, 2015)

ASSESSING FOR METABOLIC SYNDROME

Metabolic syndrome is a group of risk factors that raise the risk for heart disease, diabetes, and stroke. Other names for metabolic syndrome are:

- Dysmetabolic syndrome
- Hypertriglyceridemic waist
- Insulin resistance syndrome
- Obesity syndrome
- Syndrome X
  (NHLBI, 2015)

Diagnostic testing for the presence of metabolic syndrome includes triglycerides, cholesterol, blood pressure, and blood sugar levels. Nonalcoholic fatty liver disease is a strong determinant for the development of metabolic syndrome and tests of liver function are indicated.

Recommended laboratory studies for metabolic syndrome include:

- Fasting lipid profile
- Fasting glucose

A fasting lipid profile for children and adolescents should be done once between the ages of 9 and 11 and again between 17 and 21. High-risk children should be tested between 2 and 8 years old. Children younger than 2 years should not be tested. A fasting lipid profile includes:

- Total cholesterol
- High-density lipoprotein cholesterol (HDL-C)
- Low-density lipoprotein cholesterol (LDL-C)
- Triglycerides
  (AACC, 2016)

The American Diabetes Association (CDC, 2014b) recommends that children who are overweight with two or more additional risk factors for diabetes be screened every three years, starting at age 10 or at the onset of puberty if that occurs earlier. Screening using one of the following tests is recommended:

- Fasting blood glucose
- Hemoglobin A1c
- 2-hour oral glucose tolerance test (OGTT)

Currently there are no screening guidelines for diagnosing nonalcoholic fatty liver disease in children. A useful guide recommends routine liver function tests including alanine transaminase (ALT) and aspartate aminotransferase (AST) as well as liver ultrasound in all children who are overweight or obese. If any of these tests suggest fatty liver, further testing for the presence of insulin resistance should be done (Nierengarten, 2013).

Hypertension

The National Institutes of Health offers guidelines for measuring and interpreting blood pressure in children. Systolic and diastolic blood pressure are classified according to a child's age, gender, and the 50th and 90th percentiles for height (e.g., if a 2-year-old boy's height is categorized as in the 50th percentile for his age and sex, then his normal blood pressure should be 106/61).

NORMAL BLOOD PRESSURE IN CHILDREN

Age	Boys Height		Girls Height	
	50%	90%	50%	90%
2 years	106/61	109/63	105/63	108/65
5 years	112/72	115/74	110/72	112/73
8 years	116/78	119/79	115/76	118/78
11 years	121/80	124/82	121/79	123/81
14 years	128/82	132/84	126/82	129/84
17 years	136/87	139/88	129/84	131/85

Source: NIH, n.d.

If the systolic blood pressure or diastolic blood pressure is greater than the 90th percentile, blood pressure measurement is repeated two more times during the same office visit before interpreting the result.

INTERPRETING BLOOD PRESSURE FOR CHILDREN AND ADOLESCENTS		
Classification	**Blood Pressure**	**Recommendations**
Normal	Systolic and diastolic <90th percentile	• Recheck in 1 year
Prehypertension	Systolic or diastolic pressure ≥90th percentile to <95th percentile **or** BP >120/80mmHg to <95th percentile	• Recheck in 6 months • Begin weight management as appropriate
Stage 1 hypertension	Systolic and/or diastolic ≥95th percentile to ≤99th percentile plus 5 mmHg	• Recheck in 1–2 weeks • If BP remains at this level on recheck, begin evaluation and treatment, including weight management if appropriate
Stage 2 hypertension	Systolic and/or diastolic >99th percentile plus 5 mmHg	• Begin evaluation and treatment within 1 week, immediately if symptomatic
Source: NIH, n.d.		

CASE

KEVIN, AGE 7

Kevin was screened for overweight and obesity at school. He and his parents were referred to the nurse practitioner for assessment because he had a steadily increasing BMI over the past six months. At the initial appointment, height and weight were obtained and BMI was calculated and added to his current chart. He is now in the 92nd percentile, which classifies him as overweight.

In taking a family history, the nurse practitioner learned that Kevin's mother, age 32, has always been overweight and is constantly dieting to maintain her weight. She is also taking medication for hypertension. Kevin's father is 33 years old. His weight has been normal all his life and he has normal blood pressure. Kevin's maternal grandmother, age 57, is overweight and has type 2 diabetes. His maternal grandfather is 58 and of normal weight; he recently suffered a stroke. Both paternal grandparents are in their late 50s and are of normal weight. The grandfather suffers from angina pectoris. Grandmother is in good health. The nurse discussed Kevin's increased risk for obesity and comorbidities based on this history.

A review of systems reveals that Kevin enjoys school and has a number of friends he plays with both at school and after school. His mood is most often upbeat. He has no symptoms of diabetes and denies headache or breathing difficulties. He sleeps 8 to 10 hours every night. Kevin denies any abdominal discomfort and reports he has regular bowel movements. He denies any foot, hip, or knee pain. Kevin has no allergies to medications and is currently on no medications.

On physical examination Kevin is an alert, well-developed, overly nourished, smiling young boy with a small frame and normal musculature. He has a round trunk and protruding abdomen.

- Vital signs: within normal limits
- Skin: overall even color; no areas of hyperpigmentation, growths, or striae; normal hair distribution
- HEENT (head, ears, eyes, nose, throat): face is symmetrical with no abnormalities; eyes, PERRLA, no papilledema; no tonsilar enlargement; thyroid normal; lungs, normal breath sounds
- Heart: normal heart sounds, regular rhythm, no murmurs
- Abdomen: presence of excess adipose tissue, normal bowel sounds, no evidence of discomfort or tenderness to palpation, no hepatomegaly
- Genitalia: both testes descended, no hernias
- Extremities: no edema, normal pulses, no deformities, no gait deviations observed

Because Kevin is in the 92nd percentile for BMI and has risk factors (maternal overweight and hypertension and family history of stroke, cardiovascular disease, and type 2 diabetes mellitus), a fasting lipid panel and glucose were obtained. Liver function studies were deferred at this time. Blood pressure screening showed a normal-for-age blood pressure of 117/79. Fasting blood glucose was 80 mg/dl, cholesterol 150 mg/dl, and LDL 100 mg/dl, all of which were in the normal range.

Assessing Behaviors and Attitudes

EATING AND NUTRITION

Dietary assessment has several purposes. First of all, it establishes a baseline of eating patterns to determine targets for intervention. Secondly, it provides a means of monitoring change in targeted dietary areas and behaviors. Thirdly, it allows for ongoing feedback to the child and parents.

The following are important features in assessment of diet behaviors:

- Sweetened beverage consumption
- Fruit and vegetable consumption
- What the family eats in a typical day
- Frequency of eating out
- Frequency of family meals
- Consumption of excessive portion sizes

- Daily breakfast consumption
- Types of snacks available
- TV watching while eating
- Attempts to lose weight by dieting, smoking, purging, laxative use

PHYSICAL ACTIVITY

Physical activity is known to protect against the development of obesity by resulting in an increase in energy expenditure and increase in resting metabolic rate. These increases are likely to decrease the possibility of a positive energy balance that results in overweight and obesity. Assessing physical activity provides the clinician with a base for discussion of modifications.

Activity behavior assessment should include:

- How many hours of television are watched each day
- How many hours are spent playing video games each day
- How many hours are spent on the computer and using other screen devices ("screen time") each day
- What other types of sedentary activities occur each day
- How much physical activity is obtained daily
- How often the patient and family do something active together

ATTITUDES

Assessing attitudes involves a psychosocial assessment and can be accomplished using a behavioral risk assessment tool that should include screening for:

- Depression
- Self-perception or concerns about weight
- Readiness to change
- Success, barriers, and challenges

PREVENTION AND TREATMENT

Prevention and treatment of pediatric obesity is necessary to the health and well-being of children and adolescents. It involves education and counseling, assessing readiness to make lifestyle changes, encouraging involvement in obesity prevention programs, and advocating for the development of these programs and improved public health.

Childhood obesity is far easier to prevent than to treat, and many points in the healthcare system offer opportunities for prevention. Healthcare professionals can play a vital role in the weight management of children and adolescents by helping create greater awareness about obesity assessment, complications, and interventions.

The management of childhood overweight and obesity is wide ranging and involves the entire family, not just the affected child or adolescent. Any weight management intervention must include discussions about basic obesity facts and misconceptions, offering literature and reliable resources, nutritional education, physical activity and exercise recommendations, and psychological support. For example, in the home, an occupational therapist can assist children and their families to develop a healthier lifestyle by offering suggestions that will increase activity levels, improve nutritional choices, and ensure their homes provide safe and accessible areas to meet these goals (AOTA, 2013a).

Dietary recommendations stress avoiding or reducing calorie-dense, nutrient-poor foods as well as sugar-sweetened beverages, sports drinks, fruit drinks, and juices. Activity recommendations call for 60 minutes of moderate to vigorous physical exercise each day and a reduction in screen time. Support for breastfeeding and education for parents about proper nutrition and physical activity is also important, along with the creation of programs for childcare facilities, schools, and communities that encourage healthy habits (U of M, 2013).

Education and Counseling

Teaching and counseling parents and children on the importance of healthy food and physical activity to the lifetime health of children are essential. Healthcare professionals have an opportunity to provide such guidance with each patient contact. For instance, education and counseling of young women can help them to understand the need to achieve and maintain a healthy weight before and during pregnancy as well as the possible benefits of breastfeeding in reducing the risk of obesity in their infants.

Counseling has been recognized as a significant factor in the treatment of overweight/obesity in children. Researchers have determined that a type of counseling that works well is called **motivational interviewing**. This type of counseling is a method that is goal oriented and family/patient centered. It attempts to influence individuals to consider making changes rather than offering specific directions. However, the counselor is intentionally directive in the resolution of ambivalence, a central focus of this method, which recognizes that all change has a negative side (loss of the comfortable and familiar) as well as a positive side. If both are not addressed, the result may be resistance and refusal to move forward despite the realization that it is in the person's best interest to do so.

A study conducted with the American Academy of Pediatrics assessed the impact of motivational interviewing provided by primary care pediatricians and supplemented by the same type of counseling from dietitians. Both pediatricians and dietitians who used this technique to counsel families about a child's weight were successful in reducing children's BMI percentile 3.1 more points than comparison children over a 2-year period (AAP, 2014).

An intensive group therapy approach has also been found to be superior to the standard family-based therapy for adolescents who are overweight in helping them to achieve changes in lifestyle and in reducing BMI (Schwarz, 2015).

FOOD MANAGEMENT

Eating habits are developed from a young age, and it is important to expand children's ability to make informed food choices. Parents and children are encouraged to gain an understanding of a balanced diet in which some foods play a greater role than others. Eating should be an enjoyable activity, as well as one that contributes to good health. It is therefore helpful to stress the importance of the social context in which eating takes place. Research has shown that regular family dinners offer a great number of physical, mental, and emotional benefits including:

- Better academic performance in school
- Higher self-esteem
- Lower risk of depression
- Decreased likelihood for development of eating disorders
- Lower rates of obesity
  (Family Dinner Project, 2016)

When working with children and parents, it should also be recognized that changes in eating patterns must involve an individualized approach and must take into account cultural issues, degree of motivation, intelligence, and family resources and support.

It is important that feeding dynamics between parents or caregivers and toddlers do not involve battles over food choices or intake. Unhealthy eating behaviors can develop later on if parents are excessively restrictive and controlling. When parents force their children to "clean their plate," it can affect the ability to learn what it feels like to be full, and children may learn to eat when they are not hungry (Eneli et al., (2014).

CASE

JEFFREY, AGE 2
Jeffrey is a physically active 2-year-old visiting for his two-year well-child visit. His BMI is 17, which places him between the 50th and 75th percentiles, and he is developing normally. His mother, Hayley, has expressed the desire to learn more about how to properly nourish Jeffrey so that he can avoid becoming overweight. Both she and the boy's father have been overweight and want to prevent this from happening to Jeffrey. His pediatrician has referred Jeffrey and his mother to a nurse clinician specializing in childhood obesity management for nutritional education.

The care plan for Jeffrey for the prevention of childhood overweight and obesity involves an eating and nutrition assessment. Hayley describes what Jeffrey eats in a typical day. Following

this assessment of dietary habits, the nurse reviews with Hayley guidelines for a toddler between 2 and 3 years old. The nurse refers Hayley to the American Academy of Pediatrics website and reviews the recommendations with her *(see "Resources" at the end of this course)*.

During the counseling session, the nurse shares these ideas and advice with Hayley:

- Role-modeling has an important effect on toddlers, who are in the process of developing healthy eating habits. It is important for Hayley to exhibit the behaviors she would like Jeffrey to emulate. If she wants Jeffrey to eat vegetables, she should eat those foods along with him.
- Children learn to prefer the familiar. The foods caregivers purchase for the home and the foods children consume outside the home provide a foundation for children's later food preferences. Hayley should make foods available in the home that are appropriate for everyday consumption and avoid having foods in the house that children are restricted from eating.
- Parenting styles play a role in food management. The effect of highly controlled feeding practices and pressure to eat can decrease food preferences and intake, and restriction of specific foods can produce the opposite effects. Also, pressuring a child to eat can undermine his sense of fullness as a sign to stop eating. This disrupts a child's ability to self-regulate energy intake at a meal. In contrast, too little feeding structure and too little supervision are as counterproductive as strategies that reflect rigid parenting. It is recommended that Hayley let Jeffrey decide how much to consume and help him attend to cues of hunger and fullness to make the decision about how much to eat.
- Portion size is important. Hayley can refer to the nutritional brochure provided by the nurse that describes recommended portions. Parents can offer recommended portions or teach the self-serving of portions that are age-appropriate. As Jeffrey becomes older, it is helpful to serve plates away from the dinner table. Serving "family style" at the table encourages refills and overeating. Smaller bowls reduce the amount a child may eat.
- It is important to set a basic mealtime routine, sitting at a table, using proper utensils, and sharing the meal together as a family. Eating in front of a screen, whether TV, computer, or video game, is to be discouraged. Mindless eating can lead to overconsumption.
- There are many ways to make foods easier to eat. This includes cutting the food into bite-sized pieces, making some foods soft and moist, serving foods at room temperature, using ground meat instead of steak or chops, providing Jeffrey with a child-sized spoon and fork with dull prongs, and seating him at a comfortable height in a secure chair. At this age, it is important to allow Jeffrey the freedom to handle food, spit it out, get a feel for it, and not to concentrate on development of good manners.
- Snacks are an important part of a child's nutrition. They help manage hunger and boost nutrition. They also can keep a toddler from becoming so hungry that he becomes cranky. Snacks should be nutritious—low in sugar, fat, and salt. Fresh fruit and vegetables as well as foods containing whole grains and protein are good options.

Hayley should consider a structured snack schedule, offered at the same time each day, and allow Jeffrey to decide what he wants from among the healthy options she offers.

- Part of the plan of care for Jeffrey also involves how he eats when away from home. Currently he is cared for two days a week by his grandmother while Hayley works. Hayley can describe to the grandmother the importance of ensuring that Jeffrey is meeting his nutritional goals.

SCHOOL-BASED NUTRITION STRATEGIES

There are a number of recommendations that can be implemented in schools to help promote healthy nutrition, especially in the cafeteria. Occupational therapists, among others, can apply strategies such as:

- Educating the cafeteria supervisors and students in ways to create a calm, quiet, and comfortable environment
- Promoting positive behaviors at mealtime, posting rules, and teaching teamwork and respect for others
- Fostering enjoyable social interaction by suggesting round tables and chairs rather than rectangular tables and benches
- Promoting good nutrition and a healthy relationship with food through student and staff education
- Modifying the environment so that décor is more inviting
- Staggering class mealtimes to calm minds and bodies to better focus on eating rather than on playing
- Promoting the removal of high-calorie and sugary vending machine options
- Encouraging schools to provide a school breakfast program

Sources: AOTA, 2013b; Let's Move, 2016.

EXERCISE / PHYSICAL ACTIVITY

Childhood obesity prevention and management counseling should include information regarding the benefits of physical activity and exercise combined with food management to promote a healthy weight. Children who exercise regularly are likely to perform better in school; feel better about themselves, their bodies, and abilities; cope better with stress; and better regulate their emotions. Exercise can help children avoid feelings of low self-esteem, anxiety, and depression. Daily exercise helps children to build stronger muscles and bones and limit excess body fat.

The bodies of healthy children were meant to move. Left to their own devices, young children want to be active—to move rather than sit and watch TV or videos. Physical activity helps

children stay alert during the day and sleep well at night. The American Academy of Pediatrics recommends there be no television, computers, or video games in children's bedrooms, and television should be turned off during mealtimes. Children and teens should engage with entertainment media for no more than one or two hours a day. Television and other entertainment media should be avoided for infants and children under age 2 (AAP, 2015b).

Parents are role models, and children are sensitive to the messages that are sent about exercise. Parents are also in a position to limit media consumption.

It is recommended that children get at least 60 minutes each day of moderate to vigorous physical activity, and schools have traditionally been expected to provide at least half of this, for a total of 150 minutes each week. To improve health and fight childhood obesity, many schools are now changing physical education requirements and are finding new ways to keep children active throughout the day (ISU, 2014).

Owning and caring for a dog has shown promise in increasing children's outdoor physical activity. This unique tool is showing promise in treating childhood obesity, in particular for children living in urban areas who lack safety and space for play. Dogs provide safety, companionship, support, motivation, and the necessity for walking. When children play with dogs, "they may run, dance, and mirror an animal's natural energy, enthusiasm and exuberance for life" (Boisvert & Harrell, 2015).

CASE

JAIME, AGE 9

Jaime is a 9-year-old boy who is obese. Over the past few weeks, he has begun developing problems walking due to pain in his knees and especially his feet. Upon the school nurse's recommendation, Jaime's parents took him to see his pediatrician, who examined and diagnosed Jaime with plantar fasciitis, a common consequence of obesity. He was referred to physical therapy for evaluation and treatment.

The physical therapist's initial evaluation included Jaime's overall health status, history of his current presenting complaint, and screening for medical red flags. The examination included evaluation of pain, joint range-of-motion, manual muscle testing, bony and soft-tissue palpation, orthopedic special tests, sensation testing, postural evaluation, gait biomechanics, and static and dynamic balance testing.

Besides plantar fasciitis, the physical therapist (PT) found Jaime to have bilateral functional (as opposed to rigid) pes planus, with noted flattening of the medial longitudinal arches in weight-bearing, static standing. The PT recommended an athletic shoe with increased medial arch support, and Jaime was begun on a rehabilitative protocol to address his plantar fasciitis symptoms.

The physical therapist talked with Jaime and his parents about an appropriate long-term fitness routine, to include cardiovascular exercise, strength training, flexibility, and functionality work. Because Jaime was having pain that limits his abilities to stand or walk about, the early stages

of his prescribed fitness plan would focus heavily on non-weight-bearing activities such as using a stationary bicycle, swimming, and light resistive exercise. The PT also requested that Jaime, with the help of his parents, keep a journal describing what physical activities he does each day and how long he spends doing them.

At his next visit, Jaime's journal revealed that he is driven to school and back home each day, spends most of the day in the classroom, and at recess goes outside and sits on a bench watching the other kids play. He attends physical education class one day a week and seldom performs as well as his classmates. After school, he goes to his bedroom and does his homework or plays on the computer until dinner. The family eats together, and Jaime is expected to help with the dishes. Then he and his parents typically go to the living room and watch TV until bedtime. Some days, Jaime goes to his room and reads until bedtime.

As part of his physical therapy plan of care, an activity program was developed with a long-term goal to gradually increase Jaime's level of physical activity until he consistently attains the recommended daily level for a child his age (at least 60 minutes on most, if not all, days).

At his next treatment session, Jaime reported that his father had purchased a stationary bike and a set of free weights for them to use together. The PT reviewed safe weight-lifting technique with Jaime and his dad and set parameters for the appropriate amount of weight for Jaime to be lifting, given his age and size.

When Jaime returned the following week, he reported an increase in his overall activity, logging 60 minutes of activity on three out of the past seven days and at least 30 minutes on three of the remaining days. His parents have shown themselves supportive of his efforts, taking him to choose a new pair of sneakers and participating in a daily "family activity fun night" after dinner, beginning with the specific stretches and core strengthening exercises learned at physical therapy followed by either taking turns riding the stationary bike or swimming at the community pool. They continue logging each day's activities in order to track their progress.

The physical therapist also recommended that all "screen time" be significantly reduced and that Jaime and his parents discuss removing the computer from his bedroom to minimize temptation. However, it was also decided that Jaime would be in charge of entering the family's daily activity log on the computer in a format of his own choosing, giving him the reward of a little extra screen time on days he meets his daily activity goal of 60 minutes.

Jaime and his family brainstorm other ways in which they can all increase activity:

- Walk to school or be dropped off a couple blocks from school
- Take stairs instead of escalators or elevators
- Take a family walk after dinner instead of watching TV
- Work together in the yard doing gardening, raking, or lawn mowing
- Play a game of catch in the backyard

- Take turns riding the stationary bike during a favorite TV program; see who can ride the farthest during a commercial break
- Join the local YMCA and swim together once or twice a week
- Continue with stationary biking competition and gradually work toward outdoor cycling together

After six weeks of physical therapy intervention (1x/week), Jaime has made the following progress toward his long-term physical fitness goals:

- A reduced BMI and an absence of weight gain since program initiation
- Full participation in gym class with his peers
- 60 minutes of physical activity attained on 85% of days since the start of the program
- Approximately 70% resolution of his foot pain and independence with his prescribed home exercise program for the continued management of his symptoms

The physical therapist, Jaime, and his parents discuss his excellent progress and his eventual goals of achieving 100% adherence to his daily activity routine. Jaime shares that he has come to enjoy spending time exercising with his parents and pleasure at being able to participate with his peers in gym class. He is also happy that his foot pain has decreased and now rarely bothers him.

Due to the consistent support of Jaime's parents and his rapid progress toward his physical therapy goals, it is decided that Jaime need not follow up with physical therapy until one month later, at which time his progress and status will be reevaluated. If, at that time, Jaime is still doing well with his fitness program and his foot pain continues to abate, he will likely be discharged to a fully independent home-based program.

PSYCHOSOCIAL ISSUES

Children and parents should be provided not only with information about the physical issues related to childhood and adolescent obesity but also about the victimization and psychological effects that accompany this condition. It is important to recognize that weight bias has consequences for children's social relationships. They are rejected more often by their peers and are more likely to be socially isolated. Weight bias can lead to unhealthy weight control measures such as bingeing and purging and smoking. Weight bias has a negative effect on self-esteem and feelings of self-worth.

In order to be empathic, the healthcare provider must complete a self-examination of attitudes toward overweight and obese individuals. Recent studies show that weight bias is very common among health professionals. A recent study showed participants exhibited significant implicit and explicit anti-fat/pro-thin bias. Another study showed that many healthcare providers hold strong negative attitudes and stereotypes about people with obesity, and these attitudes may impact the

care they provide. Stigma can reduce the quality of care for patients with obesity in spite of the best intentions of the providers (Tomiyama et al., 2015; Phelan et al., 2015).

Secondly, healthcare providers must make efforts to avoid stigmatizing or offensive language that can hinder important discussions with children and families about a child's health. *Fat, obese,* and *extremely obese* are terms considered undesirable, stigmatizing, blaming, and the least motivating. Such terms as *weight* and *unhealthy weight* have been shown to be more acceptable.

Healthcare providers must educate parents about weight bias language and offer appropriate strategies to address their child's weight with sensitivity and support. Even well-intentioned parents may unknowingly criticize or tease their overweight child in ways that are very damaging. Healthcare professionals can help by addressing teasing, bullying, or associated psychological distress (such as depression and anxiety) and by identifying whether children and adolescents have a support system in place to deal with weight-bias (Tanofsky-Kraff, 2012).

CASE

BRITTANY, AGE 16

Brittany has been admitted to the psychiatric unit because she has expressed suicidal ideation. Brittany is 5 feet, 6 inches tall and weighs 250 pounds. She has elevated blood pressure and elevated blood sugar levels. Yesterday her parents contacted her pediatrician because a classmate had called to tell them that Brittany was talking about ending her life. Her pediatrician referred her to the hospital's psychiatric unit for evaluation and safety.

Brittany was sitting alone, staring out the window when the unit nurse entered the room. When approached, Brittany didn't smile but acknowledged the nurse with a nod. The nurse sat at right angles to her and introduced herself. She explained that she will be involved in Brittany's evaluation and plan of care.

After sitting quietly for a few minutes, Brittany eventually blurted out, "I've been fat all my life. I hate myself!" The nurse replied by saying, "Tell me about that." Brittany began to talk about how much she hates the way she looks and about how others tease her and call her names. Some names she recalls are "fat ass," "wide load," and "fatso." Once she was told she was "probably pretty under all that flab." Her parents have compared her unfavorably to her younger and thinner sister and constantly nag her about what she's going to do about her weight. They make comments about how much she eats and how she's to blame for her problem. Her sister and friends have joined in with the criticism.

Brittany's care plan involves working closely with her and her family to address an array of psychological issues.

Brittany's parents have a critical role to play in reducing the victimization of their daughter and improving her quality of life. It is important to help her parents and family members examine their personal attitudes about weight and to avoid communicating weight-biased assumptions to Brittany. This includes using sensitive and appropriate language and avoiding negative comments about their own or other people's weight in front of Brittany.

A goal should be to help her family understand that prejudice against overweight is still a socially acceptable prejudice and that public attitudes about fat have never been more judgmental or stigmatizing. Being overweight is considered to be caused by the individual's over-indulgence or lack of exercise and is viewed as a matter of personal responsibility. This stigmatization gives thinner children permission to think that larger children have something wrong with them or are inferior in some way.

Discussions with Brittany and her family can help them understand that their concern should not be Brittany's weight but her overall health. Working positively toward healthy eating and lifestyle should be their focus and ultimate goal.

Brittany can be encouraged to begin to work toward improving her feelings of inferiority by practicing self-talk that emphasizes self-acceptance and positive self-regard. She can set goals for herself such as, "I will say or think something positive about myself once every hour while awake." She can set goals that erase activity restrictions she has placed upon herself because of fear of ridicule and participate more fully in these experiences. Above all, she can take a bold step and communicate to the perpetrators of weight bias that their comments are inappropriate and hurtful and that nobody deserves such unkind remarks, regardless of their weight.

It may also be beneficial for Brittany to attend a support group in her local community or online for adolescents who are dealing with obesity.

RISKS INVOLVED IN DIETING

Children, adolescents, and families need to be counseled about the effectiveness and risks involved with dieting, food restriction, and weight-loss programs. Although obesity itself is associated with increased morbidity and mortality, poorly monitored weight loss and/or weight cycling can have equally problematic consequences. Very controlled-energy diets are not recommended for the large majority of children and adolescents with obesity. Among the potential complications are cardiac arrhythmias, malnutrition, electrolyte disturbances (especially hypokalemia), depression, and eating disorders (Hamdy, 2015).

GOAL-SETTING AND SELF-MONITORING

When counseling about weight management in children and adolescents, it should be stressed that the goal is to **reduce the rate of weight gain** to fit the profile expected on normal growth curves. The intent is not to cause weight loss. Children must grow into their weight, while adults must lose it. The basic principles include modifying the diet, increasing appropriate physical activity and exercise, reducing sedentary activities, and modifying eating behaviors (Hamdy, 2015).

An important part of this goal is to motivate children and adolescents to learn how to self-monitor foods chosen, calorie intake, and physical activity. This involves individual goal-setting, stimulus control, nonfood rewards, and relapse prevention.

One way in which children can be involved in monitoring foods chosen is to assign them tasks during meal preparation such as selecting the fruits or vegetables they will eat for breakfast or dinner. Cooking together allows children to see what it takes to make a healthy meal.

Setting simple goals and recording steps toward these goals on a calendar or in a journal is a beneficial tool for motivating change. It helps children learn which foods they eat that contribute the most calories, how often they eat these foods, and which situations or circumstances trigger them to eat these foods. It sets the stage for identifying eating cues and helping children learn the caloric content of foods and recommended serving sizes.

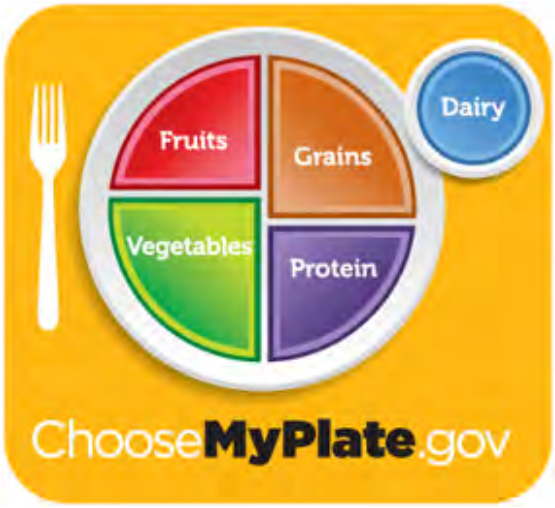
Stimulus control or cue management involves removal of high-calorie foods from the home, reducing the frequency of meals eaten outside the home, and avoiding sedentary-promoting activities.

Relapse or lapse prevention involves nutrition counseling to help young people learn how to anticipate and cope with certain situations that may prompt them to eat certain foods, such as at parties or eating at fast-food restaurants with family and friends.

CASE

SONDRA, AGE 10

Sondra has been followed by the nurse practitioner for the past two years for moderate obesity, and currently she is in the 83rd percentile, a normal, healthy weight. Sondra has been following a careful eating plan that includes the recommendations of ChooseMyPlate, which provides in-depth information about each food group, physical activity, and age-specific activity recommendations for preschoolers and school-aged children.



The ChooseMyPlate graphic was designed to be an easily understood starting point to educate individuals, families, and groups about the basics of healthy food selection and relative portion amounts. (Source: ChooseMyPlate.gov.)

Sondra has managed to maintain her weight using these recommendations. She has not dieted, but she continues to grow without gaining any additional weight. Reassessment of her dietary

regimen shows she is eating ordinary food in controlled-size portions, not special "diet" food. She eats a high-nutrient breakfast every morning, and she eats out in restaurants or fast-food outlets not more than once a week. She drinks low-fat milk and water but no sweetened beverages. Her portion sizes are appropriate for her age. She eats the recommended daily amounts for protein, fruits, vegetables, dairy products, and whole grains. She eats three meals each day, with two low-energy-dense snacks in between.

Along with following dietary recommendations, Sondra has increased her physical activity, spending more time outdoors playing and less time watching TV. She and her parents are taking daily walks together after dinner lasting 30 to 45 minutes.

Assessing Patient and Family Readiness and Barriers to Change

For successful outcomes in pediatric obesity, parental involvement is vital. Assessment is necessary to gauge the degree of parental readiness to change. This may be classified in several ways. One way to assess is the following:

- Pre-contemplation: no intention to change
- Contemplation: parent considering making changes but is not yet committed
- Preparation: the intention to change
- Action: the actual modification of behavior
- Maintenance: continuing the modified behavior
  (Jacob & Isaac, 2012)

To communicate effectively with parents of overweight or obese children and with the children themselves, the healthcare professional needs to determine 1) how important it is to the parent/child to make changes and 2) how confident the parent/child is in the ability to make the changes. If either the parent or the child fails to see the importance of making changes in diet and physical activity, the healthcare professional needs to focus on the serious health risks, both short-term and long-term. If either the parent or the child lacks confidence in their ability to make changes, the healthcare provider needs to determine what the perceived or actual barriers are. Once barriers are identified, the provider and the child and parent can explore together ways to overcome or minimize those barriers.

BARRIERS TO DIETARY CHANGES

- Lack of time and competing priorities
- Social rewards of foods high in fat and sugar
- Distorted views of portion size
- Limited access to healthy foods (geographical, income factors)
- "Tastelessness" of healthy foods

- Readily available "junk" foods at school and in the neighborhood
- Lack of parental involvement/support
- Overweight peer group
- Contrast between nutritional knowledge and "irresistibility"

Source: Macdiarmid et al., 2013.

Obesity Prevention Programs

All across the United States, parents and health professionals are working together to prevent childhood obesity and help those affected achieve and maintain a healthy weight. Programs at the local, state, and federal levels help support the efforts of individual families to eat healthier and exercise more. These efforts are gaining momentum. Some are focused on nutrition—teaching children where food comes from through school gardens and farm visits or offering healthier choices in school cafeterias. Others are focused on physical activity—bringing back recess to elementary schools, advocating for physical education programs, or encouraging walking or biking to school.

Following are examples of programs that work and could be replicated elsewhere:

LET'S GO!

Let's Go! is a nationally recognized childhood obesity prevention program initiated in Greater Portland at the Barbara Bush Children's Hospital at Maine Medical Center. It operates throughout the state of Maine, working collaboratively with teachers, childcare workers, healthcare professionals, afterschool programs, and work places. The agenda is healthy eating and active living for all children in Maine. Its shared measurement strategy is environmental and policy change, "5-2-1-0" behaviors, and reducing obesity prevalence. Mutually reinforcing activities are the "10 Strategies."

5-2-1-0 BEHAVIOR

- 5 or more fruits and vegetables each day
- 2 hours or less recreational screen time each day*
- 1 hour or more of physical activity every day
- 0 sugary drinks, more water, and low-fat milk each day

* No TV/computers in bedrooms and no screen time for children under the age of 2.

10 STRATEGIES

1. Provide healthy choices for snacks and celebrations; limit unhealthy choices.
2. Provide water and low-fat milk; limit or eliminate sugary beverages.
3. Provide nonfood rewards.
4. Provide opportunities for children to get physical activity every day.
5. Limit screen time.
6. Participate in local, state, and national initiatives that promote healthy eating and active living.
7. Engage community partners to help support and promote healthy eating and active living.
8. Partner with and educate families in adopting and maintaining a lifestyle that supports healthy eating and active living.
9. Implement a staff wellness program that includes healthy eating and active living.
10. Collaborate with food and nutrition programs to offer healthy food and beverage options.

Following initiation of the program, Let's Go! reported in 2015 that engagement with childcare programs, schools, afterschool programs, healthcare practices, and awareness of messages among Maine parents showed remarkably positive results and in all cases save one exceeded projected goals. Let's Go! toolkits are available online *(see "Resources" at the end of this course)*.

LET'S MOVE

First Lady Michelle Obama launched Let's Move in 2010. This program addresses the problem of childhood obesity and is dedicated to solving it within a generation. It has been instrumental in bringing the country together and engaging parents, business leaders, educators, elected officials, military leaders, chefs, physicians, athletes, childcare providers, community and faith leaders, and children themselves in the efforts to improve the health of the nation's children.

Accomplishments to date include:

- Increased access of information for families to make healthier decisions for their children
- Improvement in school meals and snacks and increased opportunities for physical activity
- Improved community access to affordable healthy foods
- Shifts in businesses to support the demands for healthier products

AWARD-WINNING CITY-BASED PROGRAMS

The U.S. Conference of Mayors (2014) awarded six cities for comprehensive, city-based programs that aim to prevent childhood obesity:

- Dallas, Texas: The **Mayor's Youth Fitness Initiative** targets children ages 6 to 12 by engaging them in activities aimed at helping to develop a lifetime love of exercising and eating smart. It is a two-hour, weekday afterschool program.

- Denver, Colorado: **Healthy Childcare Makes a Healthy Start** has as its goal to increase the number of childcare centers that incorporate evidence-based healthy eating and active living policies and activities in everyday operations.

- Little Rock, Arkansas: **Love Your School Childhood Obesity Intervention and Prevention Initiative** provides education and training for students and teachers. It includes creation of more than 300 raised-bed gardens; cooking courses; student-led weekend farmers' markets; improvement of walking trails, play spaces, and recreational facilities; and campaigns that support healthy food choices and breastfeeding.

- Monrovia, California: **Fit Together** is a broad-based community interagency partnership whose aims are to increase kids' fruit and vegetable consumption and physical activity levels, with the underlying goal of preventing obesity and other diet-related chronic diseases.

- Waterbury, Connecticut: **2014 Kids Marathon Program** introduces the sport of running to youth ages 7 to 12 over a 12-week period at no charge to the participants. The young athletes run one to two miles, two or three times per week, completing a cumulative 26-mile marathon.

- York, Pennsylvania: **Eat Play Breathe: York's Childhood Wellness Initiative** focuses on transforming the school environment by incorporating wellness into the mission and culture of each city school. Goals are to improve nutrition by installation of greenhouses, which provide opportunities for students' year-long growing and education, as well as use of garden produce in the schools and from school to home. The program also focuses on physical activity in preschools as well as K–8 classrooms.

Advocacy

Advocacy is the act or process of supporting a cause or a position expressed through strategies and methods that influence the opinions and decisions of people and organizations. The aims of advocacy are to create or change policies, laws, regulations, distribution of resources, or other decisions that affect people's lives and to ensure that such decisions lead to implementation.

This can be accomplished through a variety of persuasive actions and communications. All effective advocacies require strong communications, knowledge of the local community, and a strong relationship with community leaders and other advocates in the area. Consulting and

building relationships is intrinsic to any successful advocacy effort and should be commenced at an early stage.

Steps in advocacy include an analysis of current policies, outlining and finalizing an advocacy strategy, and framing a plan. The role of the advocate can be very visible—a public approach—or behind the scenes. It is important to identify key messages. Each message should state what you want to achieve, why you want to achieve it, how you propose to achieve it, and what specific action you want the audience to take.

Healthcare providers are in a unique position to advocate at the local, state, and national levels for changes in conditions that affect the health and well-being of members of society. Advocacy can include both promotion strategies and protection strategies.

PROMOTION STRATEGIES

Following are some examples of causes involving promotion strategies that healthcare professionals can become involved in to work toward better health outcomes for children and adolescents:

- Promoting physical activity opportunities, supporting neighborhoods that propose safe walking and biking trails, and advocating for recreational and open spaces for outdoor activities
- Advocating for the provision of physical activity throughout the school day, including increases in time allotted to recess, and working toward development of afterschool programs to promote physical activity and socialization (AOTA, 2013c)
- Supporting efforts to limit unhealthy food advertisements aimed at children and adolescents
- Fostering the practice of moderation rather than over-consumption and emphasizing healthy choices rather than restrictive eating patterns
- Being involved in research into the pathophysiology, risk factors, and early recognition and management of overweight and obesity
- Promoting school and community gardens
- Supporting an increase in available and affordable healthful foods and beverages at supermarkets, grocery stores, and farmers' markets
- Promoting anti-bullying programs and teaching children and adults to avoid derogatory or offensive weight language (AOTA, 2013c)

PROTECTIVE STRATEGIES

All children have the right to be protected from harm. Examples of protective strategies that target this goal include working toward local, state, and federal legislation to:

- Regulate foods and beverages offered in schools
- Regulate food contents in restaurants
- Regulate nutritional labeling of foods
- Further state breastfeeding laws

Laws and policies at city, state, and federal levels have been put into effect promoting healthy food and limiting access to unhealthy foods. The U.S. Department of Agriculture, for example, recently updated the minimum nutritional standards for the national school breakfast and lunch programs and requires large-chain retail food establishments and vending machine operators to disclose calorie content of items on menus and in vending machines.

Local and state governments have used urban planning tools such as zoning and/or licensing laws as well as incentive programs to regulate location and density of fast food outlets or to promote the availability of healthy foods in neighborhood corner stores. Some states have levied a tax on sugary beverages in an effort to decrease consumption (NCSL, 2015).

In 2015, the U.S. Food and Drug Administration reported the phasing out of trans fats in the food supply, and companies will have three years to remove them from their products.

Twenty-nine states, the District of Columbia, and the Virgin Islands exempt breastfeeding from public indecency laws. Seventeen states and Puerto Rico exempt breastfeeding mothers from jury duty or allow jury service to be postponed. Federal law also has established minimum protections for mothers who are breastfeeding (Public Health Law Center, 2015).

CASE

CLEARVIEW SCHOOL

Ellen is an occupational therapist employed by the local public school district. Her clinical caseload consists of school-aged children (ages 4 to 12) with a variety of physical and/or cognitive diagnoses. In the past few years, Ellen has noticed a disturbing trend on the playground of Clearview School, where she practices. An increasing number of students appear to be overweight or obese, and she sees more and more children (of all abilities) opting to sit on benches during recess, talking, or playing hand-held games rather than engaging in physical activity. Ellen brings up this observation in the staff lounge one day and finds several staff members to have strong opinions on the issue.

Darius, the physical education teacher, mentions the fact that budget cuts have reduced the frequency of physical education classes to once weekly for the elementary and middle school grades and expresses his opinion that the students' overall fitness and health are suffering as a result. Carmelita, the school nurse, agrees, stating that she has seen obesity levels in students at the school rise alarmingly in recent years. Additionally, the nurse adds, there are more than twice as many students who have metabolic syndrome at the school than when she first started working there. Richard, the cafeteria manager, complains about the presence of items such as soda and candy in the cafeteria vending machines.

As Ellen, Darius, Carmelita, and Richard continue to discuss these issues over lunch, they become frustrated that many of the school's policies (decreasing physical education, allowing soda, etc.) seem to be contributing adversely to the overall health of the student body. By the time they finish their meals, they have decided to work together and formulate a plan to advocate for their students. Over the next few days, they collaborate on the following action plan to submit to the school administration.

Objectives:

- To address internal organizational factors that contribute to childhood obesity in the student body
- To sponsor a community-based event that promotes physical fitness and healthy lifestyle choices

Rationale: Childhood obesity is a growing problem with serious health consequences. As educators and clinicians, we have a responsibility to ensure that students have healthy options for food choices and physical activity that encourage them to make healthy lifestyle choices.

Proposed Course of Action:

- Remove soda and candy machines from the cafeteria
- Ban the use of hand-held games and cell phones during recess
- Train recess monitors to lead group physical fitness activities—games, obstacle courses, etc.—and actively encourage student participation
- Prepare and give an annual presentation to each grade's health class on childhood obesity and risks for short-term and long-term health consequences, stressing overall health instead of thinness
- Design a wider variety of healthy yet enticing cafeteria options and work with the student council to incorporate student input on menu choices
- Sponsor/host an annual community-wide 5K walk to raise money for and awareness of childhood obesity and health consequences; encourage students to form relay teams and the school to award prizes to teams that raise the most money; set up a booth at the 5K walk offering free BMI screenings and health-related educational pamphlets; offer healthy snacks to walkers

The group presented their proposal to the school principal and superintendent. They were well received and subsequently invited to present at the next school board meeting. The board unanimously accepted the proposal. Over the following school year, the components of the proposal were gradually implemented within the school and plans for the community event progressed.

One year later, Ellen, Darius, Carmelita, and Richard reflected on the events of the past year

and the current status of their project:

- Official Clearview policy has banned soda and candy machines, replacing them with a build-your-own salad bar and a nonfat sorbet machine.
- Three recess monitors have been successfully trained in physical fitness games and actively recruit students to participate; use of hand-held devices is no longer permitted on the playground.
- The 5K run was successfully sponsored and executed; 674 people participated, and over $8,000 was raised for efforts to educate the community about healthy eating and the importance of physical activity. A check was presented to the mayor at a school-wide assembly designating the money to go toward a community vegetable garden at the school and improving recreational opportunities.
- The school nurse, Carmelita, documented a 5% decrease in obesity levels in the student body.

The four colleagues felt justly proud of their collaborative efforts to mobilize and advocate on behalf of their students to address the issues of student obesity and physical fitness at Clearview. They are encouraged by the success of the past year and plan to continue and expand their outreach during the upcoming school year.

MEDICAL AND SURGICAL INTERVENTIONS

Despite making changes in lifestyle, some children will continue to wrestle with extreme excess weight and its associated comorbidities and may need to turn to medical and surgical interventions to treat their condition.

Pharmacotherapy

Although there have been some hopeful signs that the prevalence of overweight/obesity rates in children and adolescents is stabilizing or declining, **severe obesity** is the fastest-growing pediatric obesity category. Despite dietary counseling, physical activity counseling, and behavioral modification counseling, some children fail to achieve results. For them, pharmacological therapy should be considered.

ORLISTAT

At this time, the only FDA-approved prescription drug recommended for the treatment of pediatric obesity is orlistat (Xenical). Orlistat is approved for ages 12 and older. It is a reversible gastric and pancreatic lipase inhibitor that limits the gastrointestinal absorption of dietary cholesterols by approximately 30%. Orlistat is available by prescription at a dosage of 120 mg three times a day taken with meals and is also approved for over-the-counter use with a recommended dosage of 60 mg three times daily.

Studies show a reduction in BMI of 2.5% at one year. Side effects of orlistat include oily fecal spotting, fecal urgency, fatty/oily stool, and abdominal discomfort. This drug causes a reduction in fat-soluble vitamin levels, which may cause problems in adolescent growth and development. Therefore, a daily multivitamin is recommended along with the drug (Kelly, 2015).

METFORMIN

Metformin (Glucophage) is used for the treatment of type 2 diabetes mellitus in both adults and children at least 10 years of age. Metformin reduces hepatic glucose production, decreases intestinal glucose absorption, and increases insulin sensitivity by way of improving peripheral glucose intake and utilization. Additionally, metformin inhibits fat cell lipogenesis and may reduce food intake by increasing a glucagon-like peptide.

Metformin is not FDA-approved for treating pediatric obesity, but it has been evaluated in several small clinical trials for weight reduction in children and adolescents who are obese, obese with hyperinsulinemia, or who have gained excessive weight secondary to treatment with atypical antipsychotic agents.

Studies have shown obese children and adolescents given 1–2 mg/day of metformin for up to one year have achieved a 3% BMI reduction. Length of treatment seems to have contributed to increased effectiveness, while the size of the metformin dose was not influential. Metformin has been found to offer modest improvements in glucose, insulin, and insulin resistance. The main side effect is nausea (Kelly, 2015).

EXENATIDE

Exenatide (Bydureon, Byetta) is a medication used to treat type 2 diabetes. It is not FDA-approved for weight loss. Short-term treatment with exenatide has been shown to change the course of weight-gain and significantly reduce BMI and body weight in children and adolescents with extreme obesity, with reductions in BMI approaching 5% over a treatment period of three months.

The medication enhances glucose-dependent secretion of insulin, suppresses glucagon secretion, reduces appetite, and delays gastric emptying. It has been shown to significantly improve fasting insulin, insulin sensitivity, and beta cell function, thereby reducing the risk for type 2 diabetes. This medication must be given subcutaneously twice a day. Side effects reported include transient and mild nausea, vomiting, headache, and abdominal pain (Kelly, 2015; AstraZeneca, 2015).

Bariatric Surgery

With the continued rise in rates of severe obesity in adolescents and the limited success in obtaining a healthy weight with available lifestyle and pharmacological interventions, contemporary studies have shown that adolescent bariatric surgery is well tolerated and effective.

Adolescent bariatric surgery is a drastic, life-changing, and controversial decision. Less than 1% of weight loss surgery procedures in the United States are performed on adolescents. The most commonly performed procedures are sleeve gastrectomy (SG) and roux-en-Y gastric bypass (RYGB). The final decision to perform these procedures is made by a multidisciplinary team following careful screening of appropriate candidates considering developmental maturity, family support, and resultant disease burden without surgery. At this time, however, there is insufficient evidence regarding the safety or effectiveness to recommend use of bariatric surgery for children or pre-adolescents (Thakkar & Michalsky, 2015).

The use of bariatric surgery to treat morbidly obese adolescents remains highly controversial, not only because of the lifelong physiological implications and uncertainty about potential complications, but also because of the ethical implications.

Although there is a moral imperative to help adolescents avoid the serious health consequences of severe obesity, there are many questions that need to be addressed. Lack of maturity and relationships within families pose challenges concerning autonomy, informed consent, assent, and the assessment of what is in the best interest of the adolescent. The medicalization, bias, and discrimination concerning obesity raise questions about justice and trust among health professionals. It is important that the hidden interests of the minor, the parents, professionals, industry, and society be open for review (Hoffmann, 2013).

ETHICAL CONSIDERATIONS

Because of our national concern over the problem of obesity in children and adolescents, many ethical questions have arisen. Such questions include:

- Who is responsible for making sure that children have a healthy life—parents and caregivers, schools, communities, the state?
- How do we make certain that children are not harmed by their lack of ability to make good choices and their reliance on adults for food and other materials?
- How do we protect children from being used as market objects?
- Might our public's policy focus on weight in a weight-obsessed, thin-obsessed society bring about increased eating disorders and stigmatization?
- What is the association between individual autonomy and state authority? Is state intervention justified in protecting vulnerable populations from harming their own or other's health?
- What are the privacy issues in states where schools are mandated to screen for body-mass index adherence?
- What are ethical family interventions for childhood obesity?

Policies that give priority to key ethical principles supporting the rights of children to grow and develop in healthy environments are necessary for resolving the childhood obesity epidemic in ways that are acceptable and sustainable from a community perspective. Ethical principles to be considered toward this end include autonomy, beneficence, nonmaleficence, and justice.

Autonomy

Autonomy is the capacity of a rational person to make an informed and uncoerced decision. Because children do not have the capacity to make such decisions, the question of who is responsible for ensuring that a child eats healthful foods has to be asked.

For children, the right to independently self-govern and select options based on their own wishes is forfeited as they are unable to make health-related choices. Autonomy should allow the child to create a plan and implement it, as well as pursue his or her own chosen future. However, children, especially very young children, have little or no control over what they eat and how much physical activity they are involved in. Legally and ethically that responsibility falls to the parent.

Because parents are the decision makers and role models, the idea that they are responsible for their children's obesity has been raised, yet this issue is controversial. The U.S. Supreme Court has recognized the right of parents to direct the upbringing of their children free from government interference but has also found that the state has an undeniable interest in the health, safety, and welfare of children within its borders. Perryman (2011) writes, "Within legal boundaries, parents have the right to raise their children as they wish, and they have a responsibility to protect their children from harm. This creates an ethical dilemma when children become obese."

The inclusion of childhood obesity as a child protection issue in the United States remains widely debated. Only a minority of states have acknowledged obesity as a form of neglect or medical neglect. In these states courts determine whether or not a child is endangered using criteria typically set forth by statute. Courts determine whether further interventions are necessary and if removal from the home is warranted, attempting to balance the rights of the parent and the best interest of the child when making such a determination (Garel, 2014).

Beneficence

Beneficence refers to an action that is done for the benefit of others. Actions can be taken to prevent or remove harm or to simply improve the situation of others. Under this ethical principle, food made available to children should meet the recommended dietary guidelines for optimal nutrition for children. Unhealthy snacks and sugar-sweetened beverages undermine the efforts to encourage children to eat nutritionally sound meals. Schools have an obligation to question and refute policies that do not benefit their students and their communities and to question students' right to choose foods of poor nutritional quality at school, thus conflicting with the societal value of child protection (Crawford et al., 2011).

When considering actions done to prevent or remove harm, the marketing of goods and services that contribute to obesity should be considered. Children are very likely to falsely interpret such marketing messages as truthful. Psychologists working in companies involved in advertising to children have knowledge of children's behavior and are in a position to manipulate them accordingly. Advertising to children can be viewed as inappropriate and unethical because its purpose is to manipulate a vulnerable audience and to treat this audience as a means to a monetary end (Watson, 2014).

Nonmaleficence

Nonmaleficence means to do no harm and asks the question: Do the benefits outweigh the burden? When children and adolescents are provided easy access to foods of poor nutritional quality in quantities that contribute to obesity, it should be construed as causing harm. One of the most common ethical dilemmas arises in trying to balance beneficence and nonmaleficence. What are the risks of developing a new public policy or initiative to combat the obesity problem, and what are the benefits?

Justice

Justice means that resources for the treatment of childhood obesity are accessible to all in need and that these children receive equitable and just treatment. Treatment of childhood obesity options vary in their availability and their cost, and socioeconomic status dictates who has the resources to pay for it. The presence or absence of insurance may determine whether or not individuals have access to treatment or medications for obesity. Family-based treatment often requires professional leadership, educational materials, activity equipment, and available facilities, all of which can impose a financial burden (Perryman & Sidoti, 2015).

CONCLUSION

The problem of childhood obesity continues to plague our modern world, and there is continuous study being done to unlock the mysteries involved in its origins and how best to combat it. We all—the government, community members, healthcare providers, parents, and educators—have a serious challenge in maintaining the health, well-being, and quality of life for all our children, as they are our future.

RESOURCES

BMI calculator (U.S. DHHS)
http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm

Childhood obesity facts (CDC)
http://www.cdc.gov/obesity/data/childhood.html

Growth charts
http://www.cdc.gov/growthcharts/

Institute for Healthy Childhood Weight (American Academy of Pediatrics)
https://ihcw.aap.org

Let's Go!
http://www.letsgo.org/

Let's Move!
http://www.letsmove.gov/

Surgeon General's Call to Action to Support Breastfeeding
http://www.surgeongeneral.gov/library/calls/breastfeeding/

WE CAN (Ways to Enhance Children's Activity and Nutrition) (National Heart, Lung, and Blood Institute)
http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/

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1. The most prevalent nutritional disorder among U.S. children and adolescents today is:

a. Anorexia nervosa.
b. Binge eating.
c. Obesity.
d. Metabolic syndrome.

2. Which is a **correct** statement concerning assessment of body-mass index (BMI) in children and adolescents?

a. BMI for children and adolescents remains constant unless a lot of weight is gained or lost.
b. Patterns of growth are the same for male and female children and adolescents.
c. BMI for children and adolescents takes into account age and sex.
d. Severe obesity is having a BMI greater than or equal to the 85th percentile.

3. Overweight and obesity rates in children ages 2 to 19 are highest among:

a. Blacks and Hispanics/Latinos.
b. Asian/Pacific Islanders.
c. Children in the New England region.
d. Children in the Western United States.

4. A short-term health consequence of childhood obesity is:

a. Osteoarthritis.
b. Metabolic syndrome.
c. Stroke.
d. Colon cancer.

5. Childhood obesity increases the risk for developing which chronic condition in adulthood?

a. Slipped capital femoral epiphysis
b. Blount disease
c. Nonalcoholic fatty liver
d. Type 2 diabetes

6. Studies on the cognitive function of children and adolescents who are obese have found:

a. Normal gray and white matter development in the brain.

b. Deficits in executive functioning.

c. No effect on brain development.

d. No effect on general mental ability.

7. Bullying has been found to have which effect on girls 6 years and older with a high BMI?

a. Losing weight due to feelings of shame

b. Bullying other children who are obese

c. Developing anorexia nervosa

d. Gaining more weight over time

8. Although many different factors contribute to obesity, the majority of cases of obesity are caused by:

a. Environmental obesogens.

b. Obesity gene mutations.

c. Epigenetic changes.

d. Self-originating or unknown factors.

9. One of the strongest and most reliable predictors of later obesity in children is maternal:

a. Gut bacteria.

b. Milk intake.

c. Heart defects.

d. Obesity.

10. Which is a **correct** statement about early childhood feeding?

a. Studies have found a link between breastfeeding and lower obesity risk.

b. Breastfeeding infants for longer than one year increases childhood obesity.

c. Formula feeding decreases serum levels of leucine, insulin, and insulin-like growth factor 1.

d. Breastfeeding leads to passivity in feeding and overconsumption.

11. Through consumption of plant-based vegetable oils, the human body manufactures endocannabinoids, which trigger:

a. Termination of eating.

b. Suppression of the hunger hormone.

c. Increased food intake and appetite.

d. Hair and skin problems.

12. A lack of sleep in children increases the risk for obesity by:

a. Increasing high blood pressure and risk of stroke.
b. Stimulating the release of hormones involved in hunger and appetite.
c. Causing faster metabolism of food and stimulation of the hunger center.
d. Increasing the emotional triggers of comfort food consumption.

13. Three environmental risk factors extensively studied for their contribution to the high rates of childhood obesity are family income, education level, and:

a. Access to parks.
b. Access to food.
c. Family members' health.
d. Proximity to extended family.

14. Parents' ethnicity and cultural beliefs and practices:

a. Can cause them to underestimate their child's body size.
b. Has no influence on food choices for their child.
c. Contribute to lower physical fitness and calorie expenditure.
d. Do not influence a child's taste preferences.

15. Which source of parental stress has the highest association with childhood obesity?

a. Poor physical health
b. Poor mental health
c. Having financial stress
d. Being a single parent

16. A child's self-regulation of energy intake is influenced by parental failure to:

a. Respond to their child's cues of hunger or feeling full.
b. Offer nutritious food to their child.
c. Spend time eating with their child.
d. Bottle feed their child during his or her infancy.

17. The body-mass index for an 8-year-old boy measures 20, which is in the 95th percentile for his age and sex, placing him in the designated weight category of:

a. Underweight.
b. Healthy weight.
c. Overweight.
d. Obese.

18. During physical examination of a child who is obese, an important finding that increases the child's risk of developing cardiovascular disease is:

a. Acanthosis nigricans.
b. Purple striae.
c. Truncal obesity.
d. Papilledema.

19. A component of an assessment for a child who is obese includes testing for comorbidities such as diabetes, high blood pressure, and:

a. Late sexual maturation.
b. Chronic obstructive pulmonary disease.
c. Hyperlipidemia.
d. Congenital disability.

20. Laboratory testing for a child who is 10 years of age or older and overweight with two or more additional risk factors for diabetes should occur every:

a. Six months.
b. One year.
c. Three years.
d. Five years.

21. A dietary assessment for a child includes evaluation of:

a. Parent and child attitudes about weight and weight loss motivation.
b. Readiness to change the child's dietary habits.
c. Levels of physical activity to determine sedentary lifestyle.
d. Baseline eating patterns to determine targets of intervention.

22. When counseling a new mother who is obese about reducing the risk of obesity in her baby, the clinician:

a. Explains that her own obesity has not caused an increased risk of obesity in her baby.
b. Tells her that genetics prevents her from reducing the baby's risk of obesity.
c. Discusses practical strategies related to her successfully breastfeeding her baby.
d. Recommends supplementing breast milk with formula during the baby's growth spurts.

23. During a well-child visit, a child's parents ask for suggestions about starting to teach their toddler healthy eating habits. The clinician tells them it is important to:

a. Provide only foods the child is familiar with and likes.

b. Serve food family-style while eating together at the dinner table.

c. Restrict specific foods to avoid increasing food preferences.

d. Provide nutritious snacks to manage hunger and boost nutrition.

24. The American Academy of Pediatrics recommendations regarding "screen time" state that:

a. A computer, but not a television, may be allowed in a child's bedroom.

b. Infants and children under age 2 years should not watch television.

c. Teens may engage with entertainment media for up to 3 to 4 hours per day.

d. Teens may be allowed to watch television during mealtimes.

25. While working with children and families to increase physical activity, it is important to stress that:

a. Daily exercise helps children build stronger muscles and bones and limit excess body fat.

b. Physical activity should be rapidly increased to meet the goal of 60 minutes per day.

c. Screen time should be limited to no more than 4 hours per day.

d. Sixty minutes of activity must be performed all at once in order to be effective.

26. When addressing the stigmatization of obesity with a child or adolescent and his or her family, it is important to tell them:

a. There is nothing they can do to change others' views about obesity.

b. They should examine their language and attitudes to recognize their own weight bias.

c. They should accept the stigma, because it is human nature for people to try to feel superior to others.

d. That obesity is primarily due to a lack of personal responsibility on the part of the person who is obese.

27. When discussing weight management with a 10-year-old male child who is obese and his parents, the clinician tells them that:

a. It is important for the child to self-monitor food intake and activity.

b. Dieting or restricting food intake is the most effective strategy to control the child's weight.

c. The goal is for the child to gradually lose weight.

d. Parental control of the child's calorie intake and physical activity is essential.

28. Which is a **correct** statement about advocacy by healthcare professionals to prevent childhood obesity?

a. Advocacy requires healthcare professionals to play a visible role.

b. Advocacy requires persuasive actions and communications.

c. Advocacy does not require knowledge of the local community.

d. The first step in advocacy is to designate a formal committee.

29. When counseling a 14-year-old male adolescent and his mother about medications for obesity, the clinician correctly states that:

a. The only FDA-approved medication for treatment of pediatric obesity is orlistat.

b. There is no FDA-approved medication as yet for pediatric obesity.

c. Metformin is an FDA-approved treatment for pediatric obesity.

d. Exenatide is an oral medication for obesity available without a prescription.

30. Which is a **correct** statement about ethical issues and policy-making efforts in regard to childhood obesity?

a. Beneficence is the capacity to make an informed decision about healthcare issues.

b. Parents are solely responsible for their child's overweight or obesity status.

c. Providing easy access to foods of poor nutritional quality is not an ethical issue.

d. Schools have an obligation to question and refute policies that do not benefit their students.