



NCC Pediatrics Continuity Clinic Curriculum: **Nutrition IV: Obesity** *Faculty Guide*



Goal:

To learn how to identify obese and at risk children, identify medical problems associated with obesity, and then institute a program to help the child and family combat the weight issues.

Pre-Meeting Preparation:

- Read “Obesity in Children & Adolescents”
- Read “Physical Activity Guidelines” (2008; most recent)
- Read “Impact of the Healthy Habits Clinic”
- **[CDC Website on Childhood Obesity](#): Includes links to “strategies and solutions” for parents & community advocacy. **Residents should select ONE of these programs or recommendations and be prepared to report in detail to the group.****

Conference Agenda:

- Complete Nutrition IV Quiz & Case Studies
- **Round table discussion of resident researched “strategies & solutions” to pediatric obesity. Discussions should address both anticipatory guidance for parent tips, as well as avenues for community advocacy.**

Post-Conference: Board Review Q&A

Extra Credit:

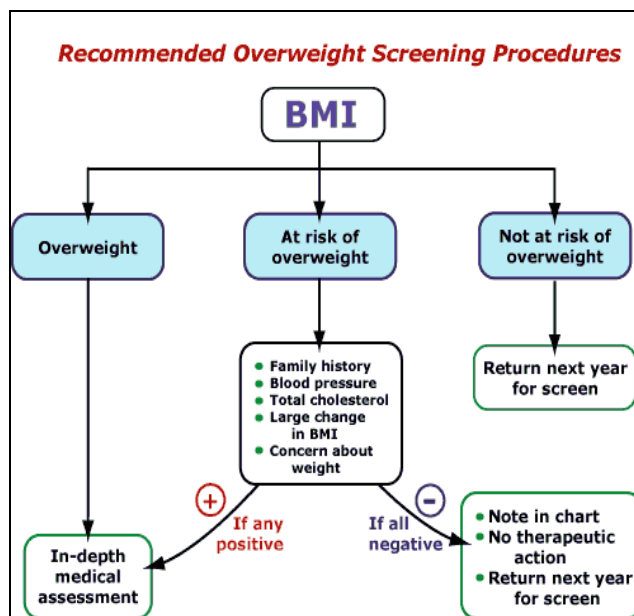
- [AAP's HealthyChildren webpage on Childhood Obesity](#)
- [Journal of Childhood Obesity home page](#)
- [Healthy Habits Brochure for Families \(printable handout\)](#)
- [Recommended Screening for Overweight and Obesity \(Quick Reference Table\)](#)
- "Child and Adolescent Obesity: A Review" (*Frontiers in Pediatrics*, 2019)
- [Pediatric Obesity -- Assessment, Treatment, and Prevention: An Endocrine Society Clinical Practice Guideline \(2017\)](#)
- "Metabolic Syndrome in Children and Adolescents" (*PIR*, 2016)
- "Pediatric Obesity Algorithm: A Practical Approach to Obesity Diagnosis and Management"

OBESITY IN CHILDREN AND ADOLESCENTS (adapted from former obesity module by Kathy Camp)

DEFINITIONS AND MEASUREMENTS

The ideal classification of obesity should accurately reflect adiposity. Adiposity, however, is difficult to measure directly. Most usable criteria currently used to define obesity rely on weight-based measures that only indirectly measure adiposity, e.g. BMI, skin fold measurements, etc. **Though not perfect, BMI has been shown to correlate with densitometry measurements, but can be inaccurate in athletes.** There is no single level of fatness in children that reliably predicts morbidity or mortality. Therefore, all current measures of obesity are only statistical. The following chart is based on the CDC definitions:

	<u>OVERWEIGHT</u>	<u>OBESE</u>
Weight for height:	>90%	>95%
Triceps skin fold thickness	>85%	>95%
BMI [kg/height in m²]	>85%	>95%



BMI-for-age is recommended to screen children aged 2 to 20 years, in order to identify children who may need further assessment and possible treatment. **For infants and children under the age of two years, plot the weight-for-length** (overweight = W:L > 95thile).

BMI increases during the first year of life decreases in years 1-4; and increases again after age 5. The relationship between obesity at age 3-5 years and adult obesity is stronger than during infancy. The relationship between obesity in adolescence and adult obesity is the strongest. **While 25% of obese infants remain obese, 80% of obese adolescents will become obese adults.**

ETIOLOGY

The etiology of obesity is likely to involve a complex interaction of diet, physical activity and, not yet identified, genetic components. Each of these is impacted upon, from a population perspective, by various social and environmental factors.

Nutrition

Too much fat is eaten by children and adolescents today: Only 15% of 6-9 year-olds have diets at or below the recommended amount of energy from fat (30%). Alternatively, 15% consumed more than 40% of energy from fat.

Fatty foods have a number of negative consequences on a child's diet. First, high fat foods are typically very palatable, leading to over consumption. Dietary fat intake may then displace more micronutrient-dense fibrous, carbohydrate-containing foods. High-fat foods are also less filling (higher energy/less volume); thus, subsequent consumption may not adjust for the higher energy previously consumed. Finally, dietary fat is stored more efficiently. Oxidation of dietary fat does not increase as fat intake increases, as is the case with protein and carbohydrate.

Genetics

If both parents are obese, 2/3 of their children will become obese. If both parents are of normal size, only 9% of their children will become obese. Obesity genes were probably preselected in early humans in a variety of combinations because they offered a survival advantage.

Physical activity

Physical activity has positive effects on children's growth and maturation. There are a number of factors that influence a child's level of physical activity:

- The percentage of time spent outdoors.
- Television viewing. The AAP recommends < 2 hours/day of screen time for all children.
- Schools often use recess to substitute for, rather than supplement physical education.
- Parents: by modeling and by creating a supportive environment. In adolescence, peer influences probably replace parental influences.

Social context

TV advertises high fat and sugar snack-foods with low nutritional value. Children's requests for foods are related to the frequency with which the foods were advertised on television.

DIFFERENTIAL DIAGNOSIS OF OBESITY

	Endocrine/Genetic	Exogenous
Family History	Obesity uncommon	Obesity common
Height	Inappropriately short for Parental heights OR Growth Rate subnormal	Height > 50%ile
IQ	Often low	Normal
Bone Age	Delayed	Normal or advanced
Physical Exam	Associated abnormalities common	Normal

Medical or endocrine causes of obesity are found in <1% of children, examples as follows:

- * Genetic causes: Prader-Willi, Laurence-Moon-Biedl, Carpenter, and Cohen syndromes.
- * Endocrine causes: Cushing's Syndrome, Hypothyroidism and Pseudoparathyroidism.

If the child has a normal physical exam, normal intelligence, and is of normal stature with a normal rate of growth, there is no underlying medical or hormonal cause for the obesity.

HEALTH CONSEQUENCES OF OBESITY

The most widespread health consequences of obesity are psychosocial. Obese children are subject to early and systemic discrimination. Many individuals associate obesity with a wide variety of negative characteristics such as laziness and sloppiness. Through increased peer pressure and criticism, obese adolescents often have a **negative self-image** that appears to persist into adulthood; **these young patients are also at higher risk for depression.** Of greater interest, recent studies have reported the presence of a **significant negative body image** in obese children as young as 5 years of age.

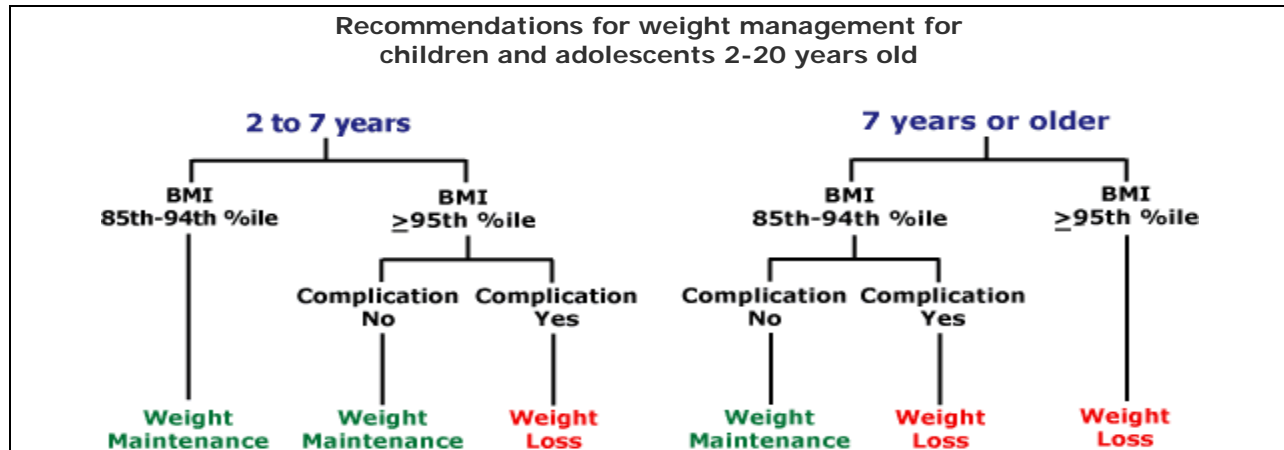
An increased prevalence of **behavioral and learning difficulties** has also been observed among children who are gaining weight rapidly. Studies, however, do not make clear whether this reflects subtle effects from the presence of psychosocial problems within these families or from undiagnosed sleep apnea.

Medical Consequences of Obesity

- **Hypertension**- In the general pediatric population, only 1% of children exhibit a persistently elevated blood pressure. Alternatively, **as many as 60% of children with persistently elevated BP** have weights of greater than 120% of the median for their sex, height, and age.
- **Sleep apnea** - Sleep apnea occurs in **approximately 7% of obese children.** However, when distinctly evaluated, **up to 1/3 of asymptomatic children** with a body weight greater than 150% of ideal will describe a history of breathing difficulties during sleep and will be shown to have sleep apnea. Further, neuro-cognitive deficits have also been shown to be common among obese children with sleep apnea.
- **Orthopedic complications**- Among young children, obesity can lead to **bowing** of the tibia and femur. The resultant overgrowth of the medial aspect of the proximal tibia is known as **Blount's disease.** Although the prevalence of Blount's disease is low in the general pediatric population, **approximately 2/3 of these patients are obese.** **Slipped capital femoral epiphyses** results from the effects of increased weight on the cartilaginous growth plate of the hip. **Between 30-50% of pediatric patients with SCFE are overweight.**
- **PCOS** - The **majority of patients** diagnosed with PCOS are either **overweight or obese.** The syndrome is characterized by **irregular menstrual cycles, multiple ovarian cysts and excessive hair growth.** In addition, PCOS causes significant **insulin resistance,** thereby increasing the woman's risk of developing diabetes.
- **Diabetes** - The epidemic of obesity and the low level of physical activity among young people, as well as exposure to diabetes *in utero*, may be major contributors to the **increase in type 2 diabetes during childhood and adolescence.** These children are generally between 10-19 years-old, obese, have a strong family history of T1DM, and have insulin resistance with poor glycemic control (A1C = 10-12%). **Please note that just the presence of hyperinsulinism carries an increased risk of morbidity, without the presence of frank DM.**
- **Other:** Obese children and adolescents are more likely to have **high cholesterol, fatty liver disease, gallstones, GERD, asthma, and pseudotumor cerebri.**

TREATMENT OF OBESITY:

In general, **weight loss** is recommended if complications such as hyperlipidemia or hypertension are identified, and for children 7 years or older with a BMI-for-age \geq 95th percentile. Otherwise, **weight maintenance** is recommended. Prolonged maintenance will allow a gradual decline in BMI units (and BMI-for-age percentile) as children grow in height. See the CDC algorithm:



Dietary components

To lose weight it is necessary to decrease caloric intake. The use/substitution of foods with more fiber may be of some help. **No particular diet has been shown to be more efficacious compared to another of equal caloric content.** There is data that foods with lower glycemic indexes (that result in less insulin release) may produce longer lasting satiety.

Exercise and activity

Increasing exercise without dietary intervention does not work, however **all interventions that are effective long term include a consistent increase in exercise/physical activity.** Exercise works both thru the increased consumption of calories and thru increasing insulin sensitivity. Positively reinforcing reductions in sedentary activities (e.g. TV, video games) increases physical activity of obese children more than just reinforcing increased physical activity.

Behavioral issues in pediatric obesity treatment

Including behavior therapy in obesity training programs significantly improves outcome. Focusing on gradual change and including families/parents in the behavior management has resulted in better outcomes. It is important to set reasonable, reachable goals. For example, a goal of 4-8 pounds per month weight loss may be reasonable in an obese adolescent, whereas decreasing or stopping the rate of weight gain would be more reasonable for an obese child. Unreasonable, unreachable goals only serve to frustrate everyone.

Negative physiologic effects of treatment

Potential exists for impaired linear growth with overzealous treatment. Changes in growth velocity, however, must be interpreted cautiously as obese children experience an increased growth velocity during periods of excessive weight gain and may thus subsequently experience a physiologic growth deceleration with weight maintenance or actual weight loss.

PEDIATRIC OBESITY WORK-UP

Definitions:

Body Mass Index = Weight in kilograms ÷ Height in meters²

- <2 years of age weight for recumbent length is >97.7th percentile of WHO growth =obese
- >2 years of age with BMI >85th percentile but <95th percentile = overweight
- BMI is >95th percentile for age and gender =obese
- BMI >120% of the 95th percentile or >35 kg/m² = extreme obesity (class 2)
- BMI >140% of the 95th percentile or >40 kg/m²= extreme obesity (class 3)

Easy calculation at <https://peditools.org/growthpedi/>

History:

- Birth history: birth weight, h/o maternal gestational diabetes
- PMHx: early FTT
- Medications: steroids, psychotropics, Depo-Provera
- Development: onset of motor/speech milestones; puberty-early/late; menstrual hx
- Dietary history: caloric intake, size of servings, frequency/number of snacks, skipping meals
- Physical activity: types & frequency, barriers to activities, screen time
- Family History: obesity, DM, HTN, CV disease, hyperlipidemia

ROS:

- Evidence of OSA: snoring, tonsillar hypertrophy
- Abdominal pain (e.g. gallbladder disease, NAFLD, constipation due to dietary habits and inactivity)
- Polyuria, polydipsia (e.g. diabetes mellitus)
- Evidence of hypothyroidism: fatigue, constipation, cold-intolerance

Physical Exam:

- Vitals: BP, HR, Ht/Wt/BMI
- General: weight distribution; evidence of genetic syndrome (e.g. PWS, Albright hereditary osteodystrophy, Down Syndrome, Fragile X).
- HEENT: fundoscopic (evidence of papilledema?); enlarged tonsils; thyroid (goiter?)
- Chest: gynecomastia
- Cardiopulmonary: evidence of asthma/ pulmonary edema
- Abdomen: RUQ tenderness (nonalcoholic fatty liver disease = NAFLD)
- GU: Tanner stage, cryptorchidism
- Extremities: SCFE, Blount disease
- Skin: acanthosis nigricans, striae, hirsutism

Labs:

BMI 85-94%ile	Fasting lipids
BMI 85-94%ile + risk factors (e.g. fam h/o obesity-related disease, ↑BP, ↑lipids, tobacco)	Fasting lipids, AST/ALT, fasting glucose, Hgb A1c
BMI ≥ 95 %ile	Fasting lipids, AST/ALT, fasting glucose, Hgb A1c

Risk Factors

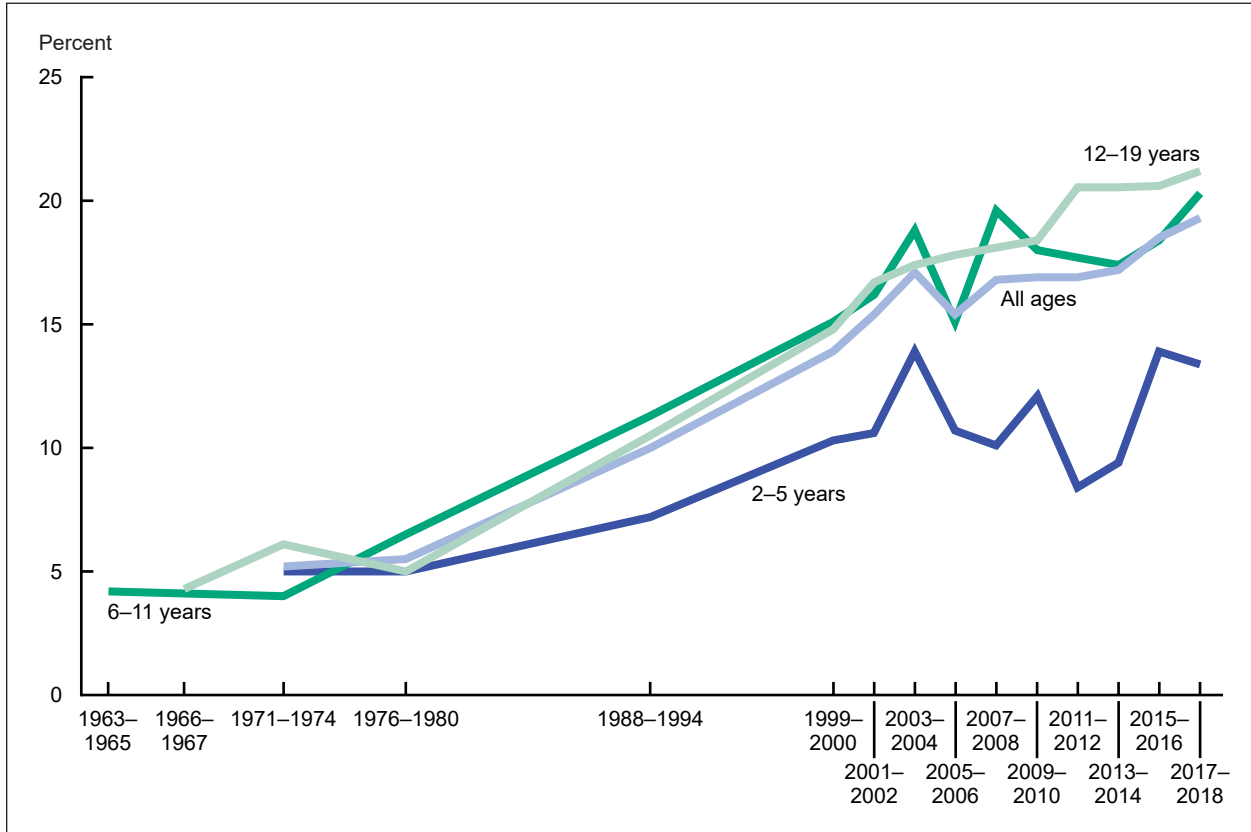
- Childhood obesity has been associated with cardiovascular risk factors, increased health care costs, and premature death.
- The prevalence of cardiovascular risk factors increases with severity of childhood obesity.
- Children who are obese or extremely obese during early childhood are also likely to be obese during middle or late childhood and adulthood.
- Obese adults are at increased risk for stroke and many chronic diseases, including coronary heart disease, hypertension, type 2 diabetes, and certain types of cancer.

Obesity and Extreme Obesity defined

A child's weight status is determined using an age- and sex-specific percentile for [BMI \(Body Mass Index\)](#), rather than the BMI categories used for adults, because children's body composition varies as they age and varies between boys and girls. The weight status of children 2 years and older is defined based on the sex-specific smoothed percentile curves for BMI-for-age in the [2000 CDC growth charts](#).

- Obesity is a BMI at or above the 95th percentile for children of the same age and sex. For example, a 3-year-old boy of average height who weighs more than 37 pounds would be considered obese.
- Extreme obesity is defined as a BMI at or above 120% of the 95th percentile for children of the same age and sex. For example, a 3-year-old boy of average height who weighs more than 44 pounds would be classified as extremely obese.

Figure. Trends in obesity among children and adolescents aged 2–19 years, by age: United States, 1963–1965 through 2017–2018



NOTE: Obesity is body mass index (BMI) at or above the 95th percentile from the sex-specific BMI-for-age 2000 CDC Growth Charts.
 SOURCES: National Center for Health Statistics, National Health Examination Surveys II (ages 6–11), III (ages 12–17); and National Health and Nutrition Examination Surveys (NHANES) I–III, and NHANES 1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, 2009–2010, 2011–2012, 2013–2014, 2015–2016, and 2017–2018.



How much physical activity do youth need?

The physical activity guidelines for children and adolescents aged 6 to 17 focuses on three types of activity: aerobic, muscle-strengthening, and bone-strengthening. Each type has important health benefits.

Aerobic, Muscle-strengthening, and Bone-strengthening Activities

Every day children and adolescents should do **1 hour or more** of physical activity.

Aerobic activities. Most of the 1 hour a day should be either moderate or vigorous-intensity* aerobic physical activity, and include and include **vigorous-intensity** physical activity **at least 3 days a week**.

As a part of the 1 hour a day of physical activity, the following should be included:

- **Muscle-strengthening on at least 3 days a week.** These activities make muscles do more work than usual during daily life. They should involve a moderate to high level of effort and work the major muscle groups of the body: legs, hips, back, abdomen, chest, shoulders, and arms.
- **Bone-strengthening on at least 3 days of the week.** These activities produce a force on the bones that promotes bone growth and strength through impact with the ground.

Youth should be encouraged to engage in physical activities that are **appropriate** for their age, **enjoyable**, and offer **variety**.

No period of activity is too short to count toward the Guidelines.



***Intensity** is the level of effort required to do an activity.

A person doing **moderate-intensity** aerobic activity can talk, but not sing, during the activity.

A person doing **vigorous-intensity** activity cannot say more than a few words without pausing for a breath.



How much physical activity do youth need for health benefits?

Participating in regular physical activity provides several health benefits for youth as summarized below. Reducing risk of some of these conditions may require longer periods of participation in regular physical activity. Other benefits, such as increased heart and lung—or cardiorespiratory—fitness, may require only a few weeks or months of participation.

Aerobic Activities

- Improved:
 - Cardiorespiratory (aerobic) fitness and muscular strength
 - Bone health
 - Cardiovascular and metabolic health biomarkers
- Favorable body composition (percentages of muscle, bone, and fat)

Moderate Evidence for Health Benefits

- Reduced symptoms of depression

Aerobic Activities by Level of Intensity

Youth should not do only moderate-intensity activity. Including vigorous-intensity activities is important because they cause more improvement in cardiorespiratory fitness.

The intensity of aerobic physical activity can be defined on either an absolute or a relative scale. Either scale can be used to monitor the intensity of aerobic physical activity.

- **Absolute intensity** is based on the rate of energy expended during the activity, without considering cardiorespiratory fitness.
- **Relative intensity** uses cardiorespiratory fitness to assess level of effort.

Those doing moderate-intensity activity will notice their heart beating faster than normal and they will be breathing harder than normal. Those doing vigorous-intensity activity will feel their heart beating much faster and their breathing being much harder than normal.

Young people can meet the guidelines in many ways. Examples of different types of activities are included below.

Examples of Moderate- and Vigorous-Intensity Aerobic, Muscle-Strengthening, and Bone-Strengthening Activities for Youth

Type of Physical Activity	Children	Adolescents
Aerobic Moderate-Intensity	<ul style="list-style-type: none"> • Active recreation such as hiking, skateboarding, rollerblading • Bicycle riding* • Brisk walking 	<ul style="list-style-type: none"> • Active recreation, such as canoeing, hiking, cross-country skiing, skateboarding, rollerblading • Brisk walking • Bicycle riding* (stationary or road bike) • Housework and yard work such as sweeping or pushing a lawn mower • Playing games that require catching and throwing, such as baseball, softball

Vigorous-Intensity	<ul style="list-style-type: none"> • Active games involving running and chasing, such as tag • Bicycle riding* • Jumping rope • Martial arts, such as karate • Running • Sports such as ice or field hockey, basketball, swimming, tennis or gymnastics • Cross-country skiing 	<ul style="list-style-type: none"> • Active games involving running and chasing, such as flag football • Bicycle riding* • Jumping rope • Martial arts such as karate • Running • Sports such as tennis, ice or field hockey, basketball, swimming, soccer • Vigorous dancing • Aerobics
Muscle-Strengthening	<ul style="list-style-type: none"> • Games such as tug of war • Modified push-ups (with knees on the floor) • Resistance exercises using body weight or resistance bands • Rope or tree climbing • Sit-ups (curl-ups or crunches) • Swinging on playground equipment/bars 	<ul style="list-style-type: none"> • Cross-country skiing • Games such as tug of war • Push-ups • Resistance exercises with exercise bands, weight machines, hand-held weights • Climbing wall • Sit-ups (curl-ups or crunches)
Bone-Strengthening	<ul style="list-style-type: none"> • Games such as hop-scotch • Hopping, skipping, jumping • Jumping rope • Running • Sports such as gymnastics, basketball, volleyball, tennis 	<ul style="list-style-type: none"> • Hopping, skipping, jumping • Jumping rope • Running • Sports such as gymnastics, basketball, volleyball, tennis

*Some activities, such as bicycling, can be moderate or vigorous intensity, depending upon level of effort.

Ways to Promote Physical Activity in Youth

Many youth are naturally physically active and need opportunities to be active. They benefit from encouragement from parents and other adults to be active. Adults can promote youth physical activity by:

- **Providing time for both structured and unstructured physical activity during school and outside of school.**
Children need time for active play through recess, physical activity breaks, physical education classes, after-school programs, and active time with friends and family.
- **Providing youth with positive feedback and good role models.**
Adults should model and encourage an active lifestyle. Praise, rewards, and encouragement help youth to be active.
- **Promoting activities that set the basis for a lifetime of activity.**
Children and adolescents should be exposed to a variety of activities: active recreation, team sports, and individual sports. In this way, they can find what they can do well in both competitive and non-competitive activities and in activities that do not require exceptional athletic skills.

Pediatric Obesity: Impact of the Healthy Habits Clinic

Prepared by Drs. Emerick & Percival, based on 2012 Fellows PI Project

1. **Our population** (from the US Army Surgeon General)
 - a. **Army children** ages 2-18 in 2010-11: **13% obese, 15% overweight**
2. **AAP Recommendations** for obese or overweight with risk factors
 - a. Make the (correct) diagnosis!
 - b. Screening labs: Fasting Lipids; Fasting glucose q2 yrs; ALT, AST q2 yrs

Pre-Healthy Habits Clinic:

Of children diagnosed with obesity (BMI \geq 95%) over 6 months:

1. **Only 69%** were correctly diagnosed w/ obesity; 31% incorrectly diagnosed as overweight
2. Screening labs were ordered **only 55%** of the time (and performed only 47% of the time)
3. Follow-up within 4 months recommended 50% of the time; actual f/u rate was only 18%

Healthy Habits Clinic:

Children ages 6-18 yrs with BMI \geq 85th percentile are eligible:

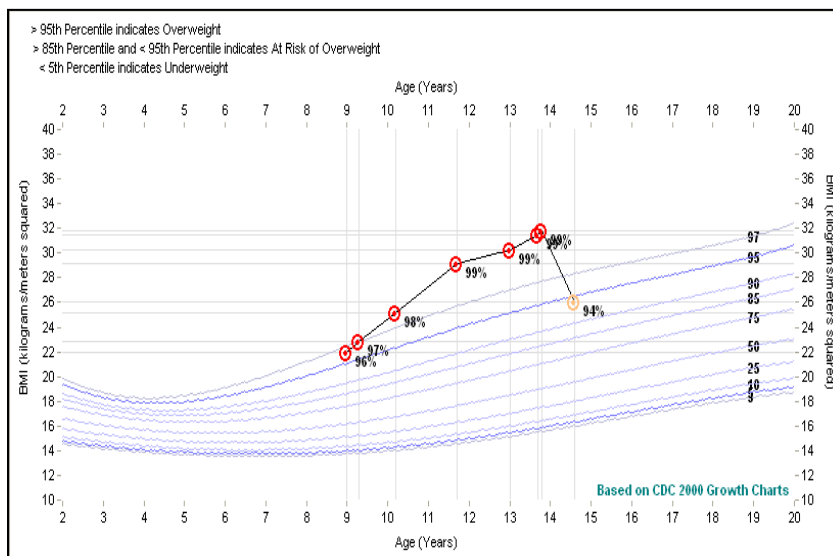
1. **Intake visit:** 0800-1100 (2nd Wed of the month)
 - * Comprehensive medical visit, SMART goal-setting and education, surveys
2. **Follow-up visits:** 1400-1600 (2nd Wed of the month; 9 sessions at the fitness center)
 - * Group exercise, education, and behavioral health modification techniques

Post-Healthy Habits Clinic:

Of children diagnosed with obesity (BMI \geq 95%) (the first 6 months of HH)

1. 81% were correctly diagnosed w/obesity; only 19% incorrectly diagnosed w/ overweight
2. Screening labs were ordered 65% of the time (and performed only 63% of the time)
3. Follow-up within 4 months was recommended 75% of the time; actual f/u was only 40%.

Inspiring Case:



HH Resources: <http://www.nccpeds.com/HealthyHabits.html> and on the PedsShare Drive

Nutrition IV Quiz:

1. Obesity in children is defined as a BMI:

- a. ≥ 20
- b. $\geq 95^{\text{th}}$ for age
- c. 25
- d. 85-95th%

2. If both parents are obese, what percentage of their children will be obese? _____

3. Of the following causes, which contributes most commonly toward adolescent obesity?

- a. Lack of nutritional knowledge
- b. Psychosocial and emotional issues
- c. Changing genetic factors
- d. Lack of affordable low calorie/low fat foods
- e. A hectic, active lifestyle

4. Common medical consequences of adolescent obesity include:

- a. Insulin deficiency and diabetes
- b. Rebound anorexia nervosa and bulimia
- c. Osteoporosis and increased frequency of fractures
- d. Depressed self-image and depression
- e. Short stature and delayed bone age

5. Which of the following statement(s) is/are true?

- a. The probability of an overweight teenager becoming an overweight adult is very high
- b. Obese infants are likely to become obese teenagers
- c. Severely obese individuals most likely have a single gene defect that accounts for their obesity
- d. It is important to set low cutoff values for identification of obesity in children in order to identify and treat all children who are overweight.

6. What percentage of low-income preschool children are overweight and/or obese? What are some contributing social factors?

7. What three-types of physical activities are recommended for children and adolescents? Give an example of each:

Nutrition IV Cases:

Case 1:

3-year-old Jeffrey is overweight. Although his parents have recently started offering him healthier foods, he will not eat them. His parents have trouble tolerating Jeffrey's crying when his favorite foods are withheld. As a result, Jeffrey ends up being offered the very foods his parents were trying to avoid.

Now that Jeffrey is 3 years old and overweight, his parents are really worried. They really want to do the "right thing," but aren't getting anywhere. **Discuss some specific recommendations to counsel Jeffrey's parents and include your rationale for each one.**

Case 2:

Jessie is an 8 year-old female accompanied by her mother for a health maintenance visit. Jessie's weight for height is just above the 90%. Her mother says to you, "Jessie and I agree that she needs to lose weight. I've just started a low calorie diet, can she just do the same?"

What additional history do you want to obtain before providing recommendations? What would be some nutritional "red flags" or areas to address?

Provide some specific suggestions for counseling Jessie and her mother on age-appropriate nutritional recommendations and include your rationale for each.

Case 3:

15-year-old Jasmine is accompanied by her mother for a health maintenance visit. Jasmine is 75 pounds overweight. Her mother says to you, “She needs help, what should I do?”

After eliciting a dietary history (see Case #2 answer key for suggestions), you perform a detailed physical exam. **What are specific areas on your physical exam you want to target?**

Provide some specific suggestions for counseling Jasmine and her mother on obesity and include your rationale for each.

What additional work-up, if any, would you like to perform?

Nutrition IV Board Review:

1. An 8-year-old girl presents for follow-up assessment for obesity management with a body mass index (BMI) of 24 kg/m^2 , only slightly improved from 25 kg/m^2 at her visit 6 months ago. At that visit, a consultation with a nutritionist was arranged, and the girl's parents report successful reduction in her consumption of sweets, juice, and fast food. Because of bullying at school and neighborhood crime, she is not allowed to play outside alone. She spends 8 hours each day watching television.

Of the following, the next BEST step in anticipatory guidance is to recommend

- A. removal of the television from the child's bedroom
- B. restriction of television and video games to no more than 4 hours/day
- C. substitution of video games for passive television viewing
- D. watching television only when eating with the family
- E. watching videos rather than commercial television

2. A nurse practitioner in your clinic has asked you to review the chart of an 11-year-old boy referred from school for evaluation of acanthosis nigricans.

Of the following, the physical examination parameter that is MOST likely to be useful in predicting comorbidities in this patient is

- A. blood pressure at the 75th percentile for height
- B. body mass index at the 95th percentile for age
- C. sum of triceps and subscapular skinfold thickness greater than 90% for age
- D. weight at the 50% and height at the 25% for age
- E. weight at the 95% and height at the 75% for age

3. During your examination of a 7-year-old boy at his health supervision visit, conducted with a pediatric resident, you determine that his weight is greater than the 97th percentile for age. His mother is obese, his father has type 2 diabetes mellitus, and one grandfather died of a myocardial infarction at 51 years of age. You counsel the family about improvements they can make in the boy's diet and level of exercise.

Of the following, you are MOST likely to advise that this child's risk of developing metabolic syndrome

- A. can be predicted by a determination of hgb A1c values
- B. is close to that of the general population because there is no family history of hyperlipidemia or systemic hypertension
- C. is reduced if he begins to develop a healthy lifestyle as a child
- D. is the same as the general population if cholesterol-lowering agents are started, even without lifestyle changes
- E. is the same as the general population if his fasting lipid profile is currently normal

4. A 10 y/o boy who recently emigrated from Central America is referred by the school nurse for evaluation of obesity. Physical examination reveals an obese but generally healthy boy who has acanthosis nigricans. He has had limited access to medical care in the past.

Of the following, the finding MOST likely to suggest an underlying cause for the child's obesity is:

- A. a normal blood pressure
- B. abdominal striae
- C. penile length at 1 standard deviation below the mean
- D. small hands and feet
- E. stature greater than the 95th percentile

5. A 15-year-old girl is concerned about irregular menses and acne. Menarche was at age 11 years and 9 months, and she remembers developing pubic hair around age 7 years. On physical examination, her vital signs are normal and her body mass index is 32.3 kg/m². She has facial comedonal and papular acne as well as mild darkening of the skin of her neck and axilla. You also note hypopigmented, narrow stretch marks on her abdomen and hair in a linear distribution from her umbilicus to the pubic symphysis and on the upper inner surface of her thighs. She is at Sexual Maturity Rating 5, and her clitoral diameter is 2mm.

Of the following, the MOST likely diagnosis is

- A. Cushing syndrome
- B. hypothyroidism
- C. Metabolic syndrome
- D. physiologic anovulation
- E. polycystic ovarian syndrome

6. A 10-year-old boy presents to your office as a new patient for follow-up care after being seen in the emergency department for acute pharyngitis. On physical examination, the boy, who is obese (>95% body mass index for age), has enlarged tonsils that are not inflamed and acanthosis nigricans. Findings on his cardiac, pulmonary, and genital examinations are normal, and his genitalia are prepubertal. According to his mother, his school performance is declining, he has prolonged sleep latency, and he has been increasingly irritable, with aggressive behavior at home and at school.

Of the following, in addition to aggressive weight management efforts, the study MOST likely to guide therapy for several of this child's concerns is

- A. Chest radiography
- B. Electrocardiography
- C. Electroencephalography
- D. Pulmonary function testing
- E. Sleep study