CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

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PHYT 701 – Motor Development and Human Movement Across the Lifespan

HEALTHY LIFESTYLES PROGRAM

"A lifestyle modification program that serves as the foundation for Duke's childhood obesity treatments."[17]

Multidisciplinary Team:
Physician
Physician Assistant
Physical Therapist
Social Worker
Registered Dietician
Nurse Practitioner

OBJECTIVES

After the presentation, students will be able to:

1. Acknowledge physical therapists' role in promoting health, wellness, and fitness;
2. Describe physical comorbidities common to children who are obese;
3. Identify potential physical impairments associated with childhood obesity and their clinical implications;
4. Explain the effects of obesity across the lifespan (e.g., adulthood).

PRESENTATION OUTLINE

1. Obesity: Definition and Statistics
2. Role of Physical Therapy
3. Childhood Obesity and the ICF Model
4. Obesity and General Health
5. Obesity and Physical Function
6. Obesity and Mobility
7. Obesity-Related Conditions
8. Obesity Across the Lifespan

DEFINITION & STATISTICS

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

CHILDHOOD OBESITY DEFINED

Body mass index (BMI) above the 95th percentile for age and sex.[6(S167,168)]

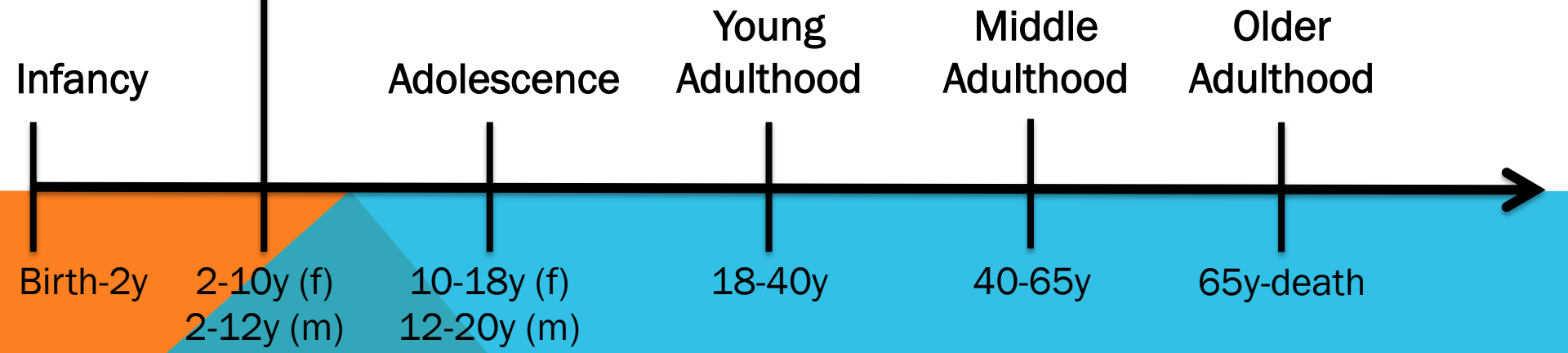


Image Source: Google Images

CHILDHOOD OBESITY BY THE NUMBERS

Percentage of Obese Children* (2011)[11]:

NORTH CAROLINA: 16.1

- Kansas: 14.2
- Maryland: 15.1
- Michigan: 14.8
- New Jersey: 10.0
- New Mexico: 14.4
- New York: 14.5
- Ohio: 17.4
- South Carolina: 21.5
- Utah: 11.6
- Vermont: 11.3
- Virginia: 14.3
- Wisconsin: 13.4

*Children aged 10-17 included in this data

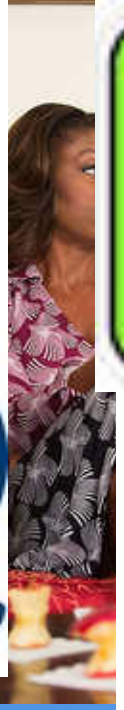
ROLE OF PT

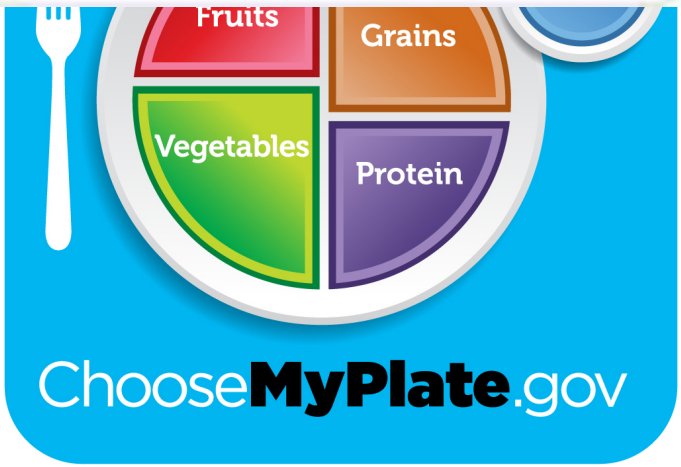
CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

PHYSICAL THERAPIST ROLE IN PROMOTION OF HEALTH, WELLNESS, AND FITNESS

"The physical therapist of the future will provide primary care that includes rehabilitation, primary and secondary prevention, disease mitigation, and health promotion to protect the physical health and mobility of the population."[43(p. 1664)]





beactive NORTH CAROLINA

All Images Retrieved from: Google Images

PHYSICAL ACTIVITY RECOMMENDATIONS

- 60 minutes or more of daily physical activity[2,4,32,42]
- Types[2,32]
  - Aerobic (e.g., brisk walking, running, hopping, skipping, jumping rope, swimming, dancing) – most days
  - Muscle Strengthening (e.g., tug of war, climbing, weights, resistance bands, push-ups, gymnastics) – at least 3 days
  - Bone Strengthening (e.g. hop scotch, jumping rope, running, sports) – at least 3 days

VISION STATEMENT FOR THE PROFESSION OF PHYSICAL THERAPY

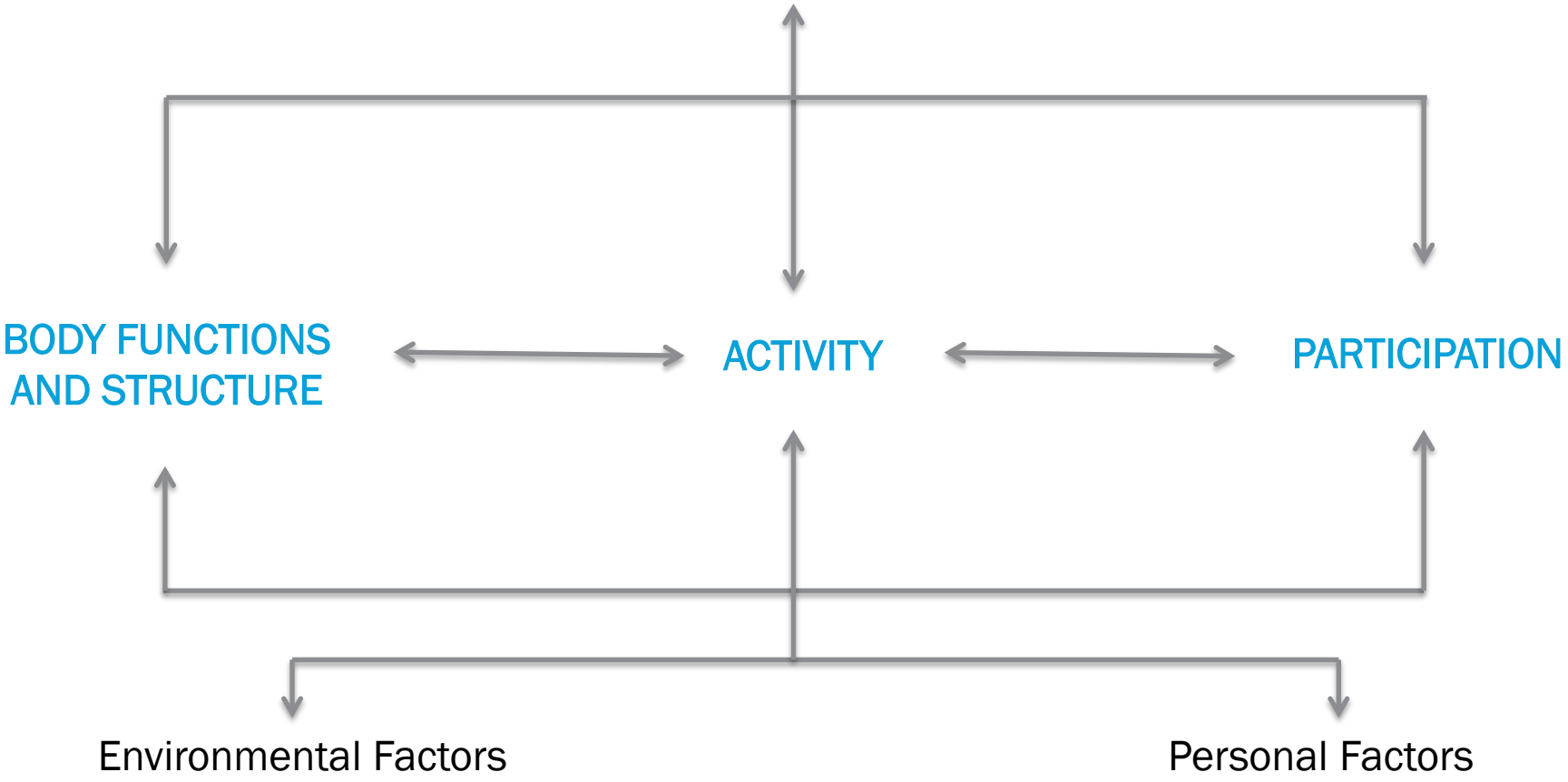
"Transforming society by
optimizing movement
to improve the human experience."[47]

ICF MODEL[19]

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

CHILDHOOD OBESITY



Is obesity the new childhood disability?[46]

Image Source: Jette[19]

GENERAL HEALTH

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

OBESITY & GENERAL HEALTH[20,34]

- Dyslipidemia
- Hypertension
- Nonalcoholic Fatty Liver Disease
- Polycystic Ovarian Disease
- Obstructive Sleep Apnea
- Type II Diabetes
- Asthma
- Metabolic Syndrome
- Psychological Disorders
- Dental Health

PHYSICAL FUNCTION

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

BALANCE

- Poorer Balance (Static and Dynamic)[13,17]
- Impaired balance performance and greater postural sway[48]
- Diminished dynamic balance[25]
  - Impaired balance due to excess weight

LOWER EXTREMITY FINDINGS

- Tight Quadriceps[14]
- Genu Valgum & Genu Recurvatum[14,44]

PAIN

- Higher prevalence of musculoskeletal pain[30,44]
  - Most common site: knee
- Higher odds of lower extremity pain[3,14,23]
  - Hip, leg, knee, ankle, foot[44]
- Positive association between obesity and LBP[14,30]

"Obesity is an important factor associated with musculoskeletal pain in children. Relative to the non-obese similar aged counterparts, obese children exhibited significantly higher complaints of pain."[14 (p. 343)]

INJURIES

- Higher odds of LE injuries (fractures, sprains/strains, dislocations)[3]
- Increased risk of LE fracture (foot, ankle, leg, and knee)[21,44]
- Increased risk of ankle injuries[49]
- More likely to have LE injuries than nonobese children; same percentage of UE injuries[33]
- Decreased odds of fracture[36]
  - Overweight compared to normal weight (↑LE fracture)

A full understanding of their movement characteristics is needed to guide clinicians in prescribing appropriate physical activity programs for this population.[26 (p. 190)]

MOBILITY

MOVEMENT ANALYSIS – WALKING[26]

- Hip Adduction
- Knee Abduction (Valgus)
- Rearfoot Inversion
- Overweight boys collapsed into hip adduction and knee valgus during stance and attempted to compensate with rearfoot inversion
- Redistribution of forces in the medial-lateral direction during walking may increase risk of LE soft tissue and skeletal injury

Frontal plane lower extremity biomechanics during walking in boys who are overweight versus healthy weight

CLINICAL IMPLICATIONS[26]

- Comprehensive musculoskeletal examination and gait analysis
- Nonweight bearing and/or low impact physical activities
- Examine muscle strength (e.g., hip abductors) and intervene with strengthening exercises
- Custom foot orthosis
- External medial/lateral support (e.g., knee bracing, ankle taping, functional foot orthotics)

Frontal plane lower extremity biomechanics during walking in boys who are overweight versus healthy weight

MOVEMENT ANALYSIS – JUMPING[27]

- More knee valgus (abducted) and hip adduction at initial contact
- After initial contact, move toward hip abduction and knee adduction
- Required more time to control and stabilize their mass
  - Reached peak moments later in the landing phase

Frontal and sagittal plane biomechanics during drop jump landing in boys who are obese

MOVEMENT ANALYSIS – JUMPING[27]

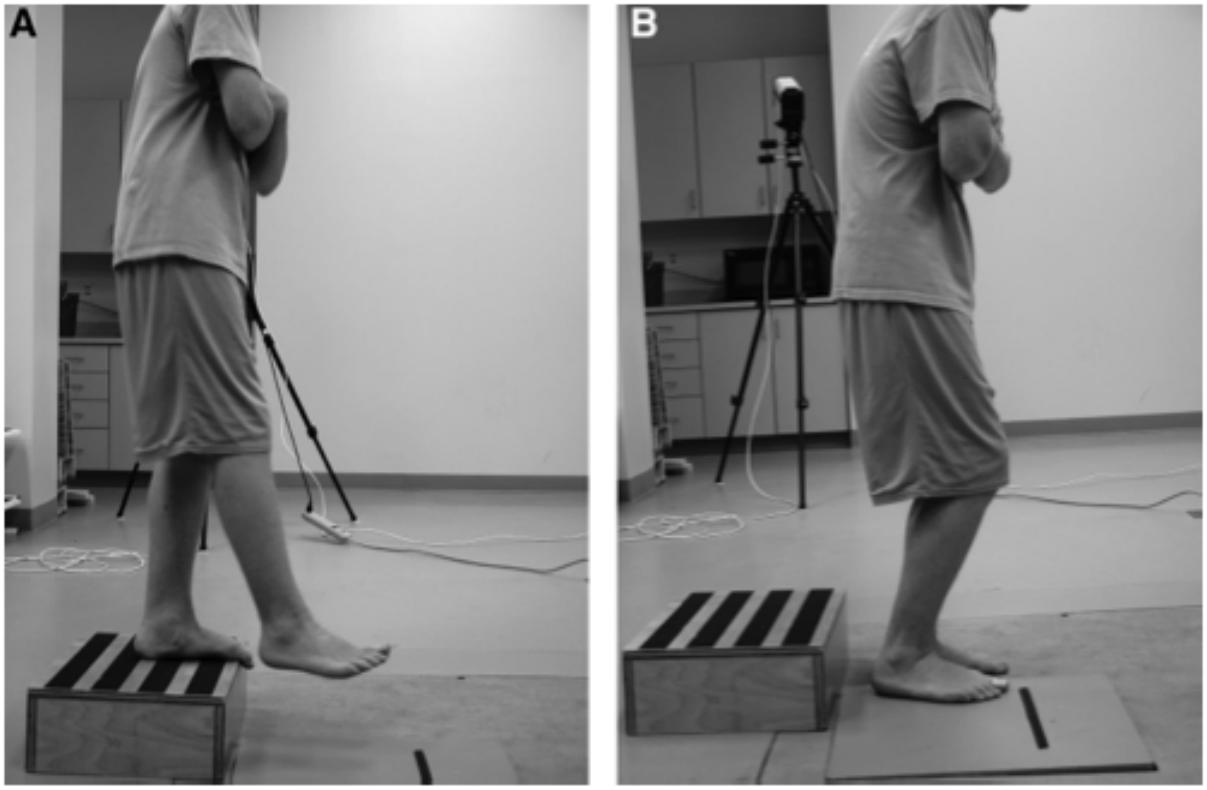


Fig. 1. Subject in starting position (A) and landing position (B) for drop jump used in this study.

Frontal and sagittal plane biomechanics during drop jump landing in boys who are obese

Image Source: McMillan, et al[27]

CLINICAL IMPLICATIONS OF JUMPING MECHANICS[27]

- Increased risk of injury
- Decreased stability and control
- Functional weakness in hip abductor muscles
- Foot Orthotics
- Knee/Ankle bracing or taping
- Non-weight bearing exercises (cycling or swimming) for individuals with severe LE alignment and/or significant joint instability

Frontal and sagittal plane biomechanics during drop jump landing in boys who are obese

"Obesity with lower extremity malalignment has been shown to increase the risk of developing knee osteoarthritis in adulthood, though the mechanism of this development is not clear."[26 (p. 187)]

"One concern to PTs working with this population is children who are overweight are typically encouraged to increase physical activity, often with minimal guidance as to how to do this safely (i.e., without damaging their joints and soft tissues)."[26 (187,188)]

"Increased repetitive loading on poorly aligned lower extremities may lead to significant, permanent changes in the musculoskeletal system, and may contribute to the development of chronic pain and musculoskeletal disorders such as osteoarthritis."[26 (p. 188)]

LOWER EXTREMITY JOINT POWER[40]

- Greater sagittal plane power phases throughout stance
  - Hip flexors, knee extensors, ankle plantarflexors
- Obese children required greater frontal plane powers at the hip and knee to control external adductor moments during weight acceptance
  - Hip abductors

Body size and walking cadence affect lower extremity joint power in children's gait.

CLINICAL IMPLICATIONS[40]

- Reduced mechanical efficiency
- Greater demand on hip musculature
- Soft tissue around the knee is predisposed to trauma and injury due to the increases in knee joint power
- Increased force to the foot can promote pain in the triceps surae mechanism, including the Achilles tendon

Body size and walking cadence affect lower extremity joint power in children's gait.

JOINT BIOMECHANICS[41]

- Overweight participants had greater peak joint moments in the sagittal, frontal, and transverse planes for the hip, knee, and ankle compared with normal weight participants.

- Increased peak joint moments increase the risk of joint loading, skeletal malalignment, and injury in overweight children

Effects of pediatric obesity on joint kinematics and kinetics during two walking cadences

CLINICAL IMPLICATIONS[41]

- Greater hip flexor and extensor moments – Slipped Capital Femoral Epiphysis
- Increased knee abductor moment – ↑ Risk Genu Valgum
- Increased knee adductor moment –Tibia Vara
- Increased joint moments in sagittal and transverse planes – Earlier progression of OA
- Increased internal rotator moments – Compromises joint stability (e.g. ACL)
- Compensations at the foot and ankle – ↑ Risk stress fractures and foot and ankle pain
- Non-weight bearing activities within exercise prescription

Effects of pediatric obesity on joint kinematics and kinetics during two walking cadences

OBESITY-RELATED CONDITIONS

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

SLIPPED CAPITAL FEMORAL EPIPHYSIS

- Nontraumatic displacement of the proximal femoral epiphysis from the femoral neck[10]
- Associated with excess weight and elevated BMI[7]

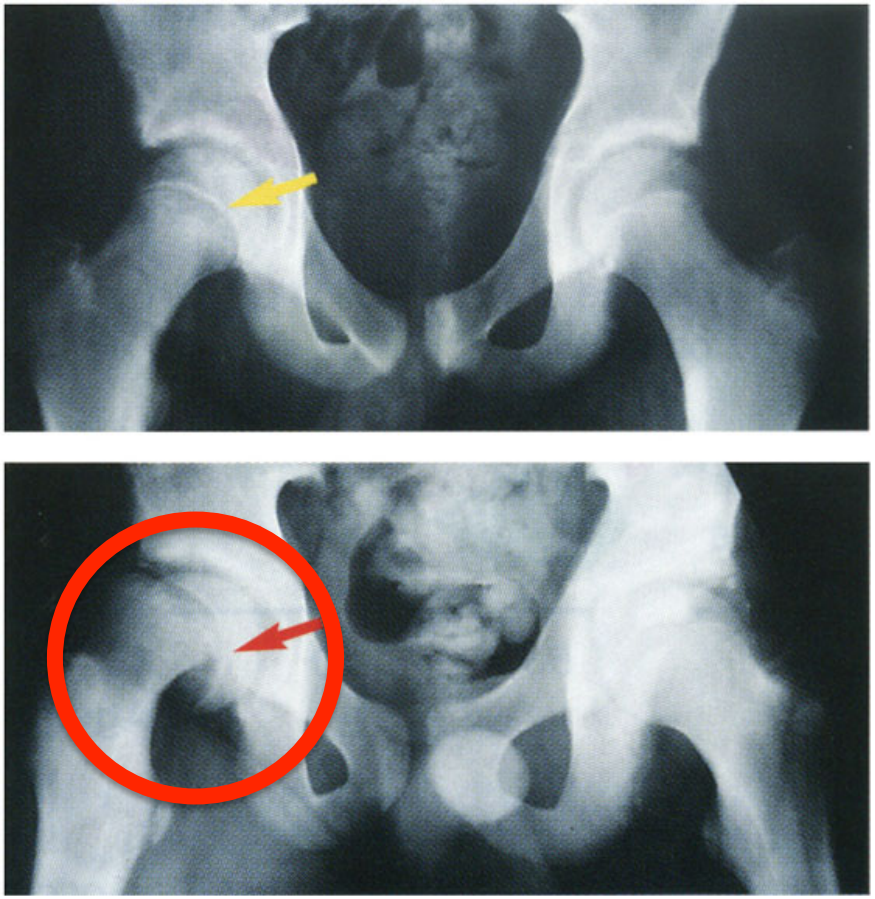


Image Source:
Seattle Children's Hospital

CLINICAL IMPLICATIONS

- Surgery – Operative Stabilization[5]
  - Single-screw fixation
- Post surgical rehabilitation – Mobility, ROM (especially IR), Strength (limited weight bearing s/p surgery)

Image Source: Aronsson, et al.[5]

BLOUNT'S DISEASE

- Varus deformity of the tibia[10,45]
- Associated with increased weight and obesity[38,39]
  - Inhibition of growth in the medial aspect of the proximal tibial physis attributed to abnormal loading

Image Source: Sabharwal, et al[37]

CLINICAL IMPLICATIONS

- Lower Extremity Bracing (Early Infantile Blount's Disease)
- Surgery
  - Hemiepiphysiodesis: restriction of growth laterally[9.29,37]
  - Tibial Osteotomy and realignment to correct deformity[8,16,37]

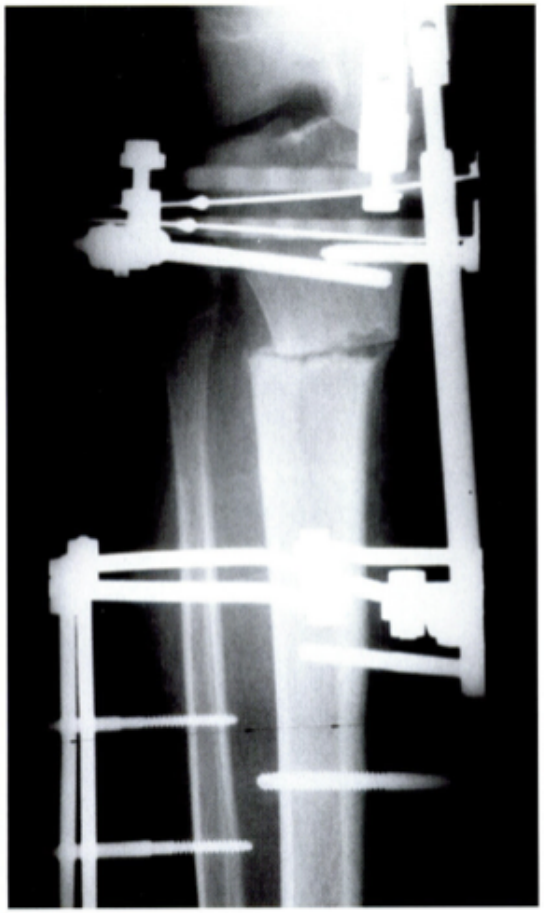


Fig. 2-D

Image Source: Gordon, et al[16]

ACROSS THE LIFESPAN

CHILDHOOD OBESITY

IMPLICATIONS FOR PHYSICAL THERAPY

OBESITY THROUGHOUT THE LIFESPAN

"The higher the BMI is in childhood,
the greater the probability of obesity in adulthood."[22 (s.197)]

"The impact of pediatric obesity rates, if left unchecked,
will translate into worsening rates of obesity in adulthood."[20(p.222)]

CHILDHOOD OBESITY & ADULT CONSEQUENCES

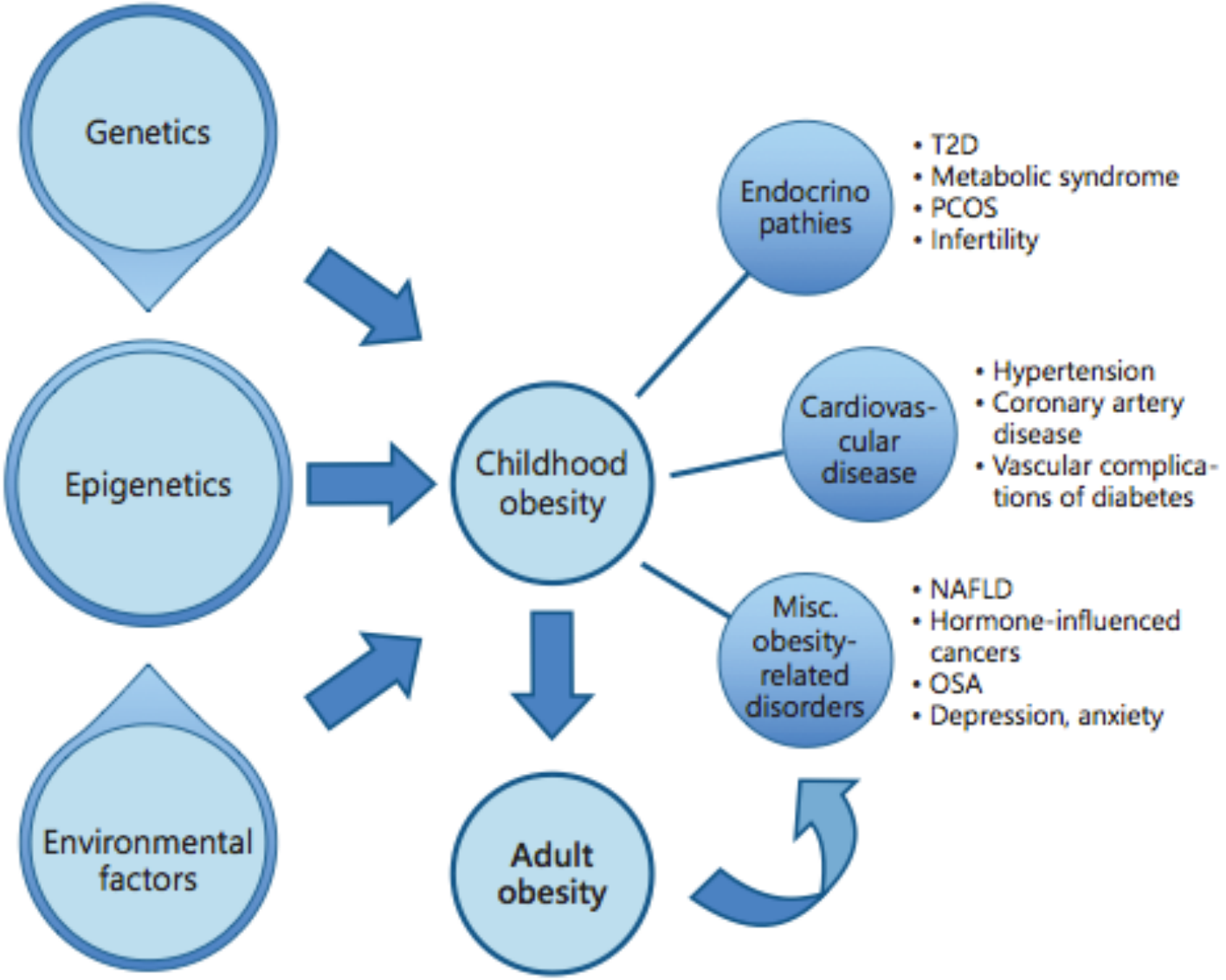


Image Source: Kelsey, et al[20]

OBESITY IN ADULTHOOD

Obesity in adulthood is know to increase the likelihood of developing[20]:

- Cardiovascular Disease (CVD)
- Type 2 Diabetes (T2D) and its associated retinal and renal complications
- Nonalcoholic Fatty Liver Disease (NAFLD)
- Asthma
- Obstructive Sleep Apnea (OSA)
- Polycystic Ovarian Syndrome (PCOS)
- Infertility
- Osteoarthitis
- Orthopedic Complications
- Psychiatric Disease
- Cancer
- Other Obesity-related Disorders

OBESITY AND OSTEOARTHRITIS

Increased risk of hip and knee osteoarthritis in individuals who are overweight or obese[24,35]

- Severity[31]
  - BMI correlated with OA severity in patients with varus aligned knees, but not valgus
- Age of Replacement Surgery[11,15]
  - Age was significantly less when BMI reached 35 kg/m^2 or more (severely obese)
  - May require more revision operations over a lifetime

Health Policy in Perspective: Physical Therapy as Partners in the National Health Agenda

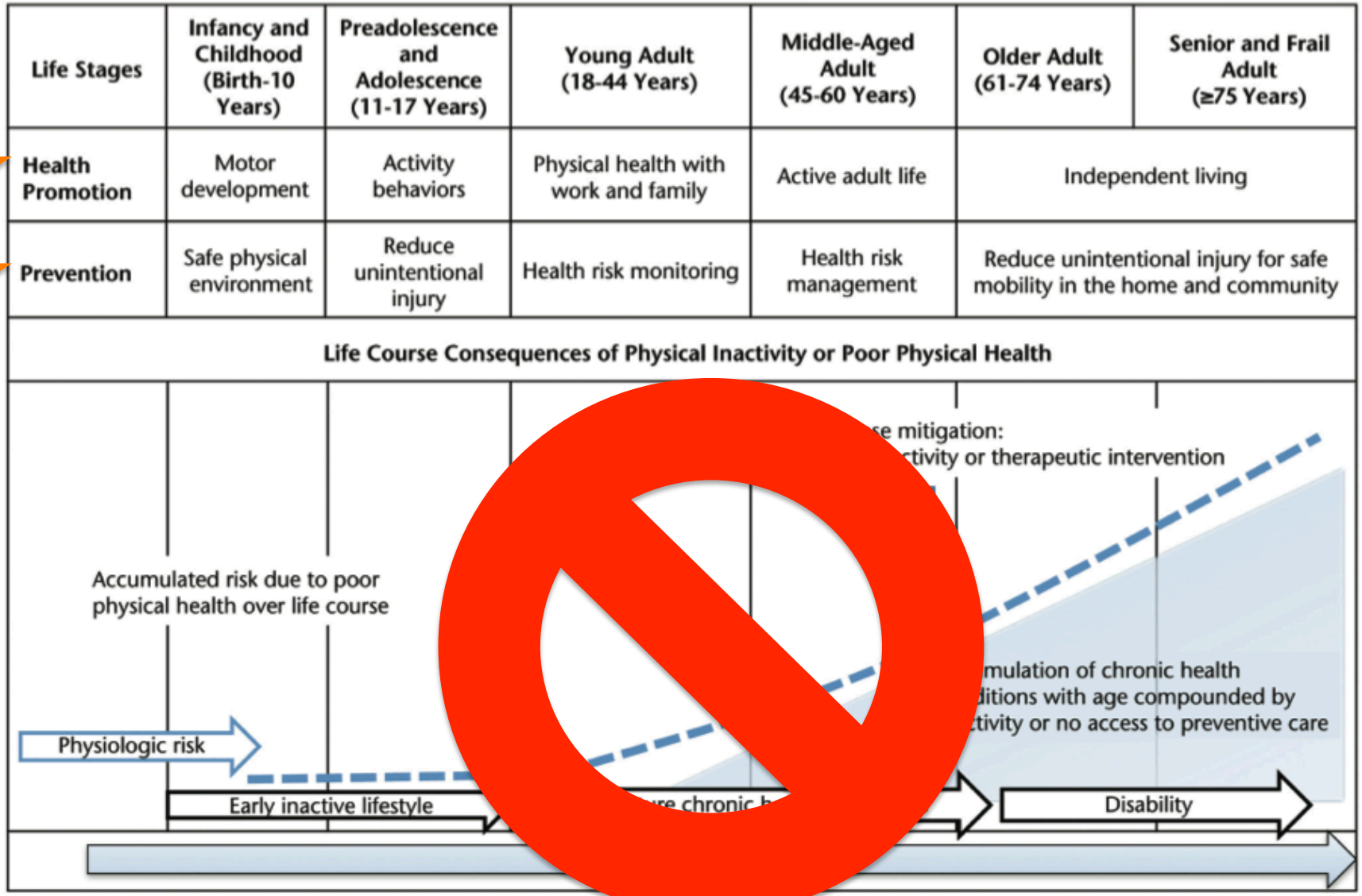


Figure.
Role of physical therapy in physical health promotion, disease mitigation, and injury prevention by life stage: age-related health risk by chronologic age. Source of data: Centers for Disease Control and Prevention. Life Stages and Specific Populations. Available at: http://www.cdc.gov/LifeStages/. Accessed May 3, 2011.

Image Source: Sullivan, et al[43]

TAKE HOME POINTS

- ✓ PTs play an important role in disease and injury prevention, disease mitigation, and health promotion.
- ✓ Childhood obesity affects multiple body systems and has a negative impact on physical, mental, and social health.
- ✓ Physical therapists, as “movement specialists,” must recognize impaired movement and promote safer modes of exercise and physical activity for patients that are obese.
- ✓ Obesity in childhood can lead to obesity in adulthood, which is associated with a decline in overall health and wellness.

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THANK YOU!

QUESTIONS?

CHILDHOOD OBESITY

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