

Physical Activity and Fitness from Pre-School Through High School: Implications for Health

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Outline

I. Physical activity and fitness

- A. Definitions**
- B. Measurement**
- C. Relationship between physical activity and fitness**
- D. Preschool children**
- E. Relationships to obesity and to other health outcomes in children and adolescents**

II. Practical implications

- A. Program design and evaluation**

What is physical activity?

- **Any bodily movement produced by skeletal muscles that results in caloric expenditure (Caspersen et al., 1985)**
- **Complex behavior**
- **Dimensions**
 - **Frequency**
 - **Intensity**
 - **Time (duration)**
 - **Type**
- **Energy expenditure = total body metabolism**
 - **TEE = REE + DEE + AEE**
(Total = rest + diet + physical activity)

How do we measure physical activity?

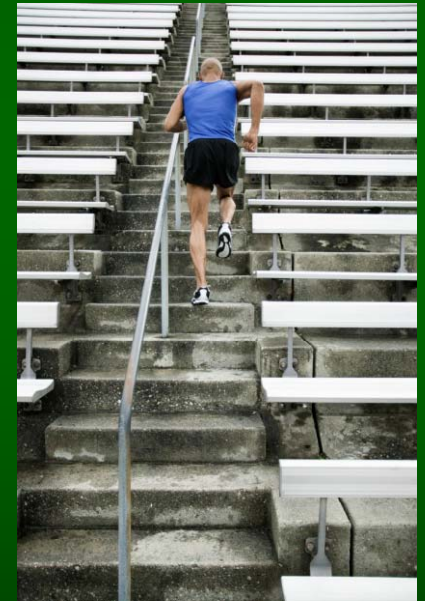
- **It depends on the population of interest**
 - Children are **not** miniature adults!
- **Different challenges exist within different age groups of children and youth**
- **Criterion measures: Direct/indirect calorimetry, doubly labeled water, direct observation**
- **Subjective measures: Self-report, interview, diary, proxy**
- **Objective measures: Heart rate monitoring, pedometer, accelerometer, newer technology**

What is fitness?

- **“An integrated measure of most, if not all, the body functions”** (Ortega et al., *Int J Obes*, 2008, 32:1-11)
- **Health-related physical fitness**
 - **Cardiorespiratory (aerobic) fitness**
 - **Muscular strength**
 - **Muscular endurance**
 - **Flexibility**
 - **Body composition**
- **Speed/agility**

How do we measure fitness?

- **It depends on the population of interest**
 - Children are **not** miniature adults!
- **Different challenges exist within different age groups of children and youth**
- **Criterion measures: VO_{2peak} ; 1-repetition maximum; Dual energy x-ray absorptiometry**
- **Field-based measures: run/walk test; grip strength; curl-ups/push-ups; sit and reach; skinfolds/body mass index**



Physical Activity \neq Fitness
Fitness is the capacity to perform physical activity

Are physical activity and fitness related?

- **Adults**

- **YES**

- **Data from epidemiologic research show that individuals who have higher fitness or physical activity levels are at lower risk for mortality than others who are unfit and inactive in the same BMI range** (LaMonte & Blair, Curr Opin Clin Nutr Metab Care, 2006, 9(5):540-6)

- **Dose-response relationships exist** (Physical Activity Guidelines Committee, 2008)

Are physical activity and fitness related? (2)

- **Children and youth**

- Measurement has been an issue

- Weaker relationship than adults

- **Example:** (Pfeiffer et al., MSSE, 2007, 39(12):2234-2241)

- From middle to high school, girls lost, on average, 0.16 kgm/min/kg/year

- Girls who reported being physically active at baseline showed increases of 0.40-0.52 kgm/min/kg/year

- **Vigorous physical activity associated with higher cardiorespiratory fitness** (Ruiz, Am J Clin Nutr, 2006, 84:298-302)

Prevention versus Treatment???

**And do not forget there is a
genetic effect.**

Preschool Children, Physical Activity, and Fitness

- **Preschool children are not as active as one might think: ~7.5 min/hr of moderate-to-vigorous physical activity (MVPA) and 27 min/hr of non-sedentary activity** (Pfeiffer et al., PES, 2009)
- **Mixed results for relationship between physical activity and body mass index**

Preschool Children, Physical Activity, and Fitness (2)

- **Fitness is difficult to assess in preschool children**
 - **Motor skill development**
- **Exercise programs can improve cardiorespiratory fitness, muscular fitness, and speed and agility**
- **Little is known regarding relationships to health outcomes (some positive relationships with bone health)**

Children and Adolescents

Physical Activity

Physical Activity and Adiposity

- **In general, there is an inverse relationship between physical activity and adiposity** (Strong et al., 2005)
 - **Cross-sectional and longitudinal studies**
- **Vigorous physical activity (VPA) is needed to reduce %fat**
- **Genetic component?; girls 8-10 yrs old in longitudinal study who had obese parents had lower fitness than those with non-obese parents (fitness and PA were relatively constant over 2 yrs)** (Treuth, MSSE, 2004 36(2):198-204)

Physical Activity and Other Health Outcomes

- **Metabolic syndrome**
 - Generally, PA has favorable relationships with components of metabolic syndrome (glucose intolerance, high BP, obesity, dyslipidemia)
 - Dose information not well known
- **Lipids/lipoproteins**
 - Not much effect, with the exception of HDL (positive relationship with PA)

Physical Activity and Other Health Outcomes (2)

- **Blood pressure**
 - Not much effect for normotensive; positive effect for hypertensive
- **Asthma**
 - No effect for pulmonary variables, but increase in fitness is possible with large enough dose
- **Mental health**
 - Weak, inverse relationship with anxiety/ depression; positive for physical self-concept

Physical Activity and Other Health Outcomes (3)

- **Bone health**
 - Positive relationship with bone mineral density, bone mineral content
- **Academic/cognitive performance**
 - Positive relationship with grades and standardized test scores, also on-task behavior

Children and Adolescents

Physical Fitness

Fitness and Adiposity

- **Inverse relationship between cardiorespiratory fitness (CRF) and adiposity**
 - **European Youth Heart Study shows these results longitudinally for total body adiposity and likely to be true for abdominal adiposity** (Ortega et al., Int J Obes, 2008, 32:1-11)
- **Overweight/obese children with higher CRF have lower adiposity**

Fitness and Other Health Outcomes

- **Metabolic syndrome**
 - Relationship with CRF
- **Lipids/lipoproteins**
 - Same as PA (not much effect except HDL)
- **BP**
 - Same as PA; more vigorous exercise shows better relationships
- **Asthma**
 - Same as PA (no change in pulmonary)

Fitness and Other Health Outcomes (2)

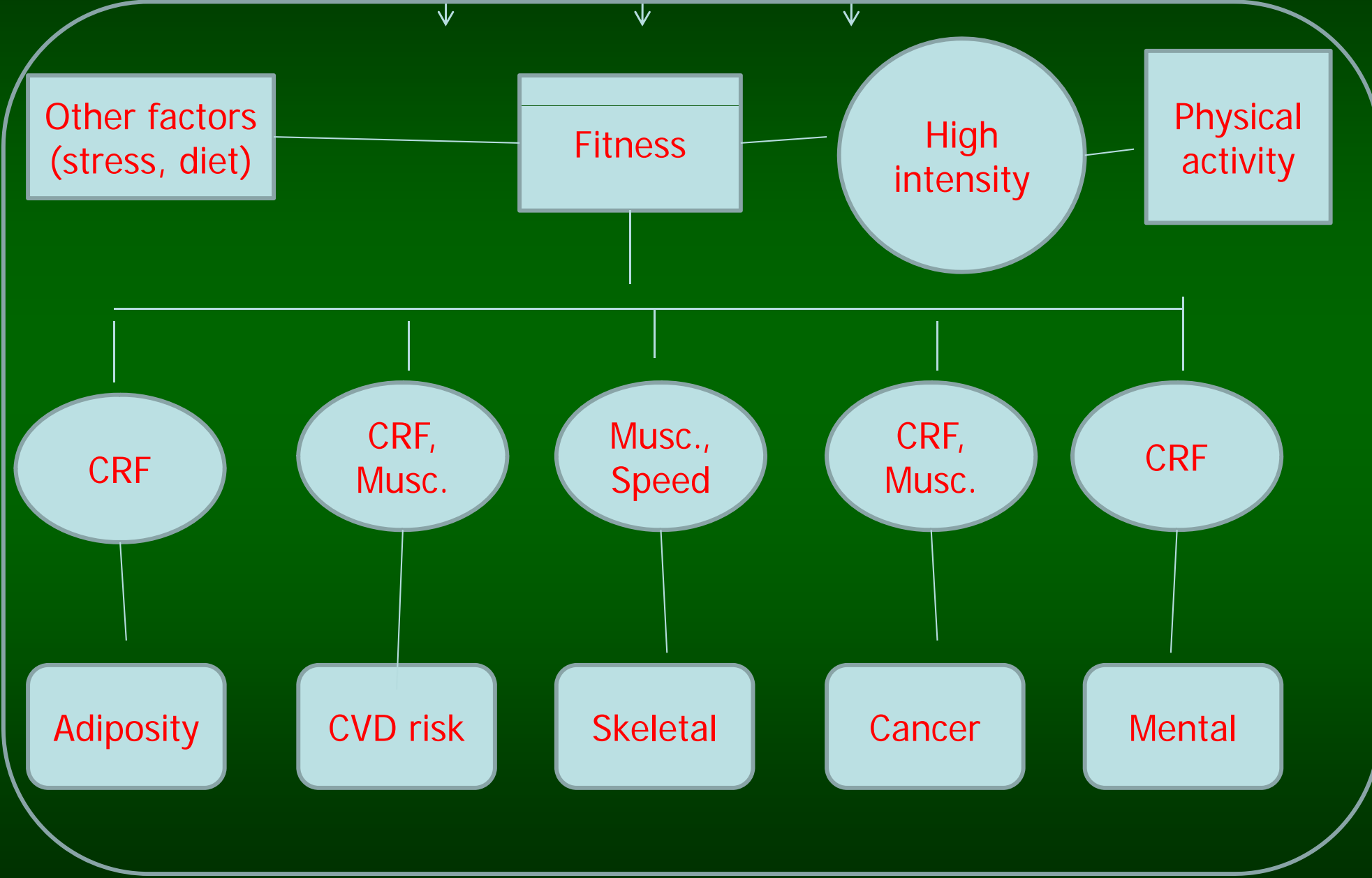
- **Mental health**
 - **Not much evidence; may be beneficial for depression and self-esteem**
- **Bone health**
 - **Muscular fitness shows positive relationship, CRF equivocal/null**
- **Academic/cognitive performance**
 - **Same as PA (positive relationship)**

Fitness and Other Health Outcomes (3)

- **Cancer**
 - **Improvement in CRF and muscular important for survivors**
- **Special notes:**
 - **Muscular fitness has shown an inverse relationship with cardiovascular disease (CVD) risk**
 - **For a given CRF, better muscular fitness is associated with lower CVD risk** (Garcia-Artero, Rev Esp Cardiol, 2007, 60:581-588)

Ortega et al., Int J
Obes, 2008

Genetic/social/environmental factors



Practical Implications

Program Design

- **Many programs have been based on health education (for diet, PA, both) and PA engagement**
- **There is need for creativity**
- **Stakeholder input is crucial (formative assessment)**
- **Program leaders may be key – more research is necessary**

Program Design (2)

- **Gaps in research** (Flynn, *Obes Reviews*, 2006, 7(Supp 1):7-66)
 - **Information is lacking for**
 - **Preschool children**
 - **Males**
 - **Home- and community-based programs**
 - **Immigrants, minorities**
 - **Follow-up beyond one year**

Program Evaluation

- **“What is the evidence that your program works?”**
- **Document, document, document (process evaluation)**
 - **Reach, dose delivered, fidelity**
- **Be prepared for barriers**
 - **E.g., Naughton et al. (2006) think fitness testing should be discontinued**

Program Evaluation (2)

- **Choose your outcomes wisely**
 - **If your intervention is 6 months long, will BMI change?**

Summary

- **Physical activity and fitness are related to each other, adiposity, and many other health outcomes in children and youth**
- **Gaps exist in knowledge regarding certain populations and in interventions**
- **Be innovative and creative, yet know what happened in the past**

Thank You!

Questions?

