IOM Workshop
Physical Activity:
Moving Toward Obesity Solutions

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Outline

- Quick History of Physical Activity and Health
- Studying the Health Impact of Physical Activity
- The Workshop
Quick History of Physical Activity and Health
Hippocrates, 460-357 B.C.

“Walking is man’s best medicine”
-Hippocrates
August Krogh (1874–1949)

- Exercise physiologist
- Studied CO₂ transport in the lungs, metabolism, & the role of insulin
- 1920 Nobel Prize recipient for his discovery of blood flow regulation through capillaries according to the tissue’s need for O₂
- Designed a bicycle ergometer to study exercise intensity
A.V. Hill (1886-1977)

- Exercise physiologist
- Distinguished phases of heat production in skeletal muscle during contraction, relaxation, & recovery
- Awarded the 1922 Nobel Prize for his discovery of heat production in skeletal muscle
- Concepts
  - Anaerobic energy production during exercise
  - Maximum $O_2$ intake
  - Determinants of $VO_2\ max$
Harvard Fatigue Laboratory

1927 - 1947
Jeremy N. Morris (1910-2009)

Found that bus conductors had fewer heart attacks than sedentary drivers (1953)
Ralph Paffenbarger, Jr. (1922-2007)

Found that active longshoremen (cargo handlers) had coronary death rates two thirds lower than sedentary longshoremen (1970)
Heart Attack Risk Reduction
Harvard Alumni Study

Physical Fitness & All-Cause Mortality - ACLS

Age-adjusted death rates per 10,000 person y

Blair et al. *JAMA* 1989;262:2395-401
Inactivity is recognized as a risk factor for coronary artery disease.”

p. 340
PA & Public Health: A Recommendation from CDC & ACSM

- Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week.

  Pate et al. *JAMA* 1995;273:402-7
1996 – Physical Activity & Health

Physical Activity and Health

A Report of the Surgeon General

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion
The President’s Council on Physical Fitness and Sports
Publications 1960-2015
“Health and...”

Number of Publications

Exercise
PA

The report was presented to the Secretary of Health and Human Services and published in June 2008.
Health Benefits of Physical Activity
Adults and Older Adults
Strong Evidence

- Lower risk of:
  - Early death
  - Heart disease
  - Stroke
  - Type 2 diabetes
  - High blood pressure
  - Adverse blood lipid profile
  - Metabolic syndrome
  - Colon and breast cancers

- Prevention of weight gain
- Weight loss when combined with diet
- Improved cardiorespiratory and muscular fitness
- Prevention of falls
- Reduced depression
- Better cognitive function (older adults)
Health Benefits of Physical Activity
Adults and Older Adults

- Moderate to Strong Evidence:
  - Better functional health (older adults)
  - Reduced abdominal obesity

- Moderate Evidence:
  - Weight maintenance after weight loss
  - Lower risk of hip fracture
  - Increased bone density
  - Improved sleep quality
  - Lower risk of lung and endometrial cancers
Health Benefits of Physical Activity
Children and Adolescents

- **Strong Evidence:**
  - Improved cardiorespiratory endurance and muscular fitness
  - Favorable body composition
  - Improved bone health
  - Improved cardiovascular and metabolic health biomarkers

- **Moderate Evidence:**
  - Reduced symptoms of anxiety and depression
More Information:
http://www.health.gov/paguidelines
Adults (18–64 years)

- 2 hours & 30 min/week of moderate-intensity aerobic PA, or 1 hour & 15 min/week of vigorous-intensity aerobic PA, or an equivalent combination of both
- Episodes of at least 10 min, spread across the week
- Additional health benefits with 300 min/week of moderate-intensity aerobic PA, or 2 hours & 30 min/week of vigorous-intensity PA, or an equivalent combination of both
- Muscle-strengthening activities on 2 or more days/week
Children and Adolescents (6–17 years of age)

- **1 hour (60 minutes) or more of PA every day**
- Most of the 1 hour or more a day should be either moderate- or vigorous-intensity aerobic PA
- Vigorous-intensity PA at least 3 days per week
- Muscle-strengthening and bone-strengthening activity at least 3 days per week
## Preventable Causes of Death, US 2005

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Attributable Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco smoking</td>
<td>467,000</td>
</tr>
<tr>
<td>Hypertension</td>
<td>395,000</td>
</tr>
<tr>
<td>Overweight &amp; obesity</td>
<td>216,000</td>
</tr>
<tr>
<td><strong>Physical Inactivity</strong></td>
<td><strong>191,000</strong></td>
</tr>
<tr>
<td>High dietary salt</td>
<td>102,000</td>
</tr>
<tr>
<td>Low dietary omega-3 fatty acids</td>
<td>84,000</td>
</tr>
<tr>
<td>High dietary trans fatty acids</td>
<td>82,000</td>
</tr>
</tbody>
</table>

Percent Disease Burden Caused by Physical Inactivity, Worldwide, 2008

CHD  Type 2 Diabetes  Breast Cancer  Colon Cancer  Premature Mortality

Lee et al. Lancet 2012;380:219-29
Studying the health impact of physical activity
Physical Activity

- Any bodily movement produced by skeletal muscles that results in energy expenditure
Attributes of Physical Activity

- Type ("aerobic," resistance)
- Specific Form (walking, swimming)
- Frequency (bouts/day, days/week)
- Intensity (VO₂, METS, RPE)
- Duration (Min/bout, Min/day)
- Context
  - Physical location (work/school)
  - Social setting (alone, group)
Measurement of Physical Activity

- Self-Report
- Surrogate Report
- Direct Observation
- Objective Assessment
  - Accelerometry
  - Pedometry
- Fitness
Expressions of Physical Activity

- Selected Intensity of PA/Time
  - MVPA (min/day)

- Dose
  - MET-Minutes

- Compliance with Guideline
  - Days/Week
Health-Related Outcomes

- Biomarkers
  - Lipids, BP, Insulin, Adiposity, Fitness

- Disease Morbidity/Mortality
  - CVD, Type 2D, Obesity

- All-Cause Mortality
Mechanisms Underlying the Health Effects of Physical Activity

- Physiological Effects of Acute Exercise
  - Marked increase in muscle metabolic rate
    - Energy throughput
  - All systems engaged in supporting active muscle
    - Neuroendocrine control
    - Cardiorespiratory function
Mechanisms Underlying the Health Effects of Physical Activity

- Physiological Effects of Chronic Exercise
  - Multiple effects on muscle metabolic apparatus
  - Cardiorespiratory function
  - Neuroendocrine control mechanisms
  - Tissue adaptations – connective tissue, bone, adipose tissue
  - Improved fitness, function
Mechanisms Underlying the Health Effects of Physical Activity

- Basic Factors Underlying Health Effects of Exercise
  - Increased insulin sensitivity
  - Lower visceral adiposity
  - Improved immune function
  - Increased blood volume and hemoglobin mass
  - Improved cardiac structure and function
  - Many others to be confirmed/determined
The Workshop

Day 1 – Physical Activity and Obesity – State of the Science

Day 2 – Innovative Strategies for Promotion of Physical Activity
The Workshop Plan – Day 1

Focus on Physical Activity and:

- Primary Prevention of Overweight and Obesity
- Prevention of Co-Morbidities in those who are Overweight or Obese
Workshop Elements

- Two Introductory Presentations
- Two Panels on Primary Prevention
- One Panel on Health Outcomes in the Overweight or Obese