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

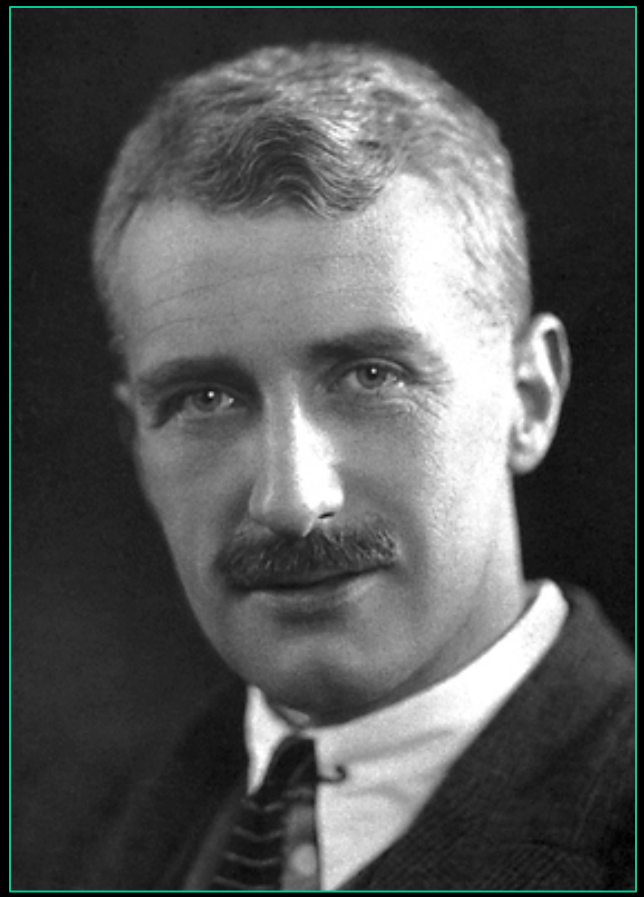
Hippocrates, 460-357 B.C.

"Walking is man's best medicine"
-Hippocrates

August Krogh (1874–1949)

- Exercise physiologist
- Studied CO_2 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 O_2
- 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

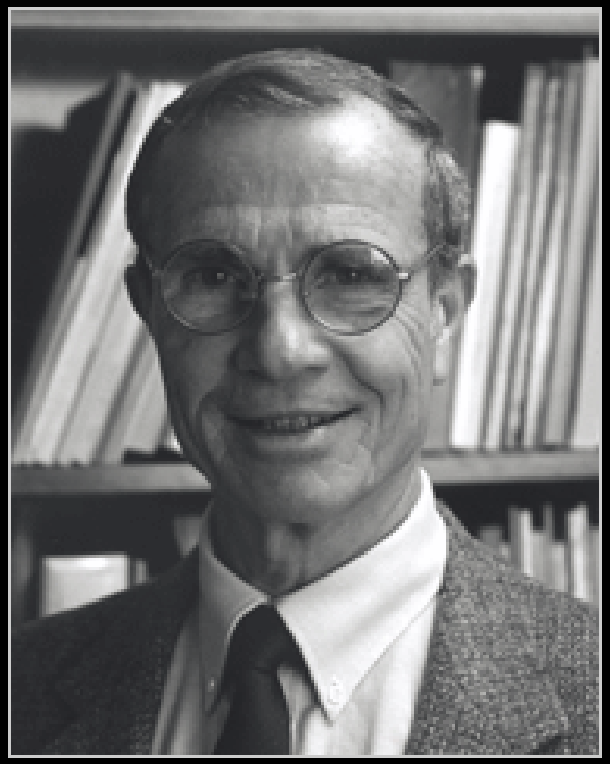
1927 - 1947

Jeremy N. Morris (1910-2009)

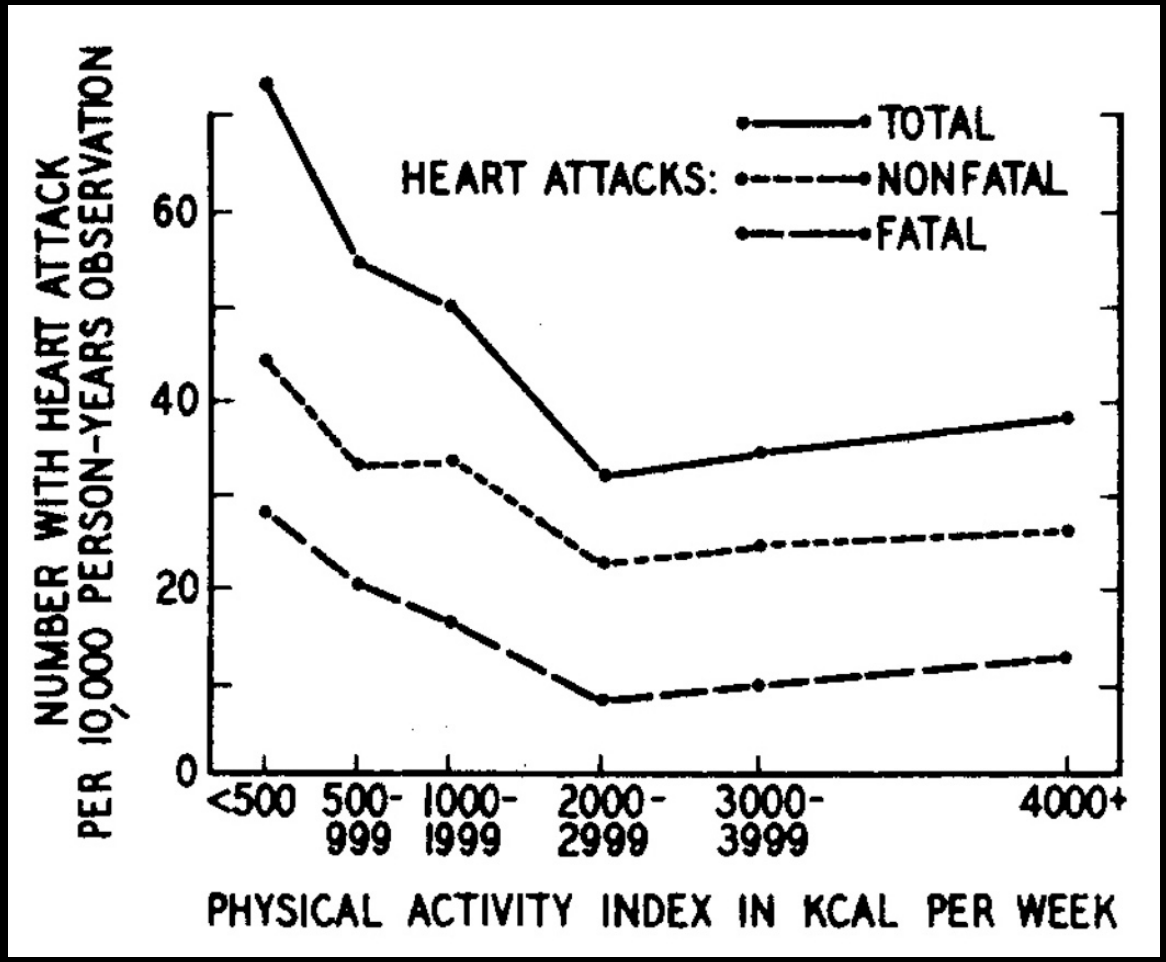
Found that bus conductors had fewer heart attacks than sedentary drivers (1953)

Ralph Paffenbarger, Jr. (1922-2007)

Found that active longshoremen (cargo handlers) had coronary death rates two thirds lower than sedentary longshoremen (1970)

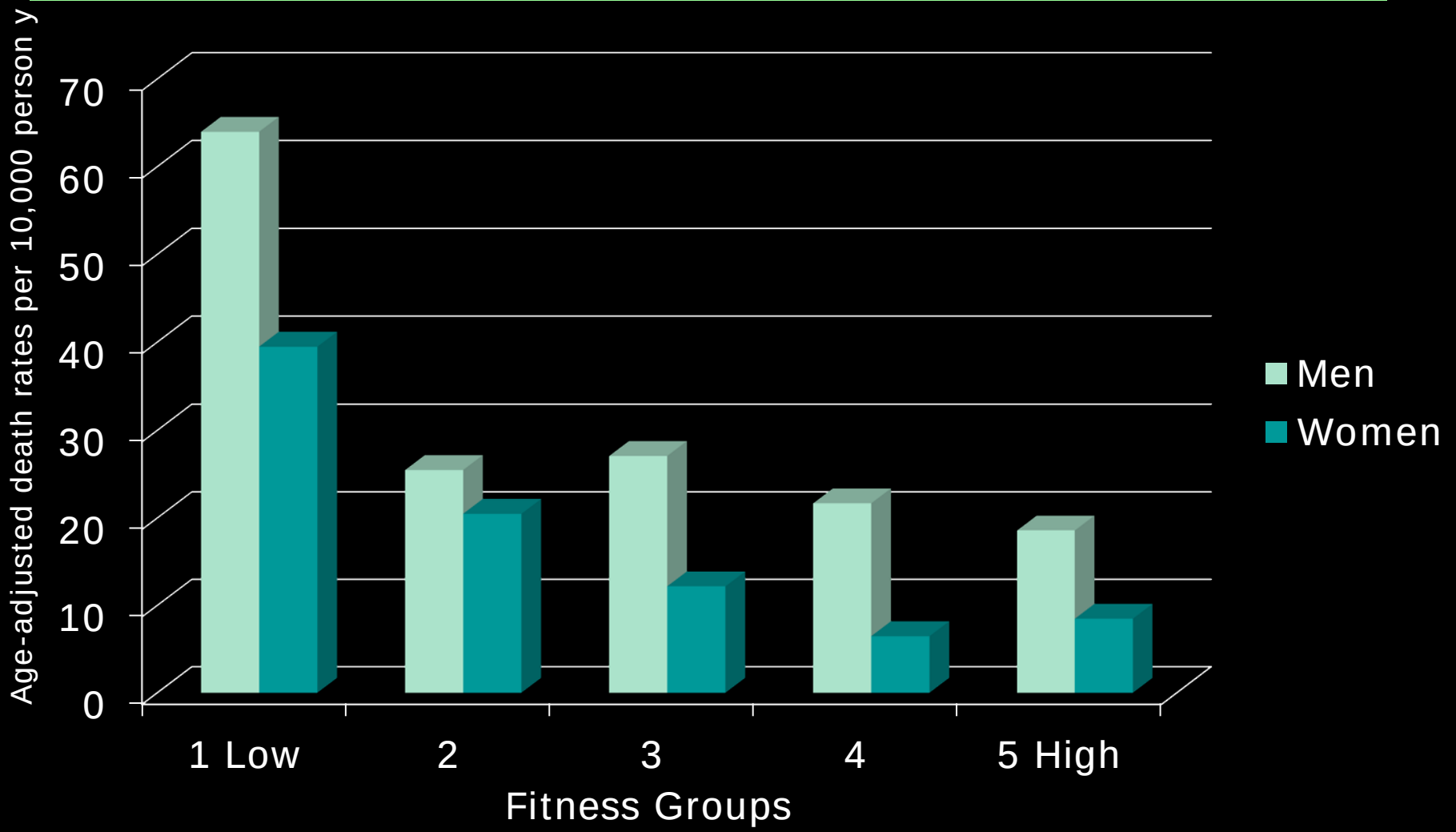


Heart Attack Risk Reduction Harvard Alumni Study



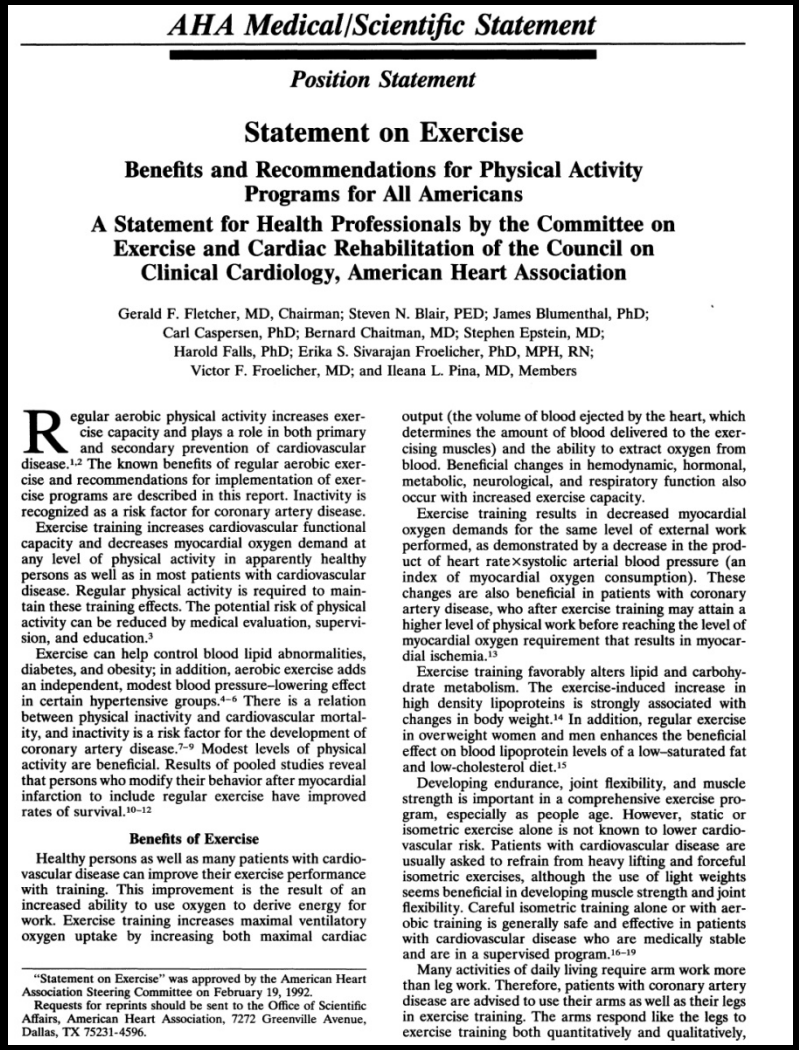
Paffenbarger et al. *Am J Epidemiol* 1978;108:161-75

Physical Fitness & All-Cause Mortality - ACLS



Blair et al. *JAMA* 1989;262:2395-401

AHA 1992 Statement on Exercise



AHA Medical/Scientific Statement

Position Statement

Statement on Exercise

Benefits and Recommendations for Physical Activity Programs for All Americans

A Statement for Health Professionals by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association

Gerald F. Fletcher, MD, Chairman; Steven N. Blair, PED; James Blumenthal, PhD; Carl Caspersen, PhD; Bernard Chaitman, MD; Stephen Epstein, MD; Harold Falls, PhD; Erika S. Sivarajan Froelicher, PhD, MPH, RN; Victor F. Froelicher, MD; and Ileana L. Pina, MD, Members

Regular aerobic physical activity increases exercise capacity and plays a role in both primary and secondary prevention of cardiovascular disease.[1,2] The known benefits of regular aerobic exercise and recommendations for implementation of exercise programs are described in this report. Inactivity is recognized as a risk factor for coronary artery disease.

Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most patients with cardiovascular disease. Regular physical activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, supervision, and education.[3]

Exercise can help control blood lipid abnormalities, diabetes, and obesity; in addition, aerobic exercise adds an independent, modest blood pressure–lowering effect in certain hypertensive groups.[4–6] There is a relation between physical inactivity and cardiovascular mortality, and inactivity is a risk factor for the development of coronary artery disease.[7–9] Modest levels of physical activity are beneficial. Results of pooled studies reveal that persons who modify their behavior after myocardial infarction to include regular exercise have improved rates of survival.[10–12]

Benefits of Exercise

Healthy persons as well as many patients with cardiovascular disease can improve their exercise performance with training. This improvement is the result of an increased ability to use oxygen to derive energy for work. Exercise training increases maximal ventilatory oxygen uptake by increasing both maximal cardiac output (the volume of blood ejected by the heart, which determines the amount of blood delivered to the exercising muscles) and the ability to extract oxygen from blood. Beneficial changes in hemodynamic, hormonal, metabolic, neurological, and respiratory function also occur with increased exercise capacity.

Exercise training results in decreased myocardial oxygen demands for the same level of external work performed, as demonstrated by a decrease in the product of heart rate×systolic arterial blood pressure (an index of myocardial oxygen consumption). These changes are also beneficial in patients with coronary artery disease, who after exercise training may attain a higher level of physical work before reaching the level of myocardial oxygen requirement that results in myocardial ischemia.[13]

Exercise training favorably alters lipid and carbohydrate metabolism. The exercise-induced increase in high density lipoproteins is strongly associated with changes in body weight.[14] In addition, regular exercise in overweight women and men enhances the beneficial effect on blood lipoprotein levels of a low–saturated fat and low-cholesterol diet.[15]

Developing endurance, joint flexibility, and muscle strength is important in a comprehensive exercise program, especially as people age. However, static or isometric exercise alone is not known to lower cardiovascular risk. Patients with cardiovascular disease are usually asked to refrain from heavy lifting and forceful isometric exercises, although the use of light weights seems beneficial in developing muscle strength and joint flexibility. Careful isometric training alone or with aerobic training is generally safe and effective in patients with cardiovascular disease who are medically stable and are in a supervised program.[16–19]

Many activities of daily living require arm work more than leg work. Therefore, patients with coronary artery disease are advised to use their arms as well as their legs in exercise training. The arms respond like the legs to exercise training both quantitatively and qualitatively,

"Statement on Exercise" was approved by the American Heart Association Steering Committee on February 19, 1992.

Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231-4596.

- "Inactivity is recognized as a risk factor for coronary artery disease."

p. 340

American Heart Association®

Learn and Live℠

PA & Public Health: A Recommendation from CDC & ACSM

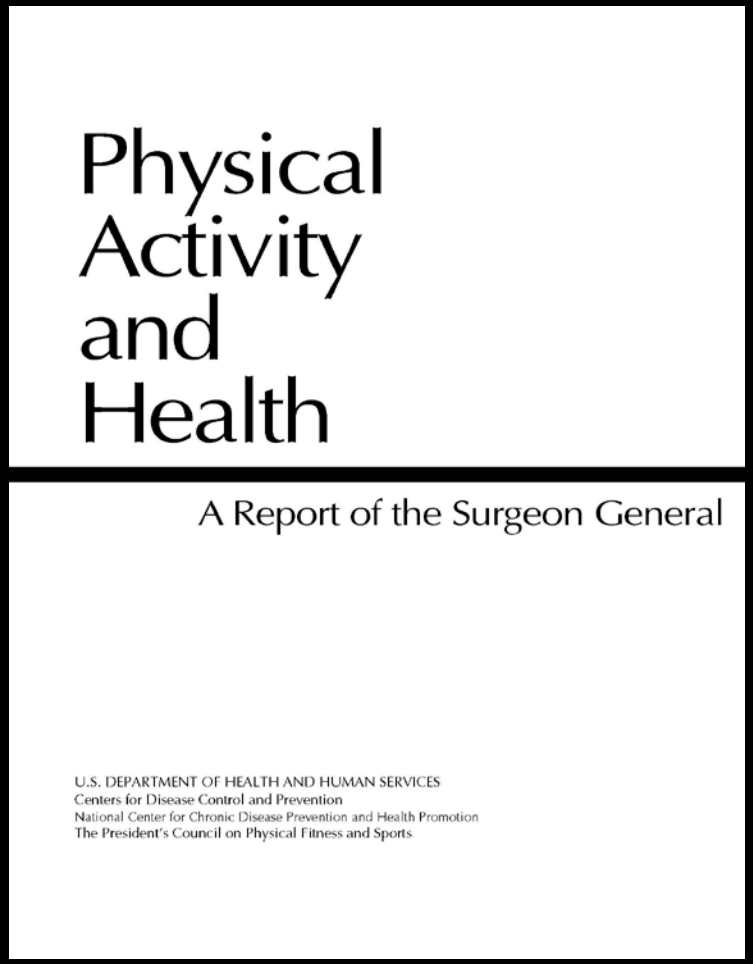
- Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week.

  Pate et al. *JAMA* 1995;273:402-7

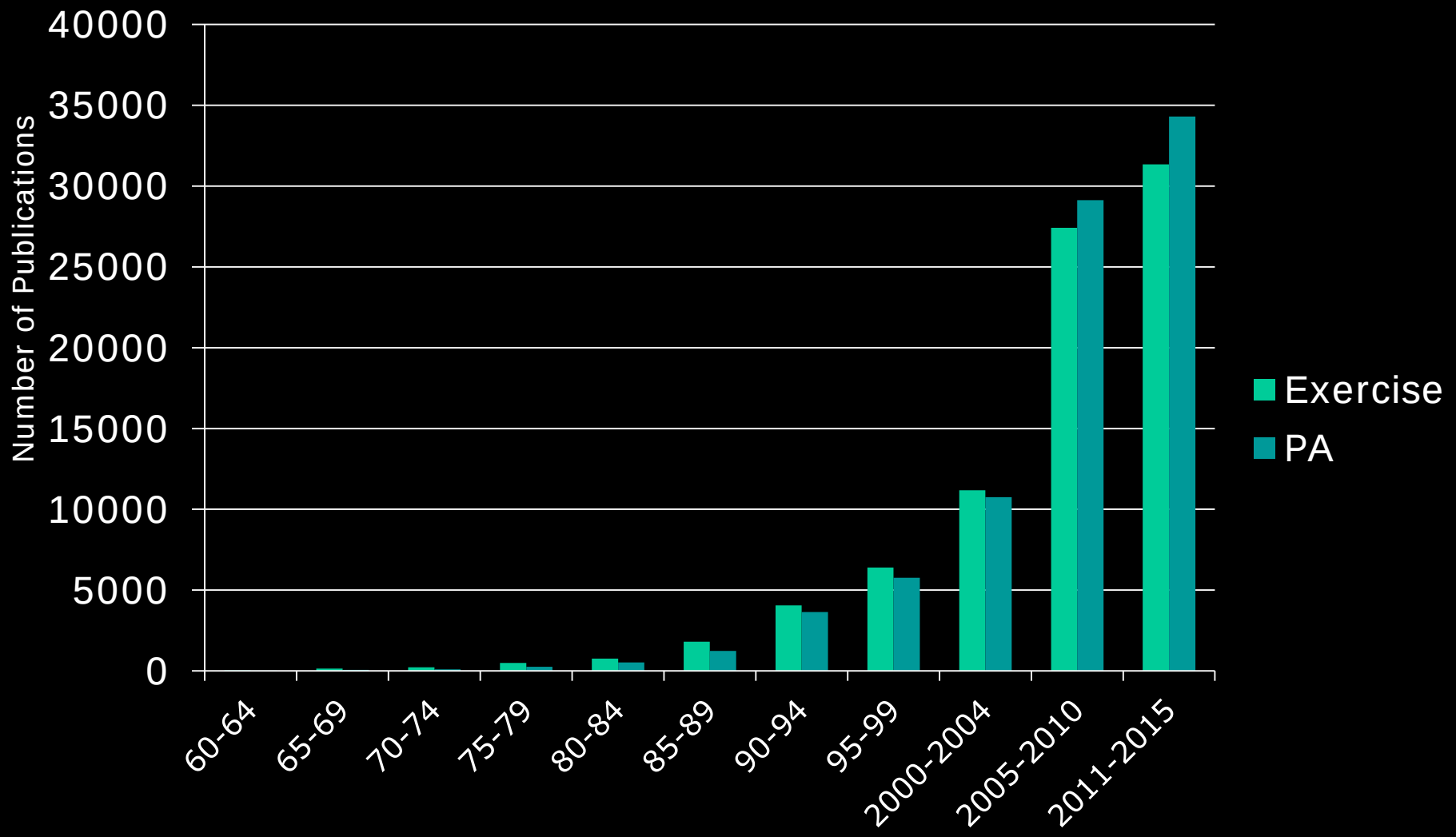
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

AMERICAN COLLEGE of SPORTS MEDICINE

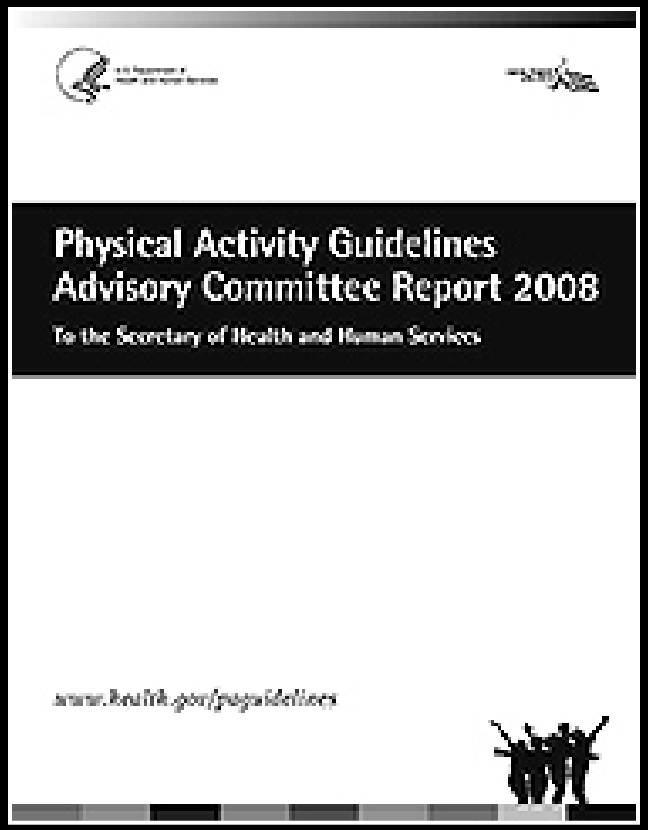
1996 – Physical Activity & Health



Publications 1960-2015 "Health and…"



Physical Activity Guidelines Advisory Committee Report 2008



- 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)

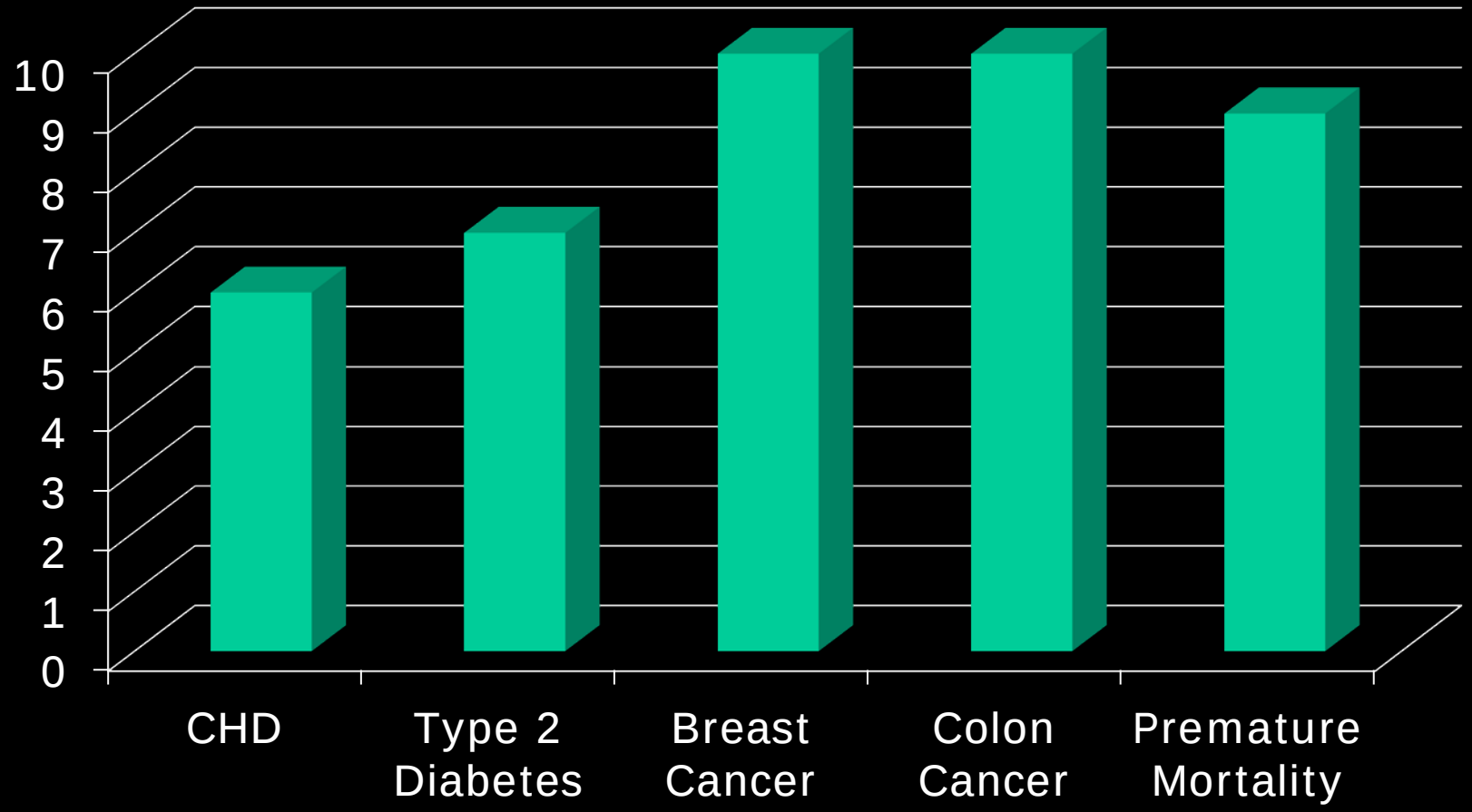
- **1 hour (60 minutes) or more of PA every day**
- Most of the 1 hour or more a day should be either moderate- or vigorous-intensity aerobic PA
- Vigorous-intensity PA at least 3 days per week
- Muscle-strengthening and bone-strengthening activity at least 3 days per week

Preventable Causes of Death, US 2005

Risk Factor	Attributable Deaths
Tobacco smoking	467,000
Hypertension	395,000
Overweight & obesity	216,000
Physical Inactivity	**191,000**
High dietary salt	102,000
Low dietary omega-3 fatty acids	84,000
High dietary trans fatty acids	82,000

Danaei et al. *PLoS Med* 2009;6(4):e1000058

Percent Disease Burden Caused by Physical Inactivity, Worldwide, 2008



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 (VO_2, 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 through-put
  - 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