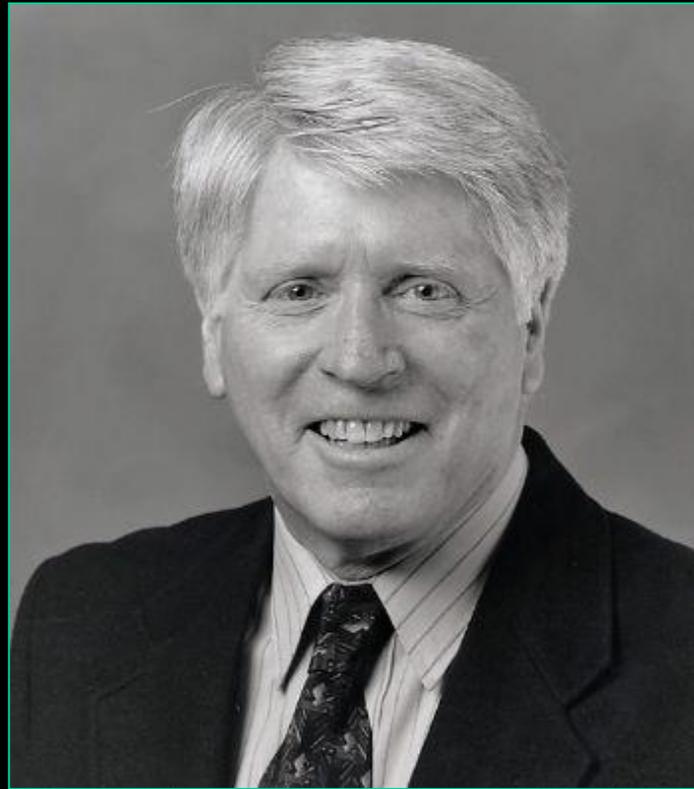


Physical Activity and Public Health: History, Status, Needs

Russell R. Pate, PhD
Arnold School of Public Health
University of South Carolina
2012



William L. Haskell



Outline

- Quick history
- What we know now:
 - Physical activity and health
 - Increasing physical activity
- Research needs

A Quick History of the Science on Physical Activity and Health

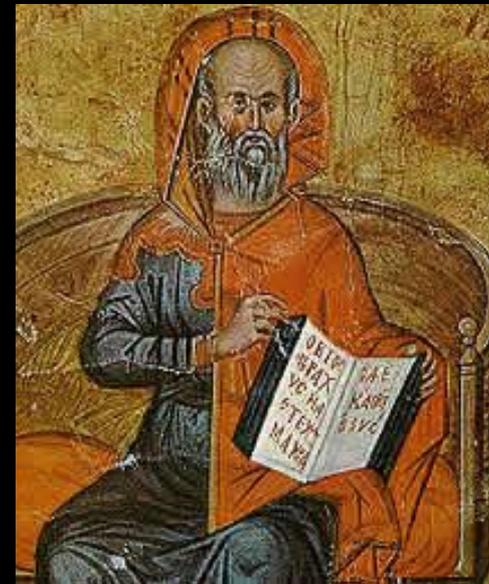
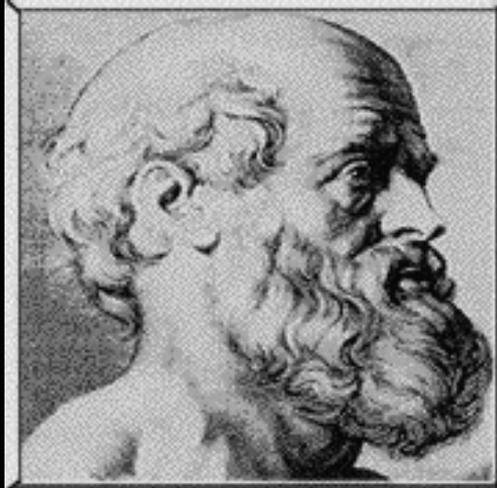


**400 B.C.
to
1990 A.D.**

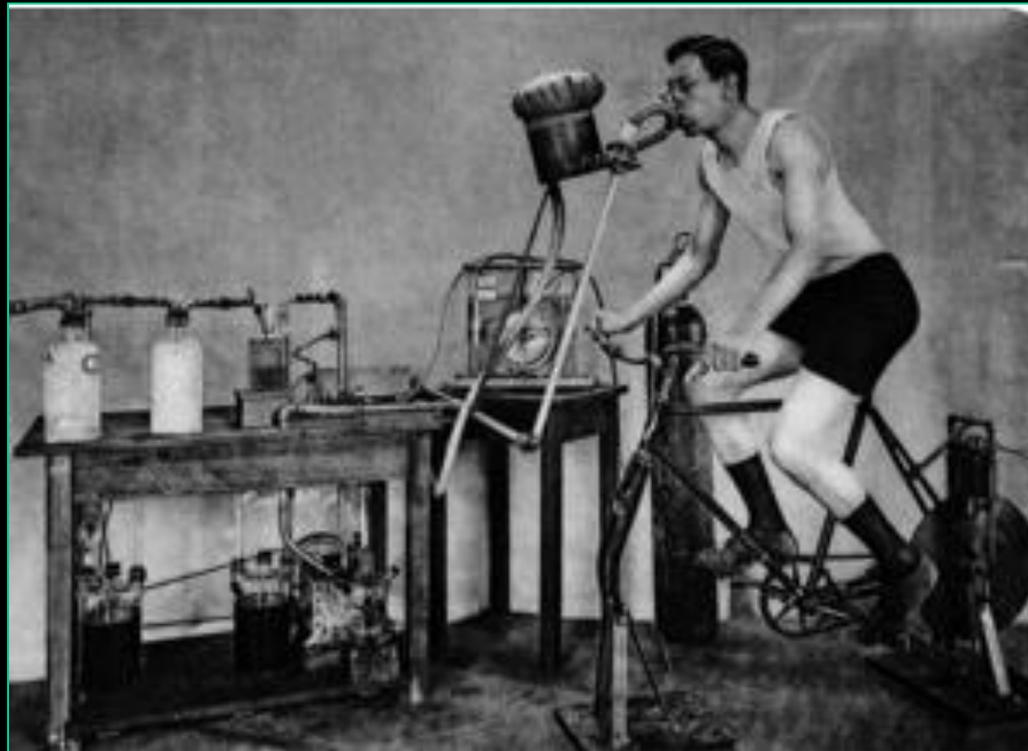


Hippocrates, 460-357 B.C.

“Walking is man’s best medicine”
-Hippocrates



Harvard Fatigue Laboratory



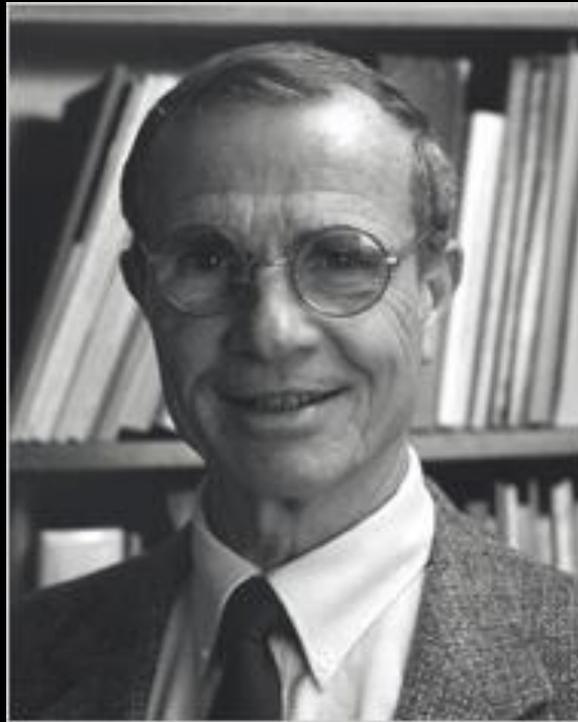
1927 - 1947

Jeremy N. Morris (1910-2009) found that bus conductors had fewer heart attacks than sedentary drivers (1953)

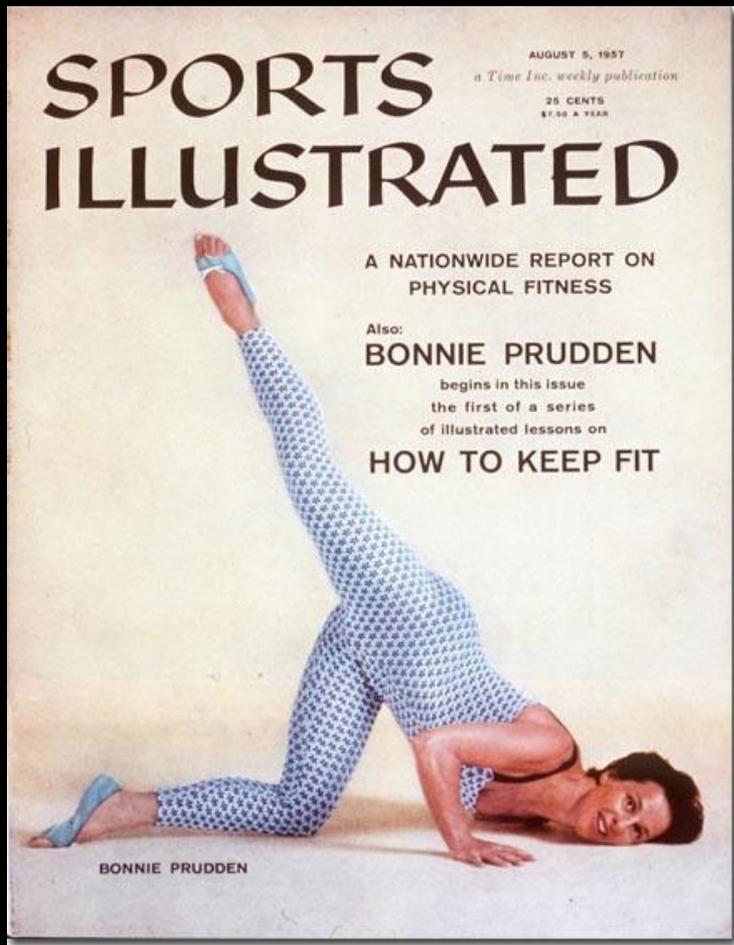


© Getty Images

Ralph Paffenbarger, Jr. (1922-2007) found that active longshoremen (cargo handlers) had coronary death rates two thirds lower than sedentary longshoremen (1970)



Bonnie Prudden (1914-2011)



- Advocate of physical fitness
- Administered Kraus-Weber test & presented results to President Eisenhower in 1955
- Wrote 15 books

William J. Bowerman (1911-1999)



- ❑ Track and field coach
- ❑ Introduced jogging as a fitness routine
- ❑ *Jogging* published in 1966 & 1967 with W.E. Harris

Kenneth H. Cooper

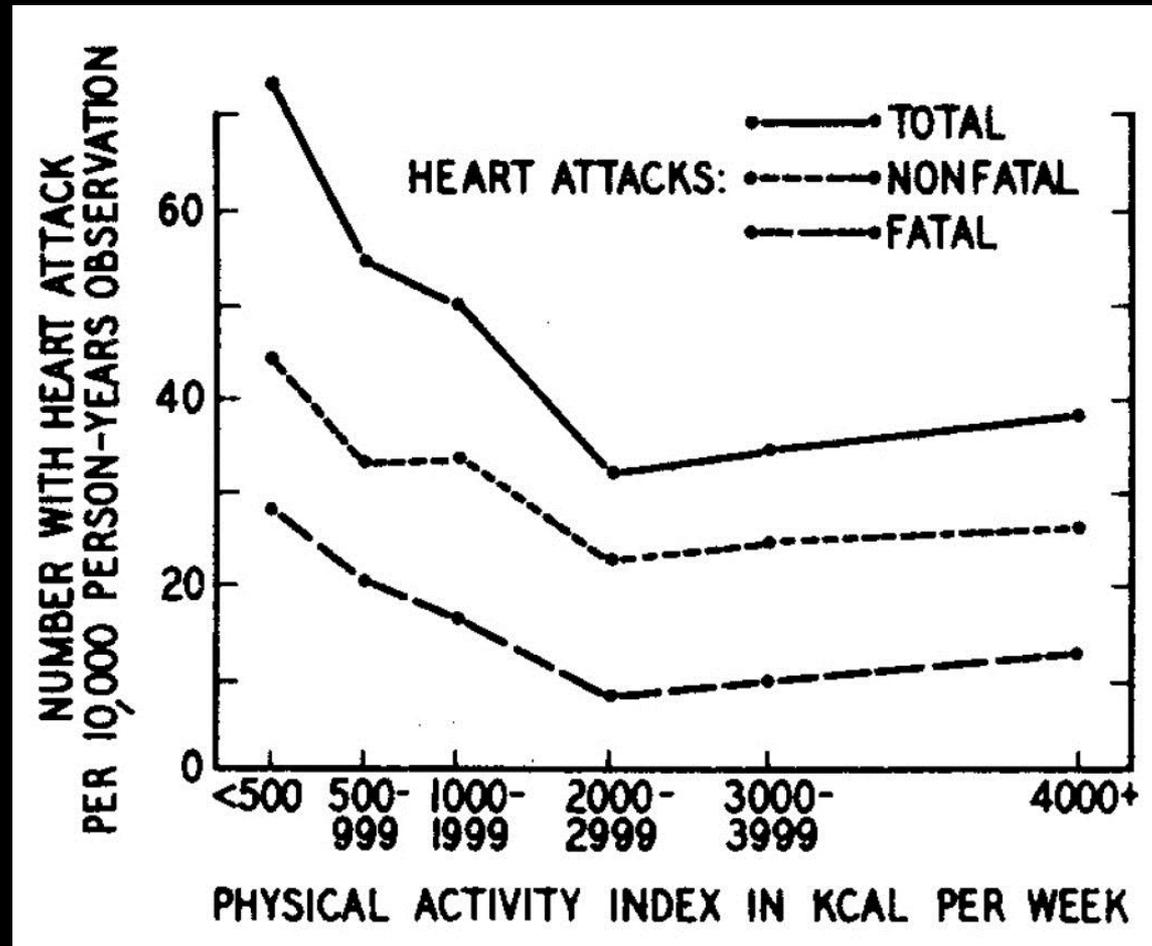


- ❑ The “Father of Aerobics”: published *Aerobics* in 1968
- ❑ Founded The Cooper Institute in 1970
- ❑ Aerobic Center Longitudinal Study (aka CCLS)
- ❑ The Cooper test: 12-min run test to assess CRF

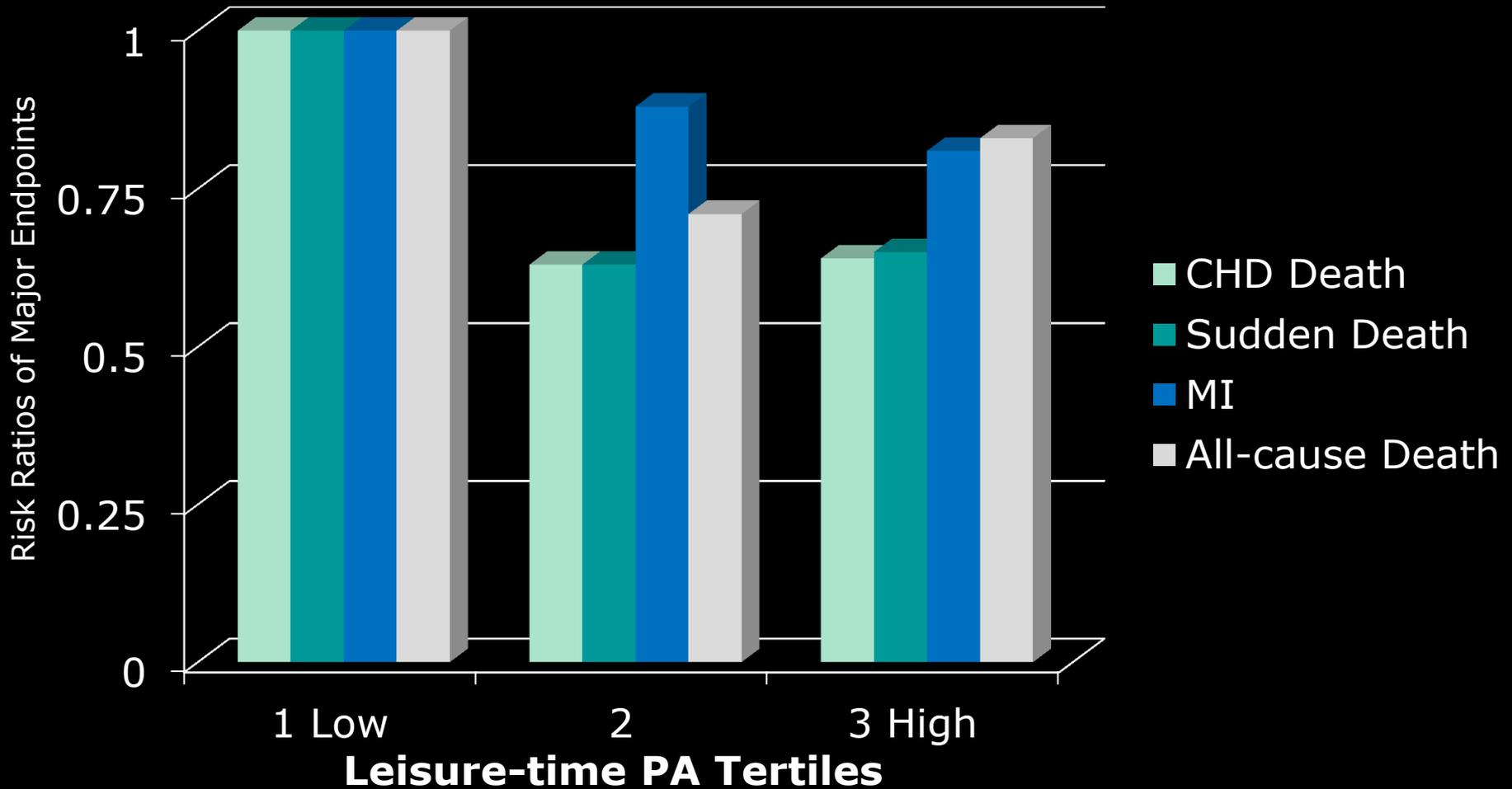
ACSM Guidelines

	MODE	FREQ (d/wk)	DUR (min)	INT (% FC)
1975	Aerobic	3-5	20-45	70-90
1980	Aerobic	3-5	15-60	50-85
1986	Aerobic	3-5	15-60	50-85
1991	Aerobic	3-5	15-60	40-85

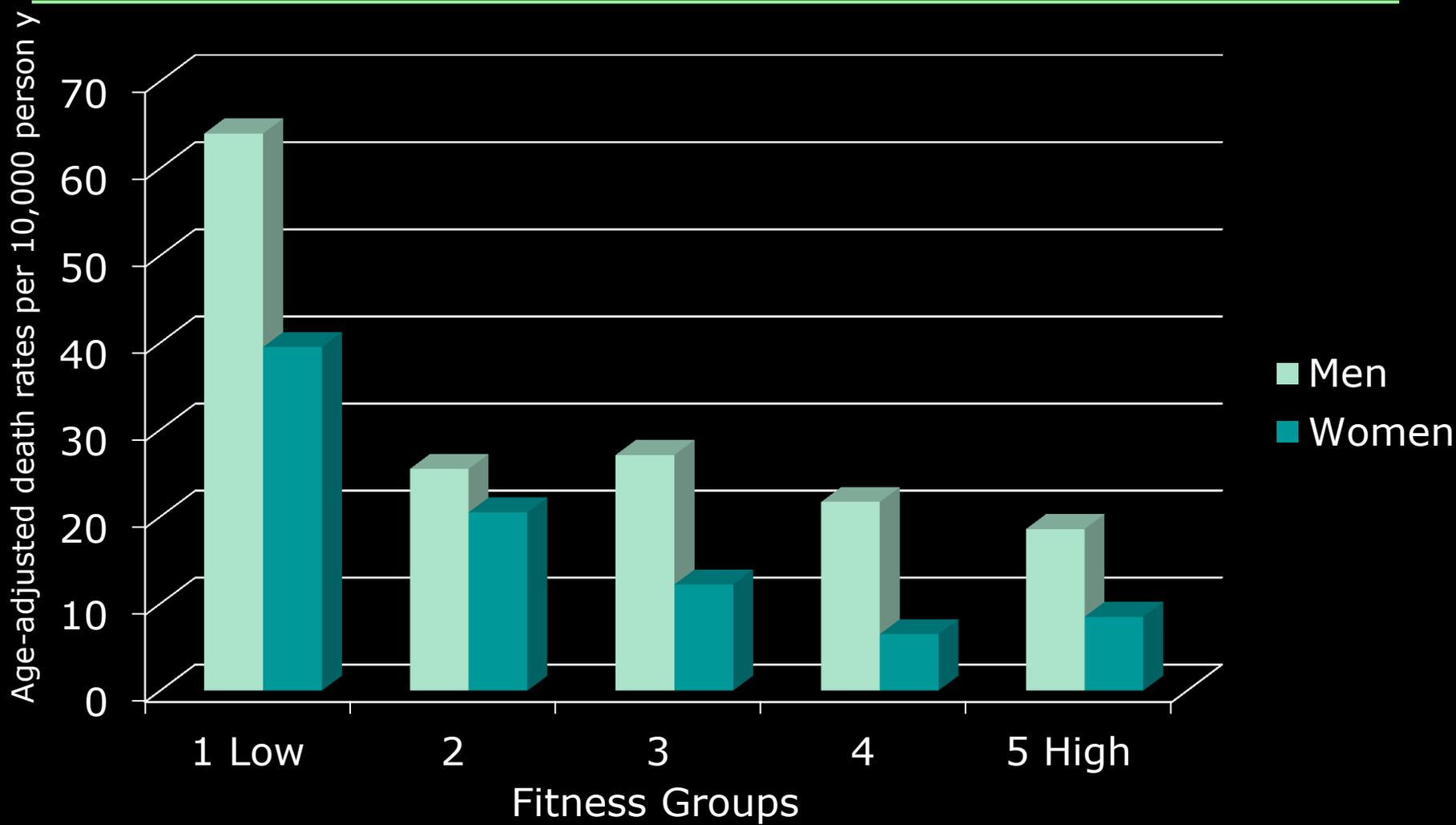
Heart Attack Risk Reduction Harvard Alumni Study



Leisure-time PA & Risk of CHD and Death, MRFIT



Physical Fitness & All-Cause Mortality - ACLS



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 \times 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,

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

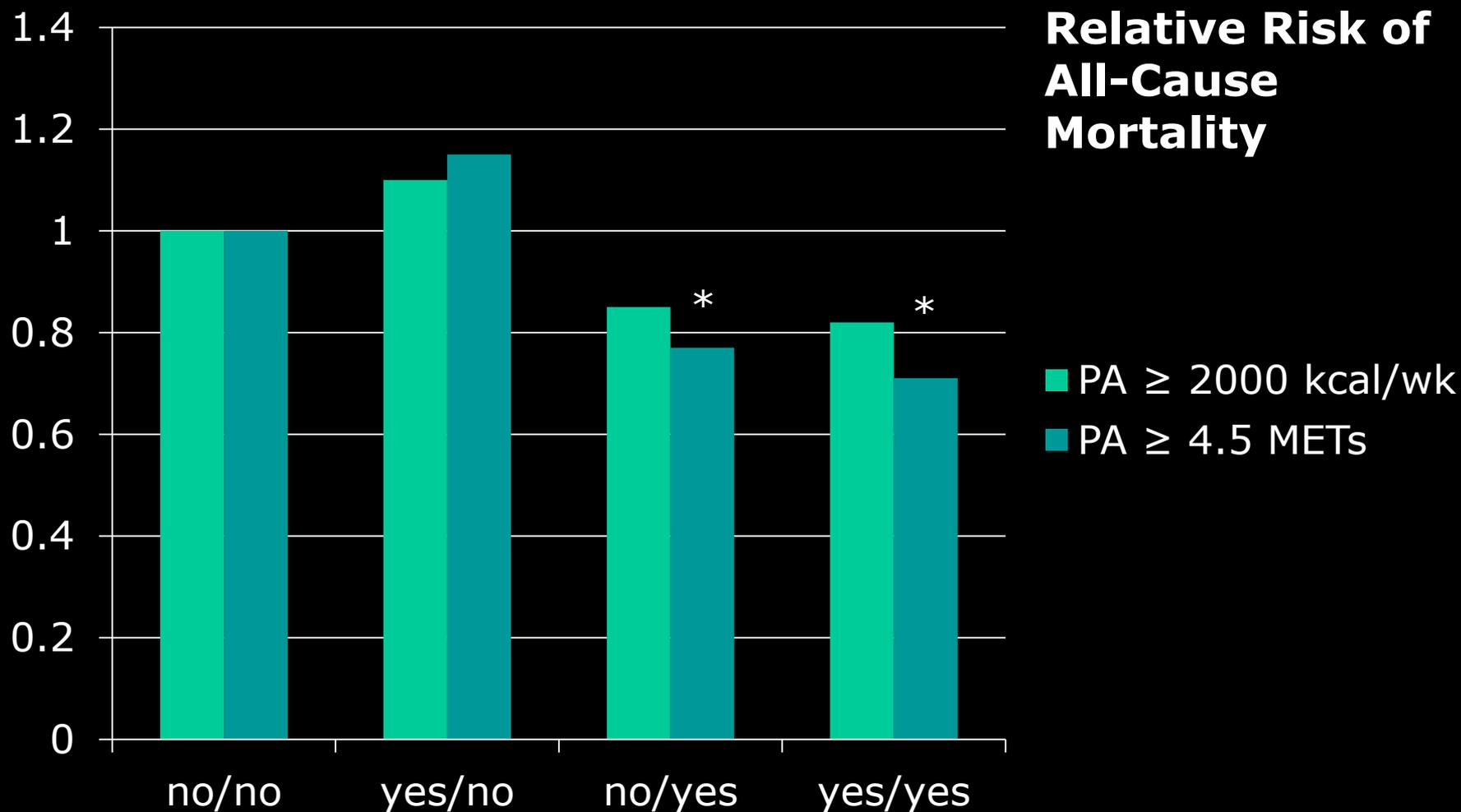
p. 340



"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.

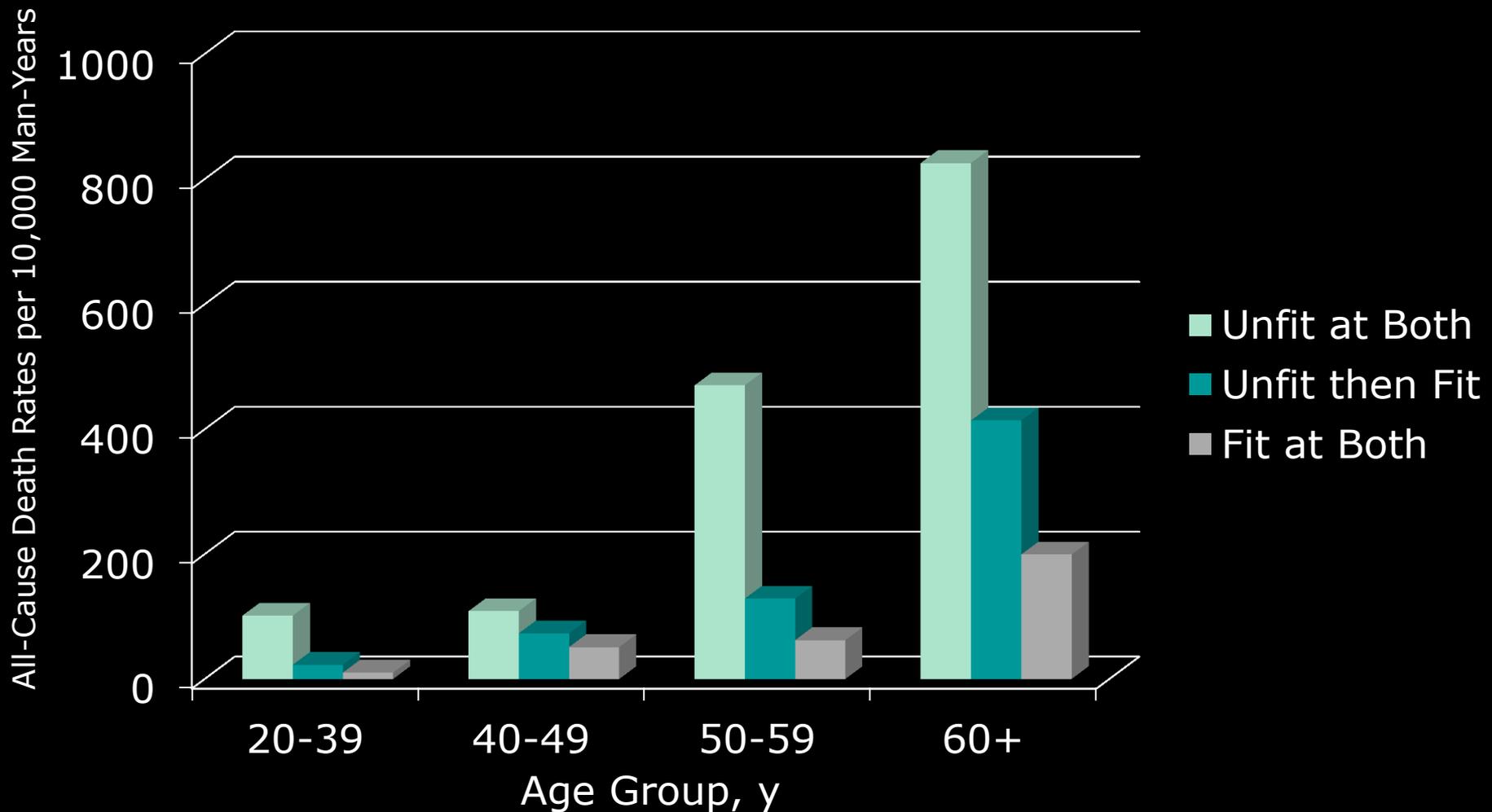
Change in PA – Harvard Alumni Health Study



* $P < 0.02$

Paffenbarger et al. *NEJM* 1993;328:538-45

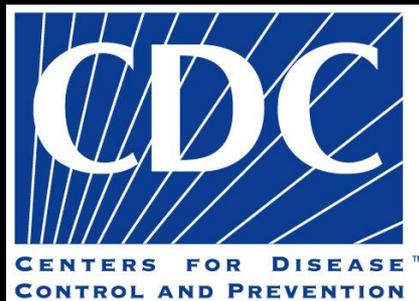
Change in Physical Fitness & All-Cause Mortality - ACLS



PA & Public Health: A Recommendation from CDC & ACSM

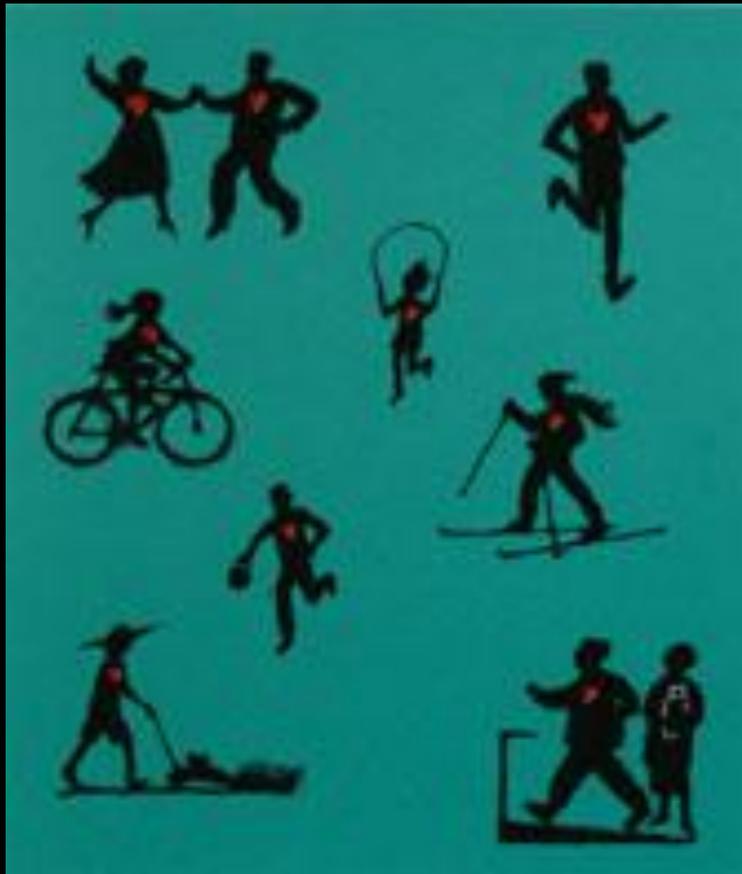
- Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week.

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



NIH Consensus Statement

Volume 13, Number 3
December 18-20, 1995



*Physical Activity and
Cardiovascular Health*

National Institutes of Health
Office of the Director

1996 – Physical Activity & Health

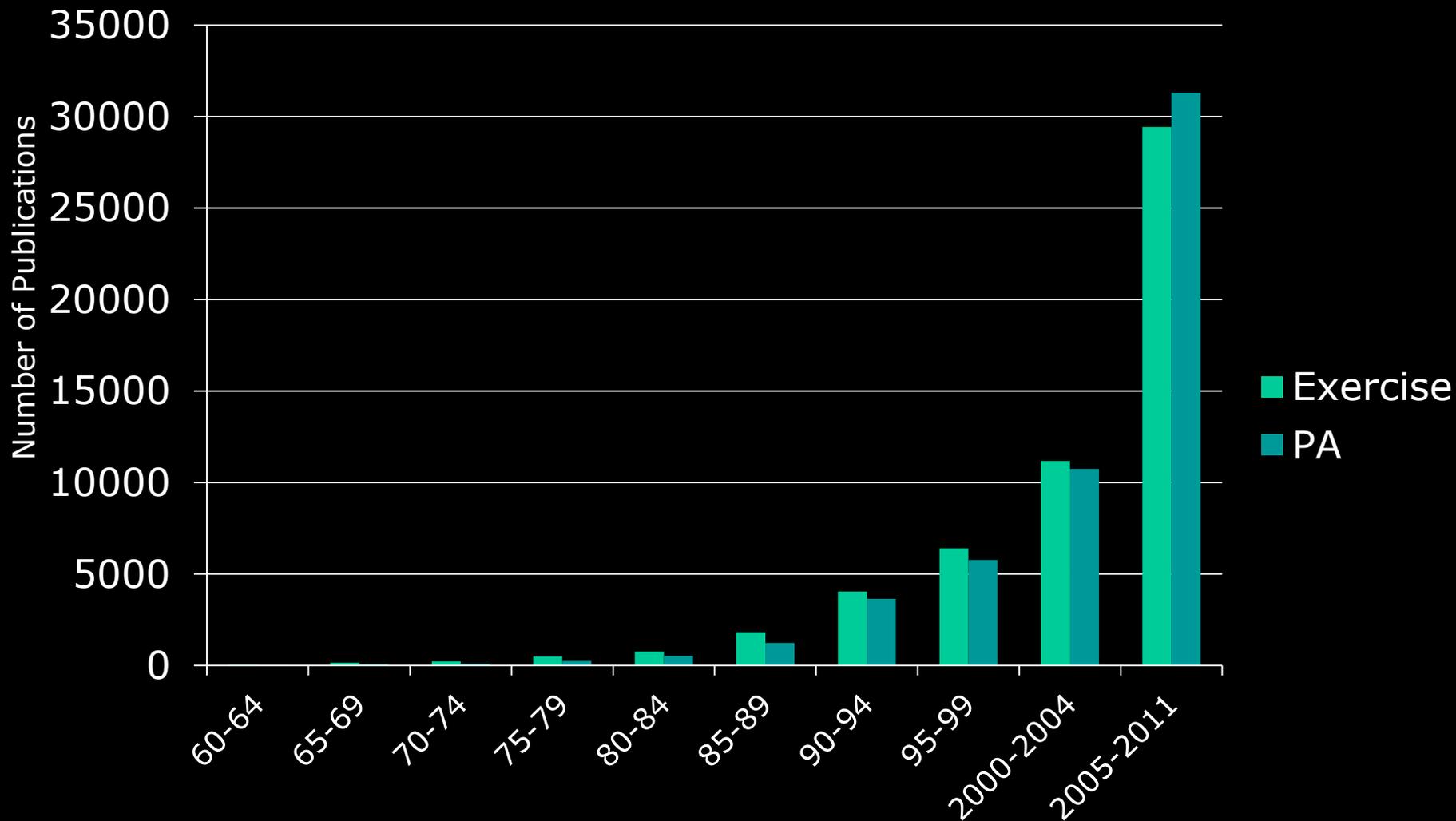
Physical Activity and Health

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 1960-2012

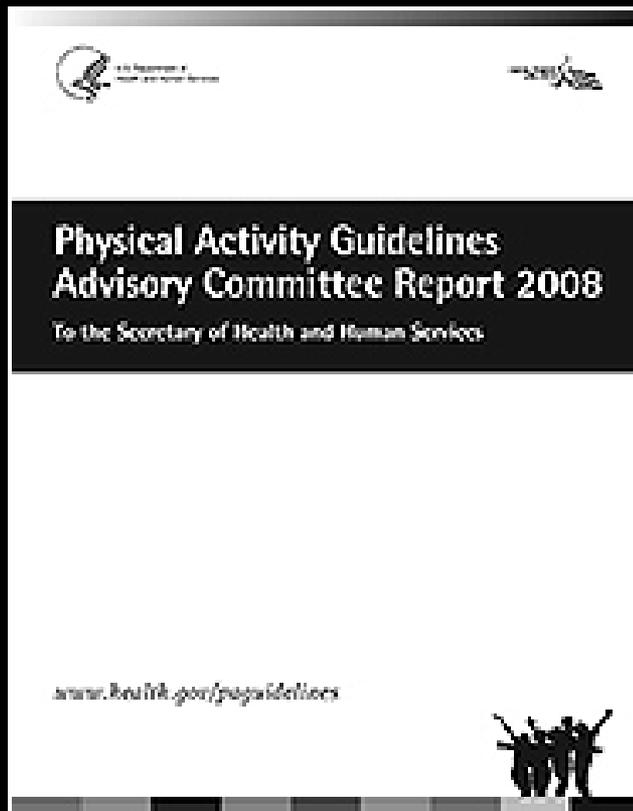
"Health and..."



What We Know About Physical Activity and Health



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>



U.S. Department of Health & Human Services

www.hhs.gov

Physical Activity Guidelines for Americans



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

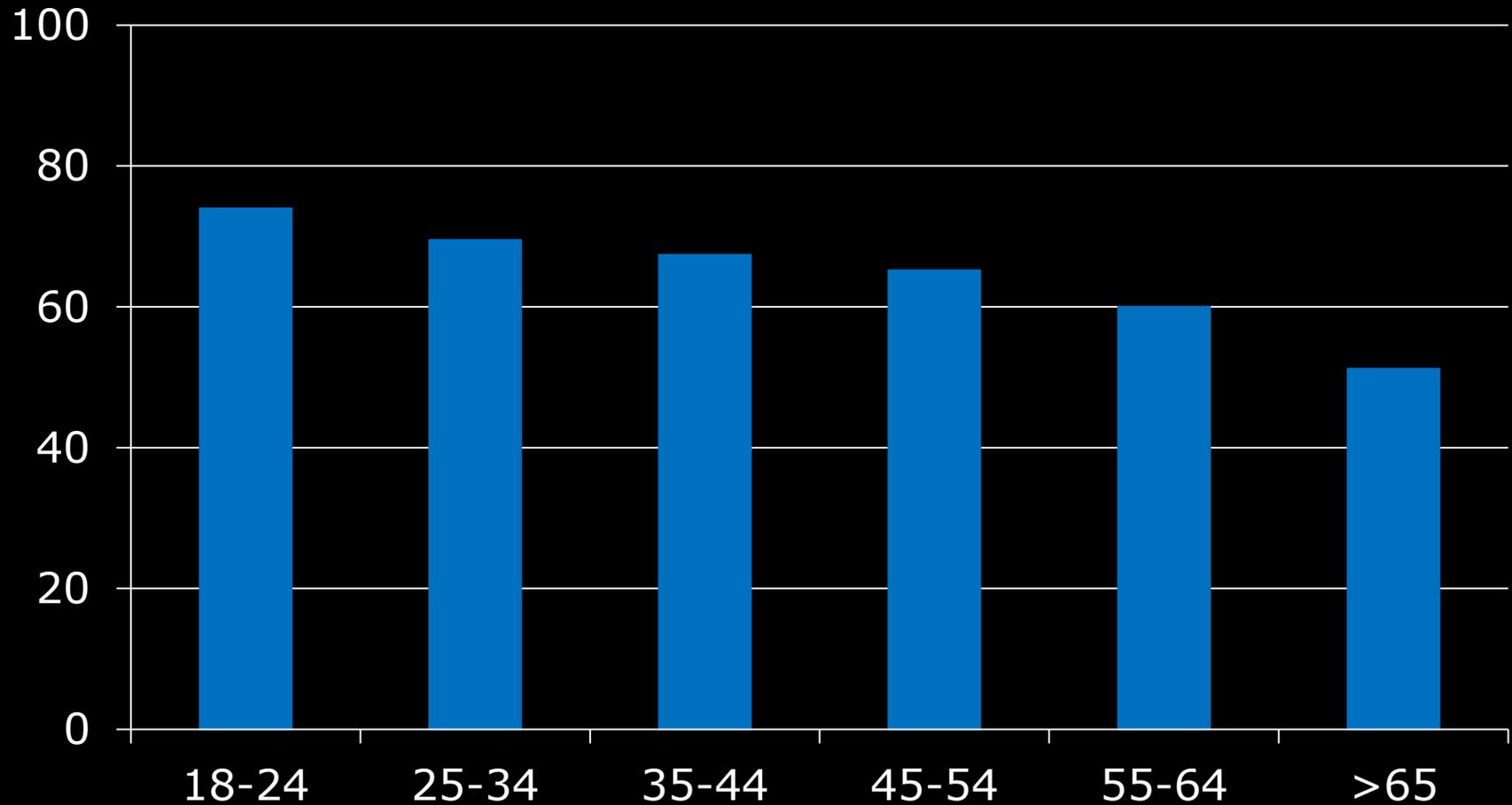


Children and Adolescents (6–17 years of age)

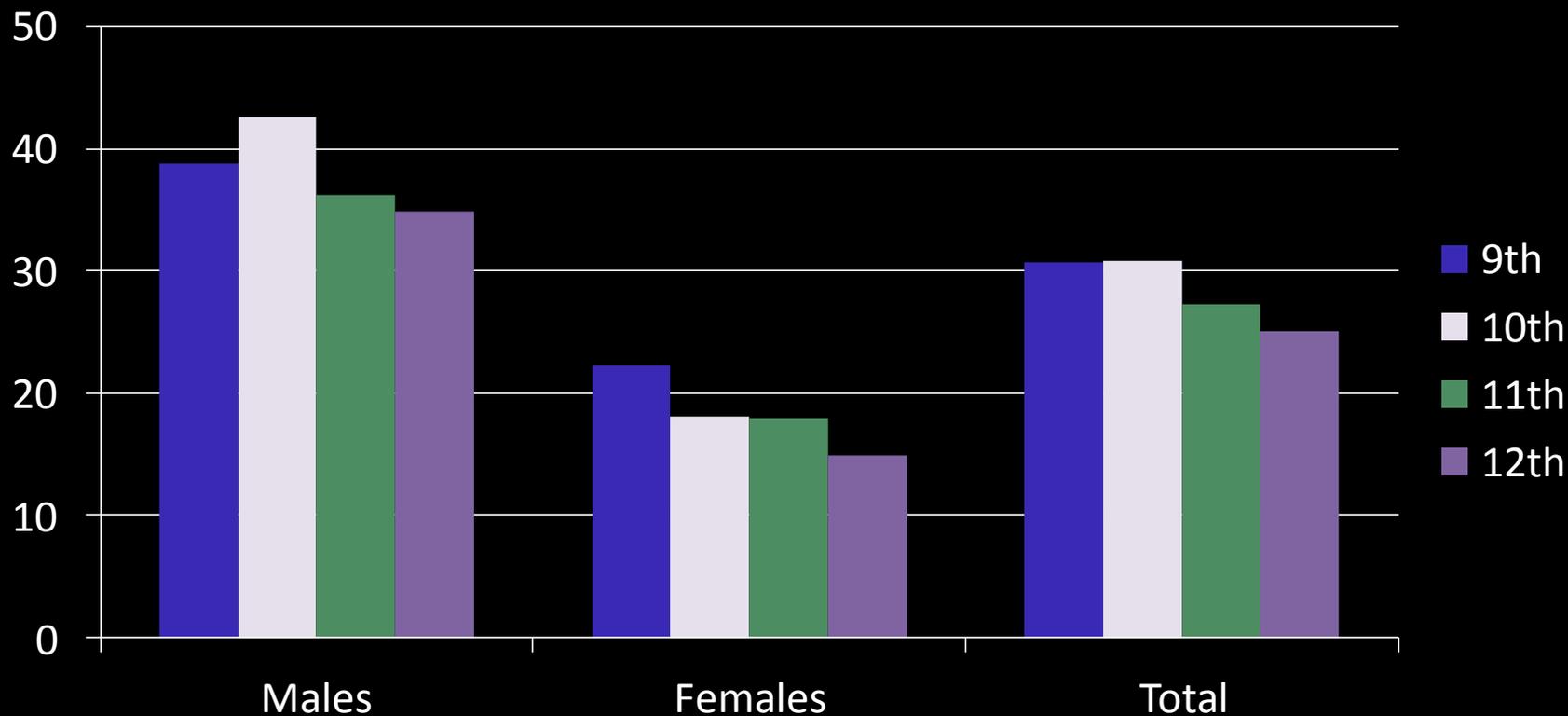
- ❑ **1 hour (60 minutes) or more of PA every day**
- ❑ Most of the 1 hour or more a day should be either moderate- or vigorous-intensity aerobic PA
- ❑ Vigorous-intensity PA at least 3 days per week
- ❑ Muscle-strengthening and bone-strengthening activity at least 3 days per week



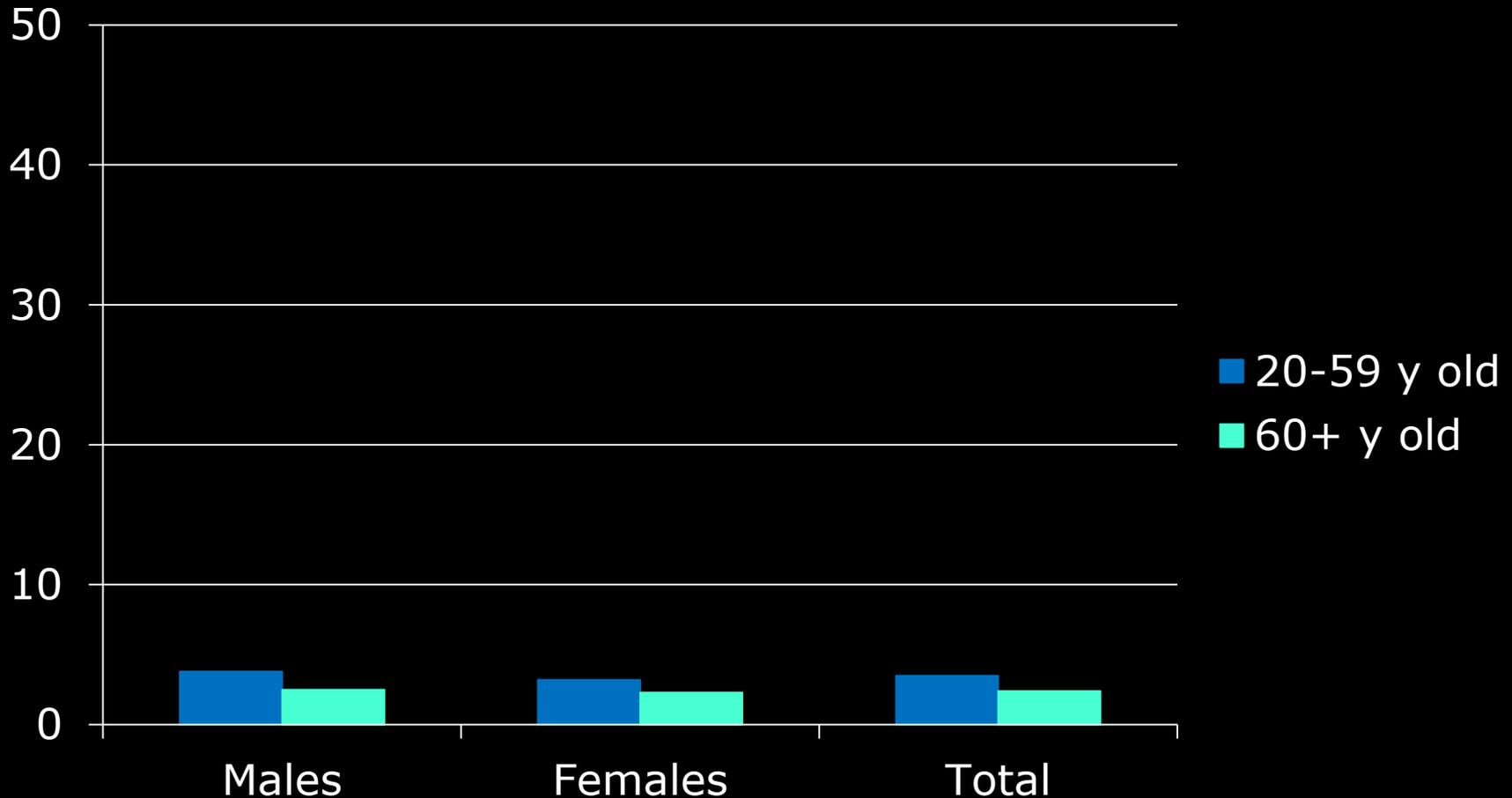
Adults: Prevalence of Meeting PA Recommendations – BRFSS 2007



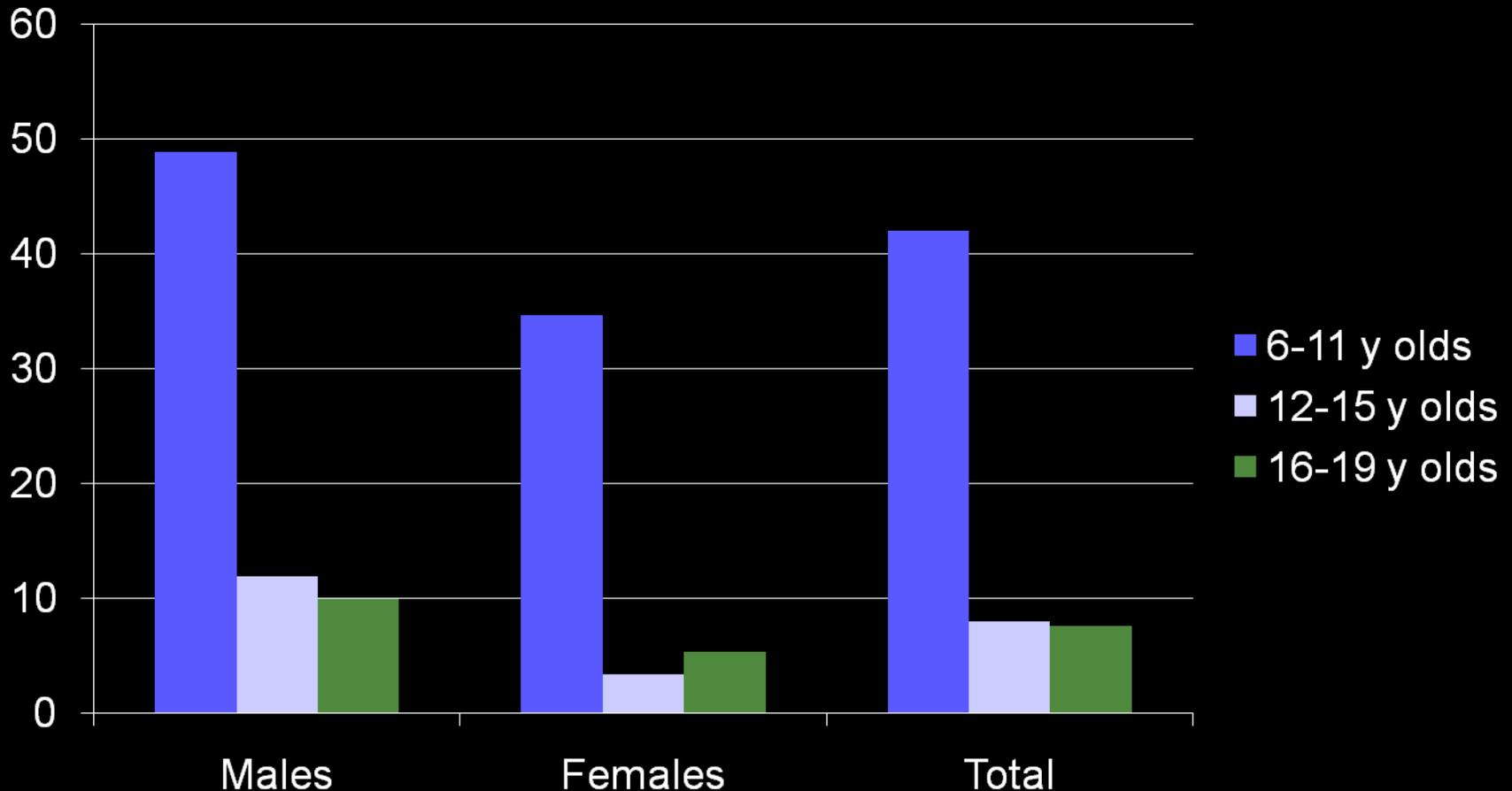
Youth: Prevalence of achieving 60 min/d of MVPA on all 7 days - YRBS 2010



Adults: Prevalence of Meeting PA Recommendations - Accelerometry



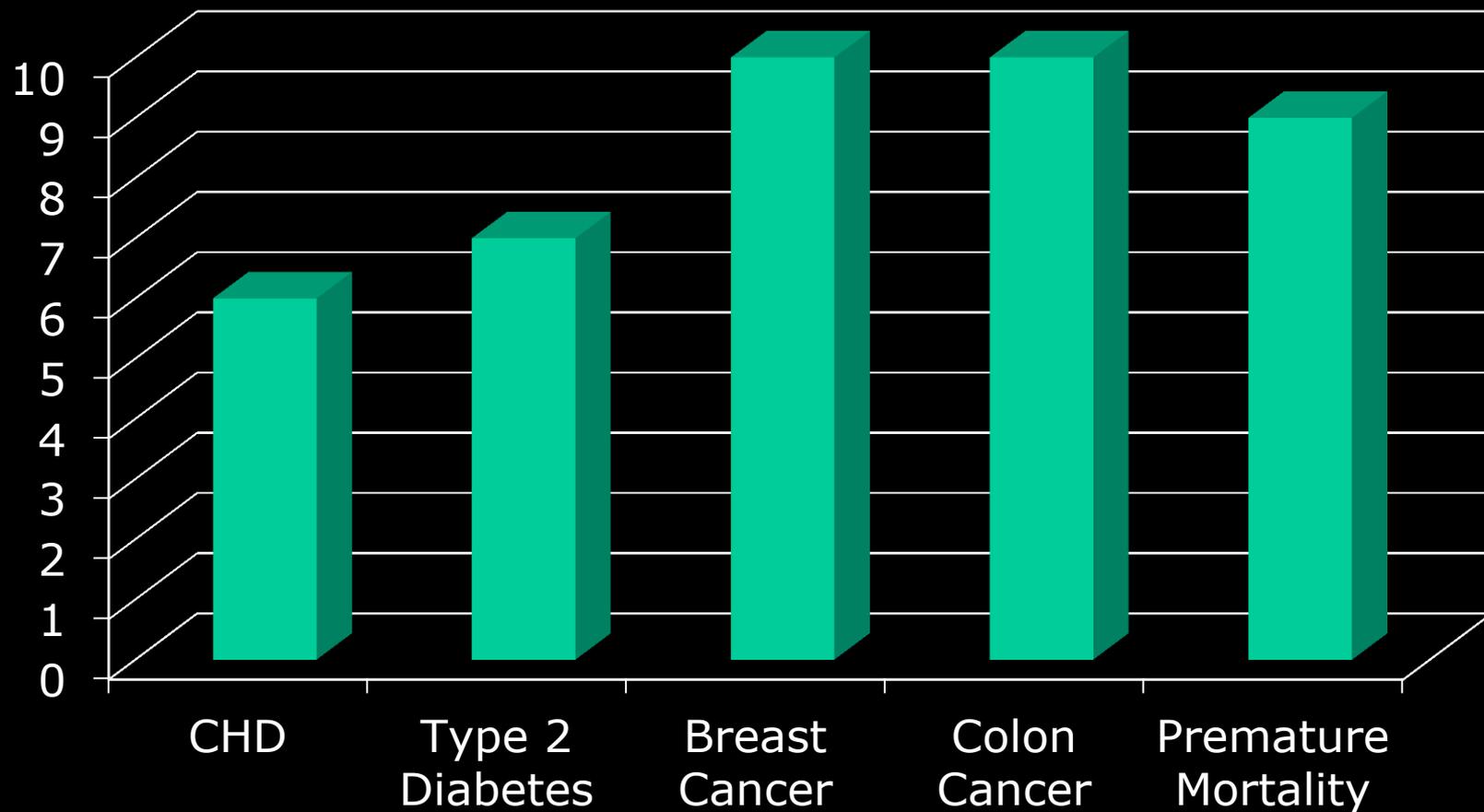
Youth: Prevalence of attaining 60 min of MVPA per day - Accelerometry



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

Percent Disease Burden Caused by Physical Inactivity, Worldwide, 2008



What We Know About Intervening to Increase Physical Activity



Guide to Community Preventive Services - 2002

Kahn EB, Ramsey LT, Brownson RC, Heath GW, Howze EH, Powell KE, Stone EJ, Rajab MW, Corso P, and the Task Force on Community Preventive Services. The Effectiveness of Interventions to Increase Physical Activity: A Systematic Review. *Am J Prev Med* 2002;22(4S):73-107.

Methods: *Guide to Community Preventive Services - 2002*

- Systematic review of the literature for PA interventions:
 - Individual approaches
 - Setting-specific interventions
 - Community-wide interventions
- Published between 1980 and 2000
- 94 studies included

Conclusions: *Guide to Community Preventive Services - 2002*

Informational Approaches to Increase PA:

- Strong Evidence:
 - Community-wide campaigns
- Sufficient Evidence:
 - Point-of-decision prompts
- Insufficient Evidence:
 - Mass media campaigns
 - Classroom-based health education focused on information provision

Conclusions: *Guide to Community Preventive Services - 2002*

Behavioral & Social Approaches to Increase PA:

□ Strong Evidence:

- School-based physical education
- Social support interventions in community settings
- Individually-adapted health behavior change programs

□ Insufficient Evidence:

- College-based health education and PE interventions
- Classroom-based health education focused on reducing TV and video game playing
- Family-based social support

Conclusions: *Guide to Community Preventive Services - 2002*

Environmental & Policy Approaches to Increase PA:

▣ Strong Evidence:

- Creation of or enhanced access to places for physical activity combined with informational outreach activities

Evidence-based Intervention in PA: Lessons from Around the World

Heath GW, Parra DC, Sarmiento OL, Andersen LB, Owen N, Goenka S, Montes F, Brownson RC. Evidence-based Intervention in Physical Activity: Lessons from Around the World. *The Lancet* 2012;380(9838):272-281.

Evidence-based Intervention in Physical Activity- Methods

- Systematic review of reviews
- Published between 2000 and 2011
- 100 reviews included:
 - School = 5
 - Workplace = 5
 - Community = 14
 - Clinical or primary care = 18
 - Several settings = 58

Evidence-based Intervention in Physical Activity- Conclusions

- Effective approaches:
 - Public communication & informational approaches
 - Community-wide campaigns
 - Mass media campaigns
 - Decision prompts encouraging use of stairs
 - Initiatives to increase social support for PA within communities, neighborhoods and worksites
 - Environmental and policy approaches can create or enhance access to places for PA
 - Urban design of land use
 - Planning at community and street scales
 - Active transport policies and practices

PAG Mid-course Report: Strategies to Increase PA among Youth

Physical Activity Guidelines for Americans
Midcourse Report Subcommittee of the
President's Council on Fitness, Sports &
Nutrition. *Physical Activity Guidelines for
Americans Midcourse Report: Strategies to
Increase Physical Activity Among Youth.*
Washington, DC: U.S. Department of
Health and Human Services, 2012.

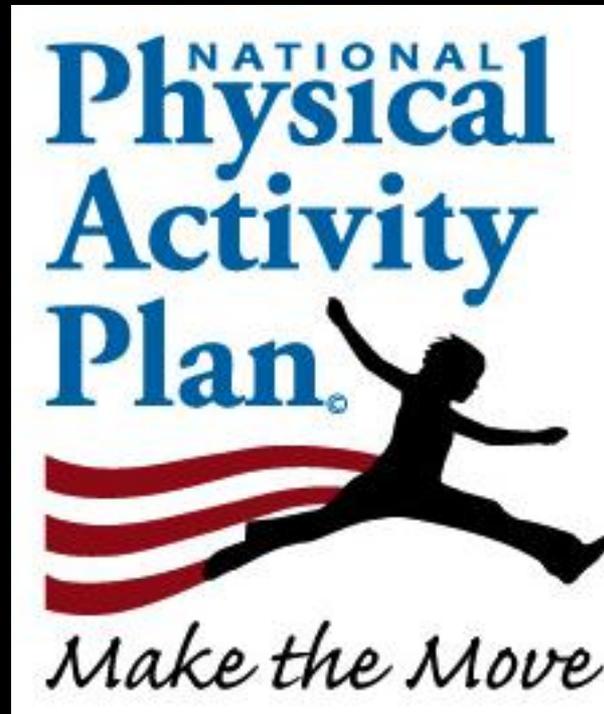
PAG Mid-course Report: Strategies to Increase PA among Youth

- Systematic review of reviews
- Youth ages 3-17 years
- Published between Jan 2001 and July 2012
- 31 reviews included:
 - Schools
 - Preschools and childcare facilities
 - Community
 - Family and home
 - Primary care

PAG Mid-course Report: Strategies to Increase PA among Youth

Intervention Type	Conclusion
Multi-Component School Intervention	Sufficient
Physical Education	Sufficient
Active Transportation	Suggestive
Activity Breaks	Emerging
School Physical Environment	Insufficient
After School	Insufficient
Preschool & Childcare Center	Suggestive
Built Environment	Suggestive
Camps & Youth Organizations	Insufficient
Other Community Programs	Insufficient
Home & Family	Insufficient
Primary Care	Insufficient

National Physical Activity Plan

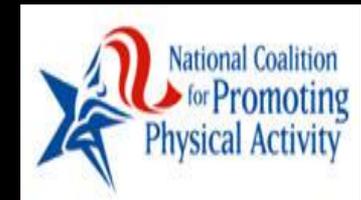
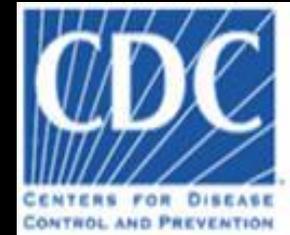
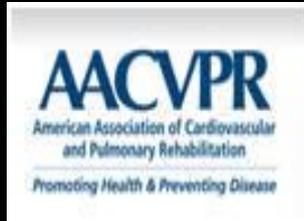


<http://www.physicalactivityplan.org>

What is a Physical Activity Plan?

A comprehensive set of strategies including policies, practices, and initiatives aimed at increasing physical activity in all segments of the population.

Organizational Partners



**American Academy
of Pediatrics**

**American Medical
Association**

**American Diabetes
Association**

8 Sectors of the National PA Plan



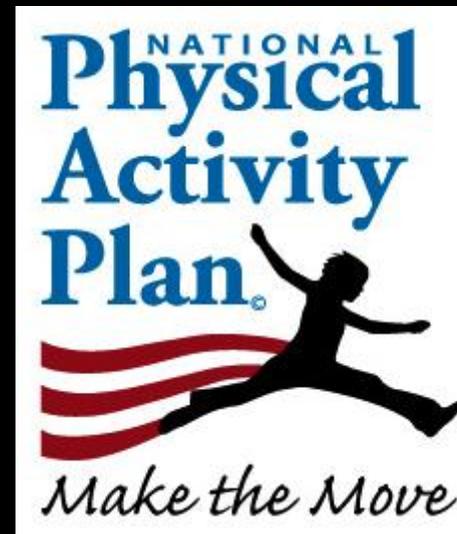
- Public Health
- Education
- Volunteer & Not for Profit Organizations
- Transportation, Urban Design, Community Planning
- Mass Media
- Healthcare
- Business & Industry
- Parks, Recreation, & Sports



Content of the Plan

Sector-specific Strategies & Tactics

- 52 Strategies
- 215 Tactics



Education



- ❑ Provide access to & opportunities for high-quality, comprehensive PA programs, anchored by PE, in pre-K through grade 12 educational settings.
- ❑ Ensure that the programs are physically active, inclusive, safe, & developmentally & culturally appropriate.

Business & Industry



- ❑ Identify, summarize, and disseminate best practices, models, and evidence-based PA interventions in the workplace
 - ❑ Cognitive and behavioral interventions
 - ❑ Environmental changes that support and encourage PA (e.g. shower facilities)
 - ❑ Policies that encourage workers to be physically active (e.g. flex time, lunch time walking groups)

Parks, Recreation, Fitness, & Sports



- ▣ Increase joint use agreements between parks and recreation, schools and youth serving organizations through workshops and presentations.

Health Care

- ❑ Increase by 10% targeted healthcare organizations that encourage members to assess and counsel patients on physical activity.



Research Needs

- Program evaluation
- Efficacy studies
- Translation
 - Dissemination
 - Implementation
- NIH-wide coordination

