

# ***Guiding the Public About Physical Activity and Health— Key Themes and Messages***

## ***R. Tait McKenzie Memorial Lecture***

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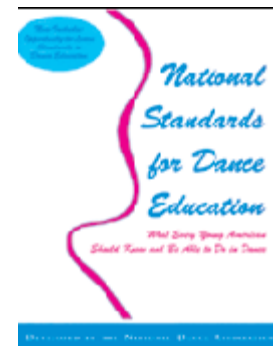
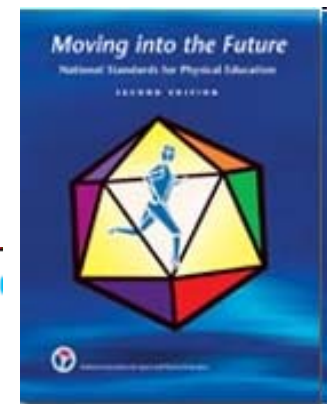
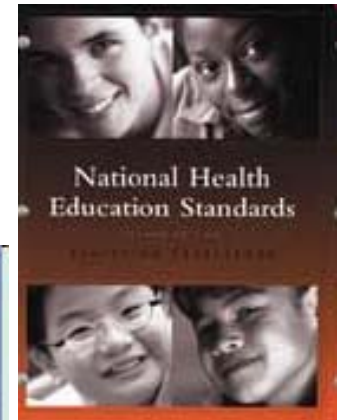
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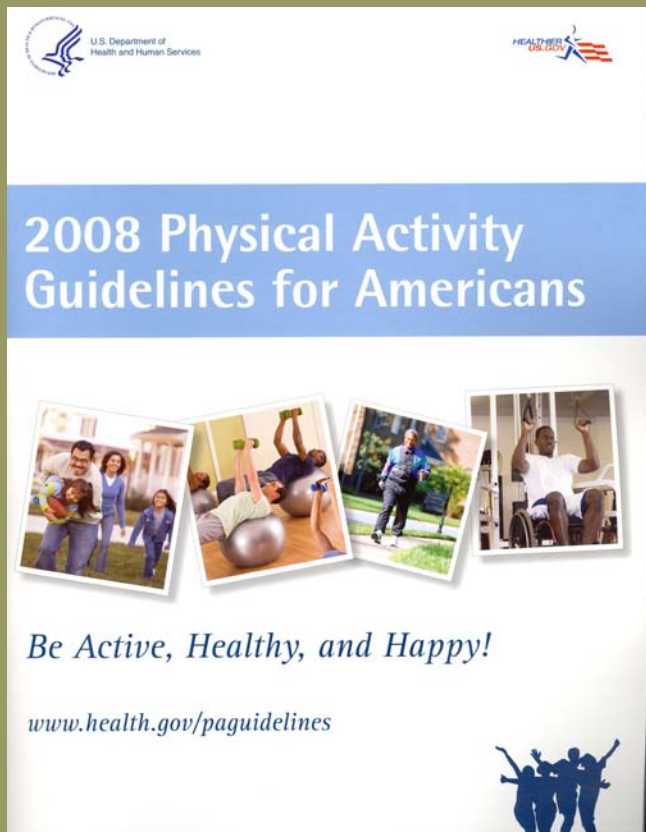
16 March 2010

# Proliferation of Guidelines

- National Guidelines Clearinghouse (AHRQ) contains 2356 separate clinical practice guidelines (12 Mar 2010)
- 1995 SG report Physical Activity & Health found 33 PA guidelines issued just between 1965-1996
- Relevant to AAHPERD, whose associations develop standards and position statements, including national guidelines



# 2008 Physical Activity Guidelines for Americans



- First national PA guidelines by HHS
- Based upon extensive evidence review
- Comprehensive
  - Children age 6+, adolescents, adults, older adults, pregnant and postpartum women, people with disabilities and chronic conditions
  - Guidance on all types of physical activity



# Brief summary of PA Guidelines: Consistent guidance over time

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- 2008 Guidelines affirm long-standing public health recommendations:
  - Adults should do at least 150 min of moderate-intensity PA each week (or an equivalent amount of MVPA)
  - Accumulate from multiple bouts
  
- Strong evidence for important health benefits
  - Guidelines list 23 distinct health benefits in adults

# With some differences compared to other guidelines

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- ❑ More flexibility on frequency of aerobic PA
- ❑ Set intensity using either absolute or relative intensity
- ❑ Muscle-strengthening activities recommended
- ❑ Balance training to reduce falls in older adults
- ❑ Daily activity for children (not 5+ days/week)
- ❑ Specific guidelines for prevention in people with chronic conditions and disabilities
- ❑ Flexibility activities acceptable but not a guideline.
- ❑ *2005 Dietary Guidelines* on weight management and PA not endorsed
- ❑ Clear statement that healthy children and adults do not need “physician approval” or consultation prior to engaging in PA
- ❑ Substantial attention to preventing adverse events

# Objectives:

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- ❑ Provide insight into the development of the *2008 Physical Activity Guidelines for Americans*
- ❑ Understand the basis for, and importance of, certain differences among existing physical activity guidelines
- ❑ Discuss some of the evidence that physical activity has remarkably strong health benefits



# Controversy and Public Health Guidelines

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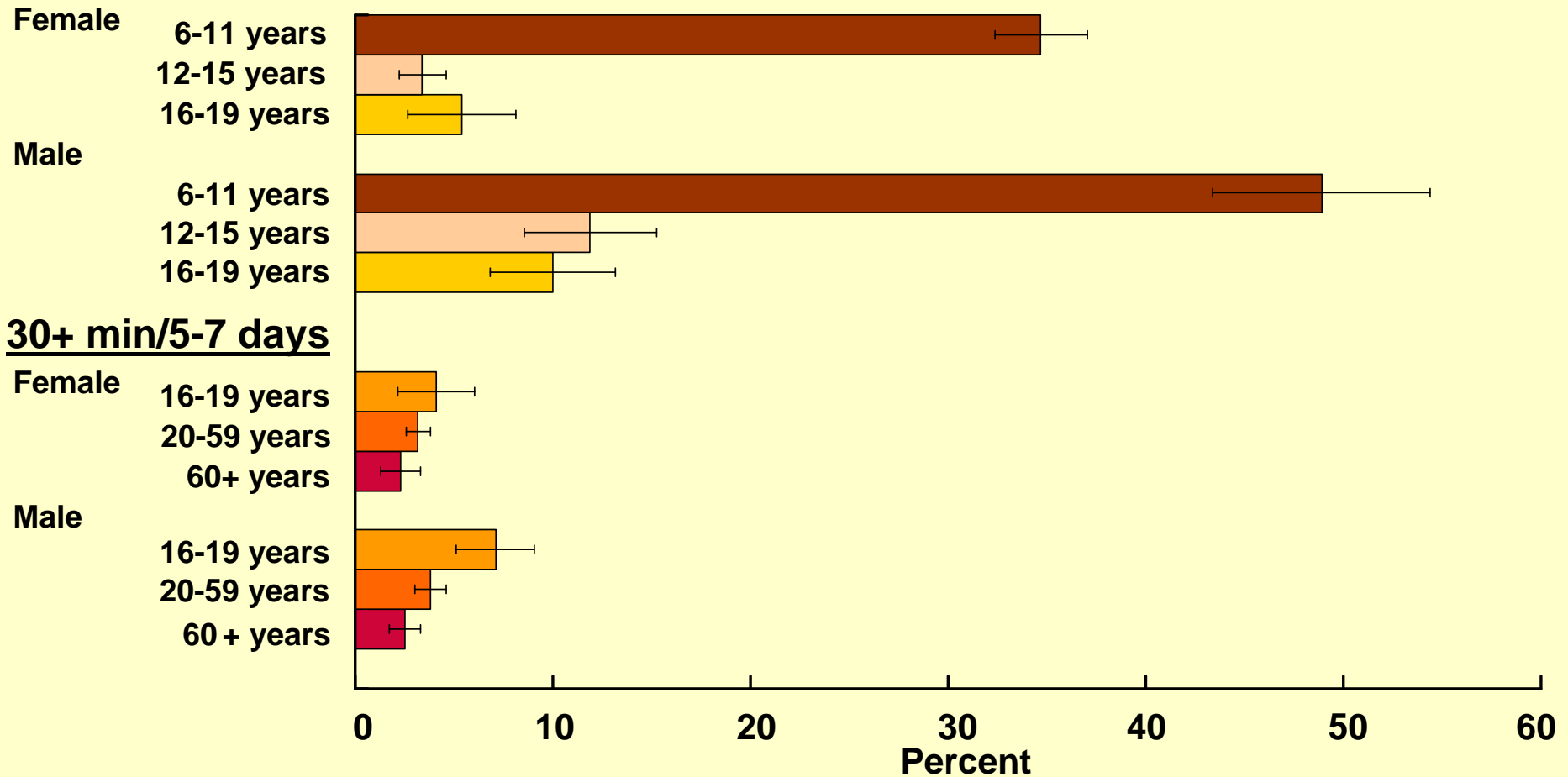
- Disagreements in guidelines can move beyond scientific forums into public view.
  - 1977 McGovern Report, “Dietary Goals for the United States” supported by AHA and not by AMA. “Individuals, organizations, and other interest groups quickly chose sides.” Food & Nutrition Board then issues more moderate recommendations, but some members accused of conflict of interest.\*
  - U.S. Senate resolution 47 (1997) asks NIH to reconsider breast cancer screening guideline in women age 40-49.
    - NIH revised recommendation to mammography every 1-2 yrs \*\*
    - This disagrees w current US Preventive Services Task Force position
  - 2003 IOM statement that 60 minutes of MVPA is needed for a healthy weight generates controversy/confusion as to whether 30 min/day or 60 min/day is core public health recommendation.

\* Swenerton & Dunkley. *J Dairy Sci* 1982;65:484-487.

\*\*Brownson et al. *Evidence-based Public Health*.

# Recommended (Old Recs) Levels of Physical Activity

## 60+ min/5-7 days



Note: Adherence: for ages 6–19 years - 60 or more minutes of moderate- or greater-intensity activity on 5 of 7 days; for ages 16 years and older – 30 or more minutes of moderate- or greater-intensity activity on 5 of 7 days, accumulated in 10-min “bouts.” I = 95% confidence interval.  
 Source: Troiano, RP, et al. Physical Activity in the United States Measured by Accelerometer. *Medicine & Science in Sports & Exercise*. 2008, 40(1): 181-188. National Health and Nutrition Examination Survey (NHANES), NCHS, CDC.





# Three parts of a public health guideline process

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## □ **Evidence statements**

- Based upon systematic review
- Mainly for scientists

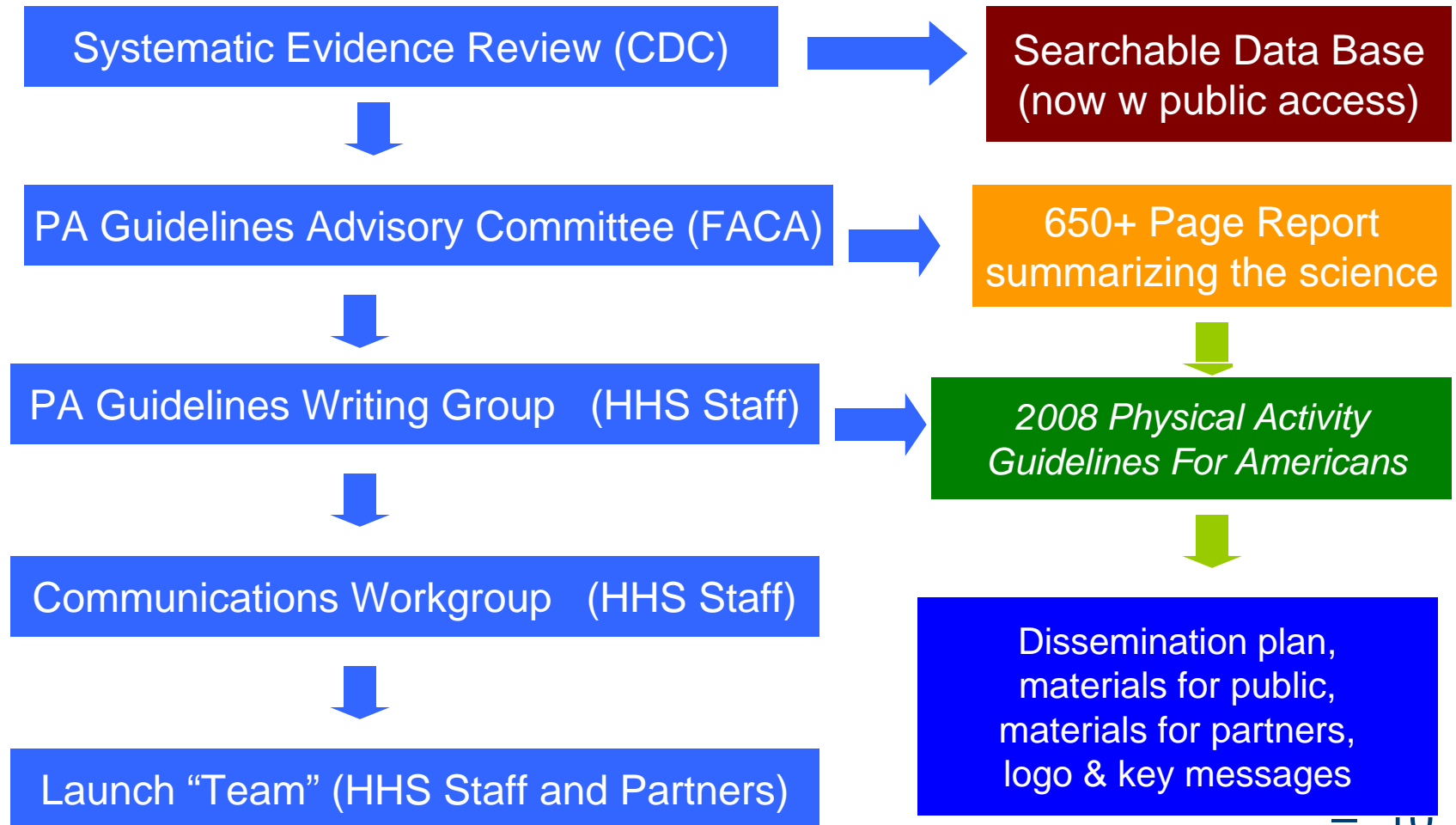
## □ **Guidelines**

- Translate evidence into guidelines for public practice – usually with “key” guidelines that identify the most important content
- Mainly for practitioners

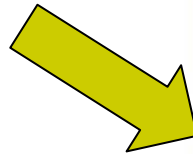
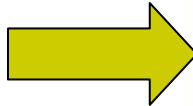
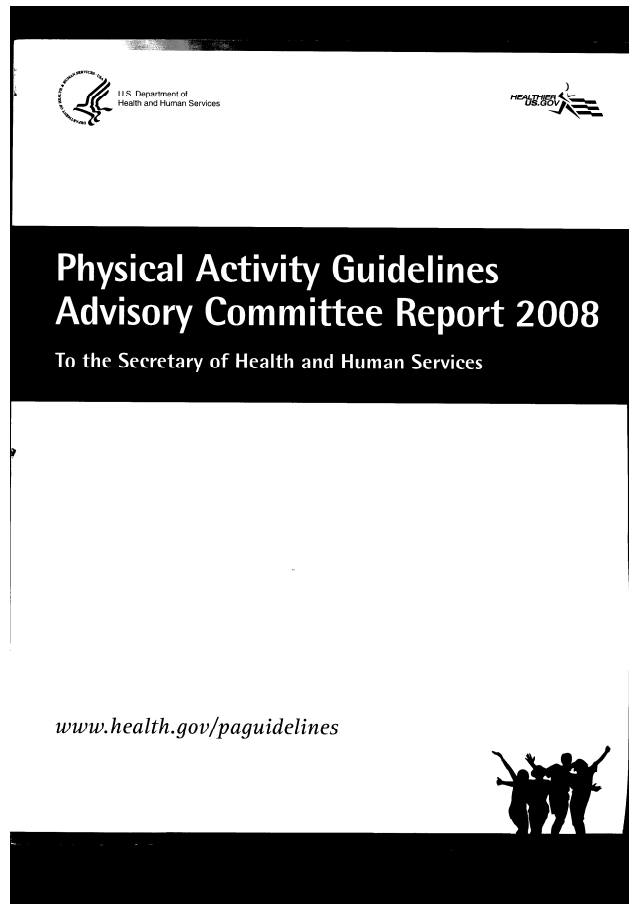
## □ **Messages**

- Seek to communicate the guidelines
- Mainly for public

# Process for Developing PA Guidelines



# The guidelines task: Translate 683 pages of science (size of phonebook) to key guidelines + explanations



## Key Guidelines for Adults

- All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.
- For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.
- For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes (5 hours) a week of moderate-intensity, or 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity. Additional health benefits are gained by engaging in physical activity beyond this amount.
- Adults should also do muscle-strengthening activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits.

## Key Guidelines for Children and Adolescents

- Children and adolescents should do 60 minutes (1 hour) or more of physical activity daily.
  - **Aerobic:** Most of the 60 or more minutes a day should be either moderate- or vigorous-intensity aerobic physical activity, and should include vigorous-intensity physical activity at least 3 days a week.
  - **Muscle-strengthening:** As part of their 60 or more minutes of daily physical activity, children and adolescents should include muscle-strengthening physical activity on at least 3 days of the week.
  - **Bone-strengthening:** As part of their 60 or more minutes of daily physical activity, children and adolescents should include bone-strengthening physical activity on at least 3 days of the week.
- It is important to encourage young people to participate in physical activities that are appropriate for their age, that are enjoyable, and that offer variety.

# Children and Adolescents (ages 6-17)

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- 60 or more minutes of physical activity daily
  - Aerobic: Most of the 60 or more minutes per day should be either moderate- or vigorous-intensity aerobic physical activity. Include vigorous-intensity physical activity at least 3 days per week.
  - Muscle-strengthening: Include muscle-strengthening physical activity on at least 3 days of the week, as part of the 60 or more minutes.
  - Bone-strengthening: Include bone-strengthening physical activity on at least 3 days of the week, as part of the 60 or more minutes.
  
- Encourage participation in physical activities that are:
  - Age appropriate, enjoyable, and offer variety

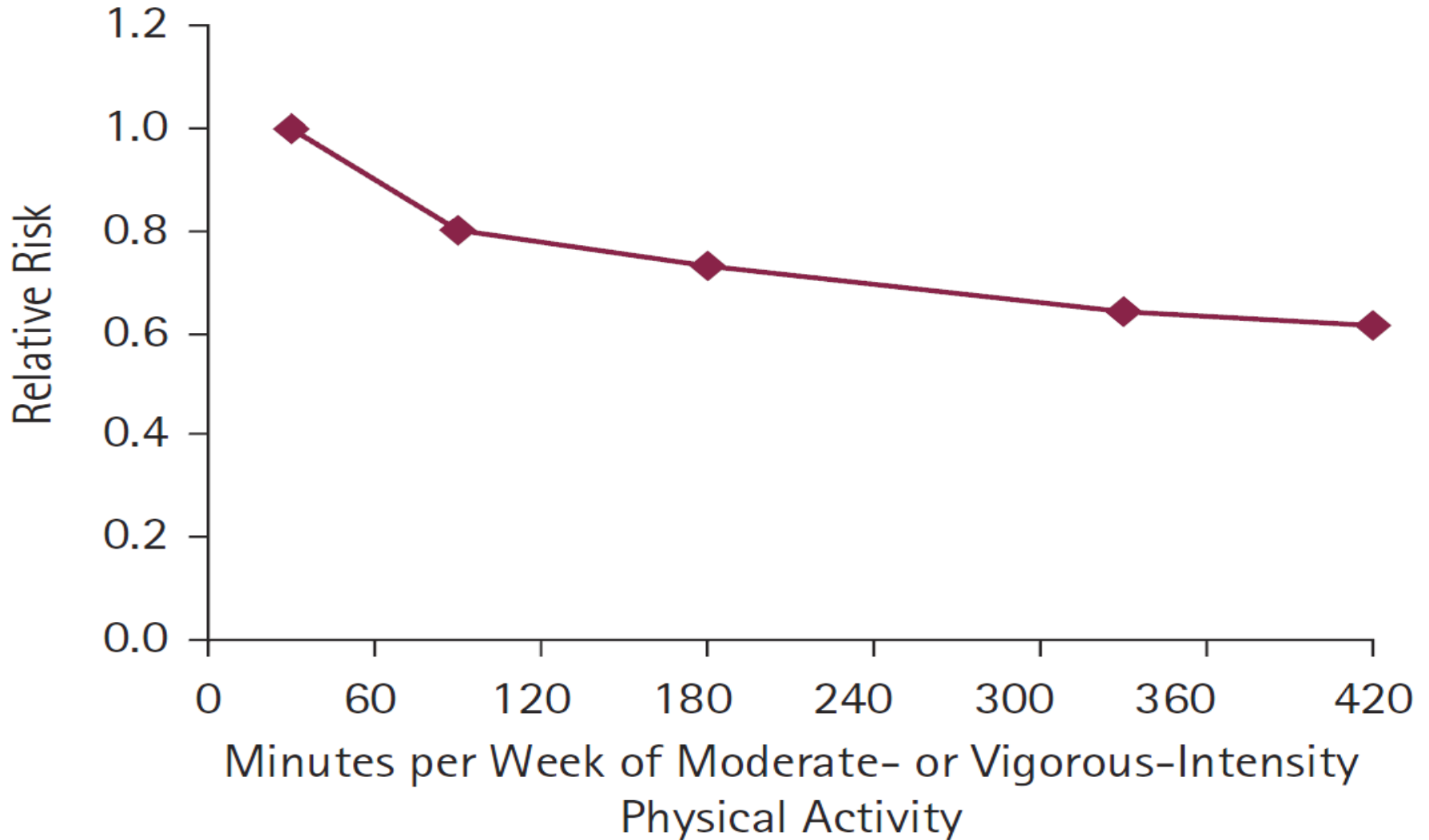


# Example of evidence statements to translate into guidelines

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- Volume of MVPA is the most important determinant of health benefits
  - Volume = total weekly amount – product of frequency x duration x intensity
  - MVPA = moderate to vigorous PA, where moderate=3.0-5.9 METs, vigorous=6.0+ METs
  - Volume of 500-1000 MET-min/week produces substantial health benefits;
    - Greater benefits from higher volumes but decreasing marginal benefit
    - Some benefit from lower volumes
    - Some health benefits require more activity than others
  
- Insufficient evidence that vigorous aerobic PA provides additional benefits compared to moderate-intensity PA; insufficient evidence on importance of frequency

# The Risk of Dying Prematurely Declines as People Become Physically Active



# The translation task involved:

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- Translate MET-minutes
  - PAGAC report: 150/min of moderate-intensity ~ 500 Met-min/week
- Communicate dose response
  - PA guidelines usually stipulate only the minimum recommended amount (e.g. 30 min x 5 days)
  - People misinterpret minimum as the target
  - (Note dietary guidance focusing more on communicating dose-response with fruits and vegetable consumption)
- Address both moderate-intensity & vigorous intensity activities
  - $3.0 \text{ METs} \times 150 \text{ min} = 6.0 \text{ METs} \times 75 \text{ minutes}$
  - Rule of thumb—2 minutes moderate = 1 minute vigorous

# 500-1000 MET-min became defined as a medium amount of activity\*

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## Classification of Total Weekly Amounts of Aerobic Physical Activity Into Four Categories

Levels of Physical Activity	Range of Moderate-Intensity Minutes a Week	Summary of Overall Health Benefits	Comment
Inactive	No activity beyond baseline	None	Being inactive is unhealthy.
Low	Activity beyond baseline but fewer than 150 minutes a week	Some	Low levels of activity are clearly preferable to an inactive lifestyle.
Medium	150 minutes to 300 minutes a week	Substantial	Activity at the high end of this range has additional and more extensive health benefits than activity at the low end.
High	More than 300 minutes a week	Additional	Current science does not allow researchers to identify an upper limit of activity above which there are no additional health benefits.

\*avoiding “moderate amount of activity” prevented confusion with “moderate-intensity” PA



# Inactivity

- “All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.”



# Substantial Health Benefits Guideline

- “For substantial health benefits, adults should do:
  - at least **150 minutes** (2.5 hours) a week of moderate-intensity aerobic activity
  - OR
  - **75 minutes** (1.25 hours) a week of vigorous-intensity aerobic physical activity
  - OR
  - an **equivalent combination** of moderate- and vigorous-intensity aerobic activity.”
- “Aerobic activity should be performed
  - in episodes of at least 10 minutes,
  - And preferably, it should be spread throughout the week.”

# Comment on frequency recommendation

- Insufficient evidence on frequency, but
  - “Spread throughout the week” is in the key guideline
  - Supporting text recommends 3 days/week as minimum frequency
- WHY?
  - Felt we needed to be specific about what “spread throughout the week” meant.
  - Know that 3 days/week produces health benefits (RCT’s)
  - Concern about injury risk with only 1 or 2 days/week
  - In observational studies, sufficiently active people usually spread the activity throughout the week.

# Additional & More Extensive Health Benefits Guideline

- “For additional and more extensive health benefits, adults should increase their aerobic physical activity to:
  - **300 minutes** (5 hours) a week of moderate-intensity,  
OR
  - **150 minutes** a week of vigorous-intensity aerobic physical activity  
OR
  - **an equivalent combination** of moderate- and vigorous-intensity activity.”
- “Additional health benefits are gained by engaging in physical activity beyond this amount.”

# Comments on Additional Health Benefits Guideline

- As total activity increases from 150 to 300 minutes of moderate-intensity PA/week, two things happen:
  - ***Additional*** benefits accrue, e.g. lower risk of breast cancer
  - ***More extensive*** benefits accrue, e.g., risk of heart disease is significantly lower with 300 minutes/week compared to 150 minutes/week



# Three themes in disagreements on PA guidelines

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- Incomplete science
  - Importance of volume MVPA vs volume of ALL activity (activity energy expenditure)
  
- Role of exercise science/physical fitness
  
- Philosophy (or Framework)
  - Obesity
  - Youth

# Corollary

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- Issue of total MVPA versus Total PA is essentially:
  - Does less sitting/lying and consequently more light-intensity activity energy expenditure affect health, independent of amount of MVPA?
  - Conceptually, this issue = importance of NEAT
    - NEAT = non-exercise activity thermogenesis
    - (IMHO, use of “exercise” is misleading term)

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- What was the Surgeon General's recommendation for physical activity released in the 1990's?



# The unnoticed disagreement in total volume vs MVPA volume in 1995-96

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- 1996 SG report major conclusions:
  - #2 “Significant health benefits can be obtained by including a moderate amount of physical activity (e.g. 30 minutes of brisk walking or raking, 15 minutes of running, or 45 minutes of playing volleyball) on most, if not all, days of the week.
  - #3 “Additional health benefits can be gained through greater amounts of physical activity.”
  
- 1995 CDC/ACSM recommendation
  - Every U.S. adult should engage in at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week.

# From SG Report “At A Glance”

“A moderate amount of physical activity is roughly equivalent to physical activity that uses approximately 150 Calories (kcal) of energy per day, or 1,000 Calories per week.

## EXAMPLES OF MODERATE AMOUNTS OF ACTIVITY

Washing and waxing a car for 45–60 minutes

Washing windows or floors for 45–60 minutes

Playing volleyball for 45 minutes

Playing touch football for 30–45 minutes

Gardening for 30–45 minutes

Wheeling self in wheelchair for 30–40 minutes

Walking 1 <sup>3</sup>/<sub>4</sub> miles in 35 minutes (20 min/mile)

Basketball (shooting baskets) for 30 minutes

Bicycling 5 miles in 30 minutes

Dancing fast (social) for 30 minutes

Pushing a stroller 1 <sup>1</sup>/<sub>2</sub> miles in 30 minutes

Raking leaves for 30 minutes

Walking 2 miles in 30 minutes (15 min/mile)

Water aerobics for 30 minutes

Swimming laps for 20 minutes

Wheelchair basketball for 20 minutes

Basketball (playing a game) for 15–20 minutes

Bicycling 4 miles in 15 minutes

Jumping rope for 15 minutes

Running 1 <sup>1</sup>/<sub>2</sub> miles in 15 minutes (10 min/mile)

Shoveling snow for 15 minutes

Stairwalking for 15 minutes

Less Vigorous,  
More Time



More Vigorous,  
Less Time

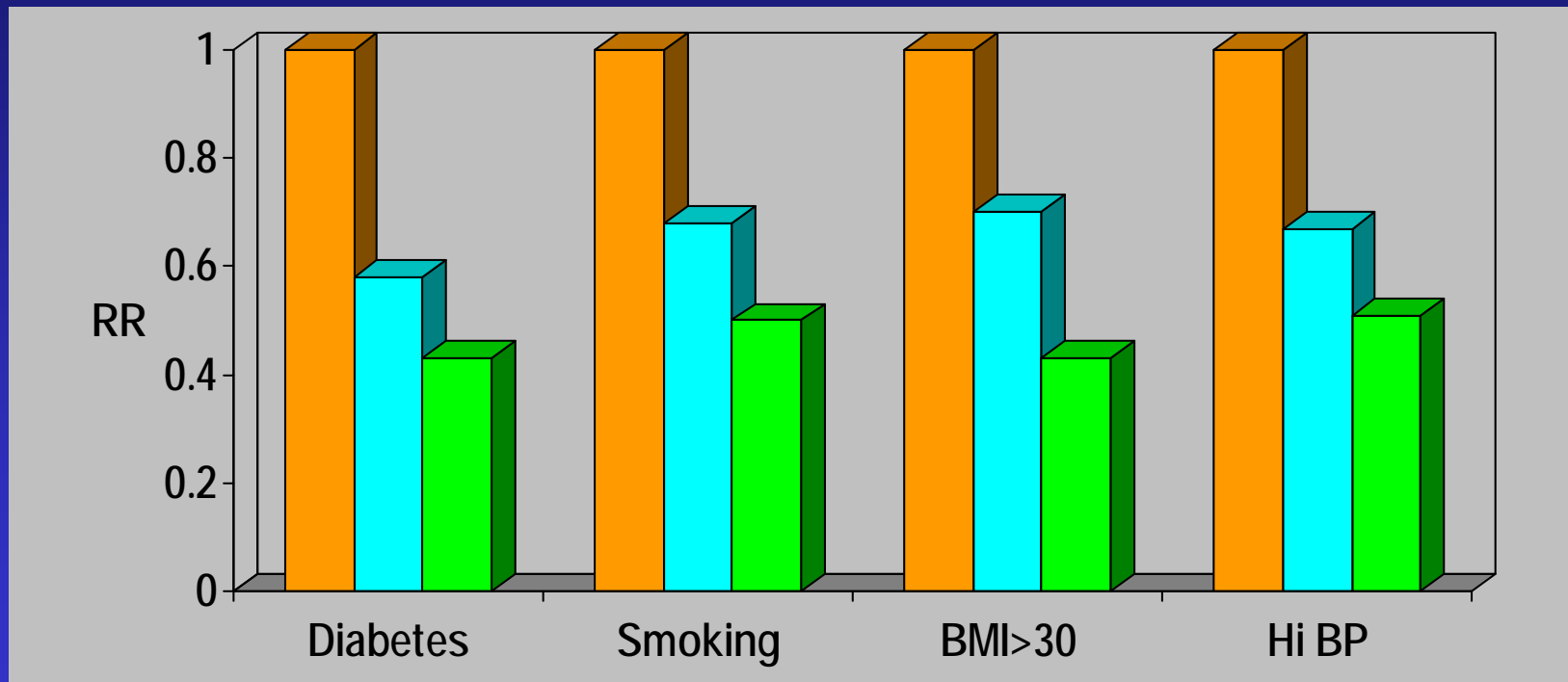
# PA Guidelines and Pedometers Programs

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- Some pedometer programs are based upon total caloric expenditure
  - A target of 10,000 steps/day based upon calculation that this requires 2000 Kcal/week [Ainsworth et al. BJSM 2009].
  - Simply counting steps ignores intensity and bout duration
- Pedometer programs can be effective
  - IMHO, they help people meet guidelines, but step targets per se are not a PA guideline
- In this context, issue could be phrased:
  - “Every step counts, but some count more than others.”

# Endurance Capacity (Fitness) and Mortality In Older Men

■ <5 MET (n=1575) ■ 5-8 MET (n=1885) ■ > 8 MET (n=2743)



Myers. NEJM 2002;346;793-801.





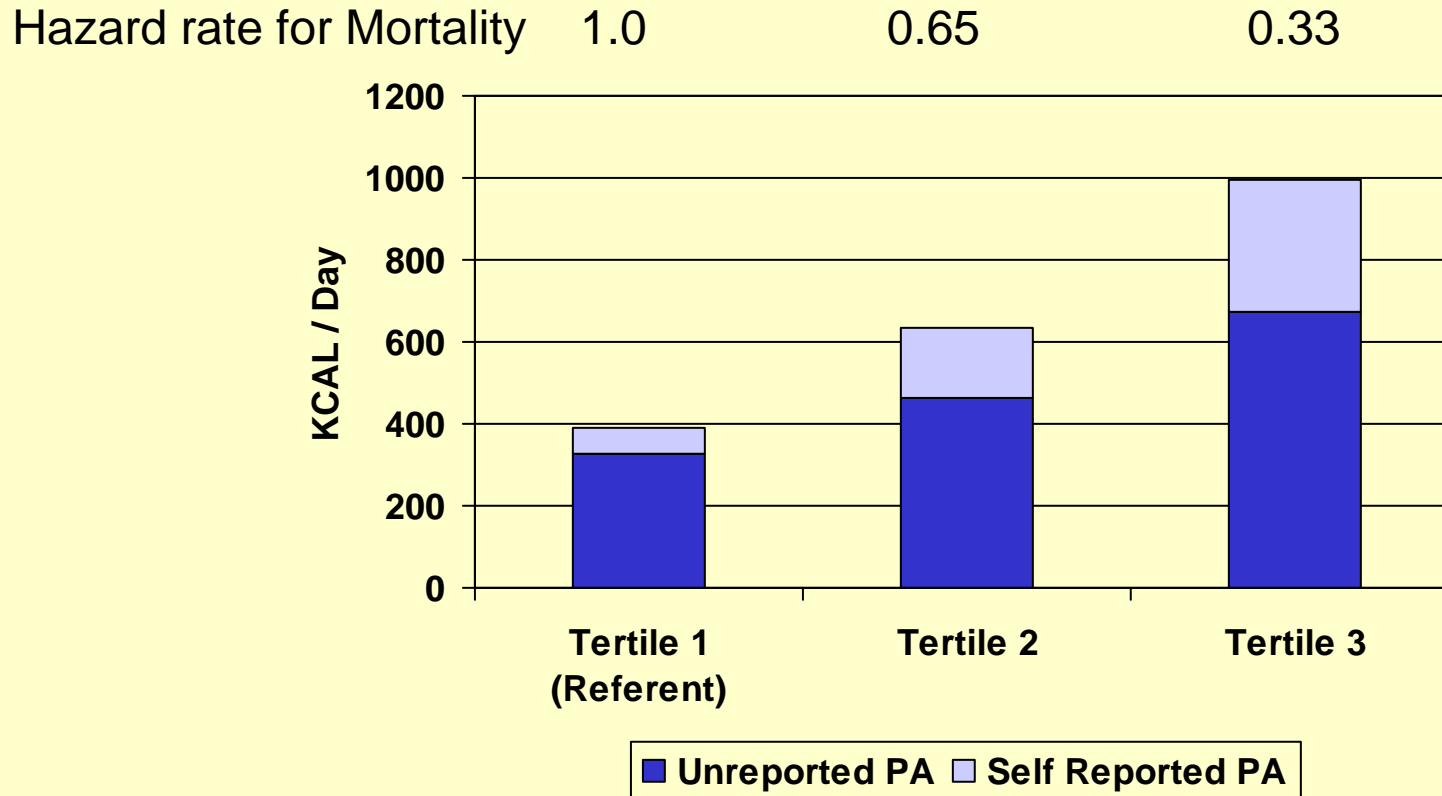
# Arguments for MVPA

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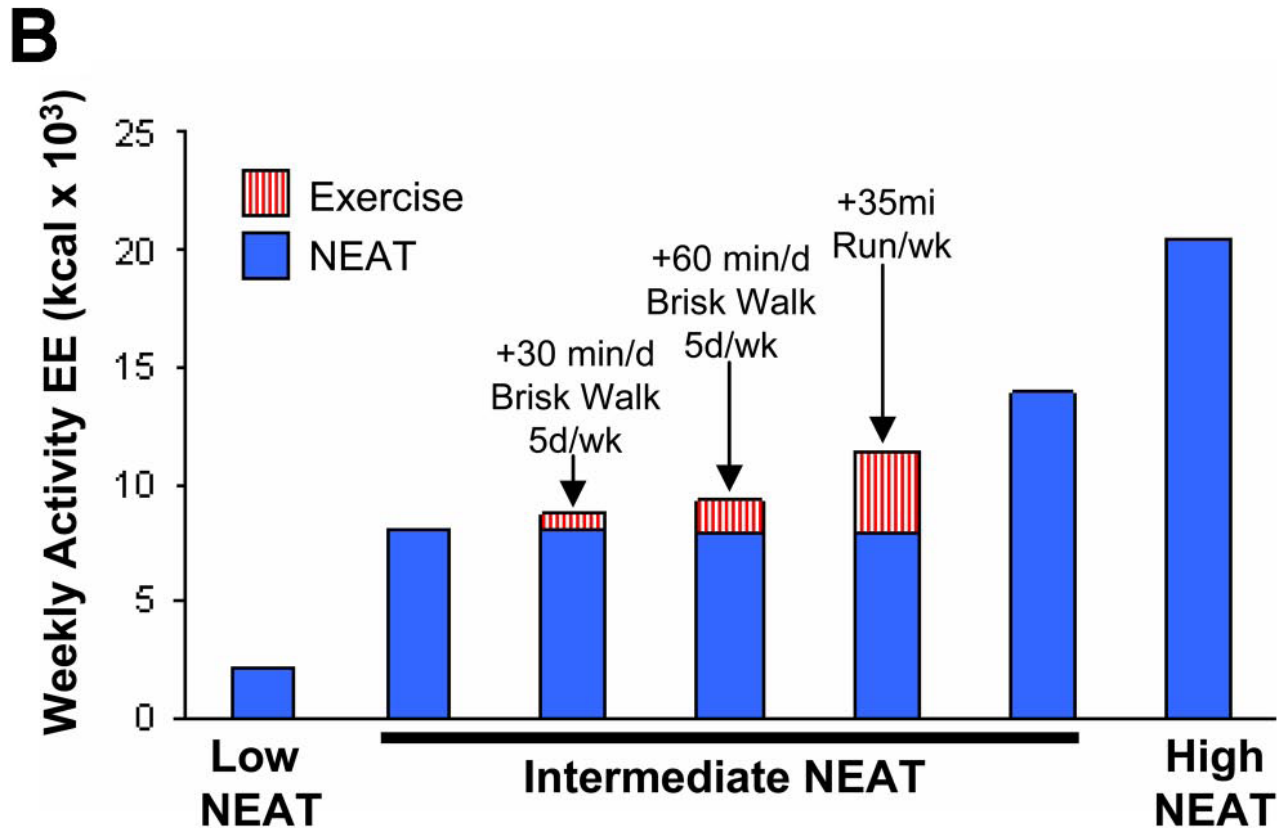
- Consistent with exercise science and fitness data
  - MVPA required to increase fitness;
  - Fitness strongly related to health outcomes
  
- Consistent with epidemiologic studies
  - 100's of studies compared people who do MVPA to those who don't, conclude risk of chronic disease lower in MVPA.
  
- Consistent with RCT's
  - RCT's have prescribed MVPA and shown many benefits

# Tertile of Activity Energy Expenditure and Risk of Mortality

N=302 Age 70-82 in Health ABC (Manini. JAMA 2006)  
Energy expenditure measured by doubly labeled water



# Variation in AEE (Activity Energy Expenditure), relative to contribution of MVPA to AEE

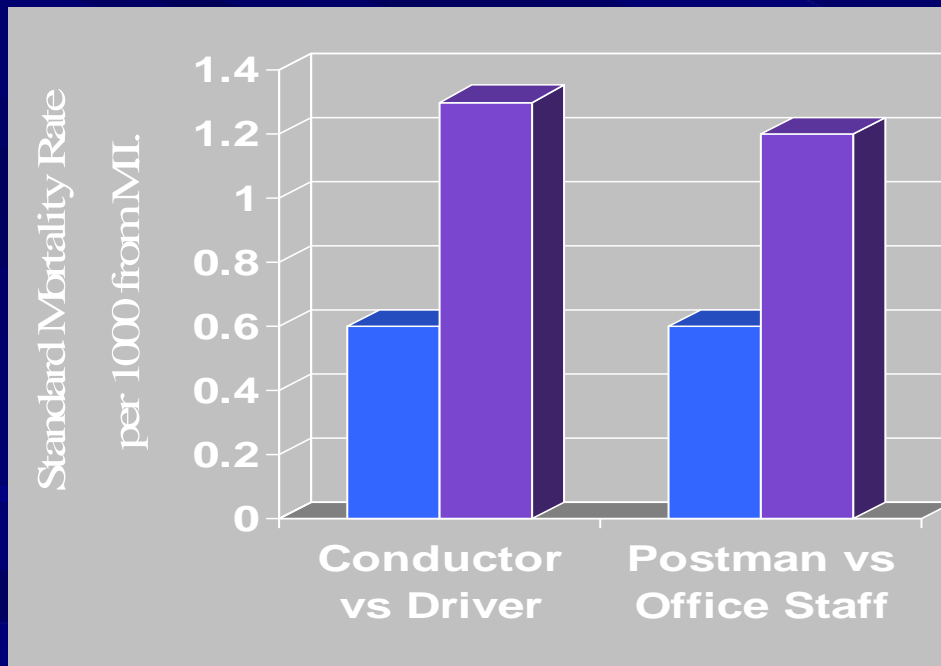


Hamilton. Diabetes 2007;56:2655

# Tribute to Jeremy Morris, MD 1910 - 2009



Jeremy Morris at 1954 World  
Conference Of Cardiology



Morris. Lancet. Nov 21, 1953

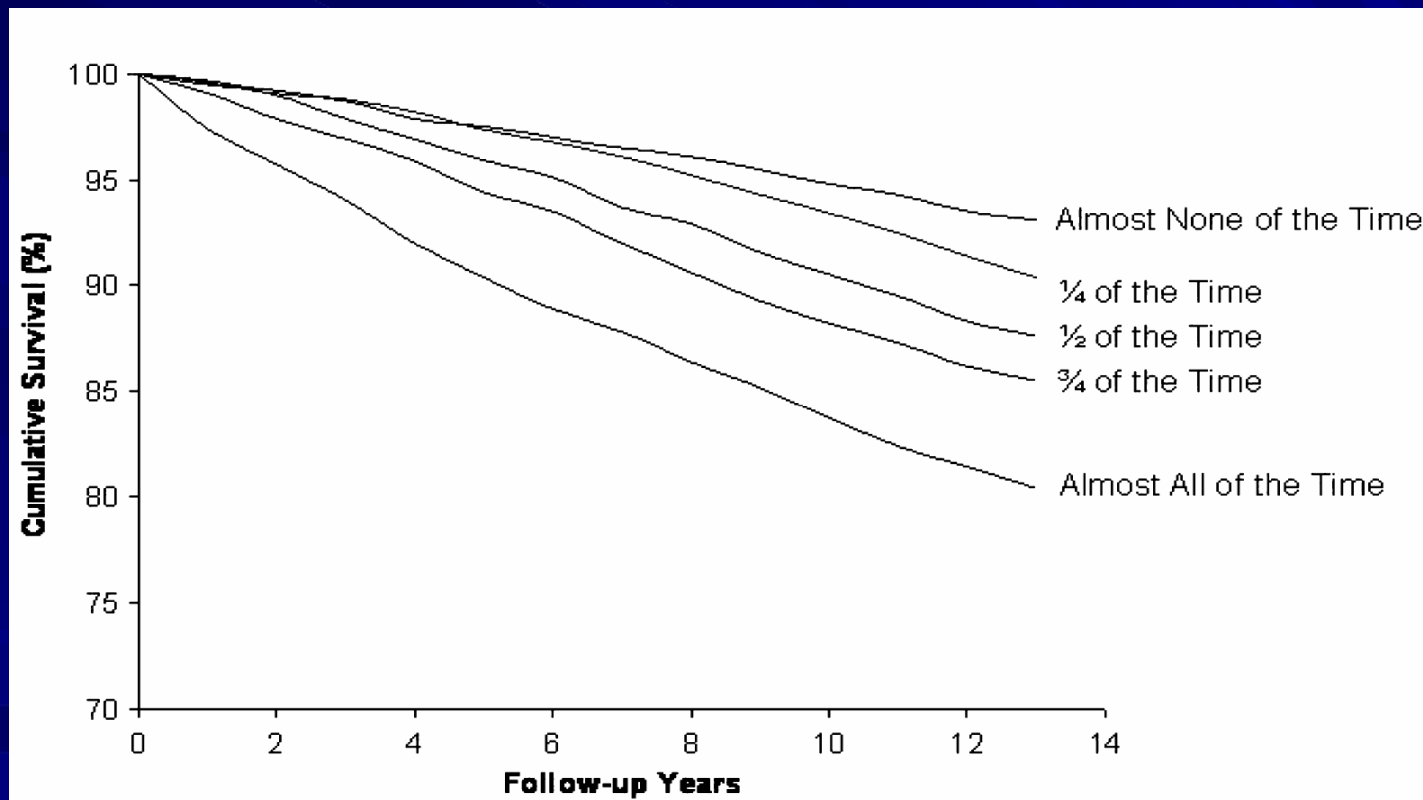


London circa 1949

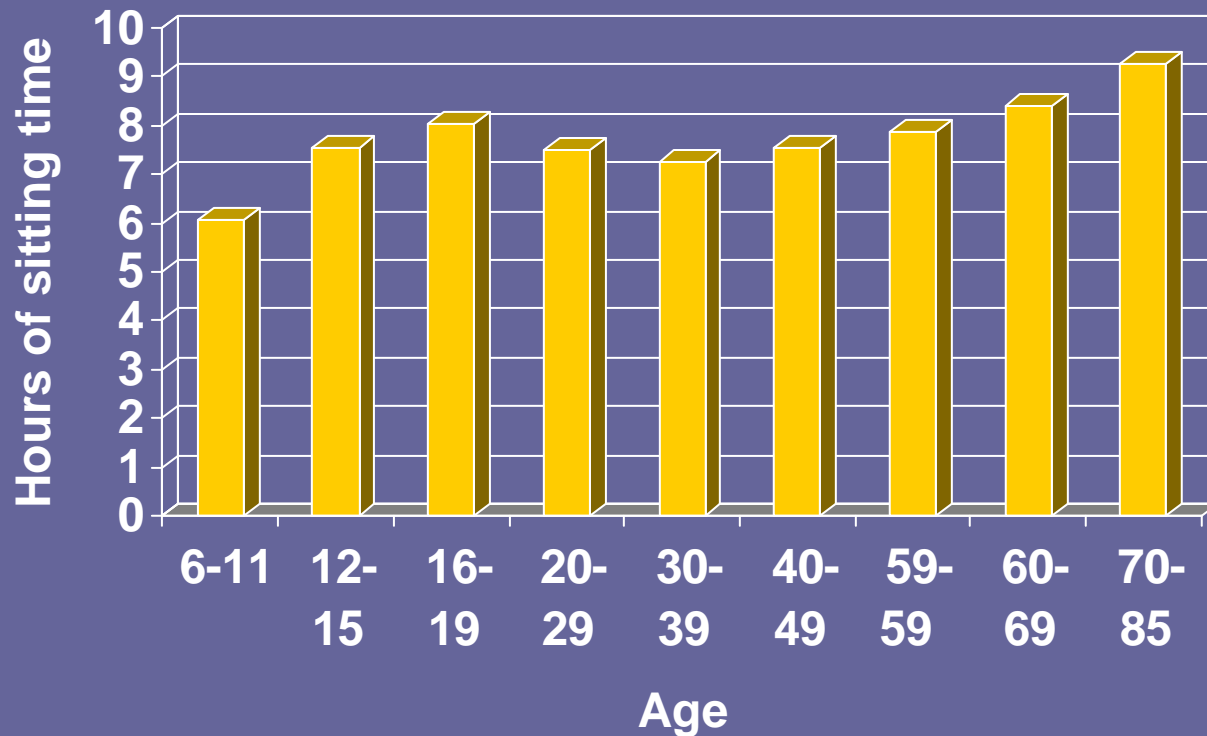


# Self Reported Sitting Time and Mortality Risk

17,013 men and women age 18–90 yr in Canada Fitness Survey



# Sitting Time assessed by accelerometer in NHANES



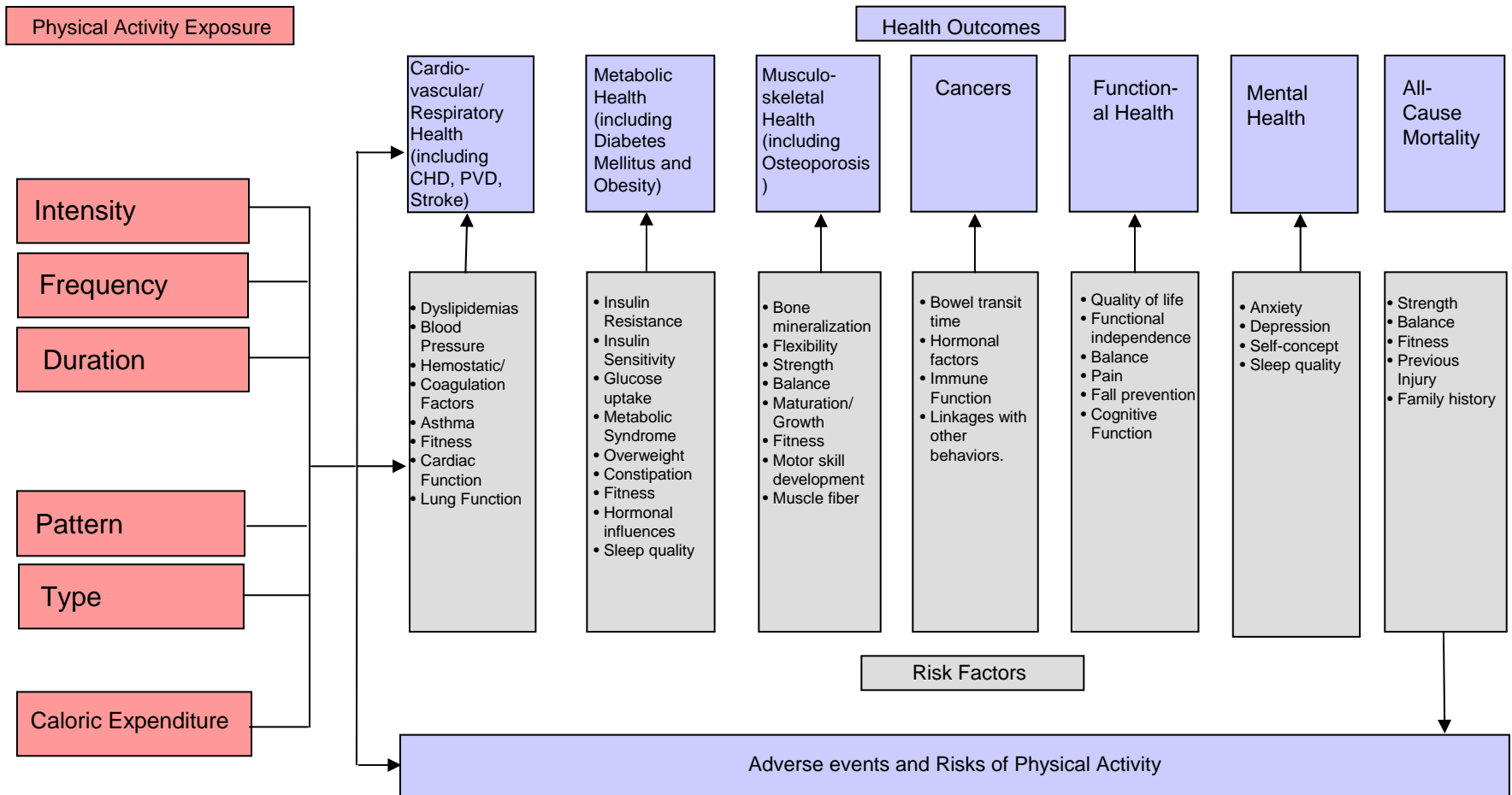
– Mathews. AJE 2008;167:875-881

# Summary of MVPA vs Total AEE

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- Some tension already re: exclusive focus on MVPA
- Future PA guidelines will need to include guidance on:
  - MVPA
  - Reducing sitting time and increasing light-intensity PA
- Evidence will come from studies using objective measures (DLW, accelerometers)
- Particularly relevant to obesity prevention

# US Physical Activity Guidelines Literature Abstraction: Conceptual Framework



All arrows will be examined for heterogeneity across demographic characteristics (eg gender, age, race/ethnicity). Evidence will also be examined for select special population groups.

# Role of exercise science in public health guidelines

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- HHS guidelines for adults focus on prevention of adverse health outcome.
  - Recommendations not based upon fitness outcomes per se
    - Stretching activity, which clearly increases flexibility, could not be linked to a health benefit, e.g. injury prevention
    - Did link the guideline of “gradually increase physical activity level over time” to the overload principle of exercise science
  - Doesn't assume the optimal regimen for fitness is also optimal for prevention
    - E.g., resistance training affects blood pressure, insulin sensitivity, and muscle strength.
- HHS guidelines for children did emphasize fitness outcomes
  - Guidelines limited to age 6+ due to insufficient research age 0-5
- Guidelines that emphasize both fitness and prevention will presumably include more guidelines that stem from exercise training research e.g., advice on warm-up and cool down.

# Implicit differences in philosophy, values, & structure of evidence review

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- With dose-response relationships, do you emphasize:
  - Dose associated with substantial benefit
    - E.g. 150 minutes of MVPA prevents diabetes in people with IGT
    - In DPP study, mean BMI reduced from ~34 to ~32
  - Dose required for total benefit
    - Blood pressure control; cholesterol control; micronutrient RDA's for vitamins.
  - Note: a philosophy we should totally eliminate any excess risk increases burden of disease attributable to the risk factor, & thereby increases its importance
- Which evidence standards?
- When to emphasize “one size fits all” versus “individually tailored”

# Summary of rationale for IOM recommendation

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- Created a normative database of energy expenditure (measured by DLW) in people versus BMI
- $PAL = TEE / BMR$  over 24 hours
- “Most adults (66%) maintaining a BMI in the healthful range had PAL values 1.6, or the equivalent of 60 min of physical activity of moderate intensity each day. Hence, on the basis of the doubly labeled water data and the results of epidemiologic studies, the physical activity recommendation for adults was judged to be 60 min/d.”

**TABLE 3**BMI and physical activity level (PAL) for normal-weight and overweight or obese men and women in 3 age groups<sup>1</sup>

	Normal-weight <sup>2</sup>		Overweight or obese	
	BMI	PAL <sup>3</sup>	BMI	PAL
	<i>kg/m<sup>2</sup></i>		<i>kg/m<sup>2</sup></i>	
Men				
19–30 y	22.02	1.74	29.62	1.85
31–50 y	22.55	1.81	30.82	1.85
51–70 y	22.95	1.63	29.55	1.72
Women				
19–30 y	21.42	1.80	29.82	1.77
31–50 y	21.64	1.83	31.91	1.79
51–70 y	22.18	1.70	30.37	1.59

<sup>1</sup> All values are  $\bar{x}$ .

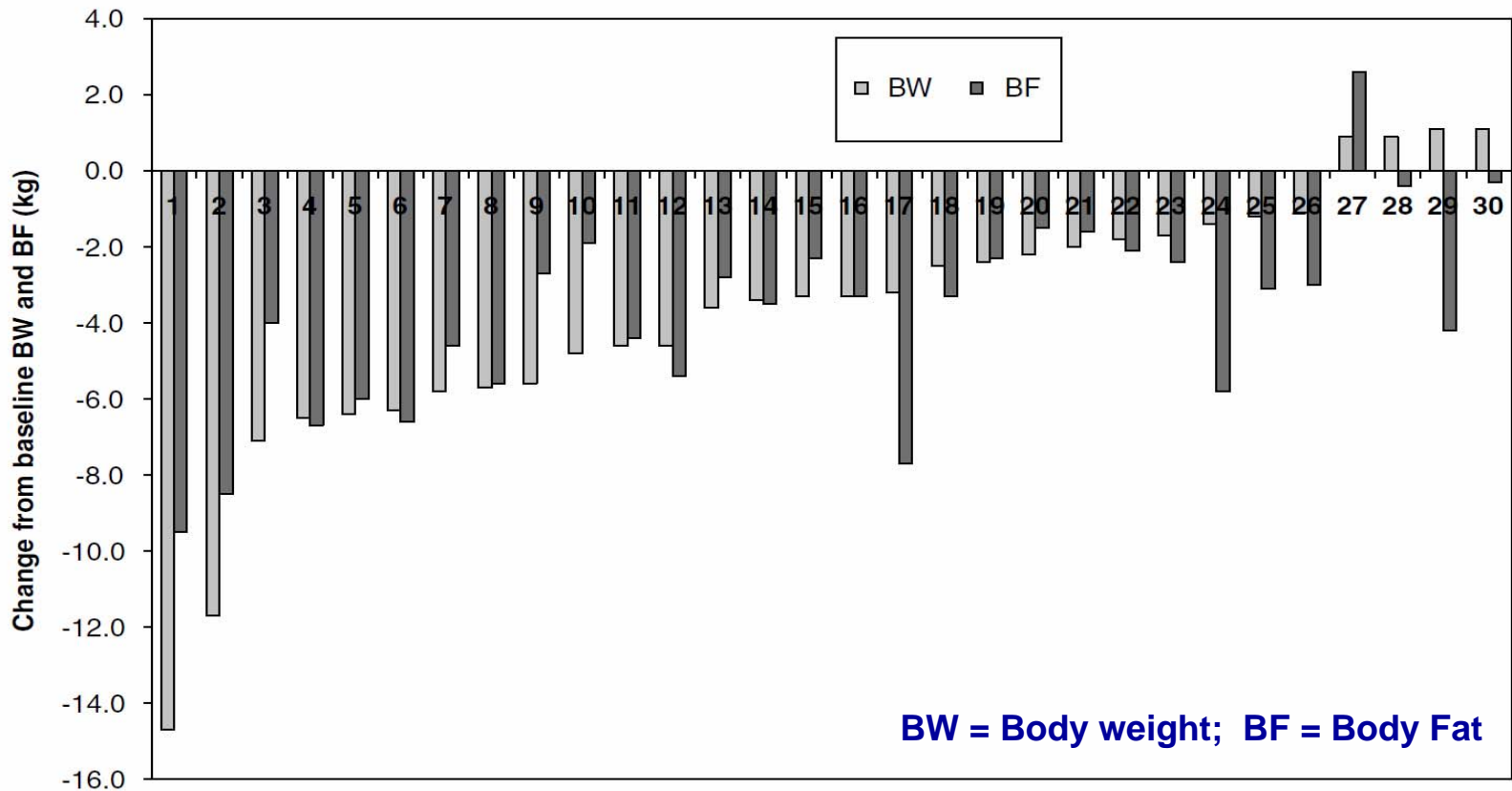
<sup>2</sup> BMI of 18.5–25.

<sup>3</sup> Expressed as total energy expenditure as a multiple of resting metabolic rate over 24 h.



# Variability in Weight Loss with Supervised Exercise

Exercise RX = 500 kcal/day x 5 d/wk x 12 weeks  
King Int J Obesity 2008;32:177



Individual body weight and fat mass changes after 12 weeks of imposed exercise. Each pair of histograms represents one participant.

# PA and healthy weight guidelines

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- Similar findings in evidence reviews for PA guidelines & Dietary guidelines
  - Dietary guidelines emphasized “one size fits all” & total elimination of unhealthy weight gain, and approach of a cut-point
  - PA guidelines emphasized importance of individual variability and dose-response relationship between PA and obesity
    - Obesity just another adverse health outcome with dose-response relationship; 150 min of PA doesn’t completely eliminate excess risk for any disease
    - Avoids problem of specifying an amount of PA (~60 minutes/day) without also specifying caloric intake.
- Comment on politics
  - Few people meet a 60 min/day guideline, so some might argue cause of obesity is therefore lack of physical activity--no reason to change policies related to food supply, access to calorically dense food etc.

# PA recommendations in youth

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- Insufficient data on frequency in adults, and even less data in youth, but youth recommendations more specific on frequency
- IMHO, philosophy often is along lines:
  - Children are naturally active, and there is no reason to err on side of recommending too little activity
  - Adults recommendations emphasize one doesn't need to do structured exercise; even more emphasis on this issue in youth-unstructured play should count. Guidelines written to reflect e.g. active play should count.

# Summary

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- Guidelines have an framework and philosophy (partly explicit & partly implicit) that can contribute to differences among guidelines.
- Major disagreements in public health guidelines can become a political issue
- Most current differences among PA guidelines do not represent major controversies
  - Exception = weight control and 30 minute / 60 minute guidelines
- Physical activity guidelines should evolve as more evidence accumulates on importance of light-intensity activity to health from studies using objective measures