Physical Activity and Reduced Risk of Cardiovascular Disease

Chicago, IL

November 21, 2008
3:30 PM – 4:45 PM
Session 7: Physical Activity and Reduced Risk of Cardiovascular Disease

Learning Objectives

- Discuss the effects of physical activity on cardiovascular disease (CVD) risk factors.
- Explain the magnitude of benefit of physical activity on reducing CVD events in both primary and secondary prevention patients.
- Describe the mechanisms of the benefit of physical activity on reducing CVD events.

Faculty

Samia Mora, MD, MHS, FACC
Assistant Professor of Medicine
Brigham and Women’s Hospital
Harvard Medical School

Dr Samia Mora is a board-certified internist and cardiologist with specialized training in cardiovascular epidemiology and echocardiography. Dr Mora has appointments in the Divisions of Cardiovascular Disease and Preventive Medicine, Department of Medicine, at the Brigham and Women’s Hospital, and is an assistant professor of medicine at Harvard Medical School. She also serves the American Heart Association as chair of the Women in Cardiology Committee, scientific advisor to the Choose to Move Program and member of the Executive Database Steering Committee. She is also a Writing Member of the American College of Cardiology/American Heart Association Primary Prevention of Cardiovascular Disease Performance Measures Writing Committee.

Faculty Financial Disclosure Statement

Dr Mora has no financial relationships to disclose.

Drug List

There are no drugs mentioned in this presentation.

Suggested Reading List


Physical Activity and Reduced Risk of Cardiovascular Disease

Samia Mora, MD, MHS, FACC
Assistant Professor of Medicine
Brigham and Women's Hospital
Harvard Medical School

Topics to be covered

• Why bother with physical activity?
• Physical activity and CVD reduction
  – Primary Prevention
  – Secondary Prevention
• How does physical activity prevent CVD?
• Fat vs unfit: which is worse?
• What dose of physical activity?

Prevalence of Metabolic Syndrome / Lifetime risk for Diabetes in U.S.

• Findings from NHANES III for metabolic syndrome
  – 24% of adults
  – 42% of individuals > age 60
• Lifetime risk of diabetes if born in yr 2000
  – 33% men
  – 39% women
• Underscores urgent need to control obesity epidemic and improve physical activity

Narayan, et al. JAMA 2003;290:1884

Trends in Health Conditions

Briefel and Johnson. Annu Rev Nutr. 2004;24:401-431

Why bother with physical activity?

What proportion of US adults report NO leisure-time physical activity?

1. 10%
2. 20%
3. 40%
4. 60%
**Current Perspective**

- Physical inactivity and increased body weight are major public health epidemics
  - 38% no physical activity
  - 66% overweight or obese
  - 32% obese

**Historical Perspective**

- Health benefits of physical activity known for a long time
  - ~ 2500 BCE, Chinese physicians advocated regular exercise, Kung fu developed to avoid illness
  - Hippocrates (460-370 BCE): To keep well, avoid too much food, too little toil
  - Ancient Olympic Games: winners only awarded an olive branch wreath, physical fitness seen as its own reward

**Early Morris Studies**

- Beginning in the 1940’s, epidemiologic studies, using comparison groups, documented inverse relation between physical activity and risk of CVD (active persons had lower disease rates)

**But drivers were also fatter!**

<table>
<thead>
<tr>
<th>Age, years</th>
<th>% with trouser waist &gt;34 inches</th>
<th>% with jacket chest &gt;40 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-29</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>35-39</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>45-49</td>
<td>40</td>
<td>33</td>
</tr>
<tr>
<td>55-59</td>
<td>63</td>
<td>51</td>
</tr>
</tbody>
</table>

Morris et al, Lancet Nov 21, 1953: 1053-57

Morris et al, Lancet Sep 15, 1956: pp 569-70

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- Smoking ↓ 73%
- Systolic BP ↓ 6.6 mmHg
- HDL-cholesterol ↑ 0.16 mmol/L
- Non-HDL cholesterol ↓ 0.28 mmol/L
- BMI ↑ 1.89 kg/m²

Hardoon et al, Circulation 2008;117:698-604
Physical activity and CVD reduction

Primary Prevention

~2.25 to 3 hr/wk of “purposeful” walking can lower CVD rates by...

1. 10-20%
2. 15-30%
3. 40-50%

Physical Activity and CHD Risk
Harvard Alumni Health Study

Physical Activity and CHD Risk
Harvard Alumni Health Study

~40% ↓ risk, comparing extreme fifths

P, trend = 0.04

Lee et al, Circulation 2000;102:897-8

Physical Activity and CHD Risk
Harvard Alumni Health Study

RR* of CHD

* adjusted for age, smoking, alcohol, diet, family history, vitamins/minerals, hypertension, diabetes

Sesso et al, Circulation 2000;102:975-80

RF = smoking, hypertension, diabetes, overweight, no alcohol, parental history

Harvard Alumni Health Study, Men <60y

RF = smoking, hypertension, diabetes, overweight, no alcohol, parental history

Sesso et al, Circulation 2000;102:975-80

Manson JE et al. NEJM 2002;347:716-25

CHD=Coronary heart disease

Walking

Relative Risk of CHD

Vigorous exercise*

P<0.008

Women’s Health Initiative Observational Study

P=0.004

Quintiles of activity (MET-hour/week**)

Average active hours per week × energy expenditure per activity

*Includes aerobics, aerobic dancing, jogging, tennis, and swimming laps

Manson JE et al. NEJM 2002;347:716-25

**Average active hours per week × energy expenditure per activity

Lee et al, Circulation 2000;102:897-8

Sesso et al, Circulation 2000;102:975-80

Manson JE et al. NEJM 2002;347:716-25
Exercise-based cardiac rehabilitation in patients with CHD reduces total mortality by...

1. 10%
2. 20%
3. 40%
4. 60%

Exercise-Based Cardiac Rehabilitation in CHD Patients

- Meta-analysis of 48 trials with ~9,000 patients (19 exercise only trials)
- ~80% men, 20% women
- 2/3 MI patients only; remainder included revascularization patients
- On average, 3.7 times/week, 53 min, 76% VO₂ max/max heart rate
**Exercise-Based Cardiac Rehabilitation in CHD Patients**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Results (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mortality</td>
<td>↓ 20% (↓ 7% to ↓ 32%)*</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>↓ 26% (↓ 10% to ↓ 39%)*</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>↓ 14 mg/dL (↓ 4 to ↓ 23)*</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>↓ 8 mg/dL (↑ 24 to ↑ 5)</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>↓ 2 mg/dL (↓ 1 to ↑ 5)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>↓ 20 mg/dL (↓ 6 to ↓ 35)*</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>↓ 3.19 mmHg (↓ 0.95 to ↓ 5.44)*</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>↓ 1.16 mmHg (↓ 2.66 to ↑ 0.32)</td>
</tr>
</tbody>
</table>

**Limitations**

- Few women (20% of total)
- Patients tended to be young (median, 55 y; range, 48-71 y)
- Majority lacked major co-morbidity (e.g., heart failure)
- Variation in intervention length
- Follow-up short (6-69 months; average 2.4 y)
- Trial quality poorly reported (details on randomization, blinded assessment, follow-up)

**Estimated Mortality Risk Reductions, CHD Patients**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Risk Reduction (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-dose aspirin</td>
<td>↓ 13% (↓ 1% to ↓ 30%)</td>
</tr>
<tr>
<td>Statins</td>
<td>↓ 21% (↓ 14% to ↓ 28%)</td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>↓ 23% (↓ 15% to ↓ 31%)</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>↓ 26% (↓ 16% to ↓ 35%)</td>
</tr>
</tbody>
</table>

**Exercise-Only vs. Comprehensive Rehabilitation**

<table>
<thead>
<tr>
<th>Exercise-only:</th>
<th>Total mortality</th>
<th>↓ 24% (↓ 2% to ↓ 41%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive:</td>
<td>Total mortality</td>
<td>↓ 16% (↓ 1% to ↓ 28%)*</td>
</tr>
</tbody>
</table>

**Moderate Exercise and Reduced Mortality**

Observational study of self-reported physical activity in 772 men with CHD

![Graph showing age-adjusted mortality rates and physical activity levels](image)

Moderate exercise is associated with reduced mortality

CHD=Coronary heart disease, CVD=Cardiovascular disease


Moderate Exercise and Reduced Mortality

CHD Patients, Cardiovascular Health Study

![Graph showing relative risk of mortality vs. energy expenditure](image)

RR adjusted for age, sex, race, smoking, alcohol, SES, obesity, prevalent diseases, type of CAD

Jansson et al. NEJM 2006;355:19-23

*Estimated mortality risk reductions in CHD patients*
### Estimated Mortality Risk Reductions, CHD Patients

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Estimated Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>↓ 25%</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>↓ 35%</td>
</tr>
<tr>
<td>Moderate alcohol</td>
<td>↓ 20%</td>
</tr>
<tr>
<td>Dietary changes</td>
<td>↓ 45%</td>
</tr>
</tbody>
</table>

Iestra et al., Circulation 2005;112:924-34

### How does physical activity prevent CVD?

**Physical Activity**
- Improves traditional CVD risk factors
- ↓ myocardial oxygen demand
- Improves endothelial function
- Effects on coagulation/clotting factors
- Effects on inflammatory markers
- Effects on autonomic tone

### Physical activity reduces CVD events by favorable effects on body weight more so than on inflammation or blood pressure.

1. True
2. False

### Effects of Physical Activity

- **Age**
- **Diabetes Mellitus**
- **Obesity**
- **Genetics**
- **Inflammation**
- **Dyslipidemia**
- **Hypertension**
- **Smoking**
- **Hypercoagulability**
- **Atherosclerosis**
- **Novel Risk Factors**

### Effect on Body Composition

173 sedentary, overweight (BMI >24 kg/m2) post-menopausal women randomized to moderate intensity exercise vs. stretching for 1 year

**Total Body Fat**
- Change in Total Body Fat
  - Low-active
  - Intermediate-active
  - High-active

**Intra-abdominal Fat**
- Change in Intra-abdominal Fat
  - Low-active
  - Intermediate-active
  - High-active

Irwin ML et al. JAMA 2003;289:323-330

Minutes per week spent in moderate-intensity sports activity (low-active, 125 minutes; intermediate-active, 126-195 minutes; and highly active, >195 minutes)
### Effect of Physical Activity on Lipids

<table>
<thead>
<tr>
<th>Year and Lipid Level (mg/dL)</th>
<th>Change from Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>1</td>
</tr>
<tr>
<td>TC</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>214</td>
</tr>
<tr>
<td>Women</td>
<td>239</td>
</tr>
<tr>
<td>LDL-C</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>138</td>
</tr>
<tr>
<td>Women</td>
<td>155</td>
</tr>
<tr>
<td>HDL-C</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>37</td>
</tr>
<tr>
<td>Women</td>
<td>47</td>
</tr>
<tr>
<td>TG</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>200</td>
</tr>
<tr>
<td>Women</td>
<td>188</td>
</tr>
</tbody>
</table>

HDL-C=High density lipoprotein cholesterol, LDL-C=Low density lipoprotein cholesterol, TC=Total cholesterol, TG=Triglycerides

*P=0.001 for change in women vs men
†P=0.03 for change in women vs men

### Effect of Exercise on Obesity and Diabetes

Nurse’s Health Study

- Reduction: Each hour a day spent walking briskly
- Increase: Each two hours a day spent watching TV
- Increase: Each two hours a day spent sitting or driving

Exercise reduces the incidence of obesity and DM

### Exercise Reduces Incidence of Diabetes: Diabetes Prevention Program (DPP)

- 3234 subjects with ↑ fasting and postload glucose levels
- Lifestyle modification, metformin, or placebo
- Goals for 2-yr follow-up:
  - ≥ 7% weight loss
  - ≥ 150 min activity/week
- Incidence of diabetes (per 100 person-years)
  - Placebo: 11.0
  - Metformin: 7.8 NNT = 14
  - Lifestyle modification: 4.8 NNT = 7
- Reduction in incidence
  - Lifestyle: 38% vs metformin 31% (P<0.05)
  - Both lifestyle and metformin vs placebo (P<0.05)


### Effect of Fitness on Blood Pressure and HTN

- 4,884 healthy women examined at the Cooper Clinic, 1970-98
- 157 developed hypertension over 5 years
- Risk adjusted for age, exam year, alcohol intake, smoking, BP, family history of hypertension, waist girth, glucose, & triglycerides


### Effect of Fitness on Inflammation (CRP)

*p<0.05 after adjusting for fatness

Hamer, Preventive Medicine 2007; 44:3-11

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**Physical Activity**

- RCT’s
  - CVD Risk Factors (BP, lipids, glucose, etc.)

**Observational epi studies**

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**CVD**
Potential Biologic Mechanisms

- Epidemiologic studies (and not just lab studies) can inform about potential biologic mechanisms underlying the protective effect of PA on chronic diseases.
- One way to assess this is to look at statistical models that do not, and that do, adjust for the mechanism of interest.
- E.g., we can look at the RR of CVD associated with being active, in a model that does NOT and that does adjust for blood pressure.
- The degree to which the RR is attenuated can be attributed to the effect of blood pressure in mediating the relation between PA and CVD.

Physical Activity and CVD Risk

% of Risk Reduction Explained by Various Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>% Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Risk Factors</td>
<td>59%</td>
</tr>
<tr>
<td>Inflammatory Markers</td>
<td>32.6%</td>
</tr>
<tr>
<td>Blood Pressure/ Hypertension</td>
<td>27.1%</td>
</tr>
<tr>
<td>Traditional Lipids</td>
<td>19.1%</td>
</tr>
<tr>
<td>Novel Lipids</td>
<td>15.5%</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>10.1%</td>
</tr>
<tr>
<td>Hemoglobin A1c/ Diabetes</td>
<td>8.9%</td>
</tr>
<tr>
<td>Homocysteine</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Risk Reduction in Cardiovascular Disease Events by Activity Level

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>% Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;200 kcal/wk</td>
<td>-27%</td>
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<tr>
<td>200-599 kcal/wk</td>
<td>-32%</td>
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<tr>
<td>600-1,499 kcal/wk</td>
<td>-41%</td>
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</tbody>
</table>

Note: Based on age and treatment adjusted relative risk at a mean 11-year follow-up in women. Source: Circulation

Mora et al, Circulation 2007;116:2110-6

Risk Reduction in CVD by Activity Level

Women’s Health Study

<table>
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<td>-41%</td>
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Age and treatment adjusted relative risk, 11 year follow-up

Mora et al, Circulation 2007;116:2110

Physical Activity and CVD Risk in Women

% of Risk Reduction Explained by Various Risk Factors

<table>
<thead>
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<tr>
<td>Homocysteine</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Heart Rate Recovery

Lauer MS, ACC Current Journal Review 2001;10
Women who were below the median for both exercise capacity and heart rate recovery had 3.5-fold increased risk of CVD death.

Mora S et al, JAMA 2003;290:1600-1607

Low Exercise Capacity and HR Recovery Combined Substantially Increase Risk

P<0.001

Fat vs Unfit: Which is worse?

Both increased body weight and physical inactivity are powerful predictors of CVD, diabetes, and death.

Both are associated with CVD risk factors and they often occur together.

This has led to some controversy over the relative contributions of each to cardiovascular risk.

“Fitness vs Fatness” debate

Fit, Fat, and Healthy?

Physical activity may attenuate the increased cardiovascular risk associated with overweight and obesity.

Maintaining healthy weight is at least as important as being active for ↓ CVD and ↓ mortality.
Physical Activity and CHD Risk
Harvard Alumni Health Study

-40% ↓ risk, comparing extreme fifths
P, trend = 0.04

RR* of CHD
* adjusted for age, smoking, alcohol, diet, family history, vitamins/minerals, hypertension, diabetes
Lee et al; Circulation 2000;102:981-6

BMI and CVD Mortality in Koreans

~60% ↓ risk, comparing extreme fifths
P, trend = 0.003

RR* of CVD Mortality
* Among never smokers; adjusted for age and physical activity
Lee et al; JAMA 1993;270:2823-8

All-Cause Mortality by Fitness & Fatness
2,196 Men with Diabetes

Risk of Death
METS
Normal Weight
Overweight
Obese

Women’s Health Study

Relative Risk of CHD
* Adjusted for normal weight
Lee et al, JAMA 2001; 285:1447-1454
For some diseases (particularly type 2 diabetes), healthy weight is more important.

Few studies have directly compared the effects of fit vs fat on CVD biomarkers.

Fatness More Closely Associated with Higher Risk Biomarkers than Fitness in Healthy Men

Women’s Health Study: Correlations of Biomarkers

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Physical Activity</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP</td>
<td>-0.10</td>
<td>0.47</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>-0.09</td>
<td>0.33</td>
</tr>
<tr>
<td>ICAM</td>
<td>-0.10</td>
<td>0.21</td>
</tr>
<tr>
<td>Homocysteine</td>
<td>-0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>-0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>0.10</td>
<td>-0.38</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>-0.04</td>
<td>0.10</td>
</tr>
<tr>
<td>Apolipoprotein A1</td>
<td>0.07</td>
<td>-0.25</td>
</tr>
<tr>
<td>Apolipoprotein B₃₀₀</td>
<td>-0.08</td>
<td>0.26</td>
</tr>
<tr>
<td>Lipoprotein (a)</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.04</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Physical Activity, BMI and Risk of Diabetes

Women’s Health Initiative

Manson et al, NEJM 2002;347:716-725


Christou et al, Circ 2005;111:1104-14

Mora et al, JAMA 2006; 295:1412-1419
Increased body weight is associated with inflammatory and lipid biomarkers
- metabolically active adipose tissue
- proinflammatory and prothrombotic
- atherogenic dyslipidemia

Association of physical activity with biomarkers independent of BMI less clear
- regular muscle movement may suppress inflammation locally
- systemically via muscle-derived cytokines or leptin
- endothelial function (nitric oxide, progenitor cells)

Grundy SM, Circ 2002;105:2696
Kasapli C, Thompson PD, JACC 2005;45:1563
Fit-Fat Summary

- Both unfit and fat were associated with higher risk biomarker levels
- Stronger associations seen for fat compared with unfit
- Most favorable biomarkers in those with normal BMI (18.5-24.9) and active (1000 kcal/wk, ~2.5 hrs/wk)

What dose of physical activity?

Current guidelines for general health benefits of physical activity recommend at least:

1. 30 min moderate activity, 5x/wk
2. 20 min vigorous activity, 3x/wk
3. Either 1 or 2
4. None of the above

Physical Activity Guidelines

<table>
<thead>
<tr>
<th>Goals</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum: 30-60 minutes, 5 days per week</td>
<td>Assess risk, preferably with an exercise test, to guide prescription (Class I, Level B)</td>
</tr>
<tr>
<td>Optimal: 30-60 minutes, 7 days per week</td>
<td>Encourage aerobic activity (e.g., walking, jogging, cycling) supplemented by an increase in daily activities (e.g., walking breaks at work, gardening, household work) (Class I, Level B)</td>
</tr>
<tr>
<td>I IIa IIa IIb II IIIIIIIIII</td>
<td>Encourage resistance training (e.g., weight machines, free weights) 2 days a week (Class IIb, Level C)</td>
</tr>
<tr>
<td></td>
<td>Encourage cardiac rehabilitation for patients with stable angina, recent MI, LV systolic dysfunction, or recent CABG (Class I, Level B)</td>
</tr>
</tbody>
</table>

No Leisure-Time Physical Activity

USA 1988–2005

Physical Activity Recommendations

Over the Years
Recommendations Before 1995

- “No pain, no gain”
- Vigorous exercise for at least 20 minutes continuously, 3X/week (e.g., running or jogging)
- E.g., recommendations from ACSM and AHA, 1970’s to early 1990’s

Recommendations After 1995

- “Train, don’t strain”
- Accumulate at least 30 min/day of moderate-intensity PA most days (e.g., brisk walking)
- First issued by CDC/ACSM 1995
- Similar recommendations adopted by many countries, including the UK (NHS Physical Activity Action Plan 2005)

ACSM/AHA 2007 Update

- Clarifies that either moderate or vigorous PA recommendation will do
- Clarifies that the moderate PA recommendation is on at least 5 days (“most days”)
- Clarifies that a combination of both moderate or vigorous activities are OK, so long as the total energy expended satisfies the minimum under either recommendation

International Association for the Study of Obesity, 2002

“The current physical activity guideline for adults of 30 minutes of moderate intensity activity daily … is of importance for limiting health risks for a number of chronic diseases … For preventing weight gain or regain this guideline is likely to be insufficient for many individuals in the current environment. There is compelling evidence that prevention of weight regain in formerly obese individuals requires 60-90 minutes of moderate intensity activity or lesser amounts of vigorous intensity activity. Although definitive data are lacking, it seems likely that moderate intensity activity of approximately 45-60 minutes per day is required to prevent the transition to overweight or obesity.”

Major Issue to Consider

- Intensity of PA and total volume of energy expended are closely correlated
- Appropriate study design or analyses are needed to get “right” answer
- E.g., if we see these rates of disease associated with different PA intensities:
  - no activity  15/10,000 (referent)
  - mod intensity  12/10,000 (p=0.32)
  - vig intensity  5/10,000 (p=0.02)
- Unclear whether it is intensity or total energy expenditure that accounts for the results

Which “dose” is best: moderate or vigorous?
**Physical Activity and CVD**

- There is a large body of evidence showing that higher volume of energy expended is associated with lower CVD rates; there is also clear evidence of a “dose-response”
- This energy expenditure can come from moderate or vigorous intensity PA
- There are limited data on whether vigorous-intensity PA confers additional risk reduction for CVD risk, beyond its contribution to the total energy expended

**Physical Activity**

- It is reasonable to follow current guidelines for general health benefits: 30 min moderate PA, 5x/wk or 20 min vigorous PA, 3x/wk or combination
- Choice of moderate- or vigorous-intensity PA can be dependent on patient preference
- Also consider risk:benefit for patient

**Conclusions**

- CVD is a leading cause of death world-wide
- Physical activity is associated with decreased risk of subsequent cardiovascular events and mortality among persons at high risk (e.g., CHD patients), and among persons at “usual” risk, who do and do not have CVD risk factors

**Topics covered today**

- Why bother with physical activity?
- Physical activity and CVD reduction
  - Primary Prevention
  - Secondary Prevention
- How does physical activity prevent CVD?
- Fat vs unfit: which is worse?
- What dose of physical activity?
Conclusions

- The magnitude of decreased risk associated with a physically active way of life is comparable to that seen with avoidance of other CVD risk factors, use of cardioprotective drugs (e.g., aspirin, beta-blockers, statins)

- Most of the benefit of physical activity on reducing CVD can be explained by favorable effects on risk factors, in particular inflammation and blood pressure

For the same caloric intake, what dose of physical activity is the minimum required for weight loss?

1. 30-60 min moderate activity, 5x/wk
2. 60-90 min moderate activity, 5x/wk