

# **Exercise and Aging**

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# Outline

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- **Age Effects on Exercise Capacity**
- **Medical Benefits of Exercise**
- **Exercise and Fitness in Clinical Populations**
- **Starting an Exercise Program**
- **Obesity in America**
  - **Overeating or “Under-activity” ?**
- **Myths..... Myth-Busting**

# Fitness vs Physical Activity

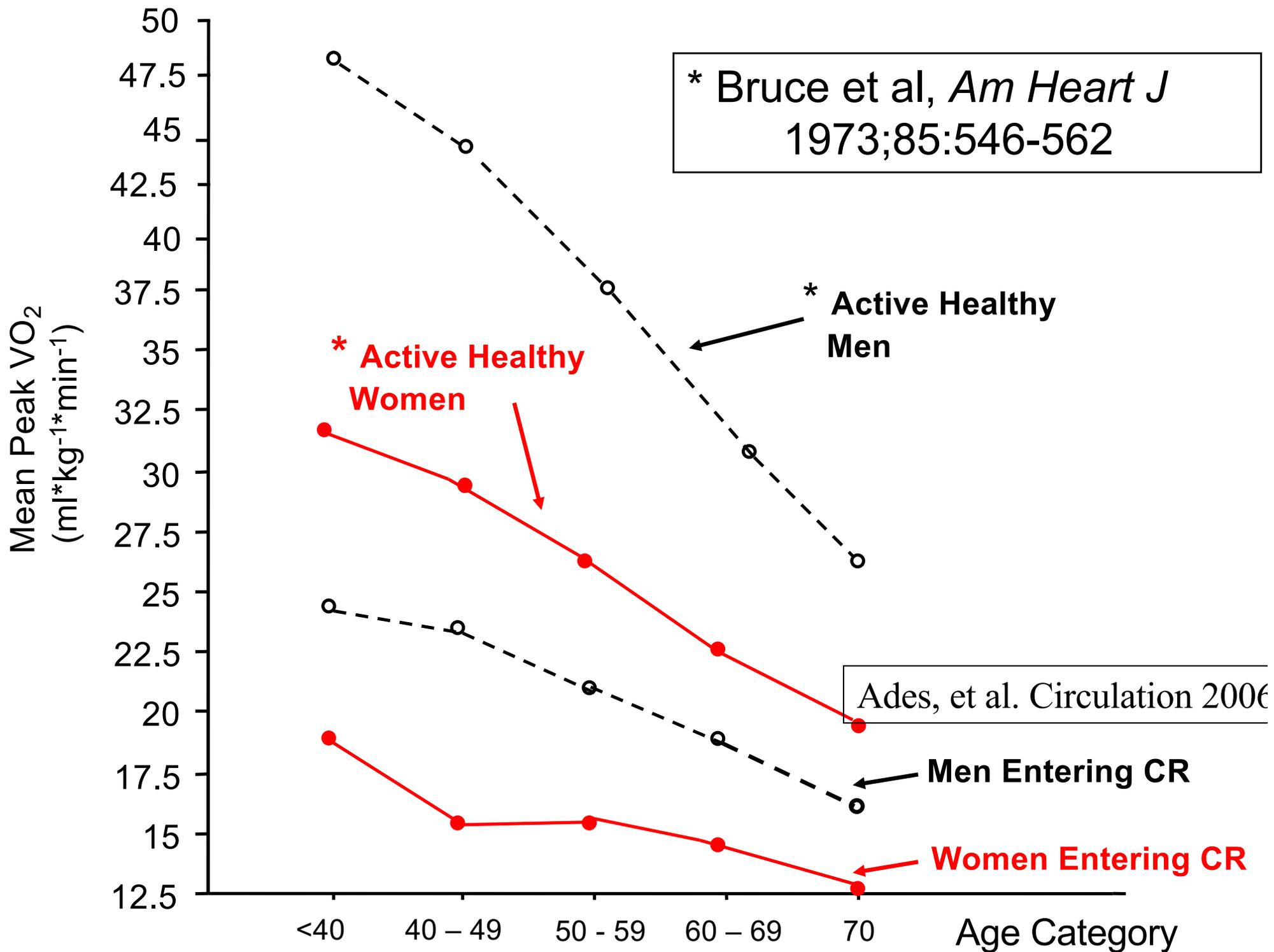
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- Fitness is partly genetic and is measured by how far you go on an exercise test
- Physical activity is behavioral and requires motivation and commitment. Often measured with questionnaires or activity monitors
- Increasing your physical activity will increase your fitness.

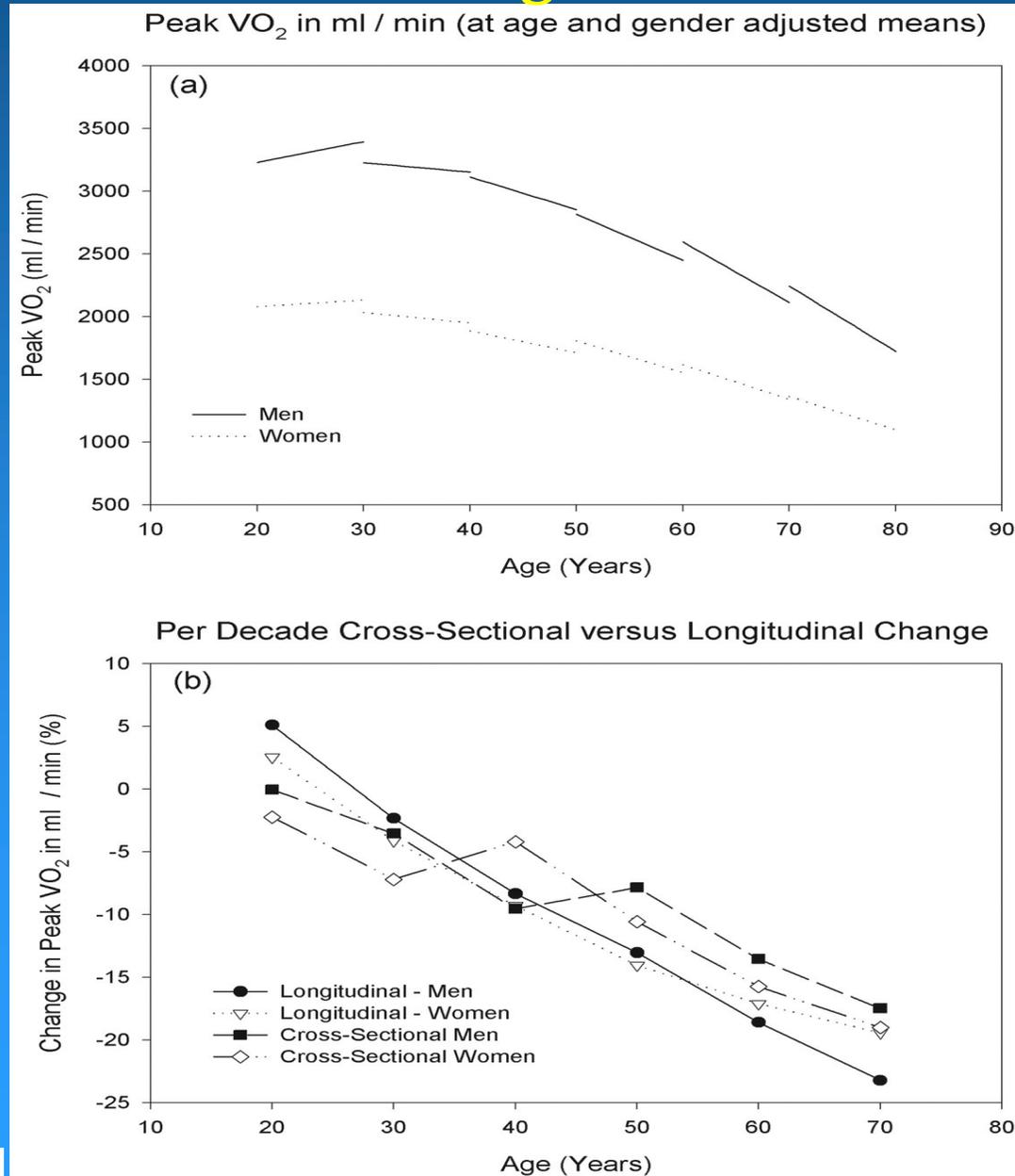
# Definition and Recommendations: Aerobic Exercise

- Either
  - Moderate intensity exercise such as walking, cycling or gardening that slightly increases breathing and HR for at least 30 minutes per day, at least 5 times per week.
  - Vigorous exercise such as running or cycling that increases breathing and HR for least 20 min per session, at least 3 times per week.

**Center for Disease Control**



# Peak VO<sub>2</sub> (Aerobic Fitness) by Gender and Age: 20s through the 70s



# Prevalence: Regular Aerobic Exercise in U.S.A.

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- 45% Meet the Physical Activity threshold
- 55% do not get adequate exercise and are at risk of heart disease (2<sup>nd</sup> to obesity as the most prevalent cardiac risk factor)
- 25% get no leisure time activity whatsoever

# Environmental Factors Related to Low Physical Activity Rates

- The Automobile
- The T.V.
- The Computer
- The Remote control
- The Elevator
- Drive-in Fast Food
- Suburban roads with no sidewalks or bike paths
- Driving Lawnmowers
- Eating Out
- Sedentary but stressful (fatiguing) jobs
- Zoom !

**Comment:** Since very, very few people get adequate exercise at work or going through a day, exercise needs to be added as purposeful exercise.

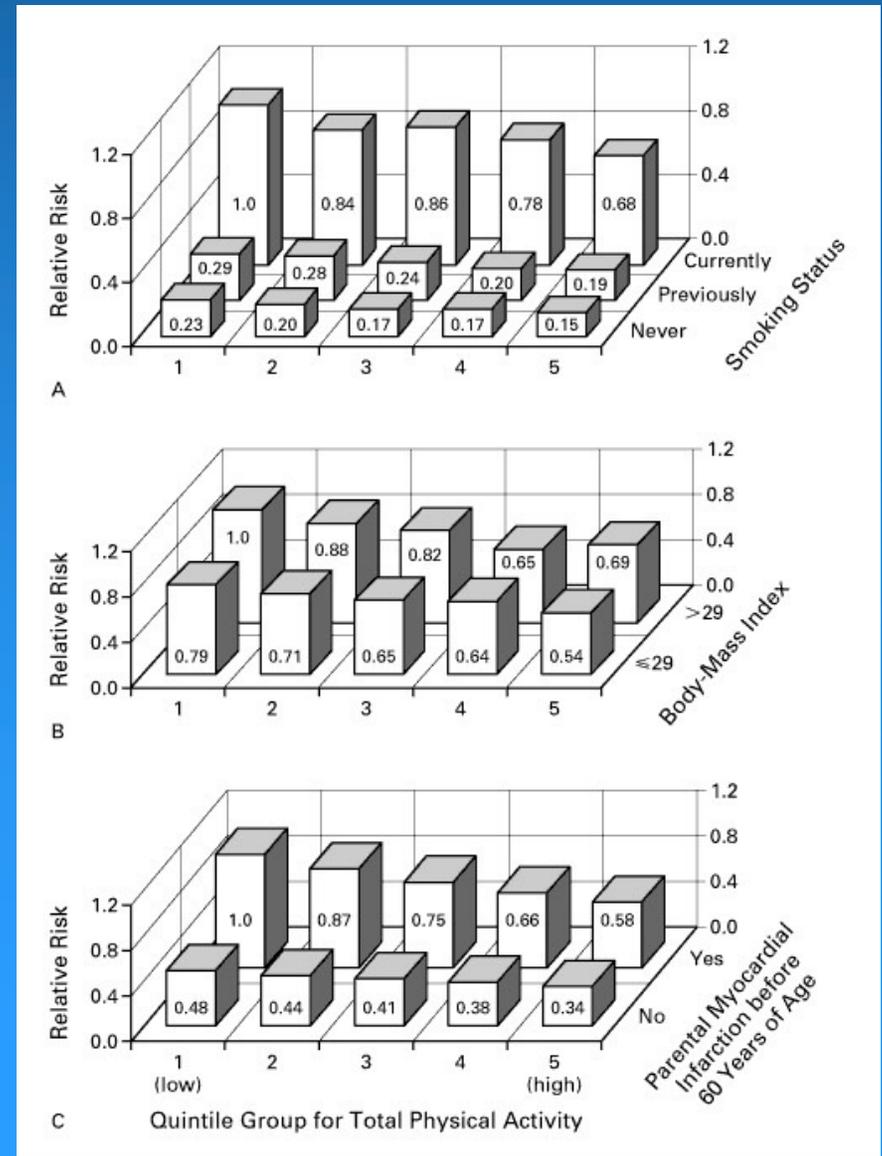
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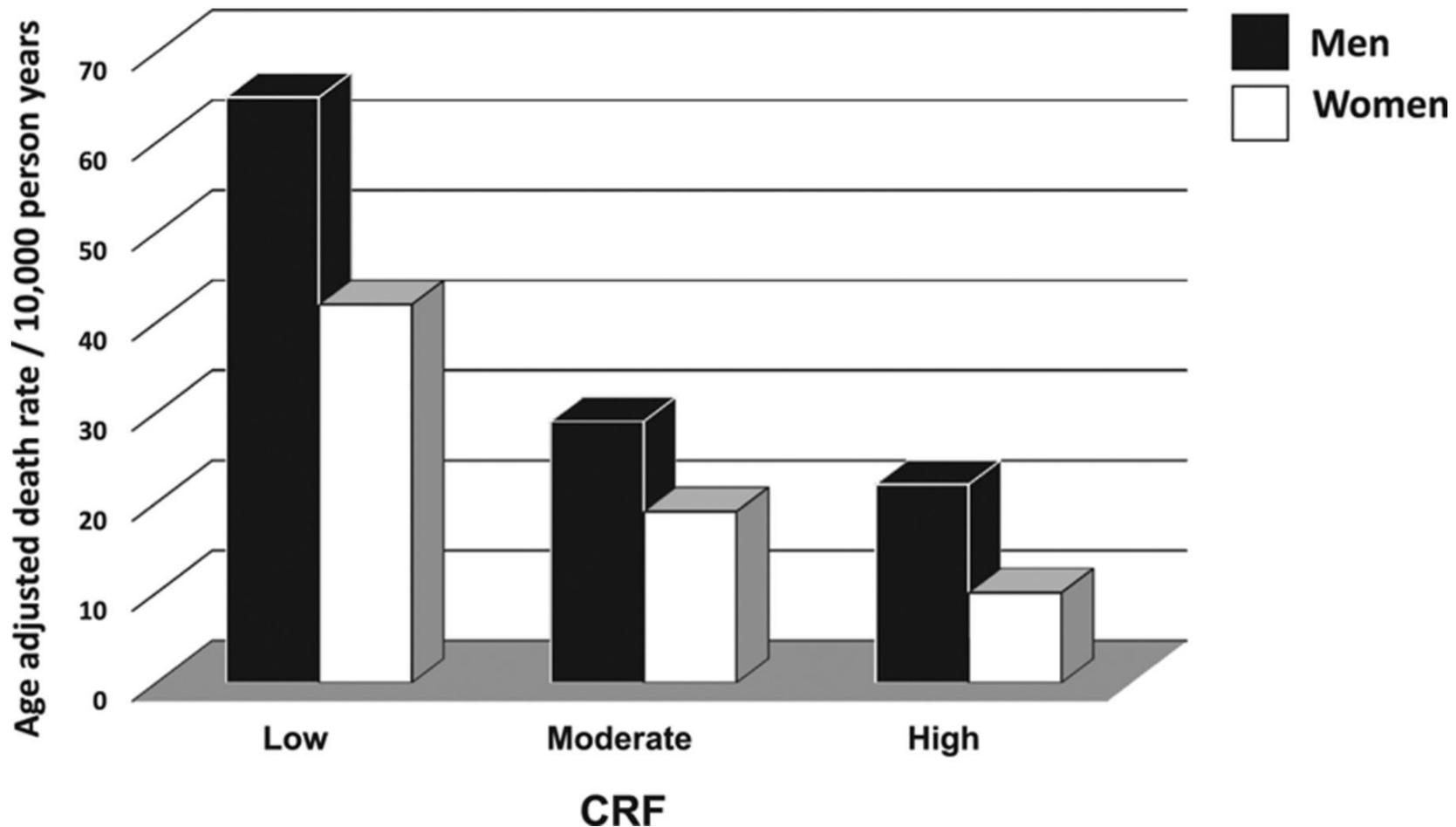
# Total Physical Activity (TPA) on 8 year Risk of Coronary Events in Post-Menopausal Women

- Nurses Health Study
- N=72,488, Age 40-73
- T.P.A. by Questionnaire
  
- TPA associated with decreasing risk of events including mortality.
- In general, Greatest benefit from sedentary to second quintile



# Aerobic Capacity and Cardiovascular Risk

- Associated with significant decrease in mortality



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**“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”**

# Established Benefits of Regular *Aerobic Exercise*

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- Prolongs Life and Prevents Coronary Heart Disease
- Improves *Quality* of Life: Vitality, Endurance, Fatigue, Depression
- Prevents Obesity
- Prevents Type II diabetes
- Lowers Blood Pressure (Modestly)
- Improves Lipid Profile: Lowers Triglycerides, Raises (good) HDL-Chol
- Lowers Cancer Rates: Colon, Breast, Prostate.
- Lowers Recurrence Rate of Breast Cancer

# Role of Physical Activity in Preventing Obesity

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- Obesity in Amish Population: No cars, No TV, No computers, Mostly farmers.
- Amish Adults: **18,400 steps per day**, 25% overweight (vs 67%), 0% obese (vs. 30%)
- Amish Children: **14,500 steps per day**, 7% overweight (vs. 16%), 1% obese

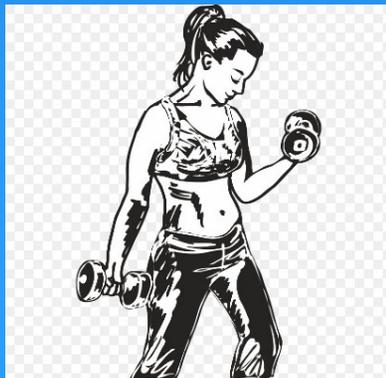
**Diet:** “Pre- WWII”, meat, potatoes, vegetables, gravy, eggs, cakes

**Average steps/day in U.S. 6,000**

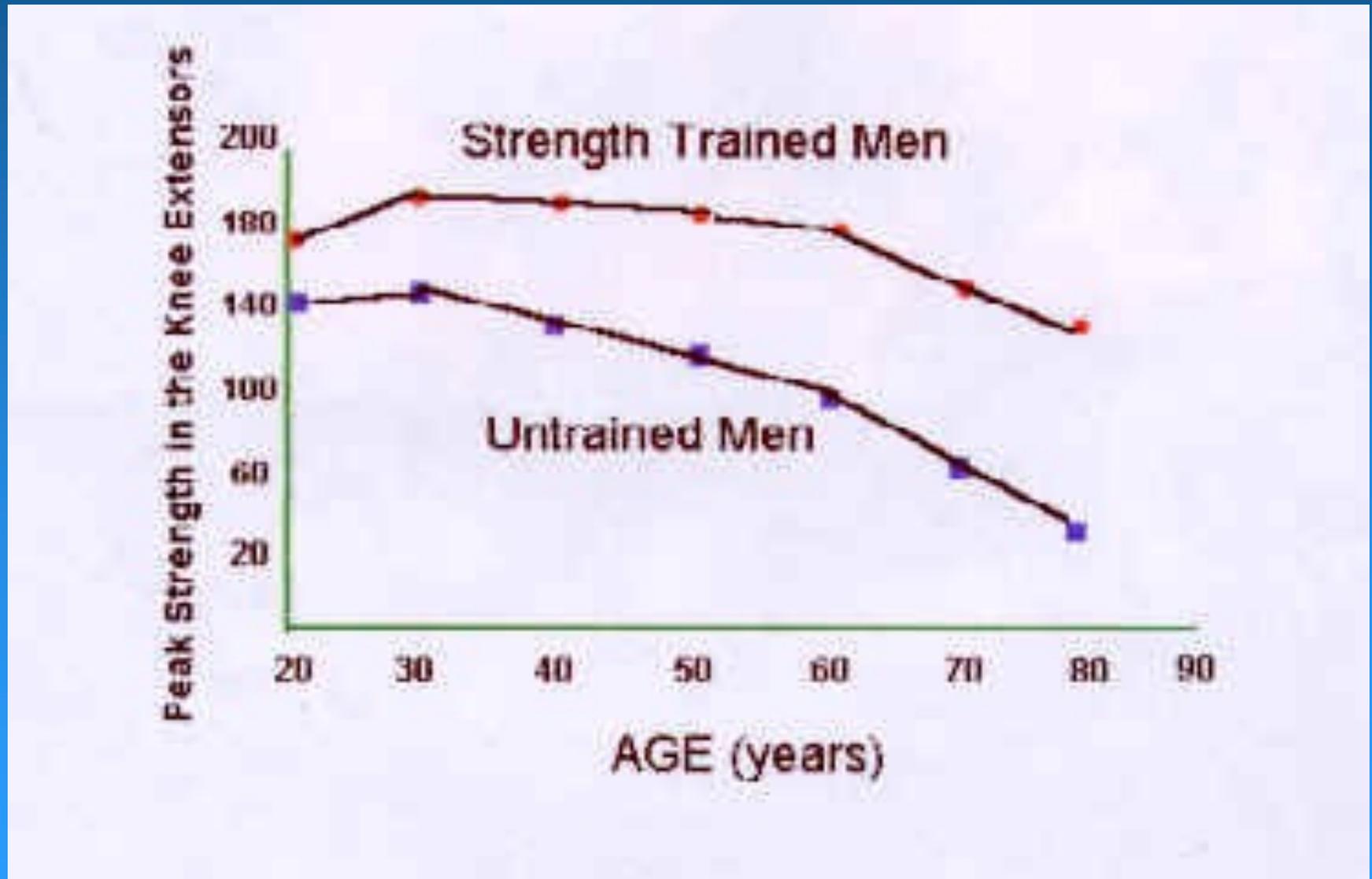
**Bassett DR, 2004, 2007**

# Definition: Strength (Resistance ) Training

- **The use of resistance to muscular contraction to build strength, endurance and size of skeletal muscles.**



# Strength with Aging



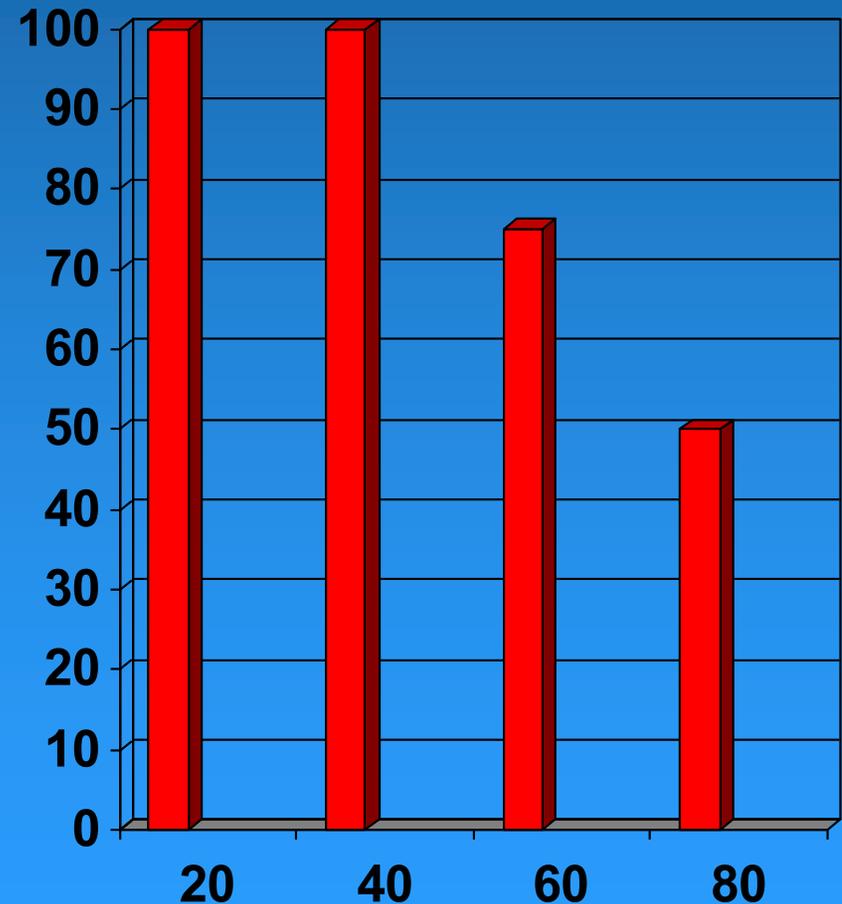
Loss of strength of roughly 12% per decade

n.b. 2-3 months of Resistance Training can increase strength 40%

# Muscle Mass with Aging

- Muscle mass begins to decrease in your 40's
- Measurably decreased by age 50 (Sarcopenia)
- Muscle mass increases only with intensive and prolonged resistance training.
- Prevention of muscle loss readily achievable.

Percent



Age in Years

Volpi E 2004 : Decreased muscle mass by middle age

Balagopal P Am J Physiol 1997 (Decreased skeletal muscle protein syntheses by middle age)

# Established Benefits of Regular *Strength* (Resistance) Exercise

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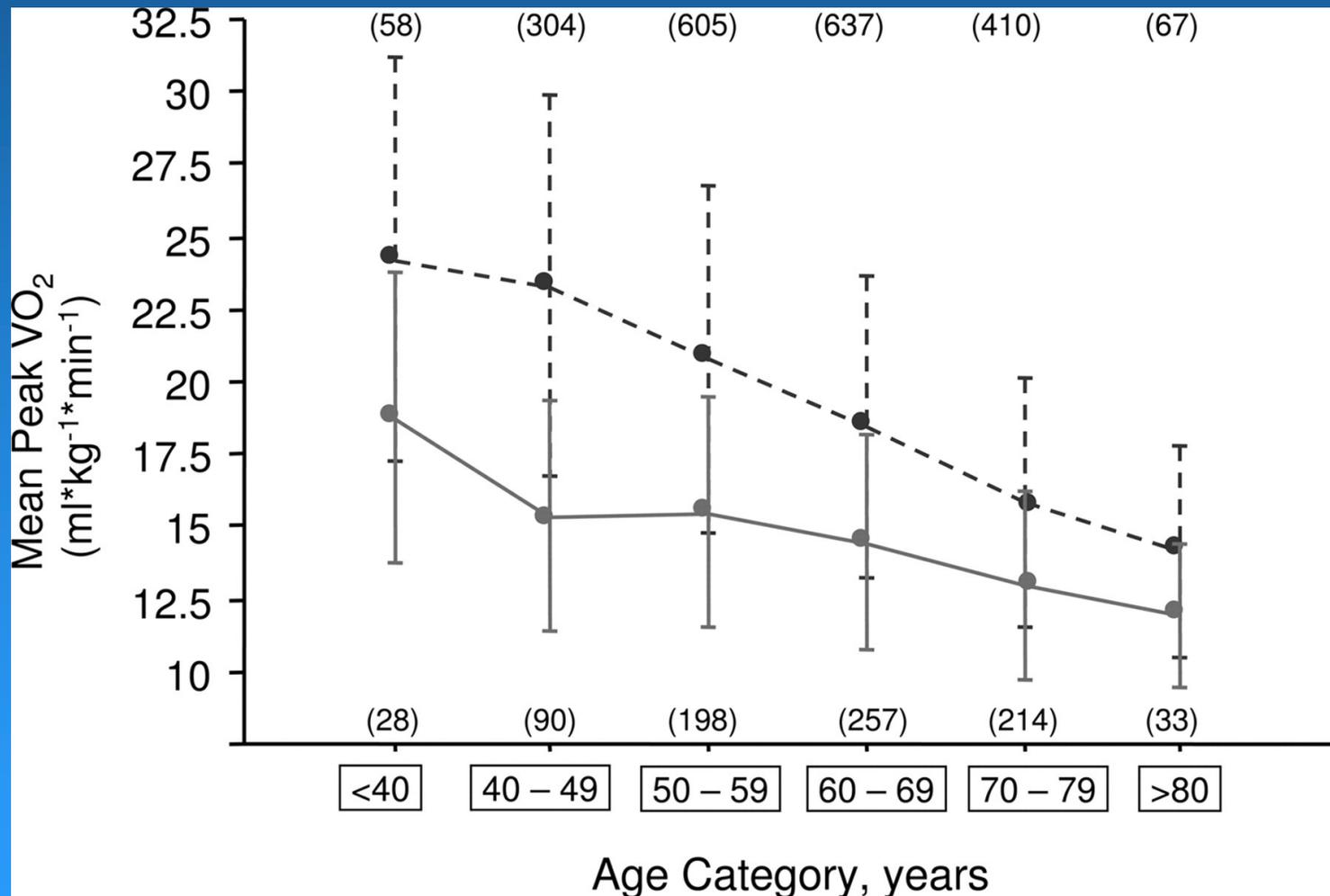
- Increased Strength and Endurance
- Increased/Maintain Muscle Mass
- Increased Resting Metabolic Rate (burn more calories at rest)
- Importance of Resistance Training increases as you age, to maintain muscle mass and prevent disability.

# Exercise in Clinical Populations

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- *Coronary Heart Disease*
- Diabetes
- Obesity
- Hyperlipidemia (high cholesterol)
- Disability of Aging.

# Peak Aerobic Capacity: Men and Women with Coronary Heart Disease



Ades, P. A. et al. *Circulation* 2006;113:2706-2712

# Exercise in Coronary Heart Disease (Cardiac Rehabilitation)

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- 25% Decreased Mortality over 3 years
  - (Mean Age 65 years)
- Improved physical function (Prevents Disability)
- Improved Lipid Profiles (HDL + 10%), Trig1 – 20%)
- Lowered Blood Pressure
- Assists with Weight Loss, diabetic control



# Exercise in Obesity / Diabetes

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- Walking Exercise and 10 lb weight loss yielded a 58% reduction in development of diabetes in middle aged overweight individuals (Diabetes Prevention Program).
- Proper diet and exercise can minimize need for medications with Diabetes
- Important role in obesity prevention and treatment.

Ref Knowler NEJM 2002)

# Exercise Behaviors: Starting an Exercise Program

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- Make a Commitment (e.g. buy shoes )
- Establish Protected Time
- Develop a habit
- Small realizable goals
- Think long-term
- Address Barriers
- Get a partner (or a dog) some days per week.

# Exercise Prescription: **FITT** for *Fitness*

- **F** *Frequency*: 3 to 5 days / week
- **I** *Intensity*: Moderate to Intense
- **T** *Time*: 20 to 30 minutes (start with less)
- **T** *Type*: *Aerobic*, activities that use large muscle groups (walking, jogging, biking, swimming, etc...)

# FITT for *Weight Loss*

- **F** *Frequency* : 5-7 days per week
- **I** *Intensity* : Light to Moderate, focusing on  
↑ duration first and then ↑ intensity
- **T** *Time* : 20 to 30 min. initially, gradually ↑  
as tolerated up to 60 min/day
- **T** *Type* : Aerobic

# Who Needs an M.D. Visit ? (Previously Sedentary)

- Generally not necessary to start a walking program. For more intense exercise:
- Are you age  $\geq 55$  ( $>45$  men) or do you have  $\geq 2$  heart disease risk factors?
- Do you have a heart condition?
- Do you get chest pain, SOB, dizziness when doing physical activity?
- Do you have a bone or joint problem made worse with physical activity?
- Are you on medicines for blood pressure or heart condition?

# Resistance Training

**F**requency : 2 - 3 x's/wk (every other day)

**I**ntensity : moderate to intense (50-90% 1-RM)

**T**ime : 1 - 2 sets, 8 - 10 exercises, 8 - 12 reps

**T**ype : Weight is Weight, "Machines" are safer.  
Generally requires a health club

# The Value of Strength Training in Older Women

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- We assessed the value of 6 months of Resistance Training. Focus on Daily Activities
- 60 women, all over 65 years of age, all with heart disease, all with difficulties in performing daily activities.
- Emphasized leg and shoulder strength which increased by 40%

# **Strength Training in Older Women with CHD: Research Design**

- **Randomized Controlled Trial:**
  - Resistance Training vs. Control Group
- **Study Population:**
  - Women  $\geq$  65 years
  - Definite CHD (MI, Revascularized, Angina)
  - > 6 months since hospitalization
  - Physical Function Score < 85 / 100
  - Not currently (6 months) in an organized cardiac exercise program

# Study Interventions

- Resistance Training:
  - 3 x Weekly, x 6 months
  - 50-80% Single Repetition Max
  - 7 Exercise (leg ext, bench press, biceps curl, shoulder press, lat pulldown, leg curl, leg press)
- Control Group
  - Non-strength Yoga
  - Breathing/ Stretching

# CR in Older Women: Role of Strength Training

A Randomized-Controlled Clinical Trial (NIA Funded)

Primary Outcome

Continuous Scale-Physical Functional Performance Test (CS-PFP)

## Light

Scarf Pickup  
Jacket on/off  
Milk jug pour  
Up from Tub  
Open Fire-Door

## Medium

Kitchen Pot-Carry  
Sweeping  
Empty Wash  
Load Dryer  
Make Bed

## Heavy

Grocery Carry  
Suitcase on bus  
Stairs  
6 minute-walk  
Vacuuming-(Oats<sup>AHA</sup>)

# Resistance Training in Older Women with CHD

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- Total Physical Performance Score: +24%
- Domains:
  - Upper Body Strength + 18%\*
  - Lower Body Strength + 23%\*
  - Balance and Coordination + 29%\*
  - Upper Body Flexibility +10%
  - Endurance +26%\*
  - 6-Minute Walk +15%\*

\* = P<0.05 vs controls

# Additional Findings

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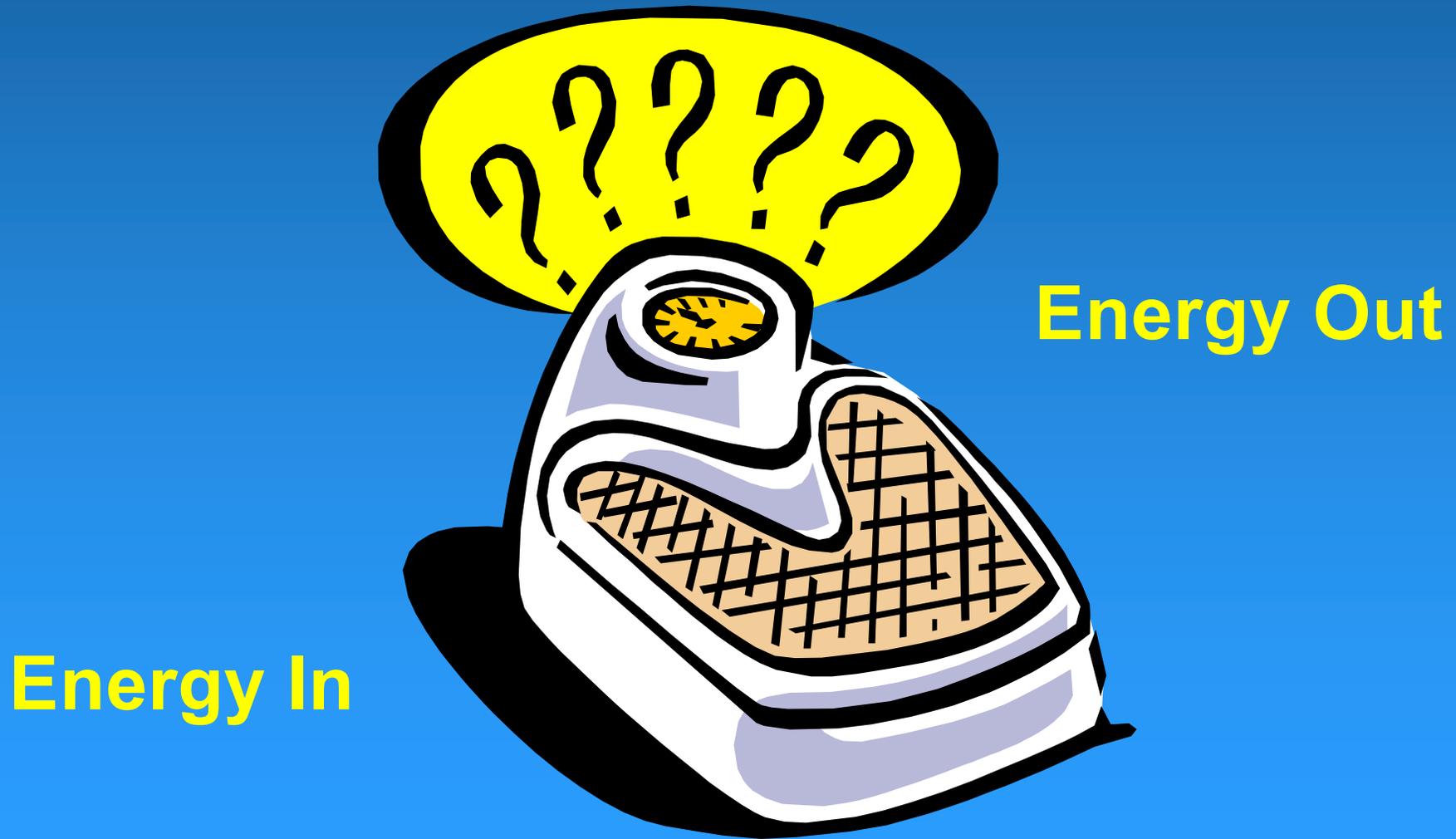
- After conditioning, 13 of 16 standardized household activities; (dressing, kitchen and cleaning, carrying groceries, walking on to bus with luggage, 6-min walk), were performed more rapidly, or with increased weight vs. controls.
- Maximal power for weight bearing activities increased by over 40%

# Conclusions: Resistance Training

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- Resistance Training results in a substantial improvement in multiple domains of *measured* physical performance in older women with CHD.
- Strength Training should be considered for older women in CR (and older men).

# Development of obesity



Overeating or *Under-active* ?

# “Small Change”

- An increase or decrease of 100 calories per day for a year results in 10 lbs of weight gain or weight loss
- 12 oz Coke = 155 calories
- Small Hershey Bar = 300 cal
- 9 “Wheat Thins” = 100 calories
- Preparing dinner and cleaning up = 100 calories
- Walking a mile = 100 calories

Can You Lose Weight with Exercise  
Alone ?

# “High-Caloric” Expenditure Exercise Protocol (In Heart Patients)

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- Low Intensity
- Increasing to 45 min-1 hr/day, 5-7 days/week
- 4 Month Duration
- Goal of 2500 Kcal/week Exercise EE (roughly 18 miles per week walking)
- $1 \text{ mile} = 100 \text{ kcal} \times \% \text{ overweight} \times 100$

# High Caloric Training in Overweight CHD Patients

No nutritional intervention. Attained 2600 kcal/week exercise ( 18-20 miles walking per week).

	<u>Pre</u>	<u>Post</u>	
Age	62.5		Change
Weight	208	197	- 11 lbs
Waist	43	40.8	- 2.2 “
Chol/HDL	5.6	4.8	
Triglycerides	240	178	-62

# In Summary

- Regular aerobic exercise is preventive and leads to a longer, disease-free life.
- Strength training is important, particularly as you get older to prevent disability
- Obesity is as much due to “Under-Activity” as it is to overeating.



**Myths and “Myth-Busting”**

# Myth-Busting

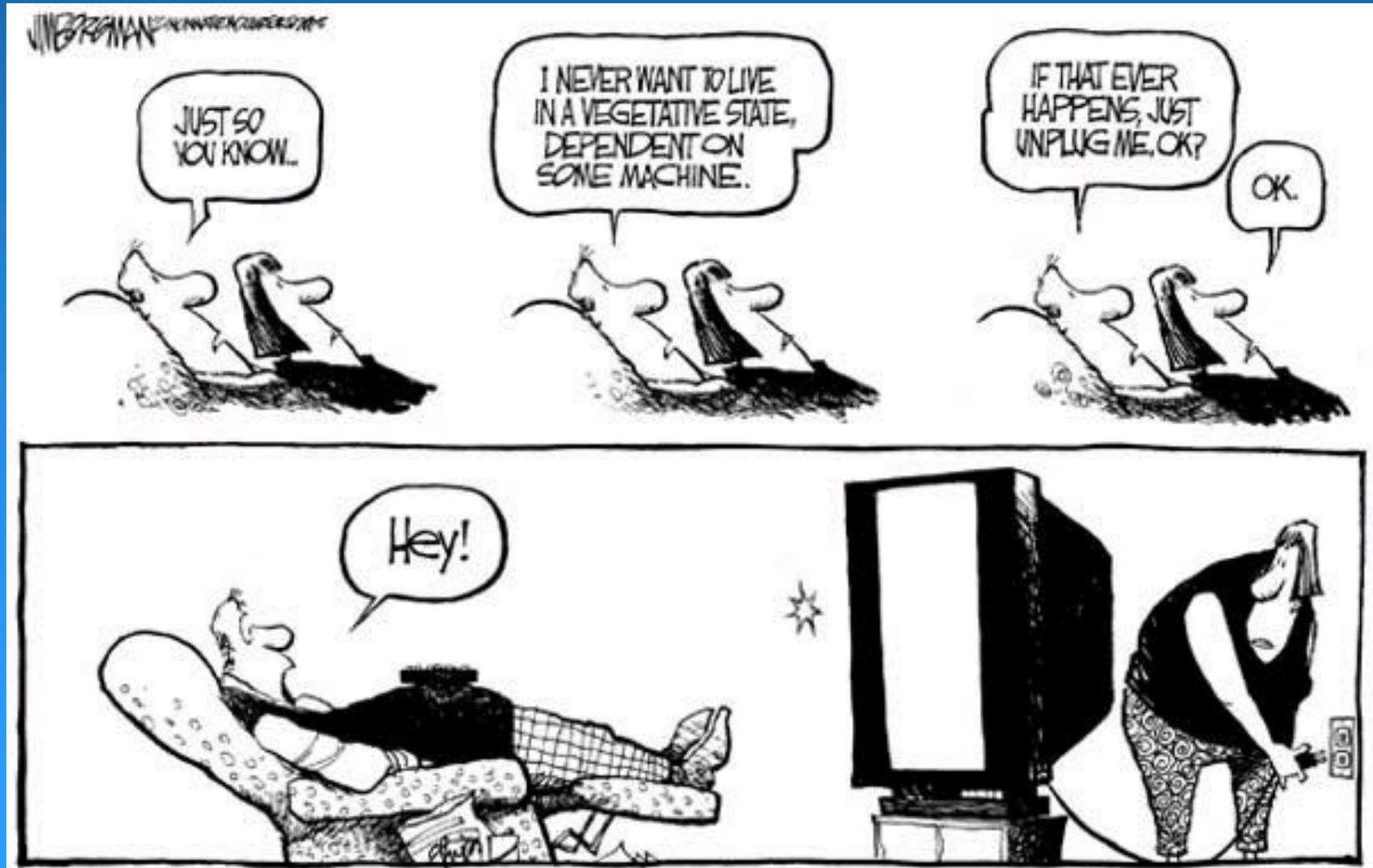
- “I only get so many heart beats in a lifetime, I don’t want to waste them exercising”. (next slide for math)
- No pain, No gain
- To get the most out exercise I need to join a gym.
- Exercise is only beneficial if you do it for at least ½ hour
- If I stop exercising, muscle turns into fat.
- The key to keeping a flat stomach and having a “6-pack” is lots of sit-ups.
- I will burn more fat if I exercise at a lower intensity.
- Exercise is the best way to lose weight quickly.
- The best time of day to exercise is at the end of the day or soon after a meal.
- I’m naturally thin so I don’t need to exercise.
- I should be short of breath and sweating to benefit from exercise.
- Overweight people eat a lot more calories than skinny people.
- If I start weight training I will gain weight and get “bulky”.
- Weight training is more important for younger people.
- I’m too busy.

# The runners heartbeat calculation

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- Run 1 hour per day, increase HR by 60 beats per minute for 1 hour
- $60 \times 60 \times 1 = + 3,600$  heart beats
- Decrease HR by 10 beats per minute for remaining 23 hours
- $60 \times 10 \times 23 = - 13,800$  beats
- The runner saves 10, 200 beats per day !

# Advance Directives: Living Will



**In the interest of time,  
didn't discuss:**

**Flexibility**

**Yoga**

**Tai Chi**

**And so forth**



Thank You !

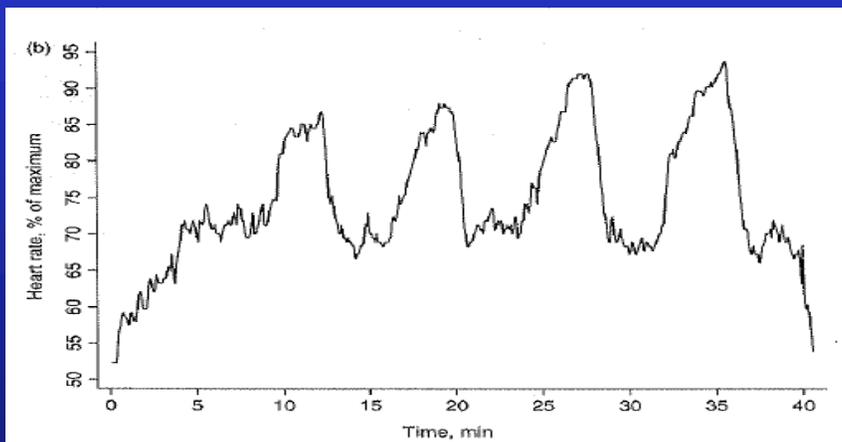
**Burlington, Vermont**



# Maximizing Fitness in CR

- Aerobic Fitness: Best predictor of prognosis in CR
- Optimized with Aerobic Interval Training
  - Multiple Studies by Wisloff et al (Norway) document greater effectiveness on fitness.
  - Has been studied Post MI, Post CABG, CHF, Met. Syndrome, Obesity
  - Not yet known if as safe as continuous training
  - Somewhat selective for fittest patients
  - Requires close supervision
  - Subjectively favored by participants over more monotonous moderate intensity continuous training

8 min warm-up (70% Max HR) → 4x4 min intervals at 85-95% Max HR → 3 min “active recovery at 70% Max HR

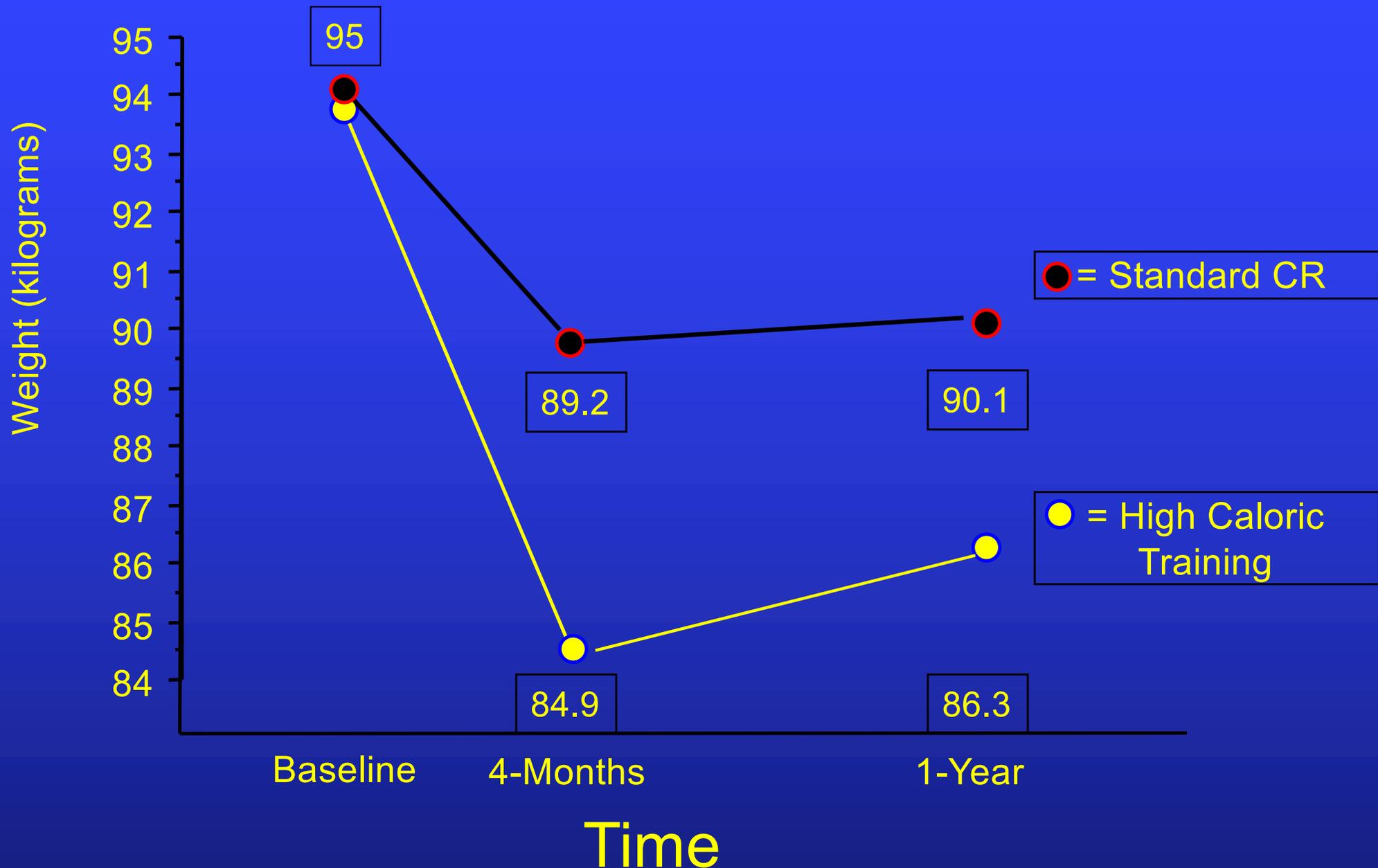


Keteyian S Am Heart J 2008 Prognosis in CHD  
Wisloff U Circulation 2007 Interval Training in CHF

# Aerobic Conditioning in Older Coronary Patients

<u>STUDY</u>	<u>Age Range</u>	<u>Peak VO<sub>2</sub></u>	<u>Work Capacity</u>
Williams: AJC 1985	65-82 (70)	N.A.	+ 53%
Ades: AHJ 1990	62-77 (68)	+ 27%	+ 62%
Ades: Circulation 1993	62-82 (70)	+ 18%	+ 54%
Lavie: JACC 1993	>65 (70)	N.A.	+ 34%
Marchionni Circulation 2003			

# Weight Loss Maintenance (N = 62)



# High-Caloric Exercise vs. *Standard CR* Exercise (N= 72, 4-Month Data)

	<b>Combined Groups</b>	<b>High Caloric Group</b>	<b>Standard CR Group</b>
<b>N</b>	72	36	36
<b>Weight (kg)</b>	-6.2 $\pm$ 5 *	- 8.2 $\pm$ 4	-3.7 $\pm$ 5 **
<b>Waist (cm)</b>	-6 $\pm$ 5 *	- 7 $\pm$ 5	-5 $\pm$ 5 **
<b>Fat Mass (kg)</b>	-4.6 $\pm$ 3.7*	-5.9 $\pm$ 3.7	-2.8 $\pm$ 3.4 **
<b>Fat Free Mass (Kg)</b>	-1.8 $\pm$ 2.1*	-2.2 $\pm$ 2.8 (-27%)	-1.3 $\pm$ 2.5 (-32%)
<b>V<sub>O</sub><sub>2</sub> max (ml/kg/min)</b>	+2 + 4*	+ 2 + 4	+ 2 + 3

\*= P <0.05 vs. baseline

\*\* = P<0.05 vs. standard CR group

# High Caloric Expenditure Exercise and Weight Loss on Cardiac Risk Factors

	<b>High Caloric Group</b>
Insulin Sensitivity (Hyperinsulinemic Euglycemic Clamp)	+ 26%
Insulin Level	- 31%
Triglycerides mg/dL	- 23 mg/dL
HDL-Chol	+ 12%
Cholesterol / HDL Ratio	- 15%
Mean Blood Pressure	- 11 mm Hg
HS-C Reactive Protein (mg/dL)	- 0.52

# High-Caloric Exercise vs. *Standard* CR: Risk Factor Response

	Combined	High Cal.	Stnd CR	P Value B.Gps.
Insulin sensitivity	+ 21% *	<b>+26%</b>	<b>+13%</b>	<0.01
Insulin	- 25% *	<b>-31%</b>	<b>-19%</b>	<0.01
T-Chol	-2%	<b>-5%</b>	<b>+1%</b>	NS
Triglyc mg/dL	-20*	<b>-23</b>	<b>-6</b>	0.07
HDL-C	+3 (8%) *	<b>+12%</b>	<b>+5%</b>	NS
LDL-C	-3%	<b>-6%</b>	<b>-1%</b>	NS
Chol/HDL	-10%*	<b>-15%</b>	<b>-3%</b>	<0.01
Mean BP mm	-7 *	<b>-11</b>	<b>-7</b>	NS

# High-Caloric Exercise vs. *Standard CR*: Inflammation and Clotting Response

	Combined Group	High Cal Exercise	Stnd CR Exercise	P Value (Between)
HS-CRP	- 0.44 <sup>^</sup>	-.52	-.37	NS
PAI-1	-29% *	-30%	-10%	0.07
tpa	-15%	-19%	-12%	0.17
Platelet Reactivity (.2 ADP Fib)	-14%	-16%	-13%	0.20

\*=P<0.05    ^= P=0.07

# Exercise for Overweight Patients in CR: Individualized Therapy

- Walk daily and walk far. “It’s part of your diet”.
- Focus on Calorie burning using readouts on treadmills and other equipment
- 1 mile = 100 Kcal for average weight individual, increase by % overweight
- Optimally combined with behavioral weight loss program
- Exercise key in maintaining weight loss.

# Preventive Programs: FAHC Preventive Cardiology Program

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- Cardiac Rehabilitation (Phase II and III)
  - Healthy Heart Weight Loss Program
  - Healthy Heart Diabetes Program
  - Healthy Heart for Seniors
  - Healthy Heart for Chronic Heart Failure
  - Healthy Heart for Peripheral Vascular Disease
- 

62 Tilley Dr. S. Burlington (Off Route 116)  
847 4514

# Walking the Dog



# Getting Started

- Focus on aerobic exercise
- Exercise every other day to start
- Warm-up
  - Start slowly, gradually increase intensity
- Cool-down
  - Stretching
- Increase duration by no more than 10%/week
- Focus on time (not speed) initially.
- After 3 to 4 weeks, increase # of days / week

# Tips to Keep it Going

- Find activities you like [or dislike the least]
- Keep at it, it will feel better in 2-4 weeks !
- Convenience is key
- Weather happens...plan for indoor alternative
- Gadgets and Gizmos (pedometer/step counter)
- Keep records
- Set (realistic) short/long-term goals
- Prioritize exercise
- Schedule it
- Be flexible
- Pack your bags the night before
- Do some type of exercise on any day where you eat.
- Reward yourself (not with food !)
- Exercise with a friend (or your dog)
- Beware of modern day conveniences
- Maximize “lifestyle” exercise

# Cardiac Rehabilitation Program



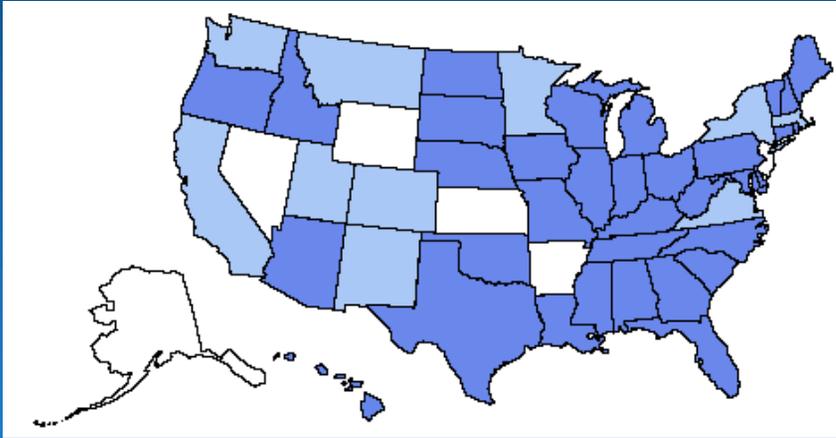
62 Tilley Dr (Rt. 116)  
S Burlington, VT

# Obesity in America

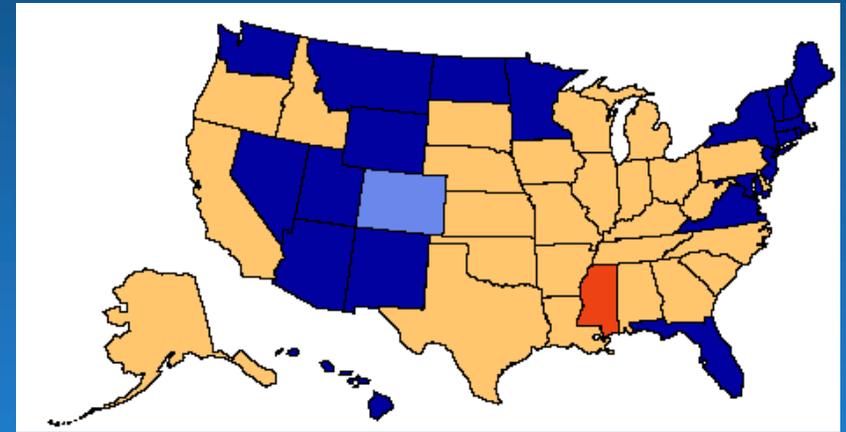
- 2/3 of adults overweight (BMI over 25)
- Most prevalent cardiac risk factor
- 1/3 Obese (BMI over 30)
  
- Defined by Body Mass Index (BMI)
- $\text{Weight in Kg} / (\text{Height in Meters})^2$
- BMI is not body composition.
- Example 100 Kg (220 lb) 2 Meters tall (6'6") =  
BMI of:  $100 / (2 \times 2 = 4) = 25$

# Obesity Trends

1990



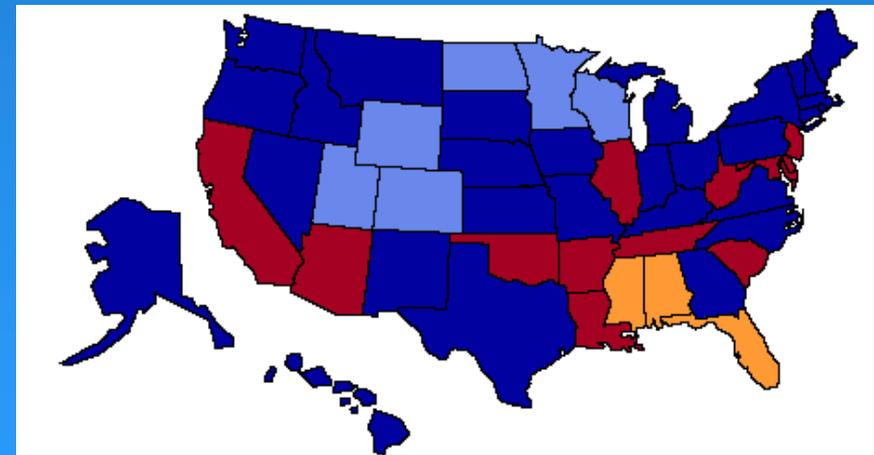
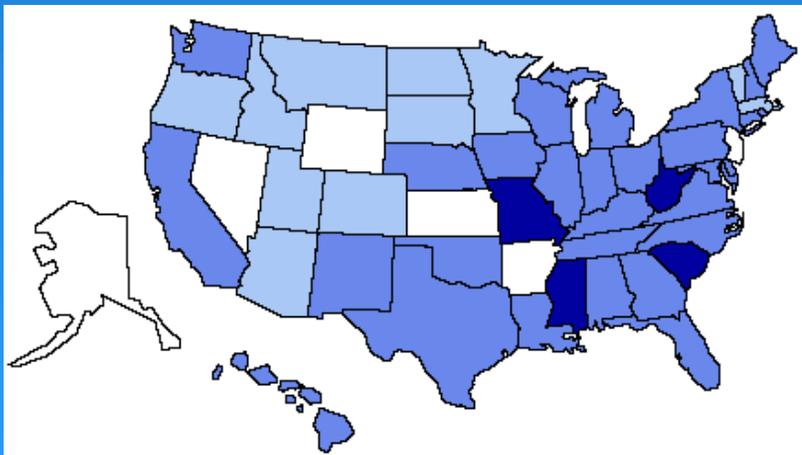
2001



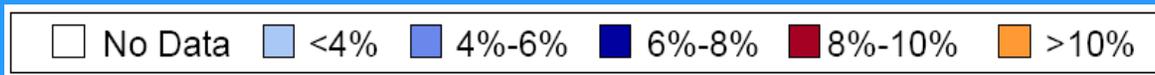
1990

# Diabetes Trends

2001



BRFSS, 1990-2001



The National Diabetes Education Program, a joint program with NIH & CDC



"And what do you folks do to maintain your cardiovascular fitness?"