# Physical Activity and Health

*Prevention Across the Lifespan*
*Center for Healthy Living*
*Western Washington University*
*March 12, 2004*
*Bellingham, Washington*

**Steven N. Blair**
**President and CEO**
**Cooper Institute**
**Dallas, Texas**

# Aerobics Center Longitudinal Study

# Design of the ACLS

1970 More than 75,000 patients 2003

Cooper Clinic examinations--including history and physical exam, clinical tests, body composition, EBT, and CRF

Mortality surveillance to 1996

More than 2300 deaths

1982 ‘86 ‘90 ‘95 ‘99

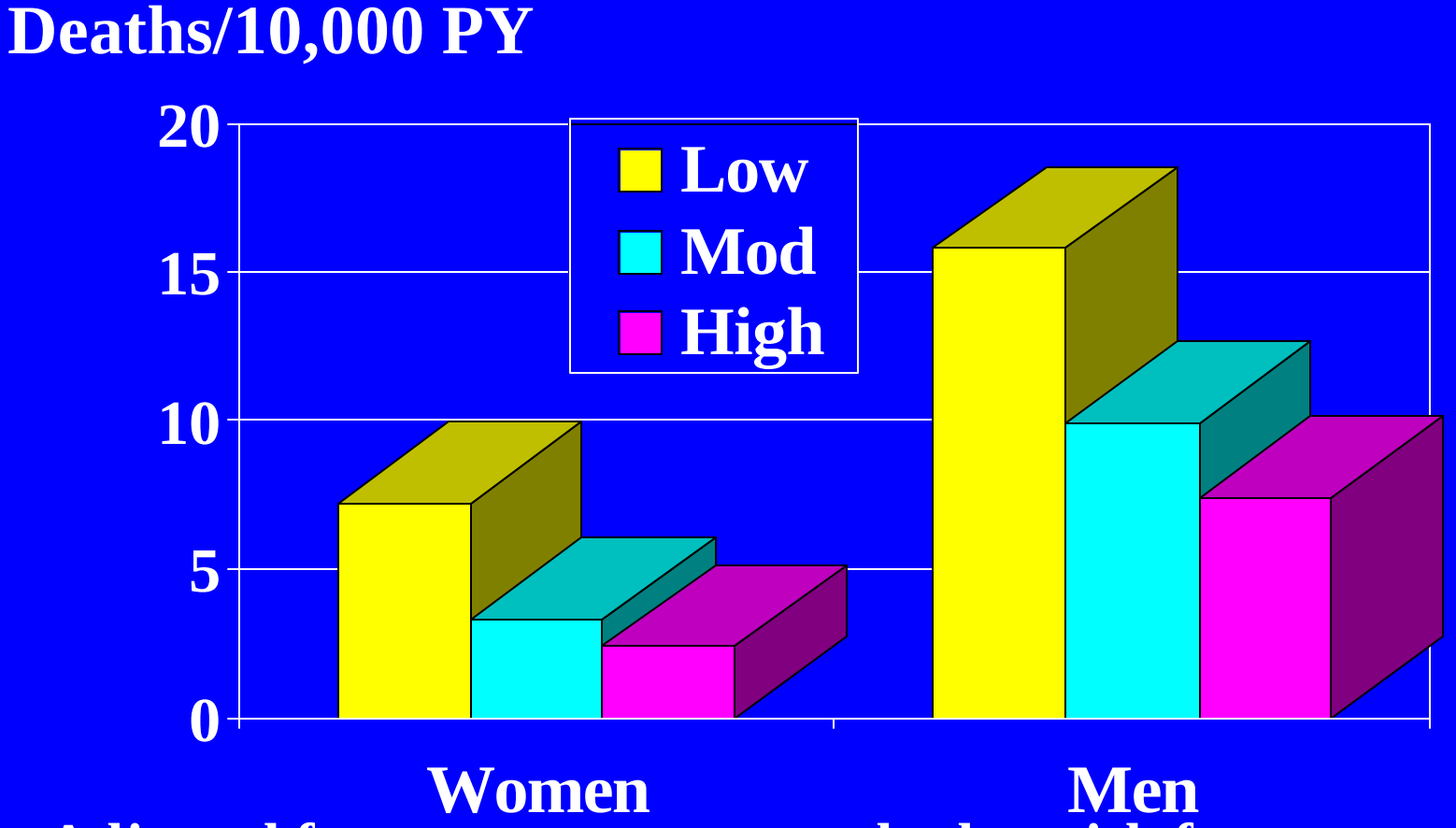
Mail-back surveys for case finding and monitoring habits and other characteristics

# Aerobics Center Longitudinal Study

- Prospective investigation of 7,080 women and 25,341 men examined at the Cooper Clinic at least once during 1970-1989
- Average age: women=42.7 yrs; men=42.9 yrs
- Approximately 97% white, mid- to upper-socioeconomic strata
- Followed for mortality to 12/31/89
  - 89 deaths during 52,982 woman-years
  - 601 deaths during 211,996 man-years

Blair SN et al. *JAMA* 1996; 276:205-10

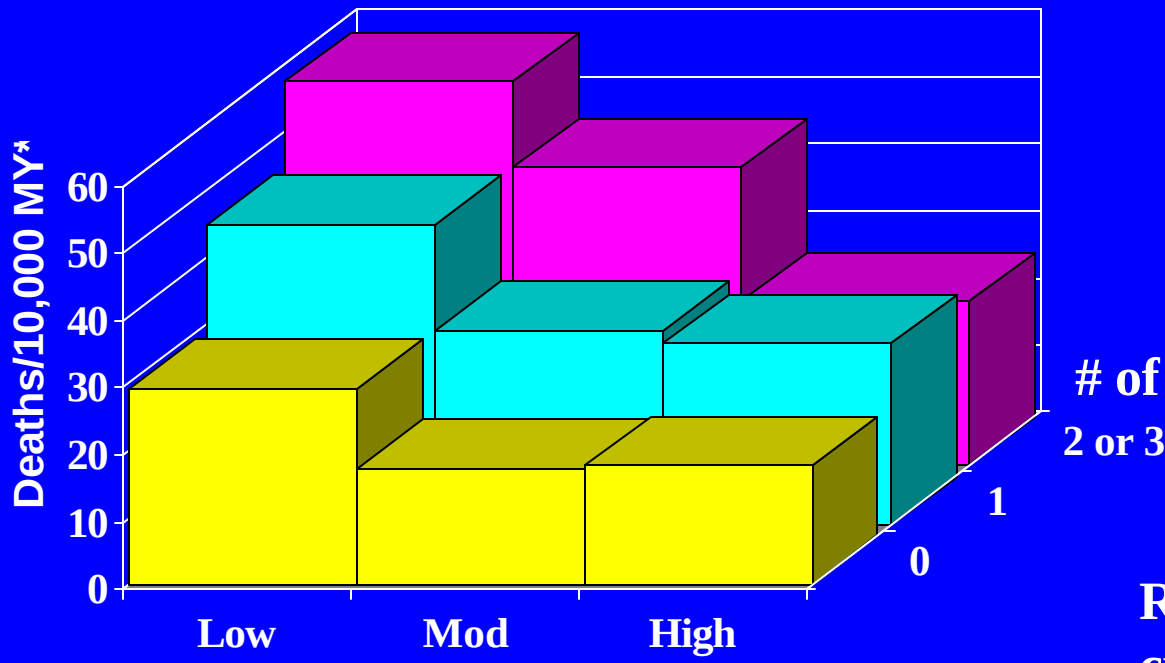
# CVD Death Rates* by Fitness Groups, 7,080 Women and 25,340 Men, ACLS




Adjusted for age, exam year, and other risk factors

Blair SN et al. *JAMA* 1996; 276:205-10

# Cardiorespiratory Fitness, Risk Factors and All-Cause Mortality, Men, ACLS



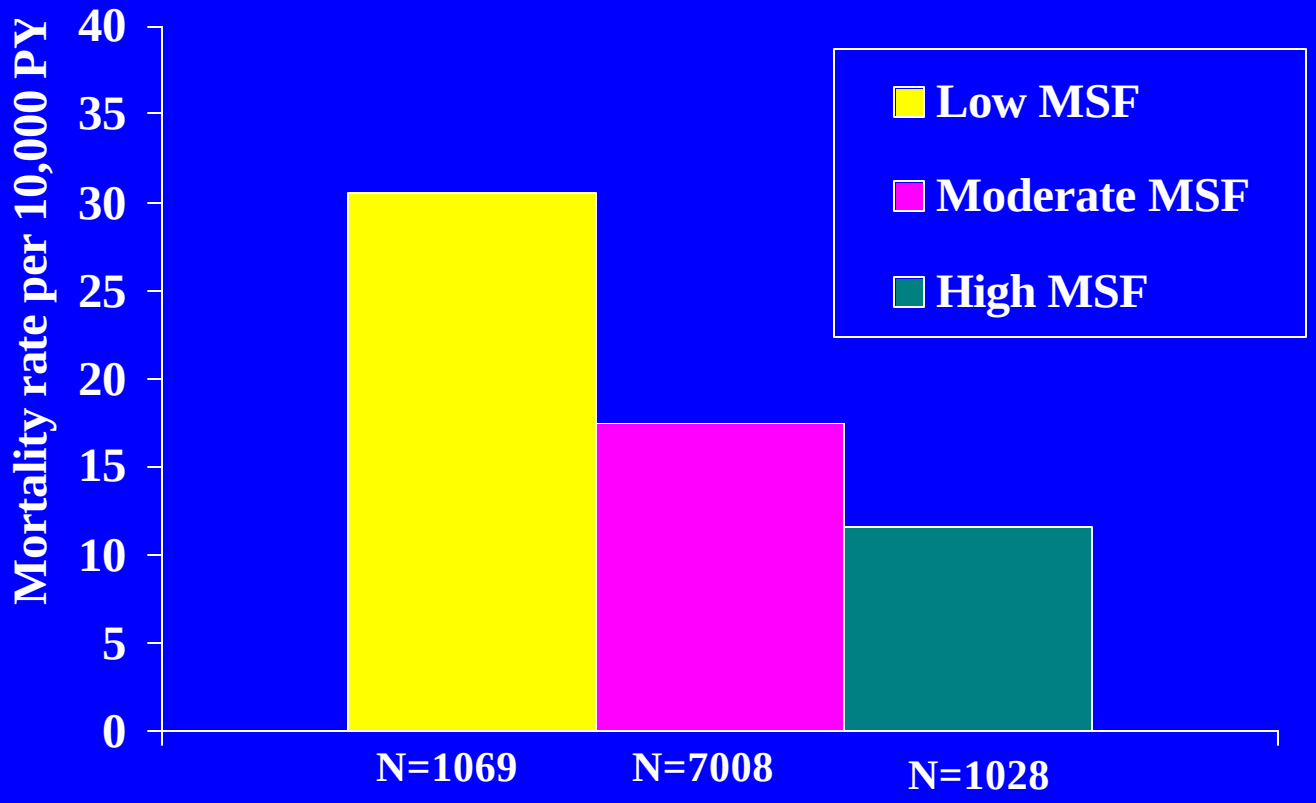

Cardiorespiratory Fitness Groups

*Adjusted for age, exam year, and other risk factors

Risk Factors
current smoking
SBP ≥140 mmHg
Chol ≥240 mg/dl

Blair SN et al. *JAMA* 1996; 276:205-10

# Mortality Rates per 10,000 Person-Years by Musculoskeletal Fitness Category, ACLS

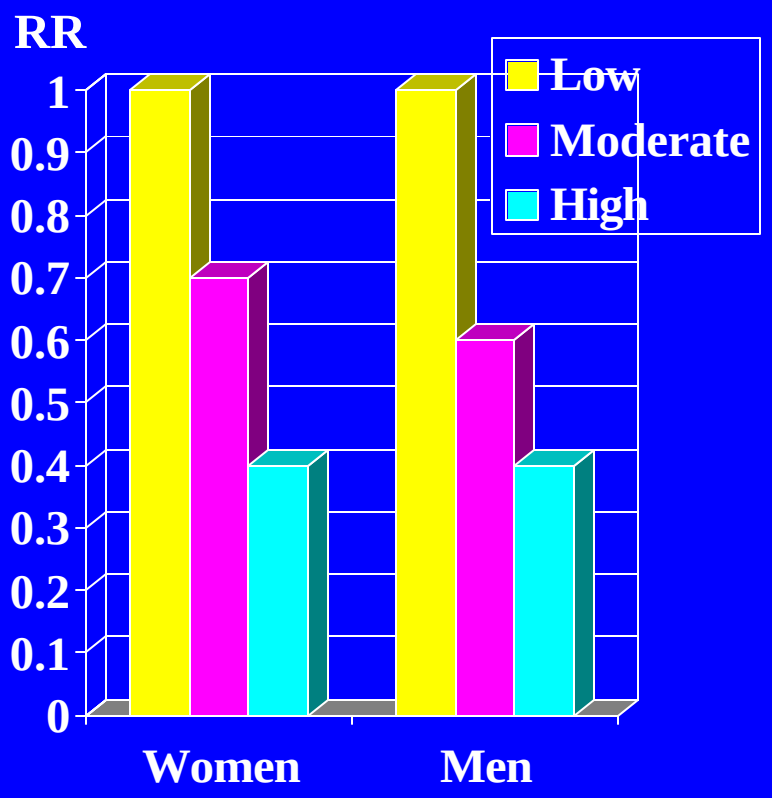



FitzGerald S et al. *J Phys Act Health 2004*

# Older Women and Men

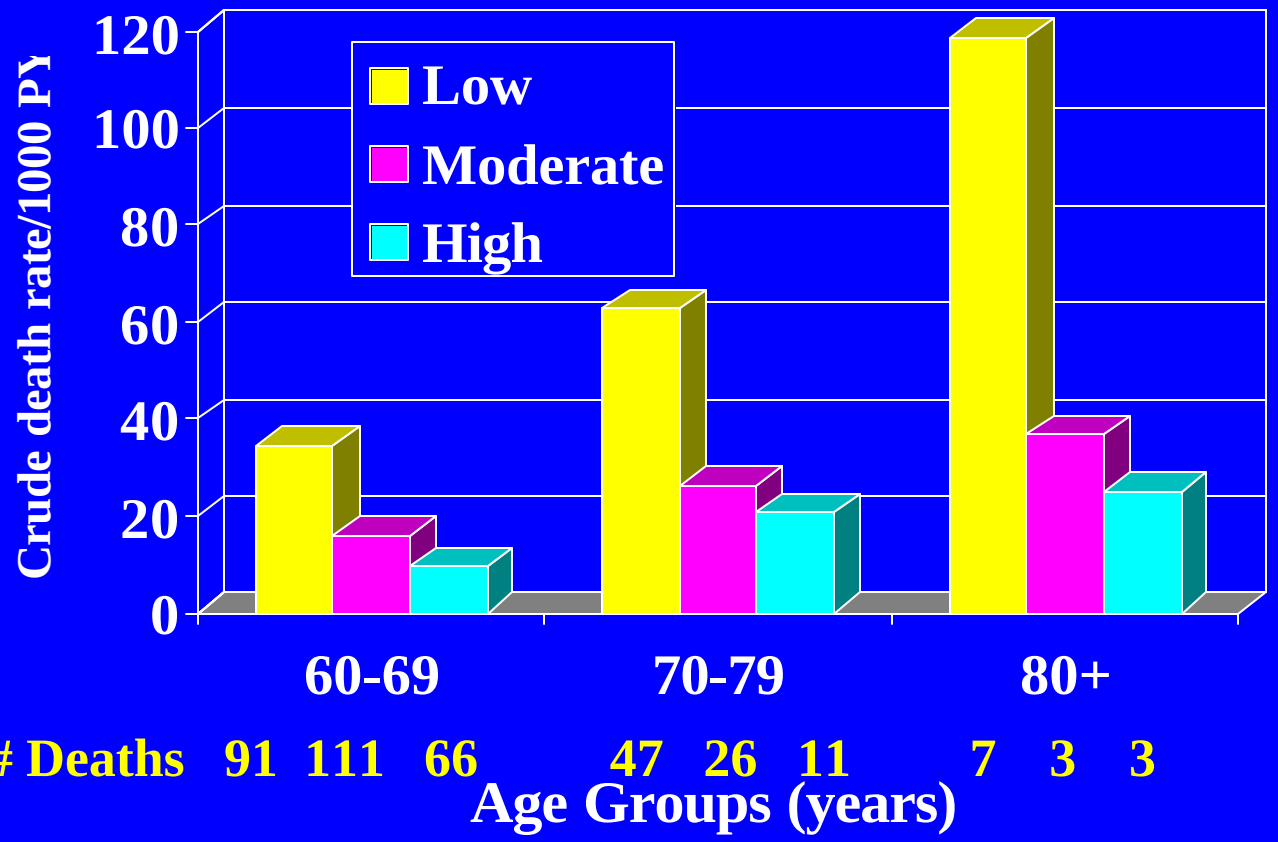
# Risk of Death by Fitness Groups, 749 Women and 1758 Men 60 and Older, ACLS

- Age, exam-year, BMI, cholesterol, high blood pressure, diabetes, smoking, CVD, parental CVD adjusted RR for all-cause mortality
- Patients with cancer and failure to achieve at least 85% of predicted max HR were excluded




Blair & Wei. Am J Health Prom. 2000

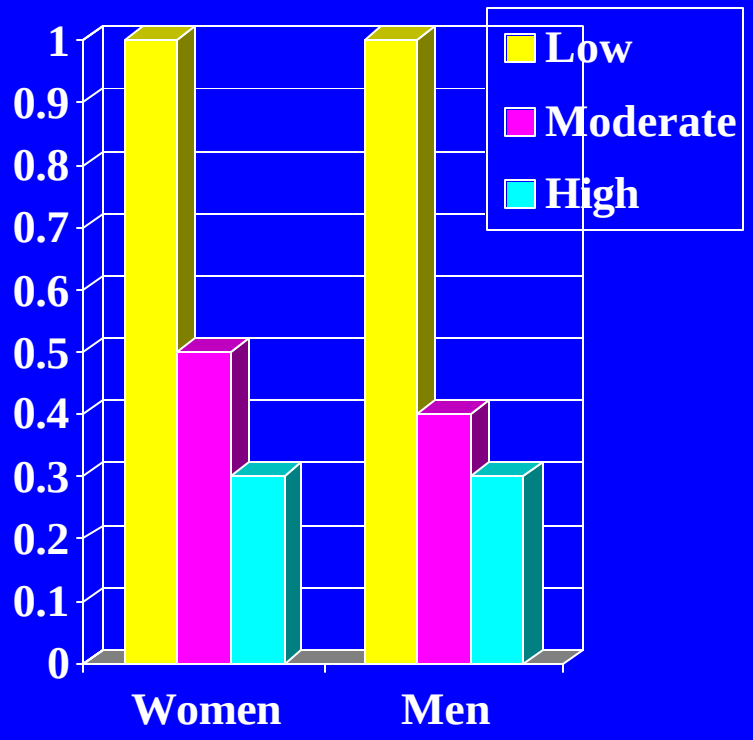
# Death Rates/1000 by Fitness Groups, 2135 Men Aged 60 and Older, ACLS




Blair & Wei. *Am J Health Prom* 2000; 15:1-8

# Fitness and Functional Limitations, Women and Men, ACLS

- OR for self-reported functional limitation adjusted for age, follow-up, BMI, smoking, alcohol intake, baseline disease, & disease at follow-up

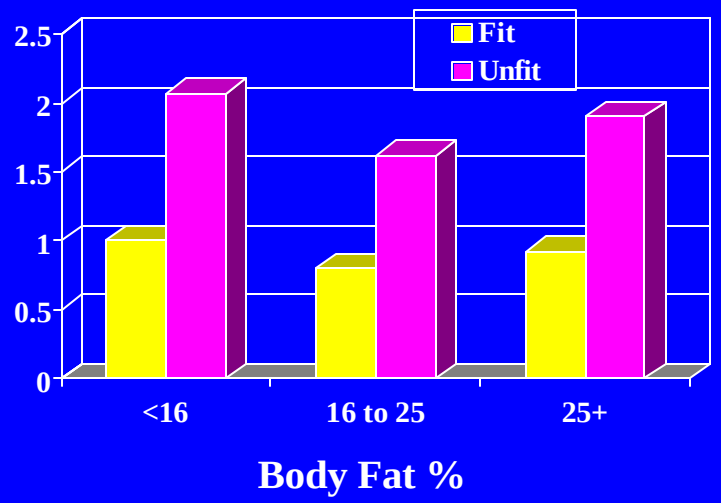



Huang et al. MSSE 1998, 30:1430-5

# Benefits of Physical Activity for Individuals of Any Size

# Cardiorespiratory Fitness, Body Composition, and All-Cause Mortality

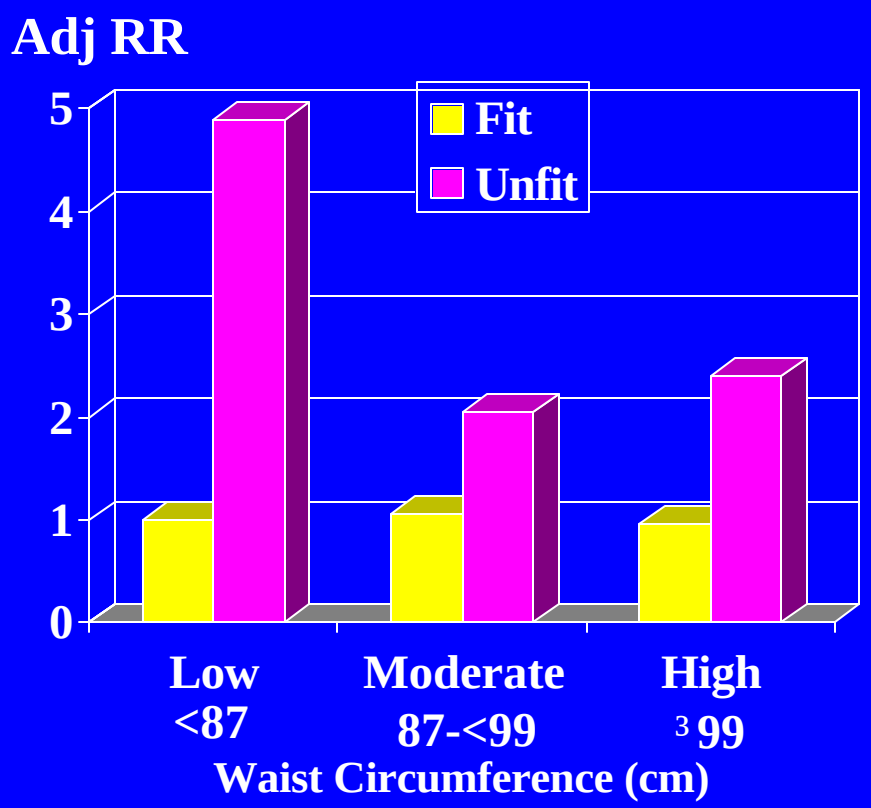
- 21,925 men, followed an average of 8 years, 428 CVD deaths
- Excluded men with MI, stroke, or cancer at baseline
- Exposures
  - CRF from a maximal exercise test on a treadmill
  - Body composition determined by hydrostatic weighing, sum of 7 skinfolds, or both
- RR adjusted for age, exam year, smoking, and parental history of CVD




Lee CD et al. Am J Clin Nutr 1999

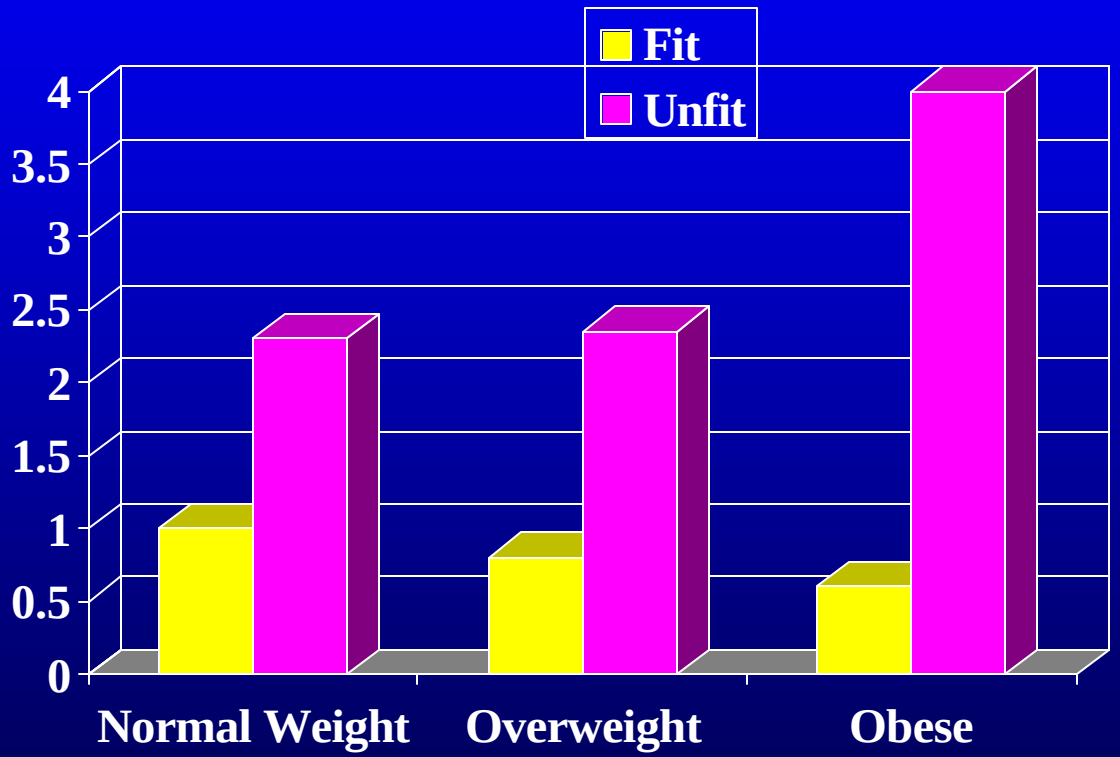
# Adjusted RR for All-Cause Mortality by Fitness and Waist Circumference

- Waist circumference measurements in a subgroup 14,043 men
- 162 deaths in 78,008 man-years
- RR adjusted for age, examination year, smoking habit, alcohol intake, and parental history of CHD




Lee CD et al. Am J Clin Nutr 1999.

# Adjusted RR for All-Cause Mortality by Fitness and BMI, ACLS Women

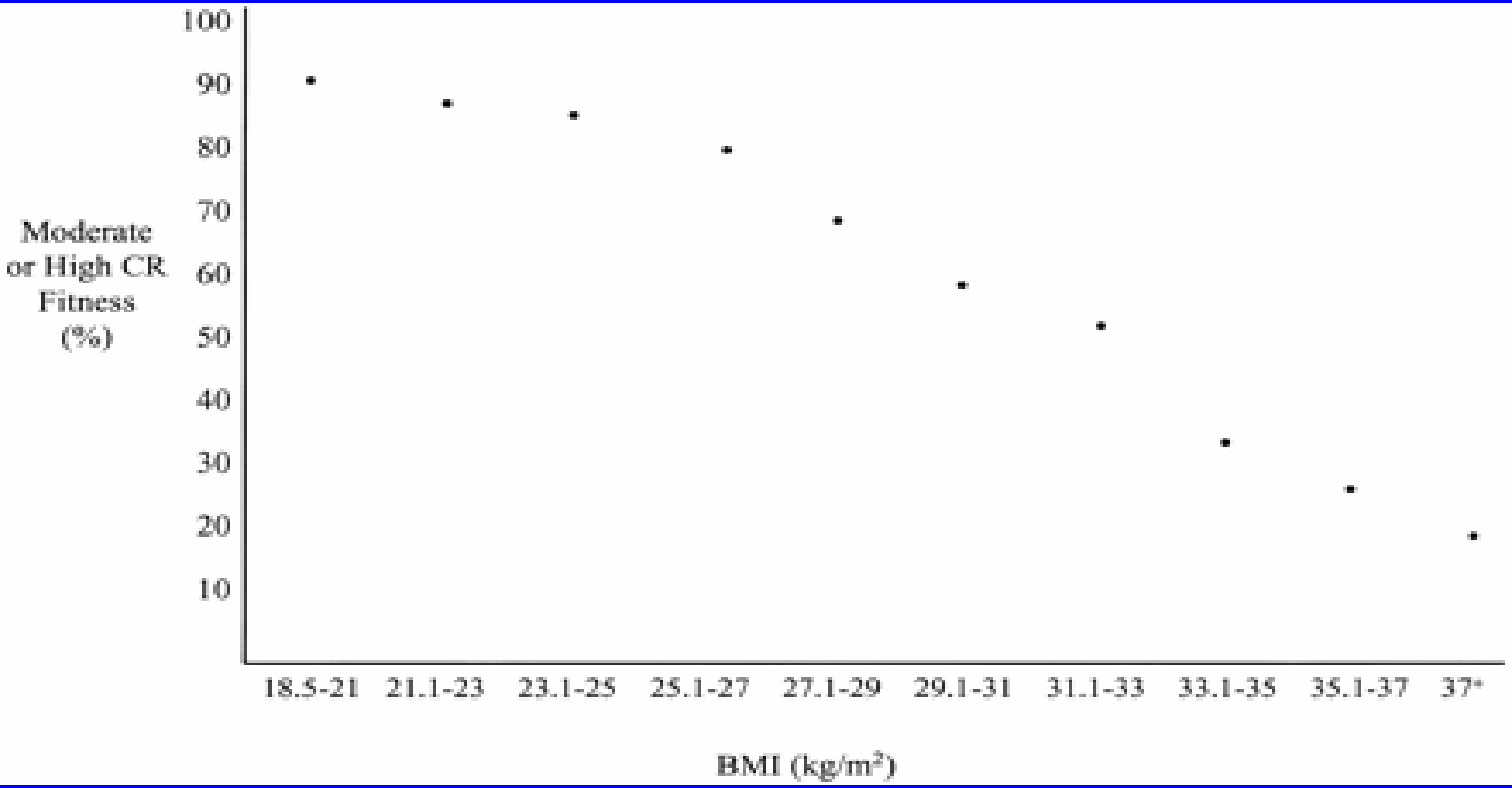



**Adj RR***

***adj for age, exam year, smoking, & health status**

**Farrell et al. *Obes Res.* 2002; 10:417-423**

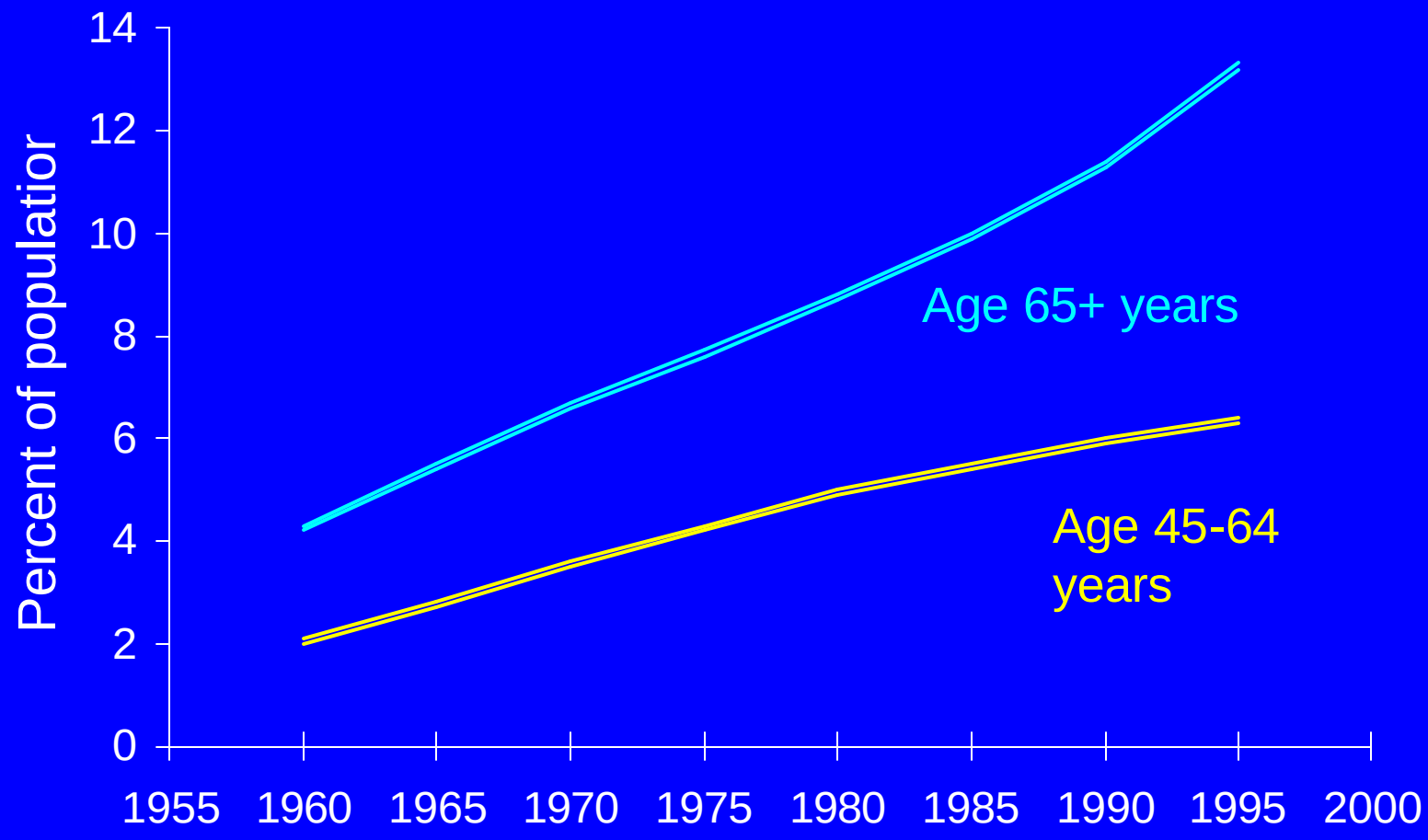
# Prevalence of Moderate or High Fitness, ACLS Women




Farrell SW et al. *Obes Res* 2002; 10:417

# Physical Activity, Fitness, Type 2 Diabetes, and Metabolic Syndrome

# Time Trends in U.S. Prevalence of Diagnosed Diabetes




Courtesy of Dr. M. Harris. NIDDK, NIH

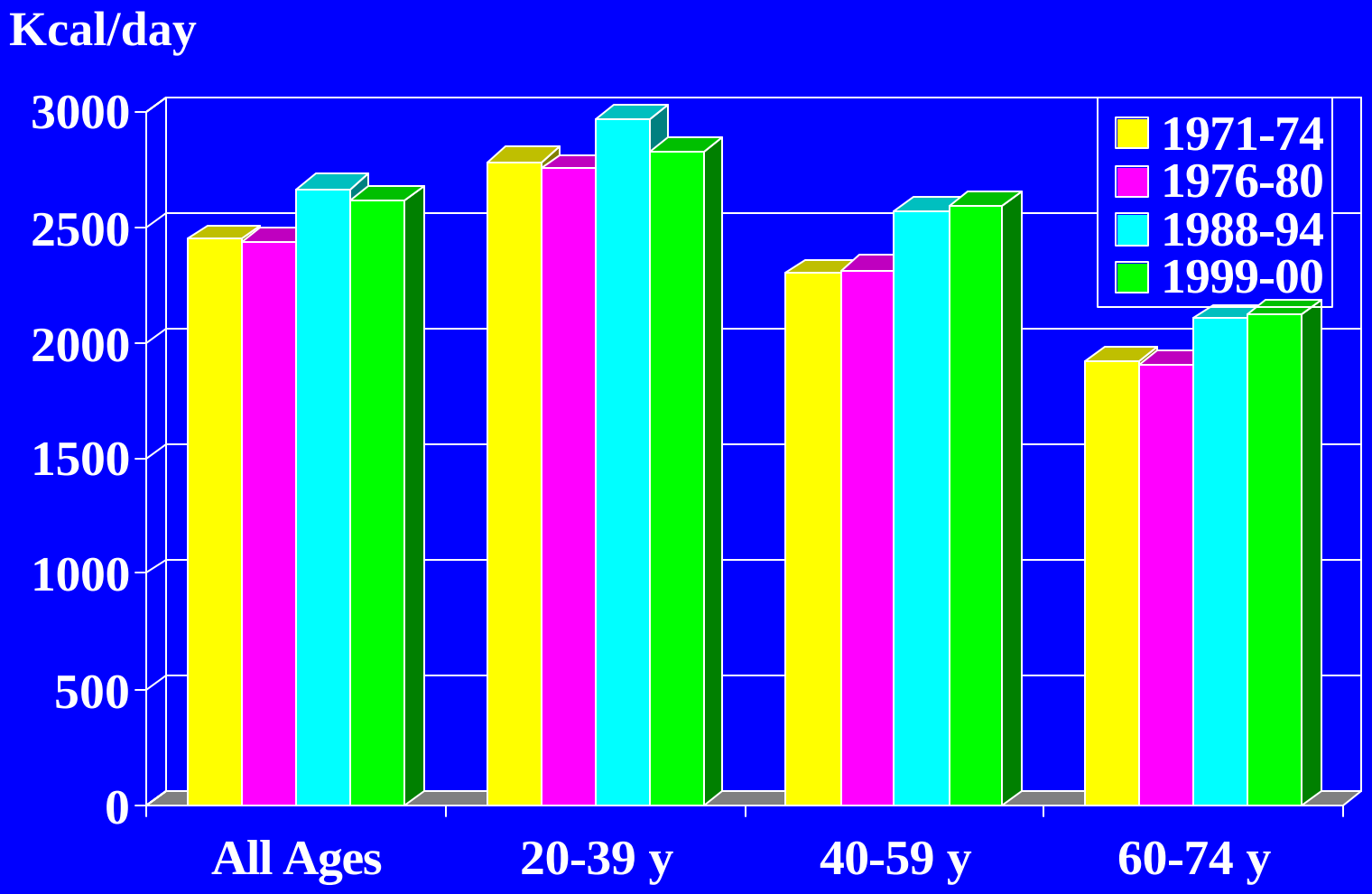
# What Is the Cause of the Increases in Obesity Rates?

# Trends in Energy Intake NHANES 1971-2000

- **Data sources**
  - **NHANES I—1971-1974**
  - **NHANES II—1976-1980**
  - **NHANES III—1988-1994**
  - **NHANES—1999-2000**
- **Surveys were representative samples of noninstitutionalized U.S. women and men aged 20 to 74 years**

**Source: *MMWR* Feb 6, 2004**

# Trends in Energy Intake 1971 to 2000, Men, NHANES

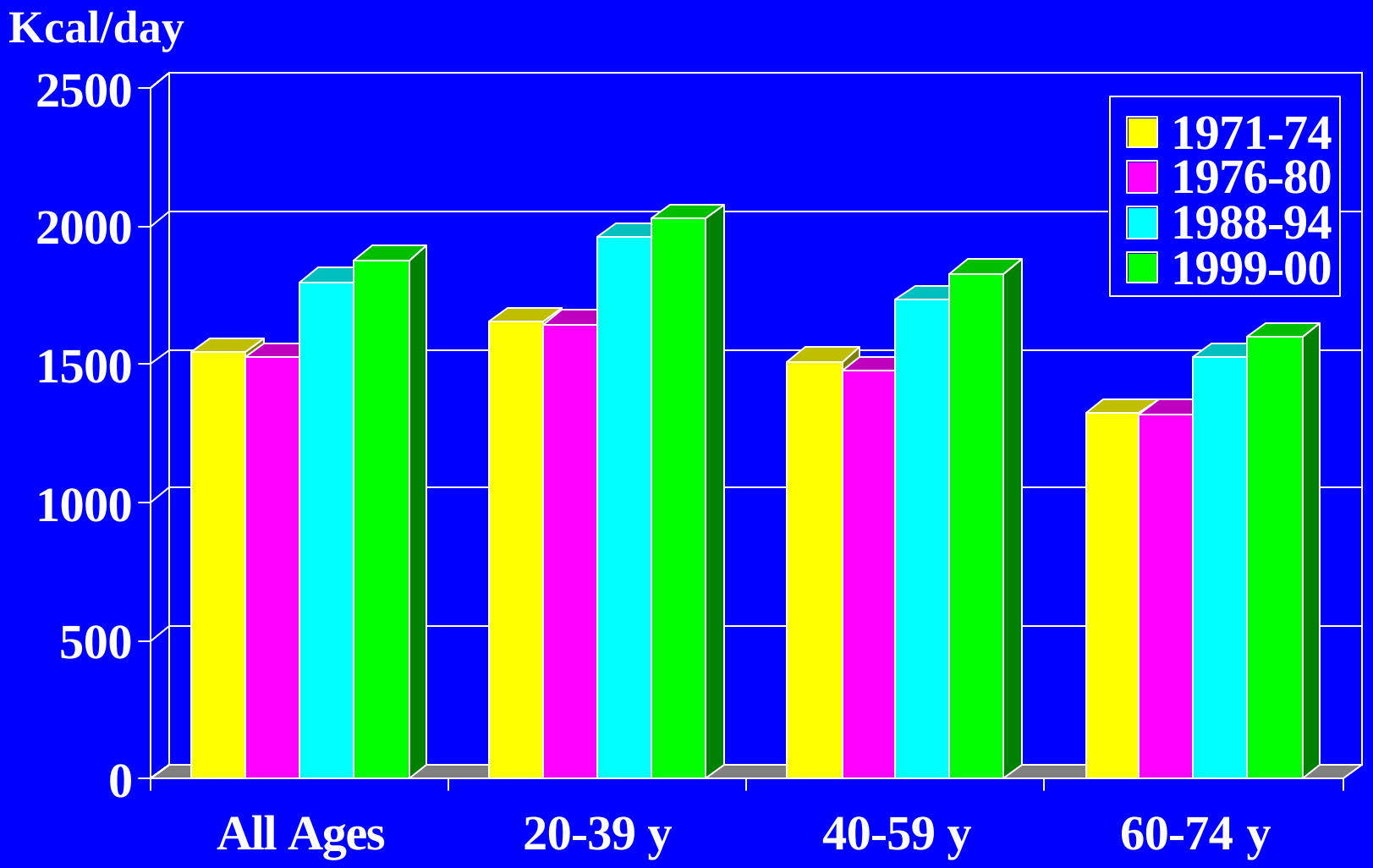



Source: *MMWR* Feb 6, 2004

# NHANES Survey Methods 1971-2000

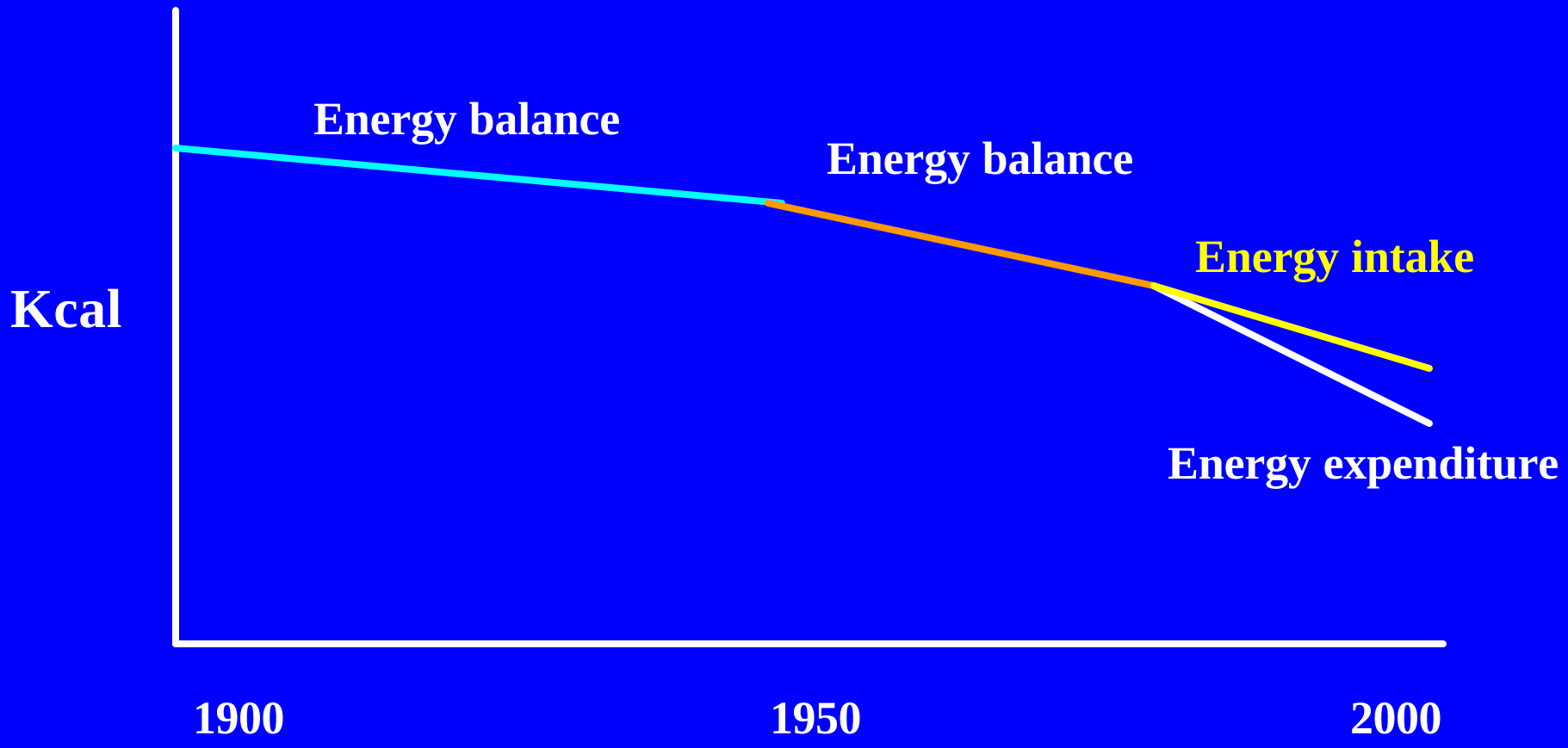
- NHANES I and NHANES II
  - 24-hour dietary recall, Monday-Friday
- NHANES III and NHANES
  - 24-hour dietary recall, Monday-Sunday
- Other changes in methodology included better probing techniques and better training of interviewers
- Other changes in dietary behavior included more meals eaten away from home and increasing portion sizes

# Trends in Energy Intake 1971 to 2000, Women, NHANES




Source: *MMWR* Feb 6, 2004

# Hypothetical Model for the Cause of the Obesity Epidemic of the Late 20th Century

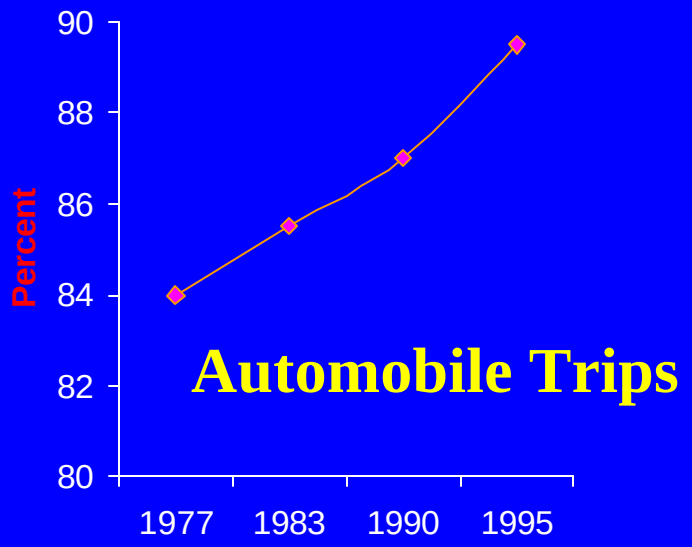


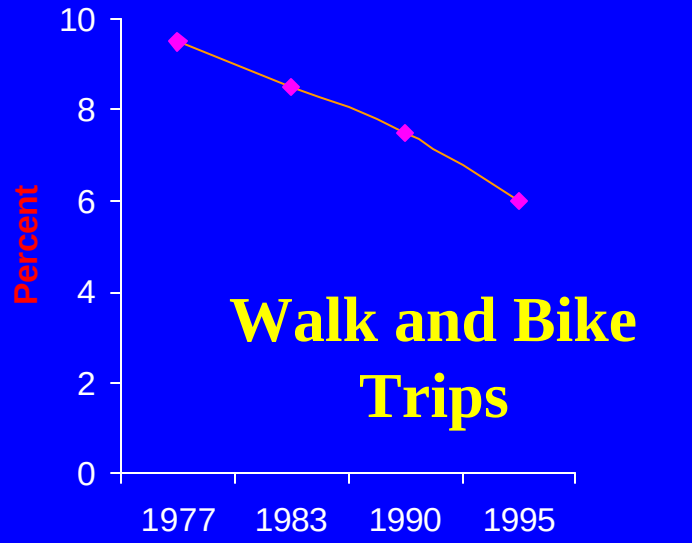
# Physical Activity Patterns and Trends

- Walking has declined significantly
- Activity at work continues to decline
- Activity at home production and leisure declined significantly
- Attempts now focus on understanding patterns and determinants of activity and inactivity
- Research to date has largely ignored work and home production [cleaning, cooking,etc]

# Travel

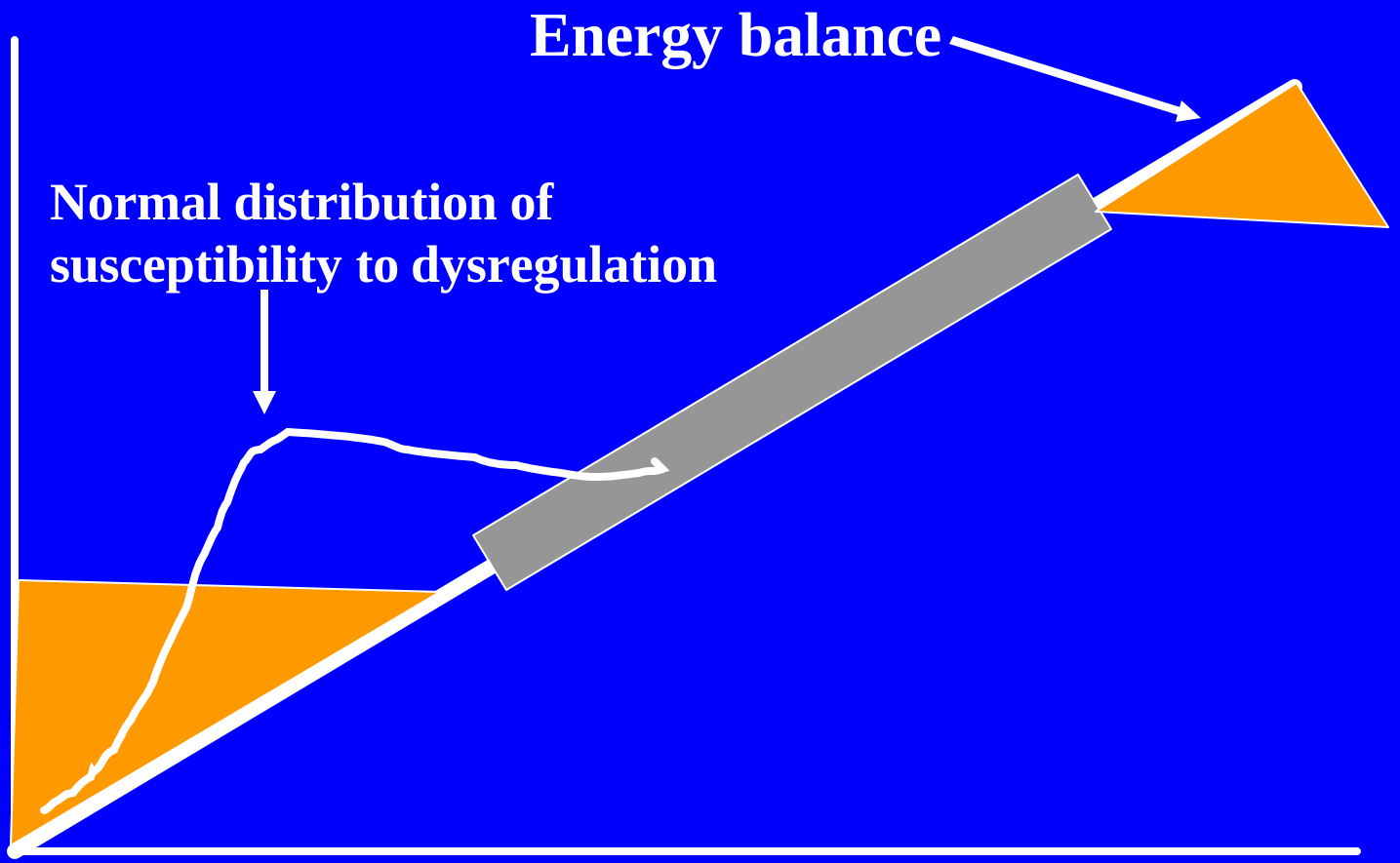
- US average= 73 mins/day of driving
- One-fourth of all trips made are one mile or less, but three-fourths of these short trips are made by car
- Children between the ages of 5-15 walk/bike 40% less in 1995 than in 1977
- For school trips one mile or less, only 31% are made by walking; within 2 miles, only 2% are made by biking.
- In the US, 6% of trips are by walking/biking. In contrast, Italy (54%), Sweden (49%)




CDC
Centers for Disease Control and Prevention

# Hypothesis Regarding Energy Intake, Expenditure, and Balance




Concept from Jim Hill & Russ Pate

# Lifestyle and Energy Expenditure

| Sedentary Way | *kcal* | Active Way | *kcal* |
|---|---|---|---|
| Using remote to change channel | <1 | Getting up and changing channel | 3 |
| 30 min of phone calls--reclining | 4 | Standing for 3 X 10 minute calls | 20 |
| Using garage door opener | <1 | Opening garage door twice/day | 2-3 |
| Hiring maid to clean and iron | 0 | 30 min of ironing<br>30 min vacuuming | 152 |

**Kcal estimates for 150-160 pound person**

**Taken from article by L. Beil, *Dallas Morning News*, 1999**

# Lifestyle and Energy Expenditure

| Sedentary Way | *kcal* | Active Way | *kcal* |
|---|---|---|---|
| 30 min waiting for pizza delivery | 15 | 30 min of cooking | 25 |
| Buying pre-sliced vegetables | 0 | 15 min washing, slicing & chopping | 10-13 |
| Using a leaf blower for 30 min | 100 | 30 min of raking leaves | 150 |
| Using a lawn service | 0 | 30 min/week each gardening, mowing | 360 |

**Kcal estimates for 150-160 pound person**

**Taken from article by L. Beil, *Dallas Morning News*, 1999**

# Lifestyle and Energy Expenditure

| Sedentary Way | *kcal* | Active Way | *Kcal* |
|---|---|---|---|
| Using car wash once/month | 18 | Washing & waxing car, 1 hr/month | 300 |
| Letting dog out the back door | 2 | Walking dog for 30 min | 125 |
| Drive 40 min, 5 min walk (parking) | 22 | 15 min walk to bus stop, 2 X day | 60 |
| Emailing colleague, 4 min | 2-3 | Walk 1 min, talk 3 min (standing) | 6 |

**Kcal estimates for 150-160 pound person**

**Taken from article by L. Beil, *Dallas Morning News*, 1999**

# Lifestyle and Energy Expenditure

| Sedentary Way | *kcal* | Active Way | *kcal* |
|---|---|---|---|
| Taking elevator up 3 flights | 0.3 | Walking up 3 flights of stairs | 15 |
| Park close as poss, 10 sec walk | 0.3 | Park 1st spot, 2 min walk, 5 X week | 8 |
| Cashier unloads shopping cart | 2 | Unload full shopping cart | 6 |
| Ride escalator 3 times | 2 | 1 flight of stairs, 3 X week in mall | 15 |

**Kcal estimates for 150-160 pound person**

**Taken from article by L. Beil, *Dallas Morning News*, 1999**

# Lifestyle and Energy Expenditure

| Sedentary Way | *kcal* | Active Way | *kcal* |
|---|---|---|---|
| 1 hour internet shopping | 30 | Shopping mall, walking 1 hour | 145-240 |
| Sitting in car at drive-in window, 30 min | 15 | Parking & walking inside, 3 X week, total of 30 min | 70 |
| Paying at the pump | 0.6 | Walking in to pay, 1 X week | 5 |
| Sitting & listening to lecture, 60 min | 30 | Giving lecture | 70 |

**Kcal estimates for 150-160 pound person**

**Taken from article by L. Beil, *Dallas Morning News*, 1999**

# Lifestyle and Energy Expenditure

- Assume a person's caloric intake remains the same
- Completing all of the tasks reviewed daily or as listed
  - Active way=10,500 kcal/month
  - Sedentary way=1,700 kcal/month
- Difference of 8,800 kcal/month is energy equivalent of 2.5 pounds/month or 30 pounds/year

**Kcal estimates for 150-160 pound person**
**Taken from article by L. Beil, *Dallas Morning News*, 1999**

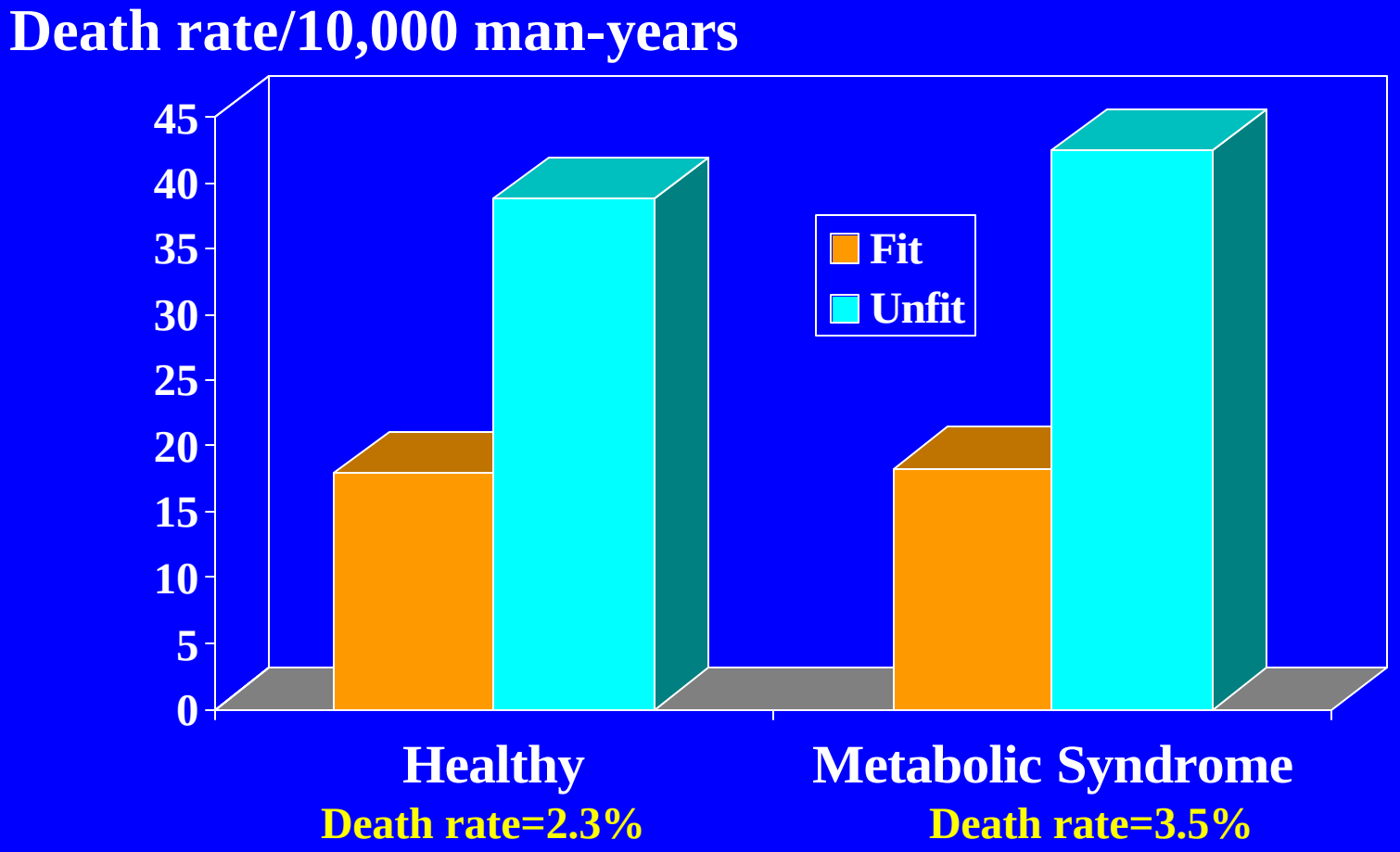
# Cardiorespiratory Fitness and Mortality, ACLS Men with Metabolic Syndrome or Type 2 Diabetes

# Fitness, Metabolic Syndrome, and Mortality in ACLS Men

- Metabolic syndrome is diagnosed if you have any 3 of—
  - High blood sugar
  - High triglycerides
  - Low HDL-cholesterol
  - High blood pressure
  - Big waist
- 19,223 men, 20-83 years of age
  - 3,757 men (~20%) with metabolic syndrome
  - 15,466 healthy men
- Followed for approximately 10 years
- 480 men died

Katzmarzyk et al. In Press. *Arch Int Med*

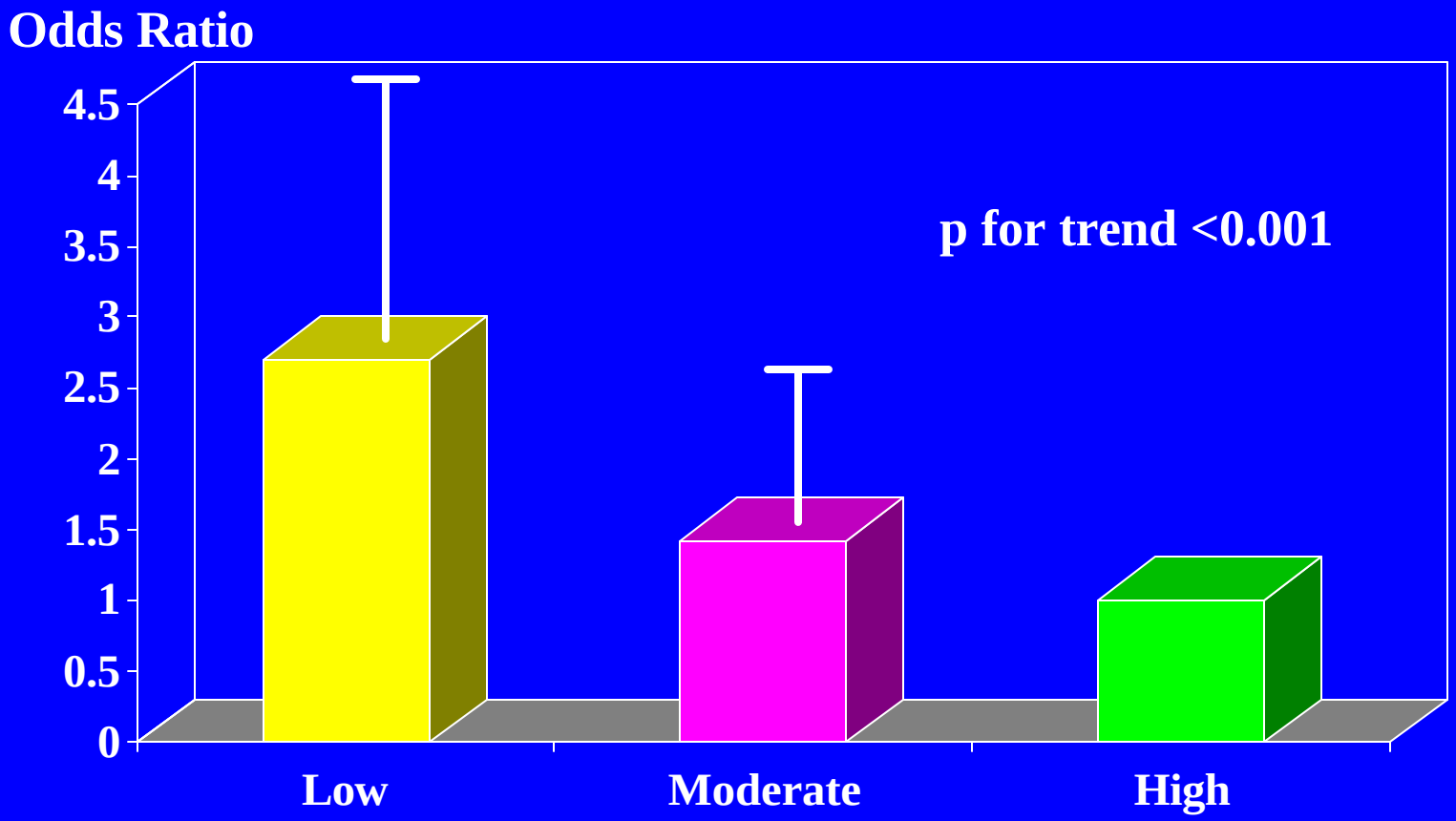
# Cardiorespiratory Fitness and All-Cause Mortality, ACLS Men




Rates adjusted for age and exam year

Katzmarzyk et al. In Press. *Arch Int Med*

# All-Cause Mortality by Fitness Groups in 3,757 Men with Metabolic Syndrome



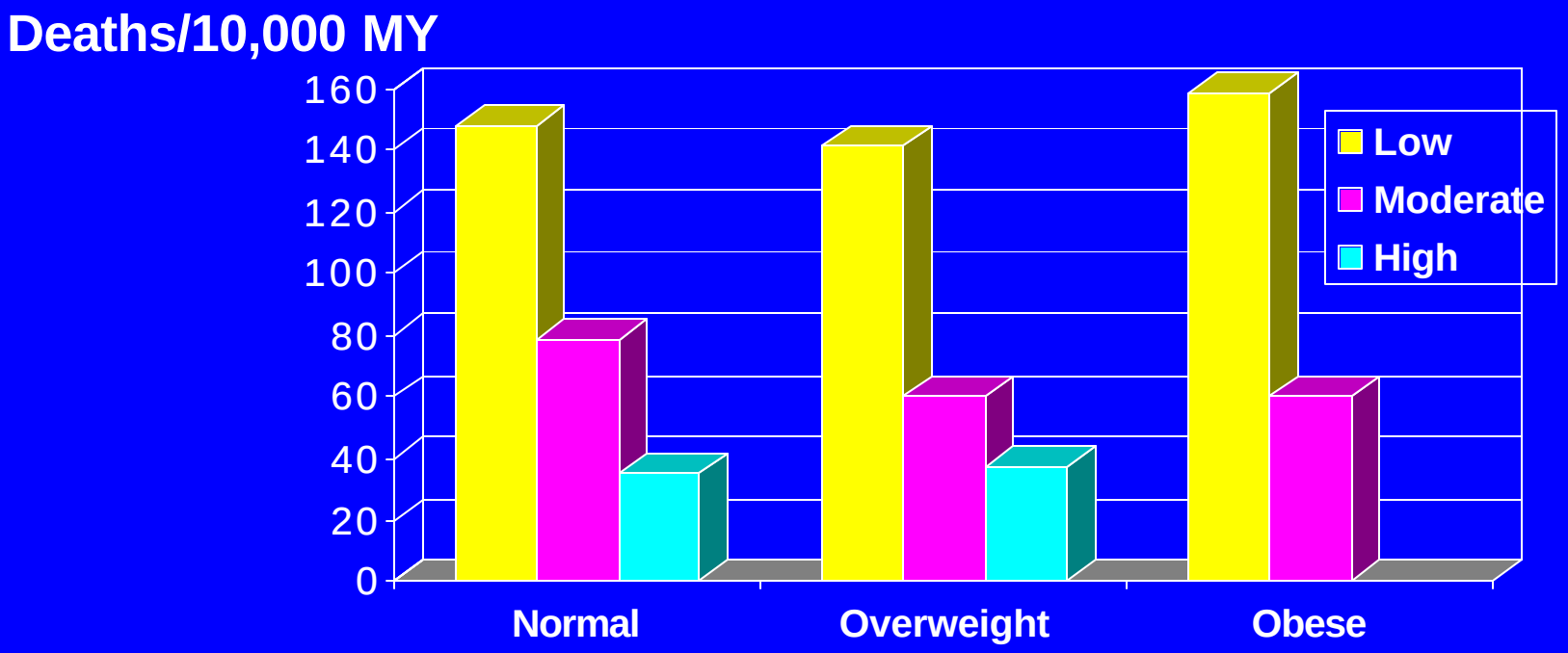

Katzmarzyk et al. In Press. *Arch Int Med*

# Fitness, Fatness, and Mortality in Men with Type 2 Diabetes

- Observational cohort study
- 2196 men with confirmed type 2 diabetes
  - fasting glucose >125 mg/dL or on pharmacological therapy for diabetes
- Mortality follow-up for up to 26 years (32,162 man-years of observation)
  - 275 deaths from all causes
  - 134 deaths from CVD
  - 71 deaths from cancer

Church et al. *Diab Care* 2004; 27:83-8

# All-Cause Mortality by Fitness and BMI Categories, Men with Type 2 Diabetes




| | Normal | | | Overweight | | | Obese | |
|---|---|---|---|---|---|---|---|---|
| Deaths | 24 | 37 | 23 | 64 | 44 | 13 | 55 | 15 |
| Men | 101 | 263 | 335 | 294 | 466 | 220 | 328 | 189 |

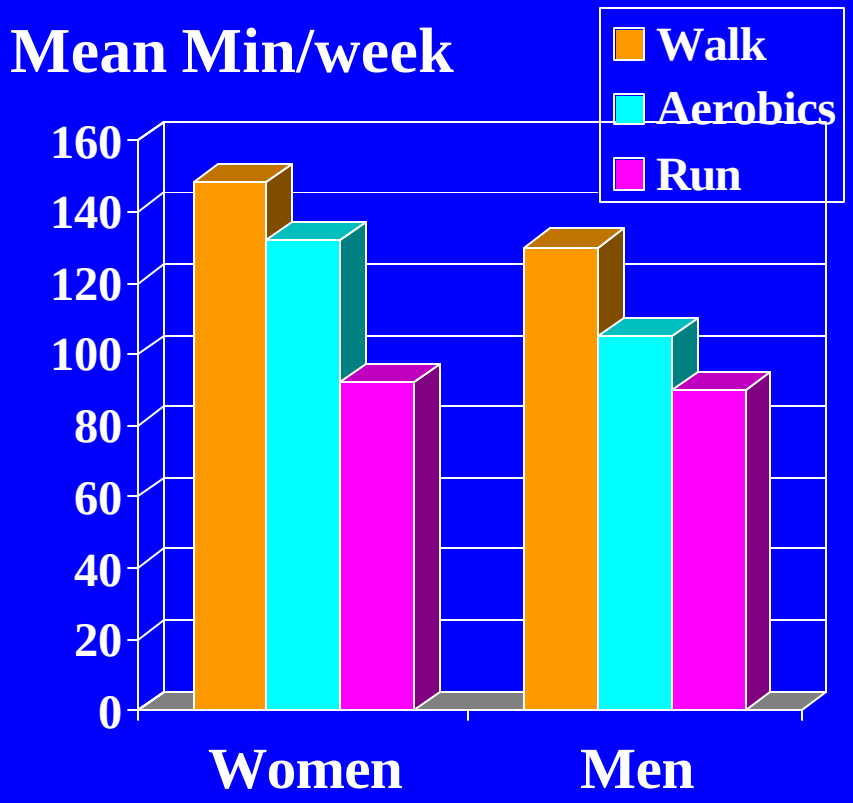
Linear trends p<0.0001 across fitness categories in all BMI groups

*Adjusted for age and year of examination

Church et al. *Diab Care* 2004; 27:83-8

# Amount of Specific Physical Activities for Moderately Fit Women and Men

- Detailed physical activity assessments in women and men who also completed a maximal exercise test
- Average min/week for the moderately fit who only reported each specific activity

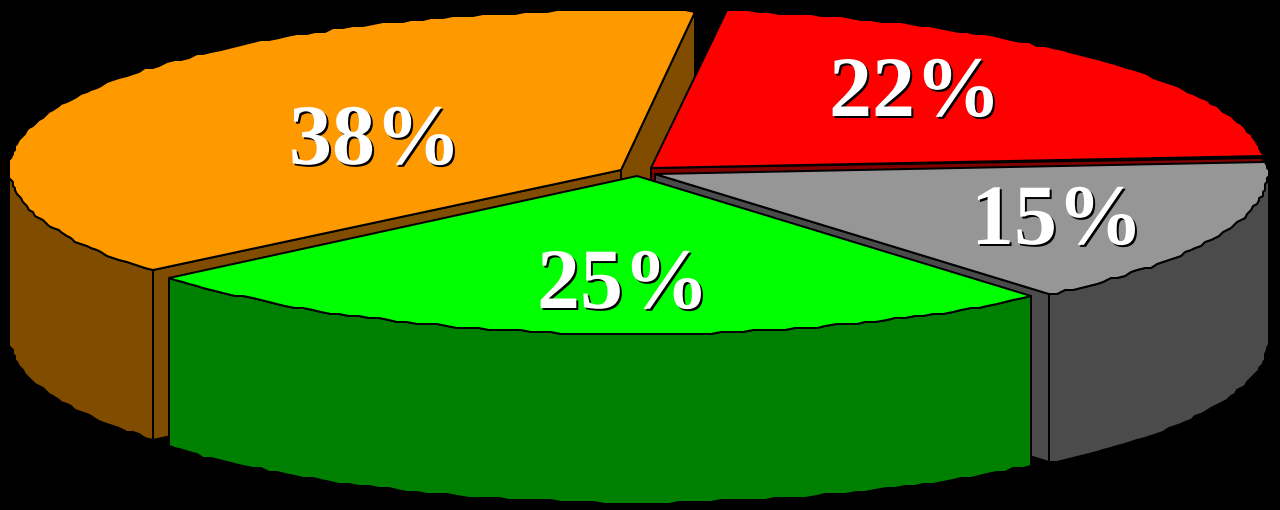



Stofan JR et al. *AJPH* 1998; 88:1807

# Public Health Burden of Sedentary Lifestyles

# Physical Activity Levels for U.S. Adults

- Sedentary
- Irregularly Activity
- Regularly Active, Low to Moderate Intensity




- Regular Vigorous Activity (3 days, 20 minutes)

Surgeon General's Report, 1996

# Consensus Public Health Recommendation for Physical Activity

- Statements from the American College of Sports Medicine/Centers for Disease Control and Prevention, American Heart Association, NIH, and the office of the US Surgeon General conclude:
  - All adults should accumulate at least 30 minutes of at least moderate intensity physical activity each day
  - This is equivalent to walking about 1.5 miles at a pace of 3 to 4 mph
  - Doing more exercise and perhaps more strenuous exercise may produce additional health benefits

# Summary

- Physical inactivity and low cardiorespiratory fitness are strong predictors of many health outcomes in most population subgroups—including patients with type 2 diabetes
- Physical activity (energy expenditure) has largely been engineered out of daily life and the 21st century environment promotes mass physical inactivity
- Physical activity interventions that seek to improve behavioral skill building in sedentary individuals have demonstrated efficacy
- 30 minutes of moderate intensity physical activity per day will provide important health benefits

# Conclusion

- **Physical inactivity is one of the most important public health problems in many countries, and governments and policy makers should give this issue more attention and concern**