

**The U.S. Obesity Epidemic:
Causes, Issues, and Action Plan**

CLOCC Meeting

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Steven N. Blair

President and CEO

Cooper Institute

sblair@cooperinst.org

Outline of Lecture

- **Energy balance issues**
- **Action plan to combat the obesity epidemic**
 - **Most of what we think we know about the epidemic is probably wrong**
 - **Most of the strategies for dealing with the epidemic probably will be ineffective**
 - **What should we do?**

**Donald Kennedy & Philip Abelson.
The Obesity Epidemic. *Science*
2004; 304:1413**

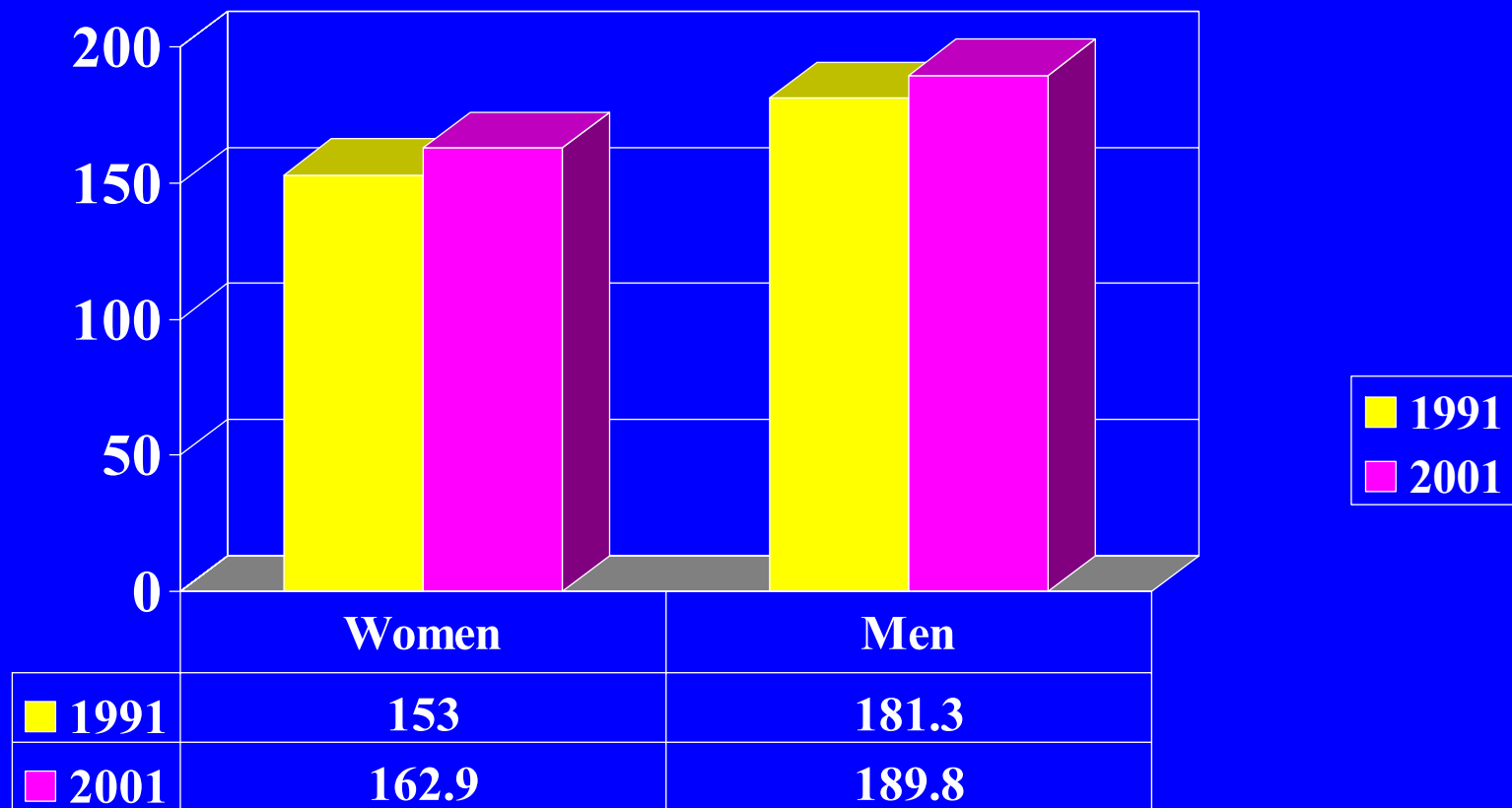
- “...Americans continued to consume an average of 3800 calories per person per day, or about twice the daily requirement.”

Evidence that even high level scientists do not understand energy balance.

Cause(s) of the Obesity Epidemic

- **Increases in energy intake**
- **Decreases in energy expenditure**
- **Combination of increases in intake and decreases in expenditure**
 - **50/50?**
 - **30/70?**
 - **70/30?**

Weight Gain in the U.S. During the Obesity Epidemic—NHANES

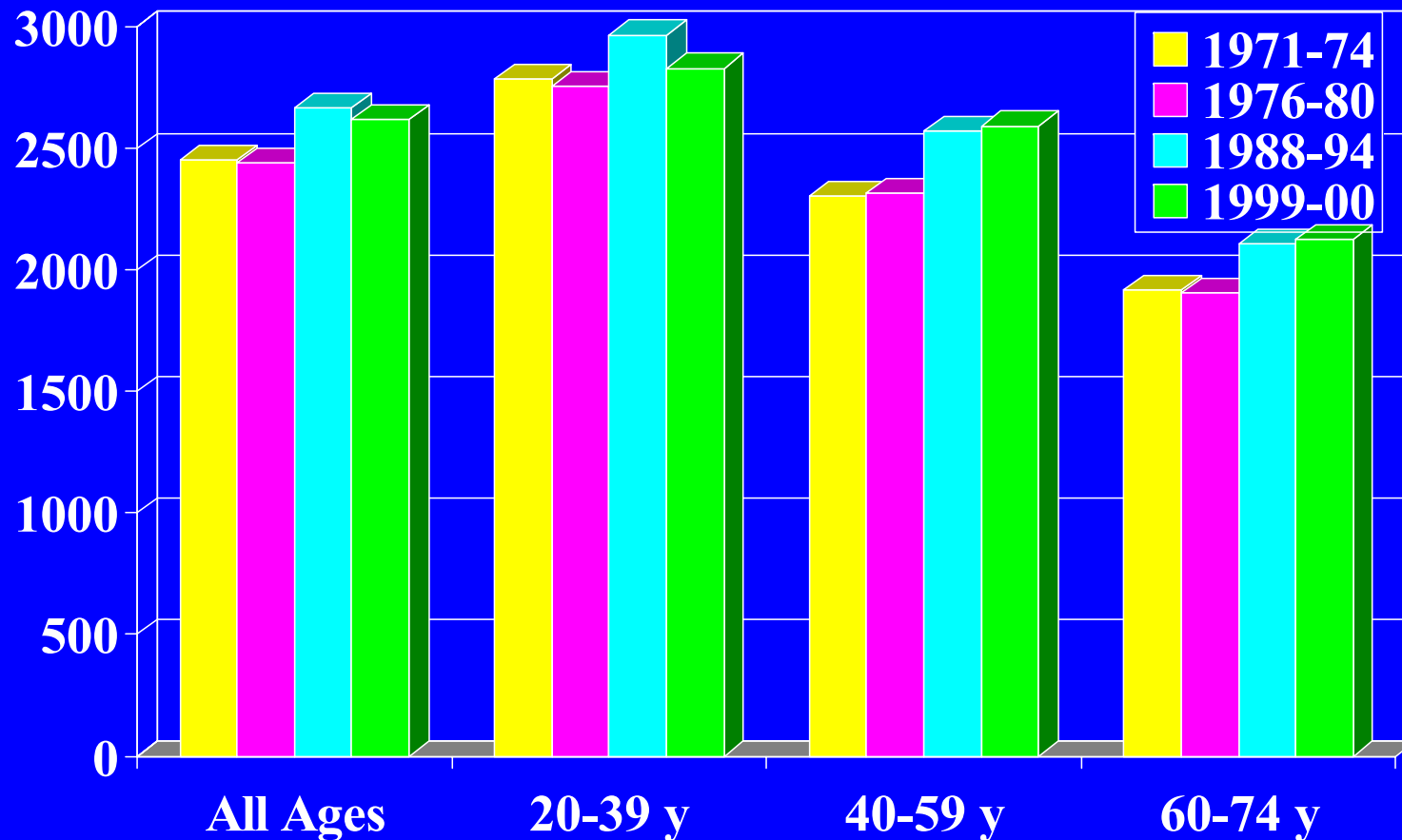


Weight in Pounds—1991 and 2001

Source—Advance Data from Vital & Health Statistics #347, Oct 27, 2004

Trends in Energy Intake 1971 to 2000, Men, NHANES

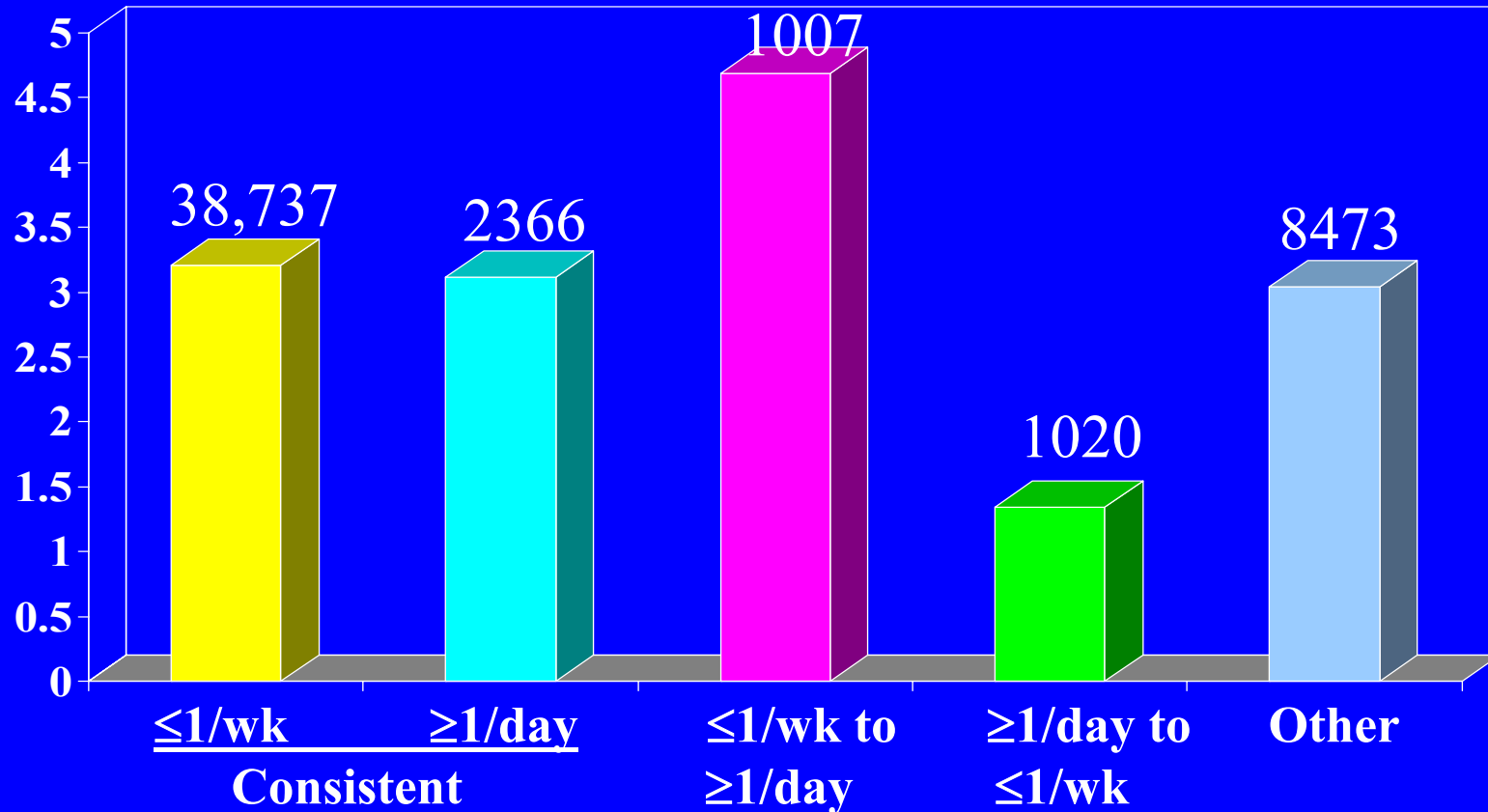
Kcal/day



Source: *MMWR* Feb 6, 2004

Weight Change (1991-1995) by Time Trends in Sugar-Sweetened Soft Drink Intake, Nurses' Health Study II

Weight Change (kg)*



*Adj for age, alcohol, physical activity, smoking, HRT, oral contraceptive use, cereal fiber, fat intake, and BMI

Physical Activity Level (PAL)

- Expresses daily energy expenditure as multiples of BMR average over 24 hours
- PAL categories
 - Sedentary—1.4
 - Limited activity—1.55-1.60
 - Physically active-- ≥ 1.75
- “In order to avoid obesity, populations should remain physically active throughout life at a PAL of 1.75 or more”

WHO Consultation on Obesity 1998

Basic Energy Requirements

- Minimal energy expenditure
 - 8 hours in bed at 1 MET
 - 16 hours of washing, dressing, and short periods of standing at 1.4 METs
 - **1.27** BMR [(2/3 x 1.4) + (1/3 x 1)]
- Allows for minimal movement, is not compatible with good health, and does not allow for energy needed to earn a living or prepare food

**FAO/WHO Joint Consultation. *Energy & Protein Requirements.*
WHO Technical Report Series #724**

Energy Requirement for Subsistence Farming

In bed at 1 MET	8 hours
Occupational activities at 2.7 METs	7 hours
Household tasks at 3.0 METs	2 hours
Exercise	--
Residual time at 1.4 METs	7 hours

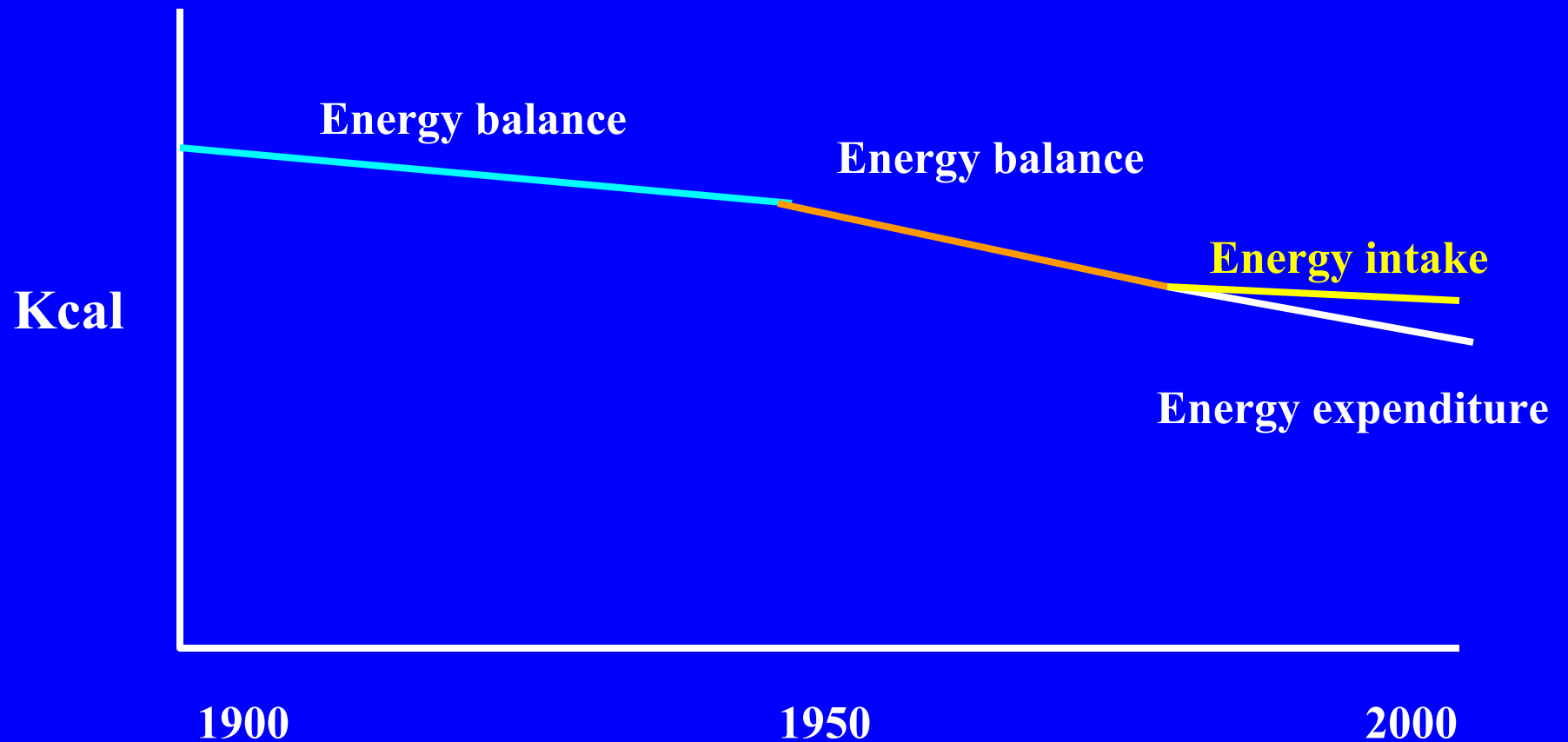
Total energy expenditure (PAL)=1.78

**FAO/WHO Joint Consultation. *Energy & Protein Requirements.*
WHO Technical Report Series #724**

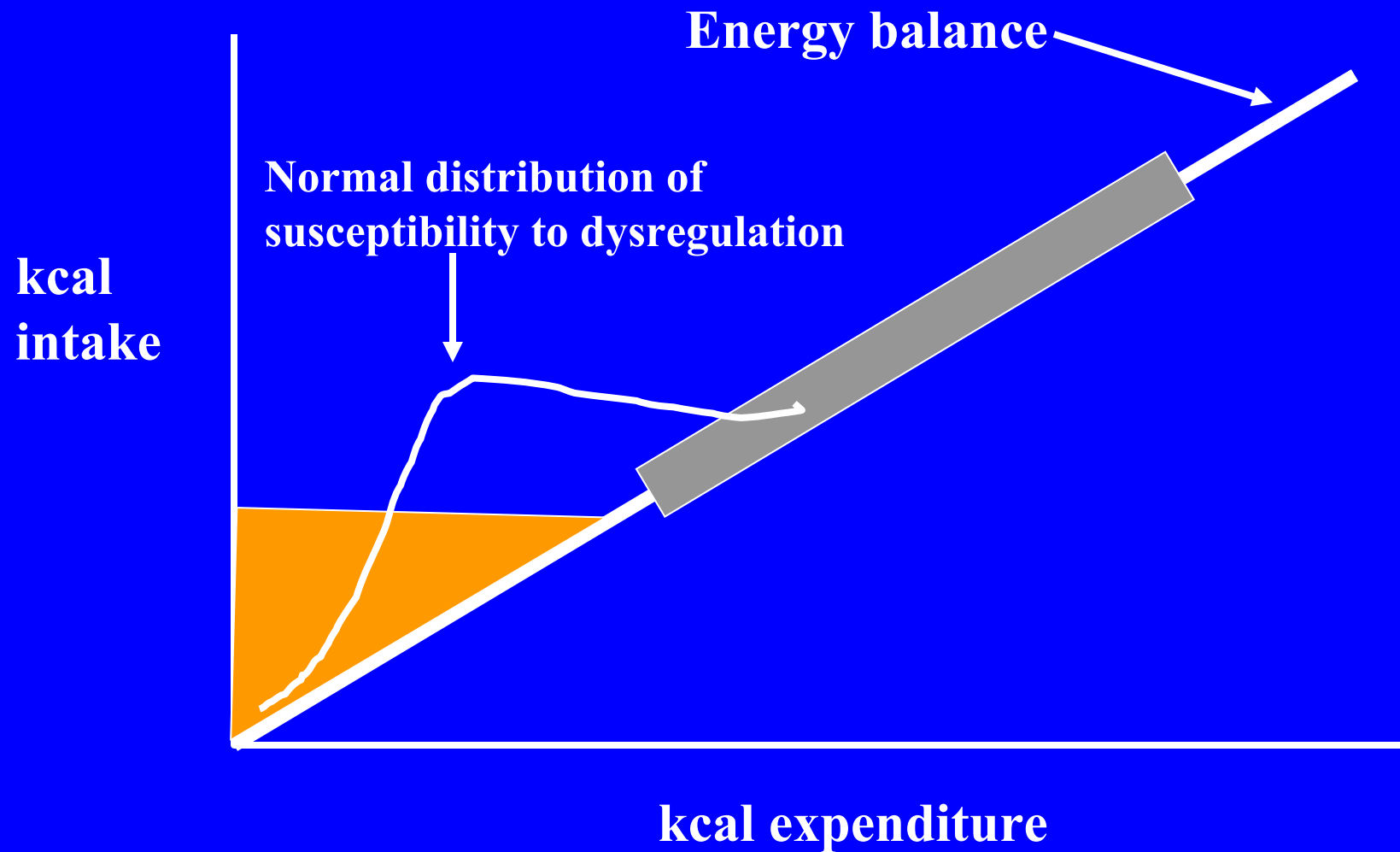
Is a PAL of 1.75 or 60 Minutes of Activity per Day Required to Prevent Weight Gain?

- **Prevalence of obesity in U.S. adults was constant $\approx 10\%$ for several decades prior to 1985**
- **Prevalence has increased rapidly to \approx one third at present**
- **If a PAL of 1.75 is required to prevent unhealthful weight gain, 90% of U.S. adults must have had a PAL of 1.75 prior to 1985**
- **Does this assumption seem likely?**

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



Energy Intake, Expenditure, and Balance



Concepts from Jim Hill & Russ Pate

Role of Sitting in Weight Gain

- **10 lean participants—BMI=23; and 10 obese participants—BMI=33**
- **Precise measurements of energy expenditure and posture**
- **Findings**
 - **Obese participants sat 164 min/day longer than lean participants**
 - **If obese had same posture allocation as lean, they would have burned an additional 352 kcal/day**

Physical Activity Recommendations

- How much physical activity is required?
 - For health benefits?
 - 30 minutes/day
 - To prevent weight gain?
 - 60 minutes/day
 - To prevent weigh regain in the formerly obese?
 - 60-90 minutes/day

Source—*U.S. Dietary Guidelines 2005*

Dietary Guidelines for Americans 2005*

Physical activity recommendations

- To help manage body weight and prevent gradual, unhealthy body weight gain in adulthood: Engage in approximately 60 minutes of moderate- to vigorous-intensity activity on most days of the week while not exceeding caloric intake requirements**

***www.health.gov/dietaryguidelines/dga2005/document/**

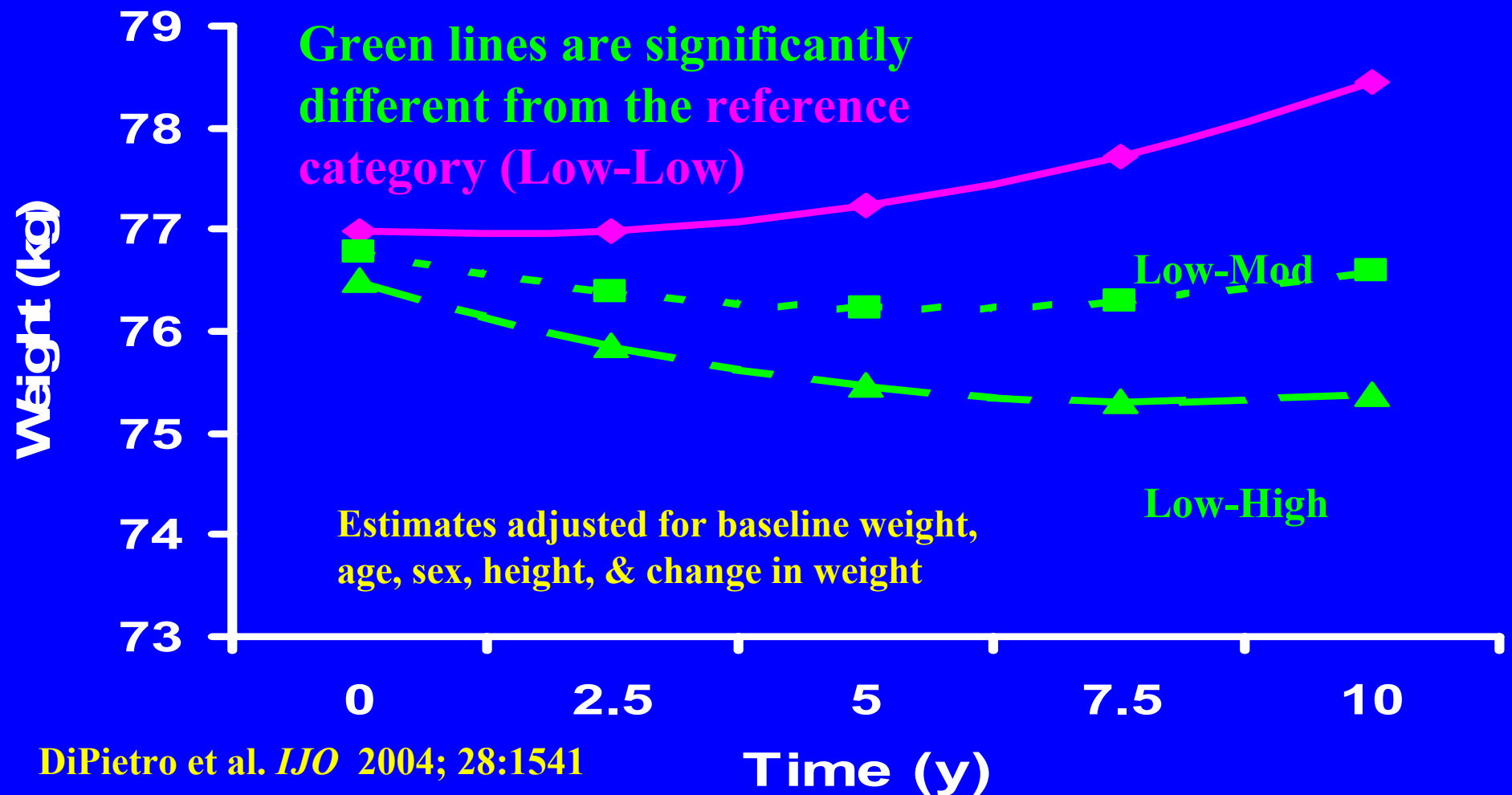
Four-examination Cohort, ACLS

3075 women and men were included in analyses

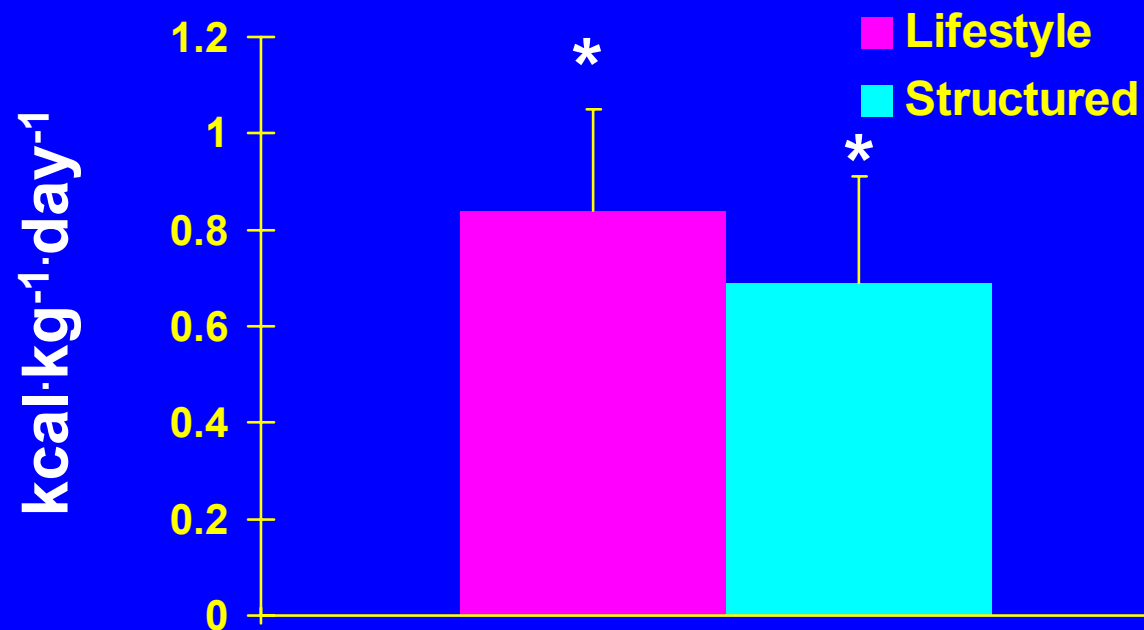
- Average age= 40.9 ± 7.0 years
- Average weight= 78.1 ± 13.0 kg
- Average follow-up= 5.2 ± 3.3 years
- Free of chronic disease throughout follow-up
- Average baseline PAL= 1.46 ± 0.09
- PAL distribution at baseline
 - 2109 individuals were <1.45
 - 755 individuals were 1.45-1.60
 - 211 individuals were >1.60

Weight Change over Time by PAL Change Groups

PAL Change Groups
Low < 1.45; Mod = 1.45-1.60; Hi ≥ 1.60



24-Month Increase in Energy Expenditure

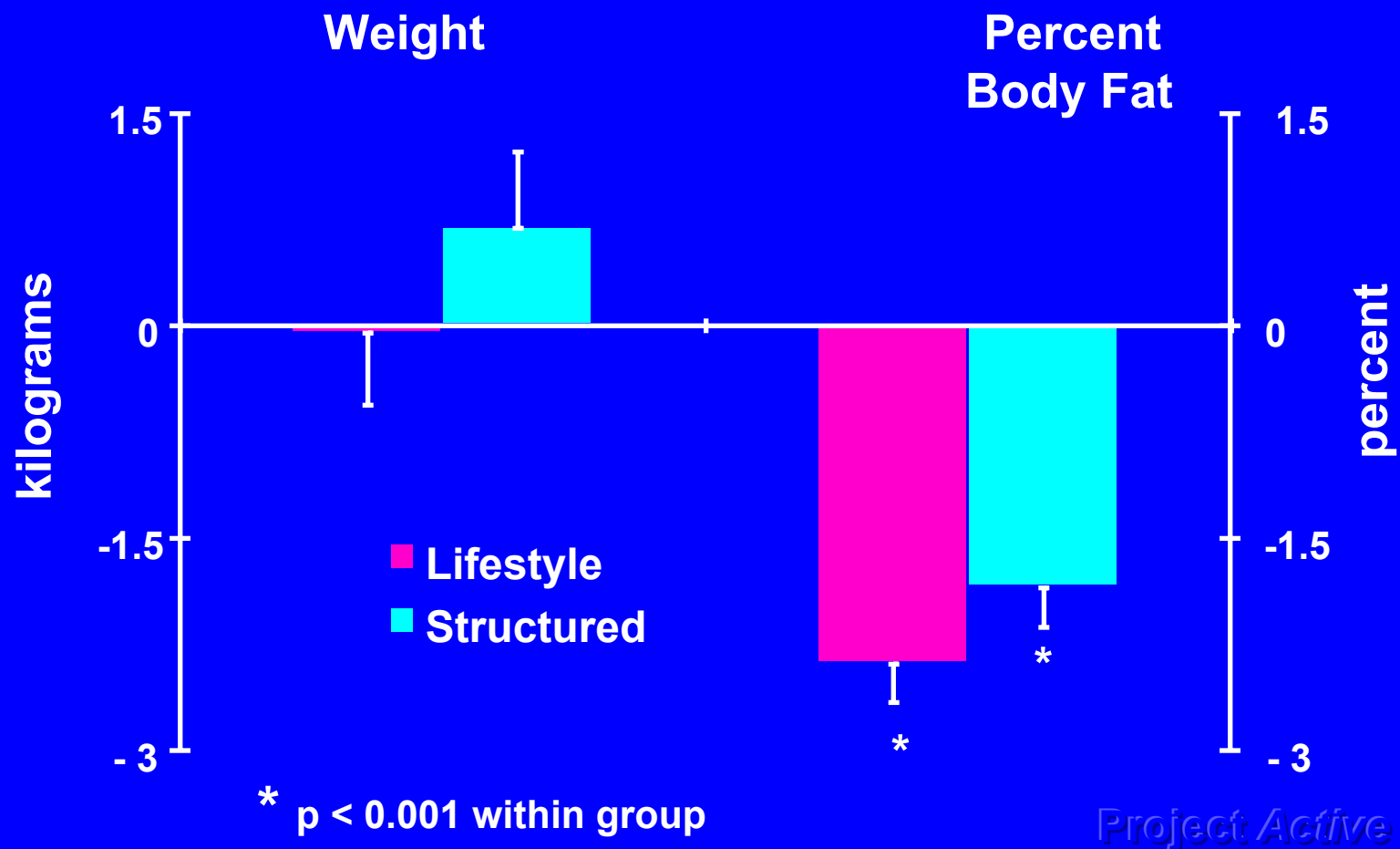


* p < 0.001 within group

Project Active

Dunn et al. *JAMA* 1999

24-Month Change in Weight and Percent Body Fat



Dunn et al. *JAMA* 1999

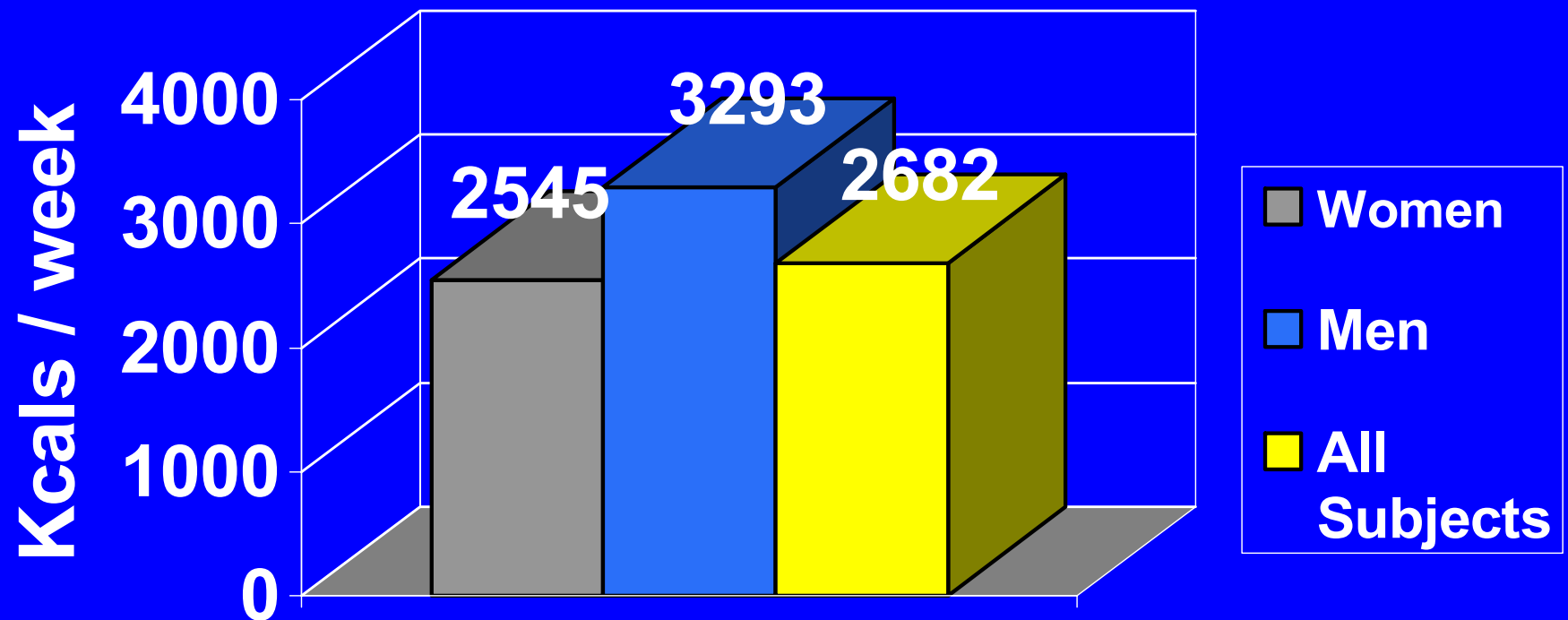
*Dietary Guidelines for Americans 2005**

Physical activity recommendations

- **To sustain weight loss in adulthood:
Participate in at least 60 to 90 minutes of
daily moderate-intensity physical activity
while not exceeding caloric intake
requirements.**

***www.health.gov/dietaryguidelines/dga2005/document/**

Average Energy Expended In Physical Activity In The NWCR



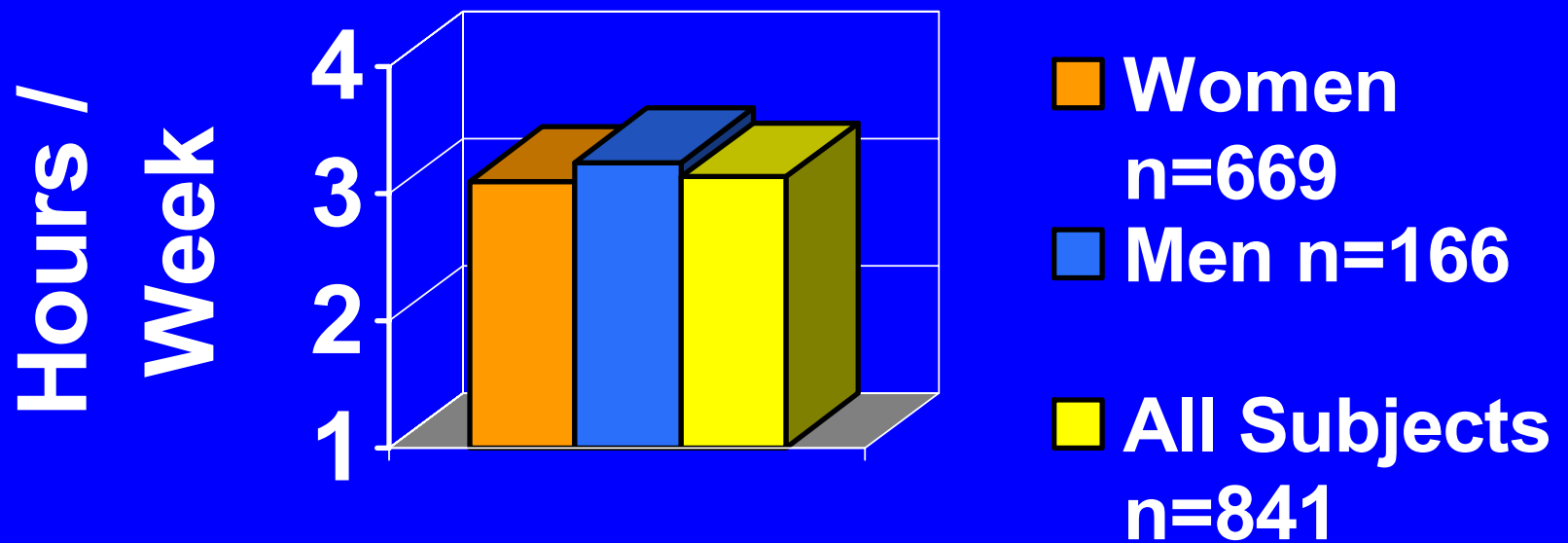
Klem et al, AJCN 1997;66:239-46.

Average Steps/day for NWCR and Non-reduced Subjects

	Steps/day Mean \pm SD	Minimum Steps	Maximum Steps
NWCR (n=26)	11071 \pm 4392	3817	20380
Non- reduced (n=19)	5275 \pm 3401 P=0.0001	1769	11879

Slide courtesy of JO Hill, PhD

Average Hours Spent Watching T.V. In The NWCR

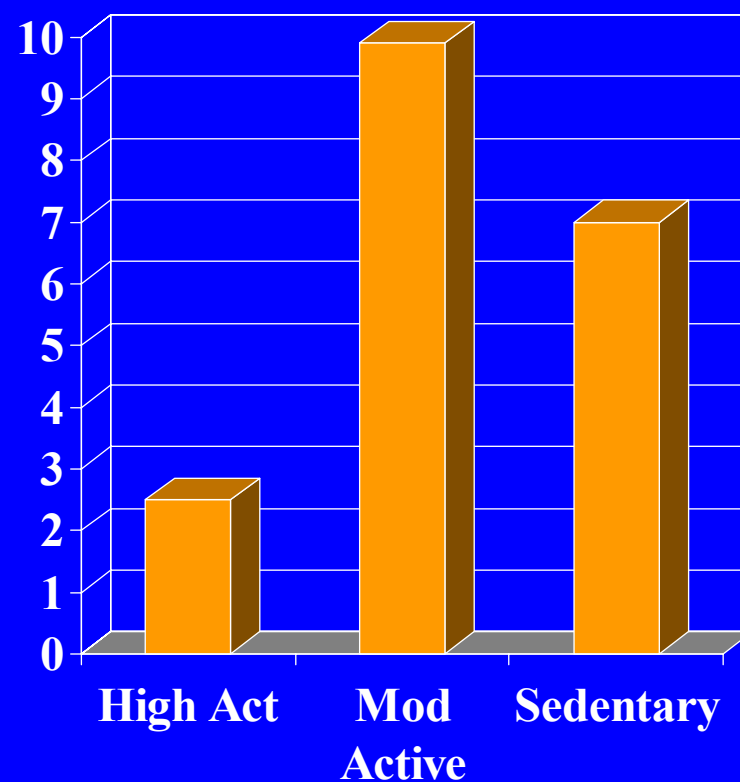


Slide courtesy of JO Hill, PhD

Preventing Weight Regain in Formerly Obese Women

- 34 women who lost >12 kg
- PA assessed by doubly labeled water
 - High act-PAL=1.89
 - Mod act-PAL=1.64
 - Sedentary-PAL=1.44
- Outcome-weight regained over 1 year
- Threshold for wt maintenance, 80 min/day of mod act or 35 min/day of vigorous act

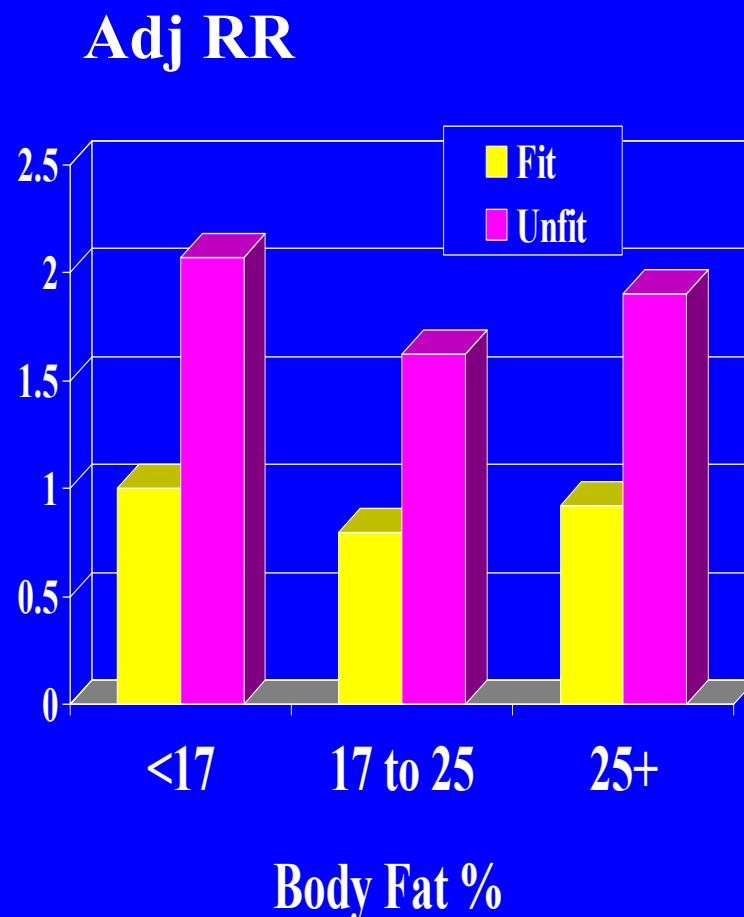
Kg gained



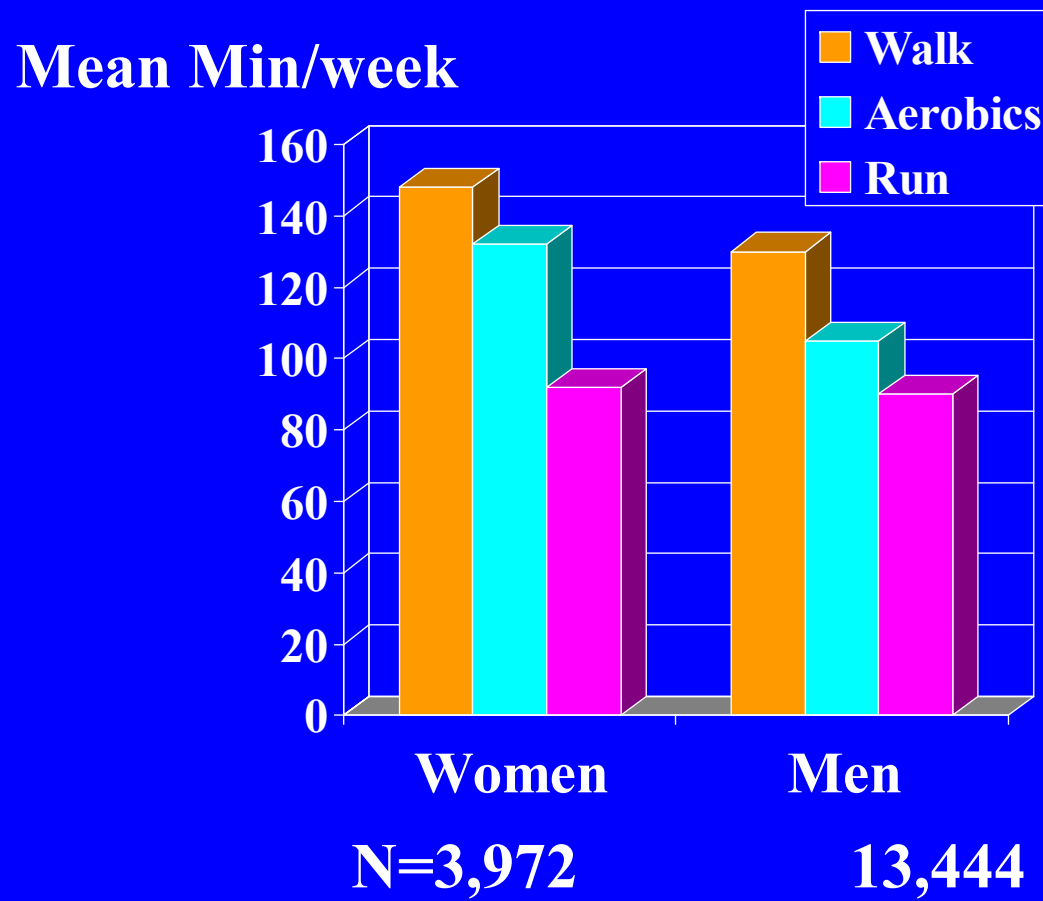
Schoeller et al. *AJCN* 1997

Cardiorespiratory Fitness, Body Composition, and All-Cause Mortality, 21,925 Healthy Men

- Fitness assessed by a maximal exercise test
- Body composition determined by underwater weighing or skinfolds
- Risk of death adjusted for age, exam year, smoking, and parental history of CVD

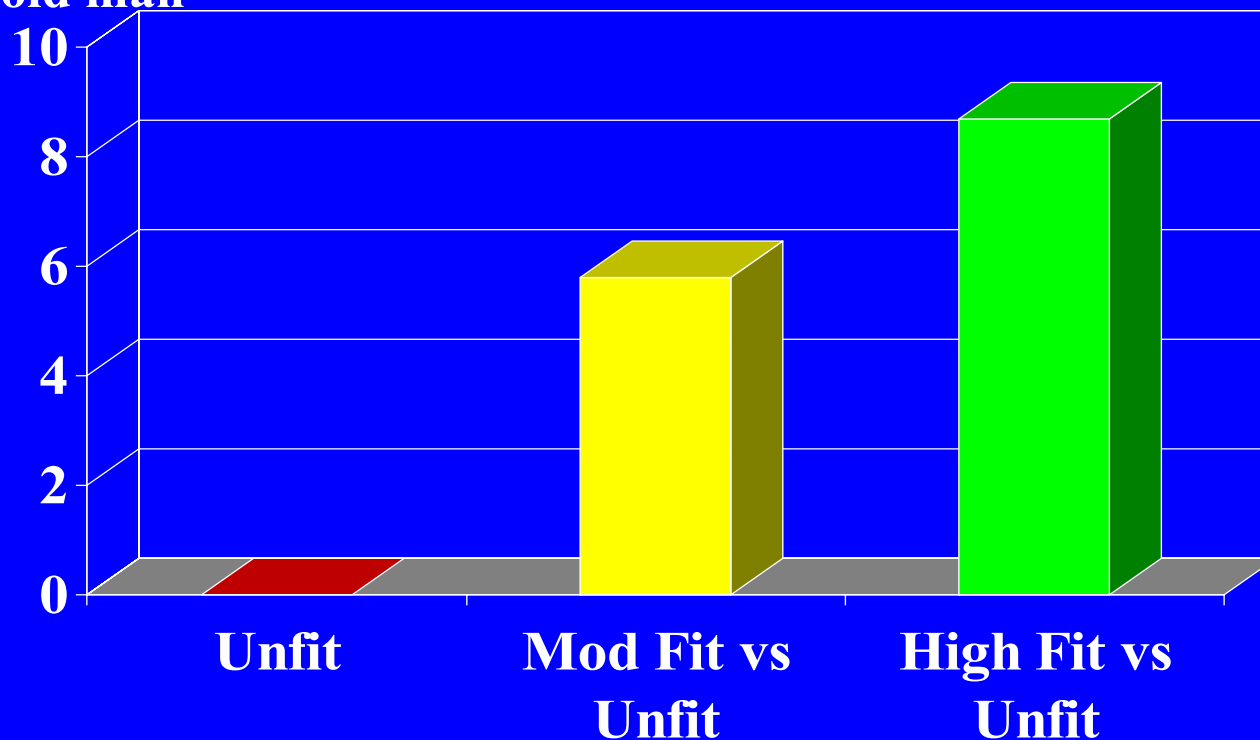


Amount of Specific Physical Activities for Moderately Fit Women and Men



Fit People Live Much Longer Than Unfit People

Years of added life
for a 45 year old man



Unfit people spend most of their time sitting

You can develop moderate fitness with 3 X 10-minute walks/day 5 days/week

High fitness can be developed by jogging 10 to 12 miles/week

ACLS. Unpublished data

**Engineering Energy
Expenditure out of Daily Life**

Lifestyle and Energy Expenditure

Sedentary Way

Active Way

	<i>kcal</i>		<i>kcal</i>
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 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

Active Way

	<i>kcal</i>		<i>kcal</i>
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

Active Way

	<i>kcal</i>		<i>Kcal</i>
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

Active Way

	<i>kcal</i>		<i>kcal</i>
Taking elevator up 3 flights	0.3	Walking up 3 flights of stairs	15
Park close as poss, 10 sec walk	0.3	Park 1 st 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

Active Way

	<i>kcal</i>		<i>kcal</i>
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

Conclusions

- **Definitive data on the causes of the current obesity epidemic are not available**
- **Energy balance is poorly understood**
- **30 minutes of moderate intensity activity on 5 days of the week provides substantial health benefits and is sufficient to prevent weight gain in some people**
- **Some individuals need more than 30 minutes/day to prevent weight gain (also some can get by with less)**
- **Prevention of weight regain in formerly obese persons may require up to 90 minutes of activity/day**