

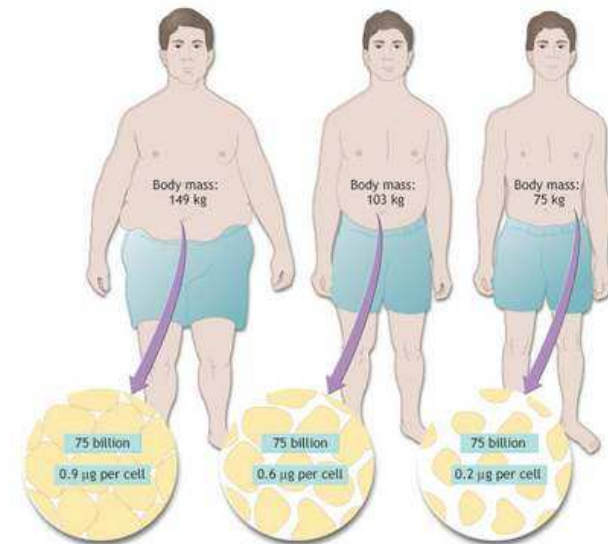
# Physical Activity Guidelines for Overweight and Obese Subjects

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Neuromuscular Research Laboratory  
Schulthess Clinic, Zurich, Switzerland

# PLAN

- **Obesity: definitions and treatments**
- **Exercise prescription**
  - Type of activity, frequency, duration, intensity
- **A practical exemple...**
- **Conclusions**



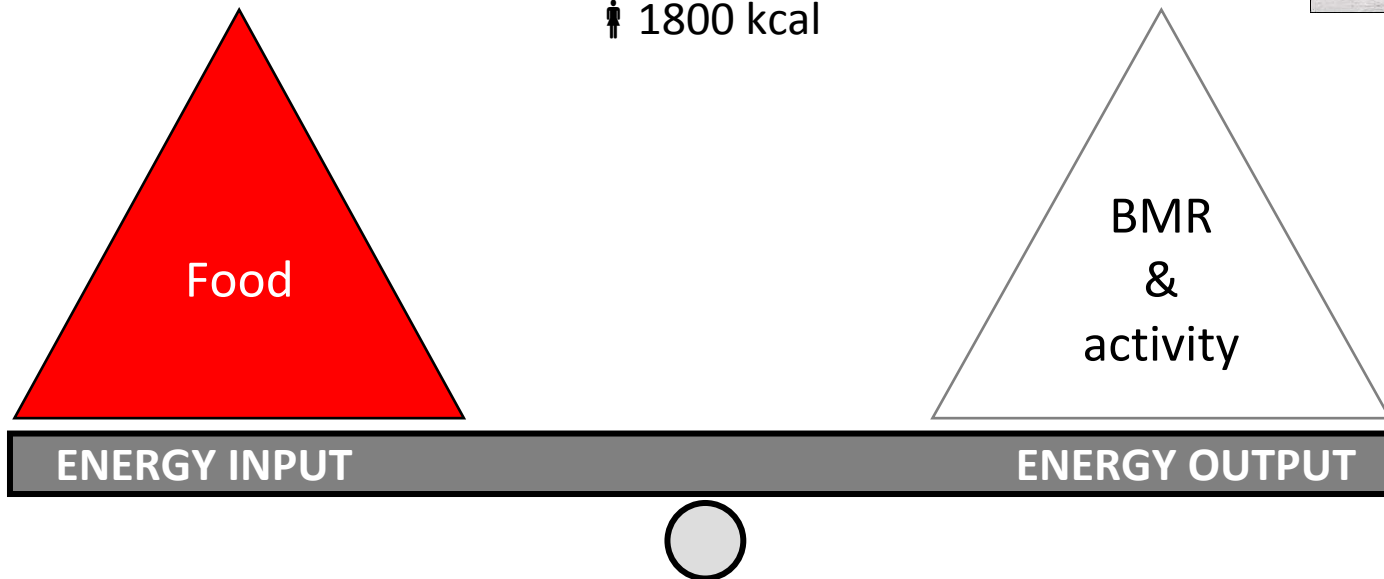
**Figure 30.13.** Changes in adipose cellularity with weight reduction in obese subjects. (Data from Hirsch J. Adipose cellularity in relation to human obesity. In: Stollerman GH, ed. *Advances in internal medicine*, vol 17. Chicago: Year-Book, 1971.)

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# Daily energy balance – a simple model



Daily  
♂ 2400 kcal  
♀ 1800 kcal

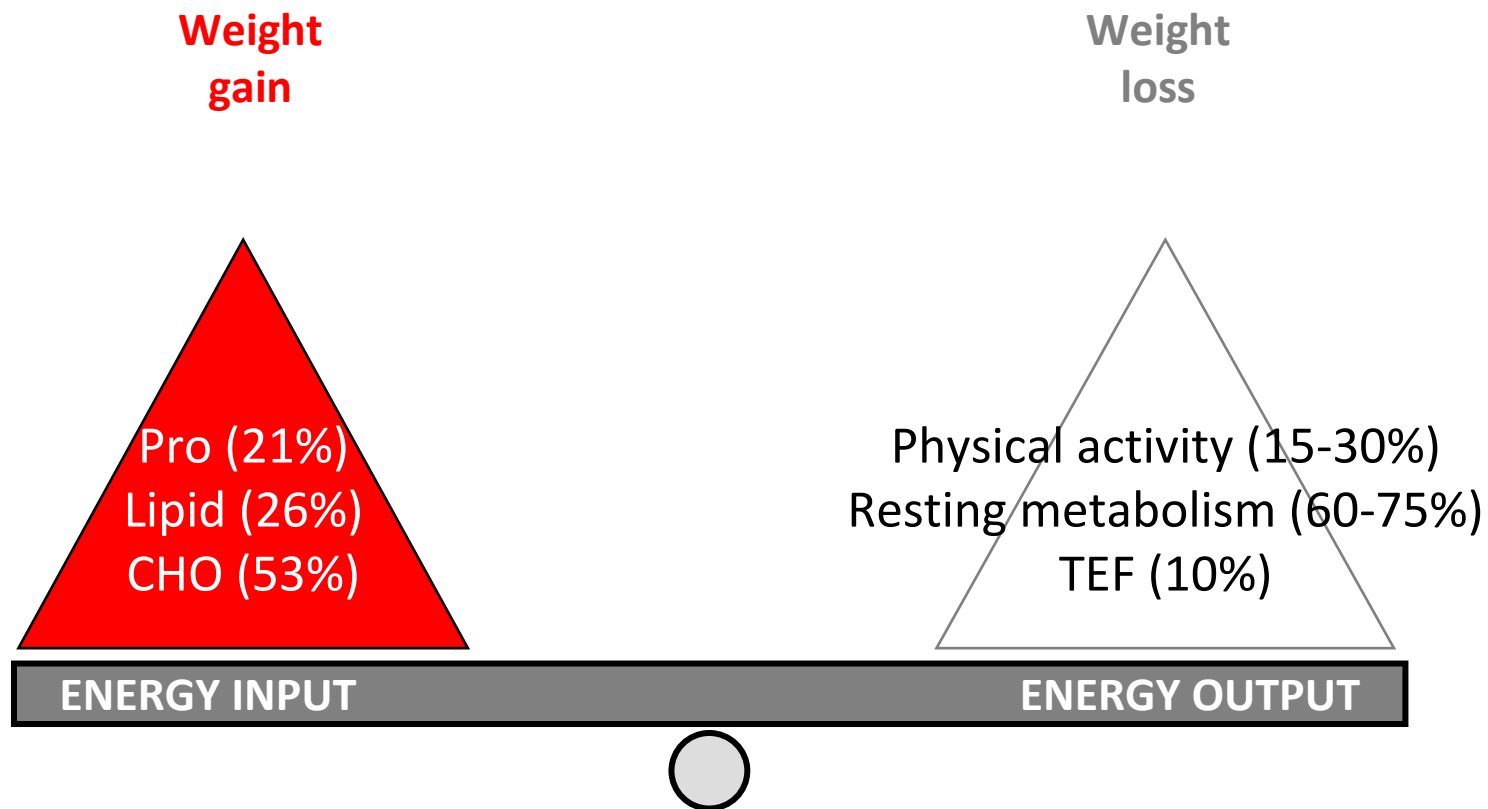


## ENERGY OUTPUT per DAY

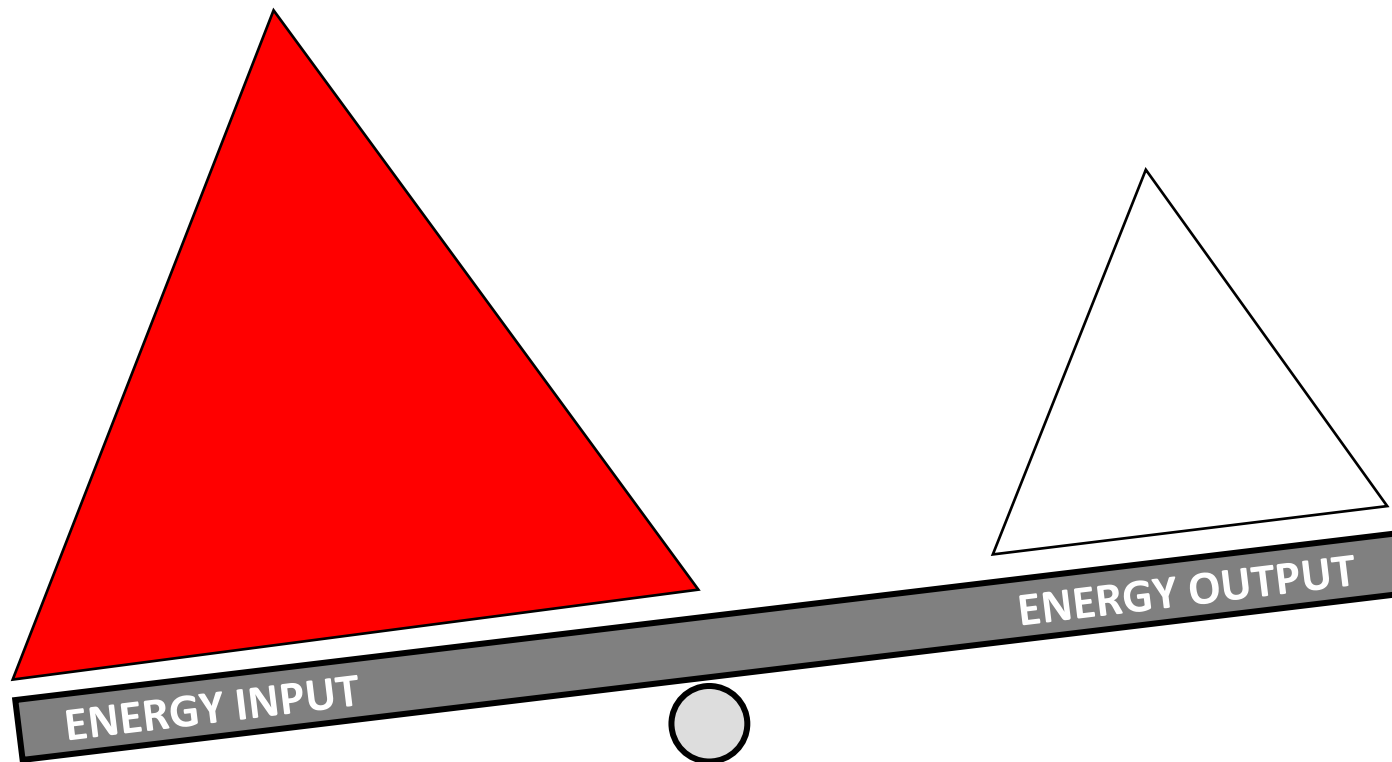
Activity	hours	PAL	kcal
Sleep	8.3	1.0	469
Personal care	1.0	2.0	113
TV & rest	0.9	1.35	69
Activities - seated	0.4	1.35	36
Children-related act.	1.4	2.0	158
Kitchen	1.0	1.8	102
Food	1.3	1.7	125
House-related act.	1.7	2.6	250
Shopping	0.5	2.5	71
Travel	1.2	1.5	102
Work	5.6	2.0	633
Walk	0.7	3.0	119
<b>Total</b>	<b>24</b>	<b>1.66</b>	<b>2247</b>

# Daily energy balance – a simple model

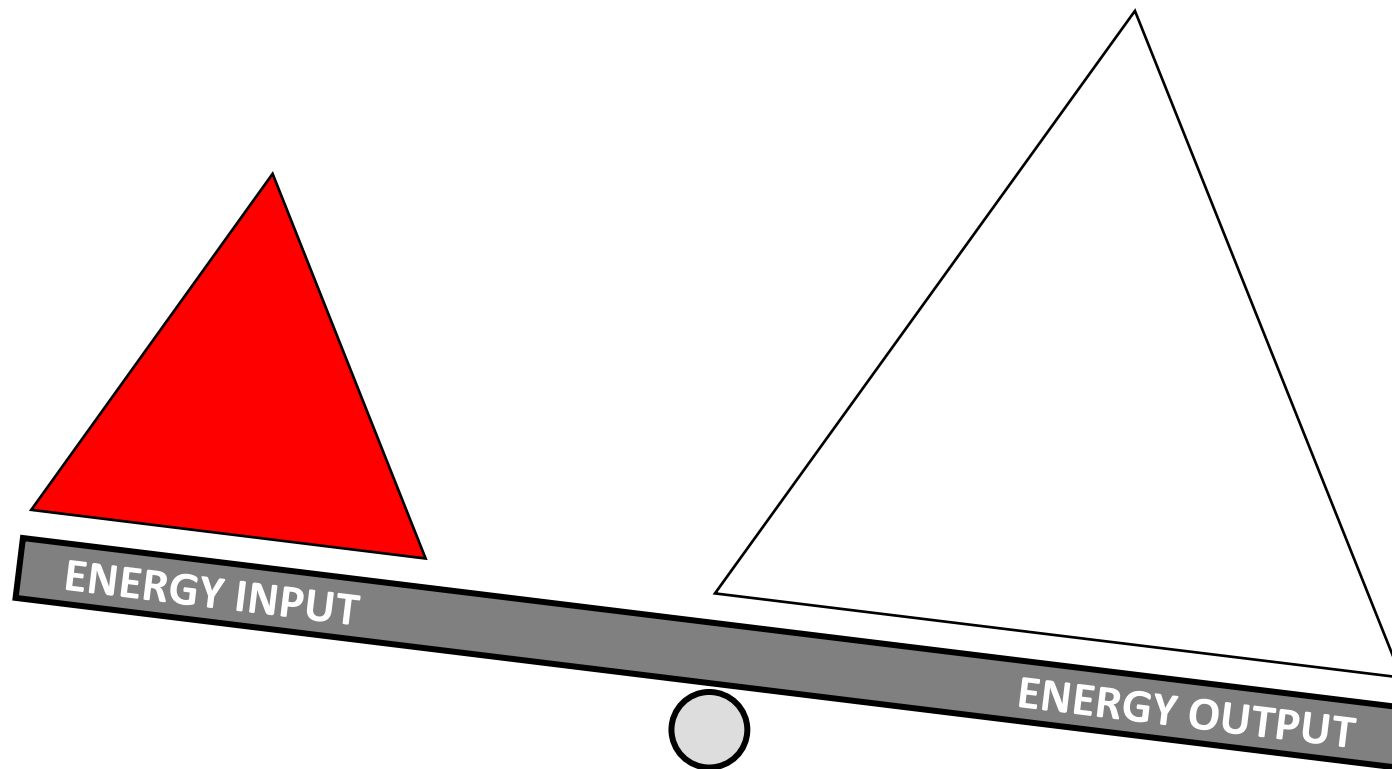
**Weight change** = total energy intake – total energy expenditure

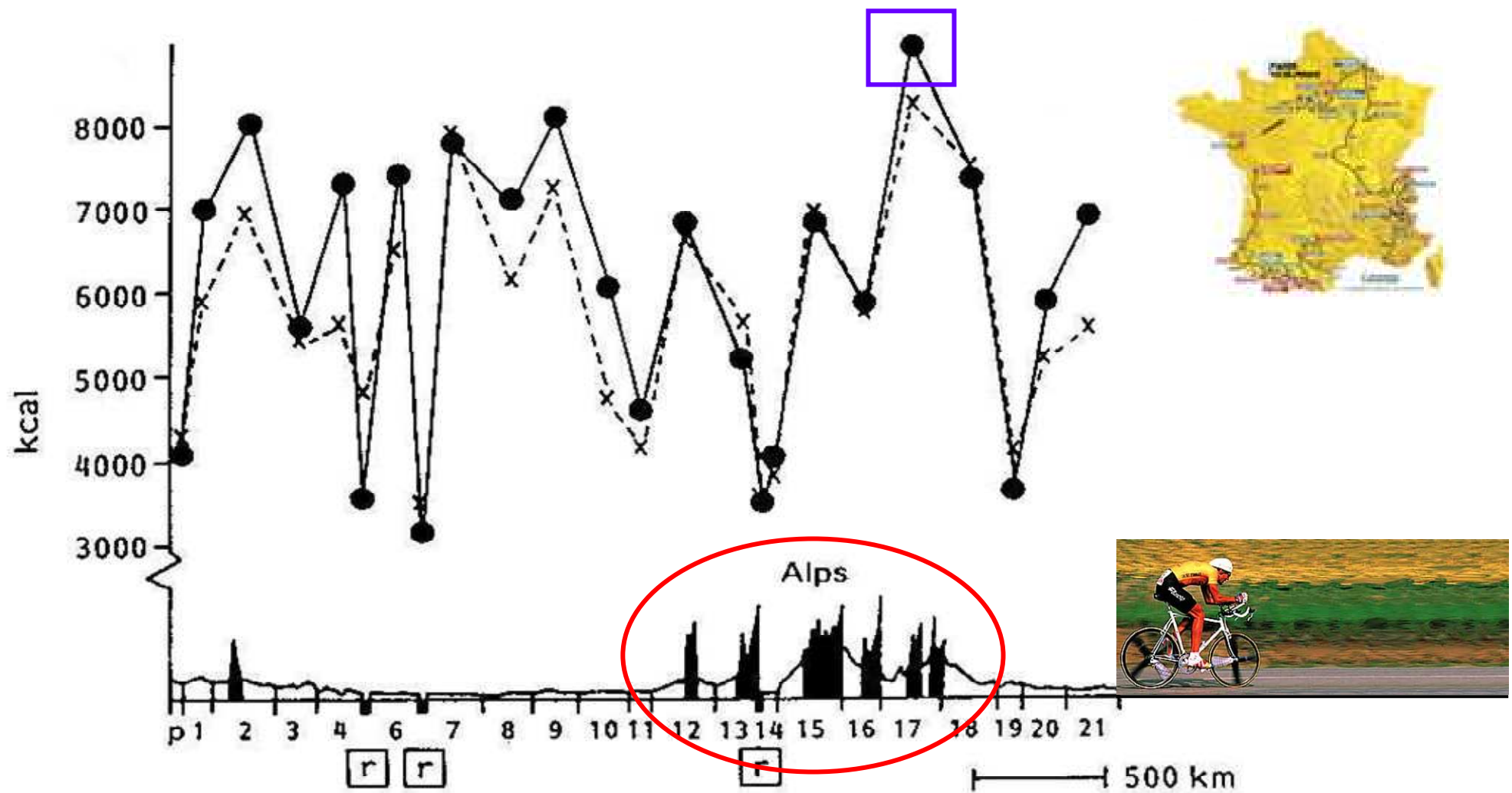


**WEIGHT GAIN**  
**positive energy balance !**  
**i.e., input > output**



**WEIGHT LOSS**  
**negative energy balance !**  
**i.e., output > input**





**Figure 2** Daily energy expenditure (•—•) and energy intake (\*---\*) as measured in a cyclist during the Tour de France. Interesting is the extremely high energy expenditure as well as the ability to match energy balance with the use of liquid nutrition in addition to the normal meals p = stage; r = rest day. Reproduced with permission from Saris et al. (165)



# Classification of overweight and obesity in adults

Classification	BMI (kg/m <sup>2</sup> )
Underweight	< 18.5
Normal range	18.5-24.9
Overweight	25.0-29.9
Obese	> 30.0
class I	30.0-34.9
class II	35.0-39.9
class III	> 40.0

# Relative risk of health problems associated with obesity

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## Greatly increased (relative risk $\gg 3$ )

---

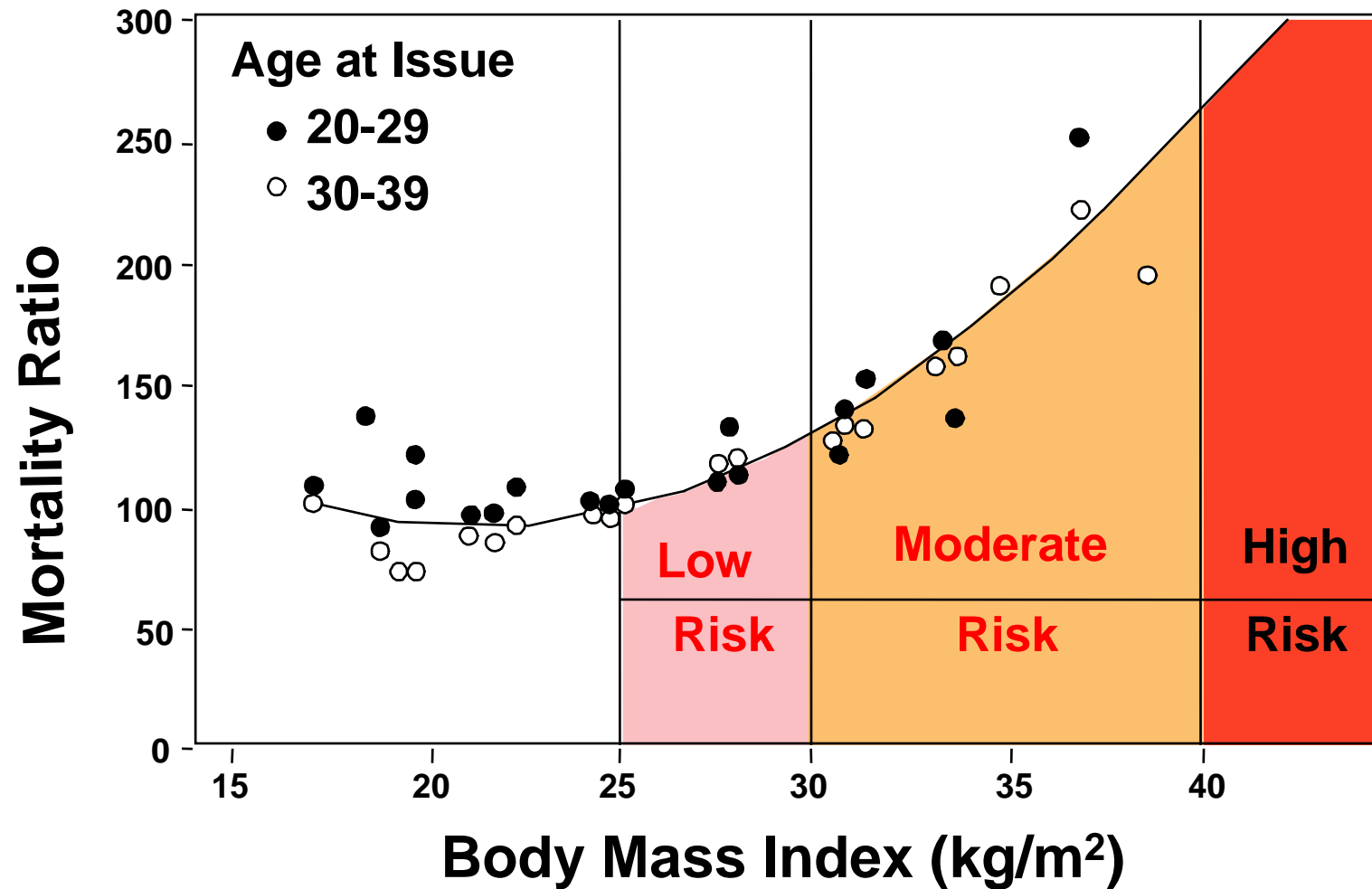
- Diabetes
- Gall bladder disease
- Hypertension
- Dyslipidaemia
- Insulin resistance
- Breathlessness
- Sleep apnoea

## Moderately increased (relative risk $\sim 2-3$ )

---

- Coronary heart disease
- Osteoarthritis (knees)
- Hyperuricaemia and gout

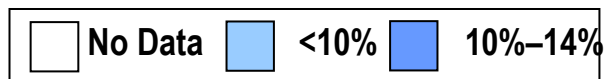
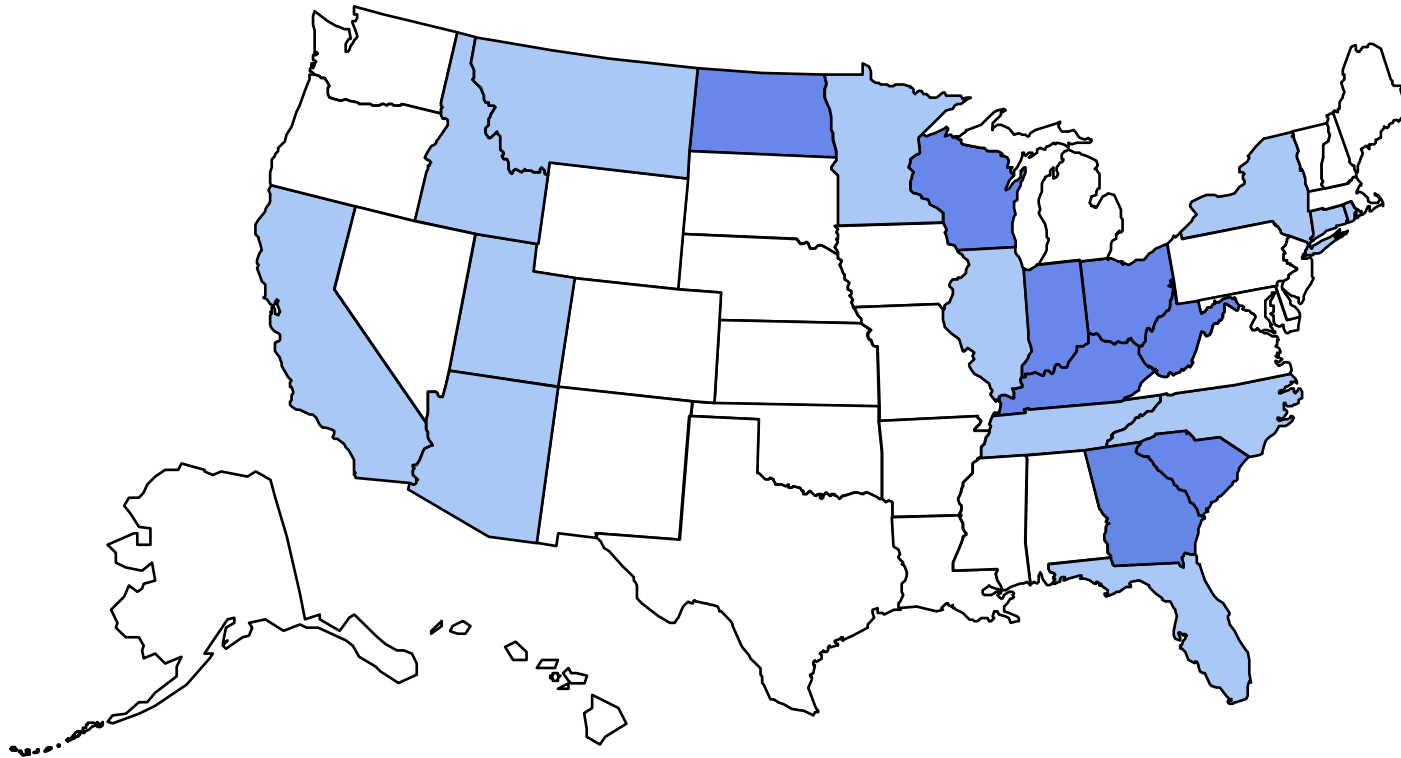
# Relation of BMI to mortality



## BRFSS, 1985

# BRFSS, 1985

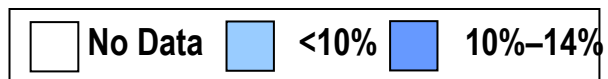
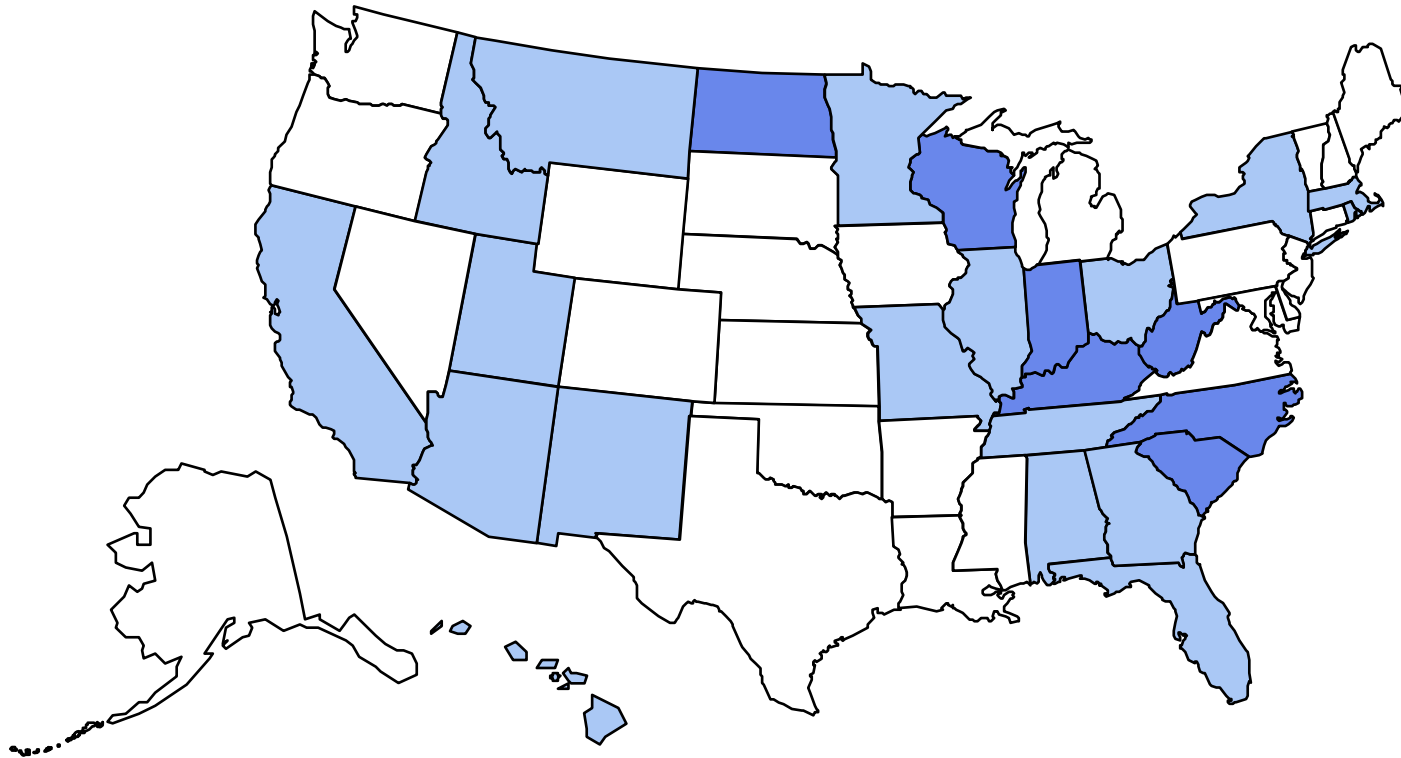
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



## BRFSS, 1986

# BRFSS, 1986

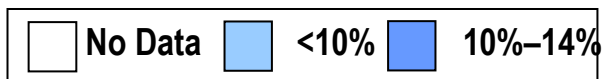
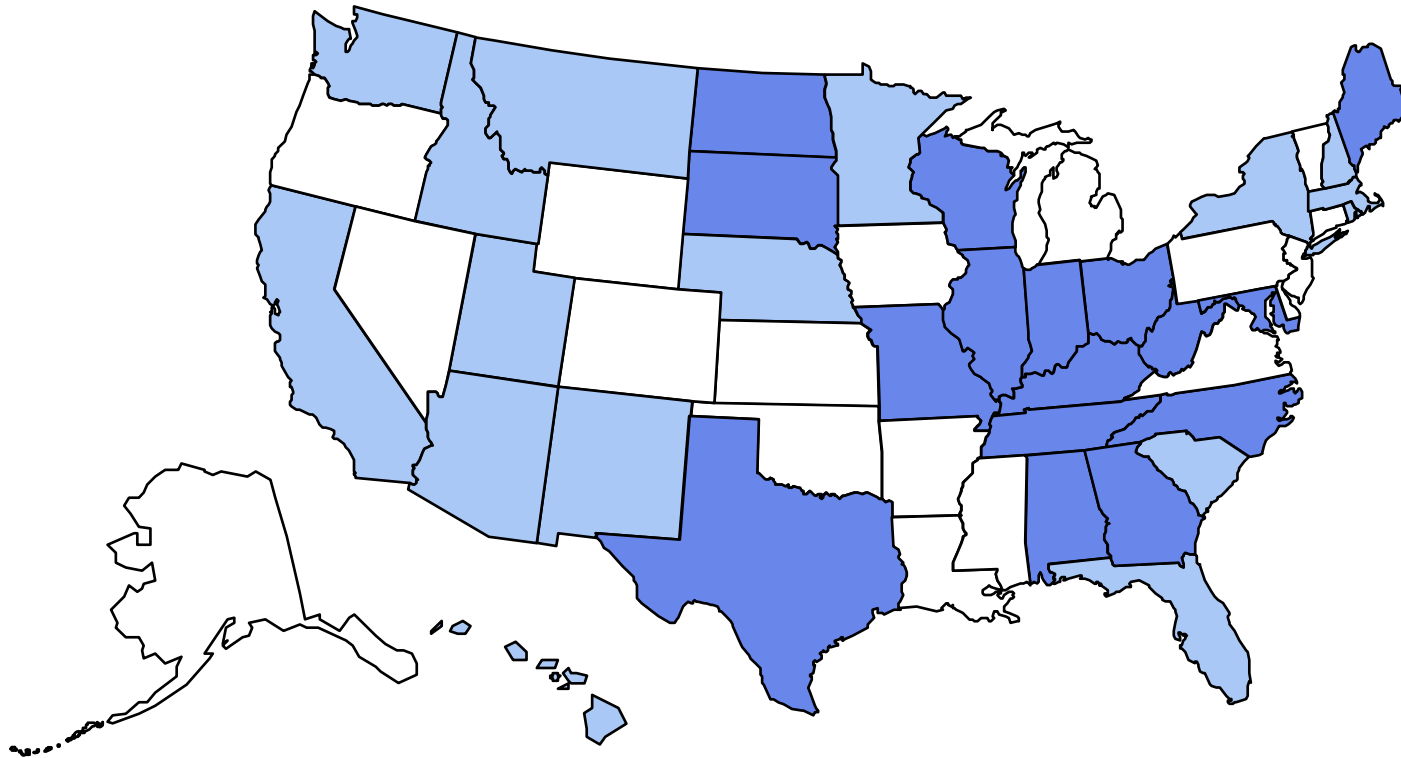
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

# BRFSS, 1987

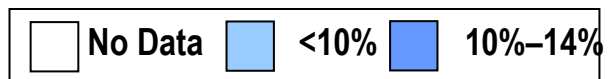
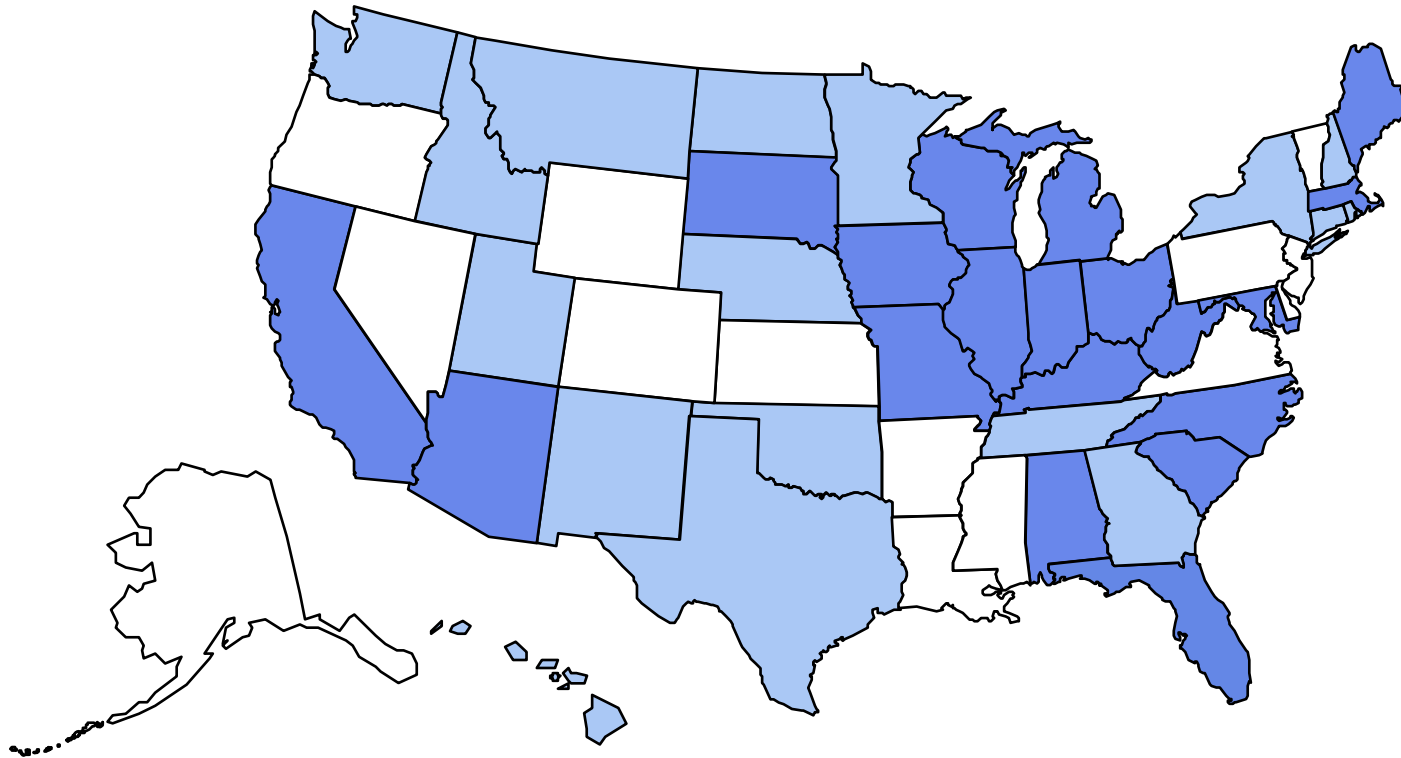
**(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)**



## BRFSS, 1988

# BRFSS, 1988

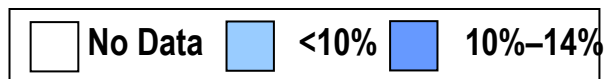
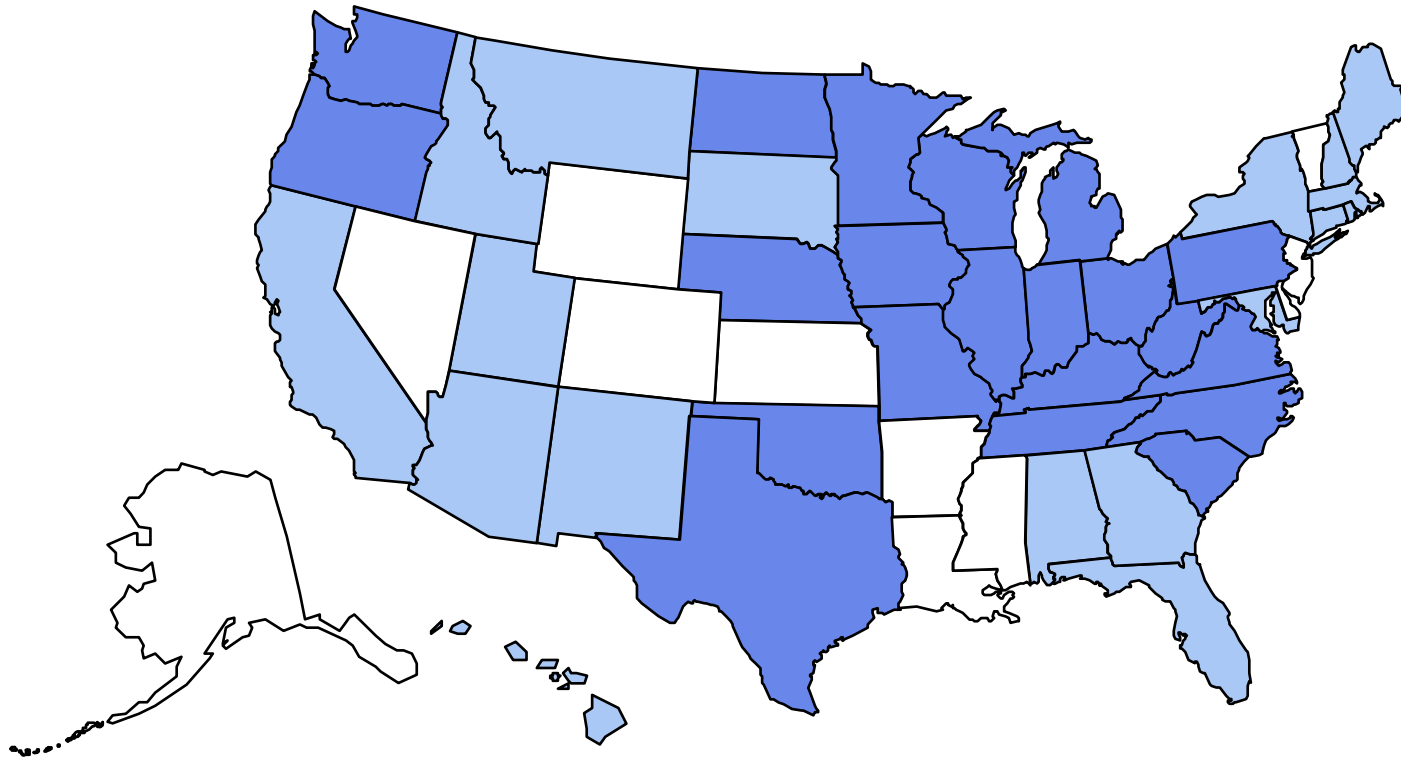
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



## BRFSS, 1989

# BRFSS, 1989

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)

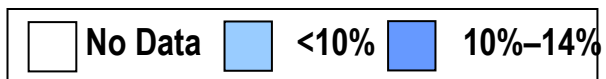
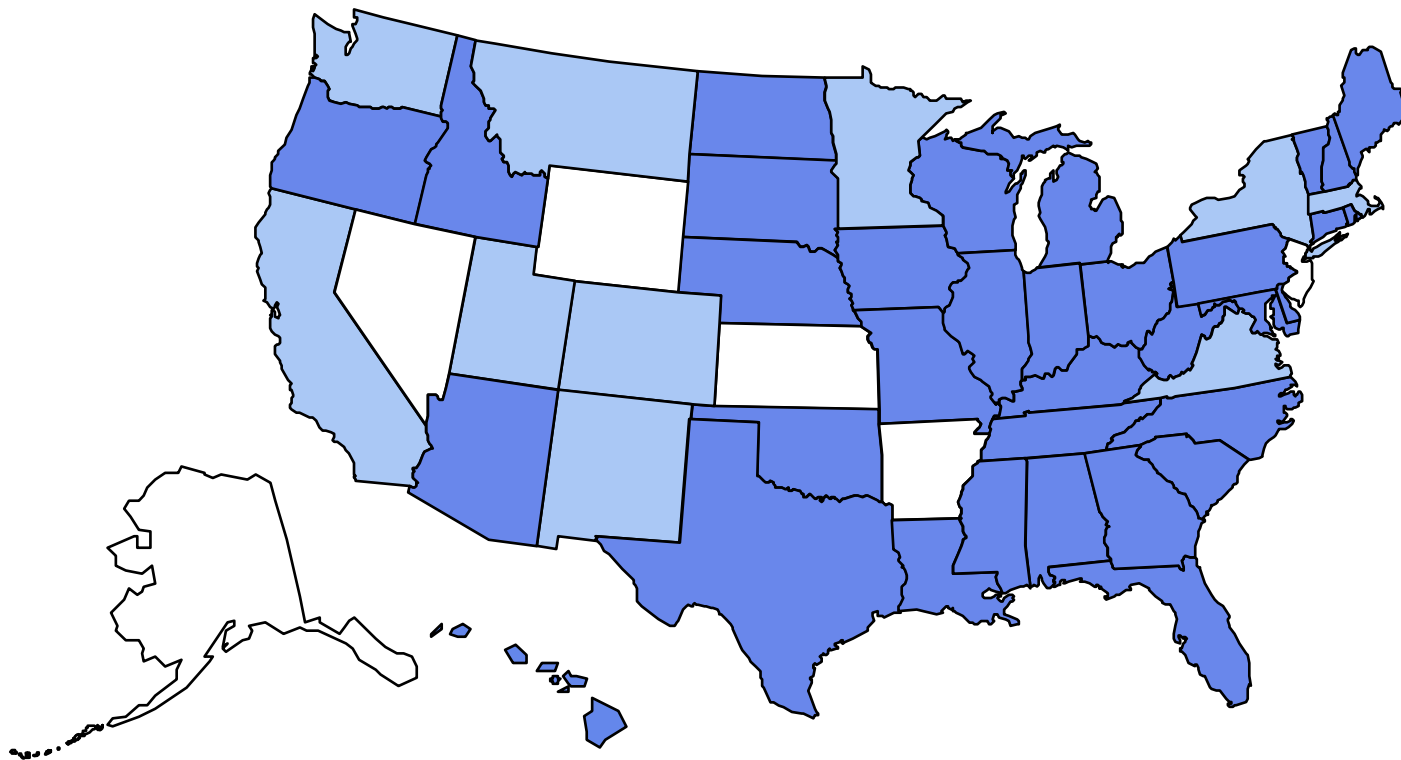




# Obesity Trends\* Among U.S. Adults

BRFSS, 1990

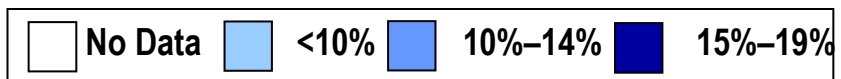
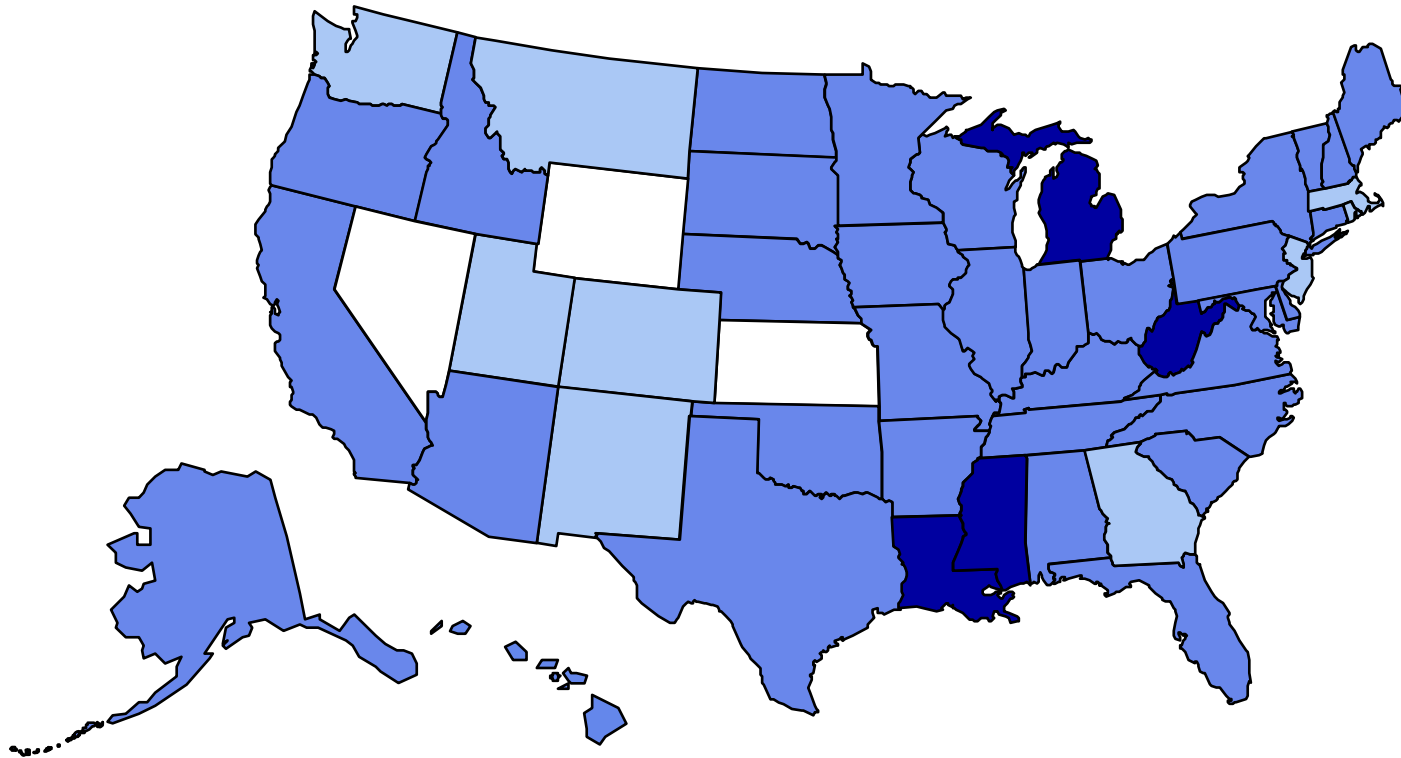
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



## BRFSS, 1991

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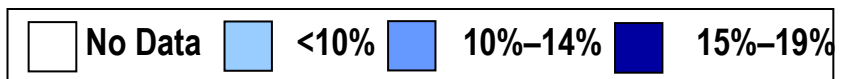
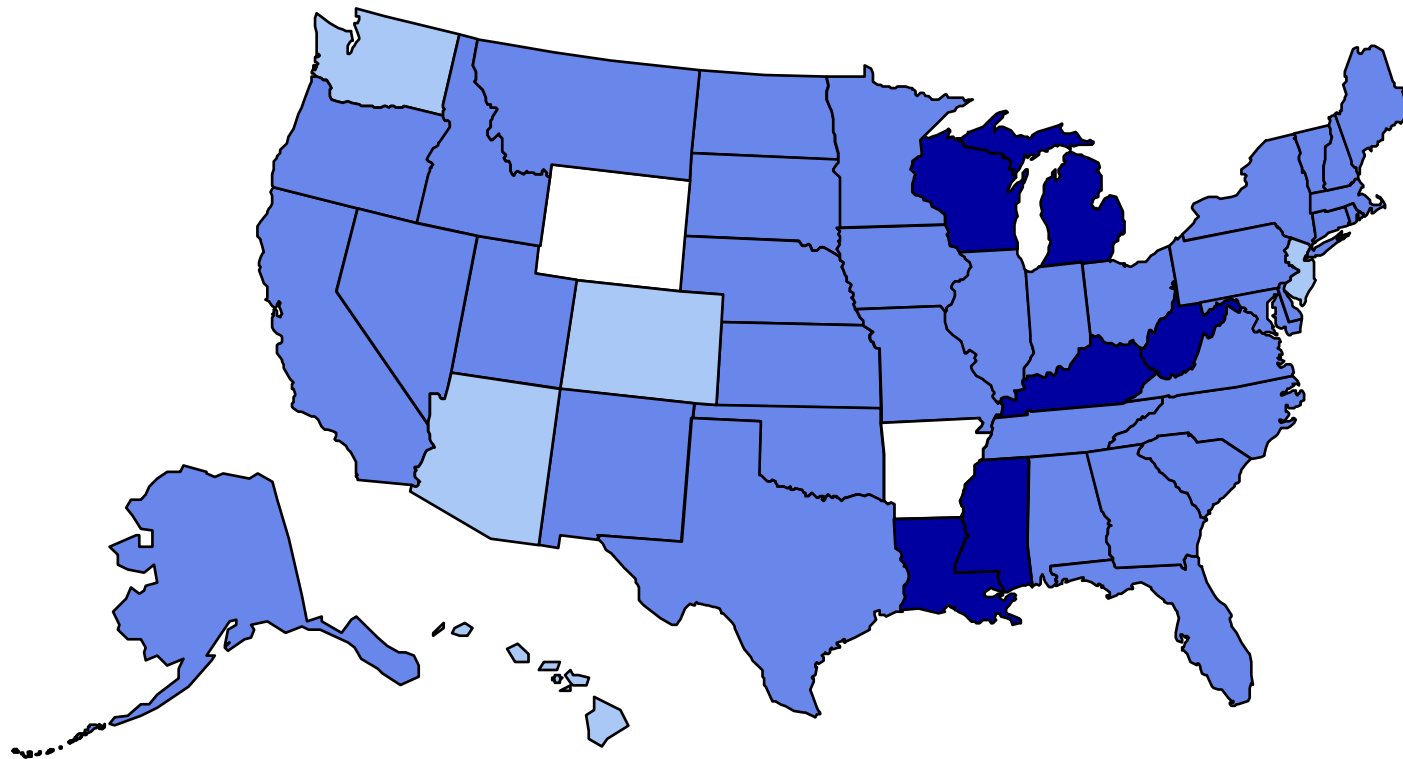
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

**BRFSS, 1992**

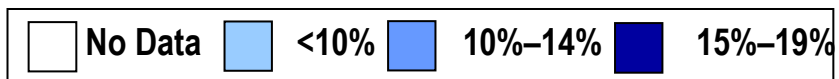
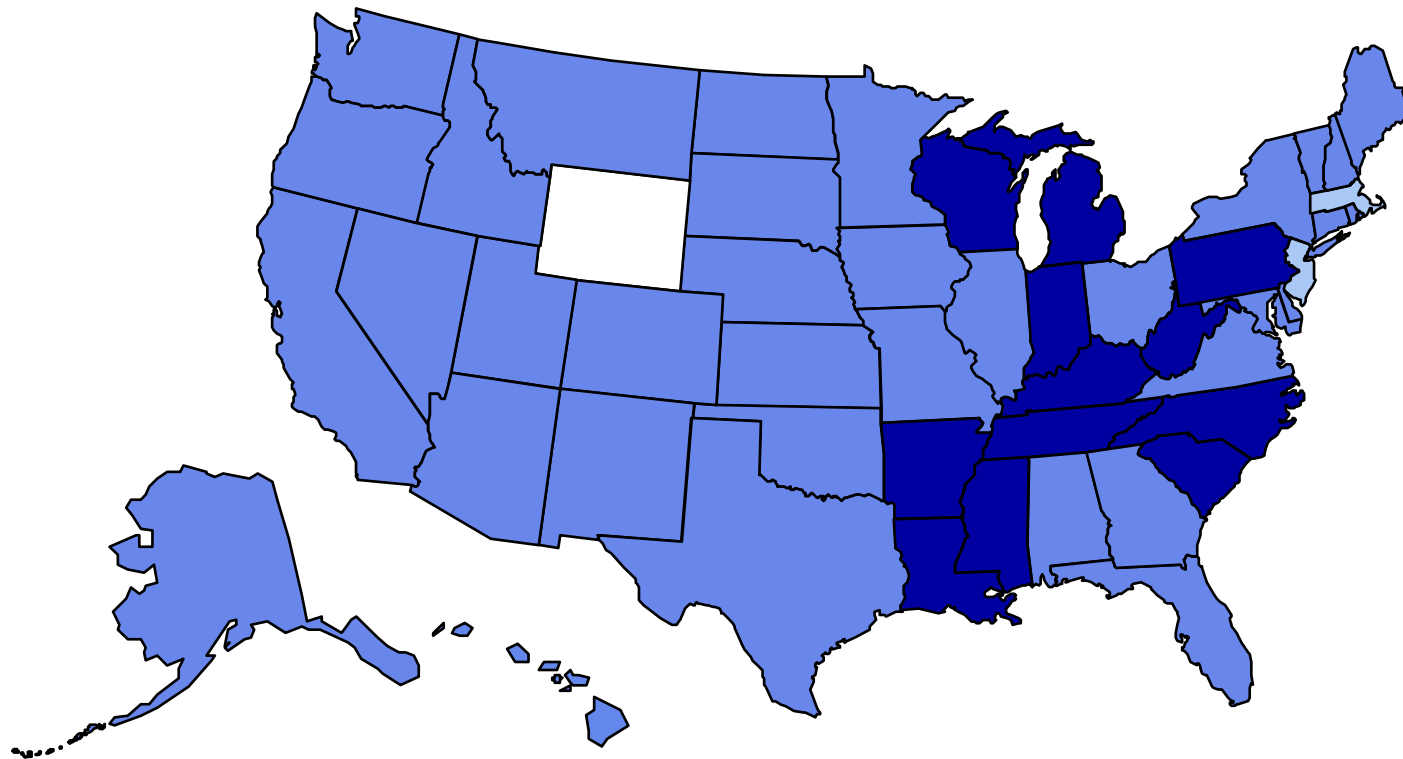
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

**BRFSS, 1993**

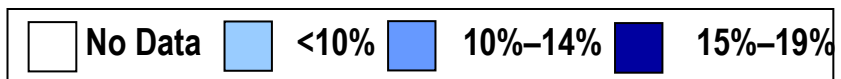
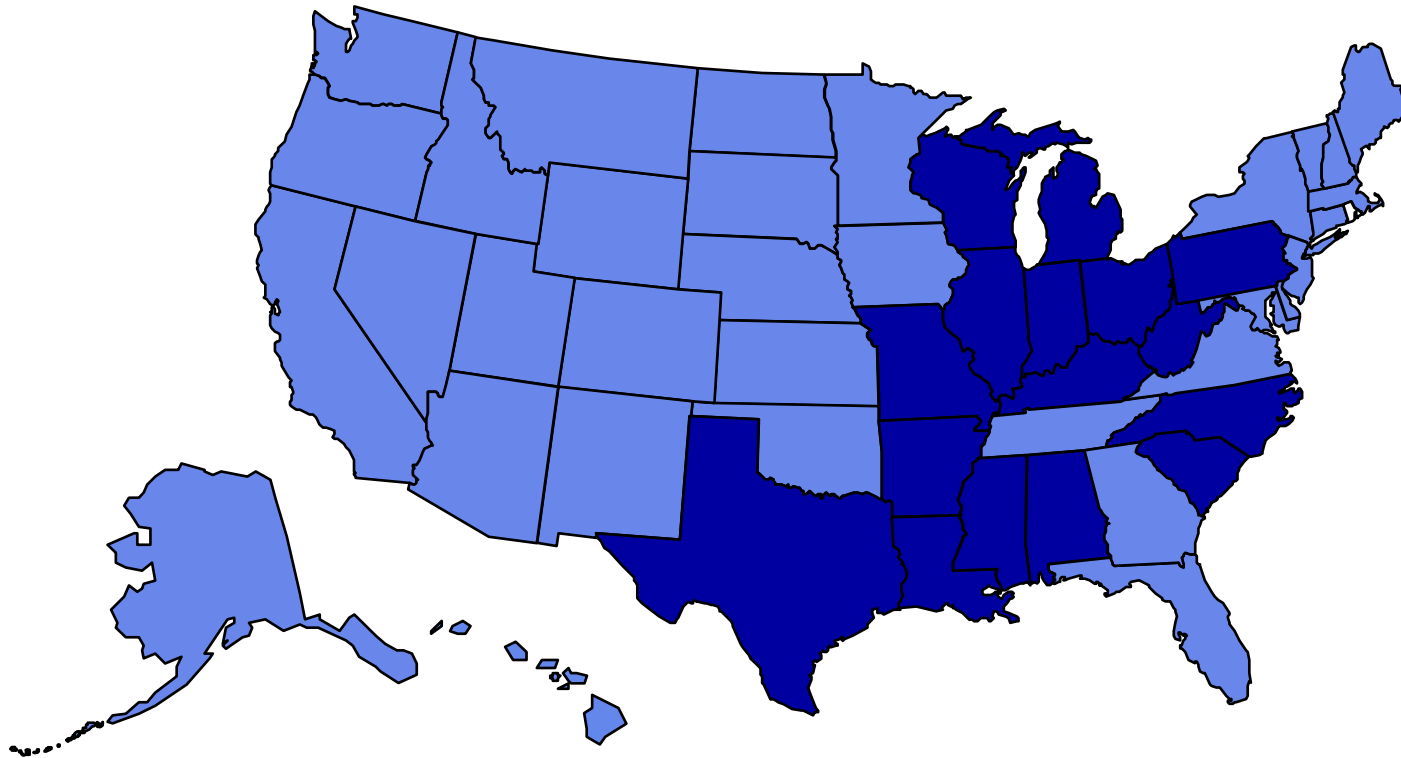
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1994

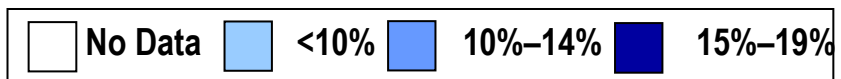
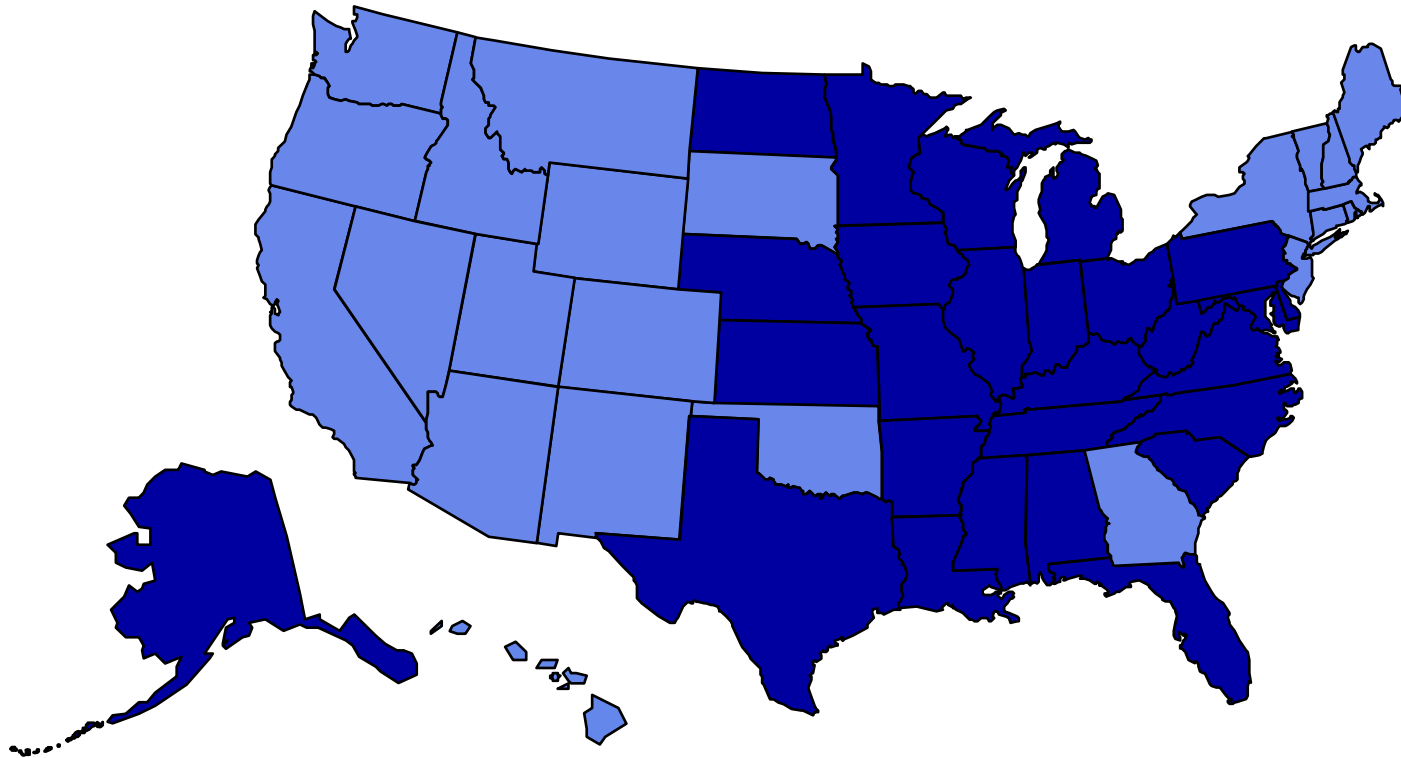
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1995

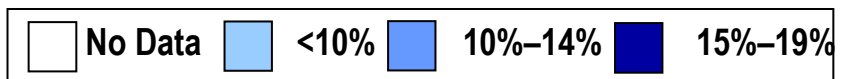
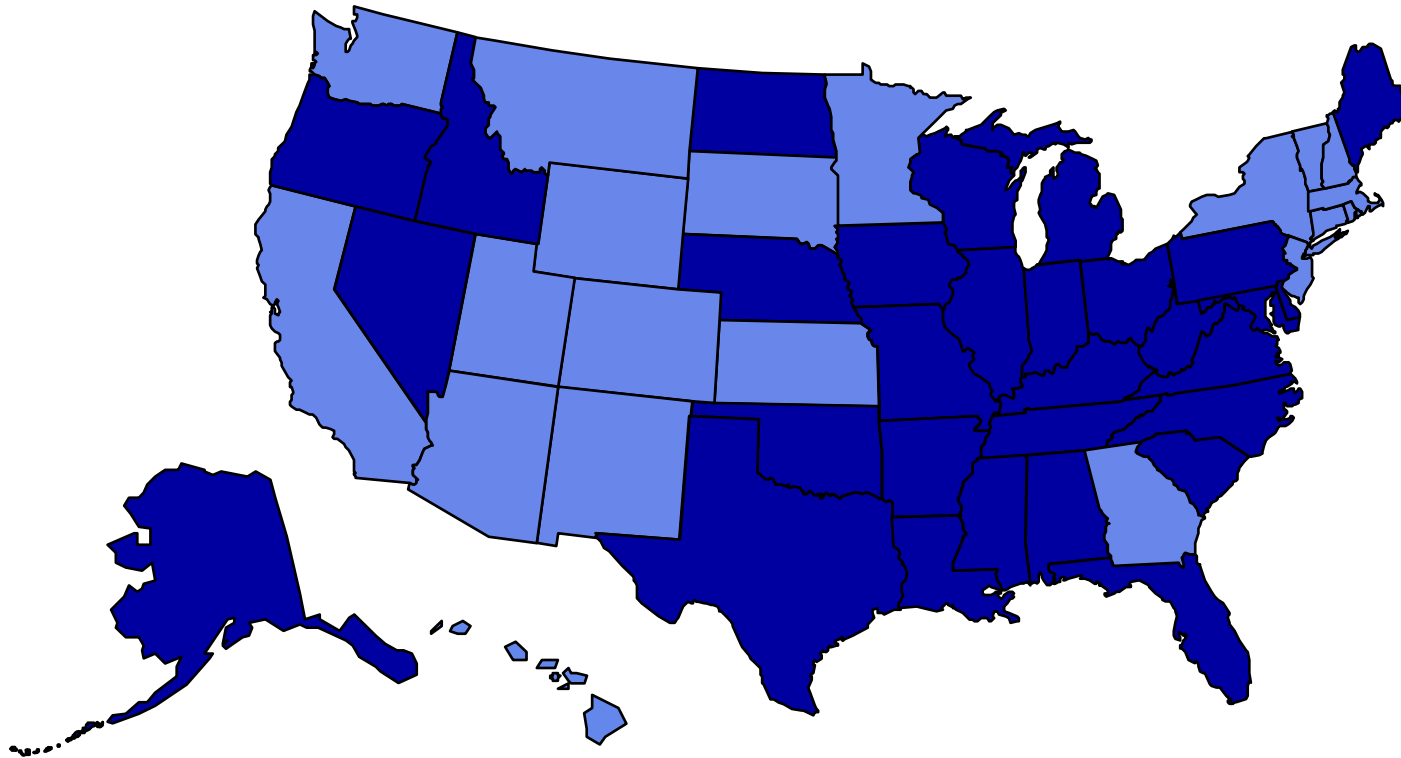
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1996

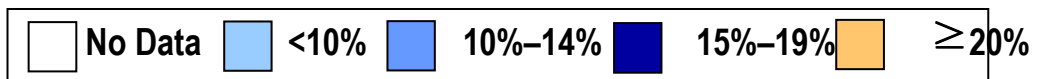
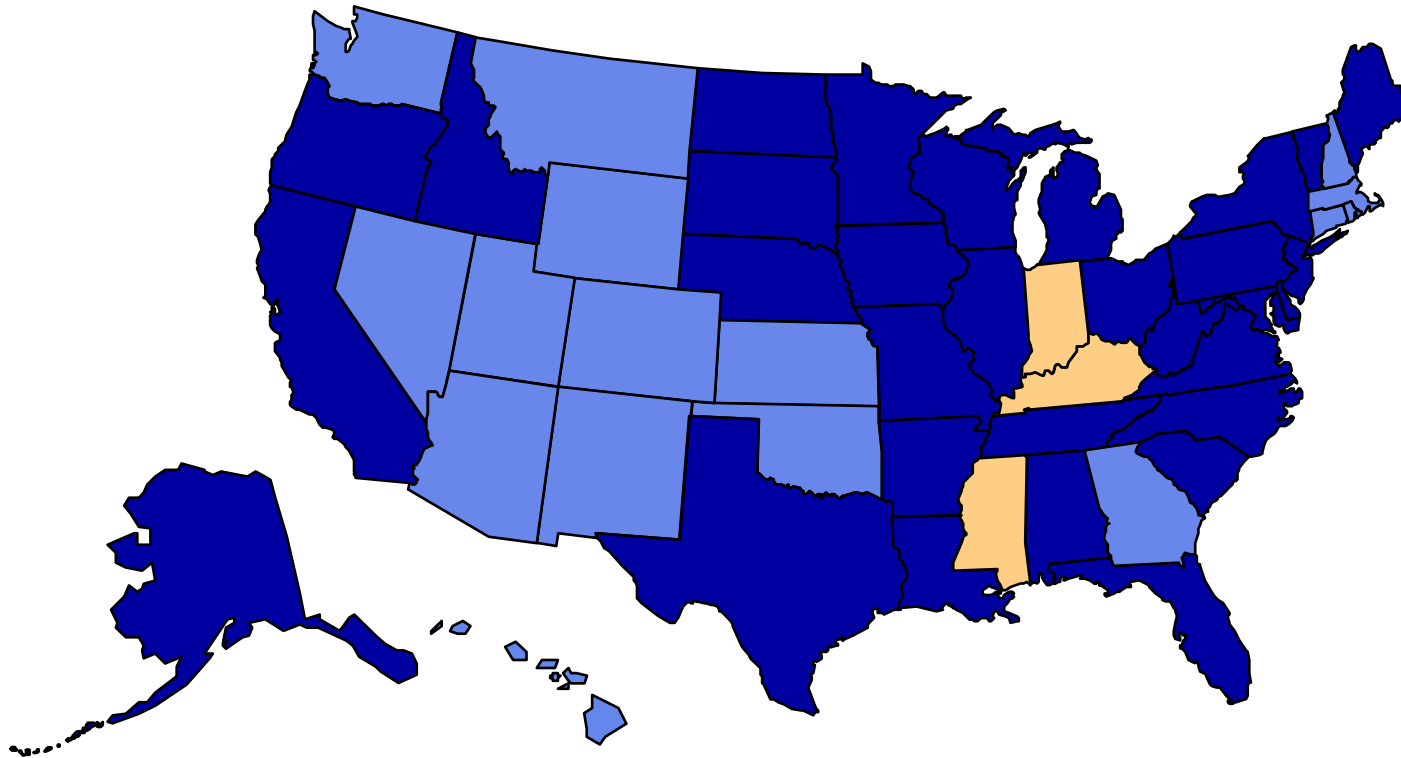
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1997

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)

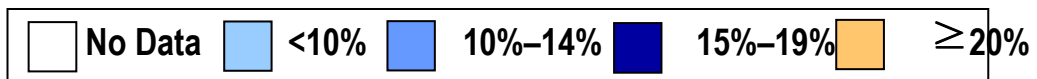
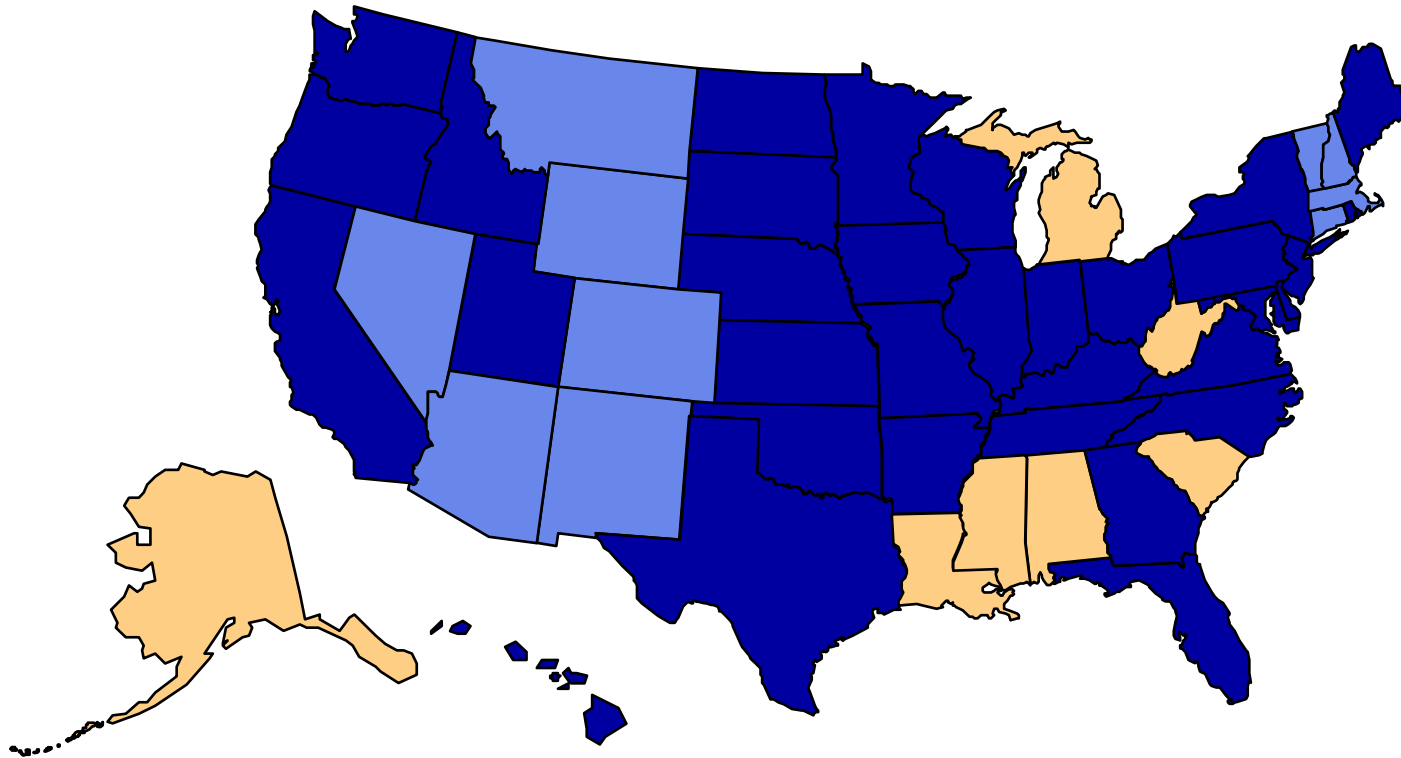




# Obesity Trends\* Among U.S. Adults

BRFSS, 1998

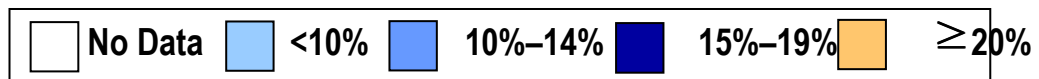
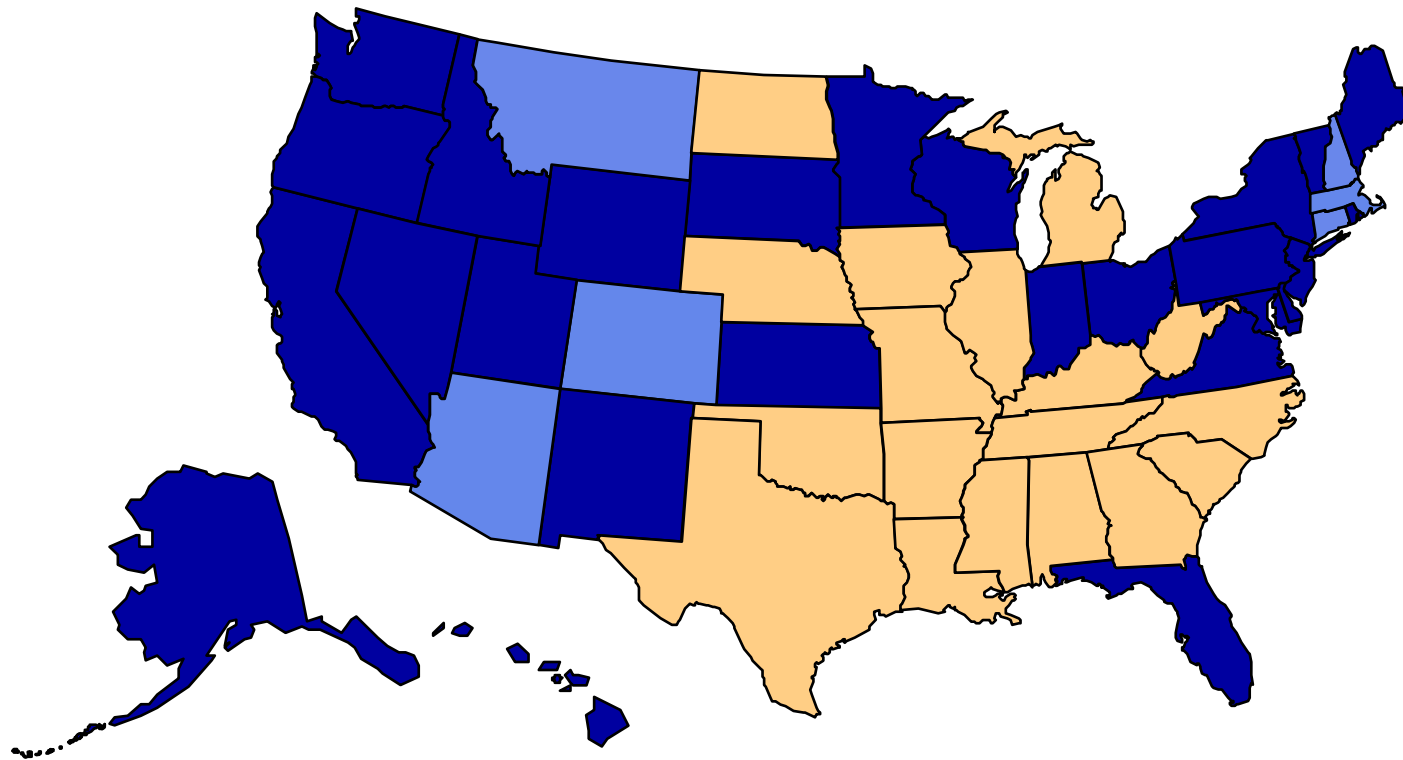
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1999

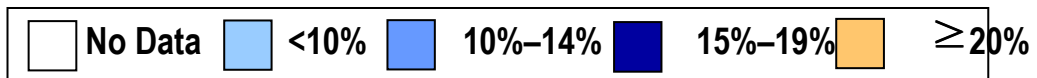
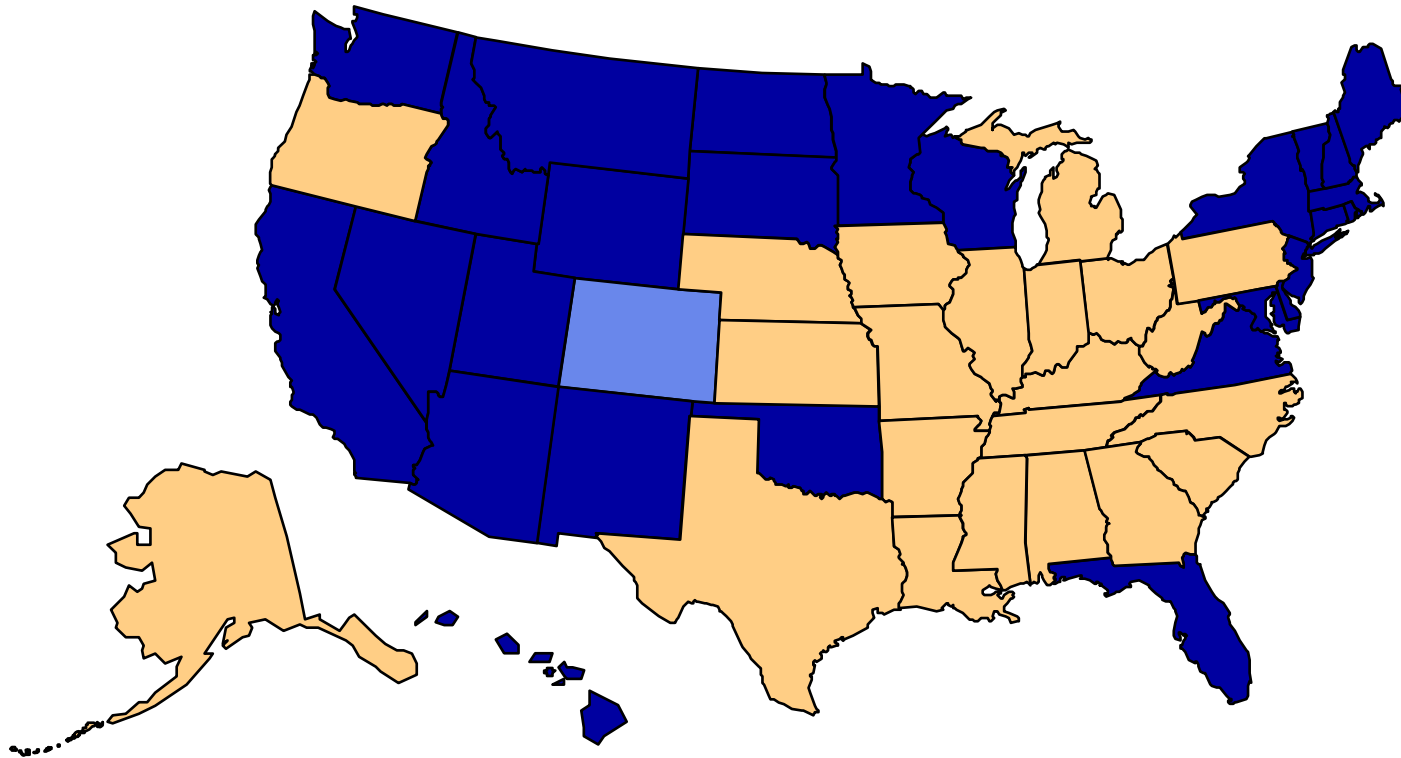
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2000

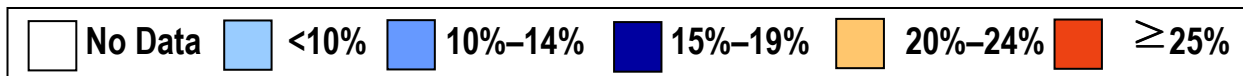
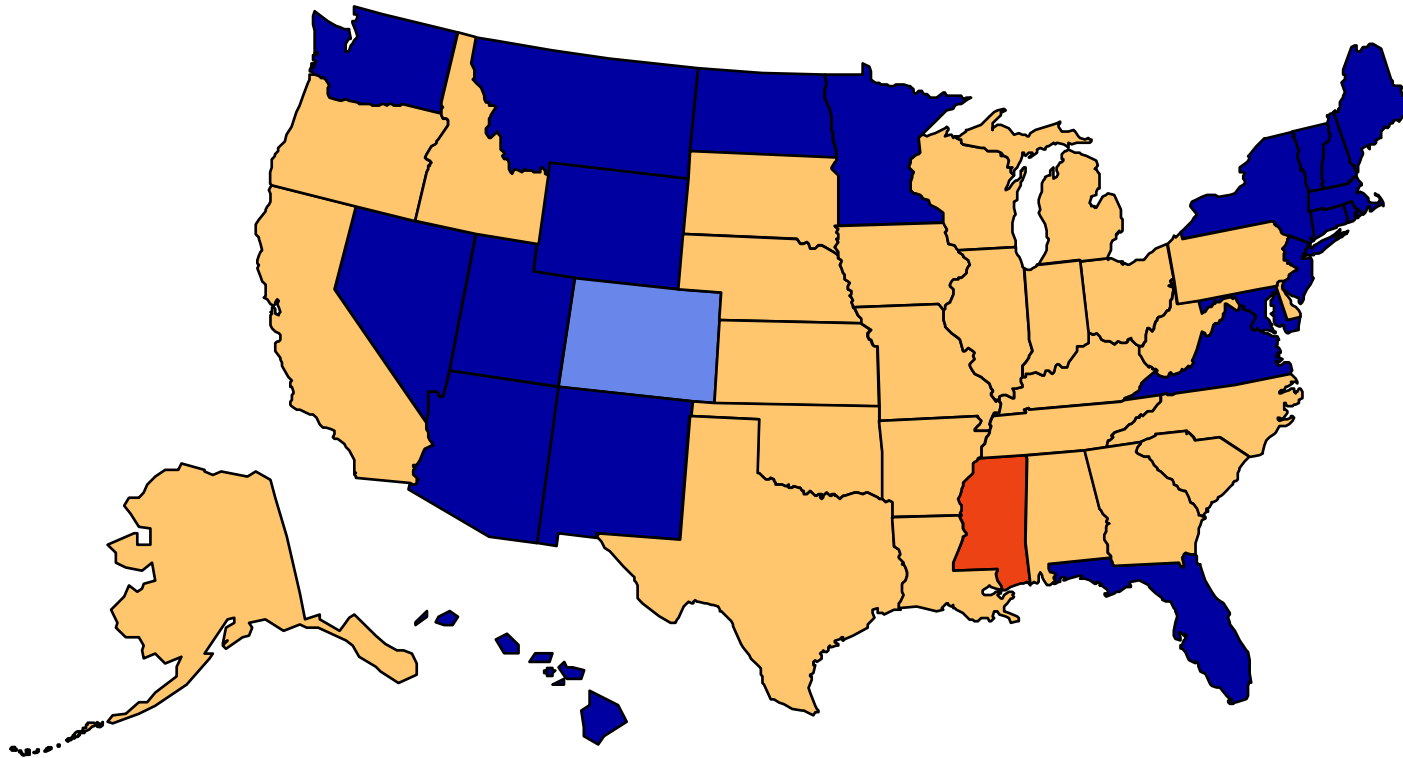
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



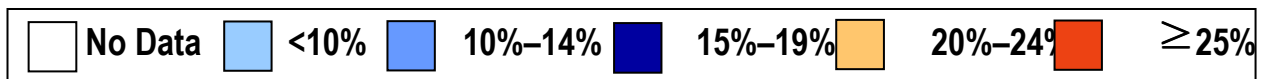
## BRFSS, 2001

# BRFSS, 2001

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



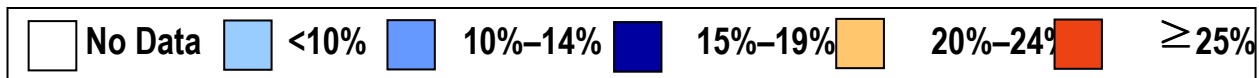
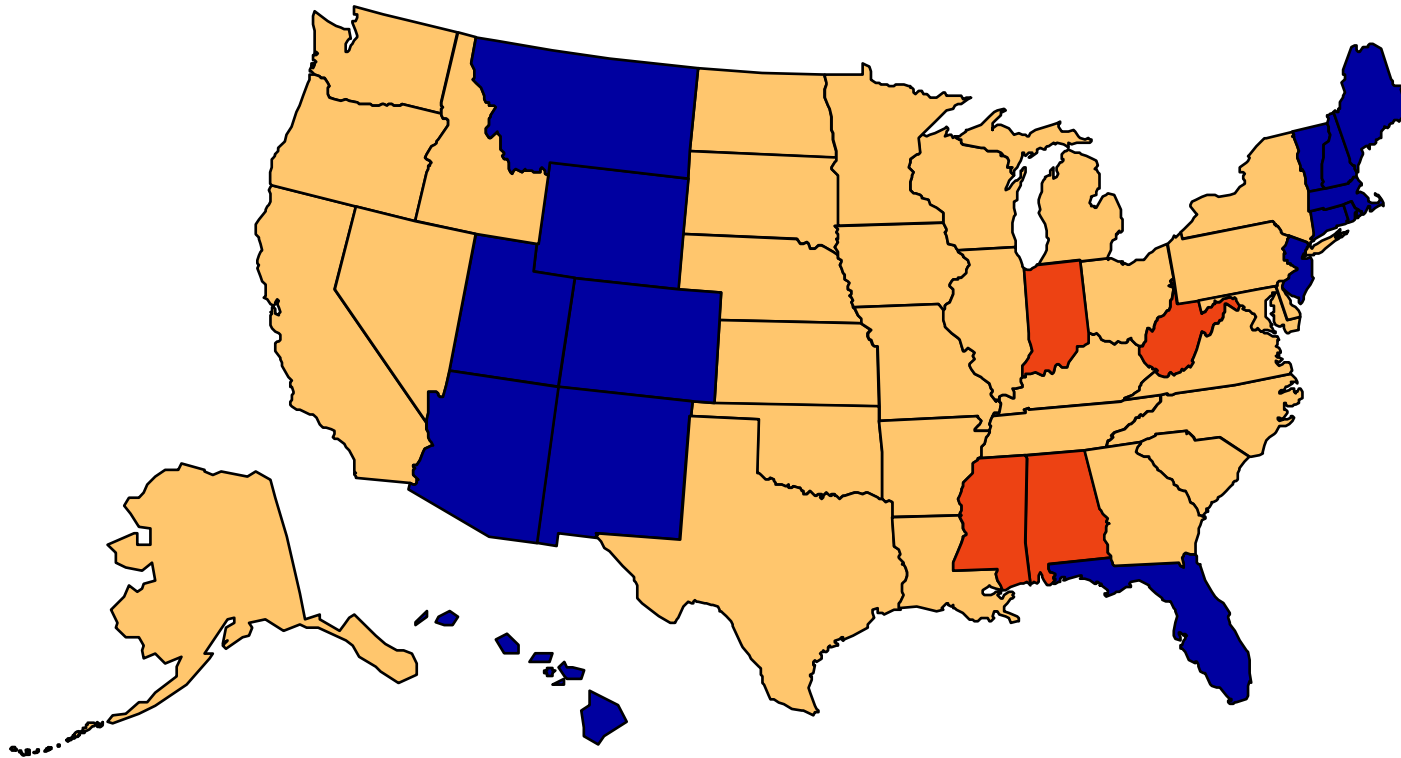
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# Obesity Trends\* Among U.S. Adults

BRFSS, 2003

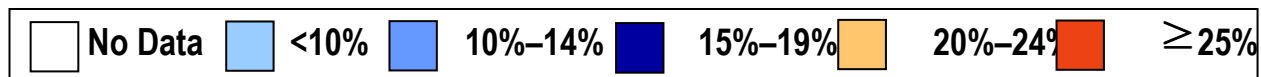
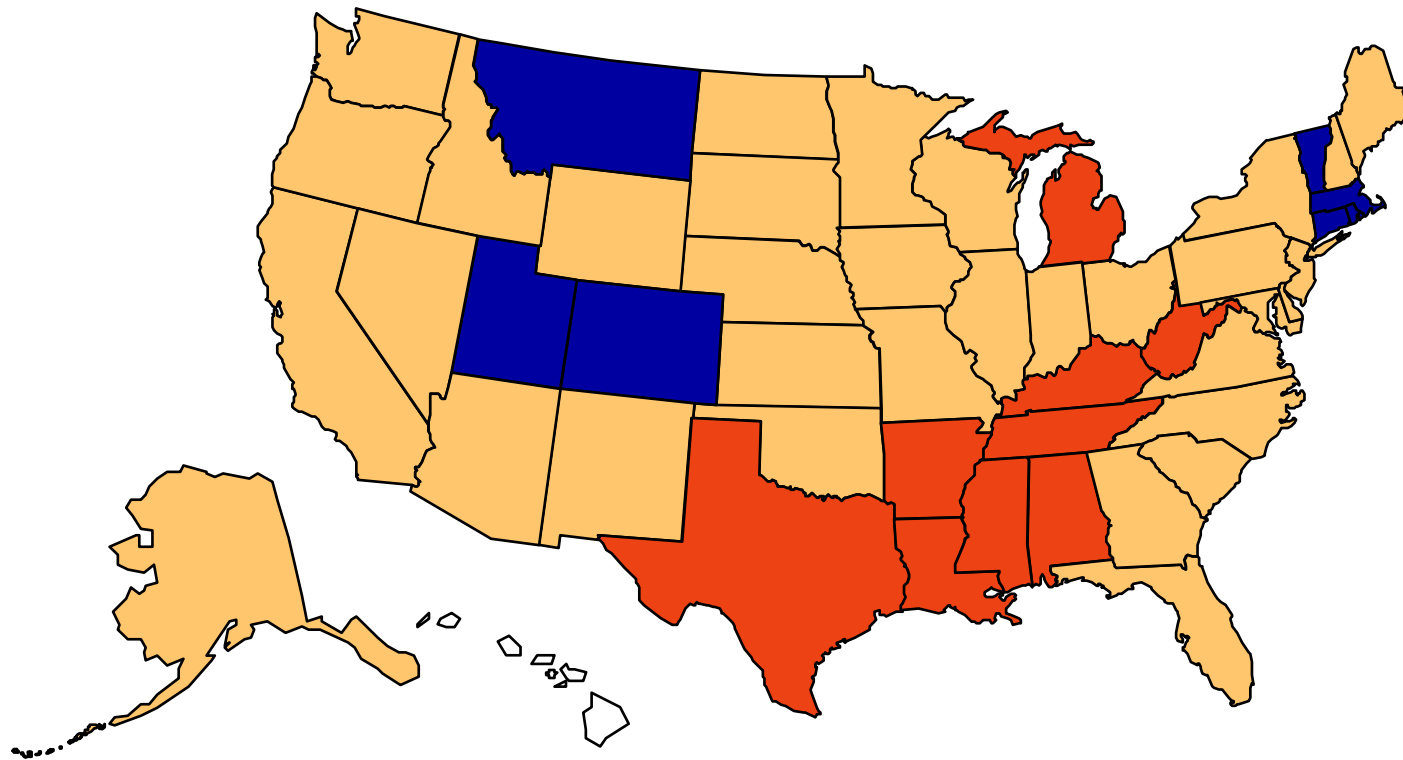
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

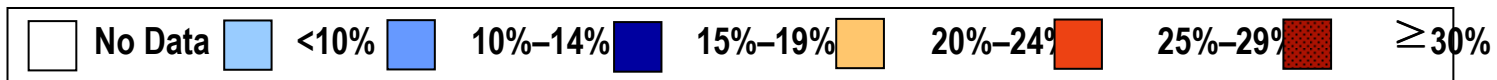
BRFSS, 2004

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



## BRFSS, 2005

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)

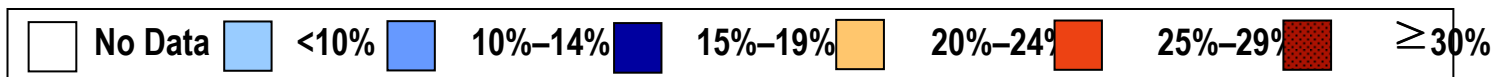
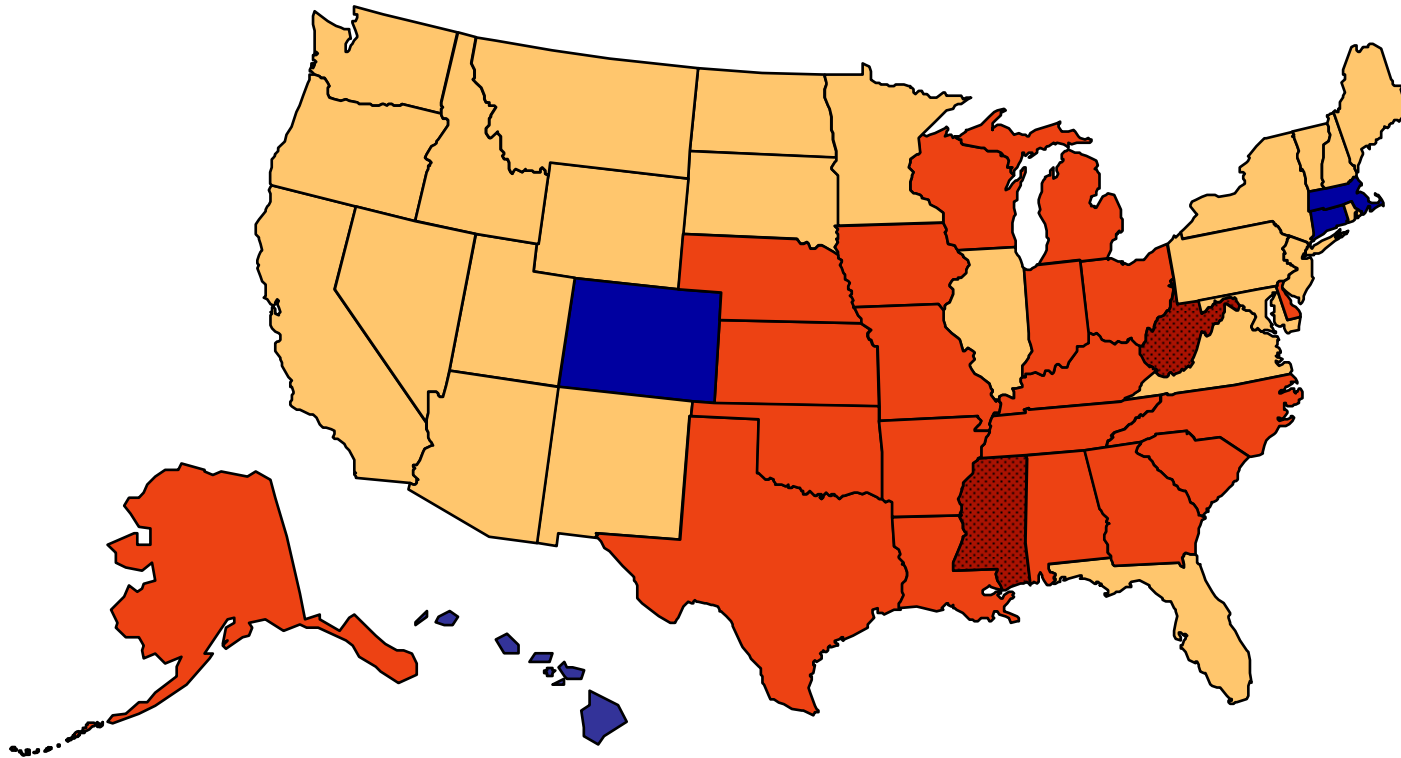




# Obesity Trends\* Among U.S. Adults

BRFSS, 2006

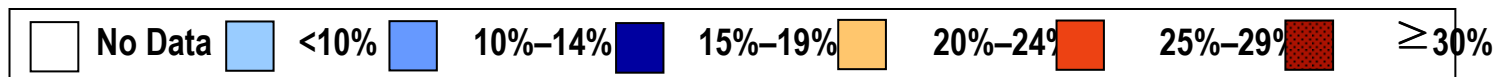
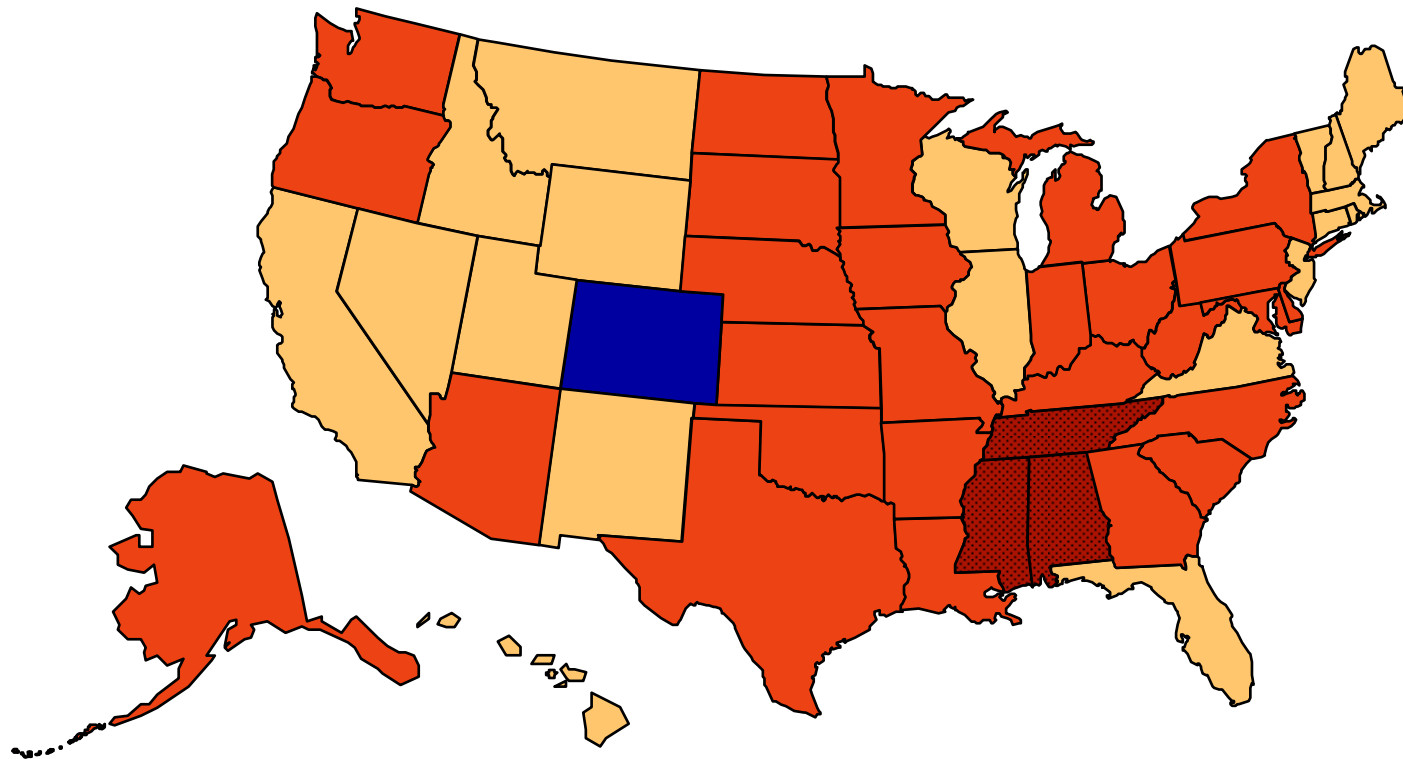
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2007

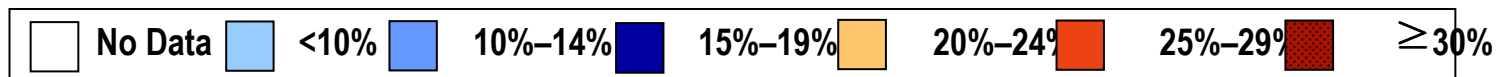
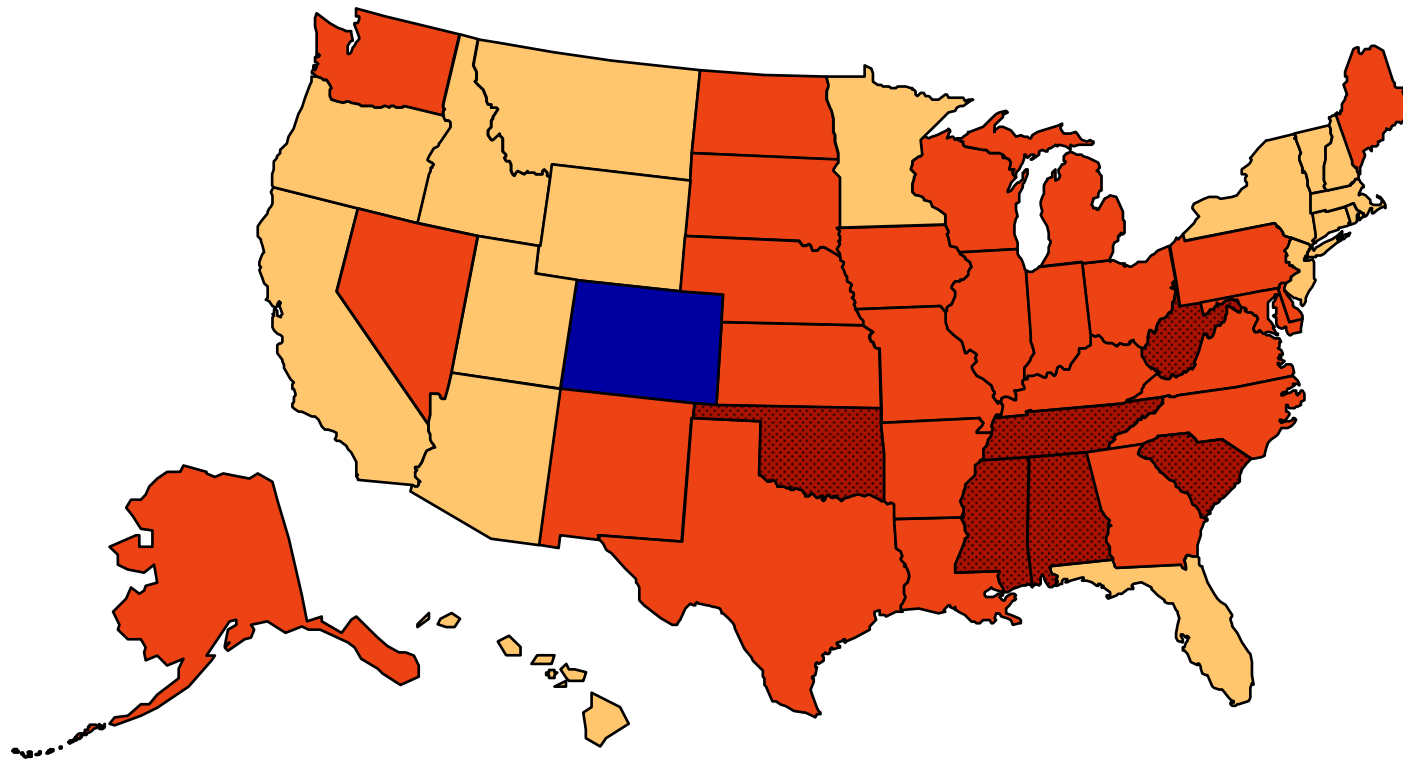
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2008

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# The possible treatments

- Diet
- Exercise
- Behavior therapy
- Psychological counseling
- Surgery
- Pharmacological
- Combinations

**in- or out-hospital**

# The proposed treatments

Class	BMI (kg/m <sup>2</sup> )	Intervention
Overweight	25.0-29.9	Diet / Exercise
Class I	30.0-34.9	Diet / Exercise (possibly Drugs)
Class II	35.0-39.9	Drugs (possibly Surgery)
Class III	> 40	Surgery

**The best approach for body weight reduction in overweight and class I obese is a combination of diet, exercise and behavior therapy**

**Exercise should be a valid adjunct, not the only option (alone it is ineffective)**

**+Exercise improves self-esteem (and adherence)**

**+Exercise is the best predictor of long-term weight maintenance**

# OBJECTIVE : long term weight loss !

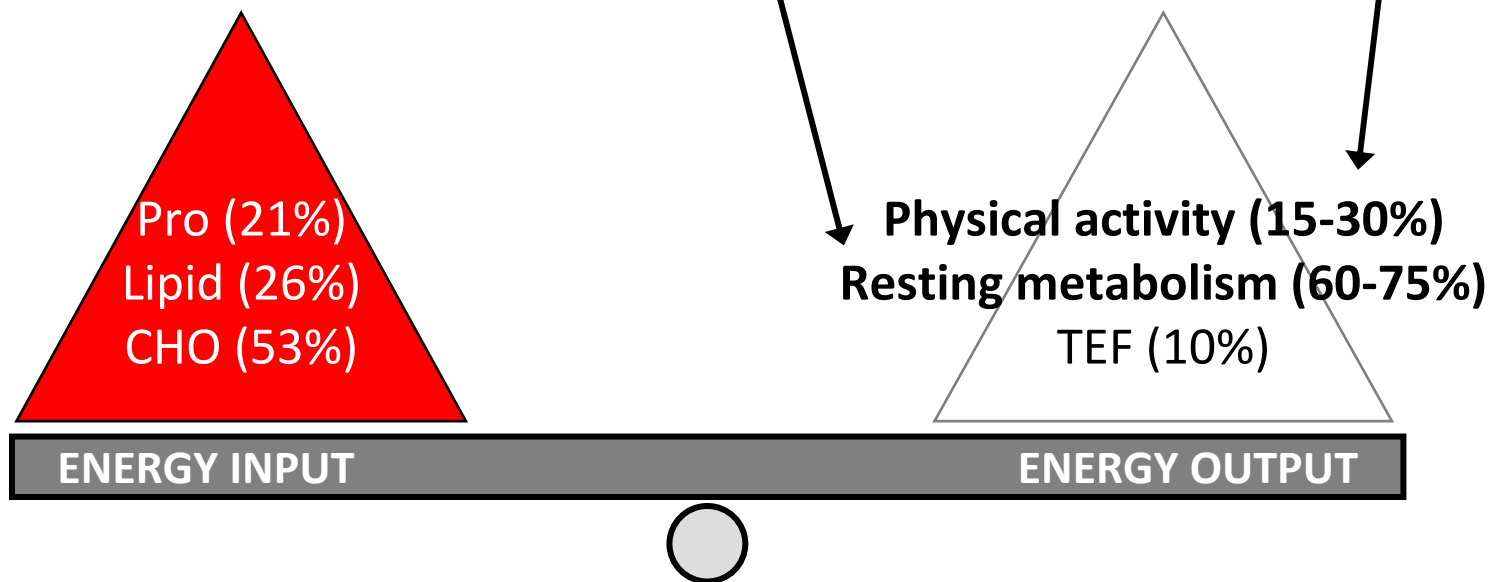


**Figure 30.17.** Percentage of patients remaining at reduced weights at various time intervals following accomplished weight loss. Red line, 60 subjects with obesity onset before age 21; yellow line, 42 subjects with obesity onset after age 21. (From Johnson D, Drenick EJ. Therapeutic fasting in morbid obesity. *Arch Intern Med* 1977; 137:1381.)

# EXERCISE PRESCRIPTION

## Objectives

- ① increase energy output (300-1000 kcal/day)
- ② oxidize lipids
- ③ maintain fat-free mass





# ENERGY EXPENDITURE during WALKING

(km/h)	(kg)	36	45	54	64	73	82	91
3.2		1.9	2.2	2.6	2.9	3.2	3.5	3.8
4.0		2.3	2.7	3.1	3.5	3.8	4.2	4.5
4.8		2.7	3.1	3.6	4.0	4.4	4.8	5.3
5.6		3.1	3.6	4.2	4.6	5.0	5.4	6.1
6.4		3.5	4.1	4.7	5.2	5.8	6.4	7.0

(kcal/min)

# EXERCISE PRESCRIPTION

## Check before exercise prescription

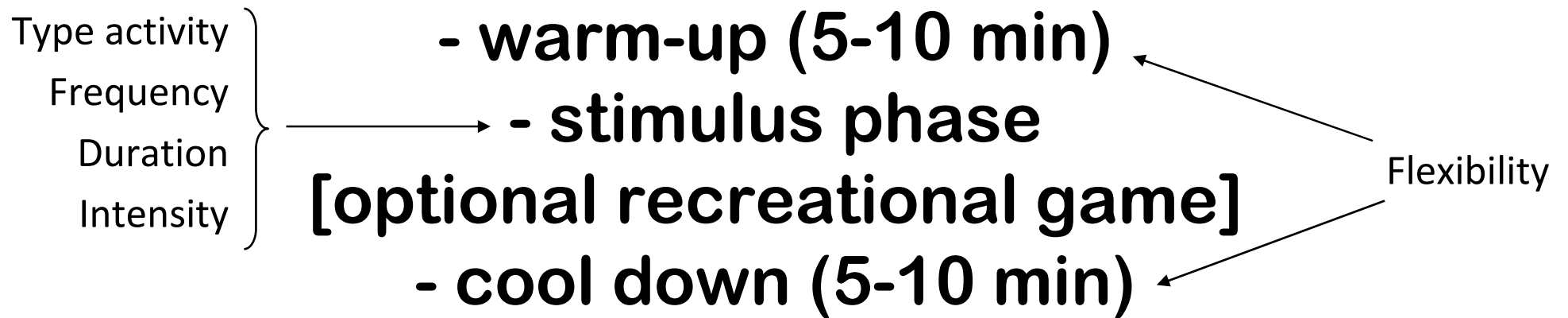
- family history
- cigarette smoking
- hypertension
- dyslipidemia
- impaired fasting glucose
- physical activity level

Increased risk of:

- orthopaedic injury
- hyperthermia

# EXERCISE PRESCRIPTION

**Main components of each training session:**



# EXERCISE PRESCRIPTION

**Aerobic (endurance) activities, where large muscle groups are mobilized, represent the best option**

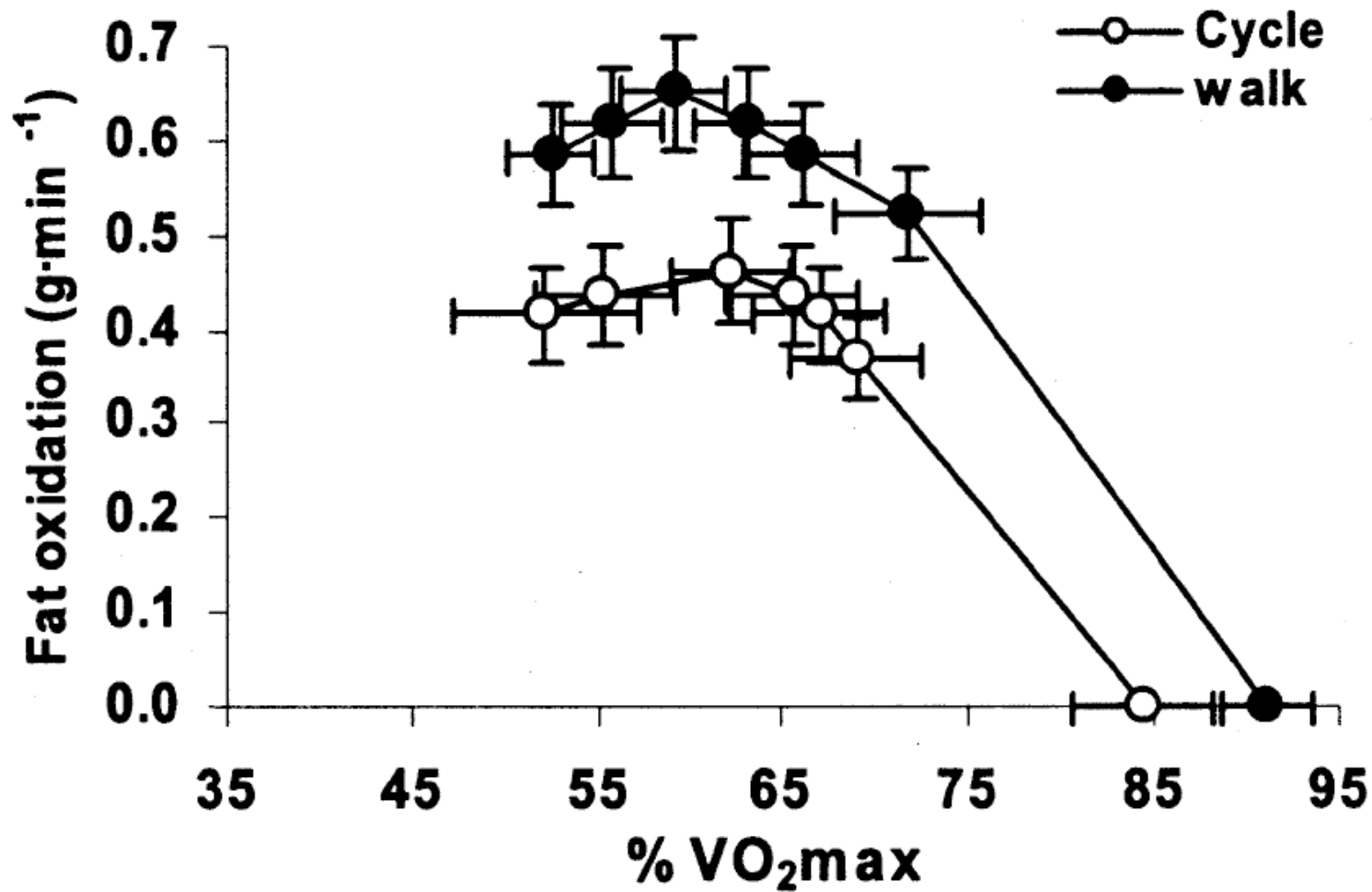


**(outdoor) walking,  
water activities...**



- Limited eccentric component
- Low stability requirements
- Rotation of exercise modalities

# EXERCISE PRESCRIPTION



# EXERCISE PRESCRIPTION

## Frequency

**5-7 days/week**

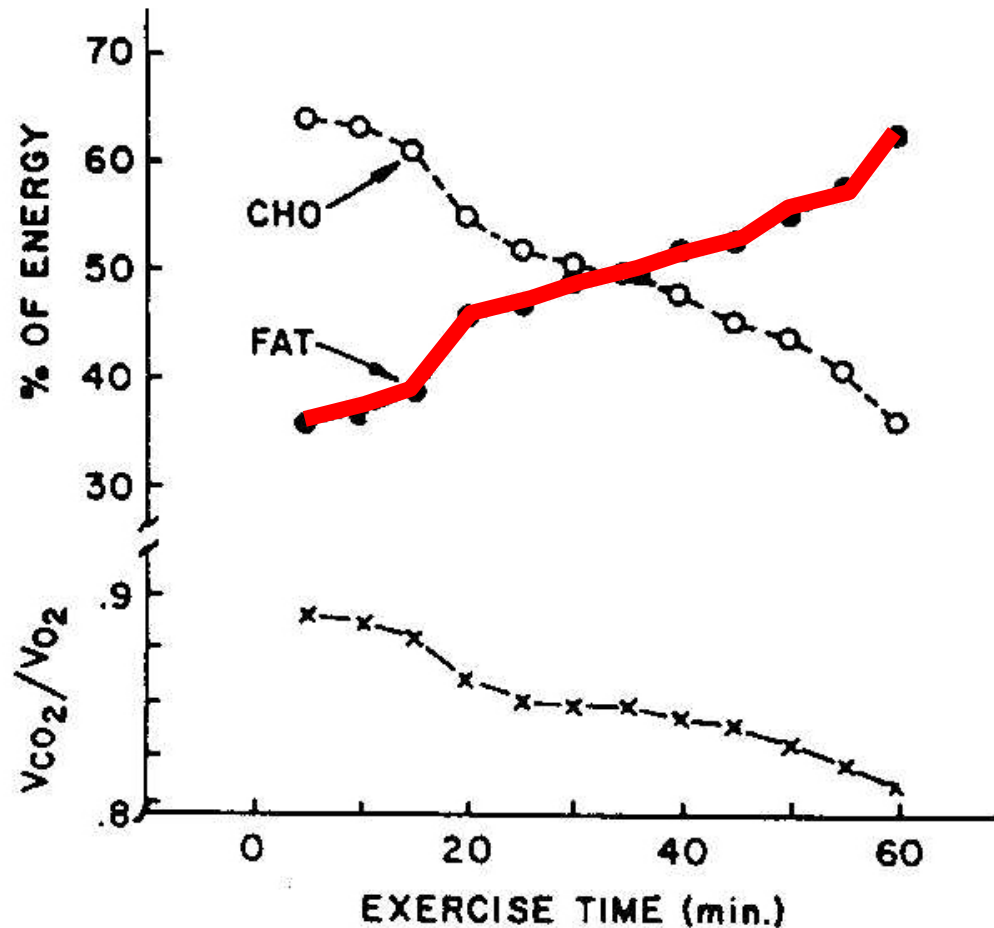
**Planned (supervised) activities**

**3-5 days/week**

**vs.**

**Incidental (non-supervised) activities**

# EXERCISE PRESCRIPTION

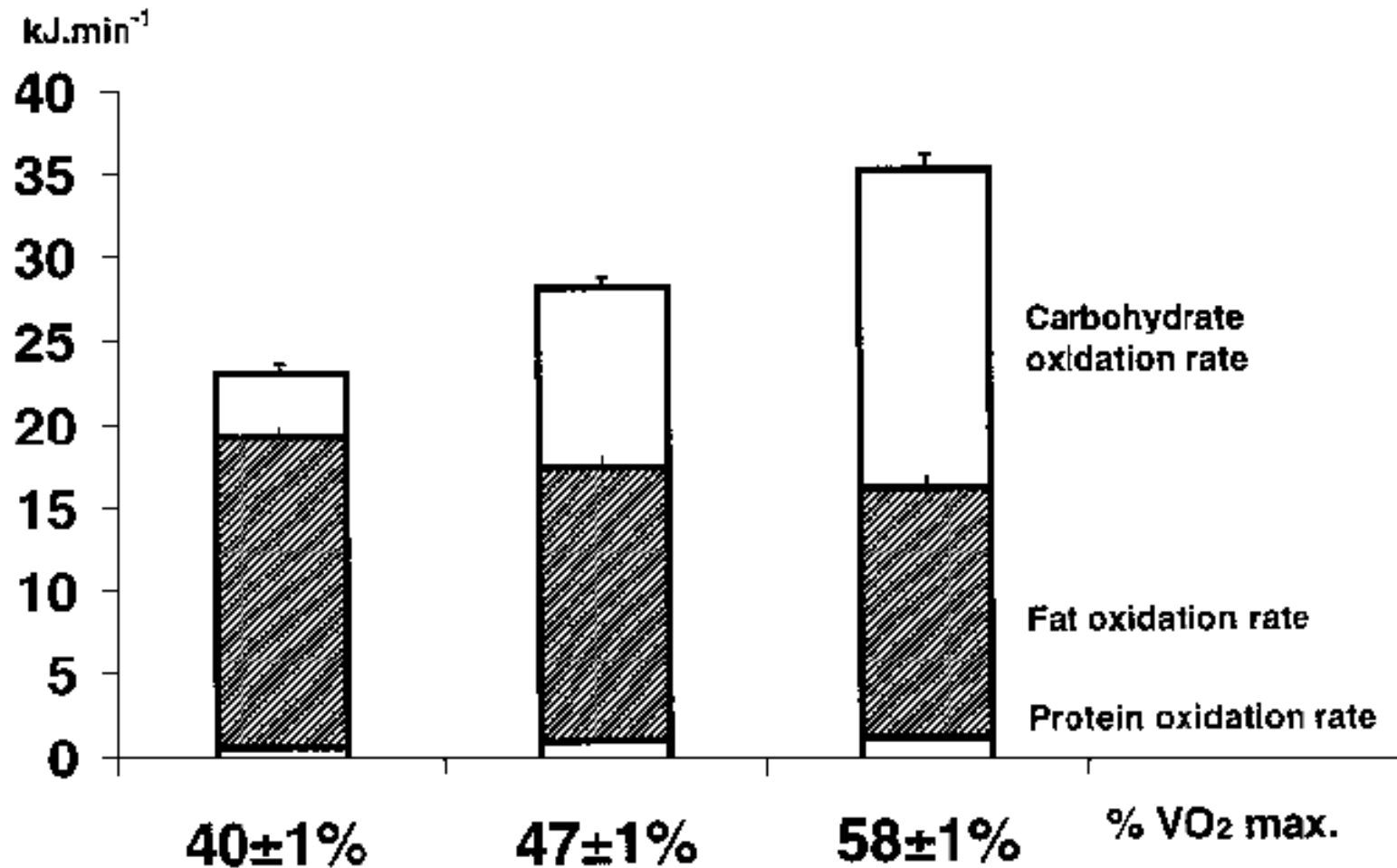


Duration/volume  
1 h/day

accumulation of  
several short bouts  
throughout the day  
is acceptable

# EXERCISE PRESCRIPTION

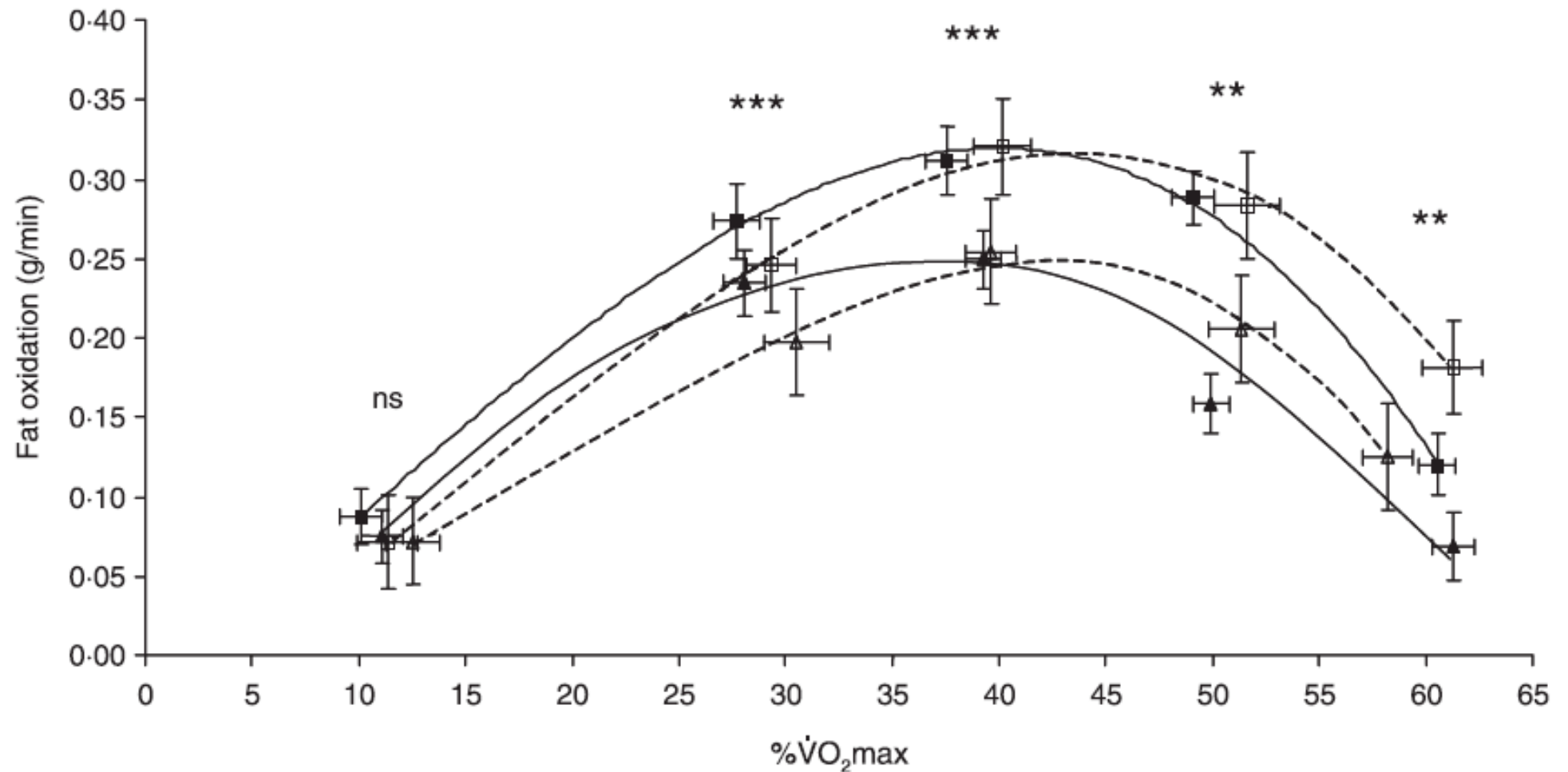
## Exercise intensity and fat oxidation rate





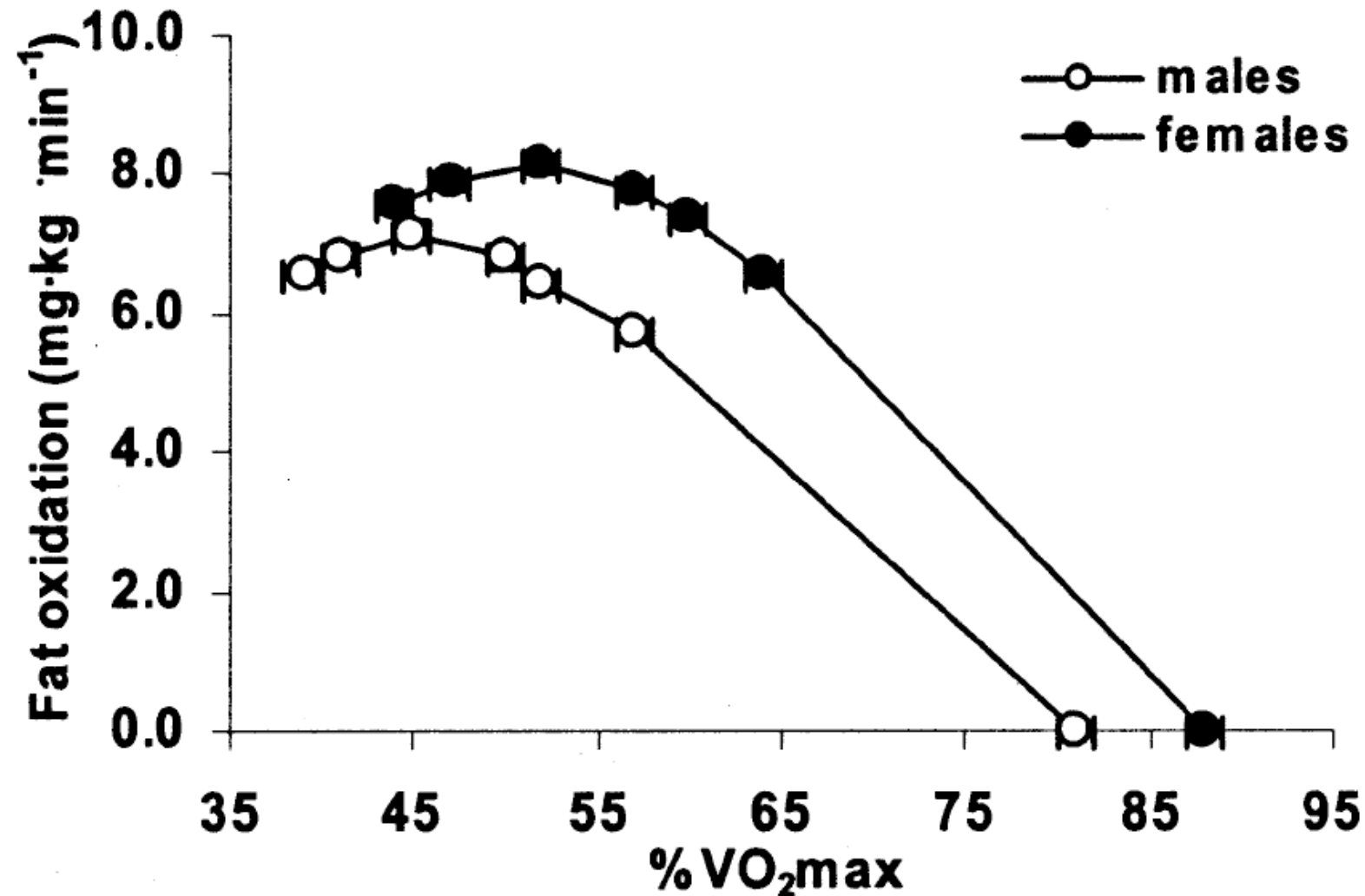
# EXERCISE PRESCRIPTION

## Exercise intensity and fat oxidation rate



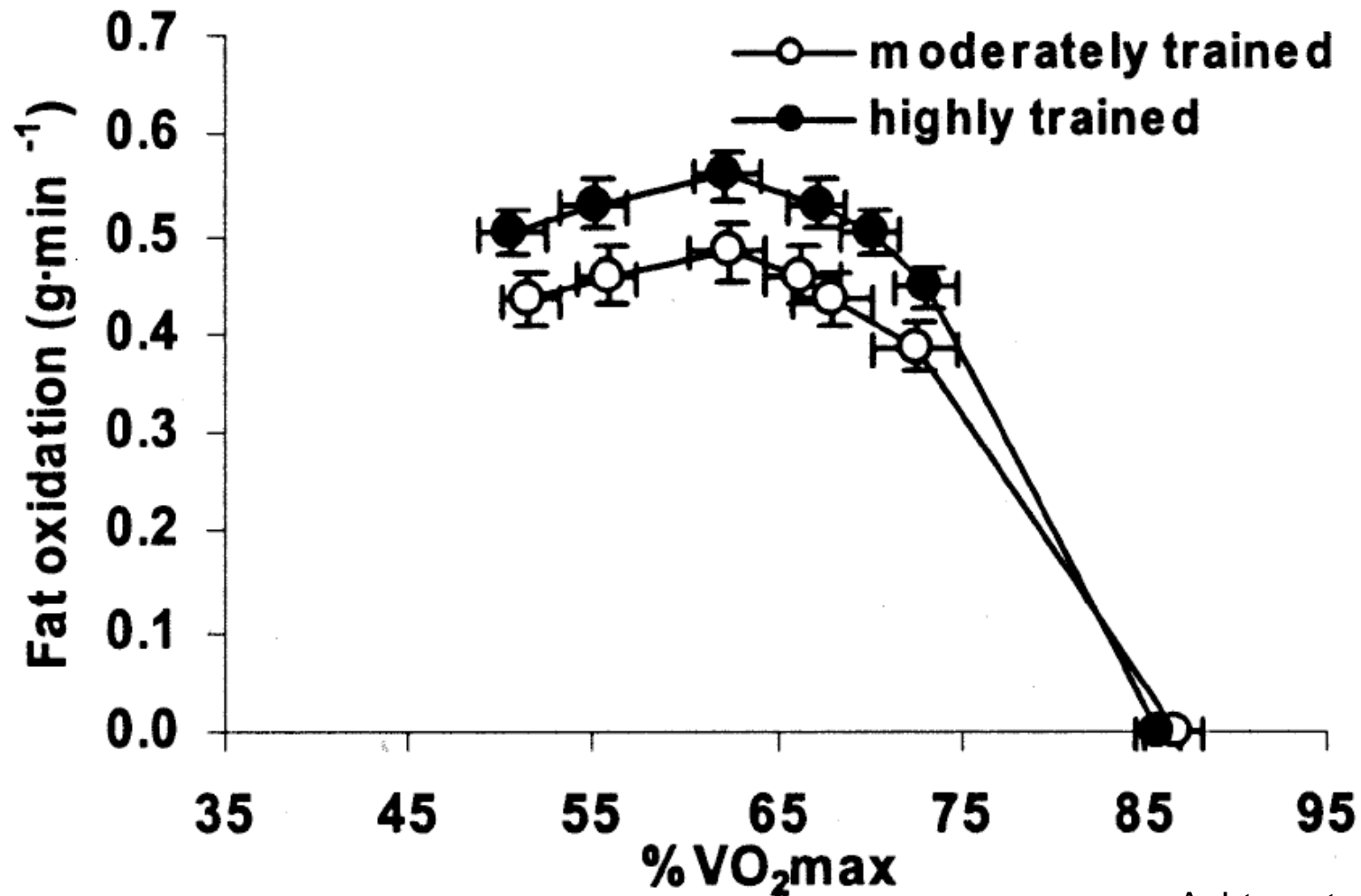
# EXERCISE PRESCRIPTION

## Exercise intensity and fat oxidation rate



# EXERCISE PRESCRIPTION

## Exercise intensity and fat oxidation rate



# EXERCISE PRESCRIPTION

## Intensity

Mainly, 40-60%  $\text{VO}_2$  max  
i.e., 55-70% max HR (moderate)

Controlled with HR or RPE  
(individually matched !)

Fat oxidation rate seems to peak at 40-65% (but affected by age, sex, PAL)

# EXERCISE PRESCRIPTION

## Classification of physical activity intensity ( $< 60$ -min exercise bout)

Intensity	$\text{VO}_2\text{R}$ HRR (%)	Relative intensity		
		$\text{V}_{\text{O}_{2\text{max}}} (\%)$	Maximal heart rate (%)*	RPE†
Very light		$<20$	$<35$	$<10$
Light		20–39	35–54	10–11
Moderate		40–59	55–69	12–13
Hard		60–84	70–89	14–16
Very hard		$>85$	$>90$	17–19
Maximal‡		100	100	20

Modified by Haskell and Pollock from *Physical Activity and Health: A Report of the Surgeon General* (4).

\*Maximal heart rate ( $\text{HR}_{\text{max}}$ ) =  $220 - \text{age}$  (Note: It is preferable and recommended that  $\text{HR}_{\text{max}}$  be measured during a maximal graded exercise test when possible); †Borg rating of relative perceived exertion (RPE) 6–20 scale; ‡maximal values are mean values achieved during maximal exercise by healthy adults.

# **EXERCISE PRESCRIPTION**

**The following forms of exercise can also be integrated into the training routine:**

- balance/proprioception**
- range of motion/flexibility**
- strength (rapid force in particular)**

# EXERCISE PRESCRIPTION

**Recreational activities, hobbies and daily activities should be increased and monitored !**

Walking  
with a dog !



Active  
video  
games !

# **Exercise for Obese – an exemple**

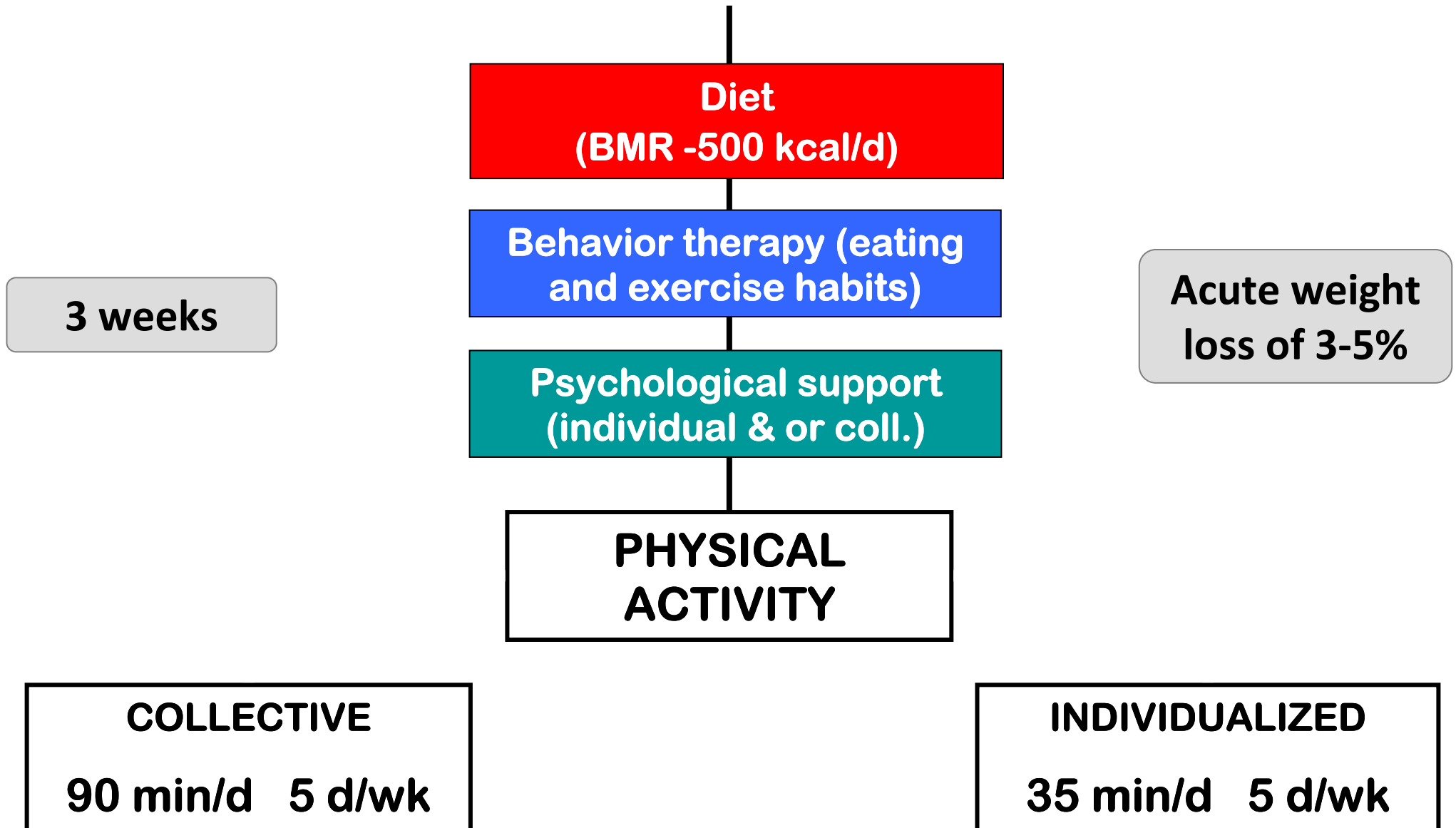
## Italian Institute for Auxology

### Piancavallo (VB), Italy





# The combined treatment



# THE 'EXERCISE' ROOM

3 bikes

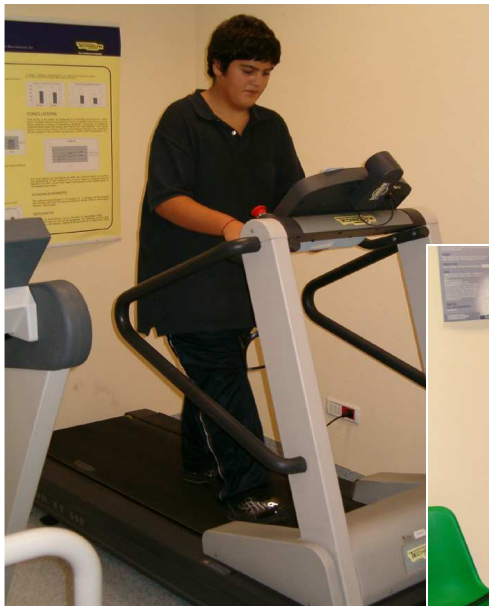
1 arm bike

2 treadmills



Isotonic machines

# TRAINING



20 min

10 min



5 min



3 x 15 reps

40-70% 1-RM

Intensity 40-70%  $\text{VO}_2$  max

# **General conclusions**

- Exercise is only a part of the process**
- Aerobic activities, 5-7 d/week, 60 min at 40-60%**
  - Exercise should increase energy expenditure, maintain fat-free mass, and improve self-esteem**
- Long-lasting behavioral changes are necessary**

# Thank you !



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