

# The epidemic of type 2 diabetes: what should we be doing?

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Professor of Clinical Diabetes and Metabolism

# Types of diabetes

## Type 1 diabetes



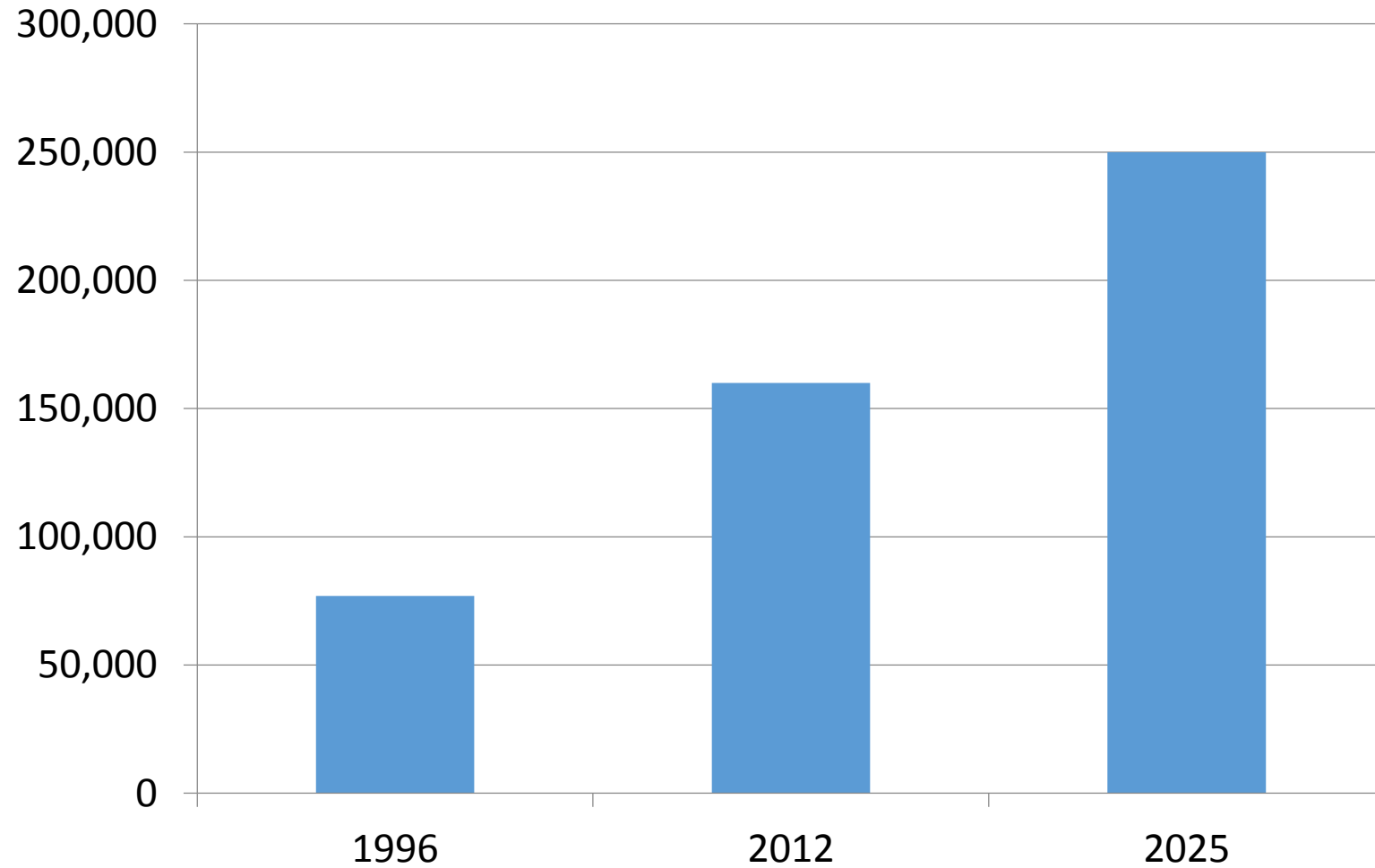
- Lack of insulin
- Autoimmune
- Usually children

## Type 2 diabetes

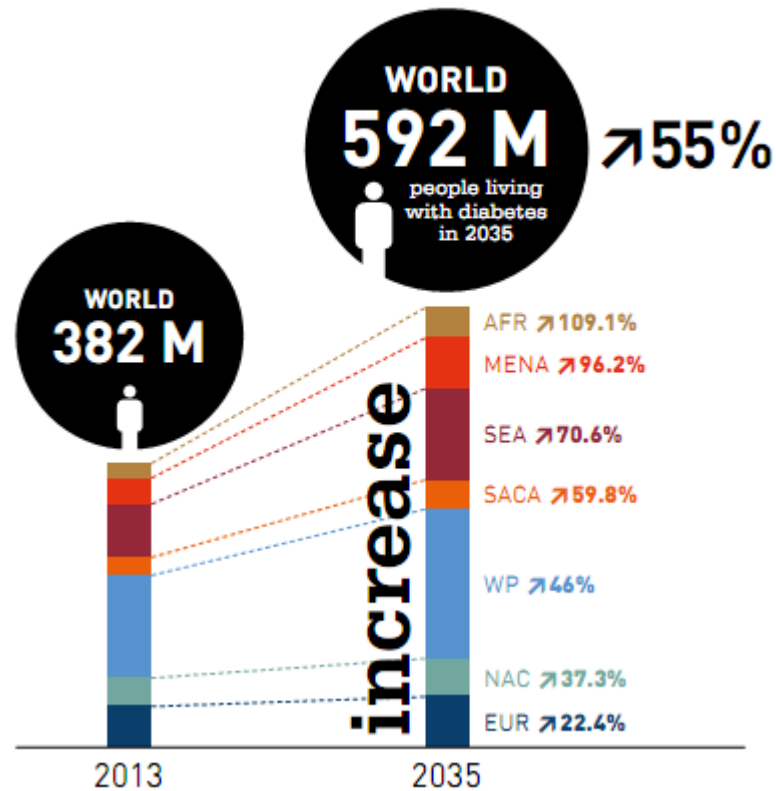


- Insulin resistance
- Lifestyle factors
- Usually adults

# Diabetes in Wales

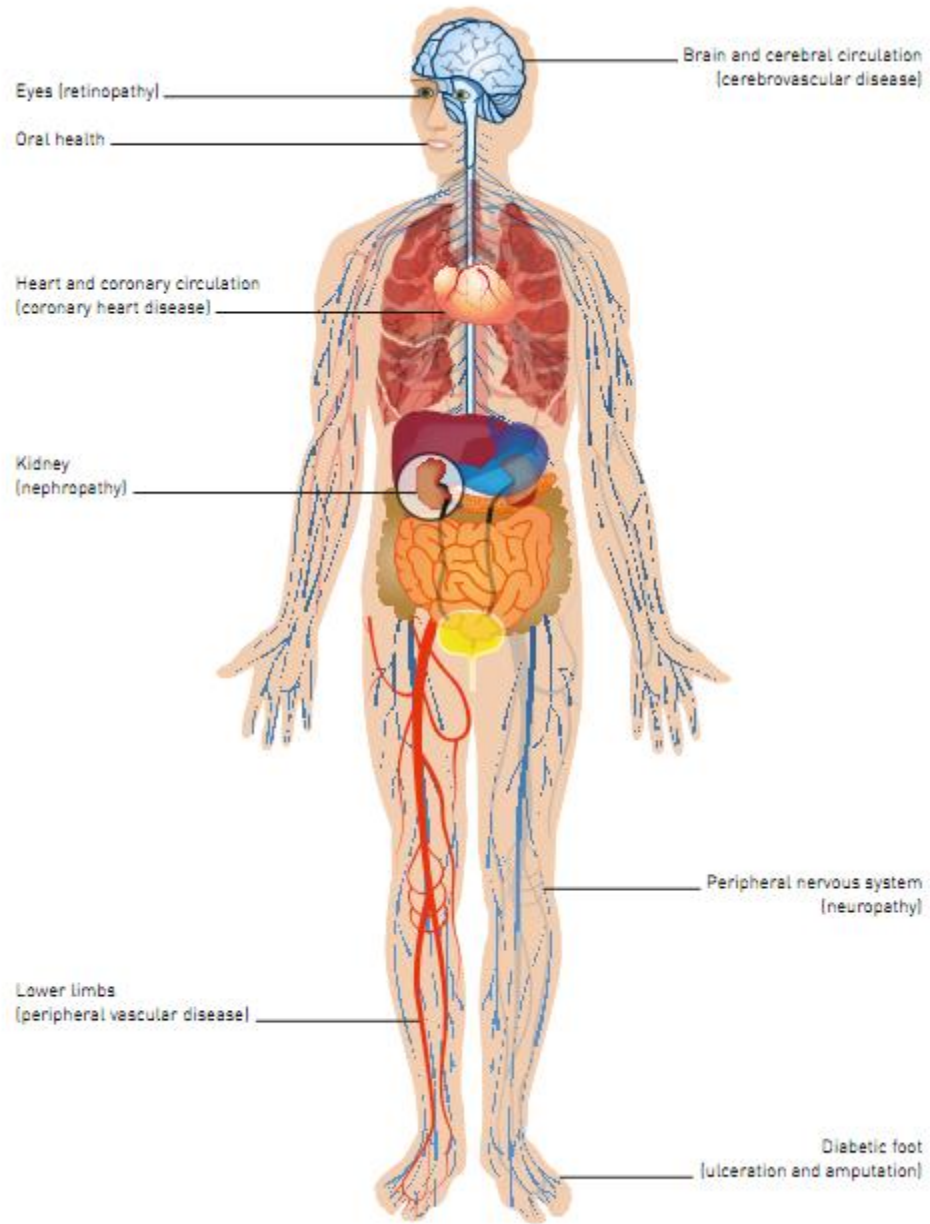


# Diabetes worldwide



382 million people have diabetes

By 2035, this number will rise to 592 million



# Major diabetes complications

- Cardiovascular disease
- Eyes
- Kidney
- Feet
  
- Liver cirrhosis
- Dementia

# Why is diabetes becoming more common?

- Genetics?
- Environment (behaviour)?

# Genetics of type 2 diabetes: Confirmed loci contributing to Type 2 DM – Genome wide association studies:

## Obesity/insulin resistance

- *FTO*
- *PPARG*

Odds ratios 1.1 – 1.5

## Pancreas development /islet function

- *TCF7L2*
- *KCNJ11,*
- *HHEX/IDE,*
- *CDKAL1,*
- *CDKN2*
- *IGF2BP2,*
- *SLC30A8*

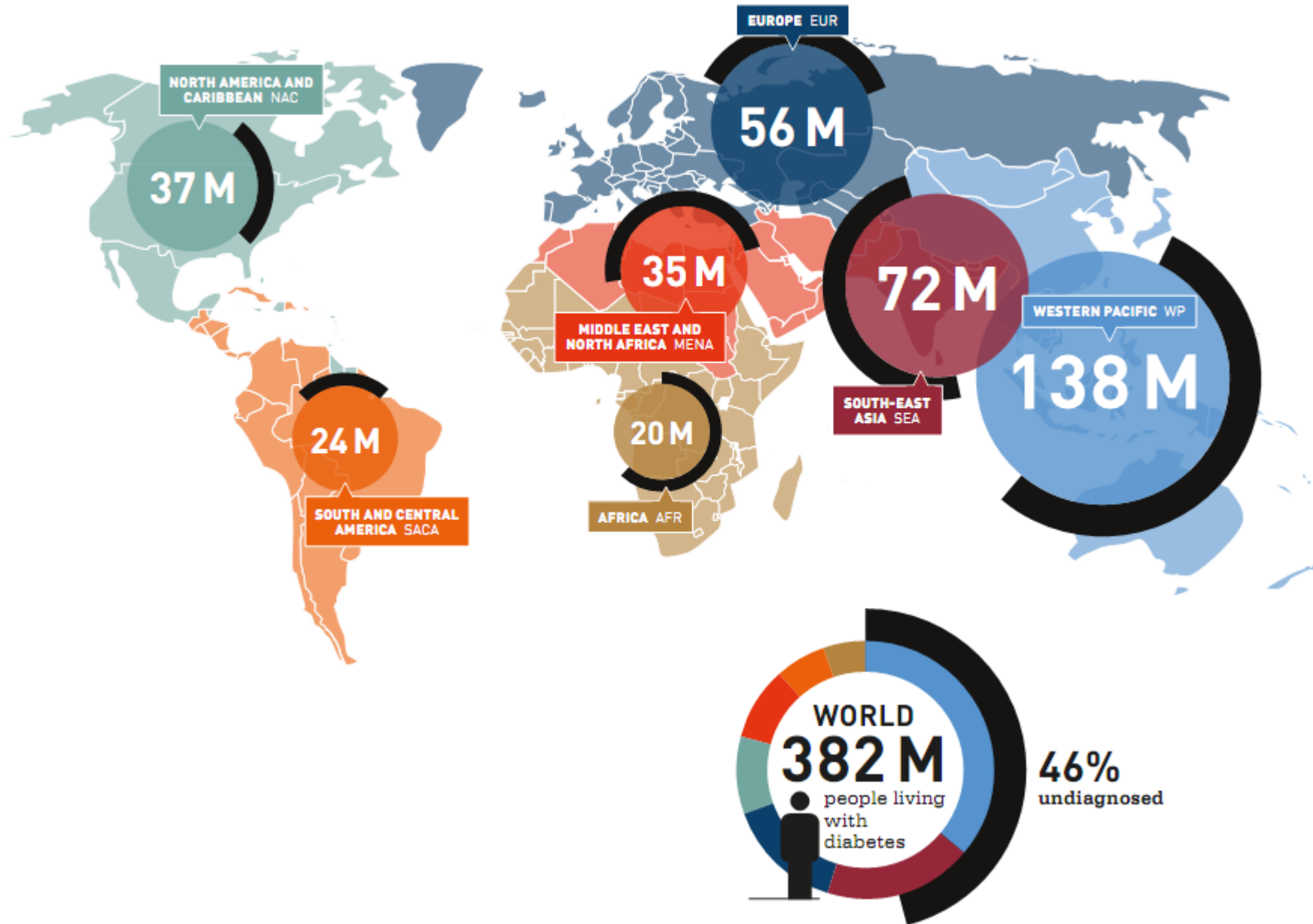
# ENVIRONMENTAL FACTORS IN TYPE 2 DIABETES

*“The richer you are, the more you eat  
and the less you do”*

	<b>Average BMI</b>	<b>Prevalence of diabetes</b>
Rural Cameroon	21.6	0.8%
Urban Cameroon	26.0	2.0%
Jamaica	24.7	7.4%
UK	27.4	11.2%

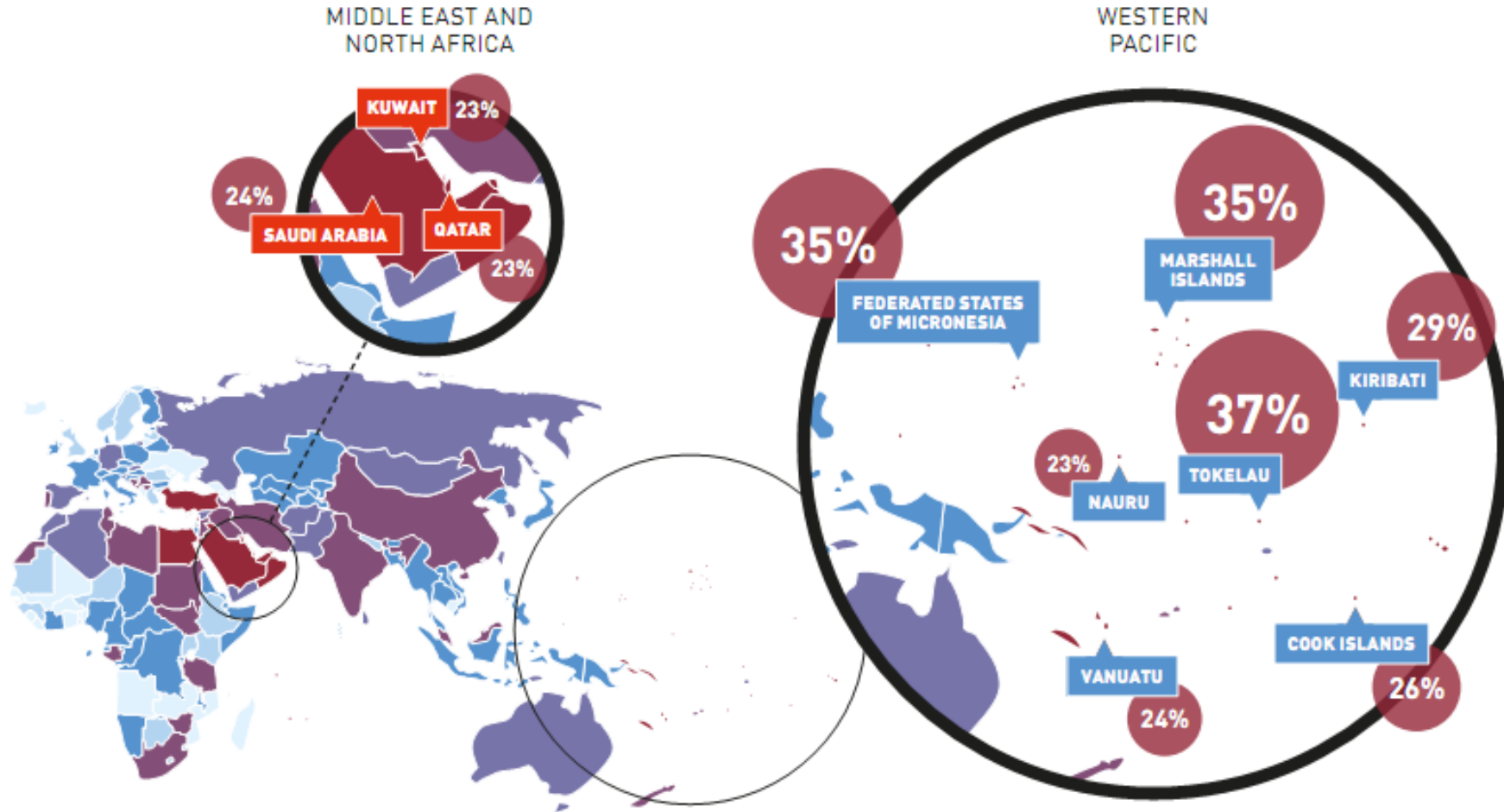


Number of people with diabetes by IDF Region, 2013



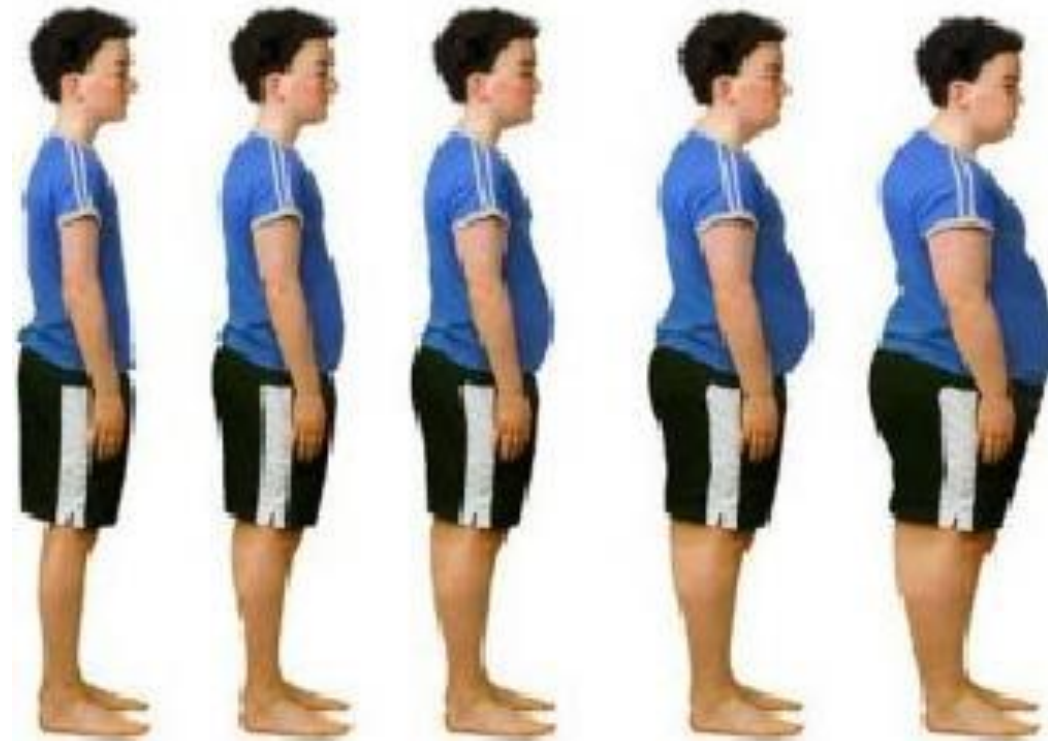
## Top 10 countries/territories for prevalence\* (%) of diabetes (20-79 years), 2013

\* comparative prevalence



# The diabetes Epidemic... (Type 2)

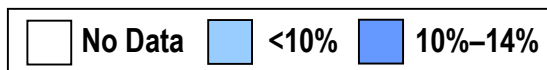
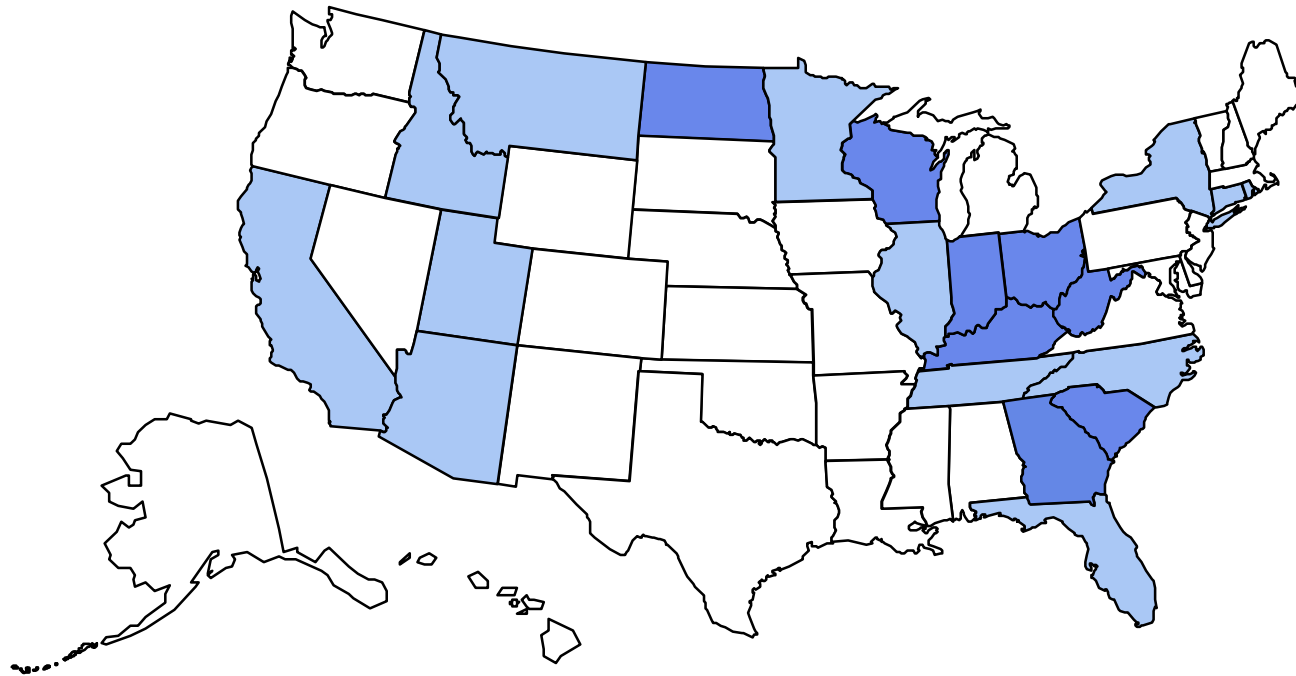
....IS LINKED TO THE OBESITY EPIDEMIC



# Obesity Trends\* Among U.S. Adults

BRFSS, 1985

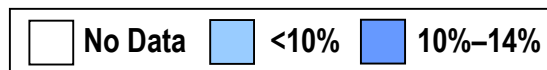
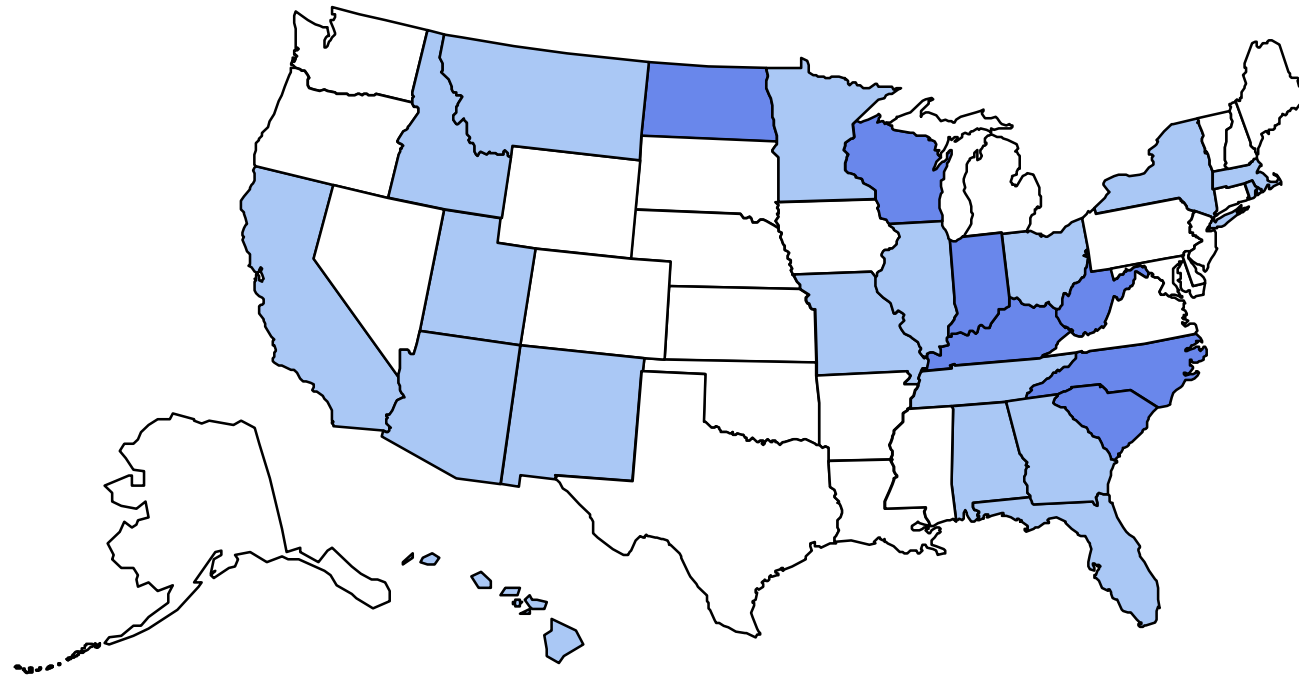
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1986

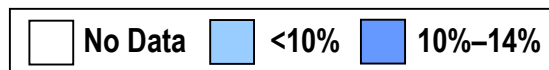
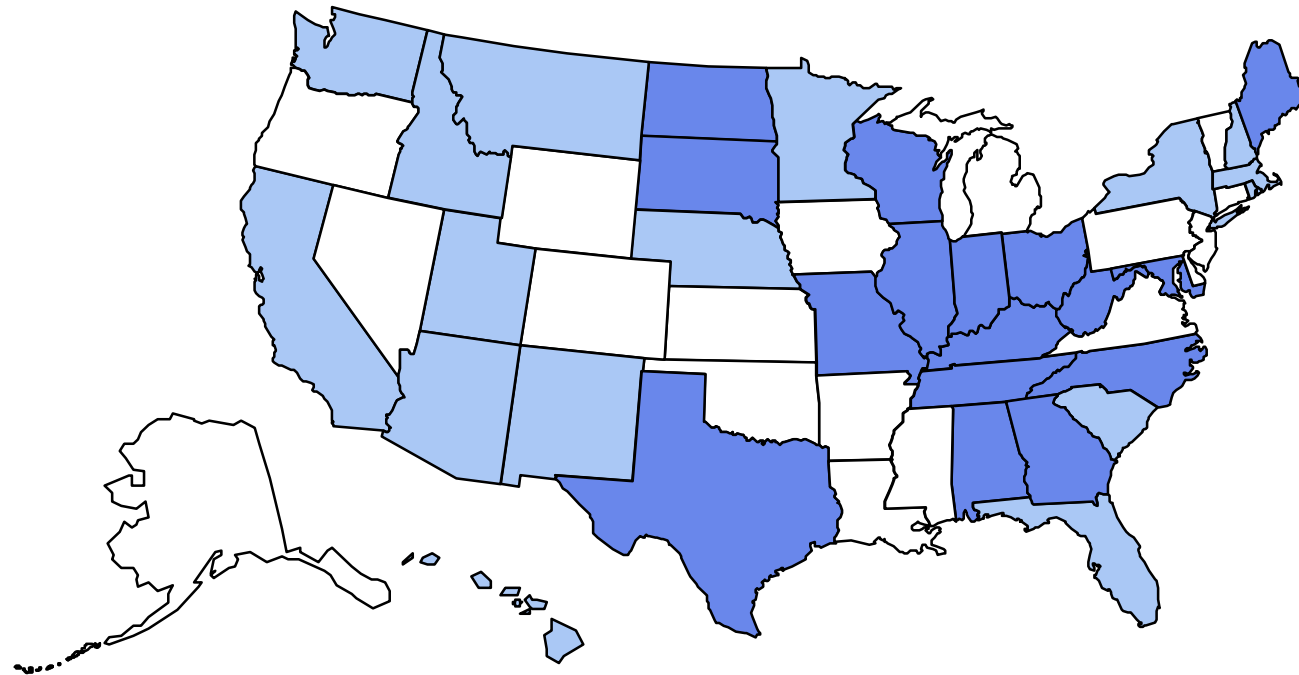
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1987

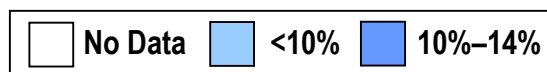
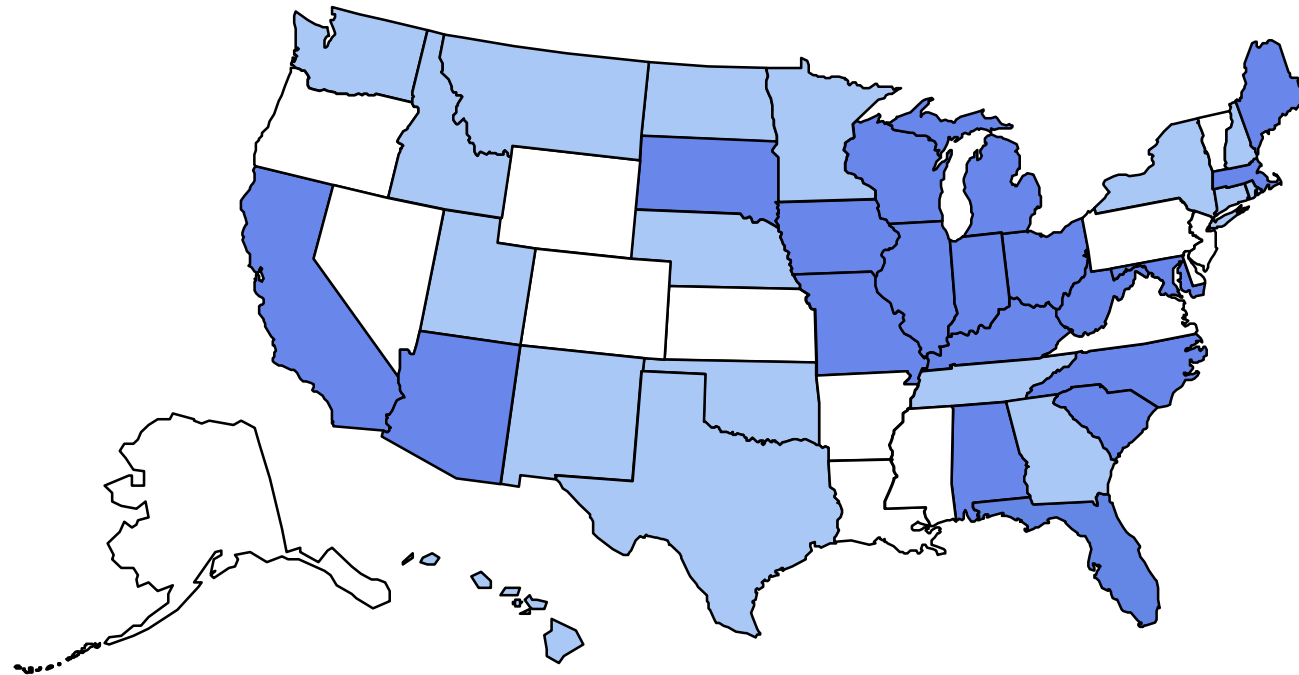
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1988

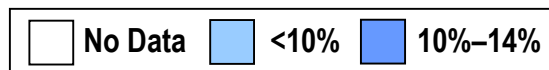
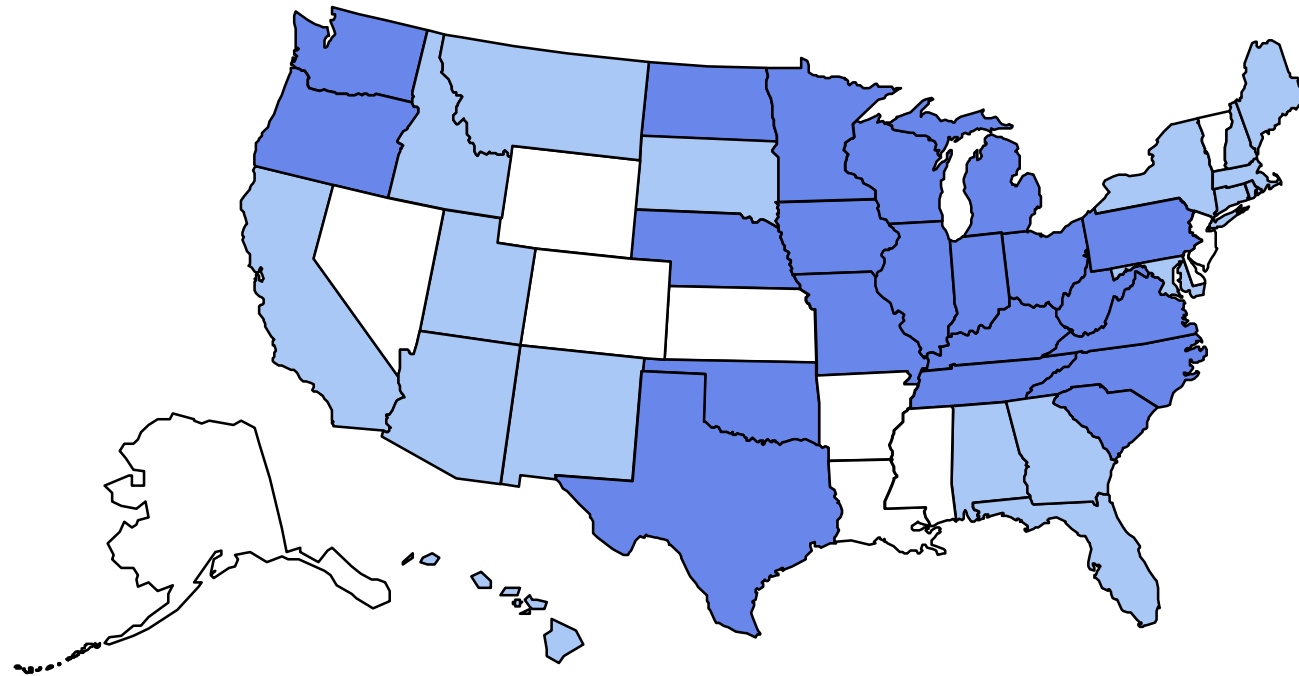
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1989

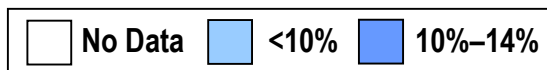
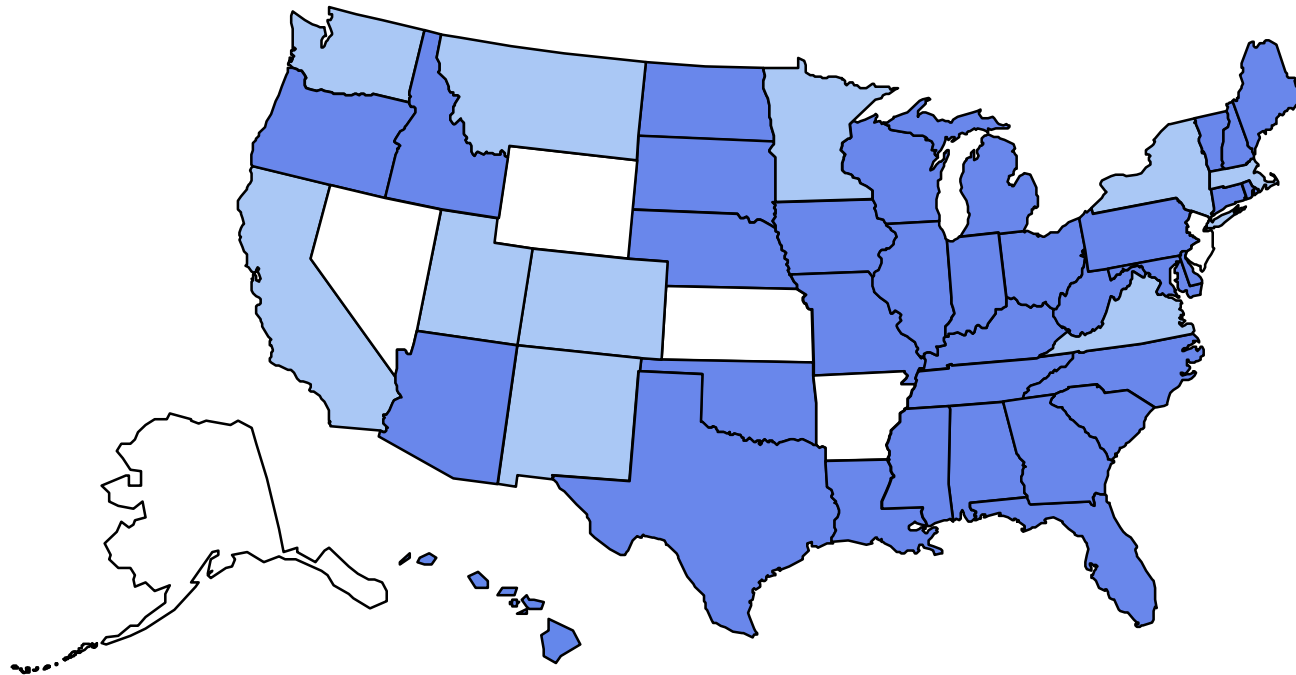
(\*BMI  $\geq 30$ , or ~ 30 lbs. overweight for 5' 4" person)





# Obesity Trends\* Among U.S. Adults BRFSS, 1990

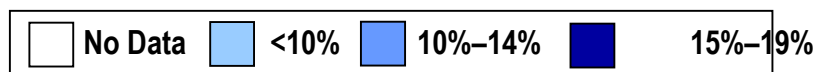
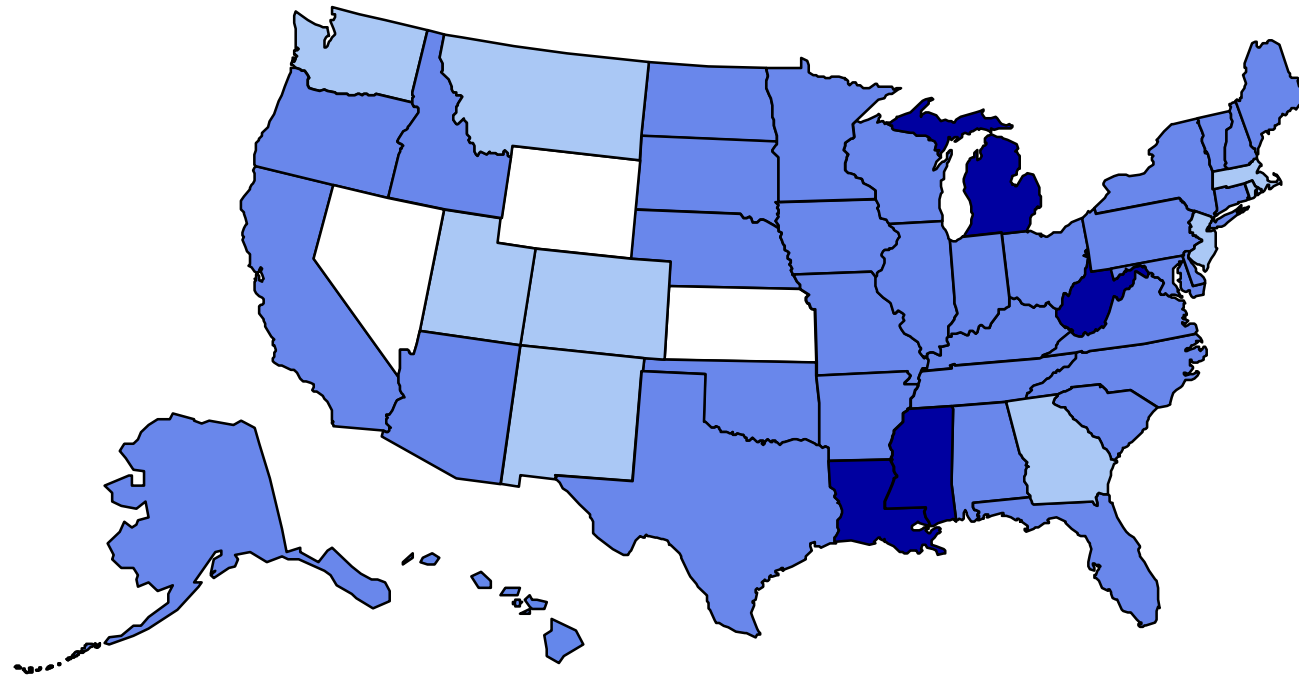
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1991

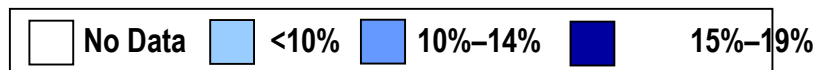
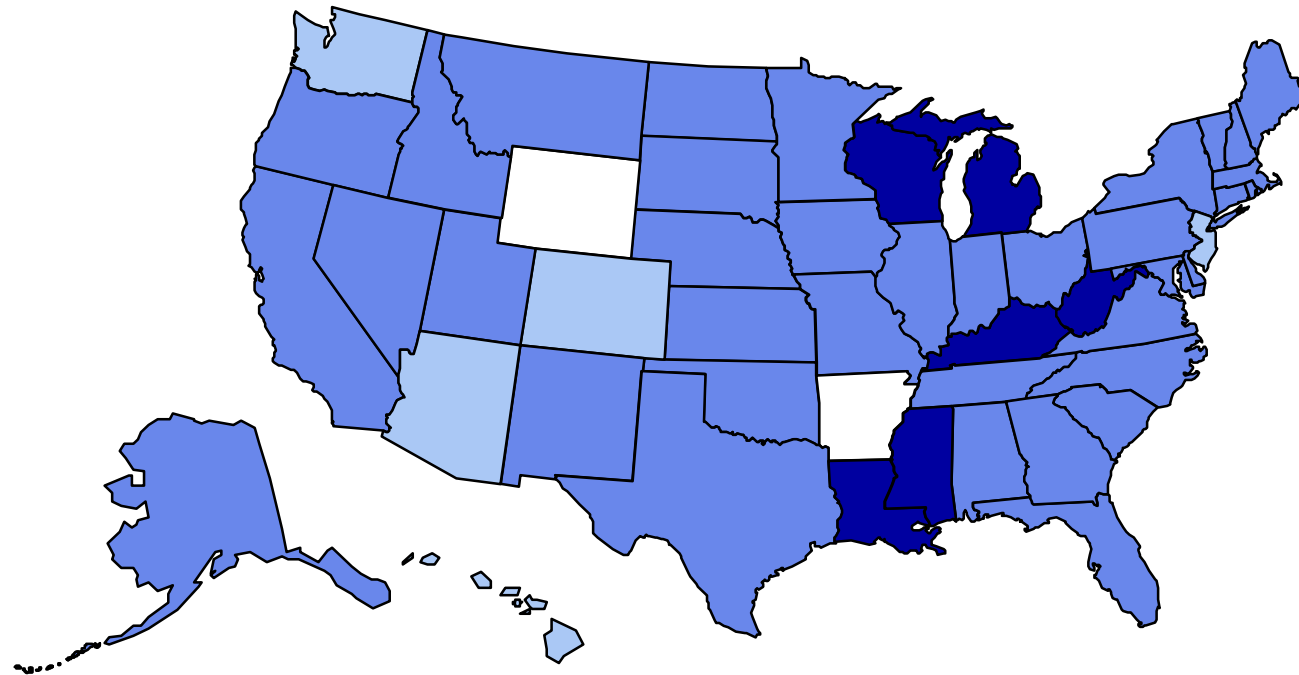
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1992

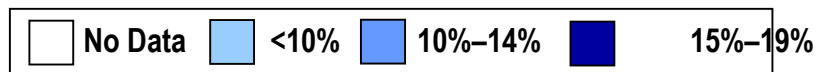
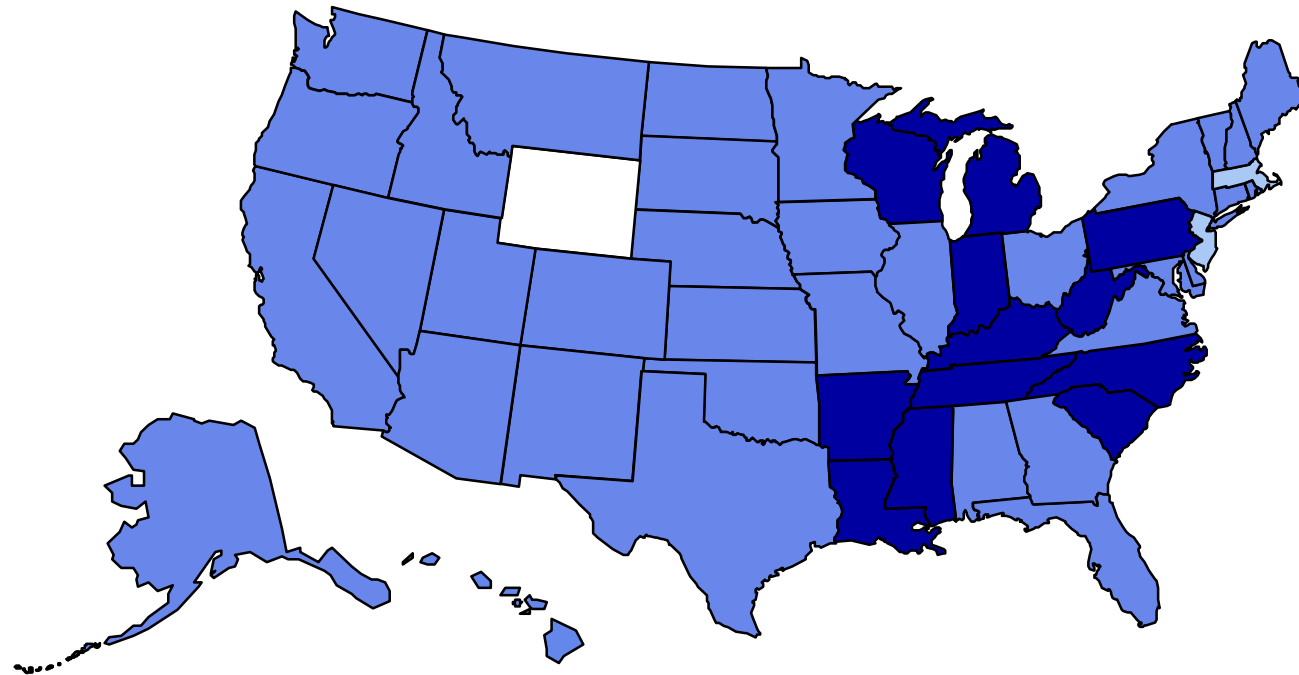
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

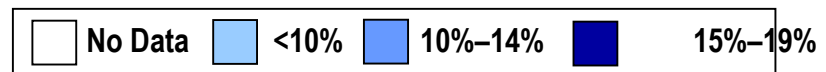
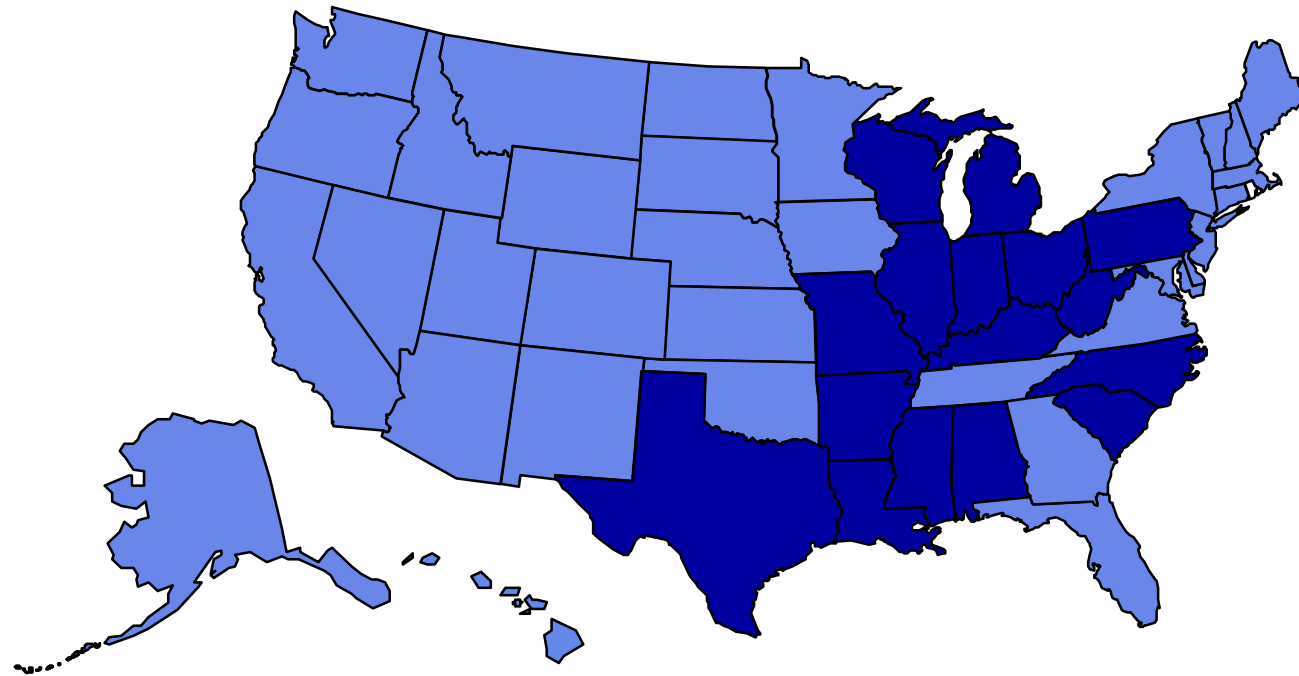
BRFSS, 1993

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



# Obesity Trends\* Among U.S. Adults BRFSS, 1994

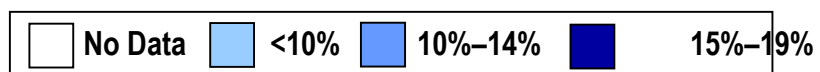
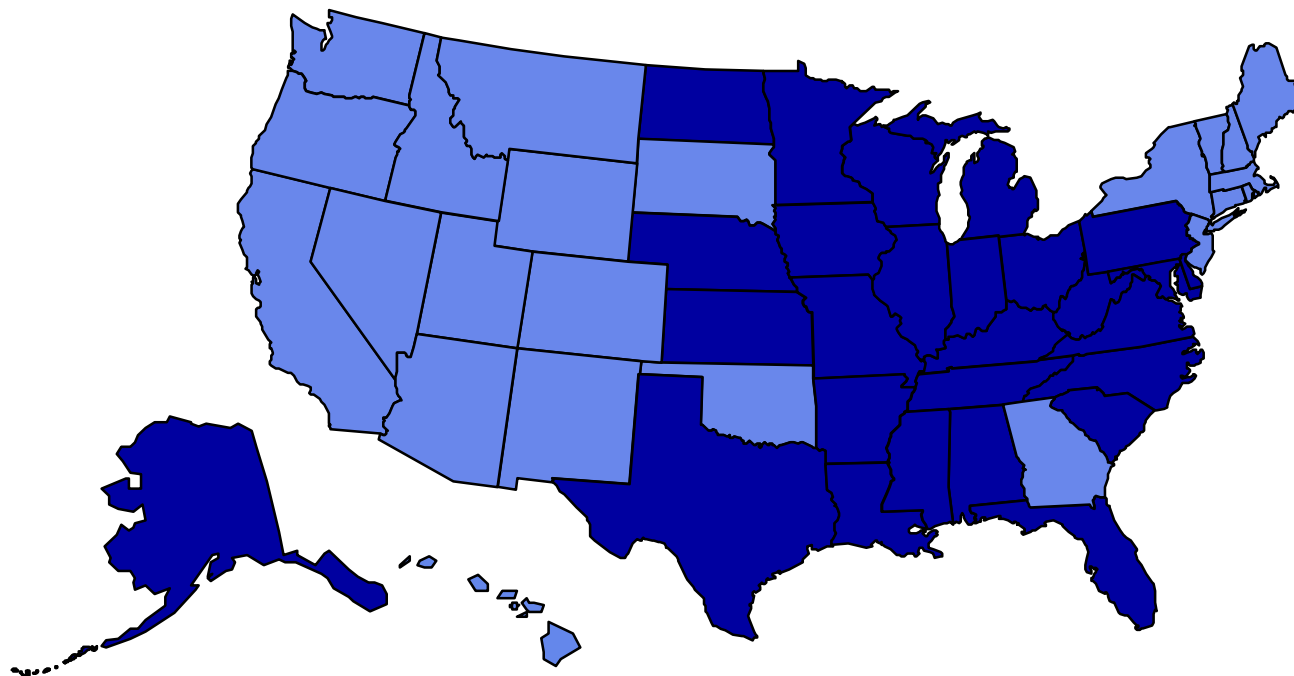
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

## BRFSS, 1995

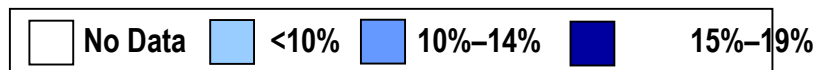
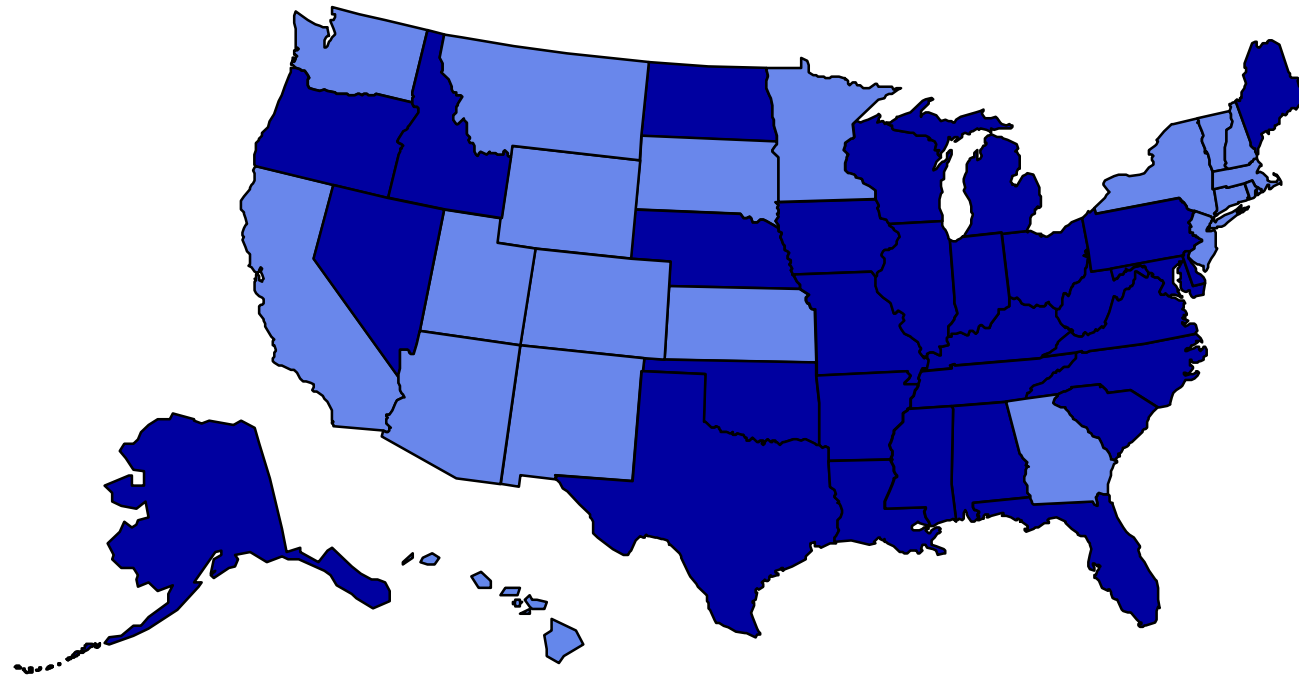
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1996

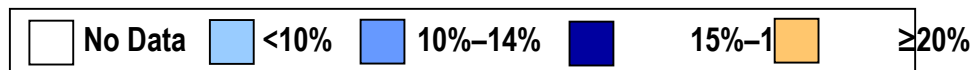
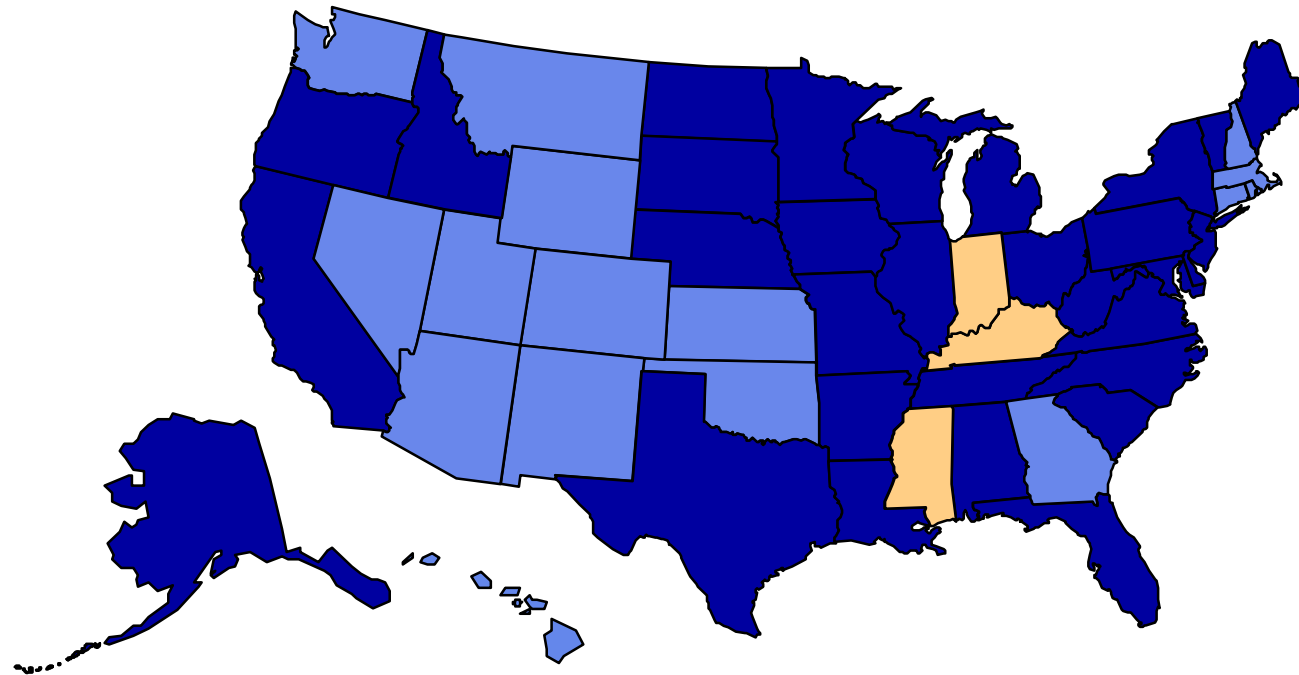
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 1997

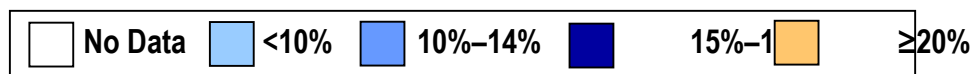
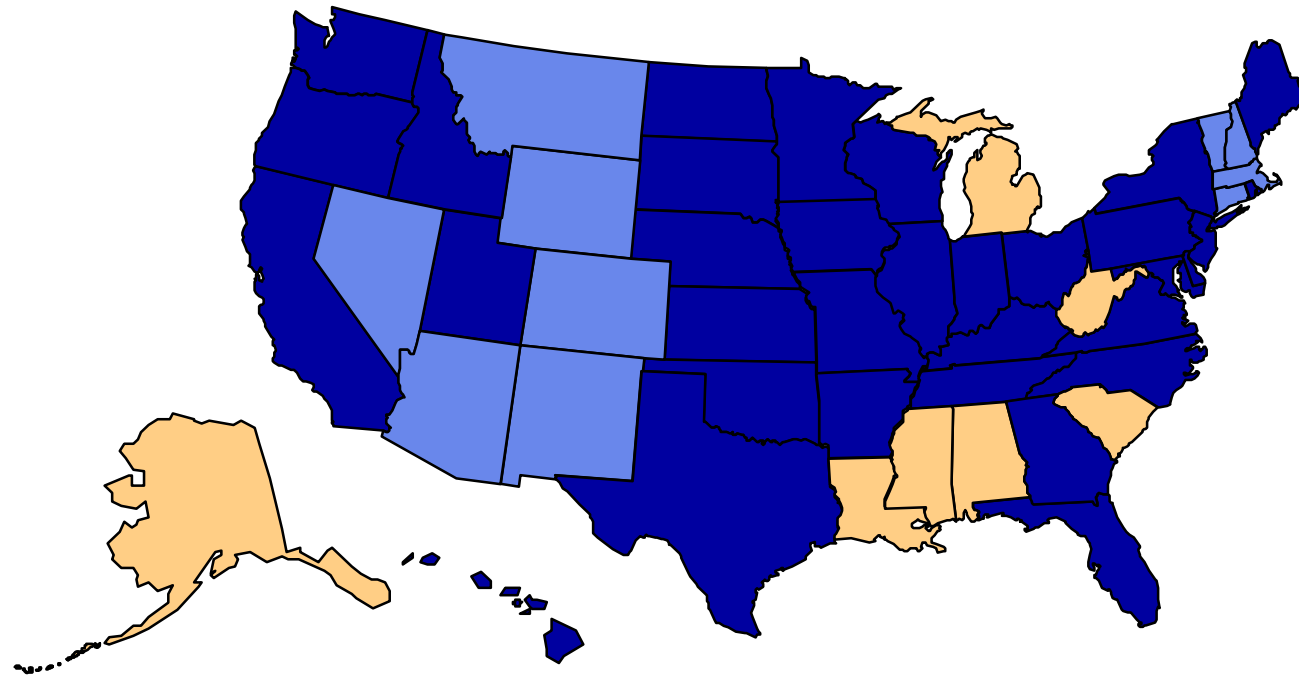
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)





# Obesity Trends\* Among U.S. Adults BRFSS, 1998

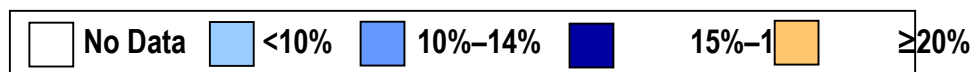
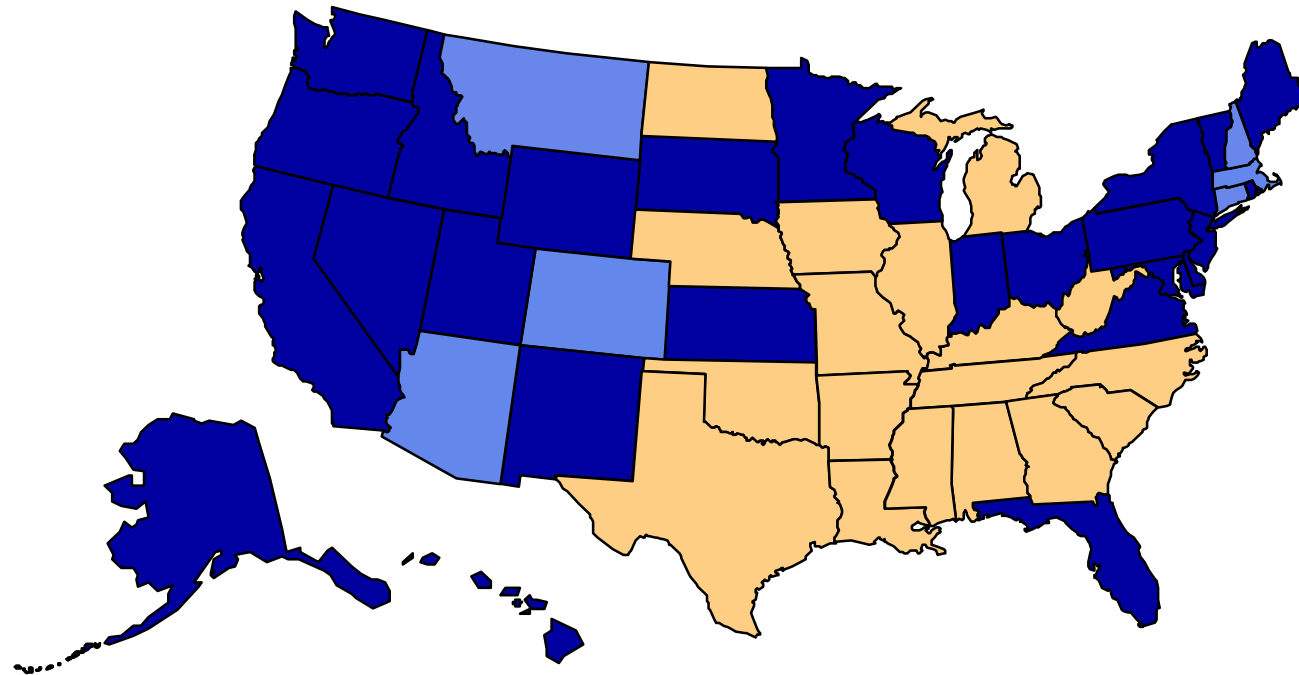
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

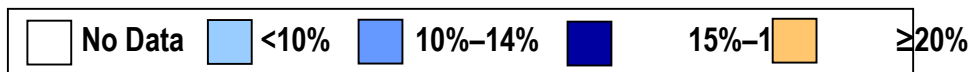
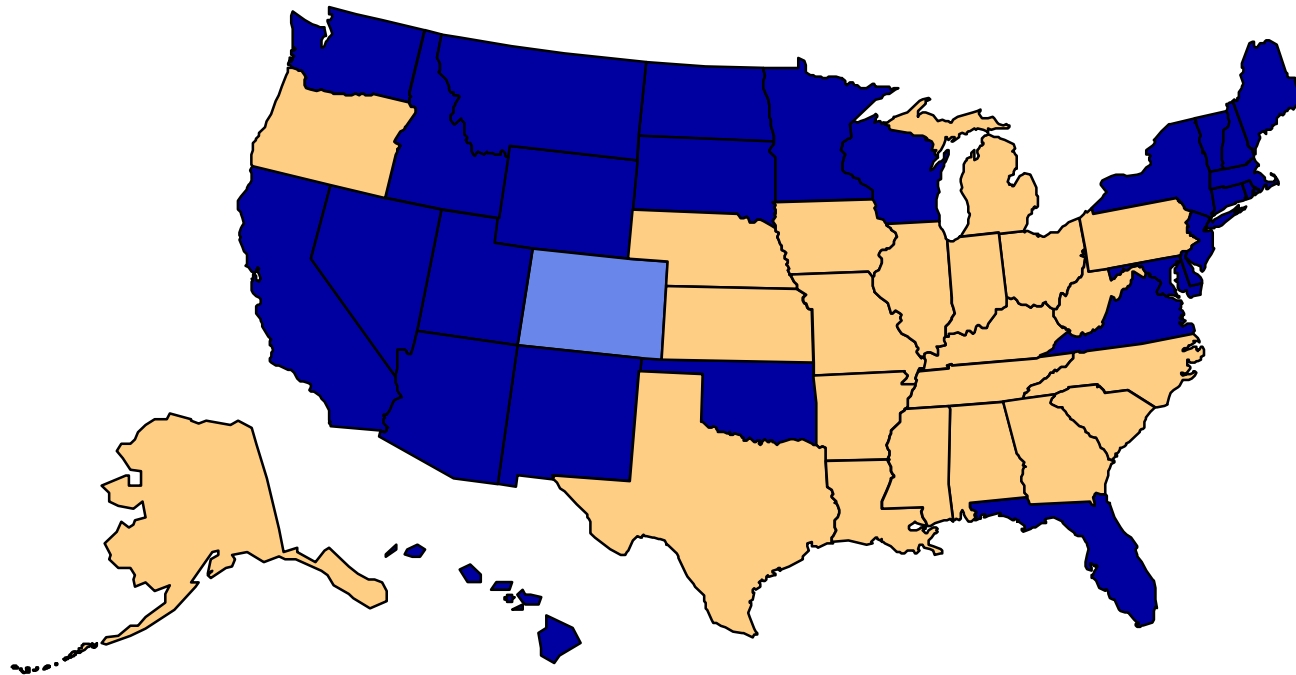
BRFSS, 1999

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



# Obesity Trends\* Among U.S. Adults BRFSS, 2000

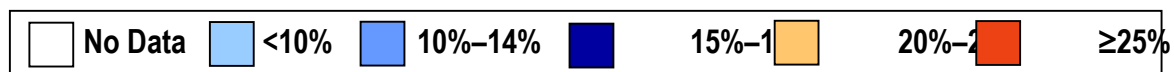
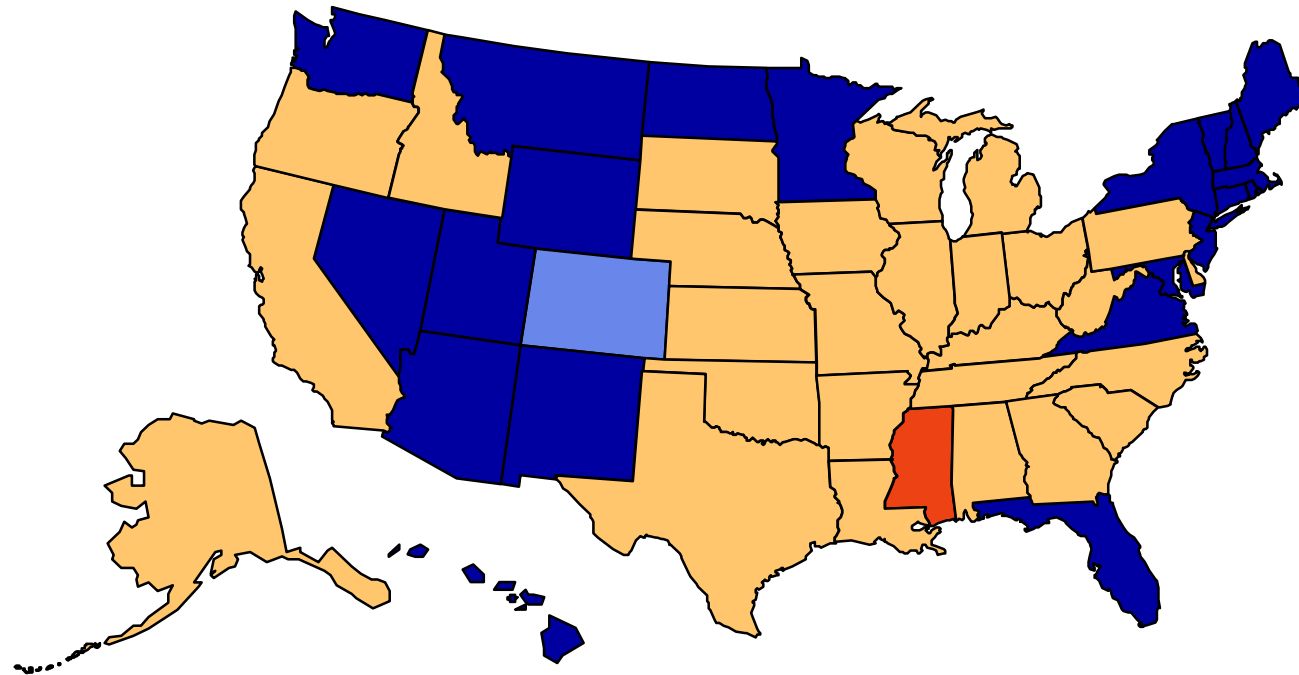
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# Obesity Trends\* Among U.S. Adults

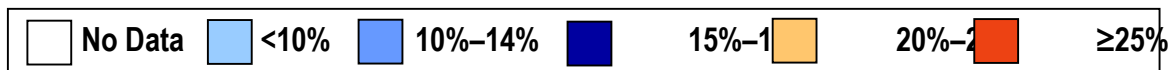
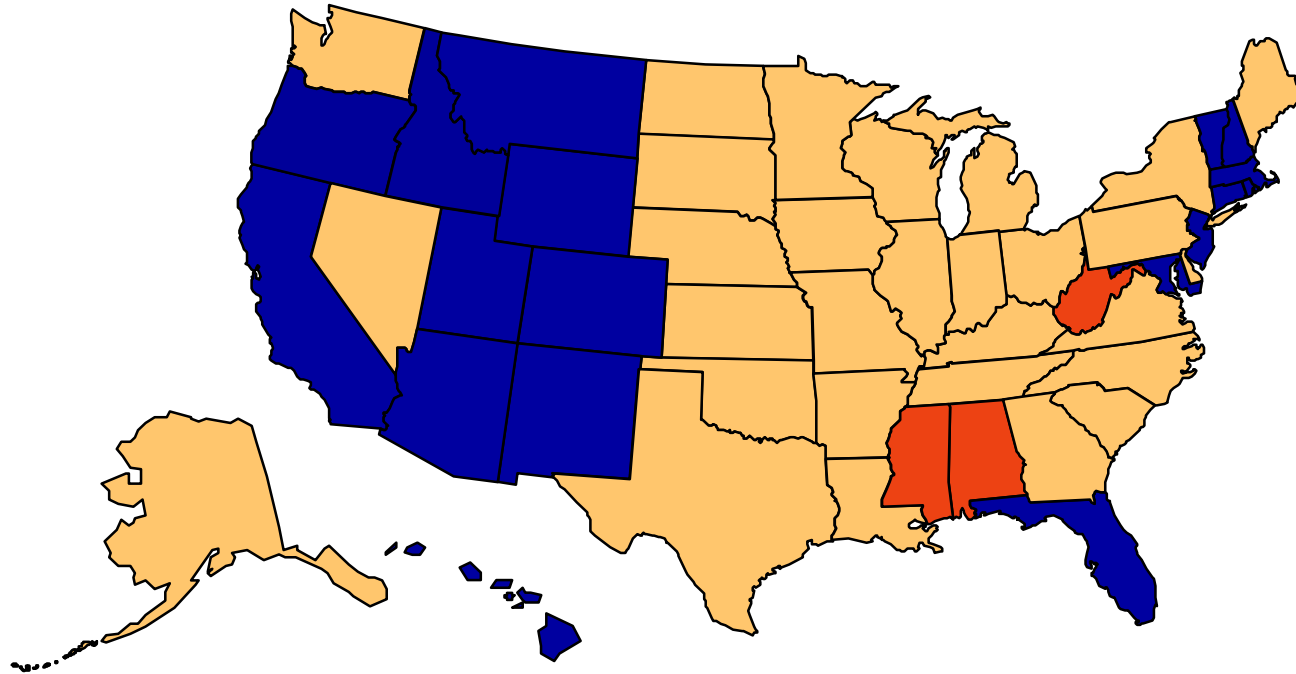
BRFSS, 2001

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



# Obesity Trends\* Among U.S. Adults BRFSS, 2002

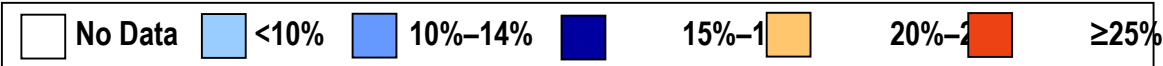
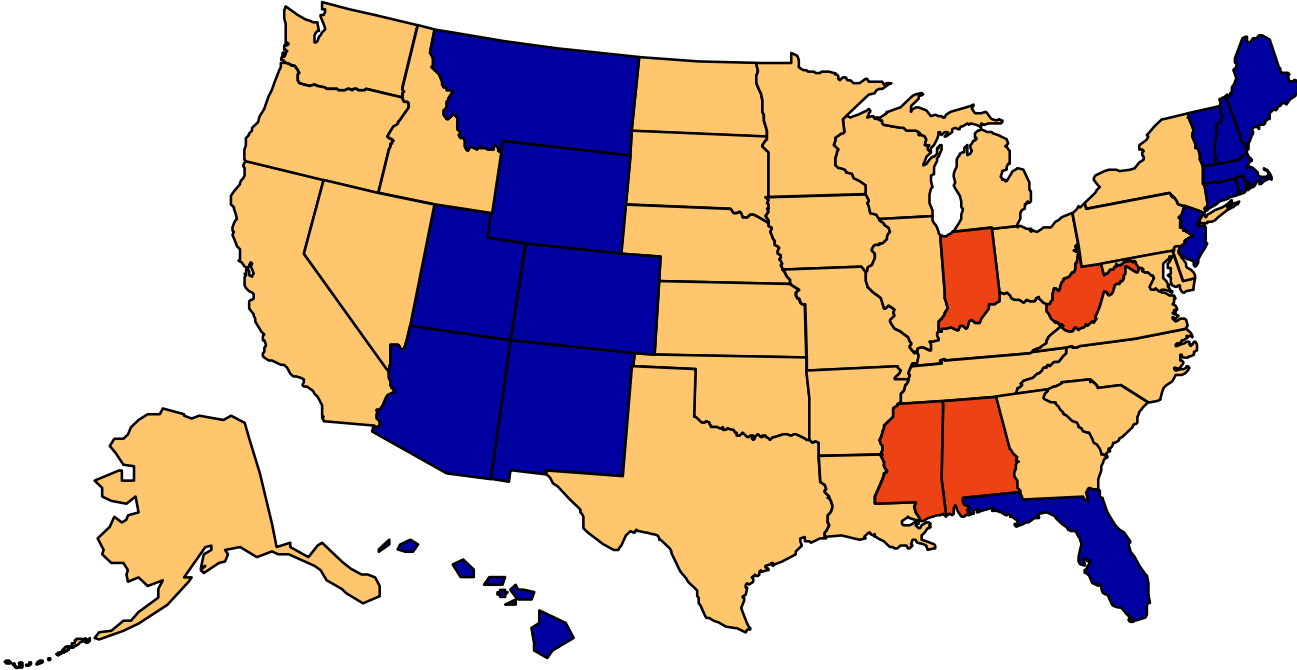
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



Obesity Trends\* Among U.S. Adults

BRFSS, 2003

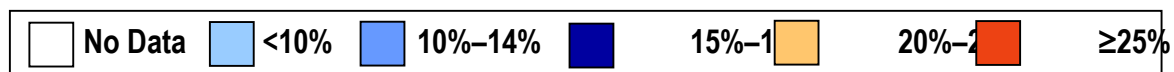
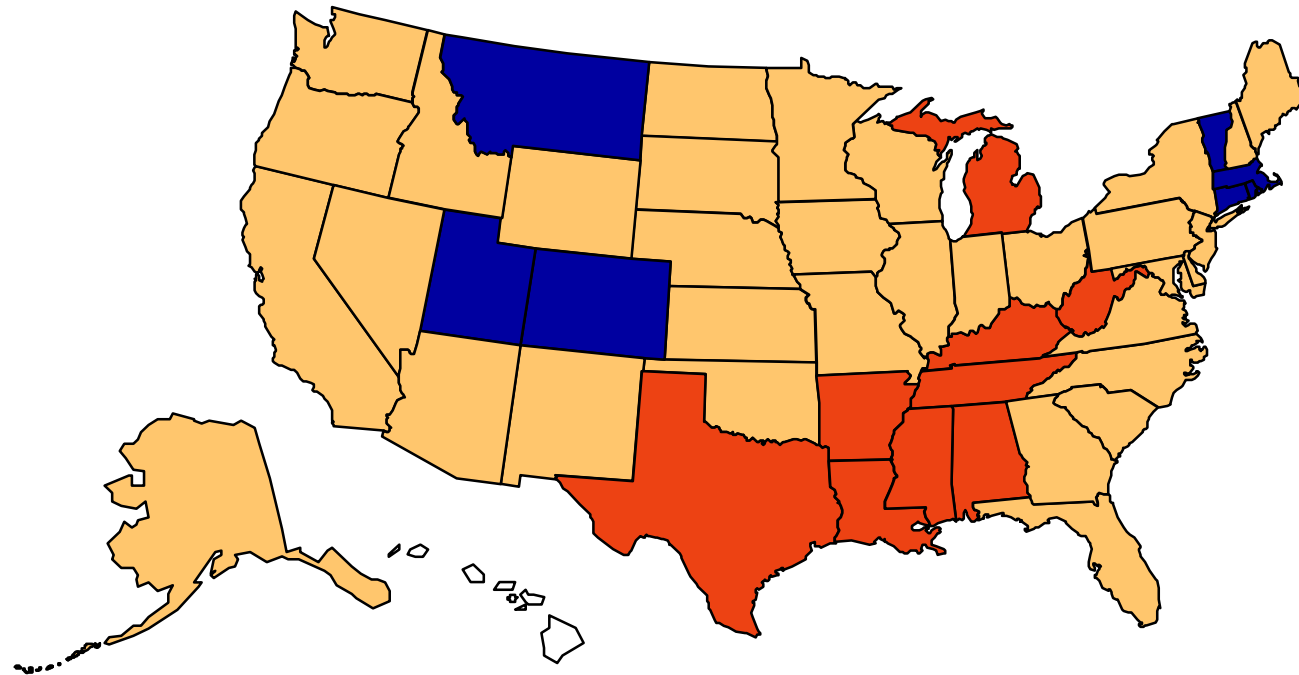
(\*BMI  $\geq 30$ , or  $\sim$  30 lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2004

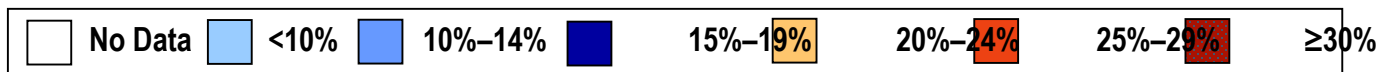
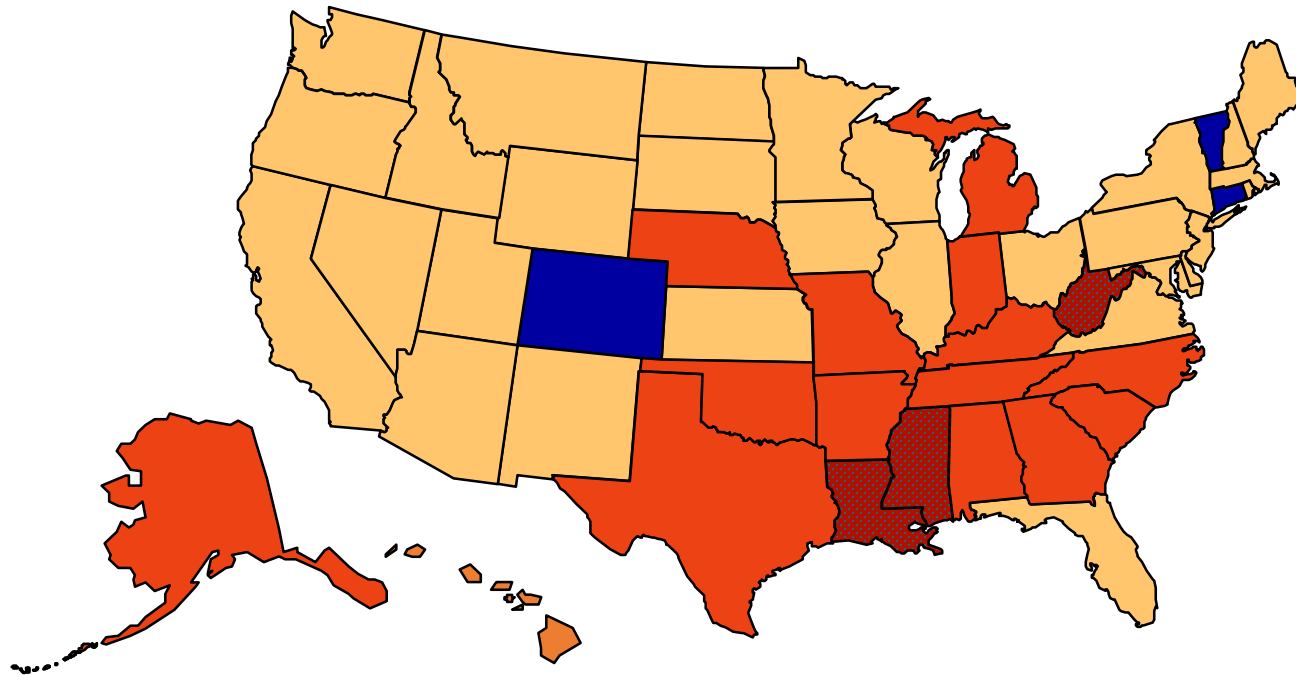
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2005

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

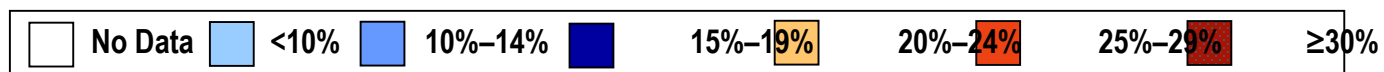
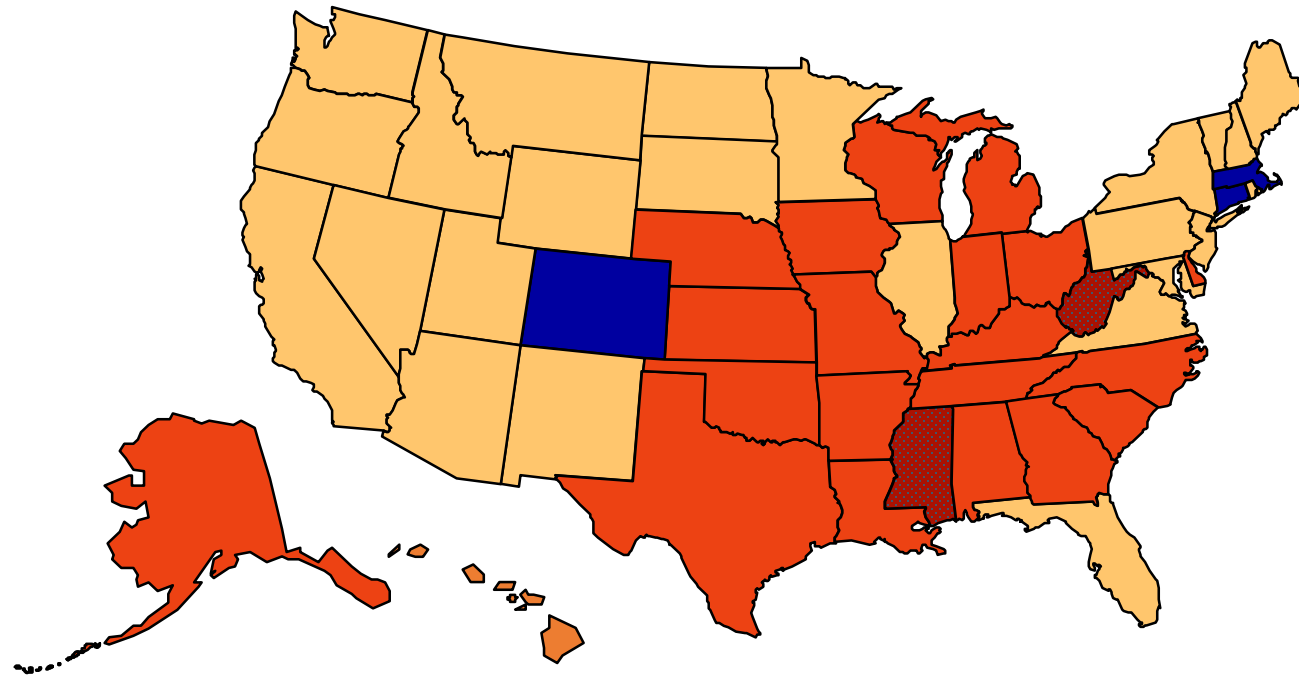




# Obesity Trends\* Among U.S. Adults

BRFSS, 2006

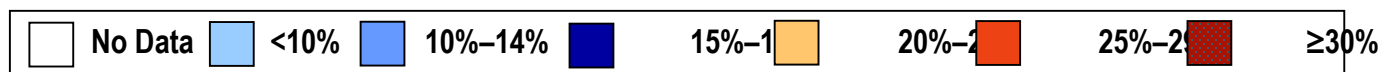
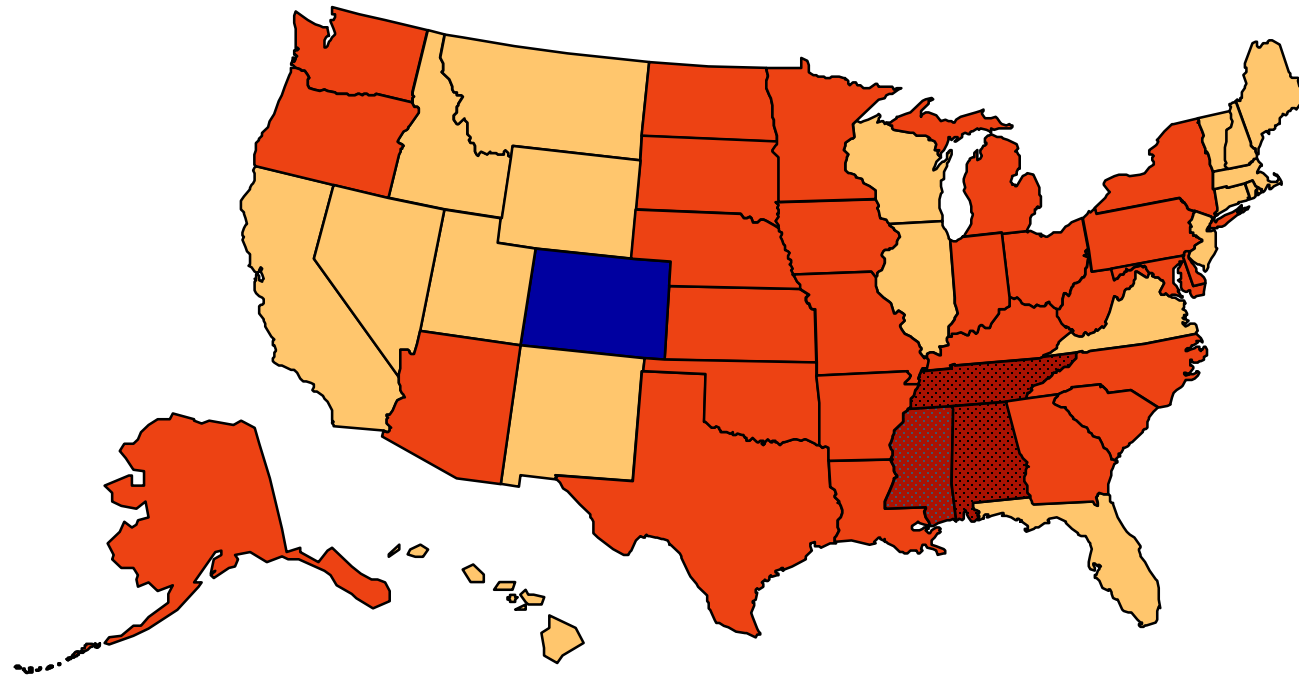
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2007

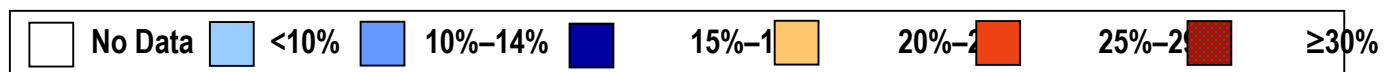
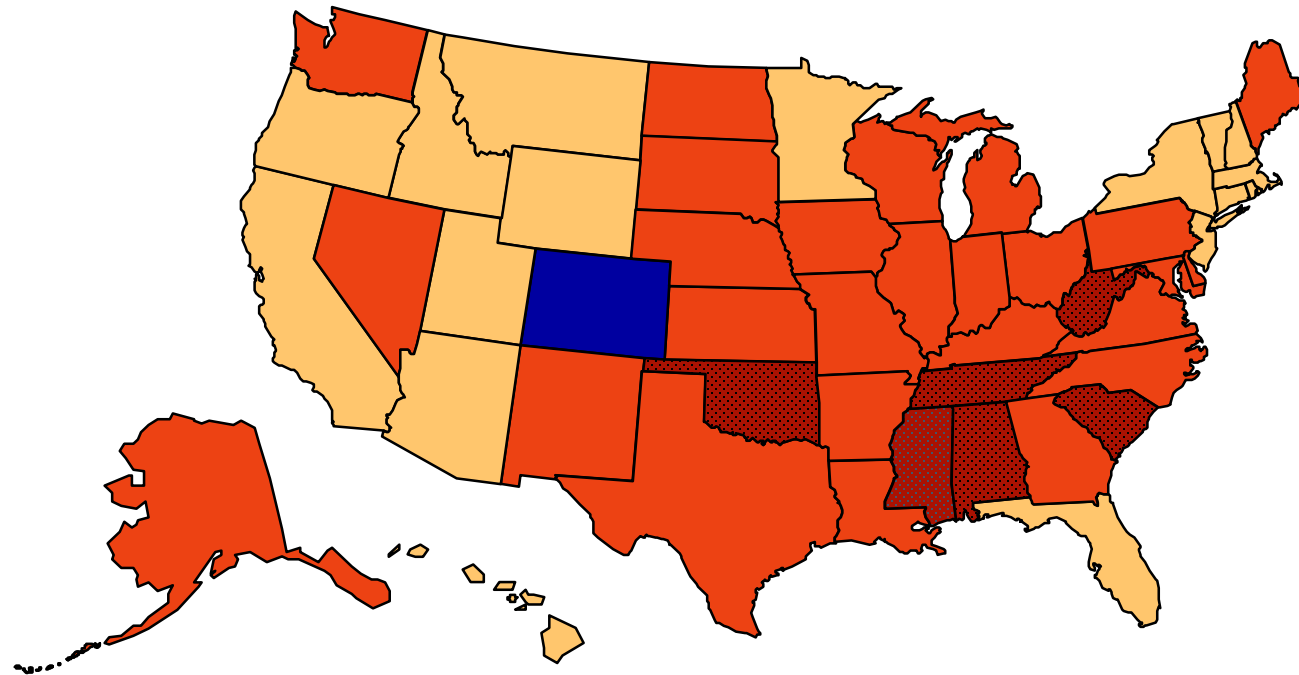
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2008

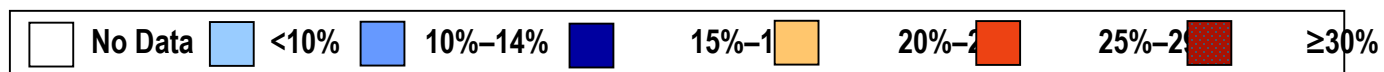
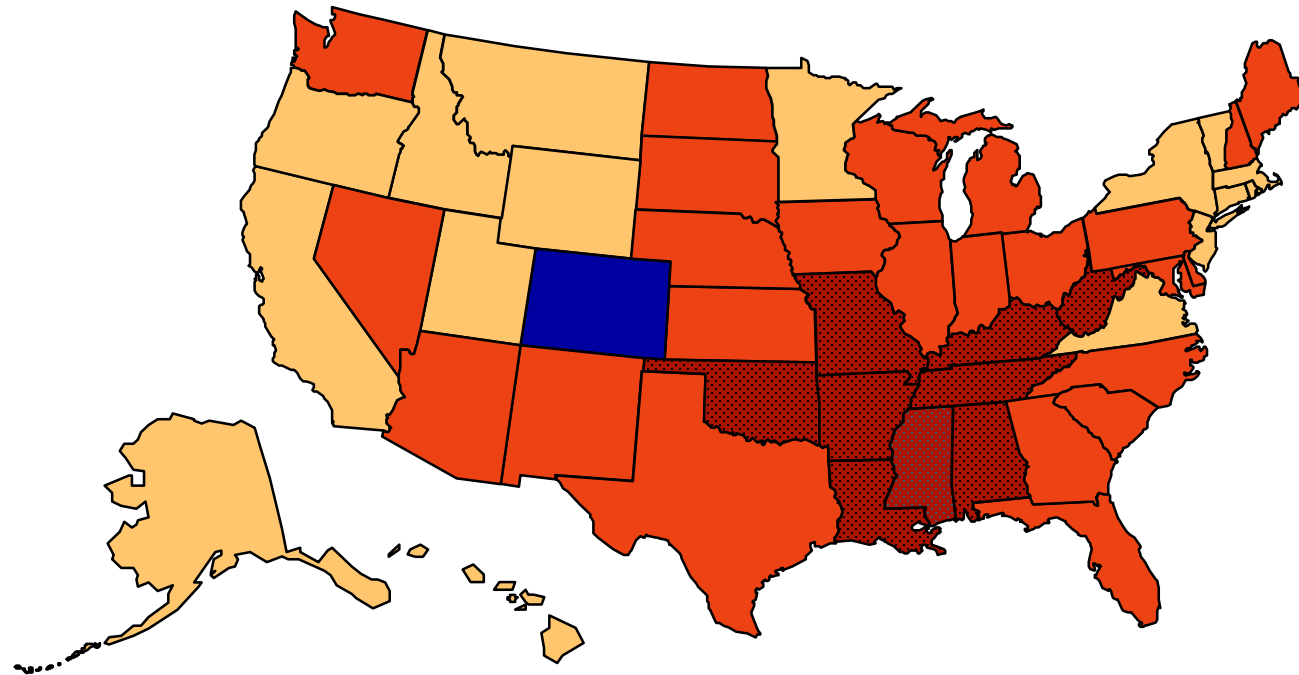
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2009

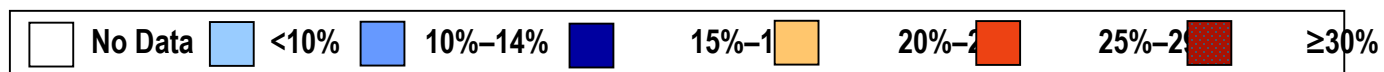
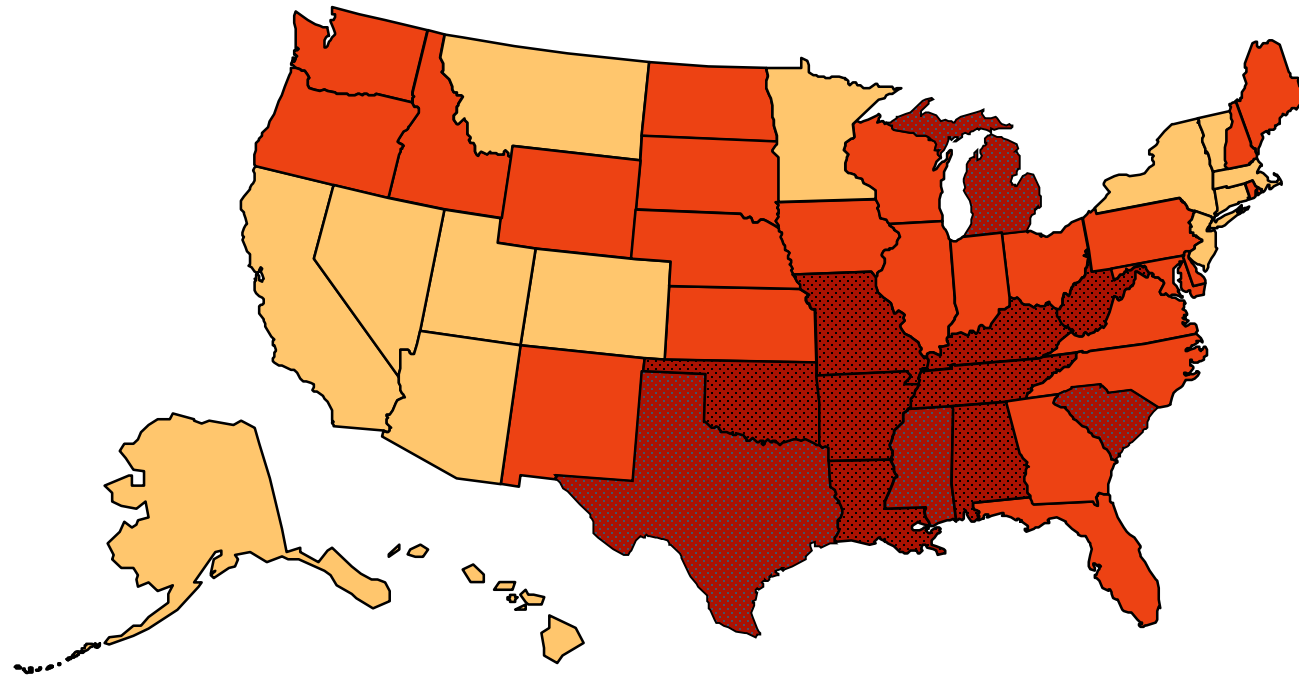
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# Obesity Trends\* Among U.S. Adults

BRFSS, 2010

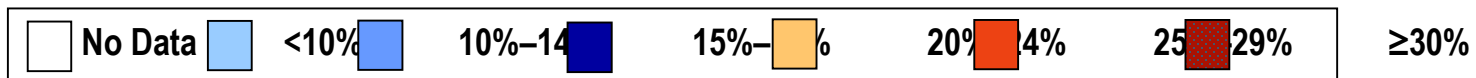
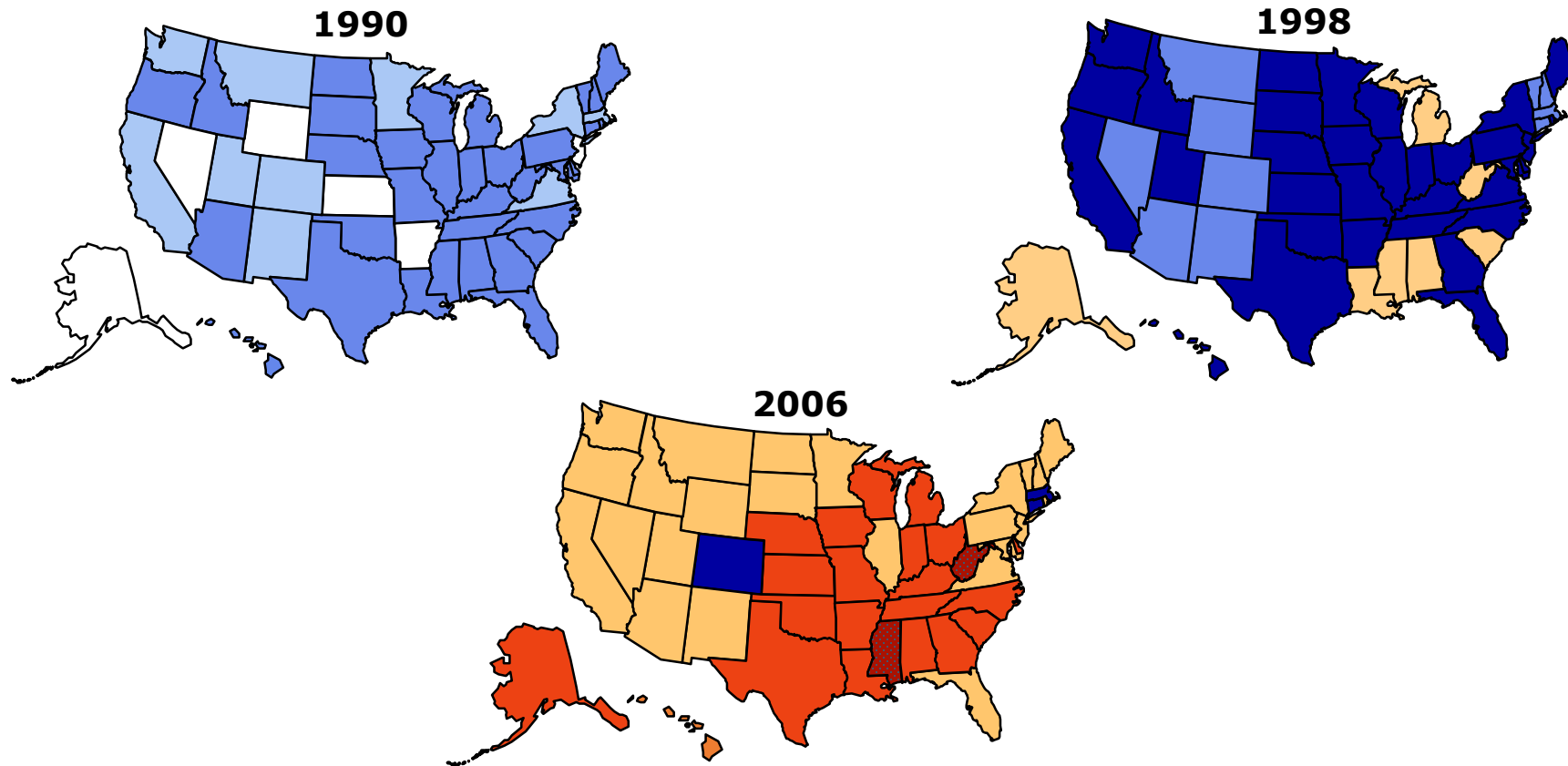
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



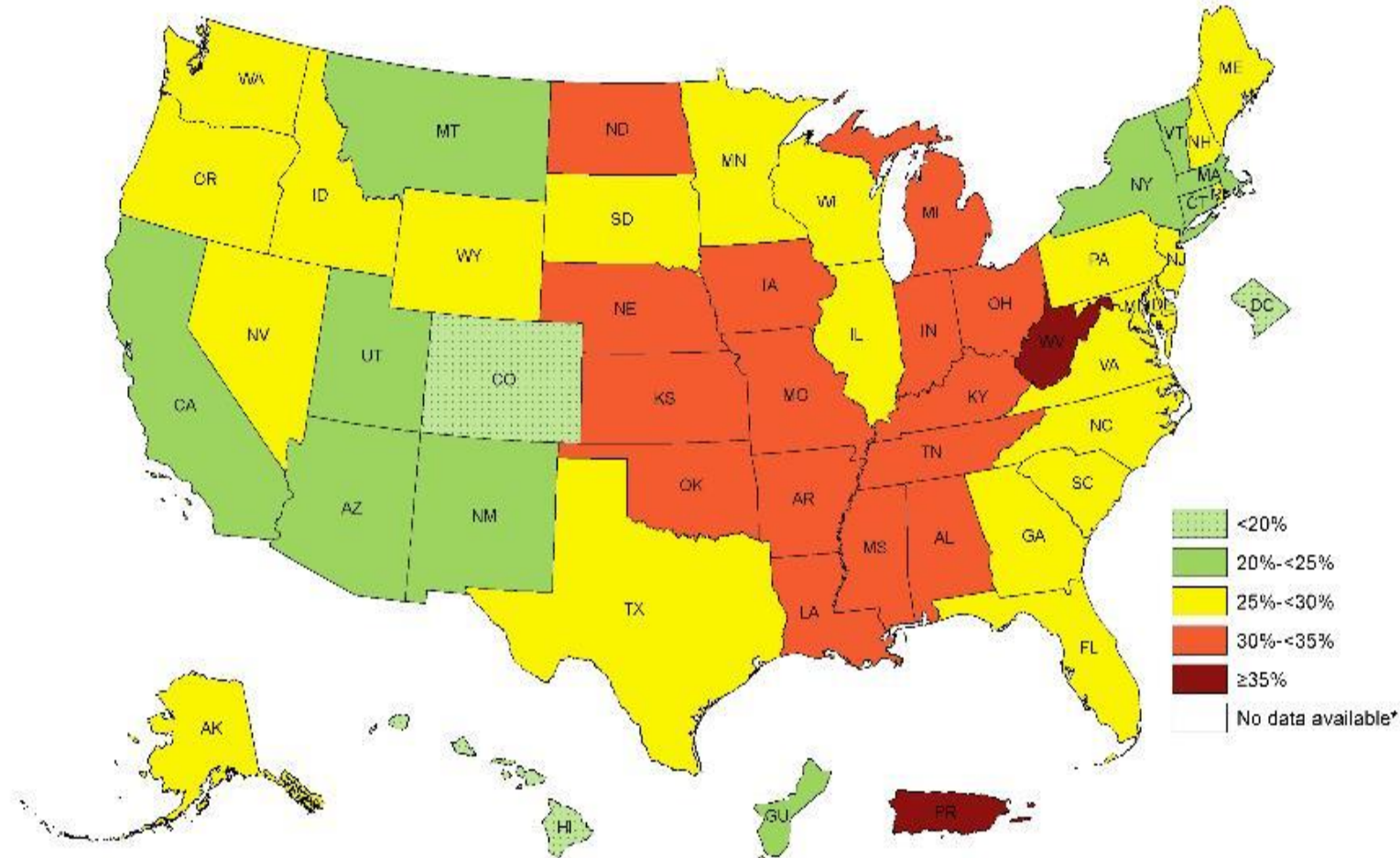
# Obesity Trends\* Among U.S. Adults

## BRFSS, 1990, 1998, 2006

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



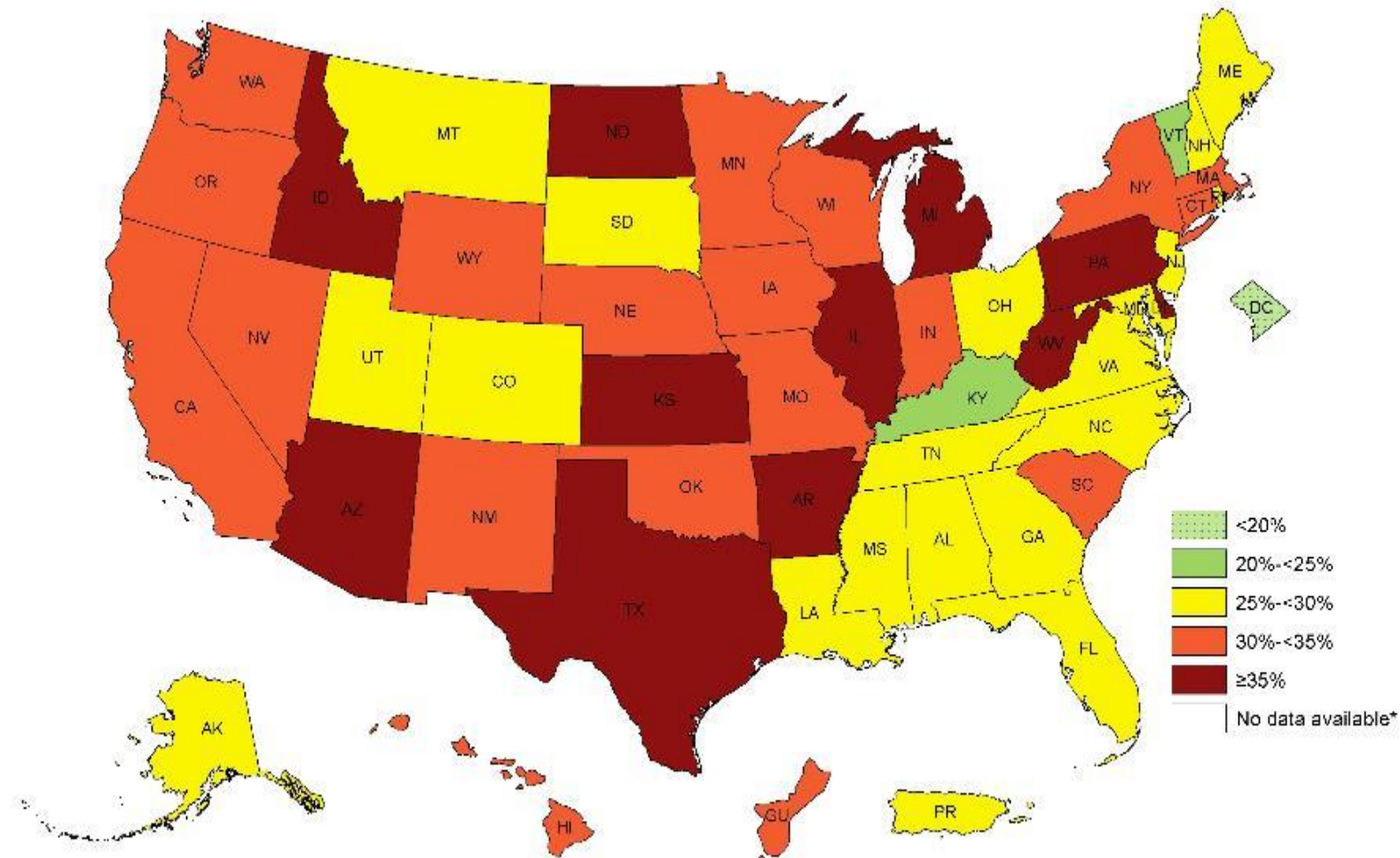
# Prevalence of Self-Reported Obesity Among Non-Hispanic White Adults, by State and Territory, BRFSS, 2013-2015



\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence)  $\geq 30\%$ .



# Prevalence of Self-Reported Obesity Among Hispanic Adults, by State and Territory, BRFSS, 2013-2015

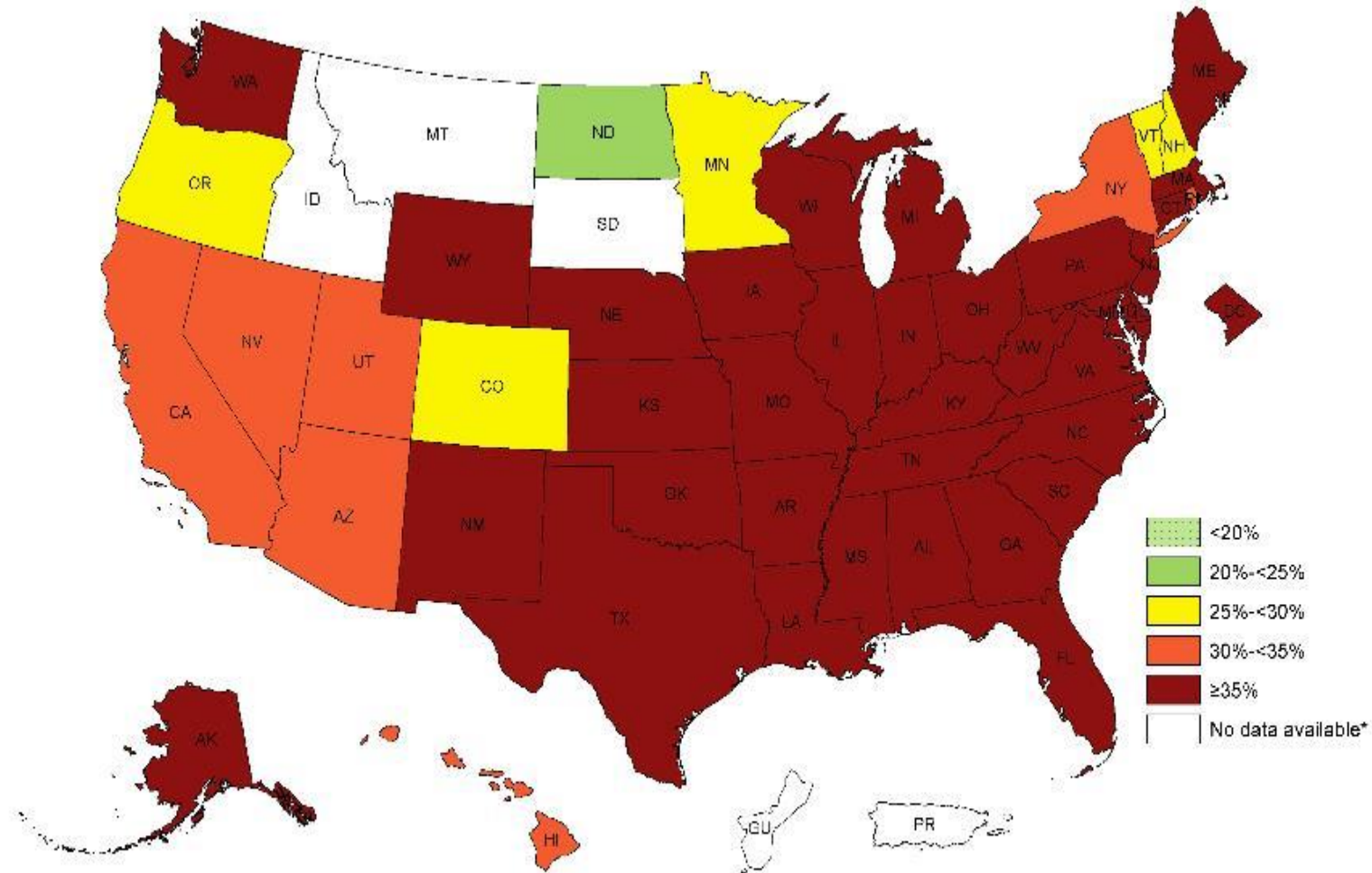


\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.





# Prevalence of Self-Reported Obesity Among Non-Hispanic Black Adults, by State and Territory, BRFSS, 2013-2015



\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.



# What is The Link between obesity and Type 2 diabetes? – fat in the wrong place



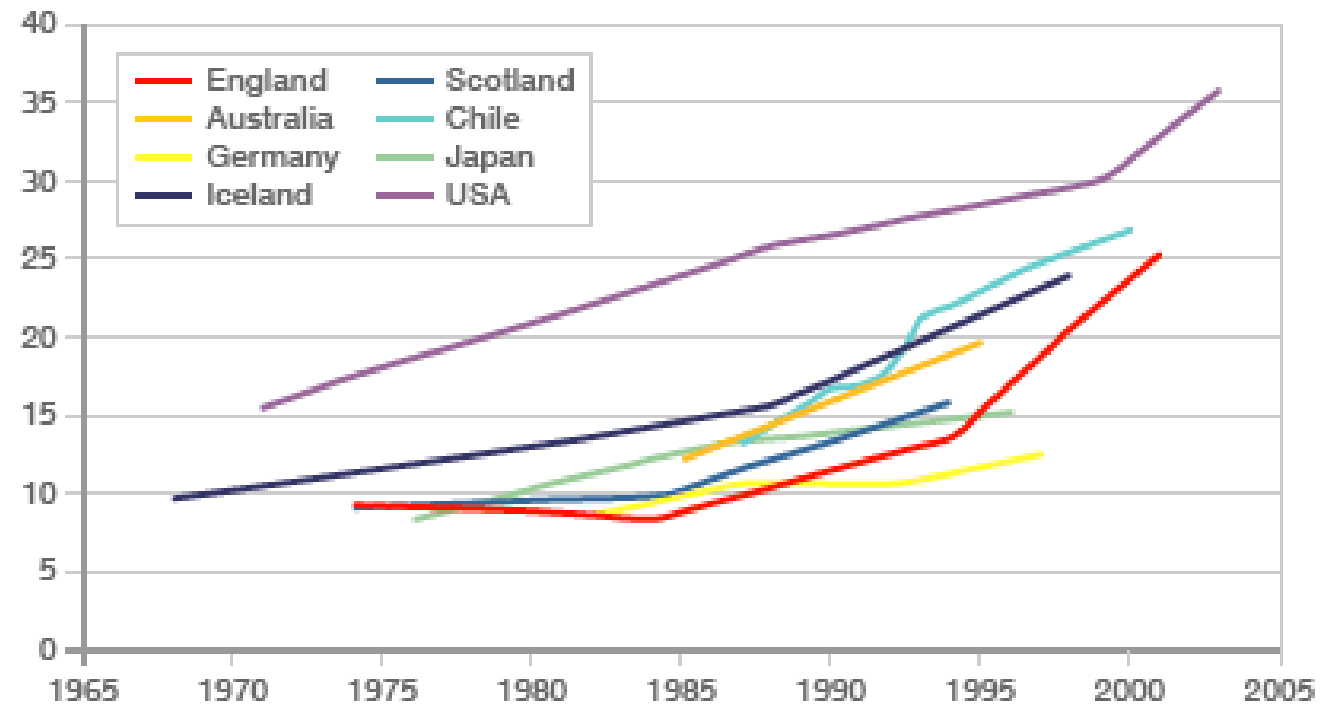
Partial lipodystrophy



# Obesity epidemic

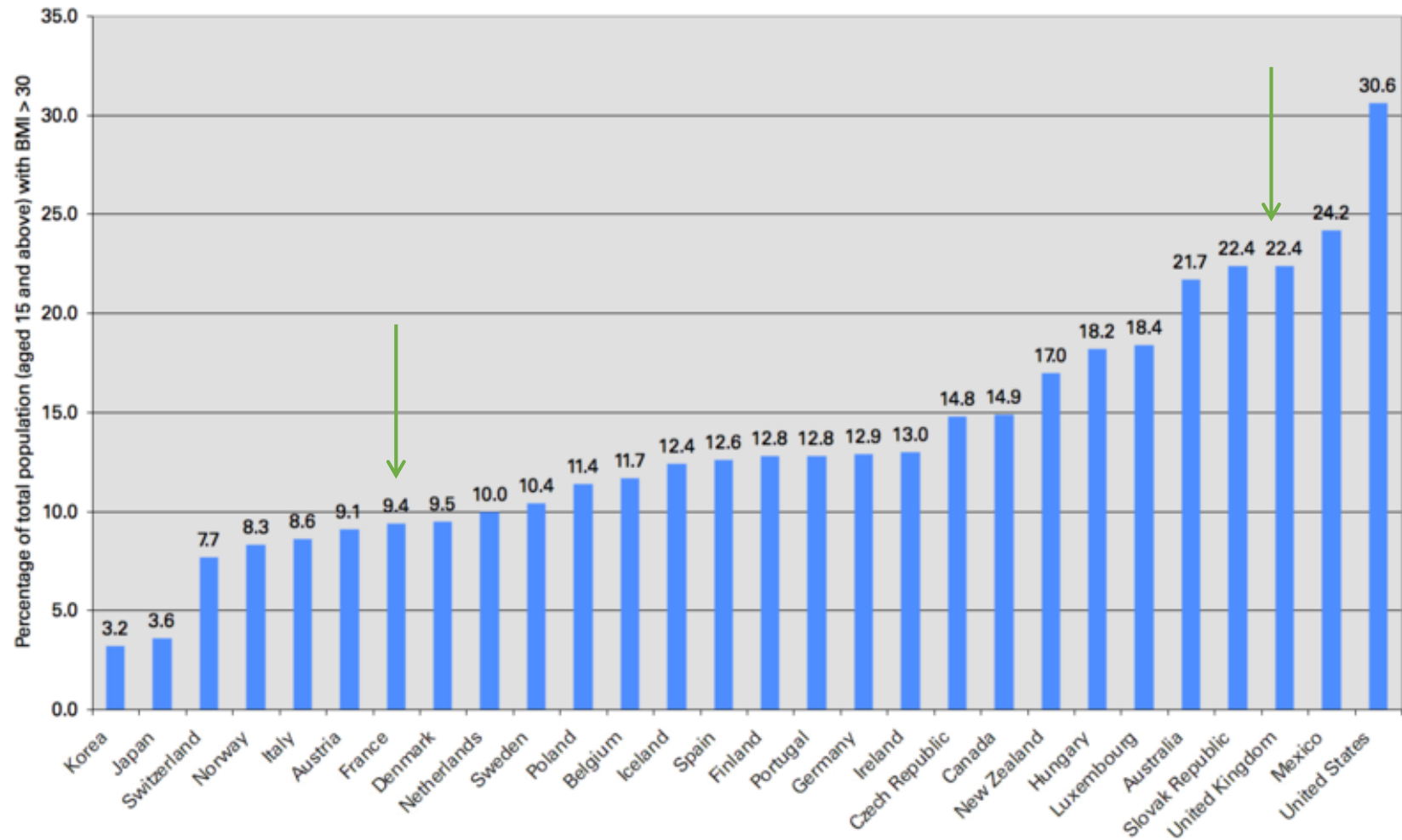
**INCREASING NUMBER OF OVERWEIGHT CHILDREN AROUND THE WORLD**

Percentage overweight



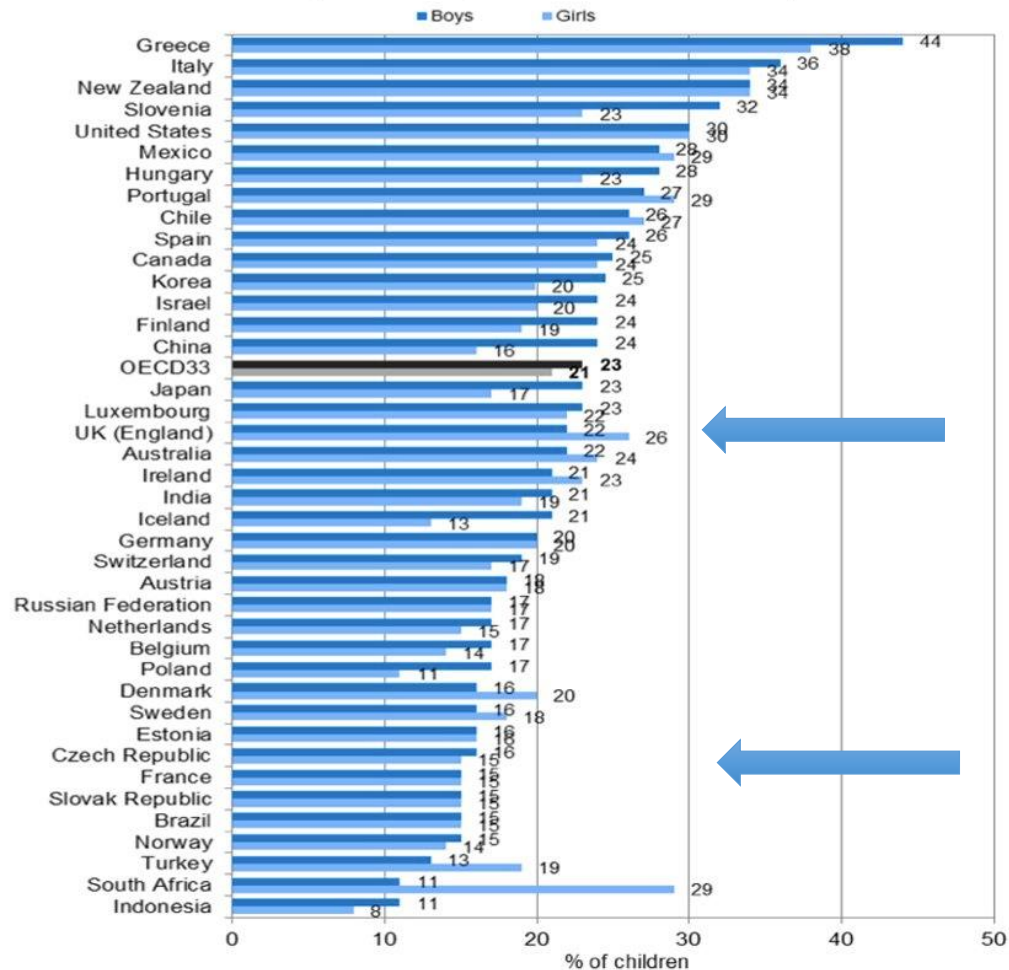
SOURCE: Government Office for Science

# Environmental factors? - Obesity in different countries



# Obesity in Children (2013)

Figure 4. Measured overweight (including obesity) among children aged 5-17, 2010 or nearest year



Source: International Association for the Study of Obesity, 2013; Bös et al. (2004), Universität Karlsruhe and Ministère de l'Éducation nationale et de la Santé for Luxembourg; and KNHANES 2011 for Korea.

# Relative risk of health problems associated with obesity

Disease	Women	Men
Type 2 diabetes	12.7	5.2
Hypertension	4.2	2.6
Myocardial infarction	3.2	1.5
Colon cancer	2.7	3.0
Angina	1.8	1.8
Gall bladder disease	1.8	1.8
Ovarian cancer	1.7	–
Osteoarthritis	1.4	1.9
Stroke	1.3	1.3

# Why are we getting so fat

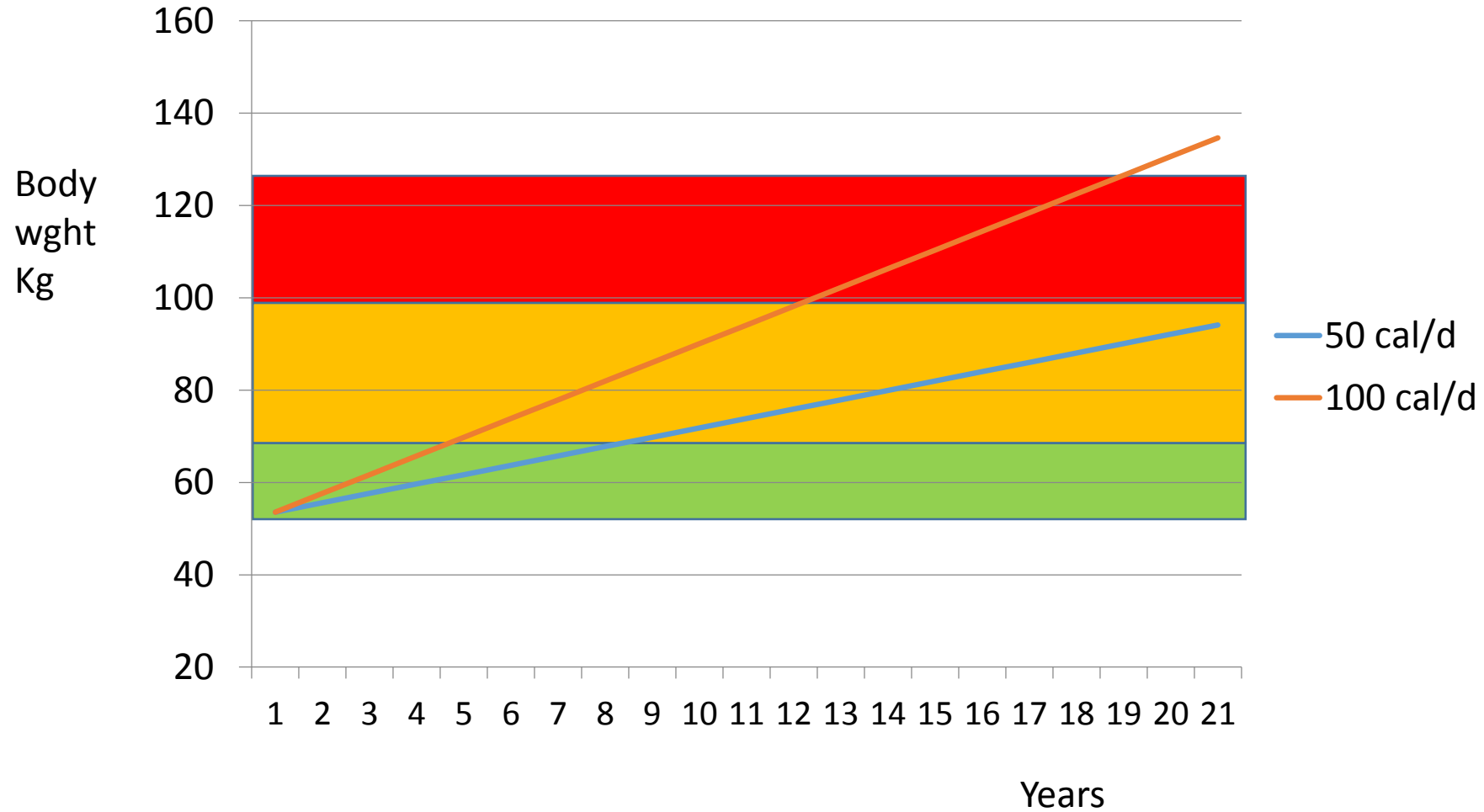
1. Small calorie increments make a big difference over time

# Yearly weight gain

Xs calories /day	Wght gain/yr
50	2.0
100	4.1
150	6.1
200	8.1
250	10.1
300	12.1



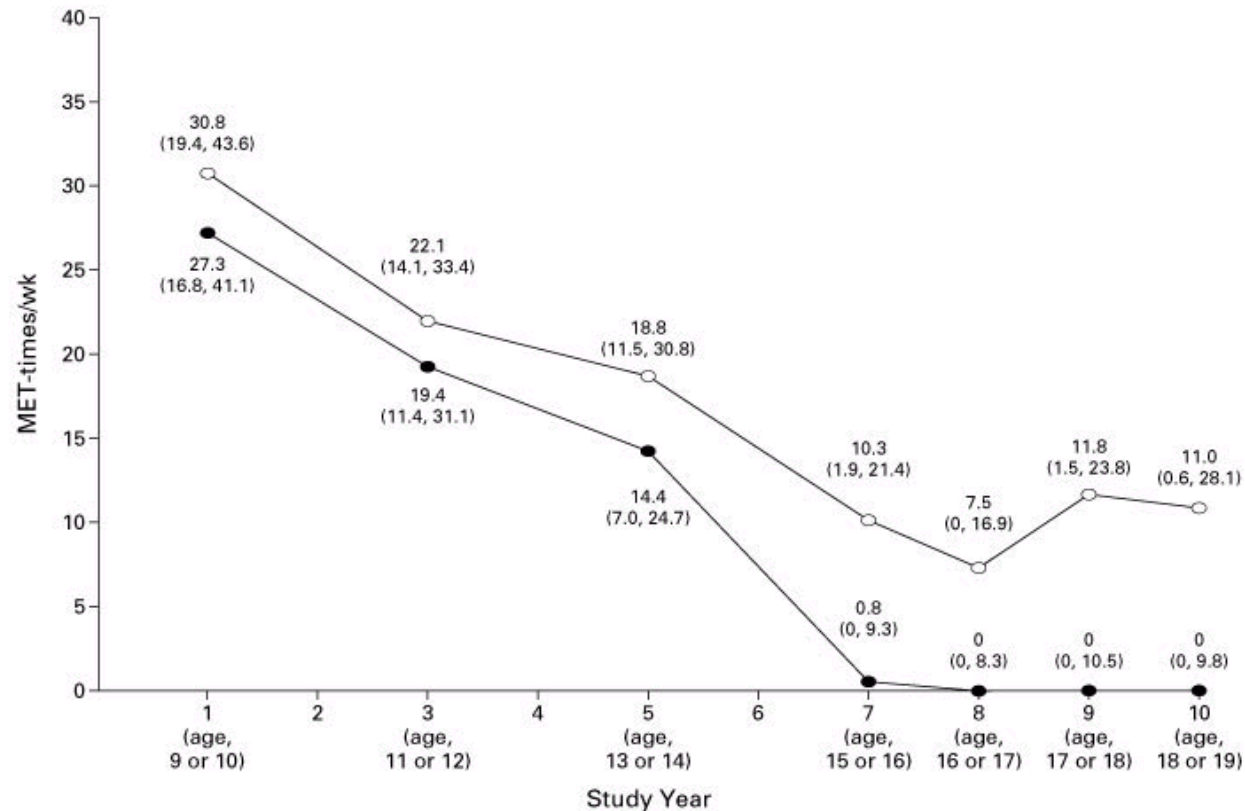
# Wght gain over 20 years 53kg female



More food or less exercise?

# Reduction in physical activity

Physical activity in children



Solid dots  
- black girls  
Kimm et al  
2002

Early ACTID trial of diet and exercise in newly  
diagnosed patients

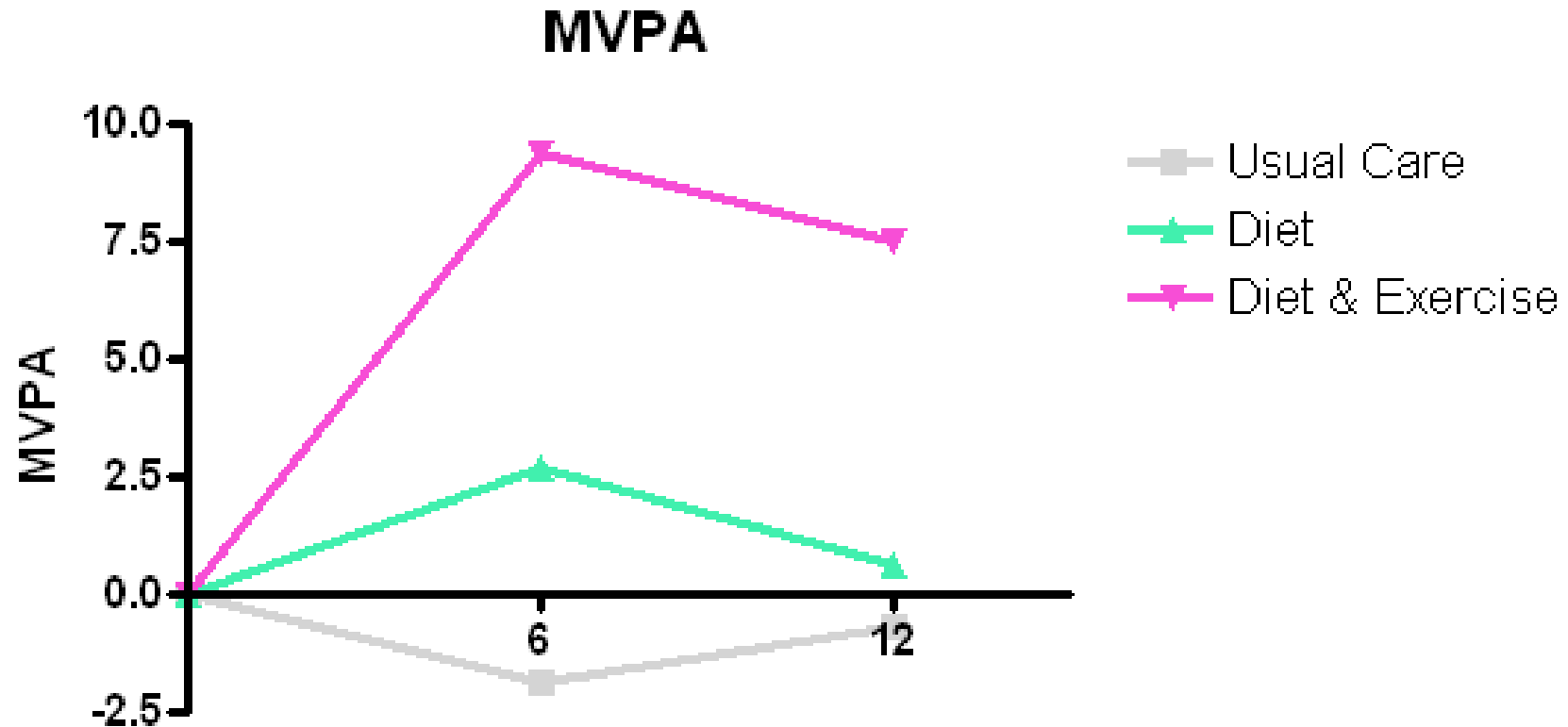
Andrews et al, Lancet 2011

# Baseline Metabolic Parameters (groups combined)

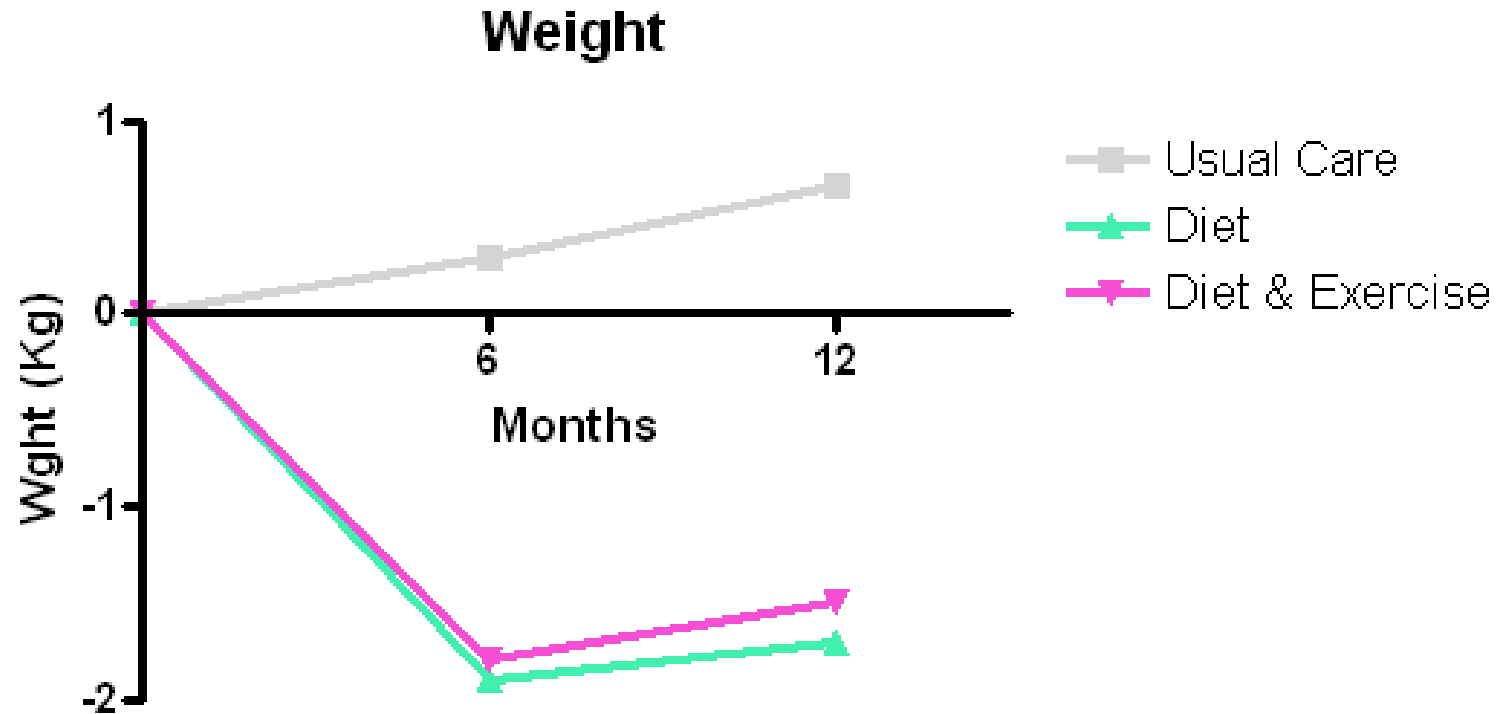
HbA1c	6.7%
BP	134/80
Min/Mod activity	26 mins/day
Weight	91kg
BMI	31



# Increases in Physical Activity (mins of activity)

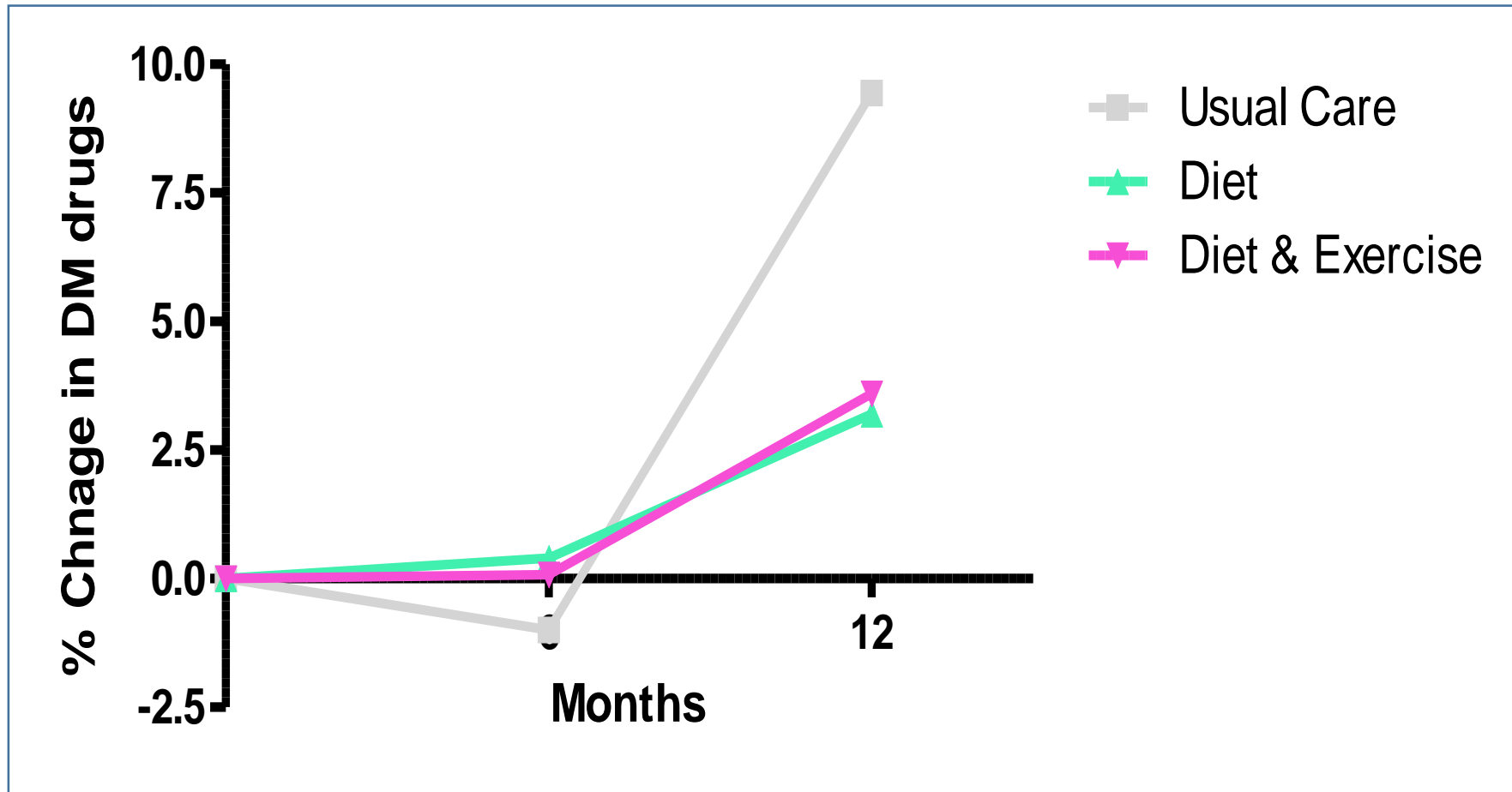


# Intensive Dietary Support (Early ACTID study) – Motivational interviewing



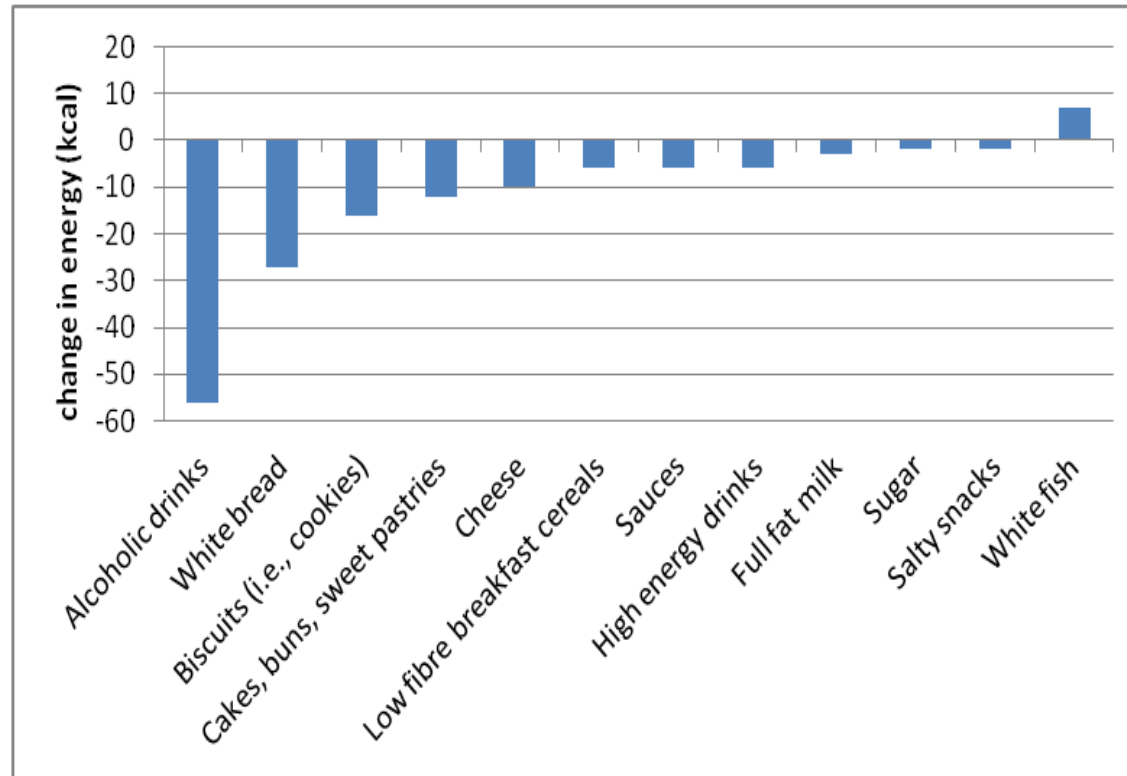
# Diabetes medication

**%DM drugs**





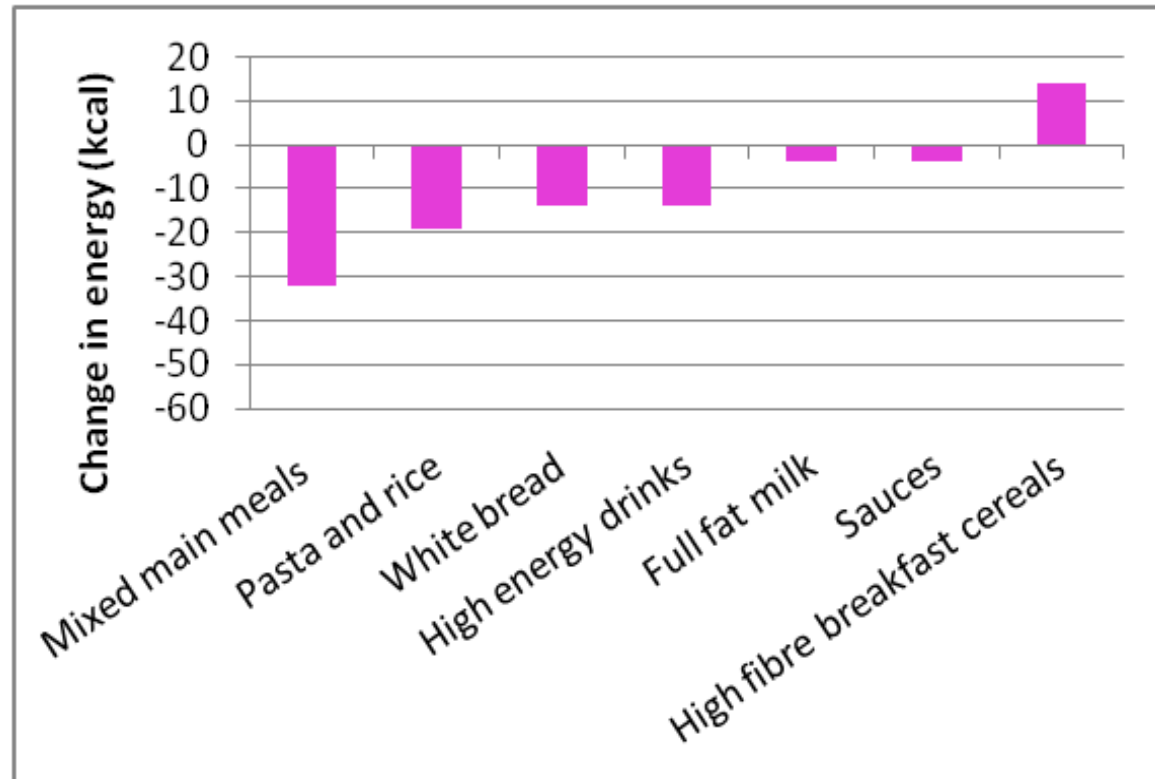
# Changes in mean energy intakes from food groups: men (n=175)



Paired sample Wilcoxon signed rank tests  $p < 0.05$

Men (blue) reduced energy by  $218 \pm 332$  kcal  
( $p < 0.001$ )

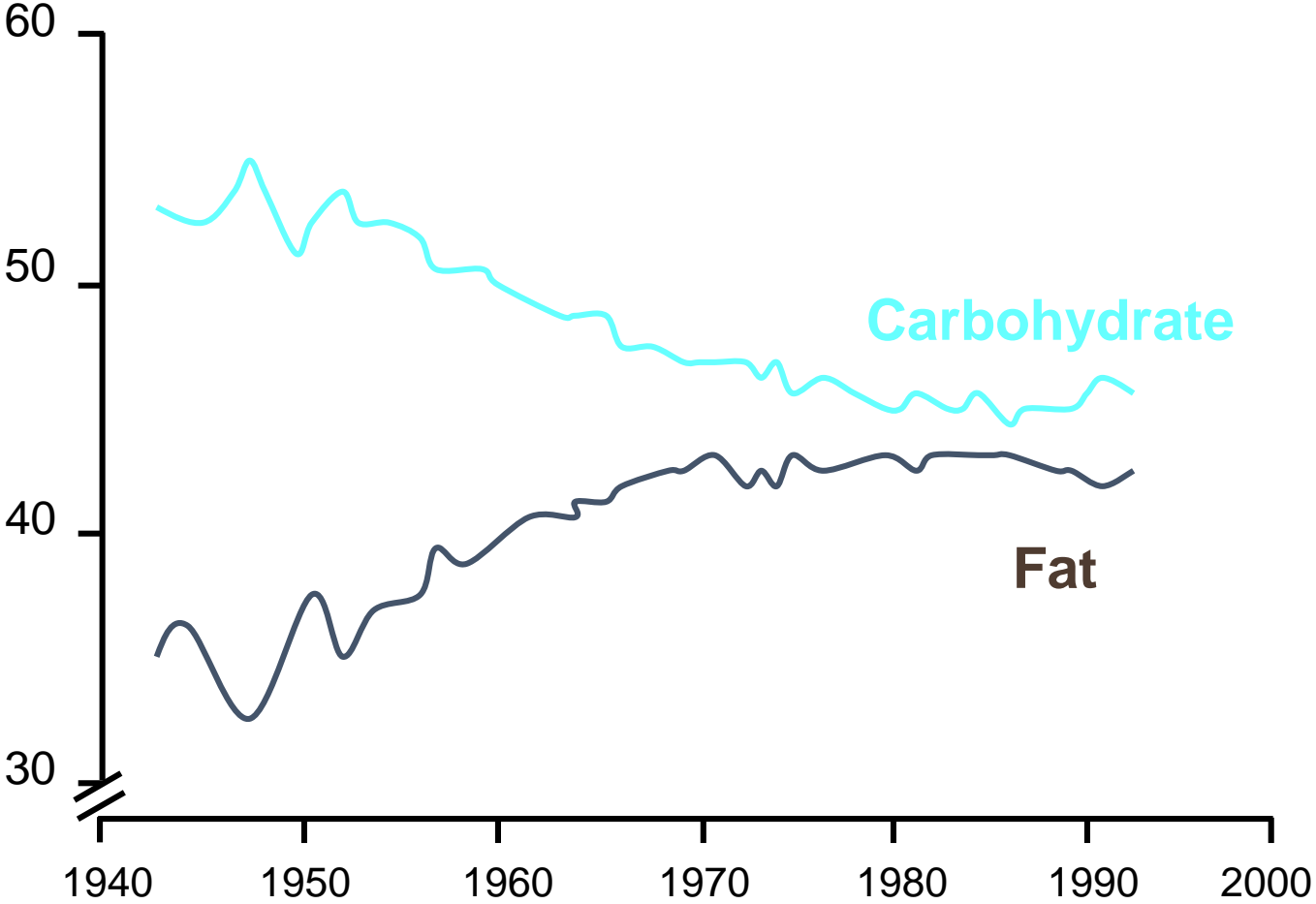
# Changes in mean energy intakes from food groups: women (n=87)



Paired sample Wilcoxon signed rank tests  $p < 0.05$

Women (pink) reduced energy by  $123 \pm 270$  kcal  
( $p < 0.001$ )

# change in food intake



*Prentice & Jebb. Reprinted with permission from the BMJ Publishing Group. BMJ 1995; 311: 437-9*

# Calories burnt per hour of exercise

	130lbs (9st 3lbs)	155lbs (11st)	205 lbs (14.5 st)
Slow walking (2mph)	148	176	233
Brisk walking (3.5mph)	224	267	354
Leisurely cycling (< 10mph)	236	281	372
Running 6mph (10 min mile)	590	704	931
Running 10 mph (6 min mile)	944	1126	1489

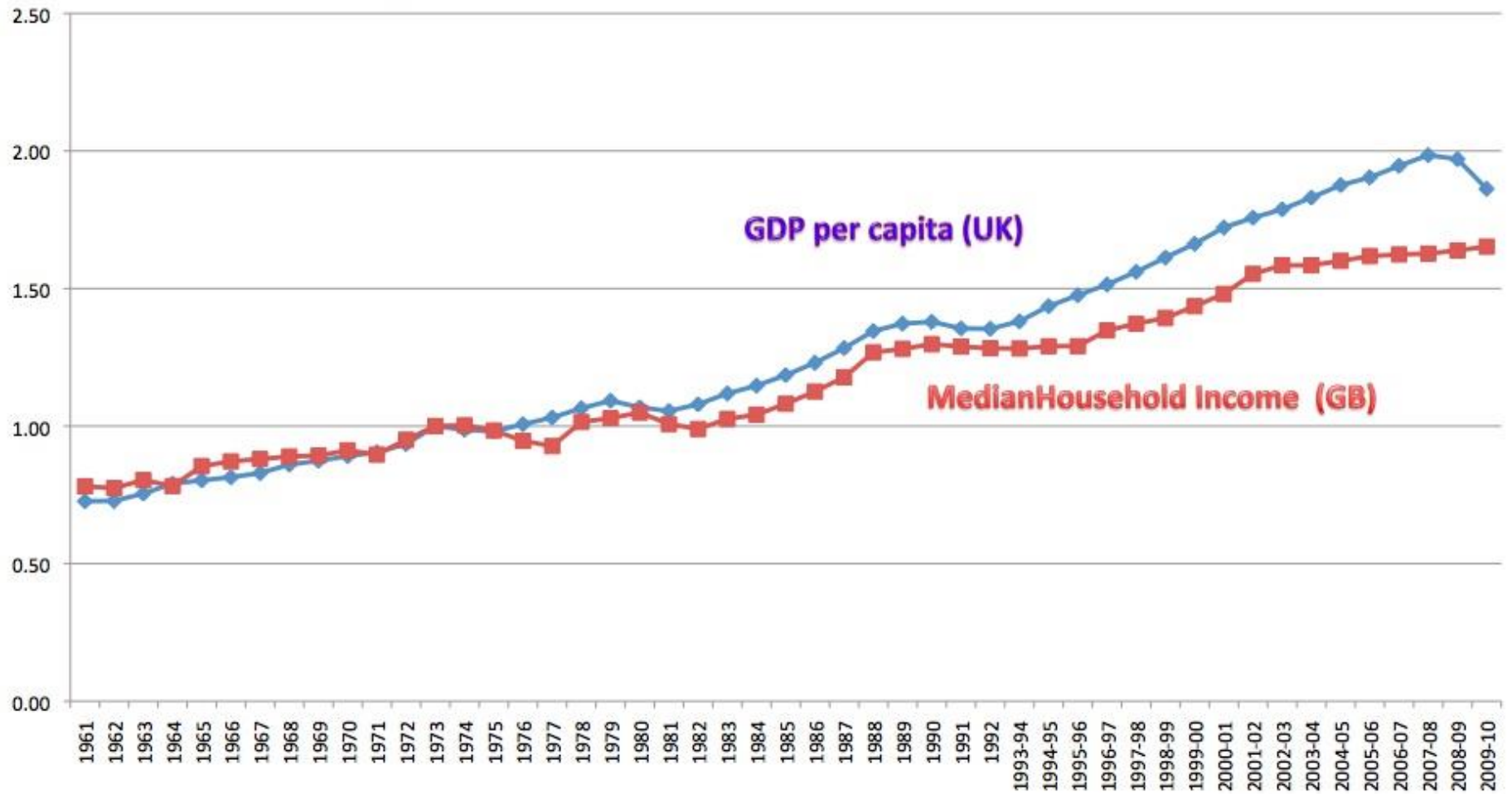


**2 digestive biscuits  
= 146 Calories**

# Why are we getting so fat

1. Small calorie increments make a big difference over time
2. Diet is probably more important than exercise
3. We can afford more calories

## GDP (UK, per capita, inflation adjusted) & median household income (GB, inflation adjusted) Index 1973=100



Calories are getting cheaper



65p per 100 cals





£2.99 per 100 cals





2 FOR...

Any 2 for £1.00



Pack of 5  
10p/doughnut

- Calories  
225,11%of your GDA
- Sugar  
7g,7%of your GDA
- Fat  
8g,11%of your GDA
- Saturates  
4g,18%of your GDA
- Salt  
0.3g,5%

= 4p/100kcal

Whole pack = 1125kcal

# How can we reverse this trend

- Increase awareness of where calories come from in our diet

# Snack Foods

Food	Calorie Content
Mars Bar/Snickers/Twix	250
Pint of beer or lager	200-250
Danish	300
Kebab	430
Crisps	200
Coke	140
Big Mac	450

Food	Calorie Content
Apple	70
Pizza slice	170
Grapes	30
Granary Bread Ham sandwich	100
Bowl of cereal (v small)	150

# “Healthy” food vs Lo Calorie



524 kcal/100g  
5.7p/cal



366 kcal/100g  
19p/cal

# Drinks



138Kcal  
42p/100 cal



1Kcal  
5,900p/100 cal

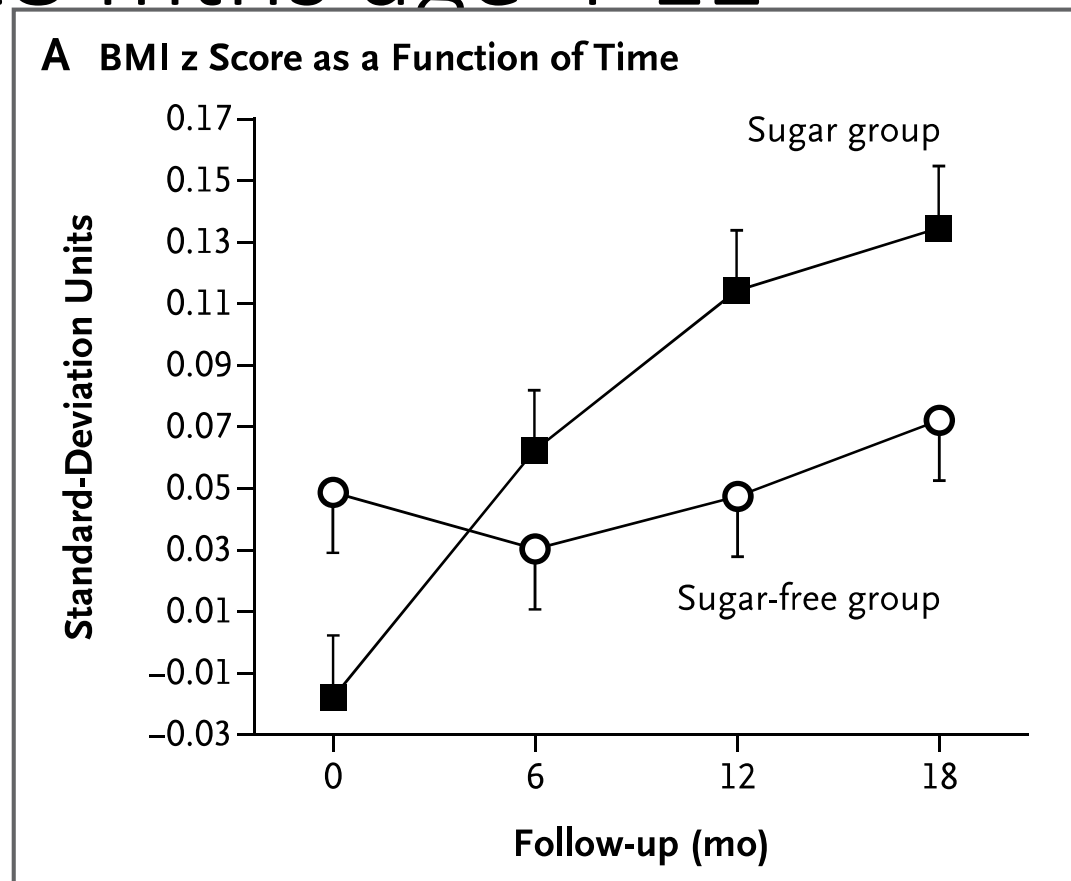


153Kcal  
45p/100 cal



132 Kcal  
113p/100 cal

# Sugar drinks (1 can/day 18 mths age 4-12)



*De Ruyter et al NEJM 2012*

# A cup of coffee?



Black  
Americano

Regular

Large

19 KCal

38 KCal



Latte

128 KCal

259 KCal



Mocha  
Latte

228 KCal





# How can we reverse this trend

- Increase awareness of where calories come from in our diet
- Reduce package sizes

Smaller packaging sizes “Go Small”

**Calories**



**384**

**240**

**80**

## **A Mars a day helps you work, rest and pay: Chocolate bars shrink in size but the price stays the same**

Chocolate giant Mars has shrunk the size of its bars from 58g to 51g

Its Snickers bars have also been reduced from 58g to 48g

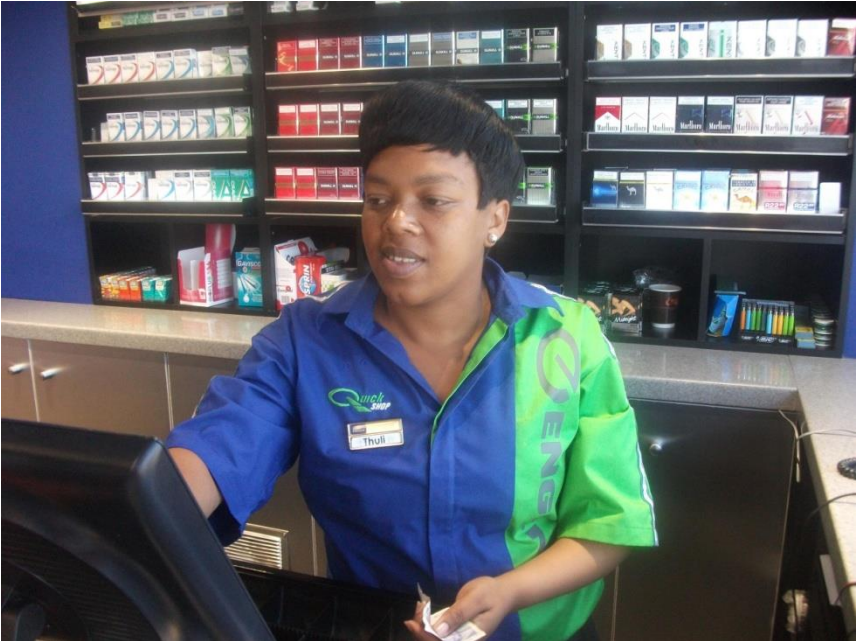
But the recommended selling price of 51p has remained the same

The company said the size reduction was essential to meet its pledge that all single-serve products will be a maximum of 250 calories

# How can we reverse this trend

- Increase awareness of where calories come from in our diet
- Reduce package sizes
- Reduce environmental cues

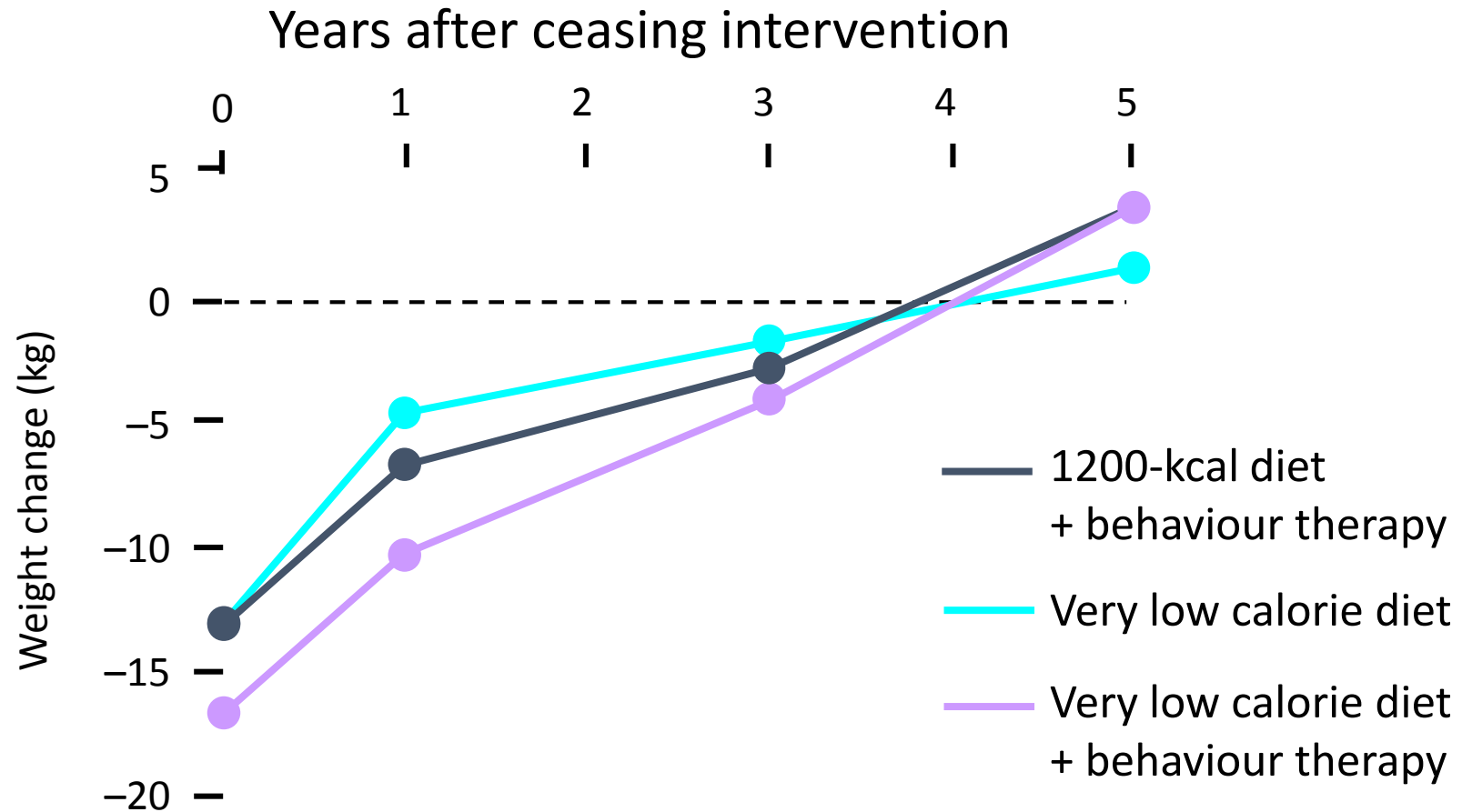
# The wall of calories



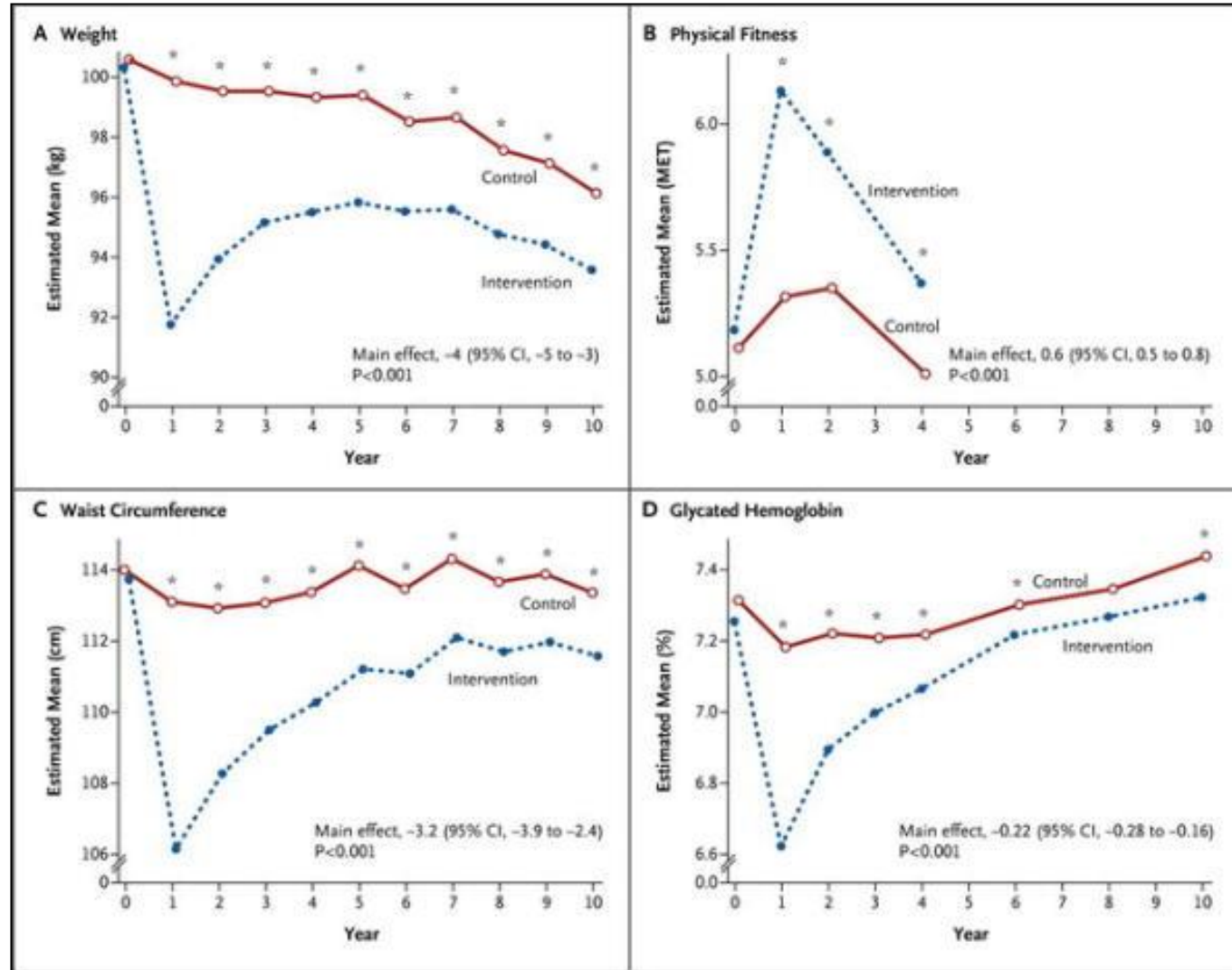
Food as a gift, finishing your plate, food with drink



# Conventional weight management tends to fail over the long term



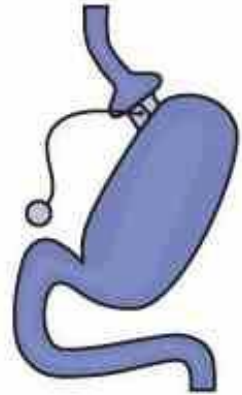
# Look Ahead study



Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes. New England Journal of Medicine. 369(2):145-154, July 11, 2013. DOI: 10.1056/NEJMoa1212914



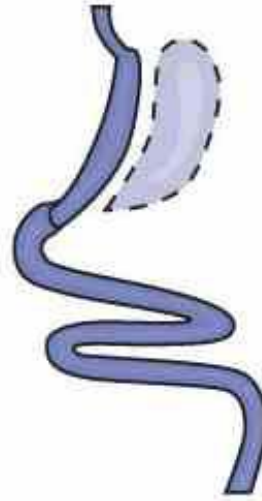
# Obesity surgery



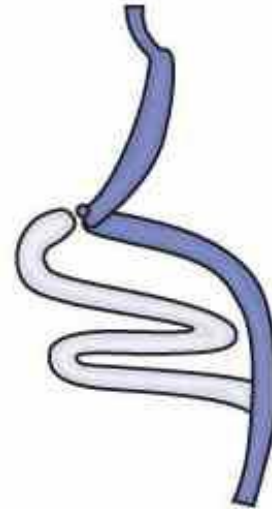
Adjustable  
Gastric Band  
(AGB)



Roux-en-Y  
Gastric Bypass  
(RYGB)

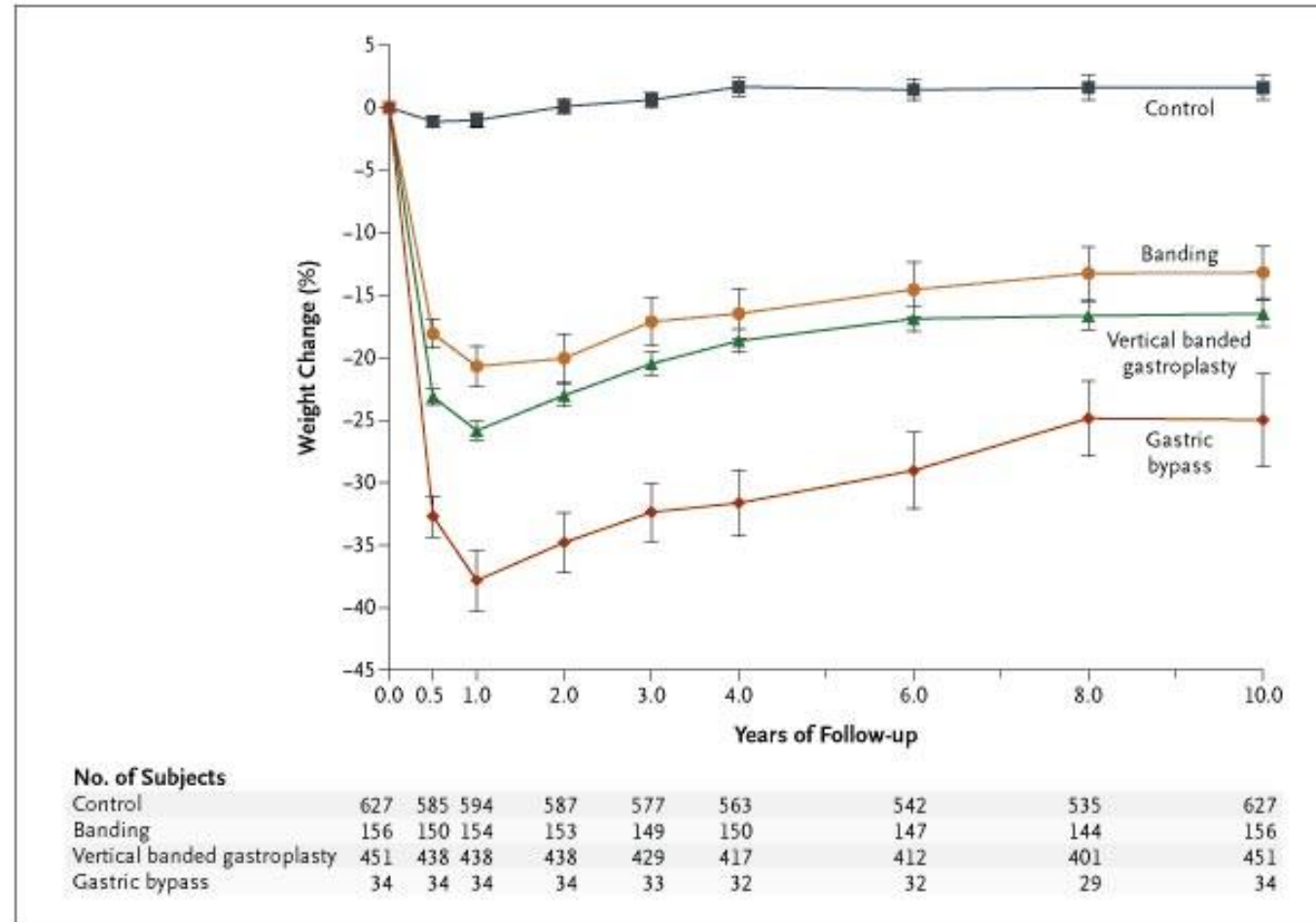


Vertical Sleeve  
Gastrectomy  
(VSG)



Biliopancreatic  
Diversion With a  
Duodenal Switch  
(BPD-DS)

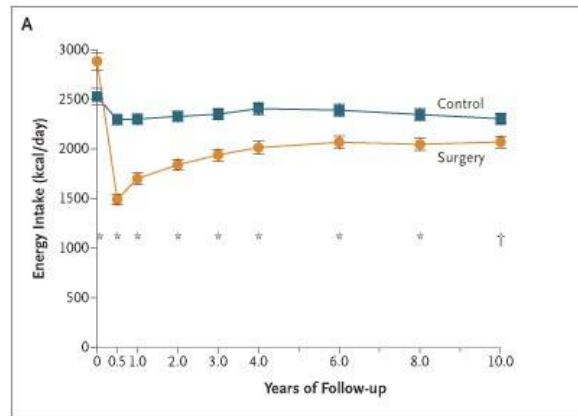
## Weight Changes among Subjects in the SOS Study over a 10-Year Period



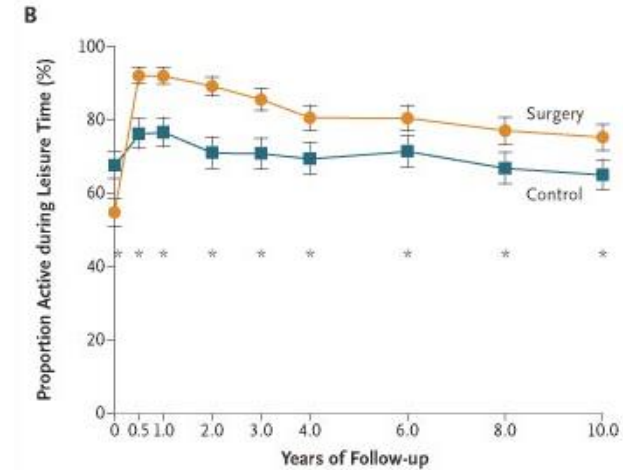
Sjostrom, L. et al. N Engl J Med 2004;351:2683-2693

# Lifestyle Changes among the Subjects in the SOS Study over a 10-Year Period

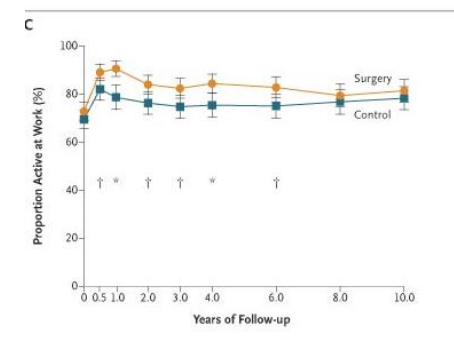
## Energy Intake



## % active in leisure time

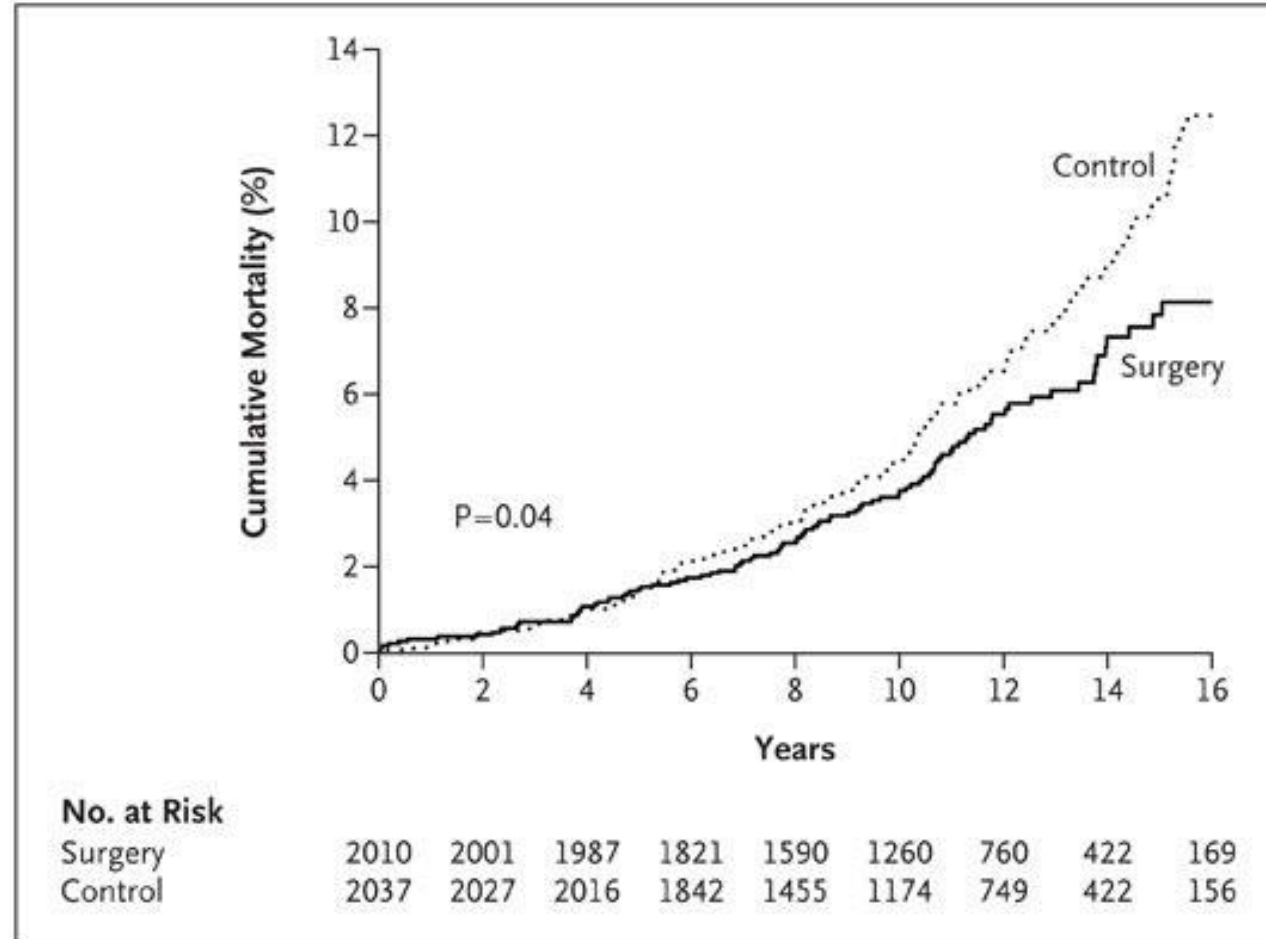


## % active in at work



Sjostrom, L. et al. N Engl J Med 2004;351:2683-2693

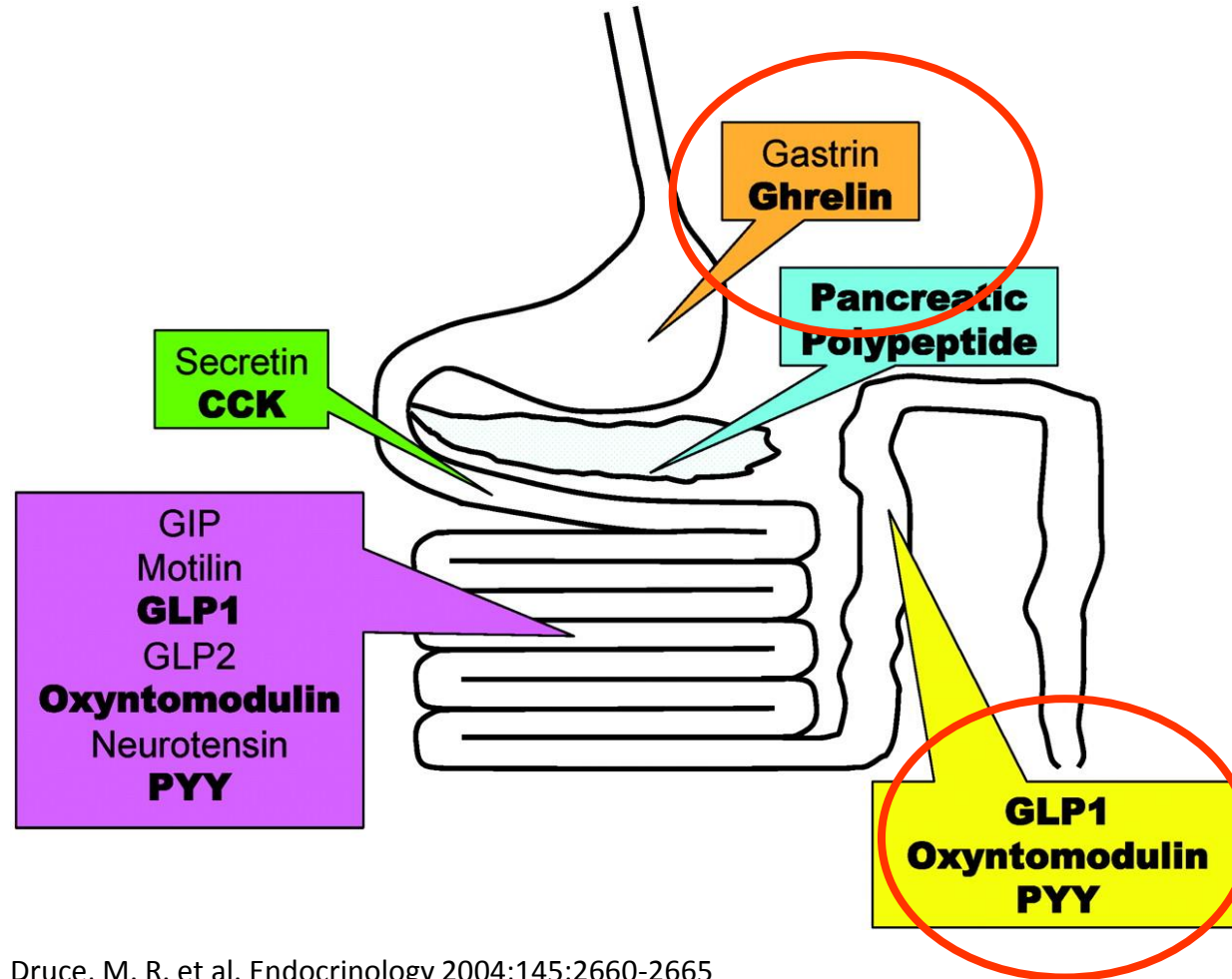
## Improved survival after obesity surgery seen after 10 years



Sjostrom L et al. N Engl J Med 2007;357:741-752

FIG. 2. Hormones produced by the gut

# The Gut Hormones



Druce, M. R. et al. Endocrinology 2004;145:2660-2665

Endocrinology

# Eating quickly – piling your plate



# SCHOOL LUNCH IN FRANCE

Fresh fruit



Water

Beet salad



Camembert  
& baguette



Chicken scallop,  
green peas

# School meals

England:



Sweden:





# Role of “sweetness”

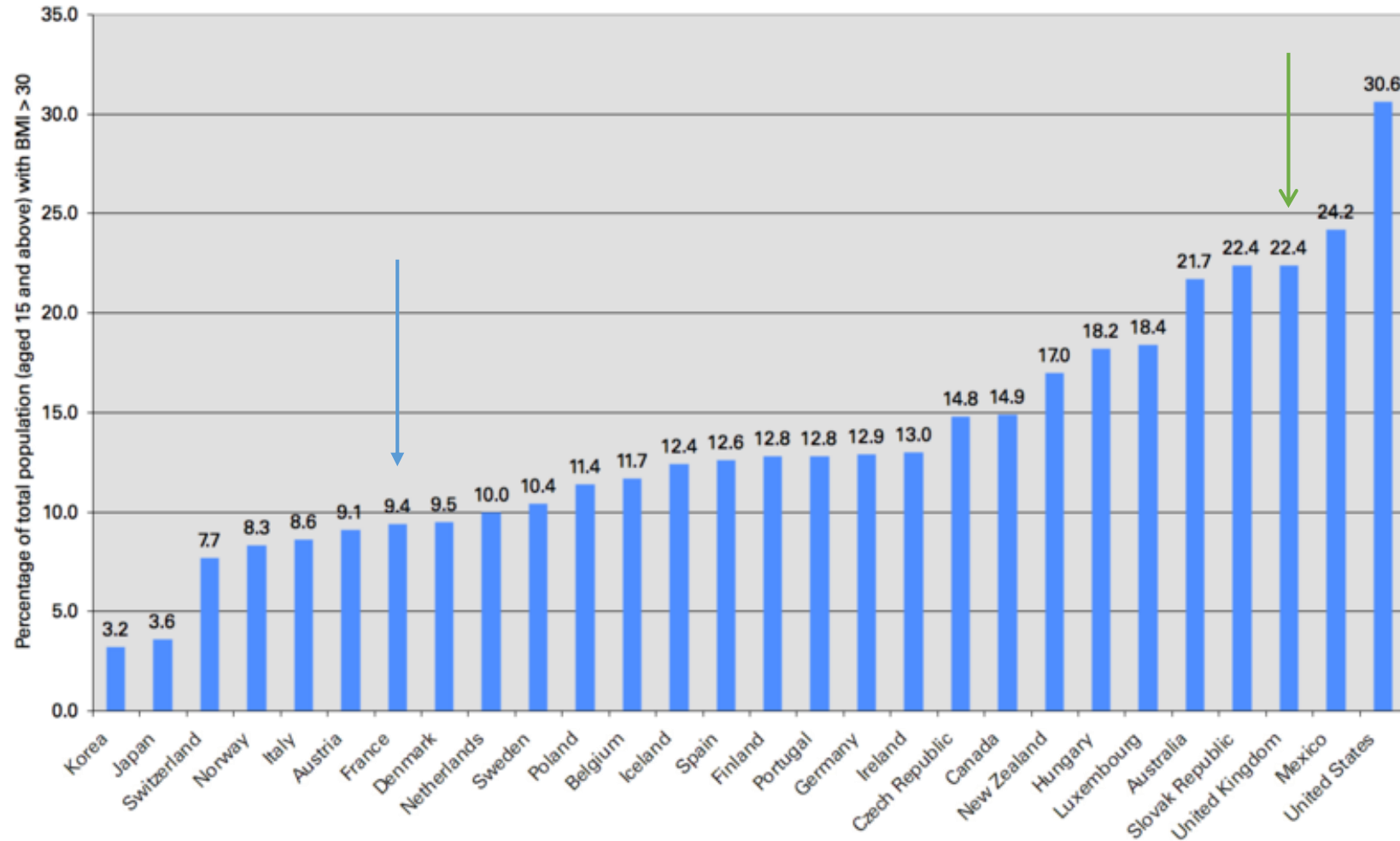
**Diet drinks and food actually trigger weight gain and diabetes, says new study**



“ 17 Comments



# Environmental factors? - Obesity in different countries



15 PENCE PER 100 CALORIES



73 pence per 100 calories

73 pence per 100 calories



# Can we have ouR cake and eat it?

Yes – if it small



...and it fills you up!



# How can we reverse this trend

- Increase awareness of where calories come from in our diet
- Reduce package sizes
- Reduce environmental cues
- Become “Foodies”
- Eat more slowly
- Understand satiety

# Conclusions

- The diabetes epidemic is a product of affluence
- It is driven by caloric intake excess to requirement
- Calorie reduction is more effective than exercise for weight reduction
- Need to re-engineer our diet and environmental clues to reverse current trends rather than conventional “diets”

Colin Dayan

Professor of Clinical Diabetes and Metabolism

# THE EPIDEMIC OF TYPE 2 DIABETES: WHAT SHOULD WE BE DOING?

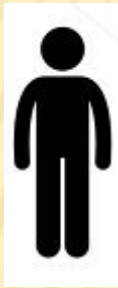




# TYPES OF DIABETES

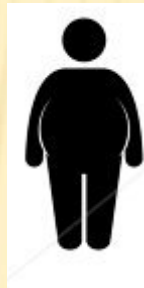
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## Type 1 diabetes



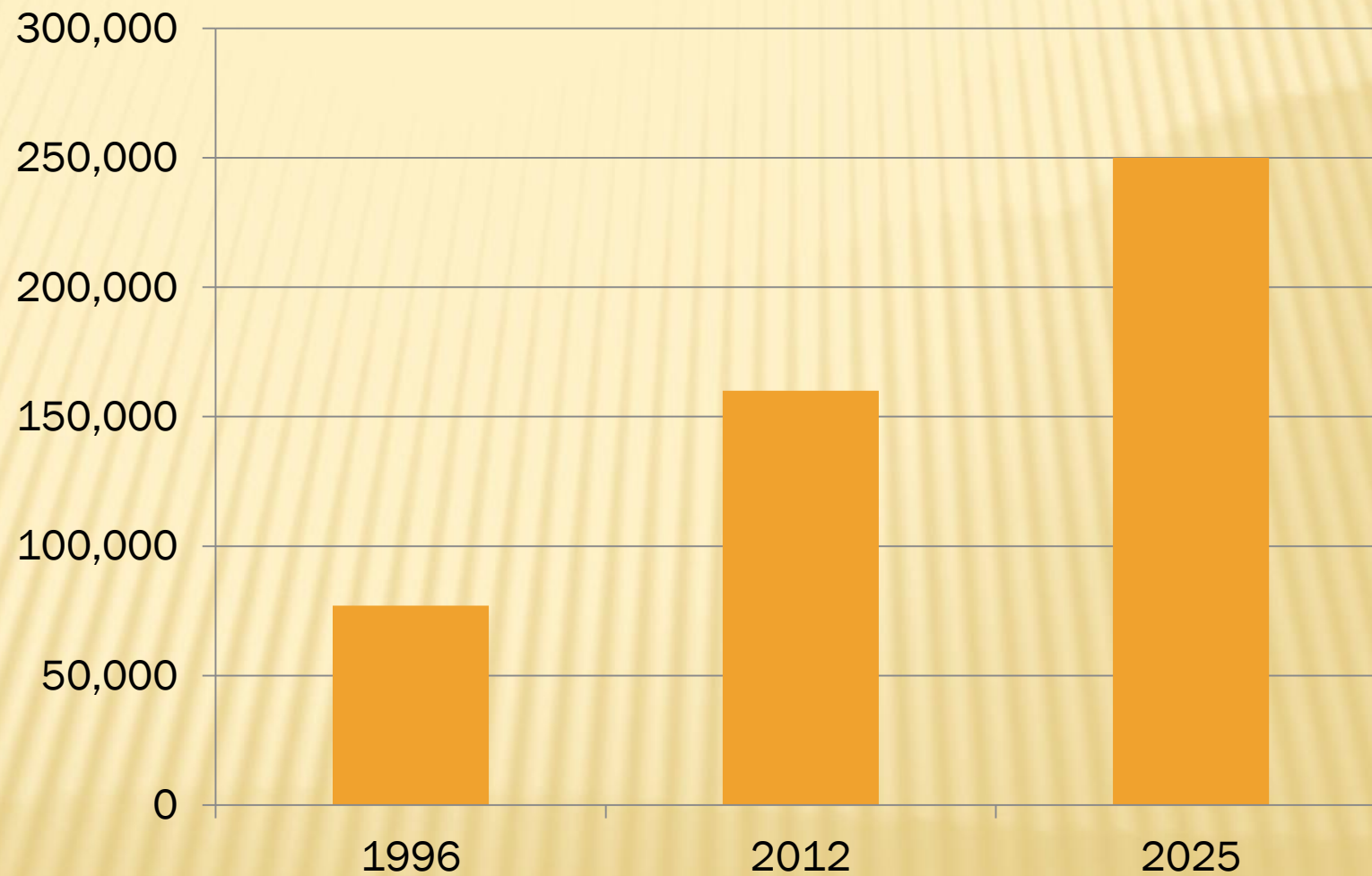
- Lack of insulin
- Autoimmune
- Usually children

## Type 2 diabetes

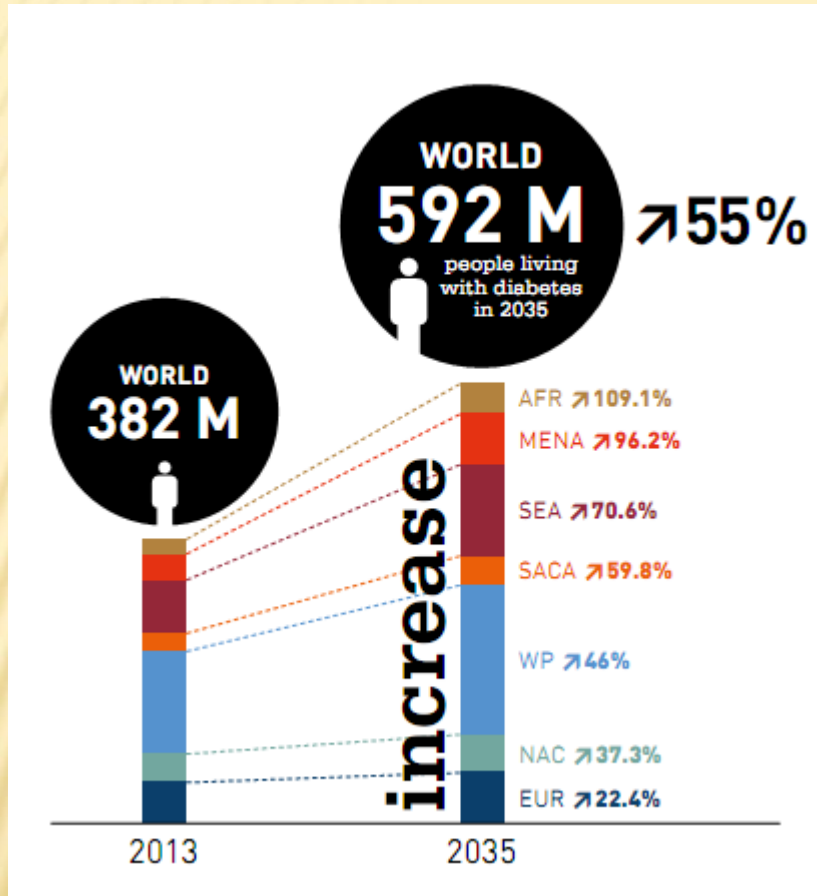


- Insulin resistance
- Lifestyle factors
- Usually adults

# DIABETES IN WALES

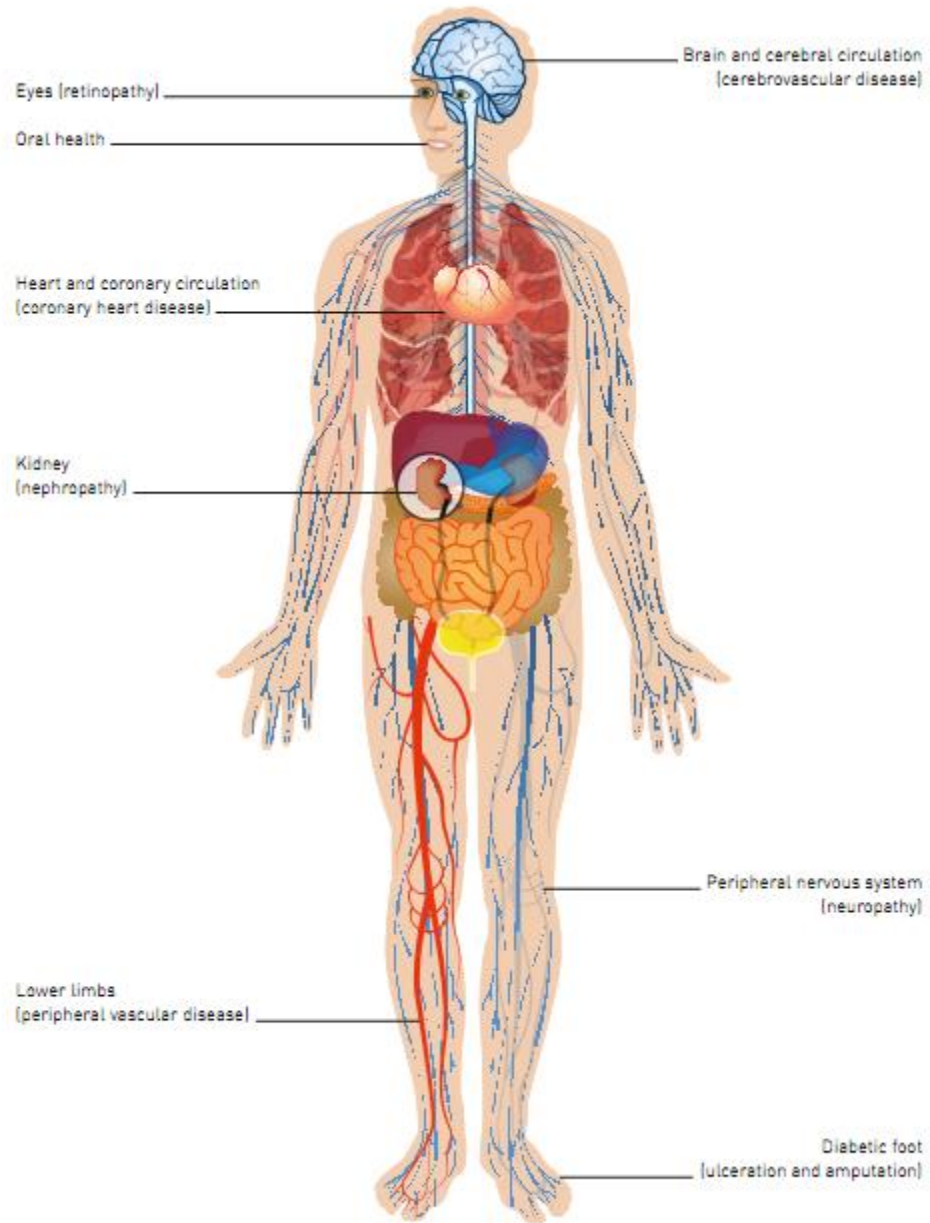


## Diabetes worldwide



382 million people have diabetes

By 2035, this number will rise to 592 million



# MAJOR DIABETES COMPLICATIONS

- ✘ Cardiovascular disease
- ✘ Eyes
- ✘ Kidney
- ✘ Feet
  
- ✘ Liver cirrhosis
- ✘ Dementia

# WHY IS DIABETES BECOMING MORE COMMON?

- ✗ Genetics?
- ✗ Environment (behaviour)?

# GENETICS OF TYPE 2 DIABETES: CONFIRMED LOCI CONTRIBUTING TO TYPE 2 DM – GENOME WIDE ASSOCIATION STUDIES:

Obesity/insulin resistance

- × *FTO*
- × *PPARG*

Odds ratios 1.1 – 1.5

Pancreas development /islet function

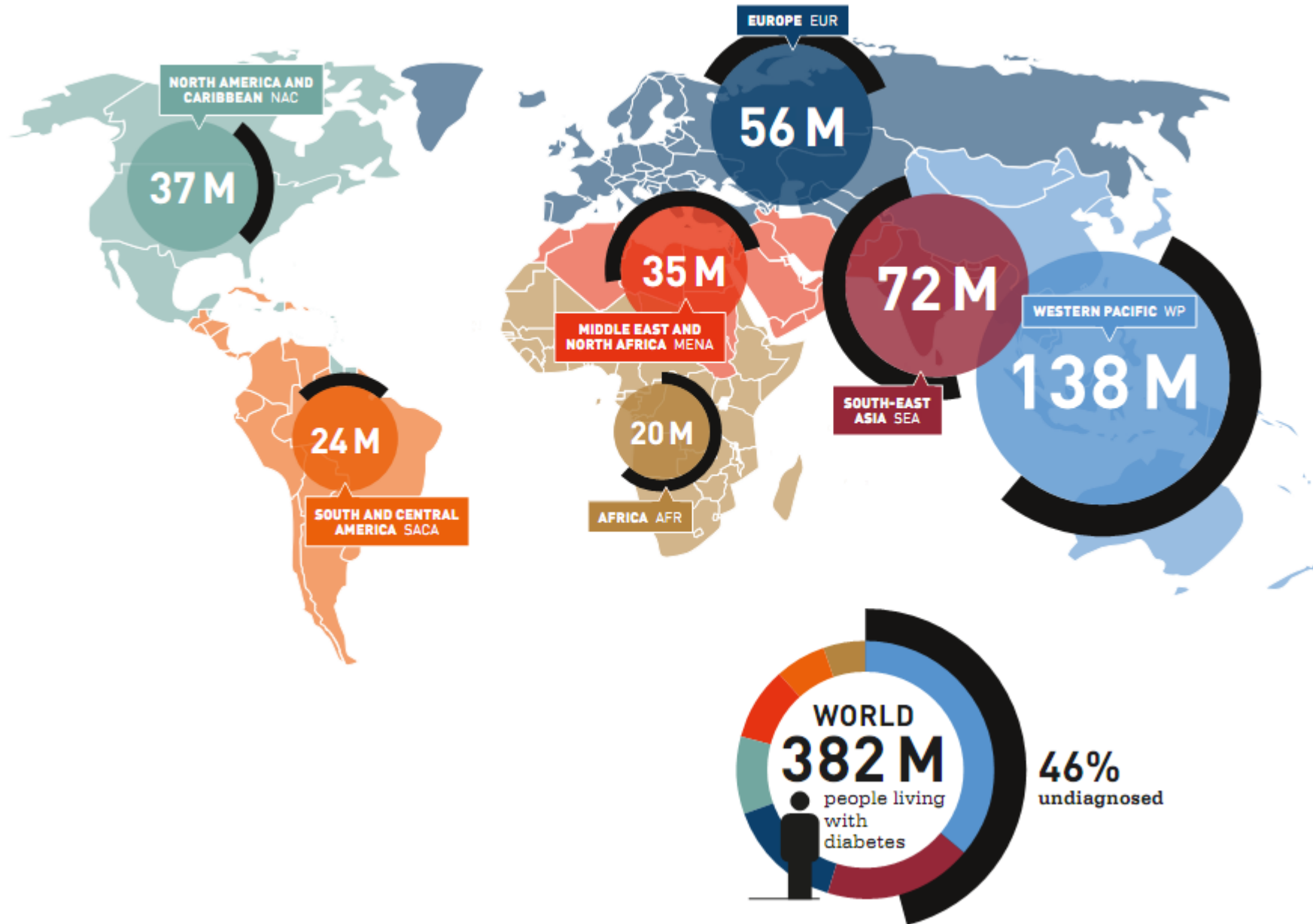
- × *TCF7L2*
- × *KCNJ11,*
- × *HHEX/IDE,*
- × *CDKAL1,*
- × *CDKN2*
- × *IGF2BP2,*
- × *SLC30A8*

# ENVIRONMENTAL FACTORS IN TYPE 2 DIABETES

*“The richer you are, the more you eat  
and the less you do”*

	<b>Average BMI</b>	<b>Prevalence of diabetes</b>
Rural Cameroon	21.6	0.8%
Urban Cameroon	26.0	2.0%
Jamaica	24.7	7.4%
UK	27.4	11.2%

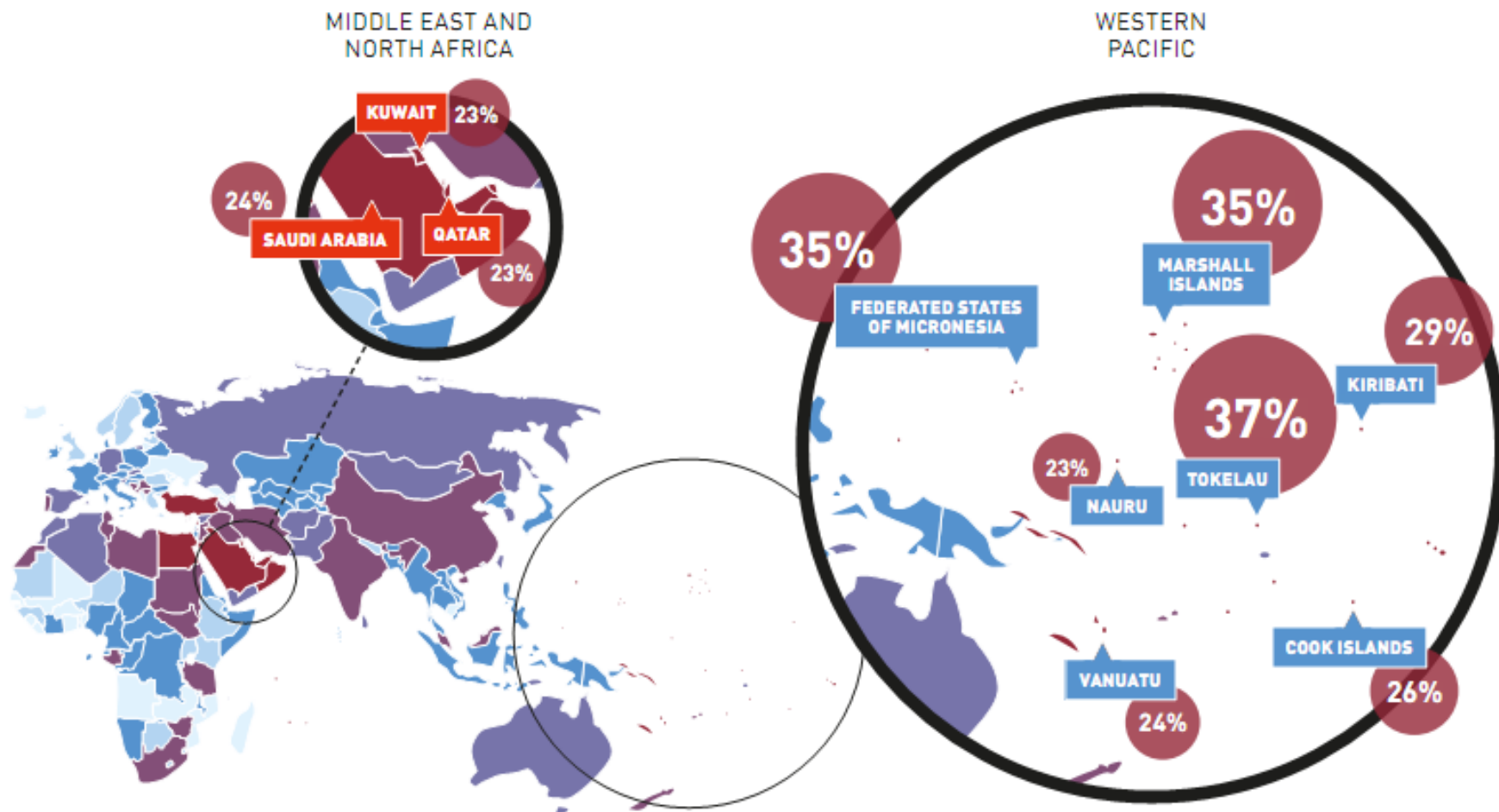
## Number of people with diabetes by IDF Region, 2013





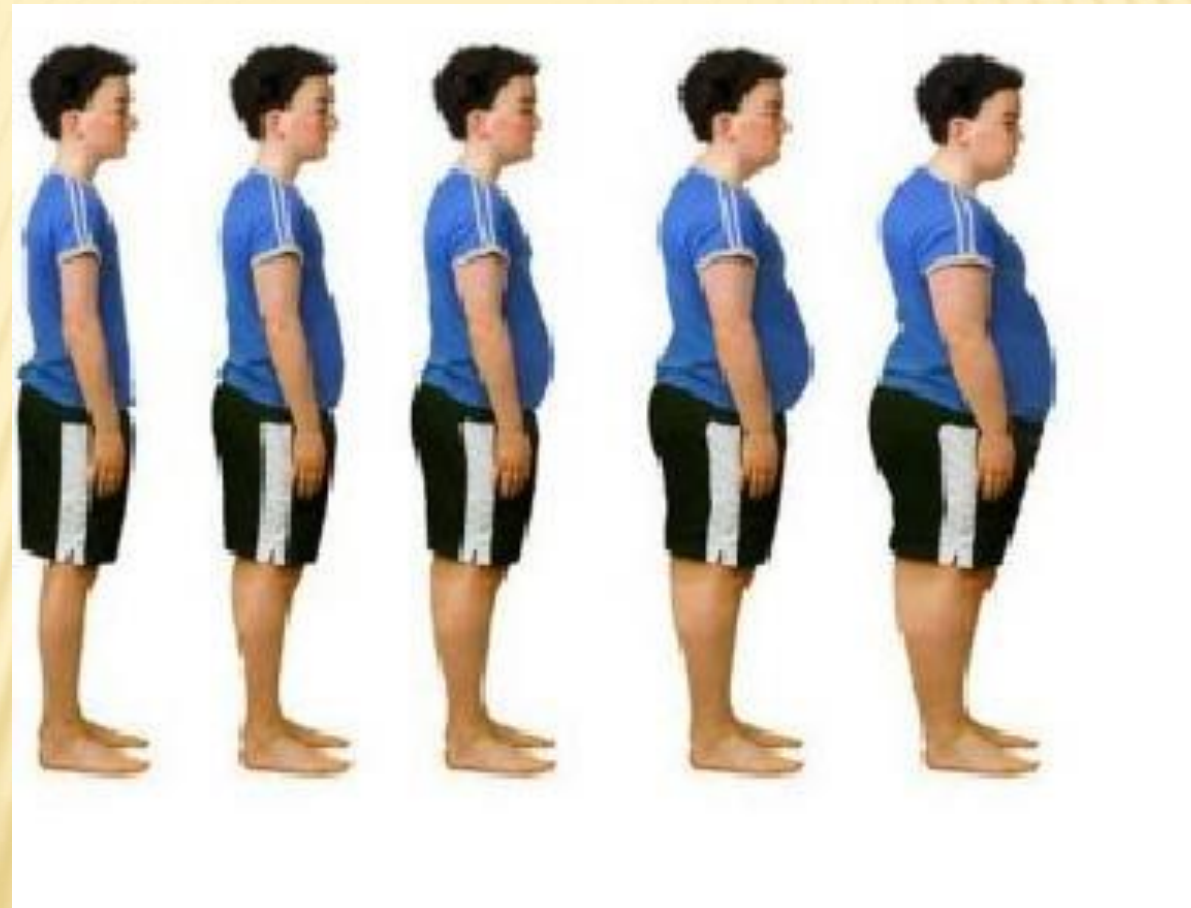
## Top 10 countries/territories for prevalence\* (%) of diabetes (20-79 years), 2013

\* comparative prevalence



**THE DIABETES EPIDEMIC.... (TYPE 2)**

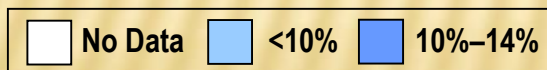
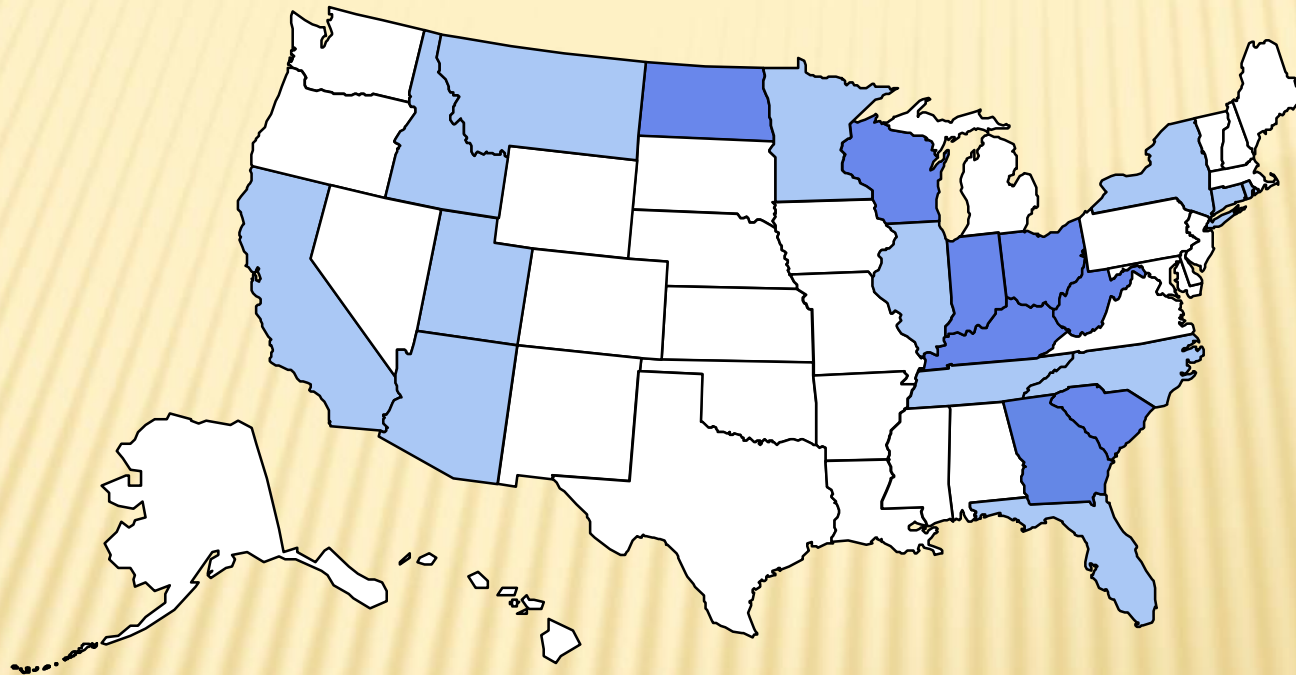
**....IS LINKED TO THE OBESITY EPIDEMIC**



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1985

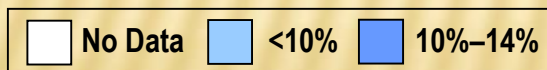
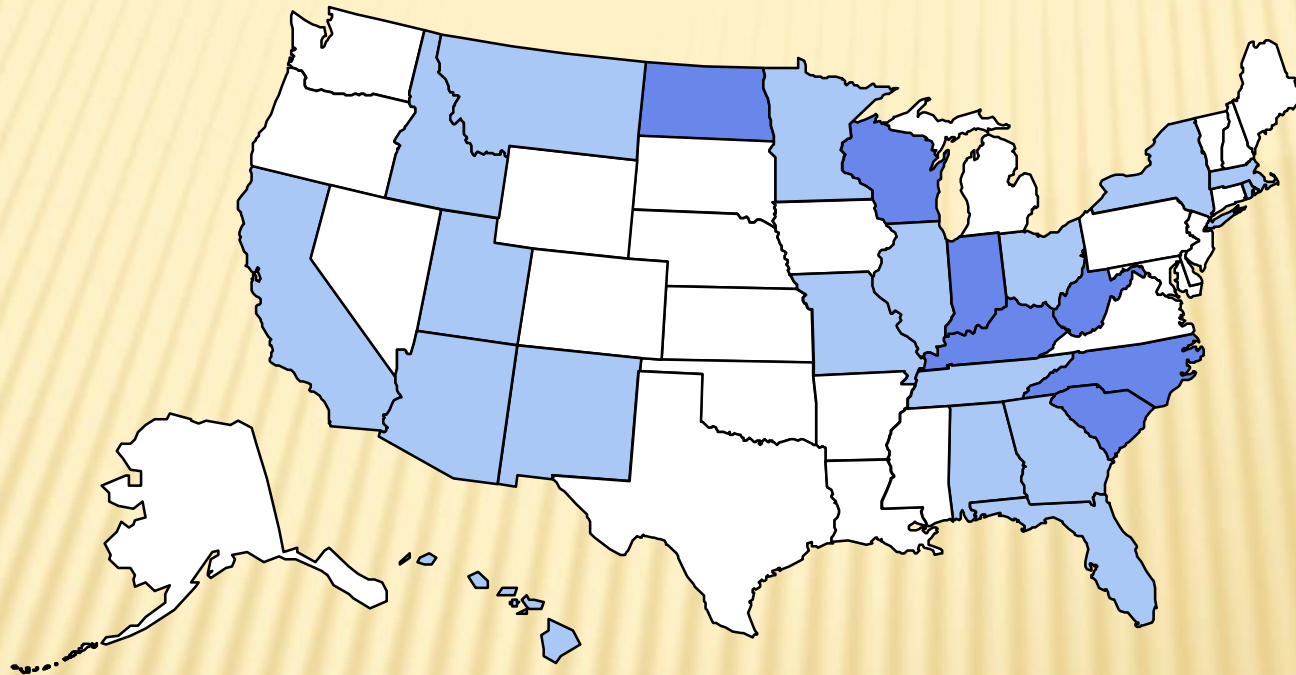
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1986

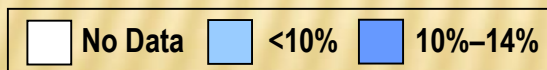
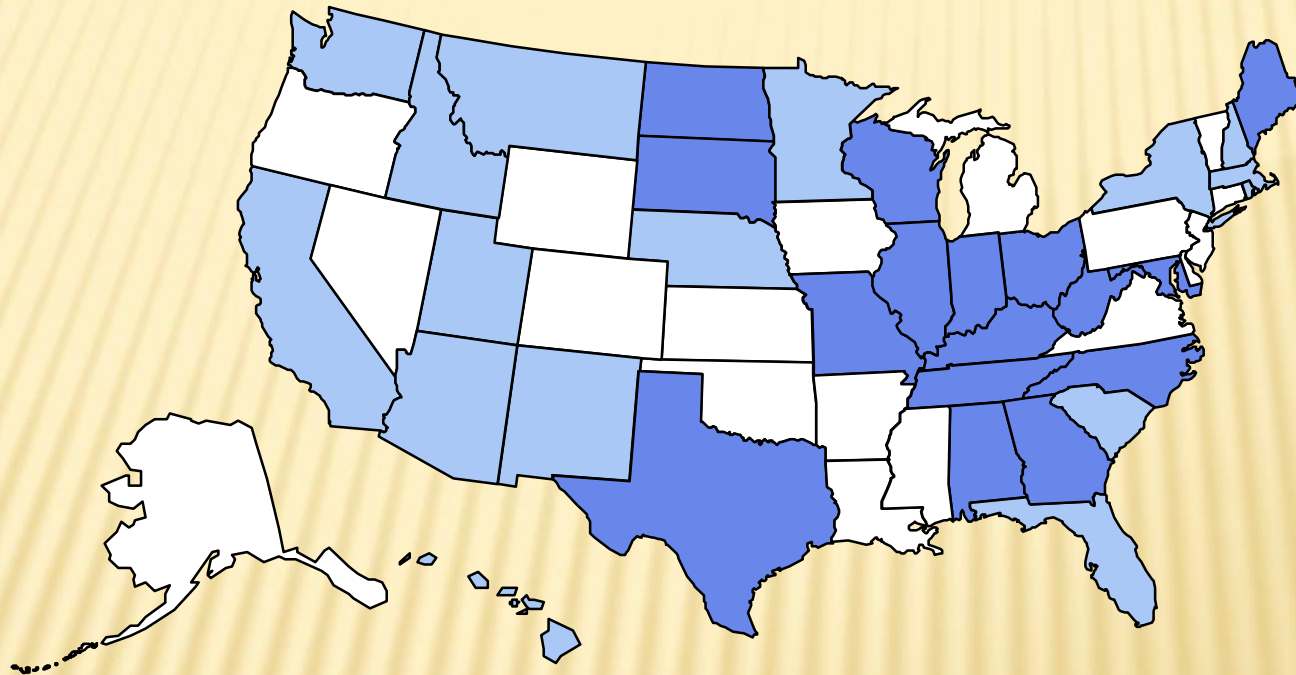
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1987

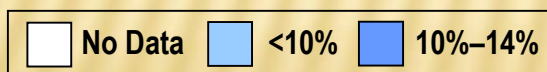
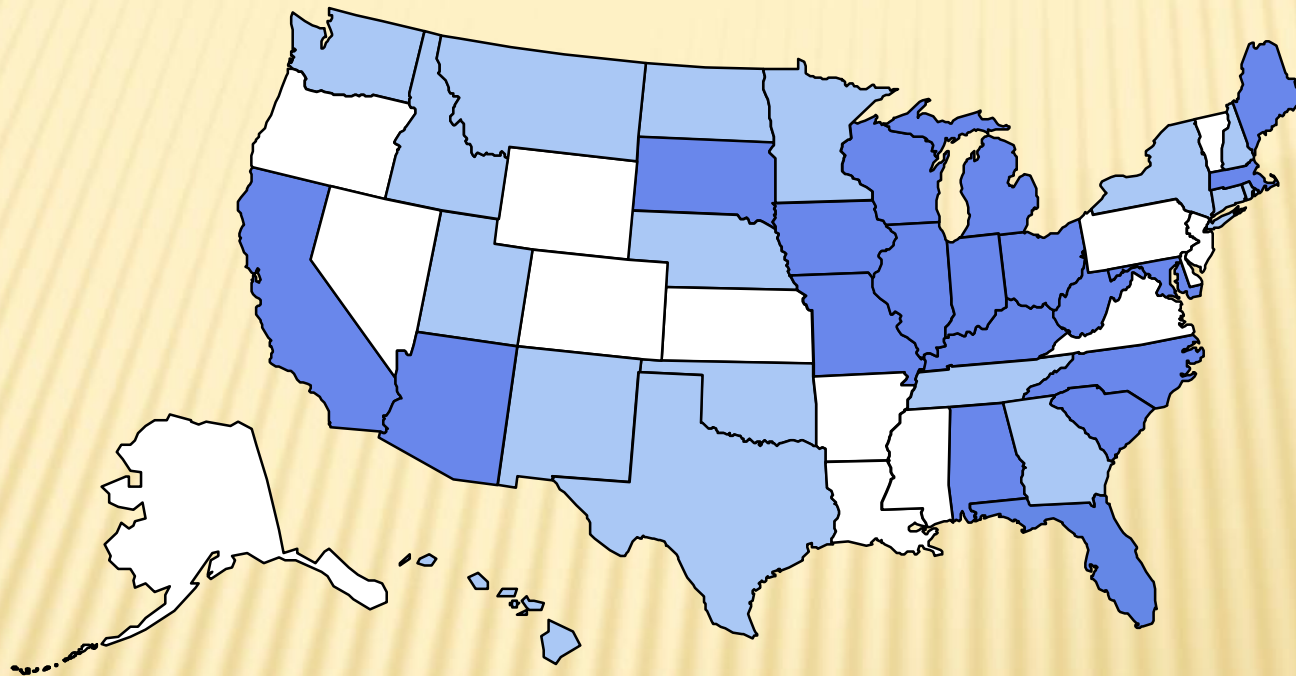
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

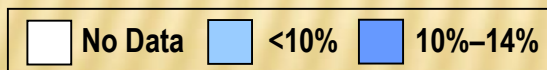
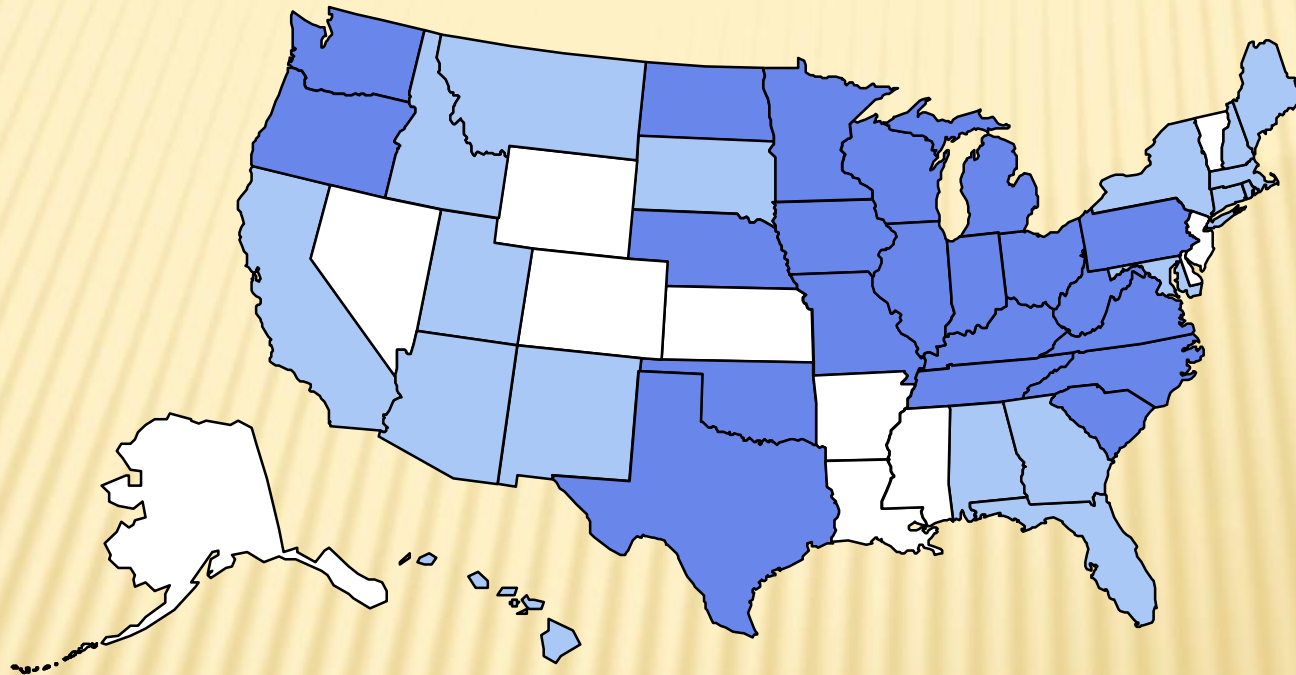
## BRFSS, 1988

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



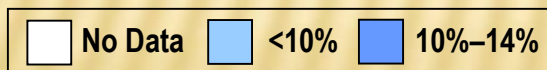
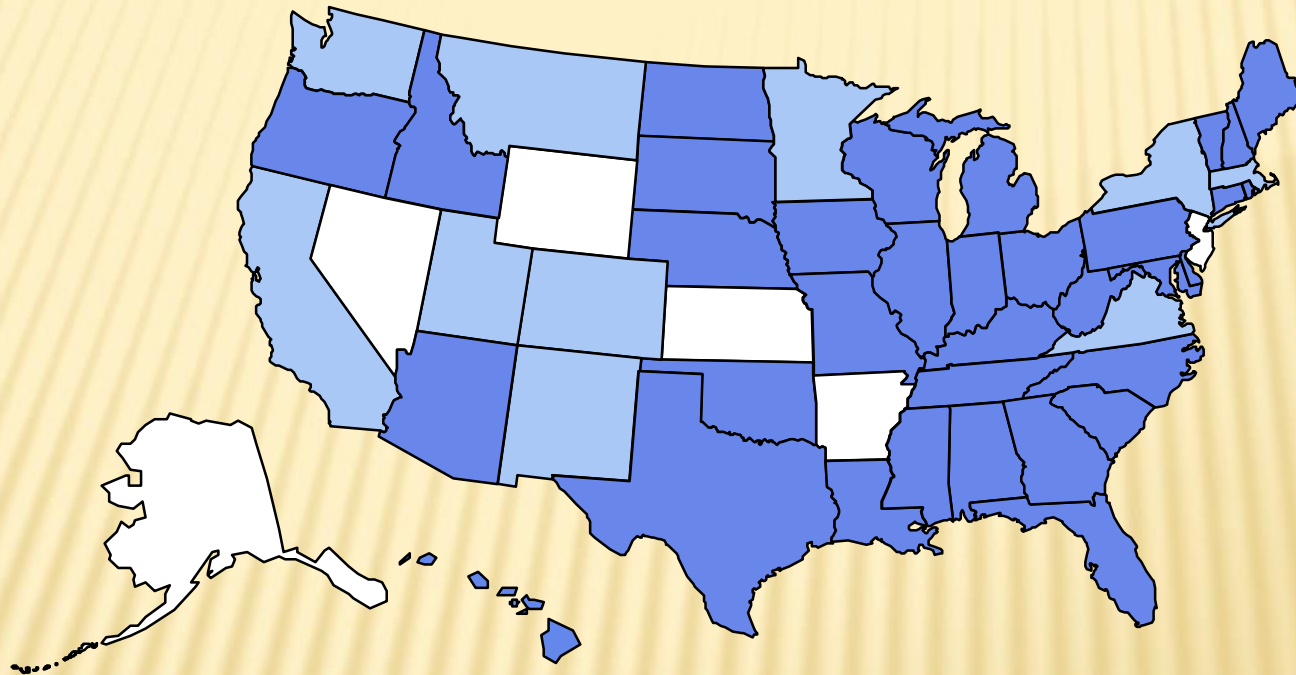
# OBESITY TRENDS\* AMONG U.S. ADULTS BRFSS, 1989

(\*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)

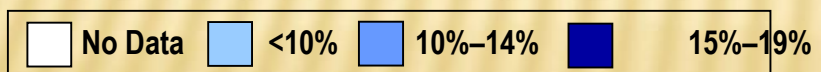
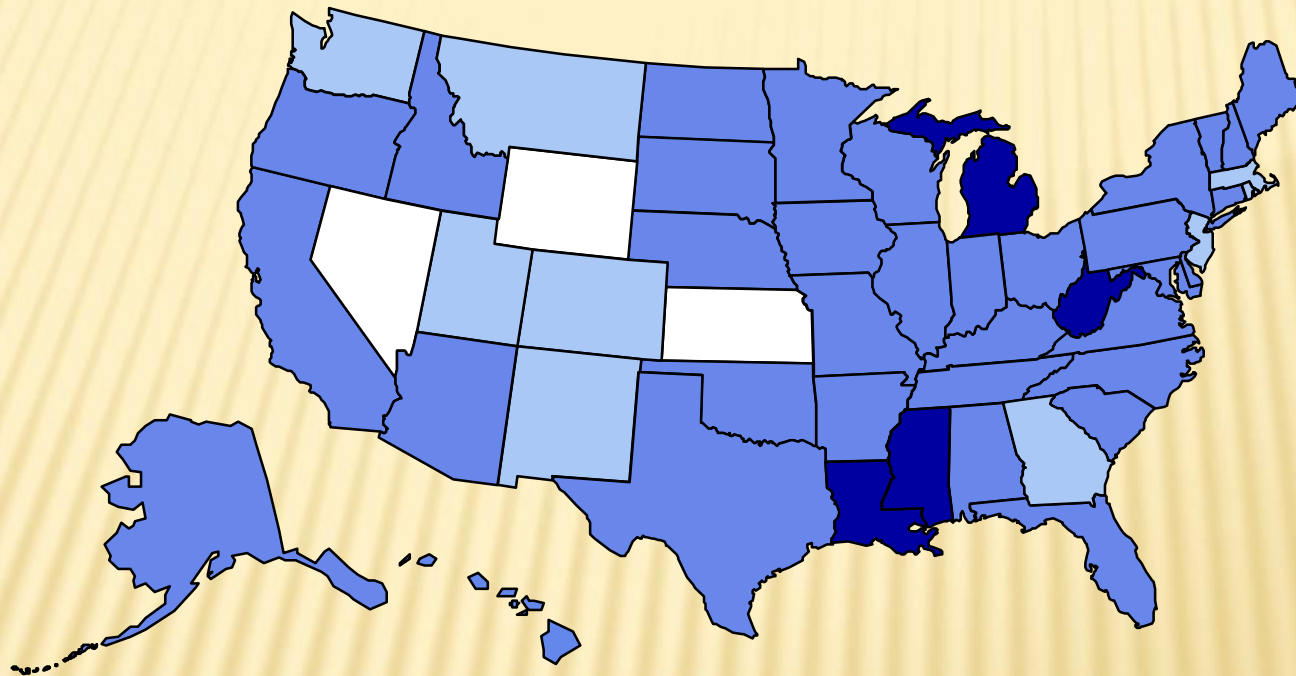




# OBESITY TRENDS\* AMONG U.S. ADULTS

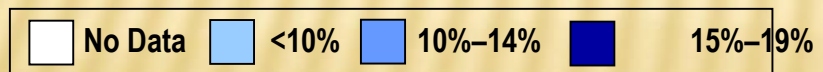
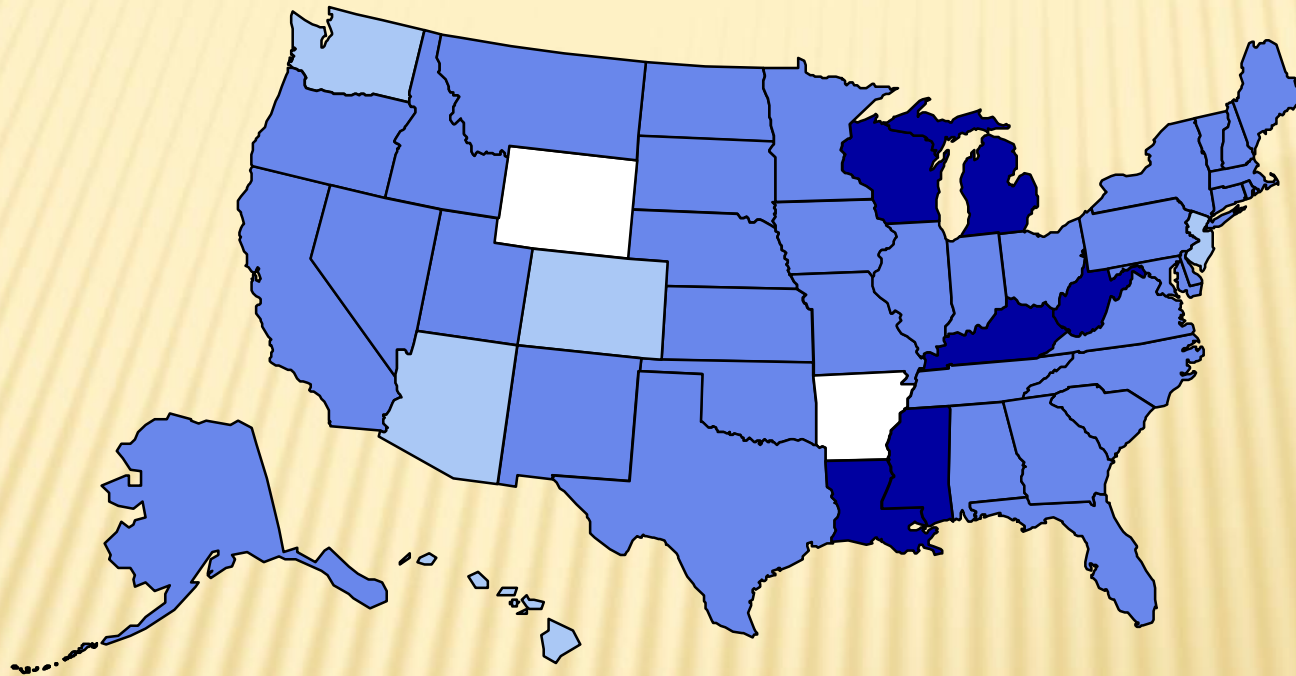
## BRFSS, 1991

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



# OBESITY TRENDS\* AMONG U.S. ADULTS BRFSS, 1992

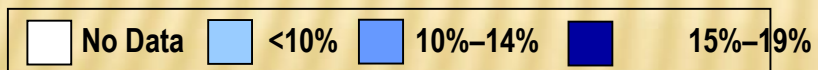
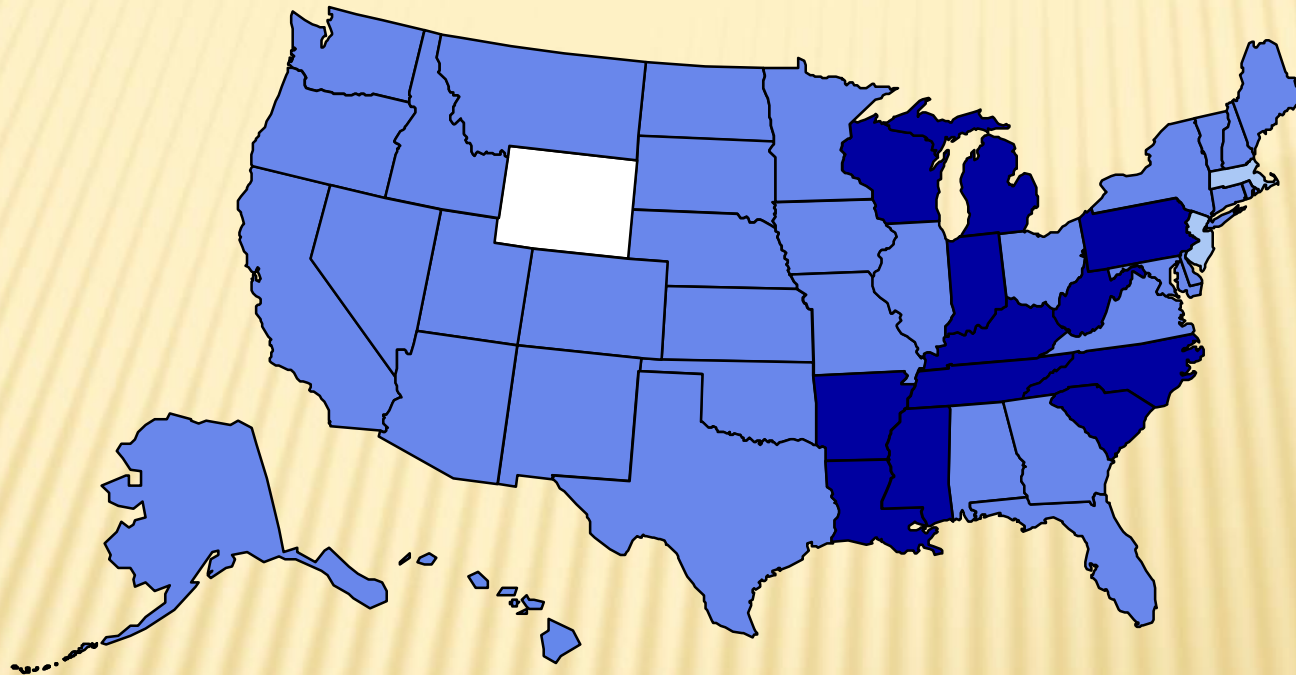
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1993

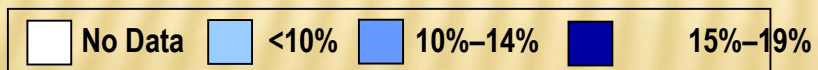
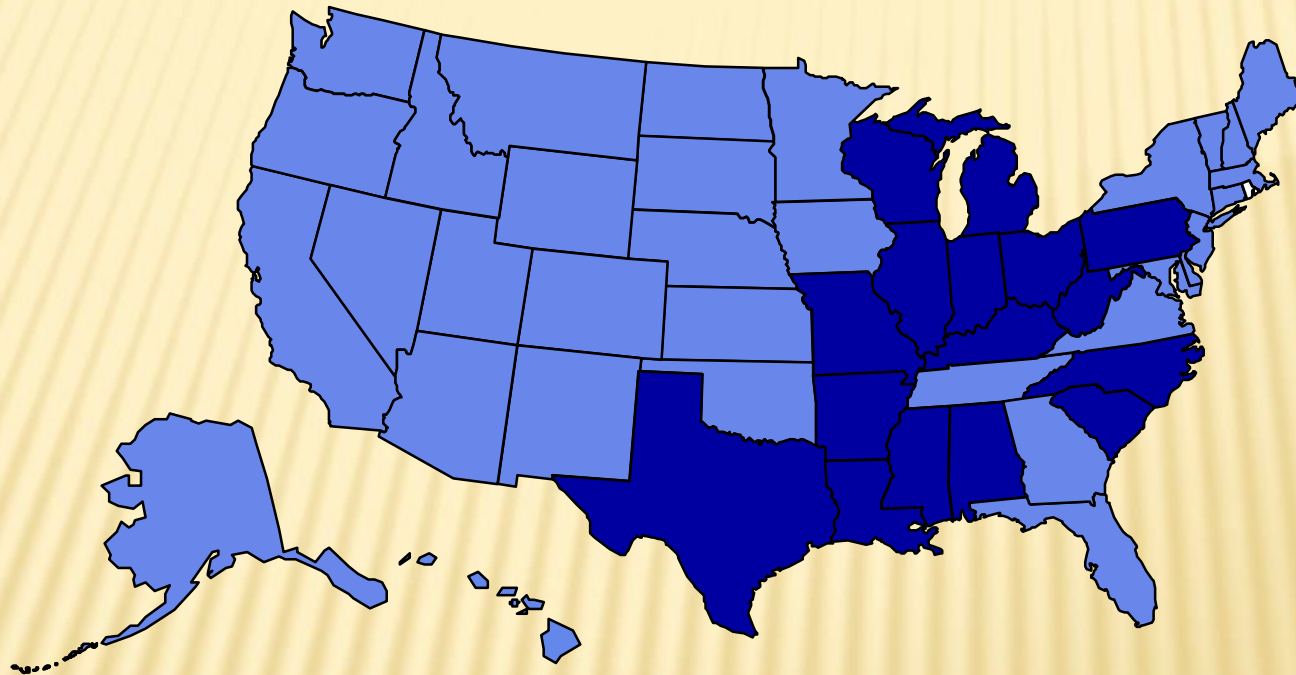
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1994

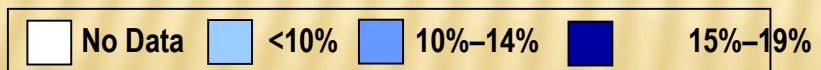
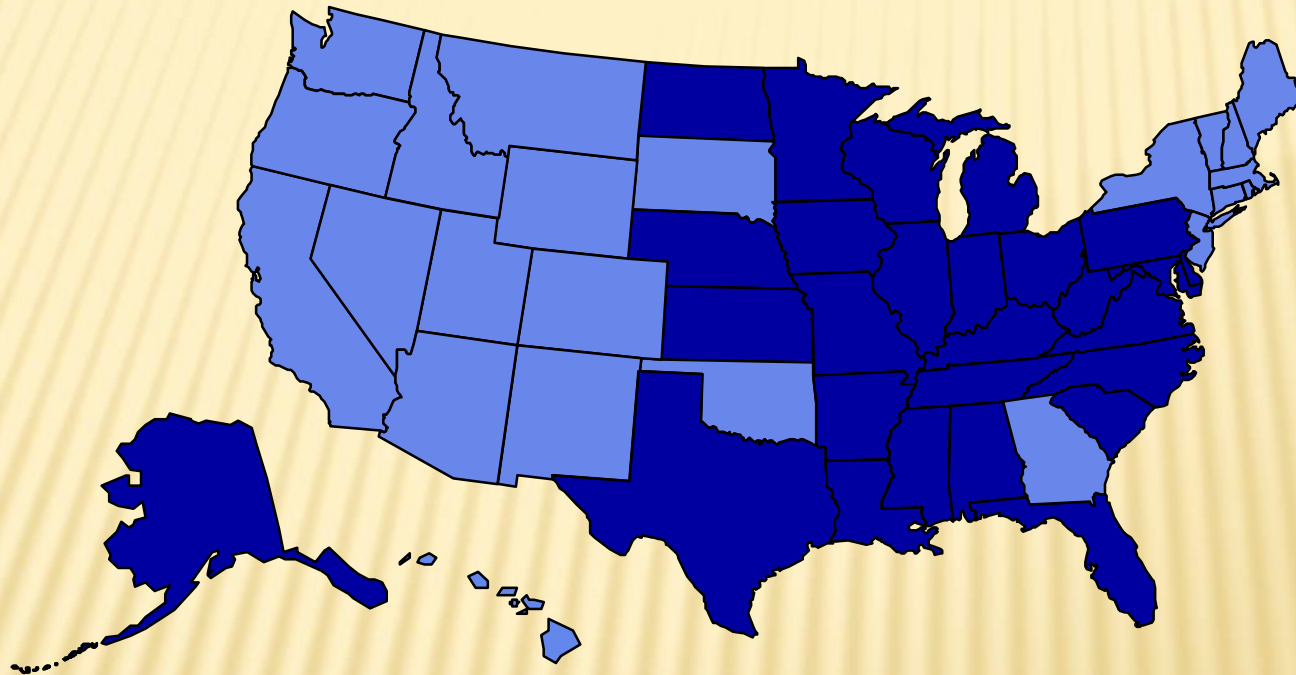
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 1995

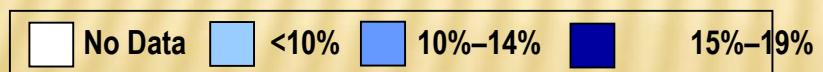
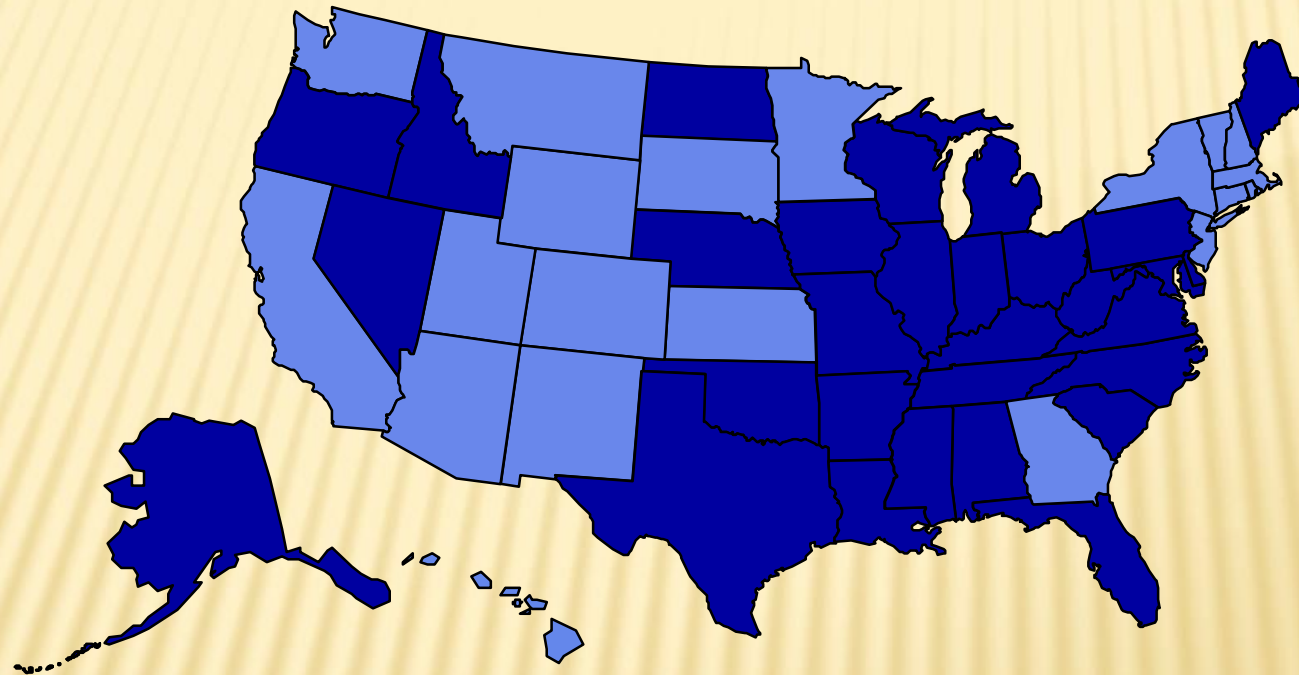
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

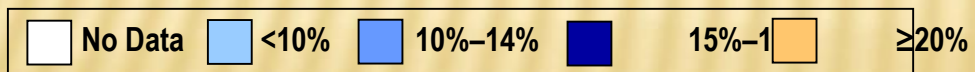
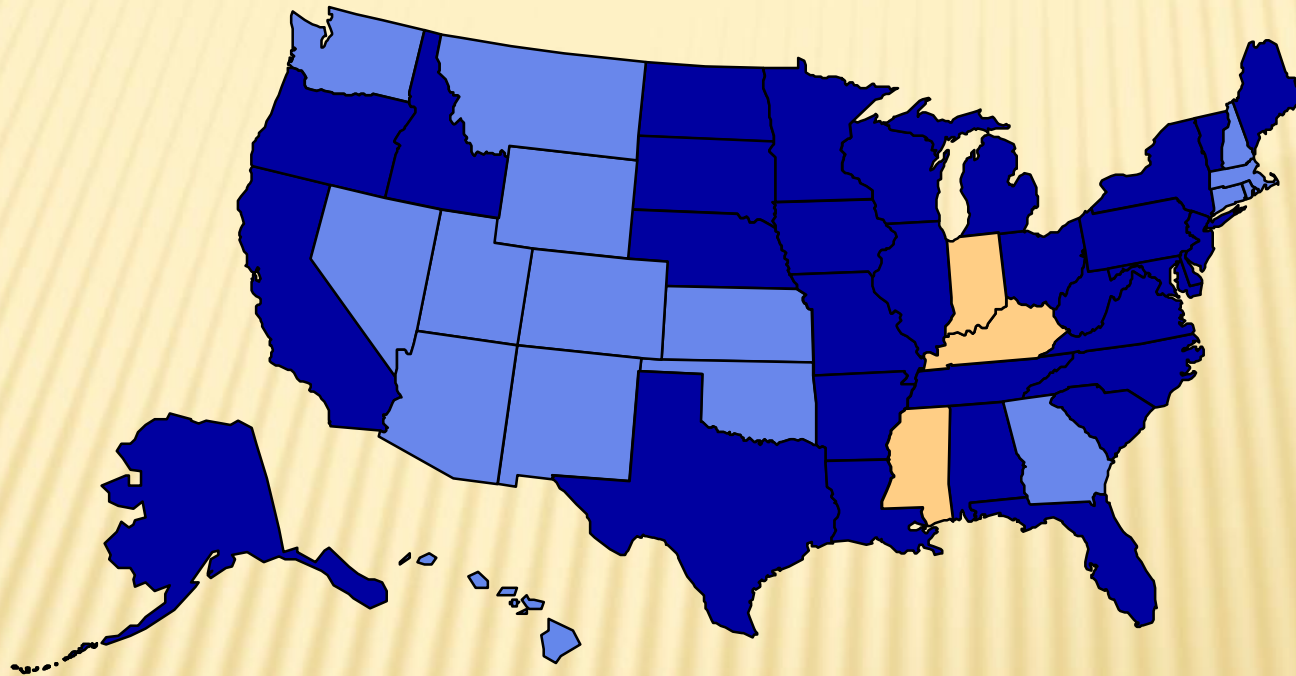
## BRFSS, 1996

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



# OBESITY TRENDS\* AMONG U.S. ADULTS BRFSS, 1997

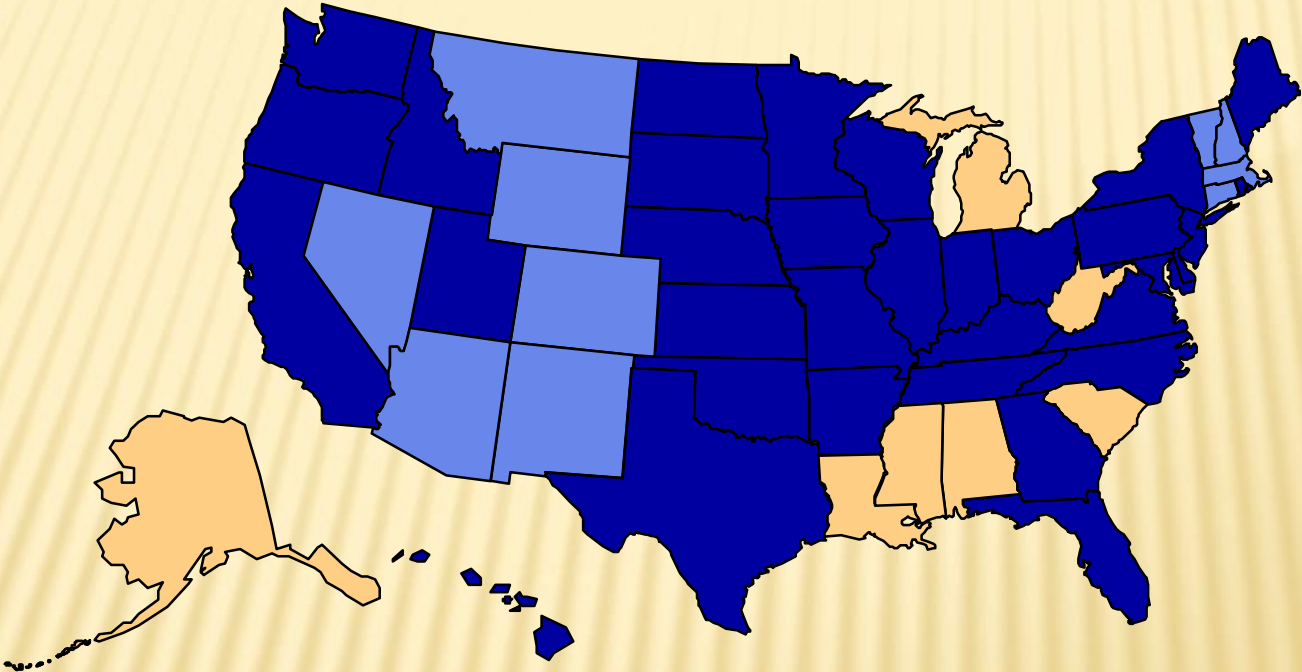
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

BRFSS, 1998

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



No Data <10% 10%-14% 15%-19%  $\geq 20\%$



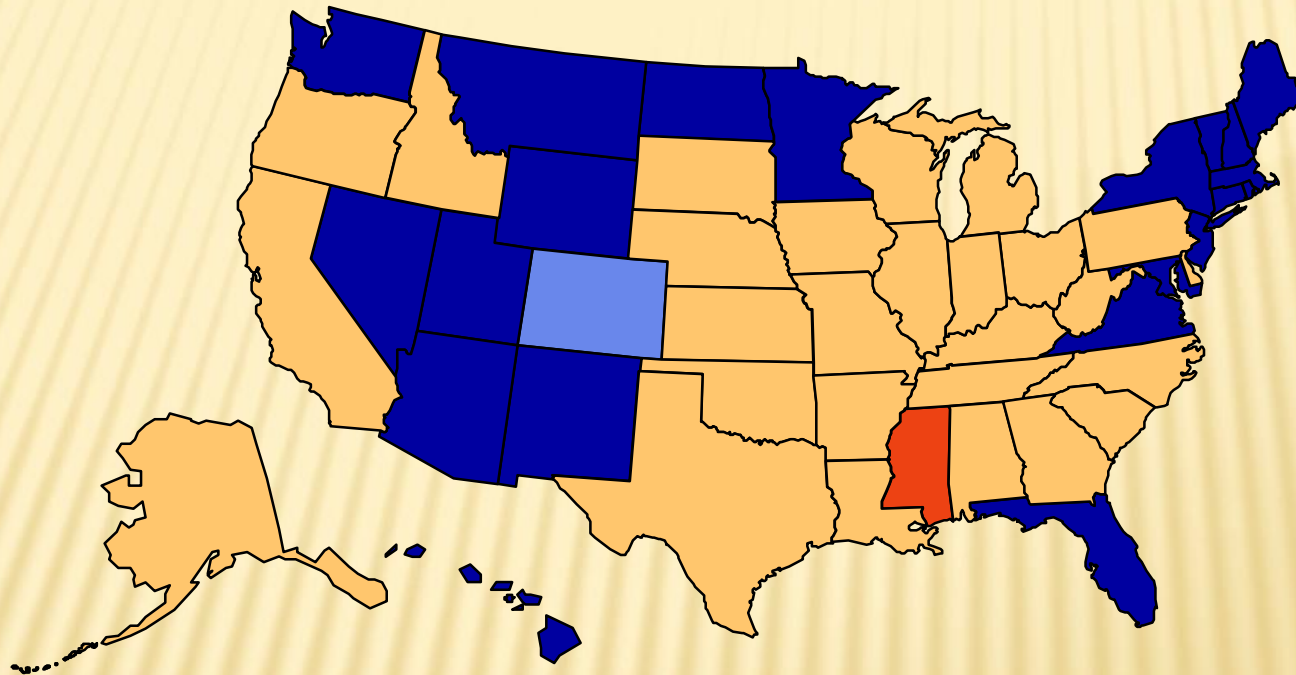




# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2001

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





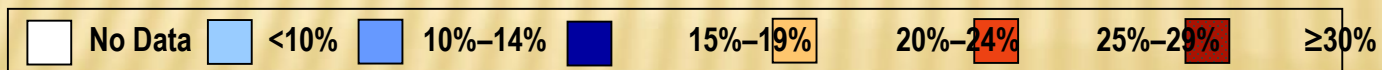
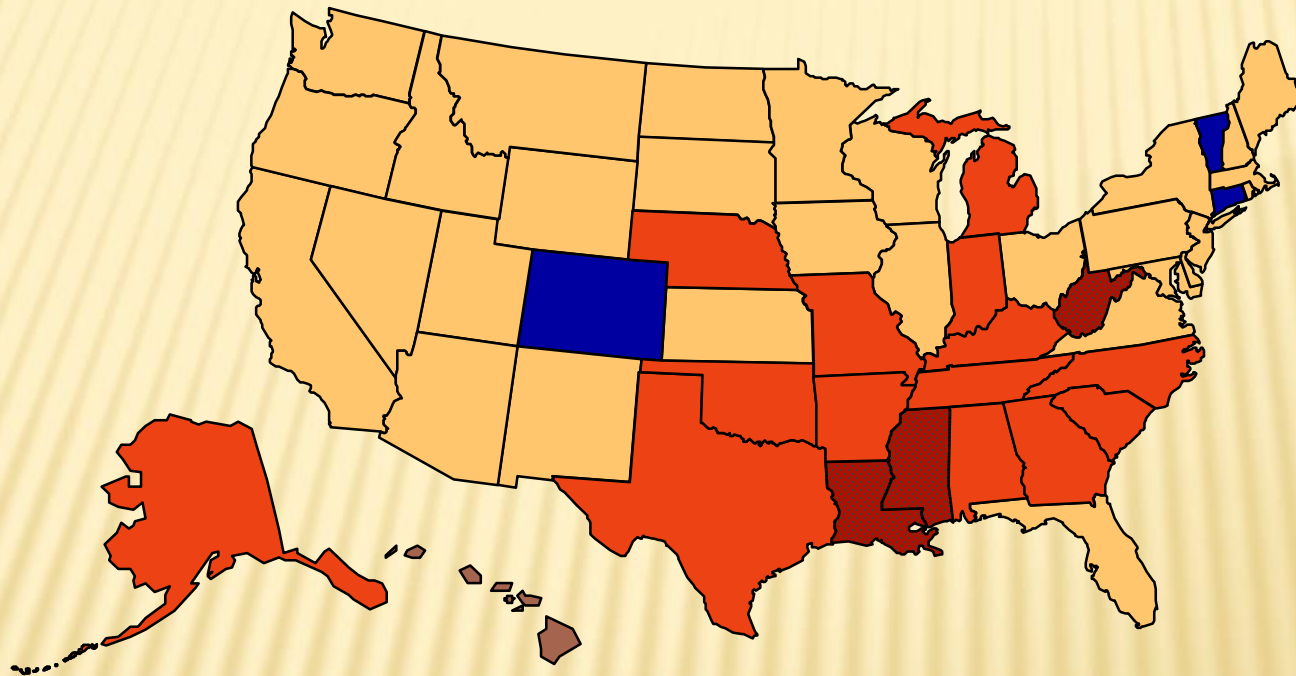




# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2005

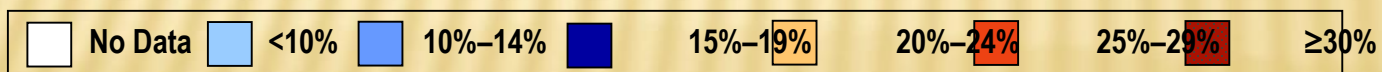
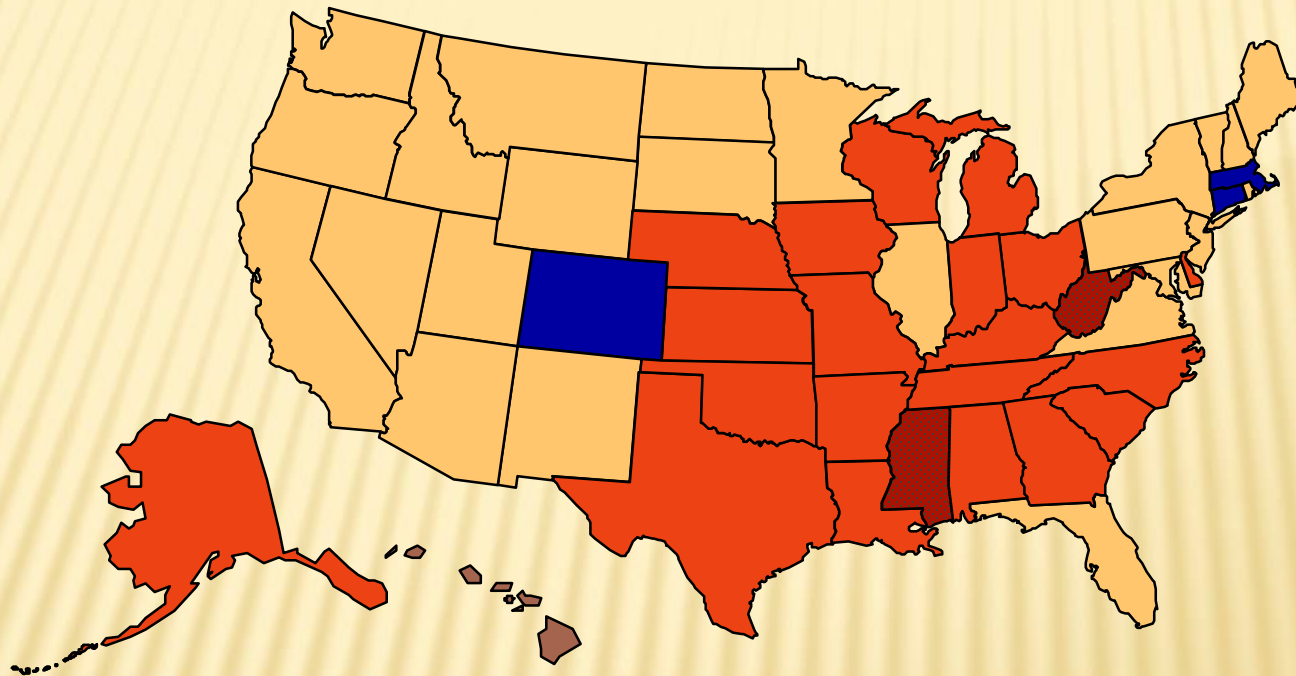
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2006

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

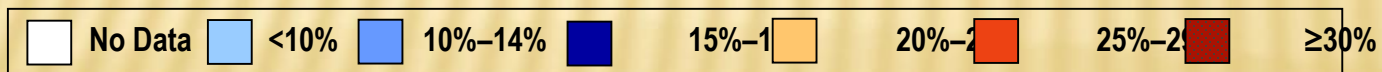
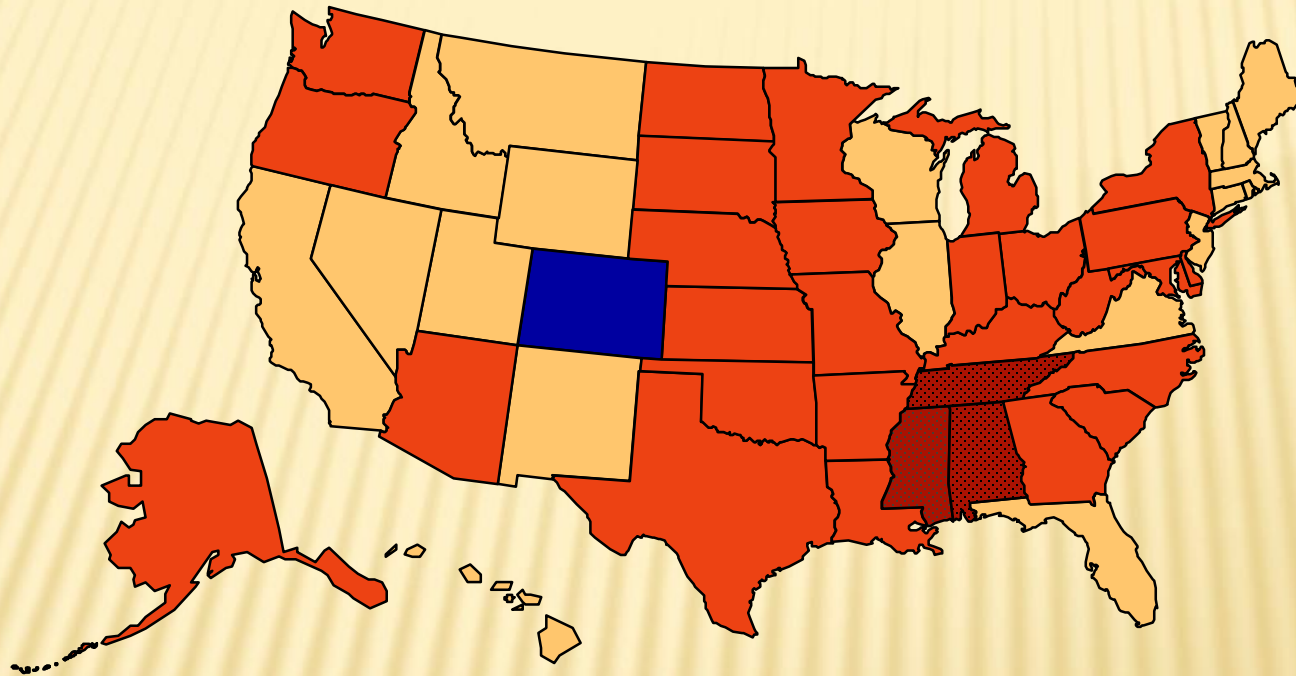




# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2007

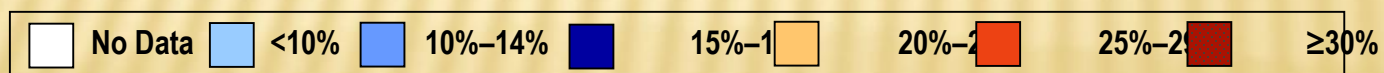
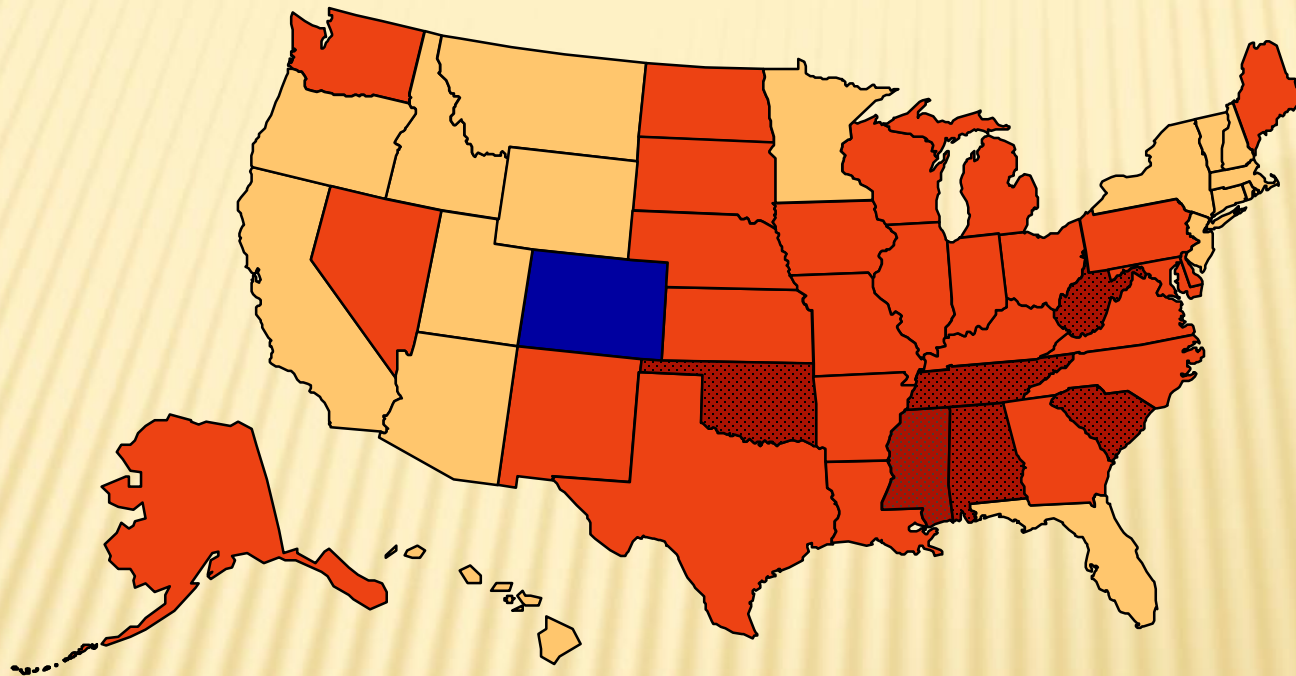
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2008

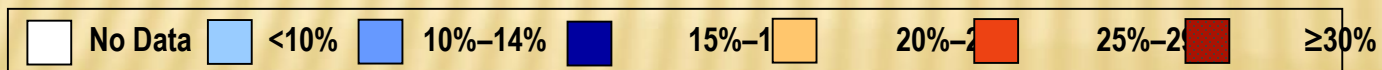
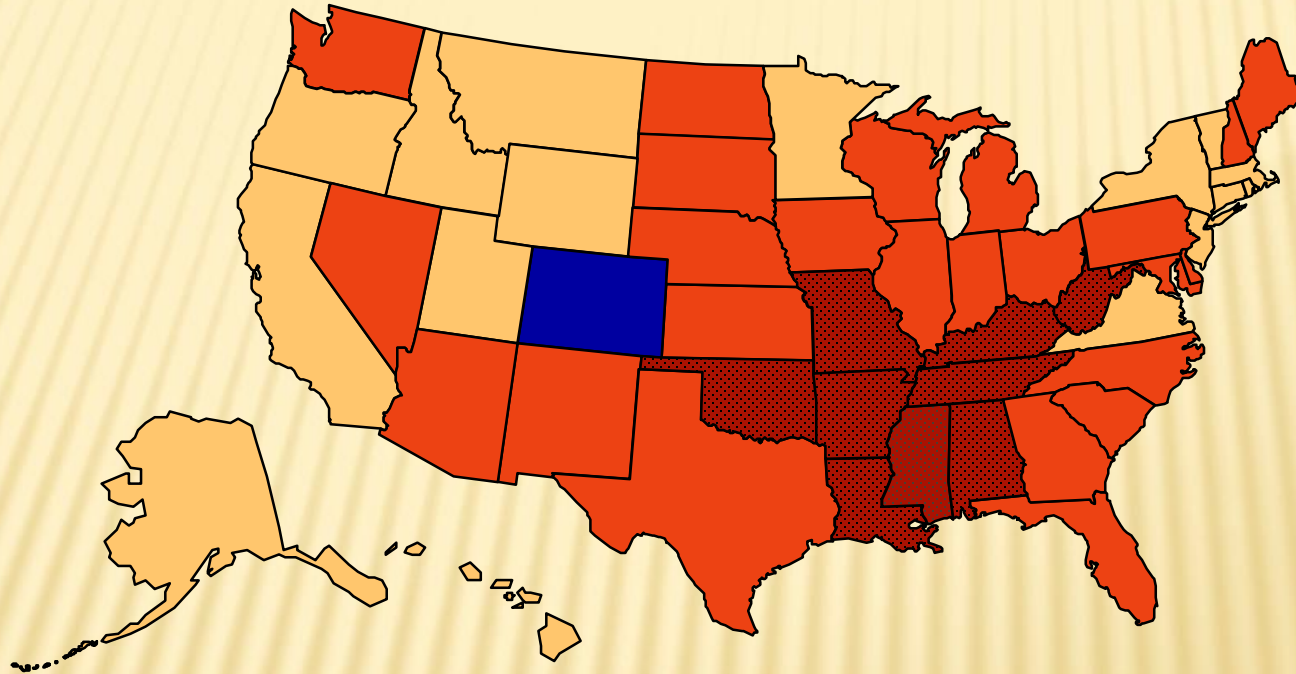
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2009

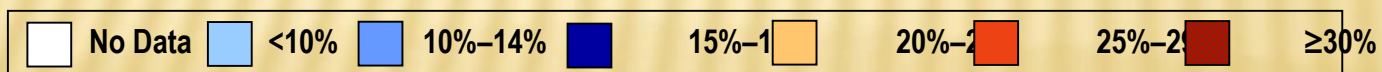
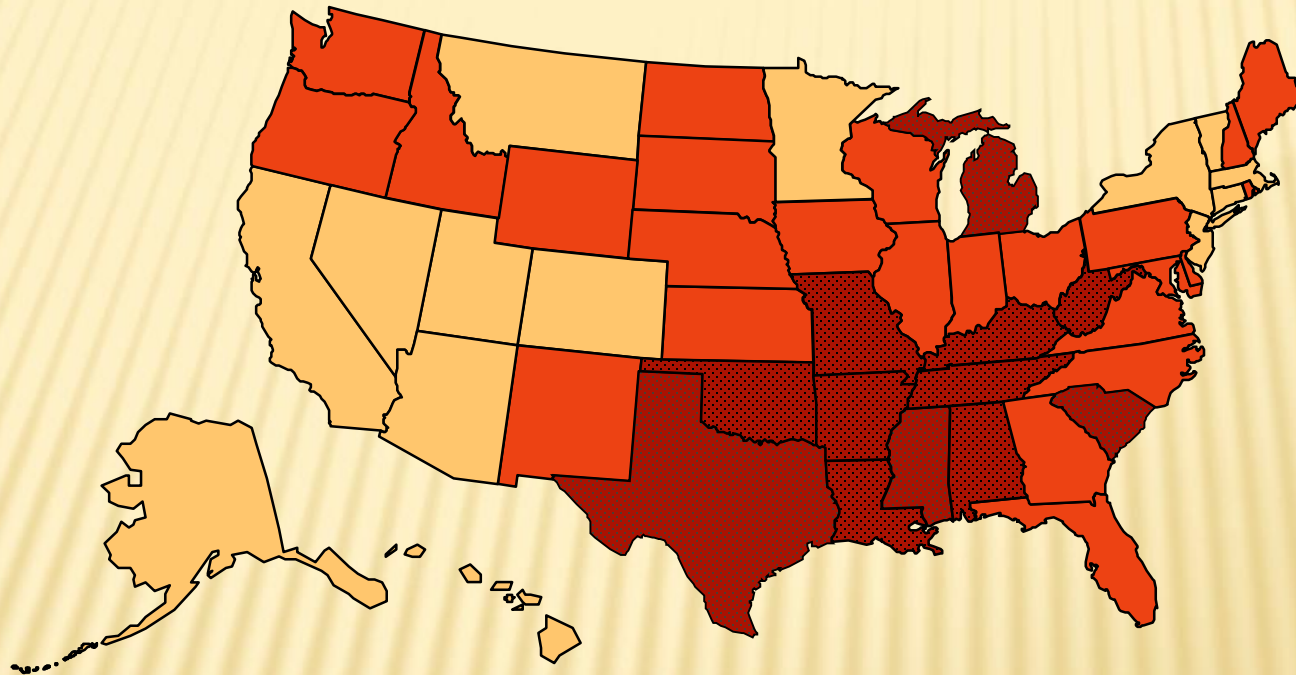
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



# OBESITY TRENDS\* AMONG U.S. ADULTS

## BRFSS, 2010

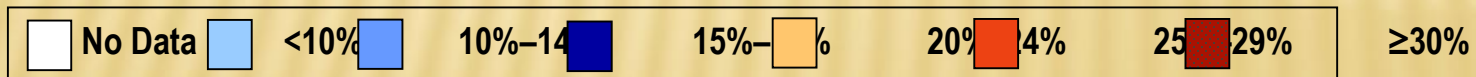
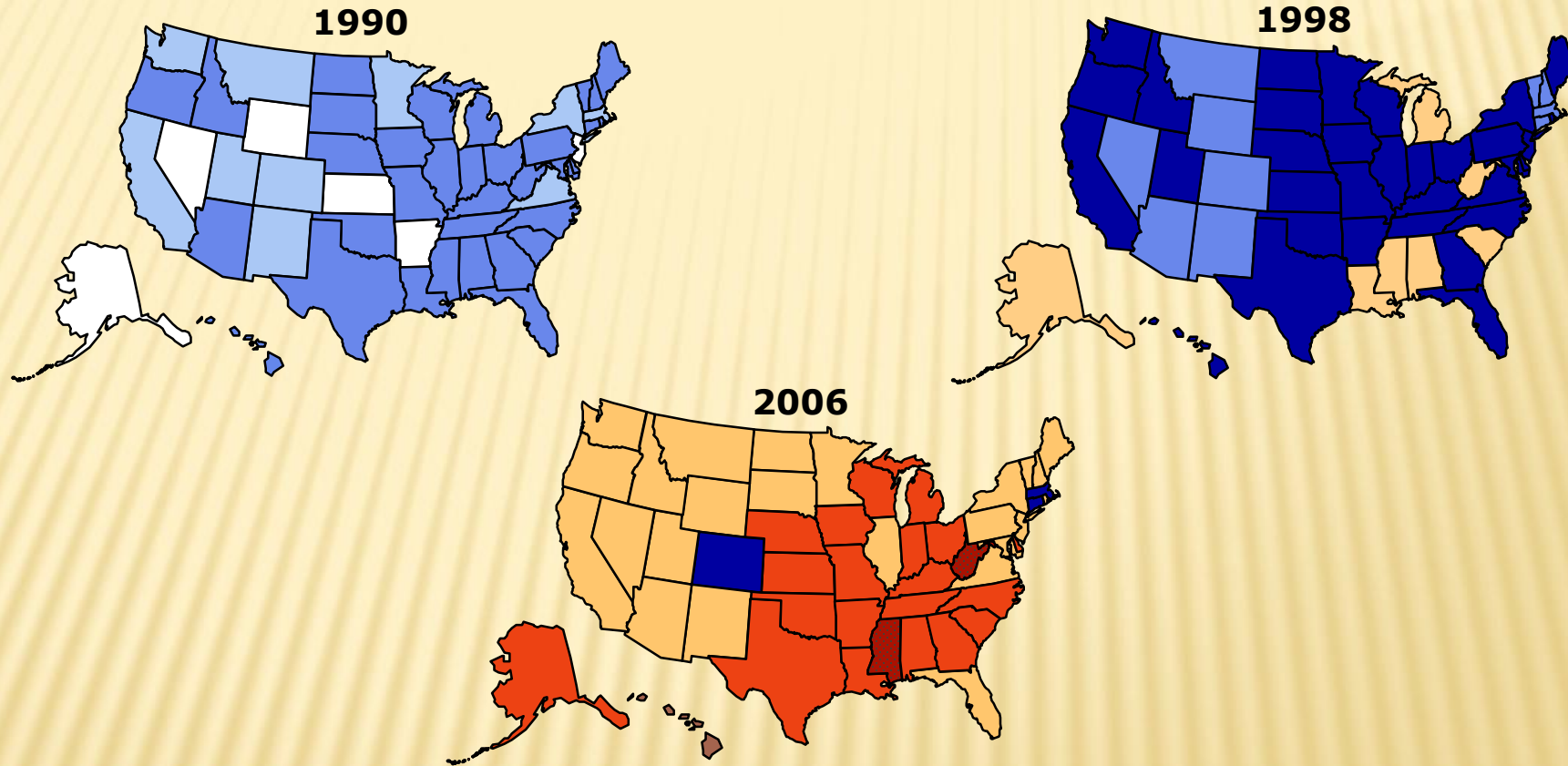
(\*BMI  $\geq 30$ , or  $\sim 30$  lbs. overweight for 5' 4" person)



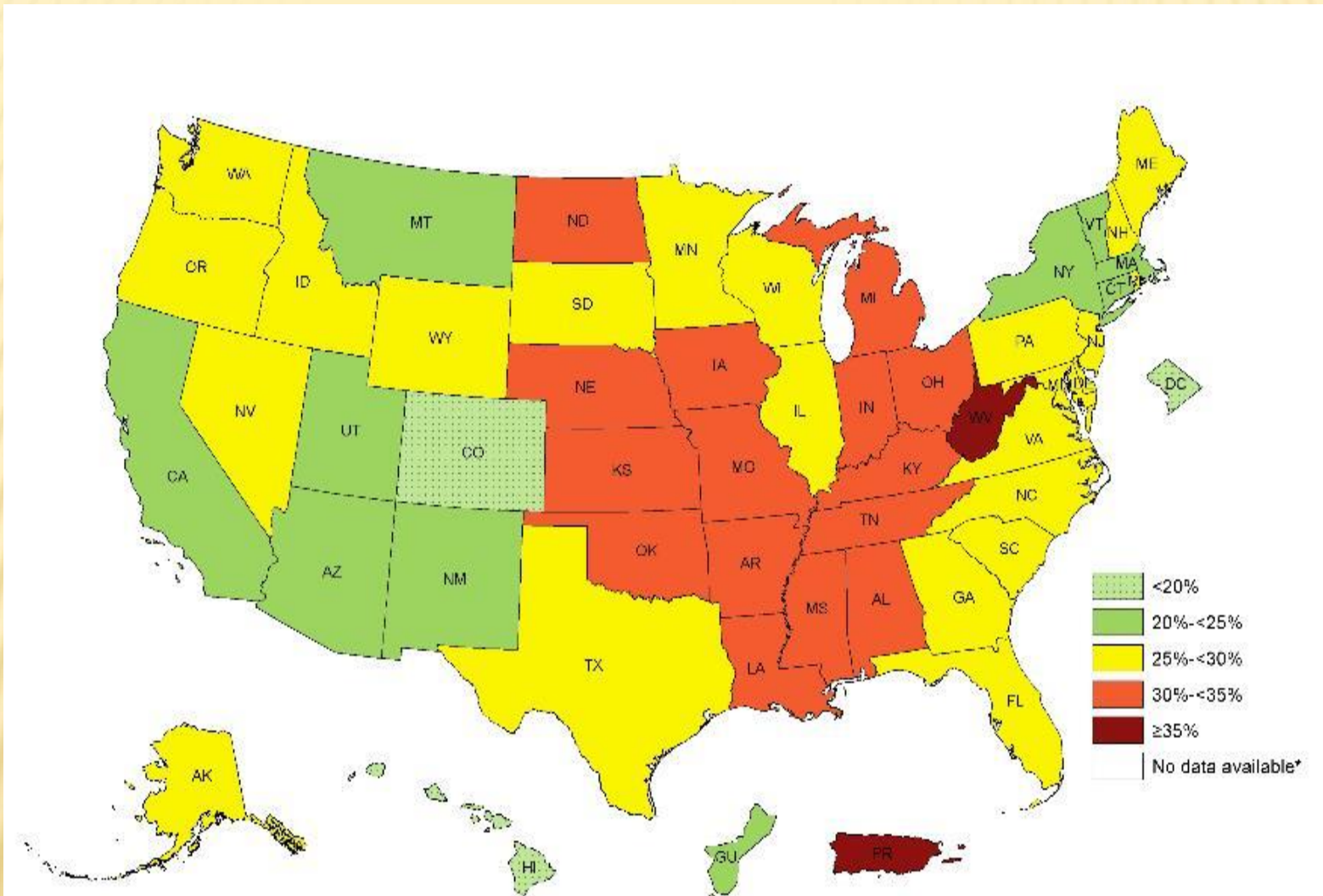
# Obesity Trends\* Among U.S. Adults

## BRFSS, 1990, 1998, 2006

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



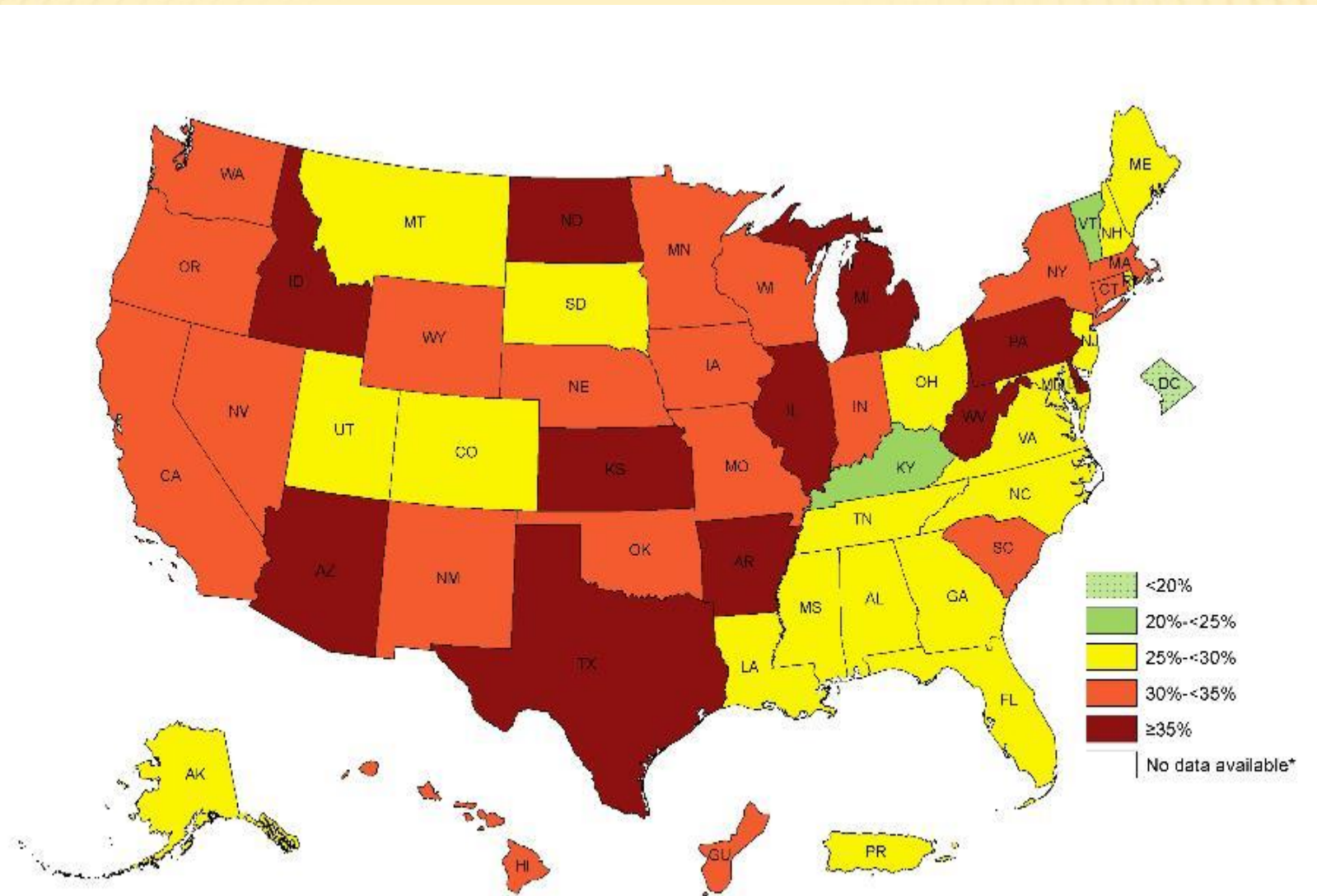
# PREVALENCE OF SELF-REPORTED OBESITY AMONG NON-HISPANIC WHITE ADULTS, BY STATE AND TERRITORY, BRFSS, 2013-2015



\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.



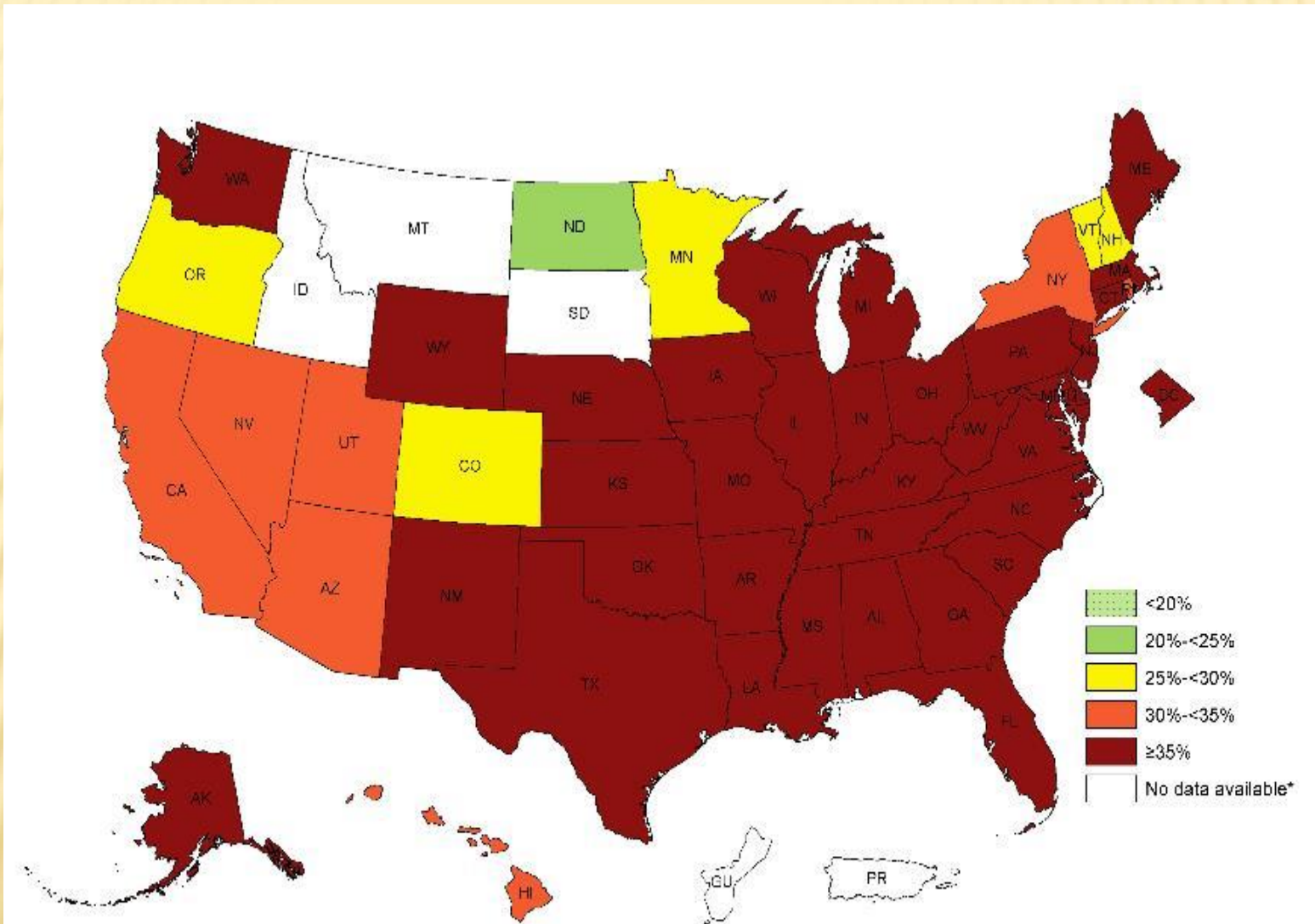
# AMONG HISPANIC ADULTS, BY STATE AND TERRITORY, BRFSS, 2013-2015



\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence)  $\geq 30\%$ .



# PREVALENCE OF SELF-REPORTED OBESITY AMONG NON-HISPANIC BLACK ADULTS, BY STATE AND TERRITORY, BRFSS, 2013-2015



\*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.





# WHAT IS THE LINK BETWEEN OBESITY AND TYPE 2 DIABETES? – FAT IN THE WRONG PLACE



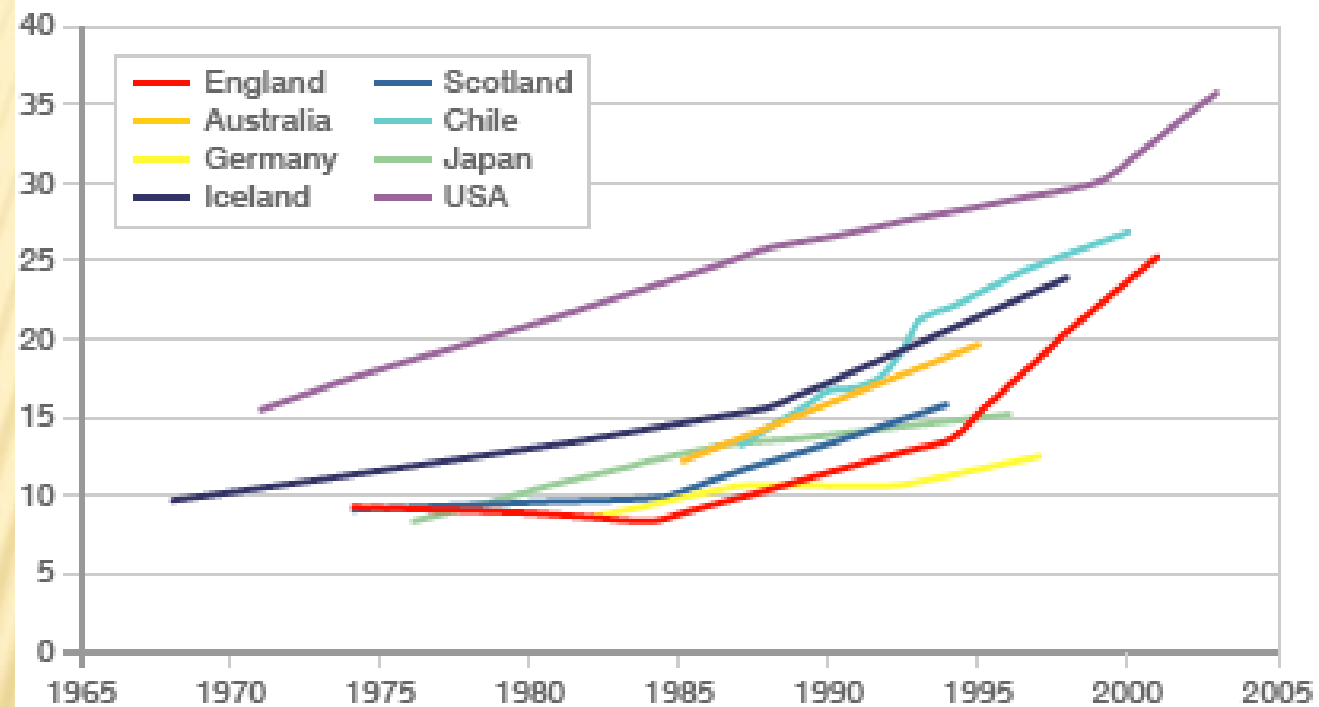
Partial lipodystrophy



# OBESITY EPIDEMIC

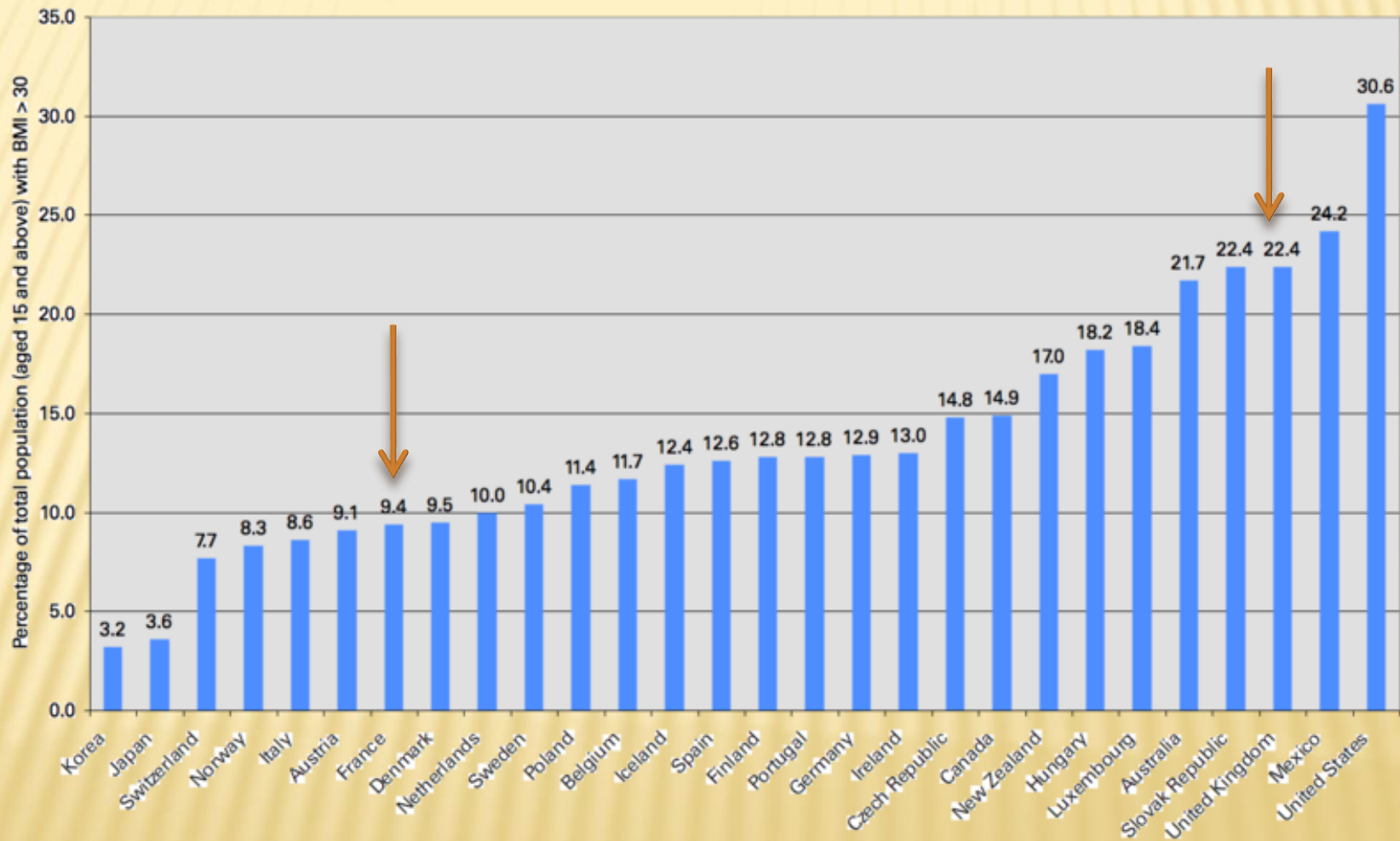
**INCREASING NUMBER OF OVERWEIGHT CHILDREN AROUND THE WORLD**

Percentage overweight



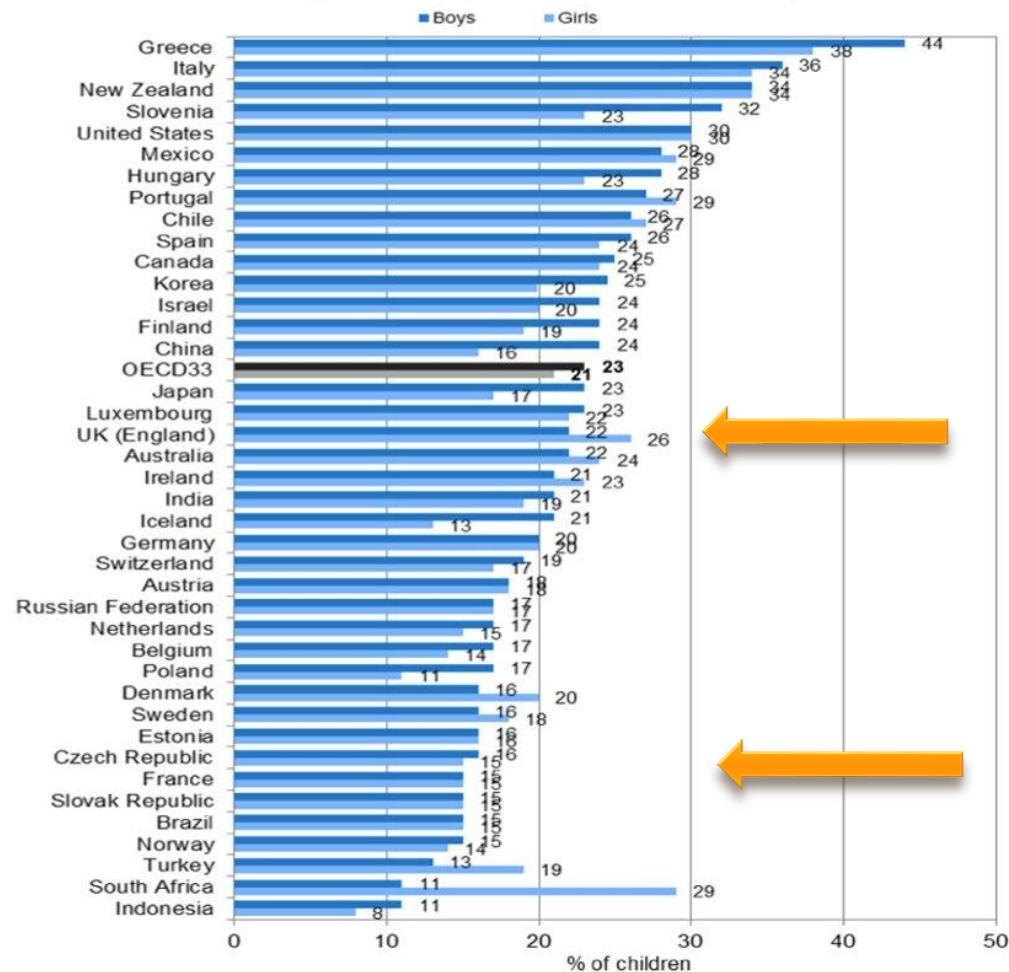
SOURCE: Government Office for Science

# ENVIRONMENTAL FACTORS? - OBESITY IN DIFFERENT COUNTRIES



# OBESITY IN CHILDREN (2013)

Figure 4. Measured overweight (including obesity) among children aged 5-17, 2010 or nearest year



Source: International Association for the Study of Obesity, 2013; Bös et al. (2004), Universität Karlsruhe and Ministère de l'Éducation nationale et de la Santé for Luxembourg; and KNHANES 2011 for Korea.

# RELATIVE RISK OF HEALTH PROBLEMS ASSOCIATED WITH OBESITY

Disease	Women	Men
Type 2 diabetes	12.7	5.2
Hypertension	4.2	2.6
Myocardial infarction	3.2	1.5
Colon cancer	2.7	3.0
Angina	1.8	1.8
Gall bladder disease	1.8	1.8
Ovarian cancer	1.7	-
Osteoarthritis	1.4	1.9
Stroke	1.3	1.3

# WHY ARE WE GETTING SO FAT

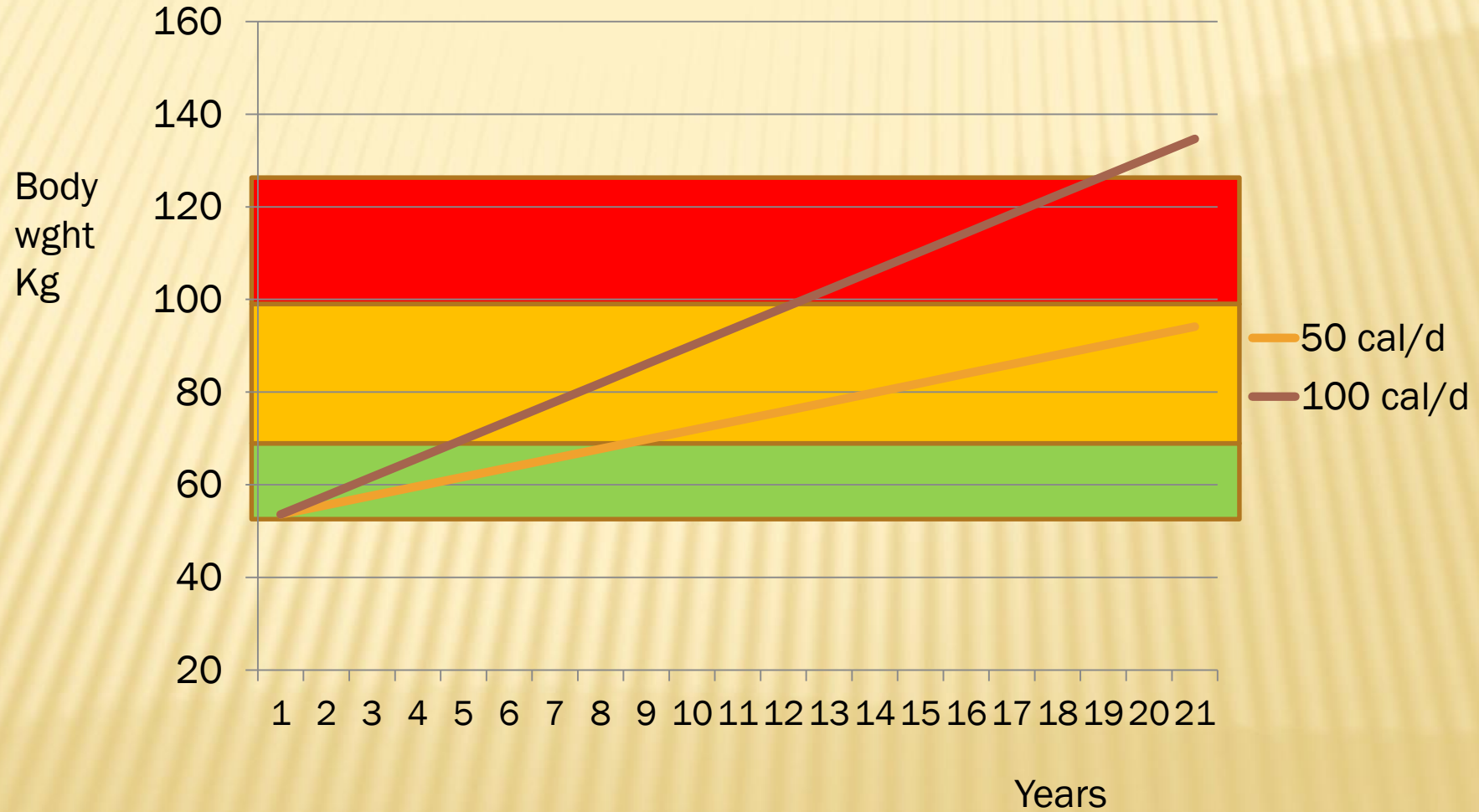
---

1. Small calorie increments make a big difference over time

# YEARLY WEIGHT GAIN

Xs calories /day	Wght gain/yr
50	2.0
100	4.1
150	6.1
200	8.1
250	10.1
300	12.1

# WGHT GAIN OVER 20 YEARS 53KG FEMALE



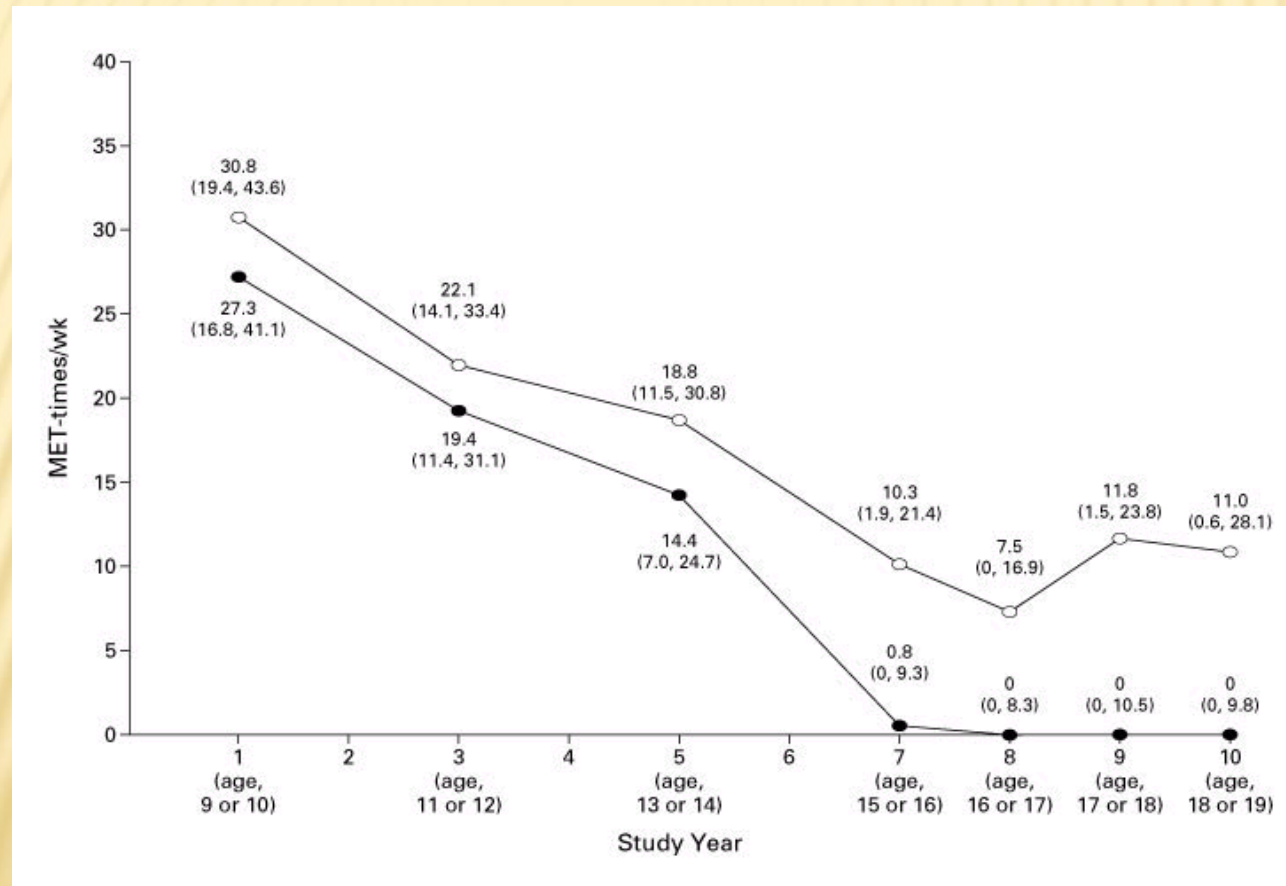


# MORE FOOD OR LESS EXERCISE?

---

# REDUCTION IN PHYSICAL ACTIVITY

Physical activity in children



Solid dots  
- black girls  
Kimm et al  
2002

**EARLY ACTID TRIAL OF DIET AND EXERCISE IN  
NEWLY DIAGNOSED PATIENTS**

**ANDREWS ET AL, LANCET 2011**

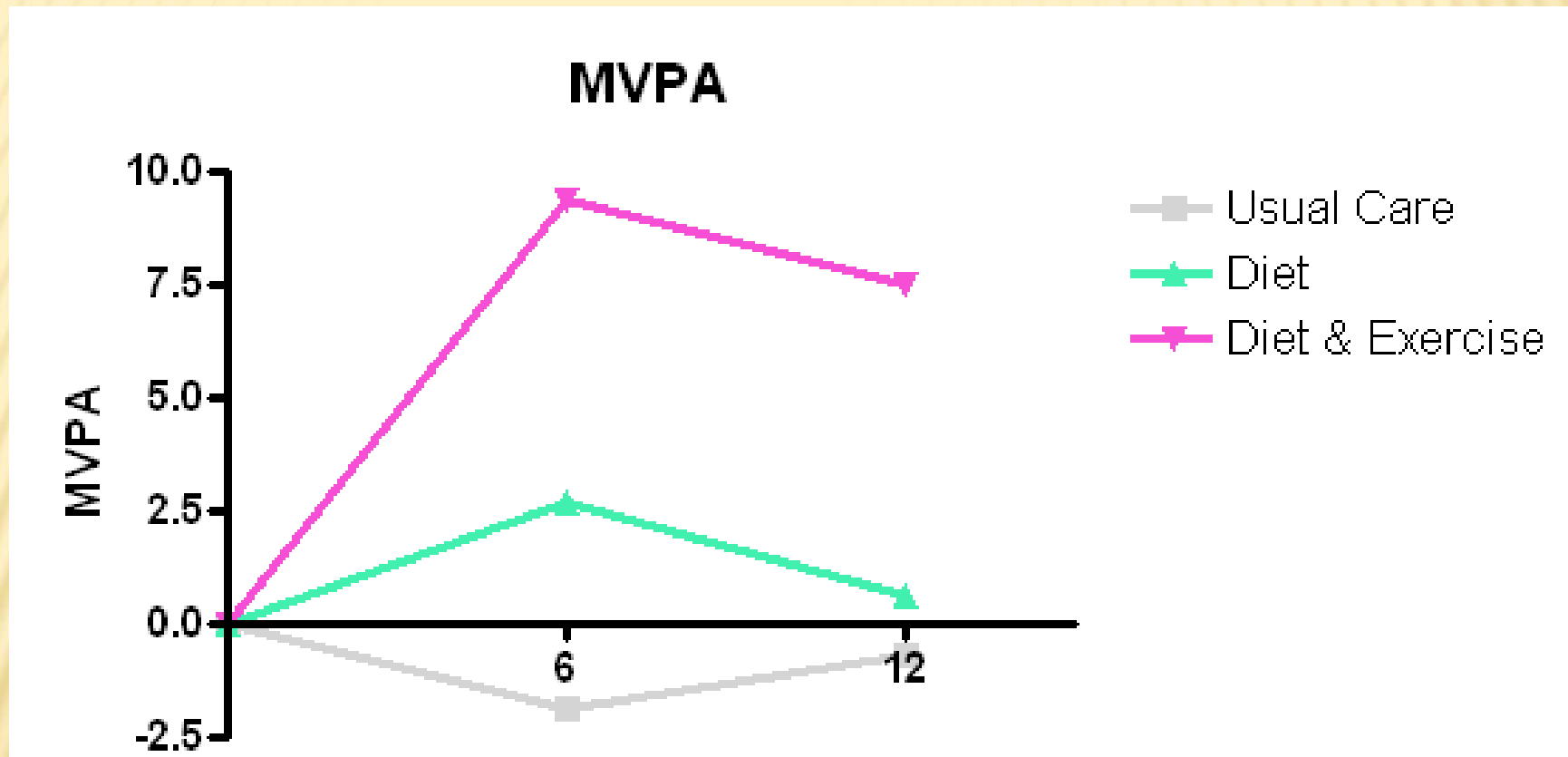
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# BASELINE METABOLIC PARAMETERS (GROUPS COMBINED)

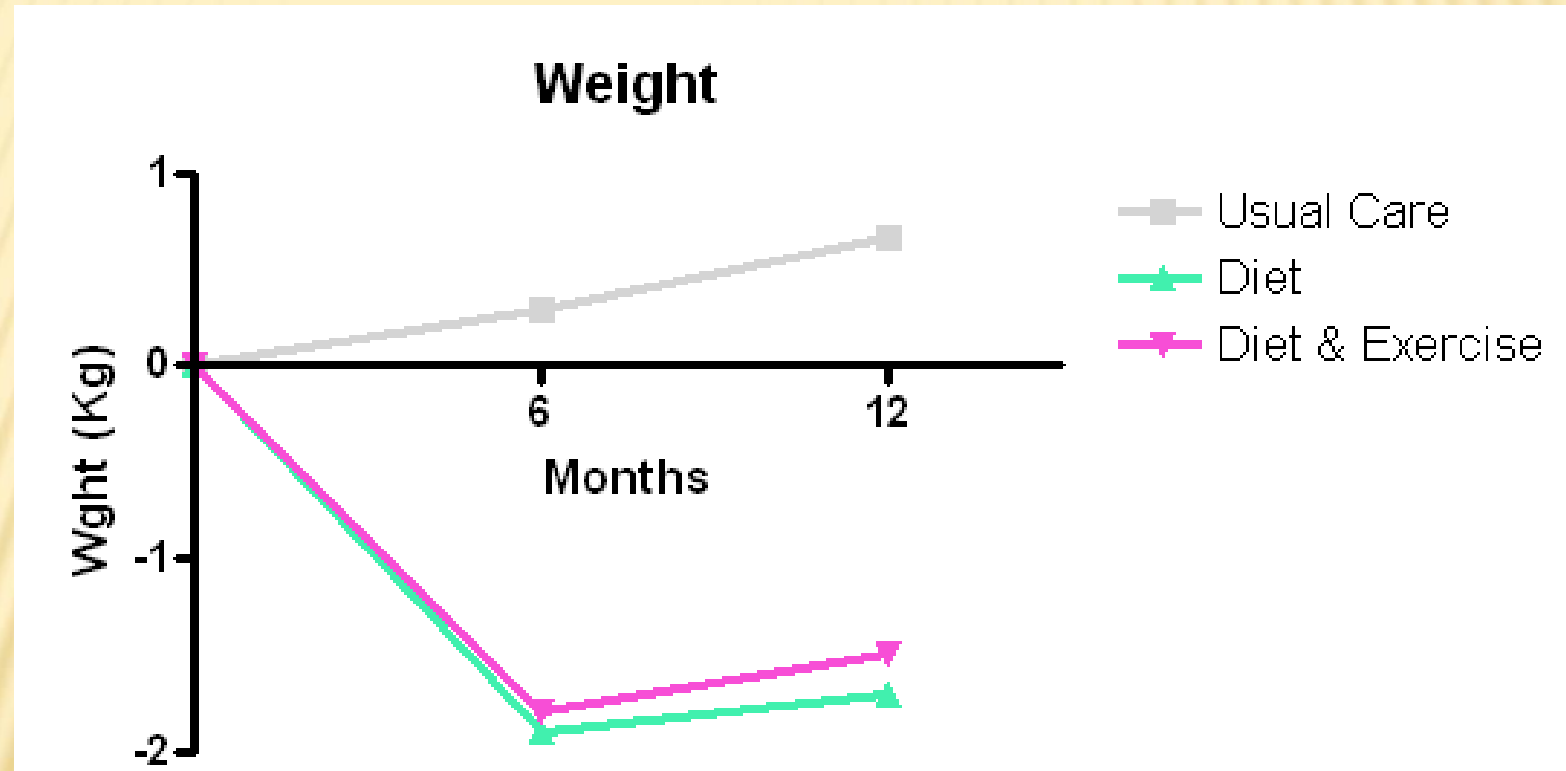
HbA1c	6.7%
BP	134/80
Min/Mod activity	26 mins/day
Weight	91kg
BMI	31



# INCREASES IN PHYSICAL ACTIVITY (MINS OF ACTIVITY)

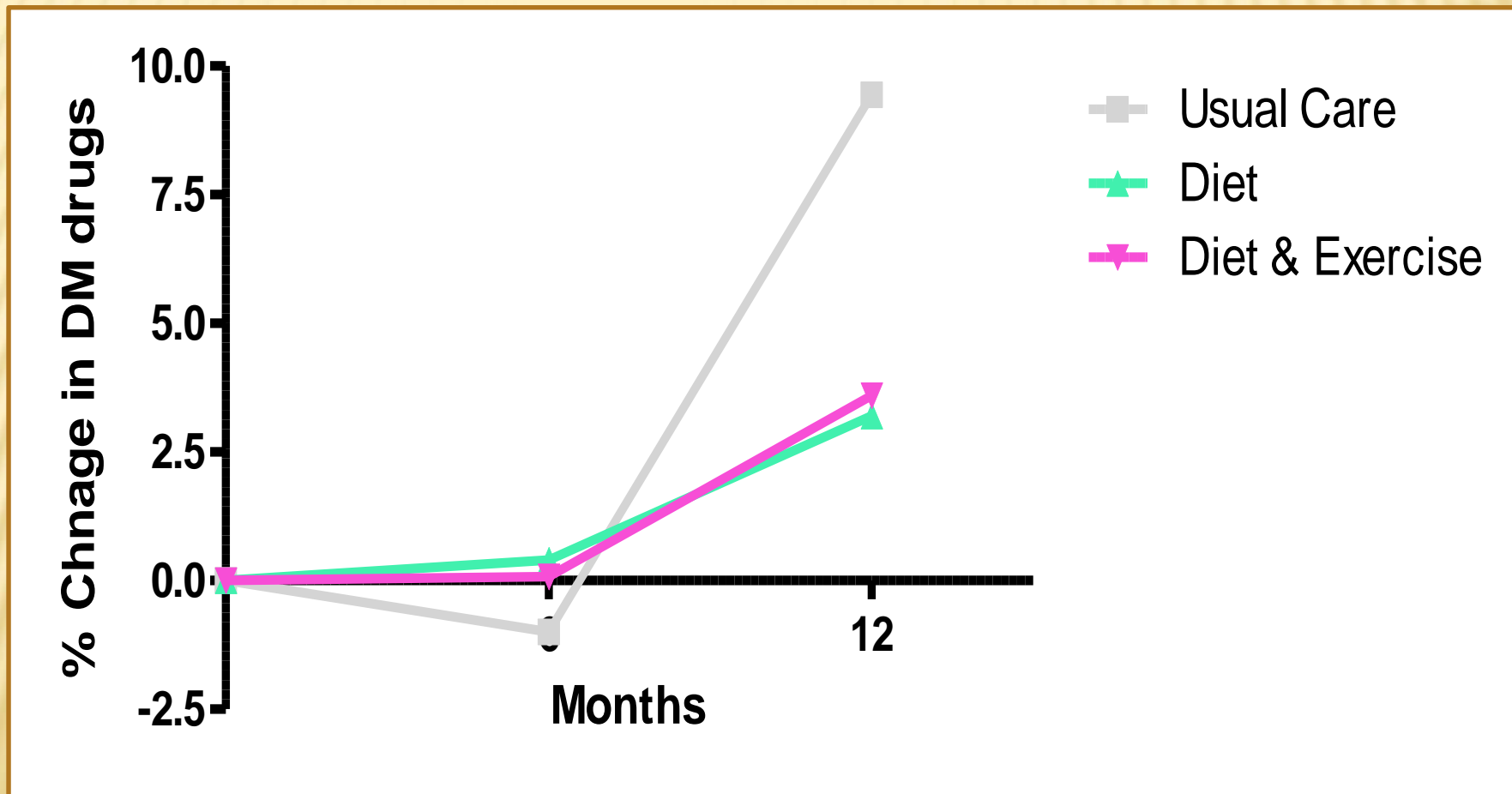


# INTENSIVE DIETARY SUPPORT (EARLY ACTID STUDY) – MOTIVATIONAL INTERVIEWING

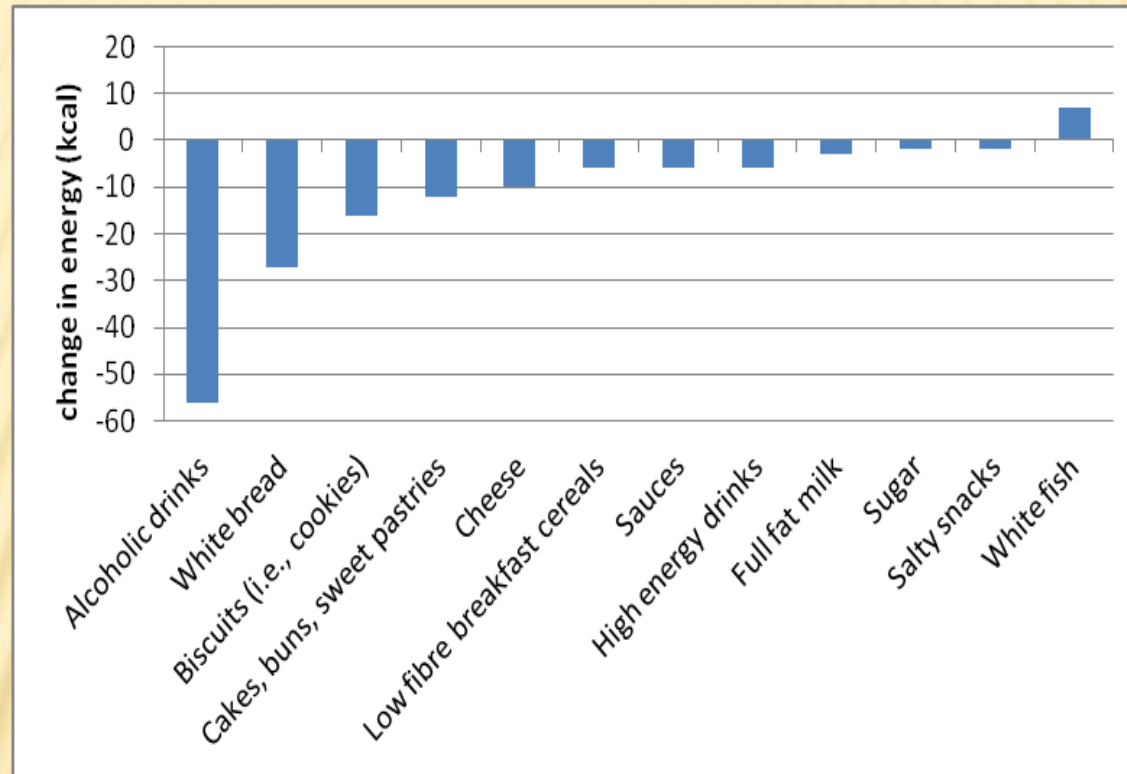


# DIABETES MEDICATION

%DM drugs



# CHANGES IN MEAN ENERGY INTAKES FROM FOOD GROUPS: MEN (N=175)

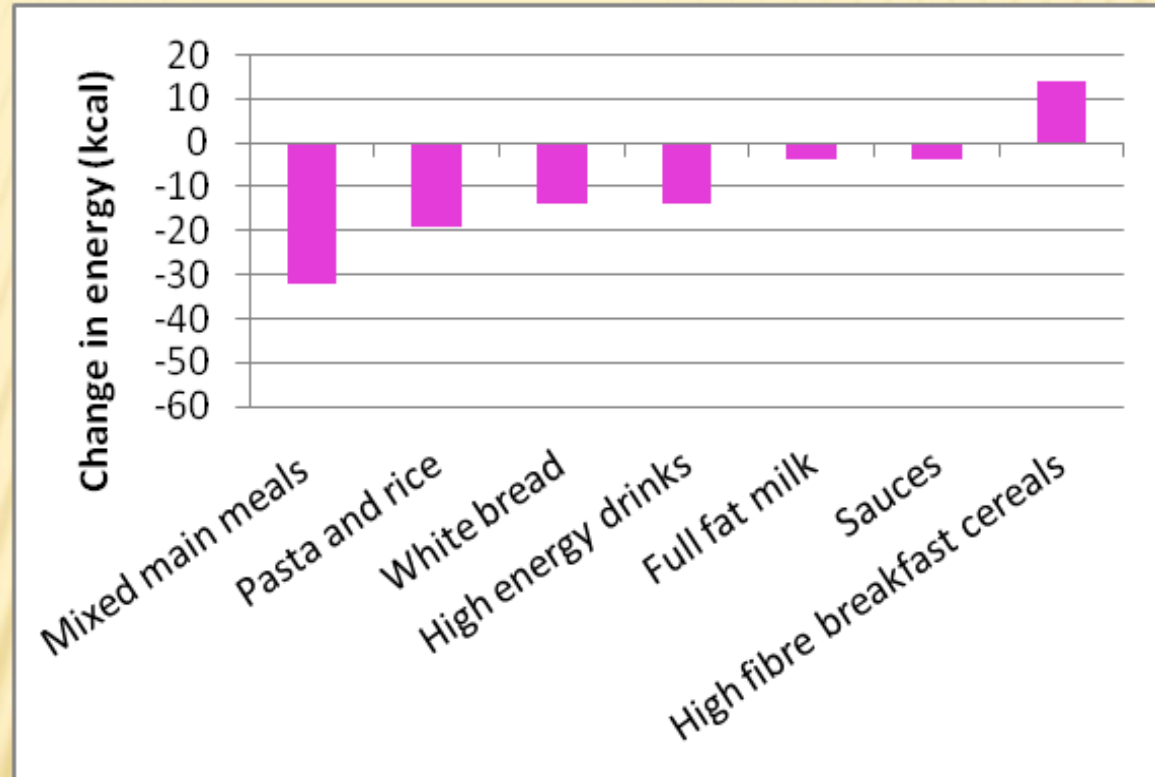


Paired sample Wilcoxon signed rank tests  
 $p < 0.05$

Men (blue) reduced energy by  $218 \pm 332$  kcal  
( $p < 0.001$ )



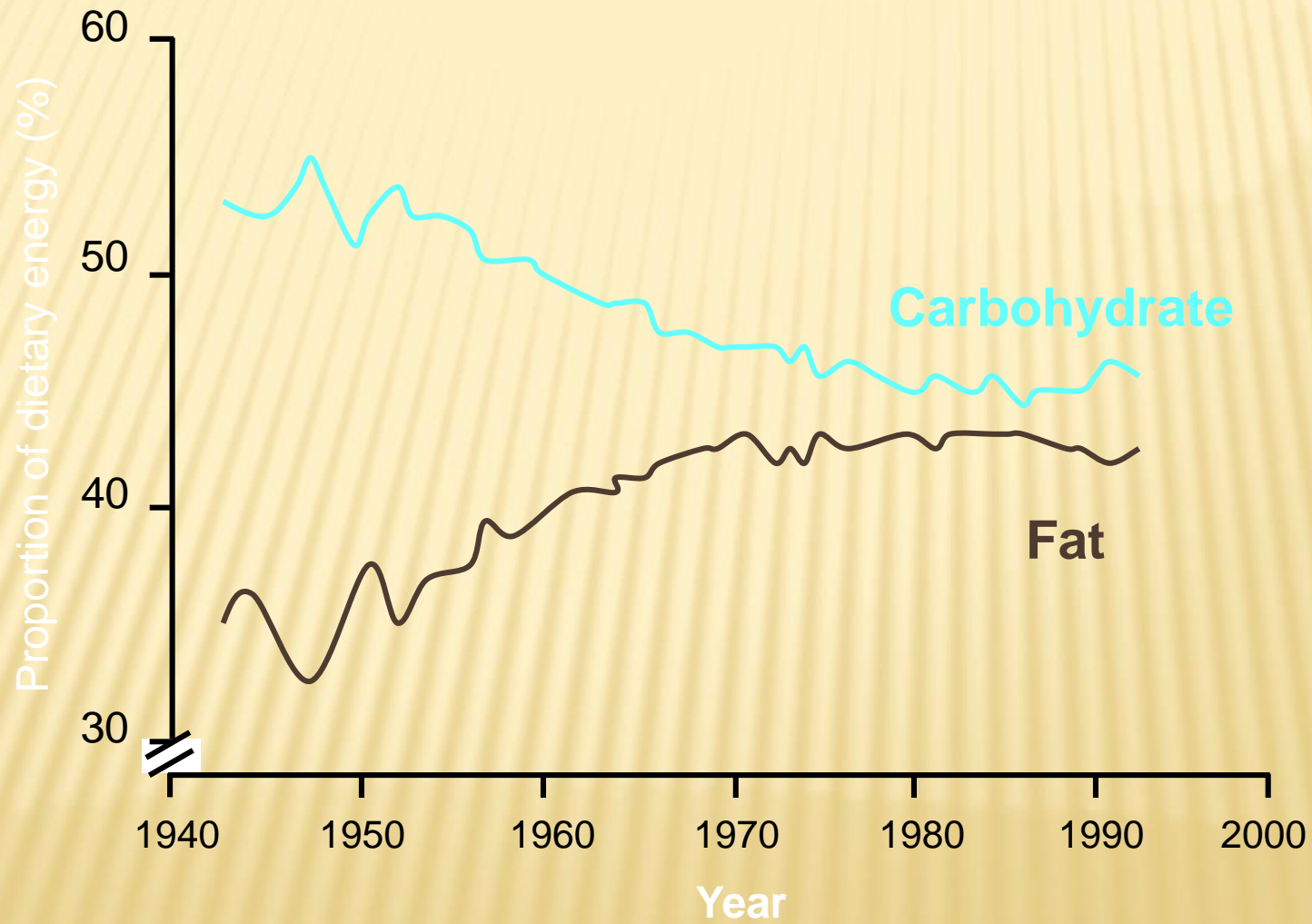
# CHANGES IN MEAN ENERGY INTAKES FROM FOOD GROUPS: WOMEN (N=87)



Paired sample Wilcoxon signed rank tests  
 $p < 0.05$

Women (pink) reduced energy by  
 $123 \pm 270 \text{ kcal}$  ( $p < 0.001$ )

# CHANGE IN FOOD INTAKE



# CALORIES BURNT PER HOUR OF EXERCISE

	130lbs (9st 3lbs)	155lbs (11st)	205 lbs (14.5 st)
Slow walking (2mph)	148	176	233
Brisk walking (3.5mph)	224	267	354
Leisurely cycling (< 10mph)	236	281	372
Running 6mph (10 min mile)	590	704	931
Running 10 mph (6 min mile)	944	1126	1489



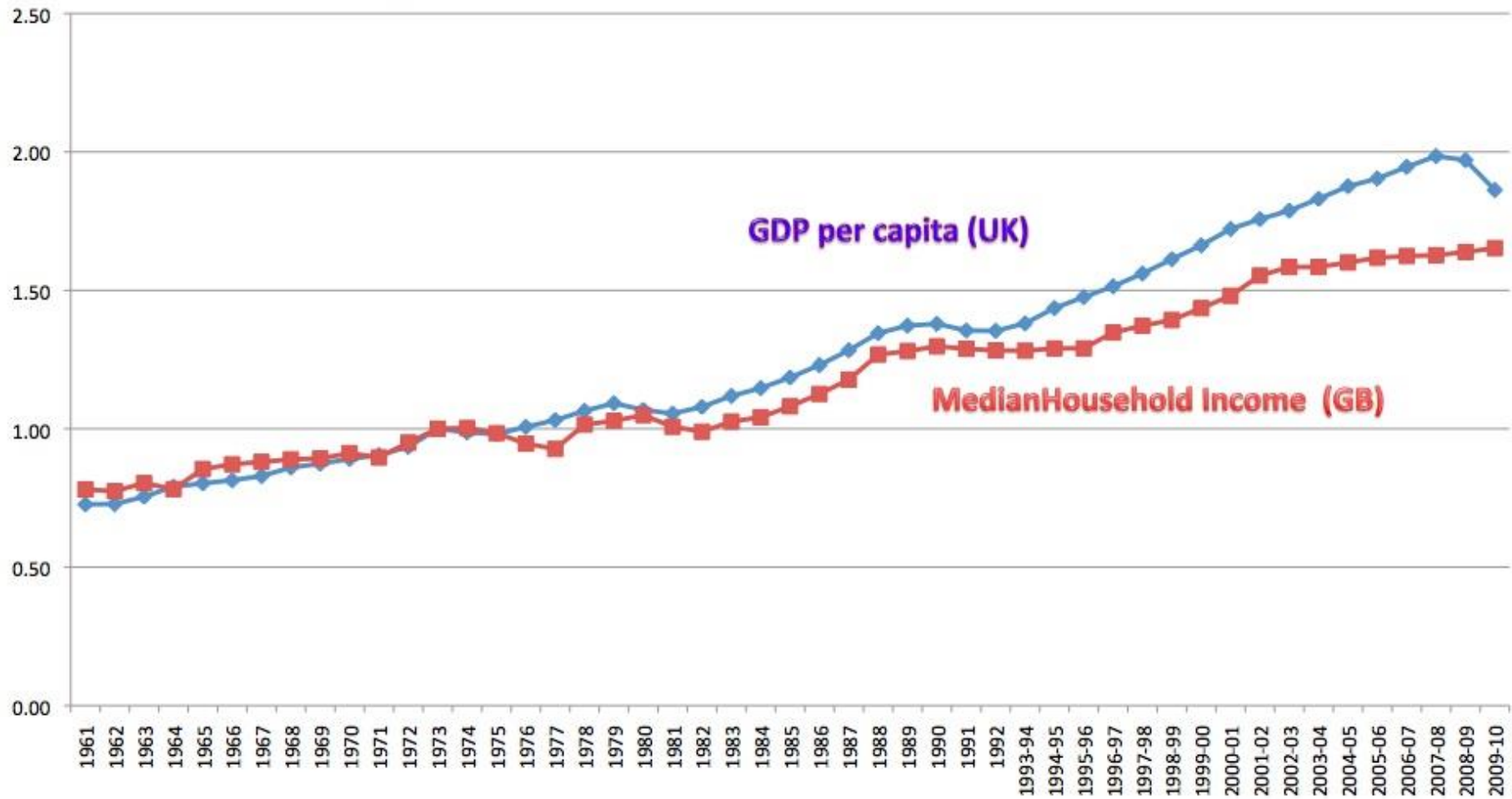
**2 digestive biscuits  
= 146 Calories**

# WHY ARE WE GETTING SO FAT

---

1. Small calorie increments make a big difference over time
2. Diet is probably more important than exercise
3. We can afford more calories

## GDP (UK, per capita, inflation adjusted) & median household income (GB, inflation adjusted) Index 1973=100



# CALORIES ARE GETTING CHEAPER



65P PER 100 CALS



**£2.99 PER 100 CALS**







2 FOR...



Any 2 for £1.00

Pack of 5  
10p/doughnut

- Calories  
**225, 11%of your GDA**
- Sugar  
**7g, 7%of your GDA**
- Fat  
**8g, 11%of your GDA**
- Saturates  
**4g, 18%of your GDA**
- Salt  
**0.3g, 5%**

= 4p/100kcal

Whole pack = 1125kcal

# HOW CAN WE REVERSE THIS TREND

---

- ✘ Increase awareness of where calories come from in our diet

# SNACK FOODS

Food	Calorie Content
Mars Bar/Snickers/Twix	250
Pint of beer or lager	200-250
Danish	300
Kebab	430
Crisps	200
Coke	140
Big Mac	450

Food	Calorie Content
Apple	70
Pizza slice	170
Grapes	30
Granary Bread Ham sandwich	100
Bowl of cereal (v small)	150

# “HEALTHY” FOOD VS LO CALORIE



524 kcal/100g  
5.7p/cal



366 kcal/100g  
19p/cal

# DRINKS



138Kcal  
42p/100 cal



1Kcal  
5,900p/100 cal

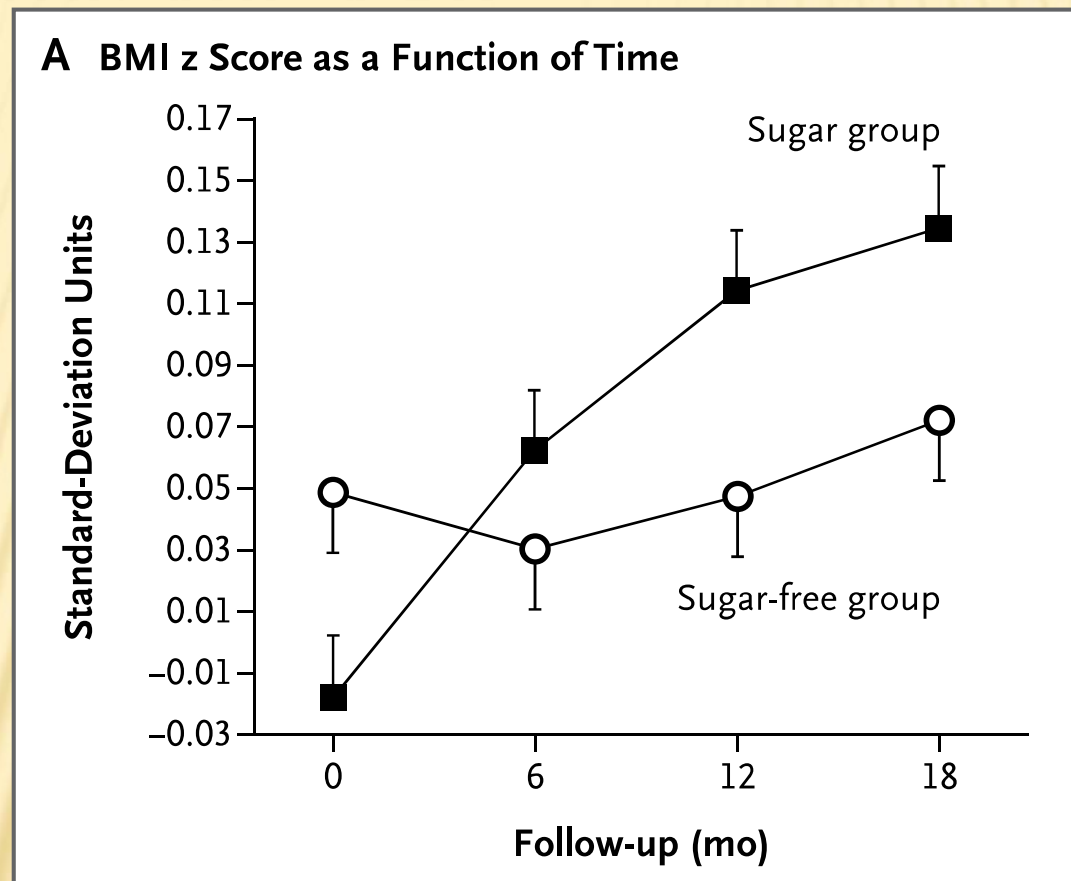


153Kcal  
45p/100 cal



132 Kcal  
113p/100 cal

# SUGAR DRINKS (1 CAN/DAY 18 MTHS AGE 4-12\_



*De Ruyter et al NEJM 2012*

# A CUP OF COFFEE?



Black  
Americano

Regular

19 KCal

Large

38 KCal



Latte

128 KCal

259 KCal



Mocha  
Latte

228 KCal



# HOW CAN WE REVERSE THIS TREND

---

- ✘ Increase awareness of where calories come from in our diet
- ✘ Reduce package sizes



# SMALLER PACKAGING SIZES “GO SMALL”



Calories

384

240

80

## **A Mars a day helps you work, rest and pay: Chocolate bars shrink in size but the price stays the same**

Chocolate giant Mars has shrunk the size of its bars from 58g to 51g

Its Snickers bars have also been reduced from 58g to 48g

But the recommended selling price of 51p has remained the same

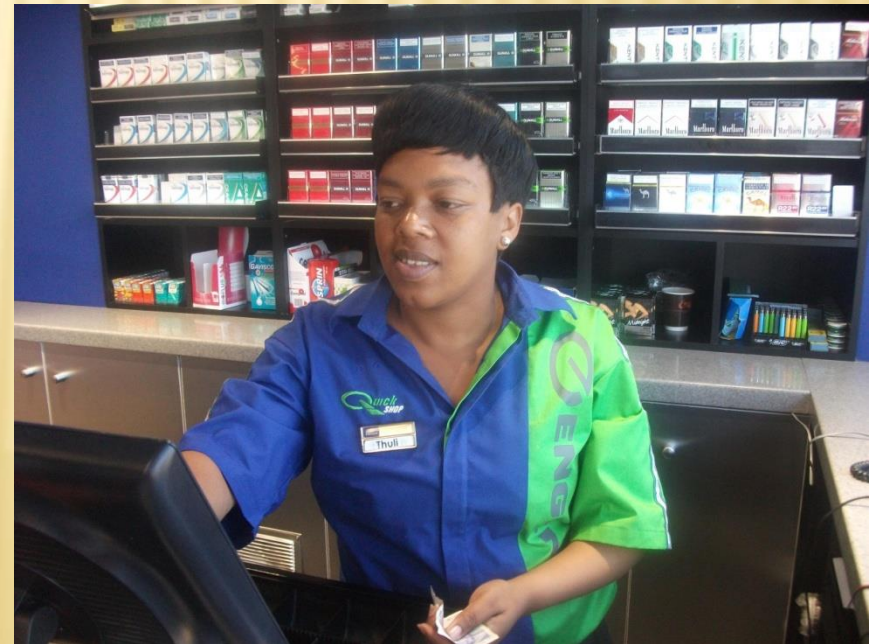
The company said the size reduction was essential to meet its pledge that all single-serve products will be a maximum of 250 calories

# HOW CAN WE REVERSE THIS TREND

---

- ✘ Increase awareness of where calories come from in our diet
- ✘ Reduce package sizes
- ✘ Reduce environmental cues

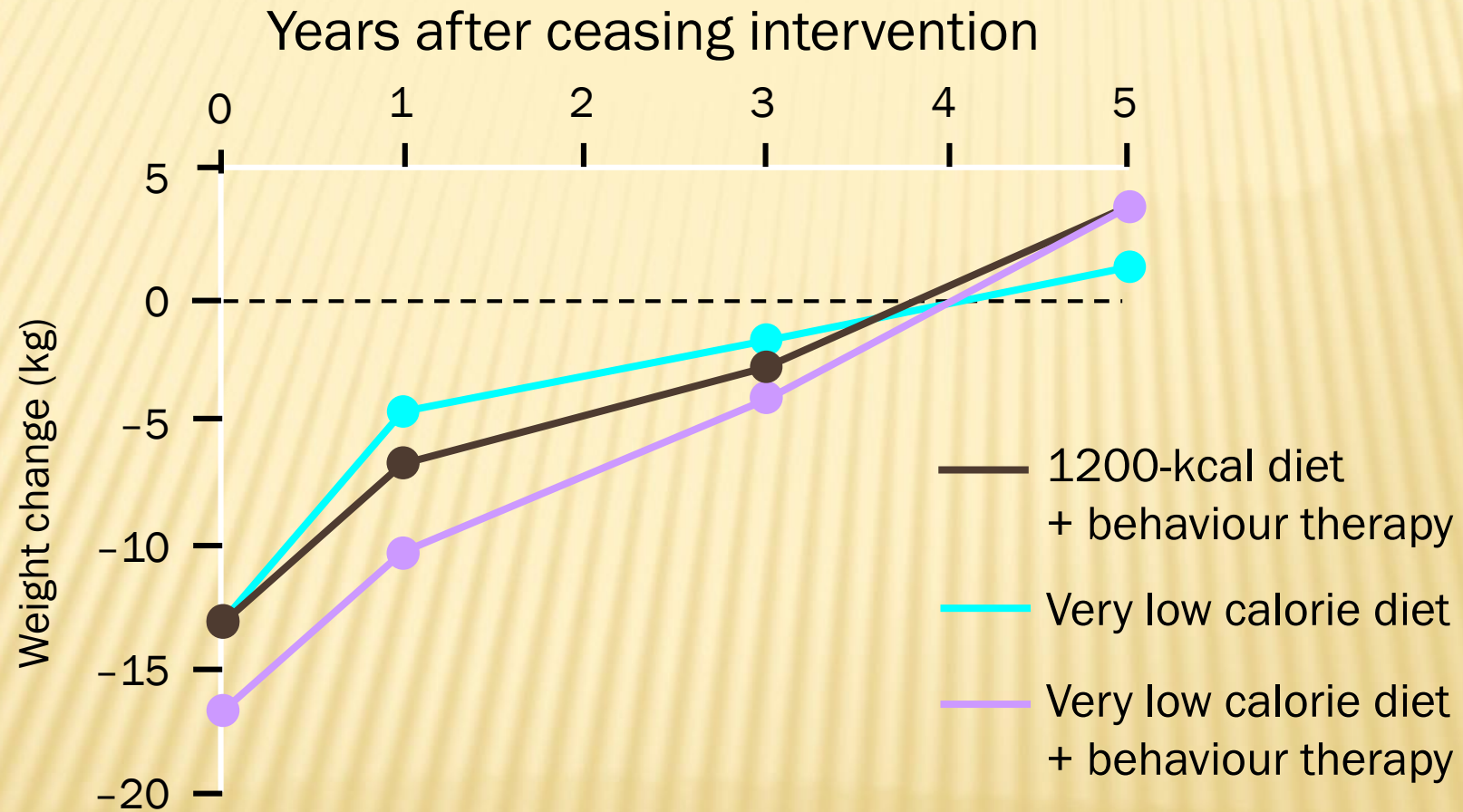
# THE WALL OF CALORIES



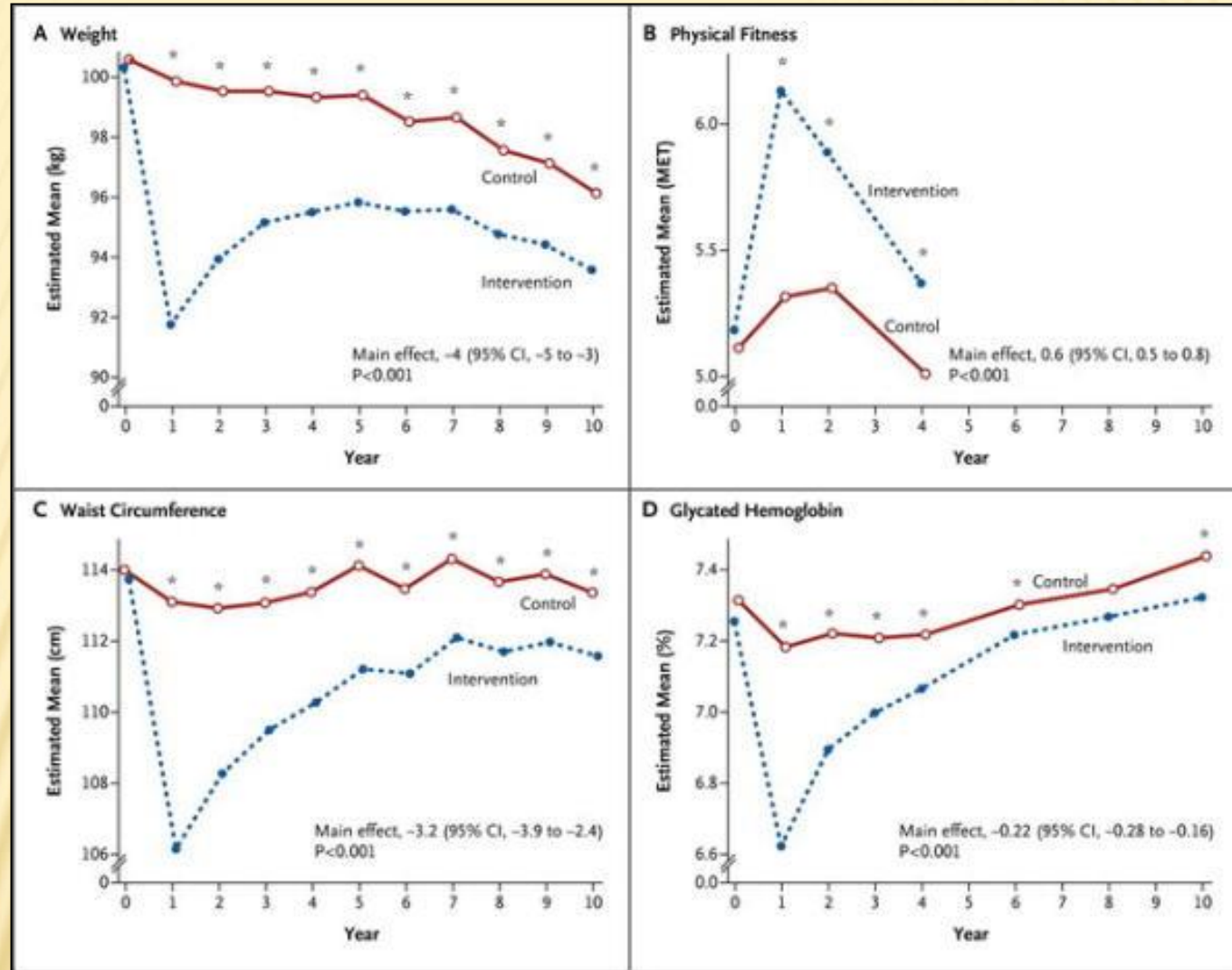
# FOOD AS A GIFT, FINISHING YOUR PLATE, FOOD WITH DRINK



# CONVENTIONAL WEIGHT MANAGEMENT TENDS TO FAIL OVER THE LONG TERM

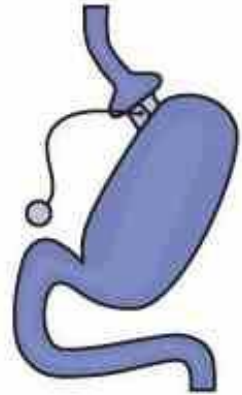


# Look Ahead study



Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes. New England Journal of Medicine. 369(2):145-154, July 11, 2013. DOI: 10.1056/NEJMoa1212914

# OBESITY SURGERY



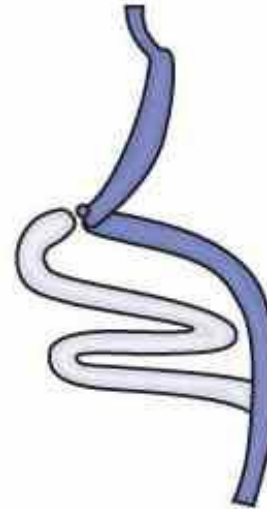
Adjustable  
Gastric Band  
(AGB)



Roux-en-Y  
Gastric Bypass  
(RYGB)



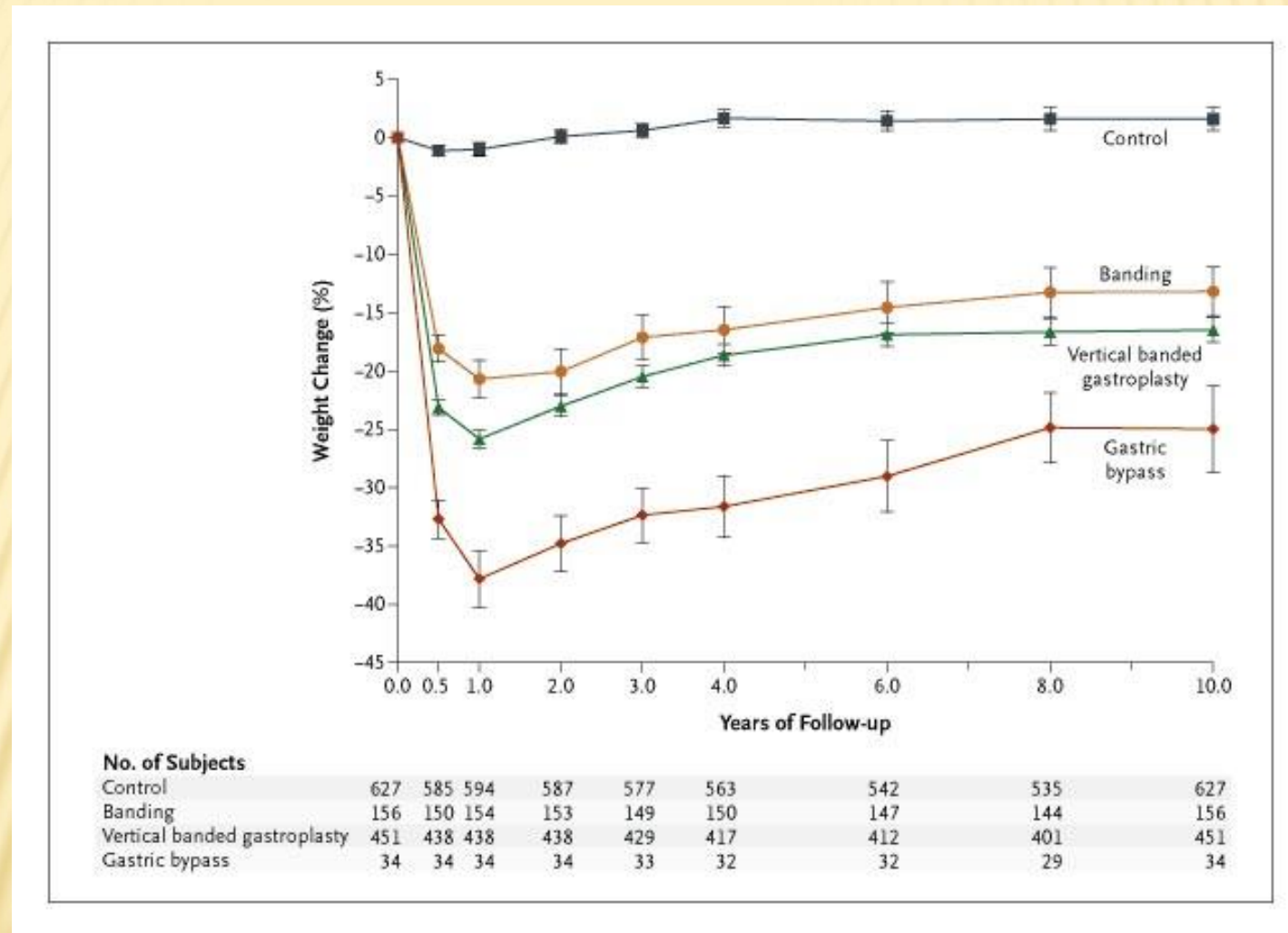
Vertical Sleeve  
Gastrectomy  
(VSG)



Biliopancreatic  
Diversion With a  
Duodenal Switch  
(BPD-DS)



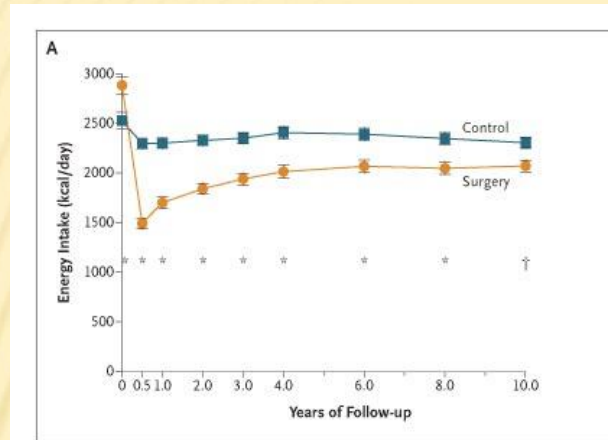
## Weight Changes among Subjects in the SOS Study over a 10-Year Period



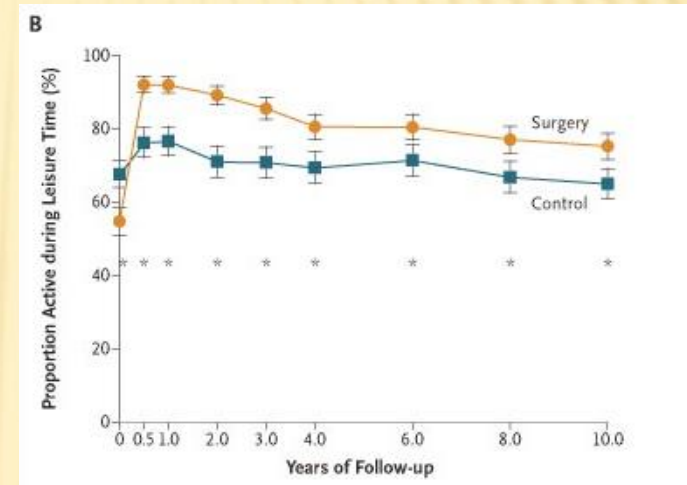
Sjostrom, L. et al. N Engl J Med 2004;351:2683-2693

# Lifestyle Changes among the Subjects in the SOS Study over a 10-Year Period

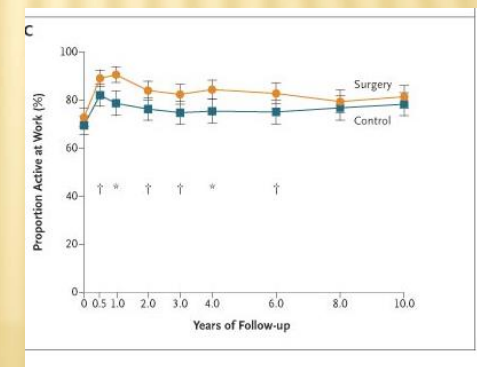
Energy Intake



% active in leisure time

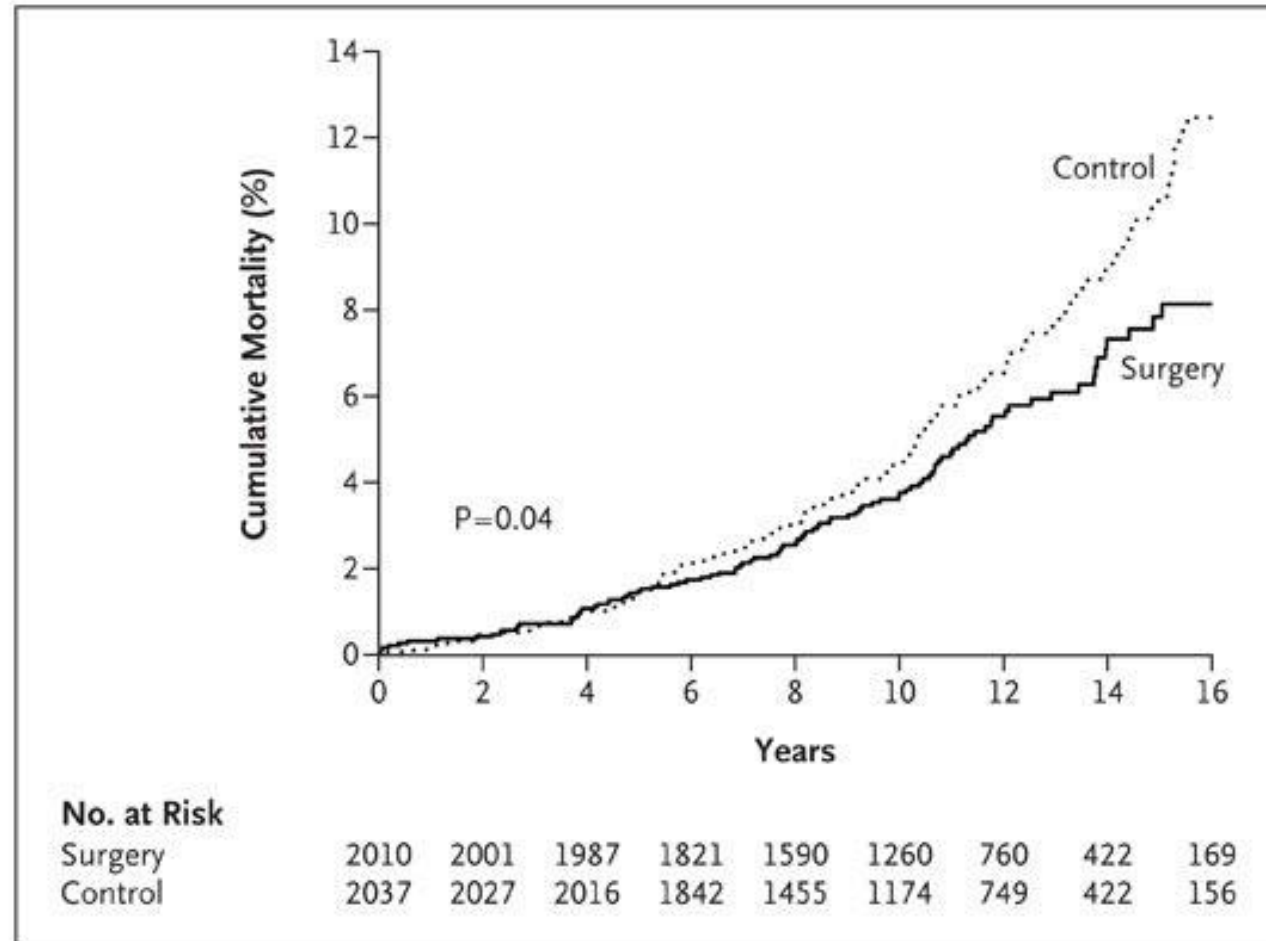


% active in at work



Sjostrom, L. et al. N Engl J Med 2004;351:2683-2693

## Improved survival after obesity surgery seen after 10 years

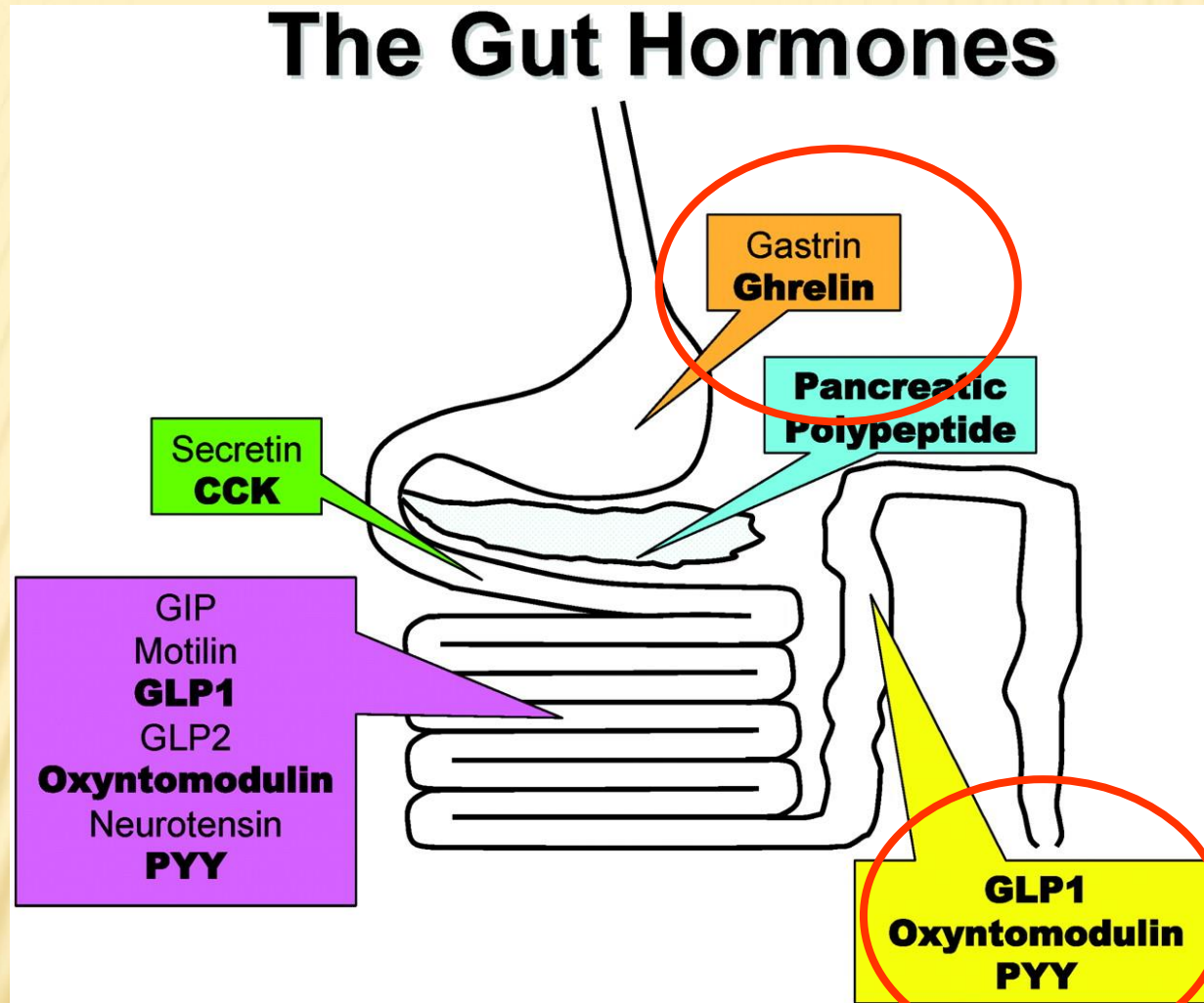


Sjostrom L et al. N Engl J Med 2007;357:741-752



The NEW ENGLAND  
JOURNAL of MEDICINE

FIG. 2. Hormones produced by the gut



Druce, M. R. et al. Endocrinology 2004;145:2660-2665

# EATING QUICKLY – PILING YOUR PLATE



**HALF  
CHIPS  
AND  
HALF  
RICE**



# SCHOOL LUNCH IN FRANCE

Fresh fruit



Water

Beet salad



Camembert  
& baguette



Chicken scallop,  
green peas

# School meals

England:



Sweden:



# ROLE OF “SWEETNESS”

**Diet drinks and food actually trigger weight gain and diabetes, says new study**

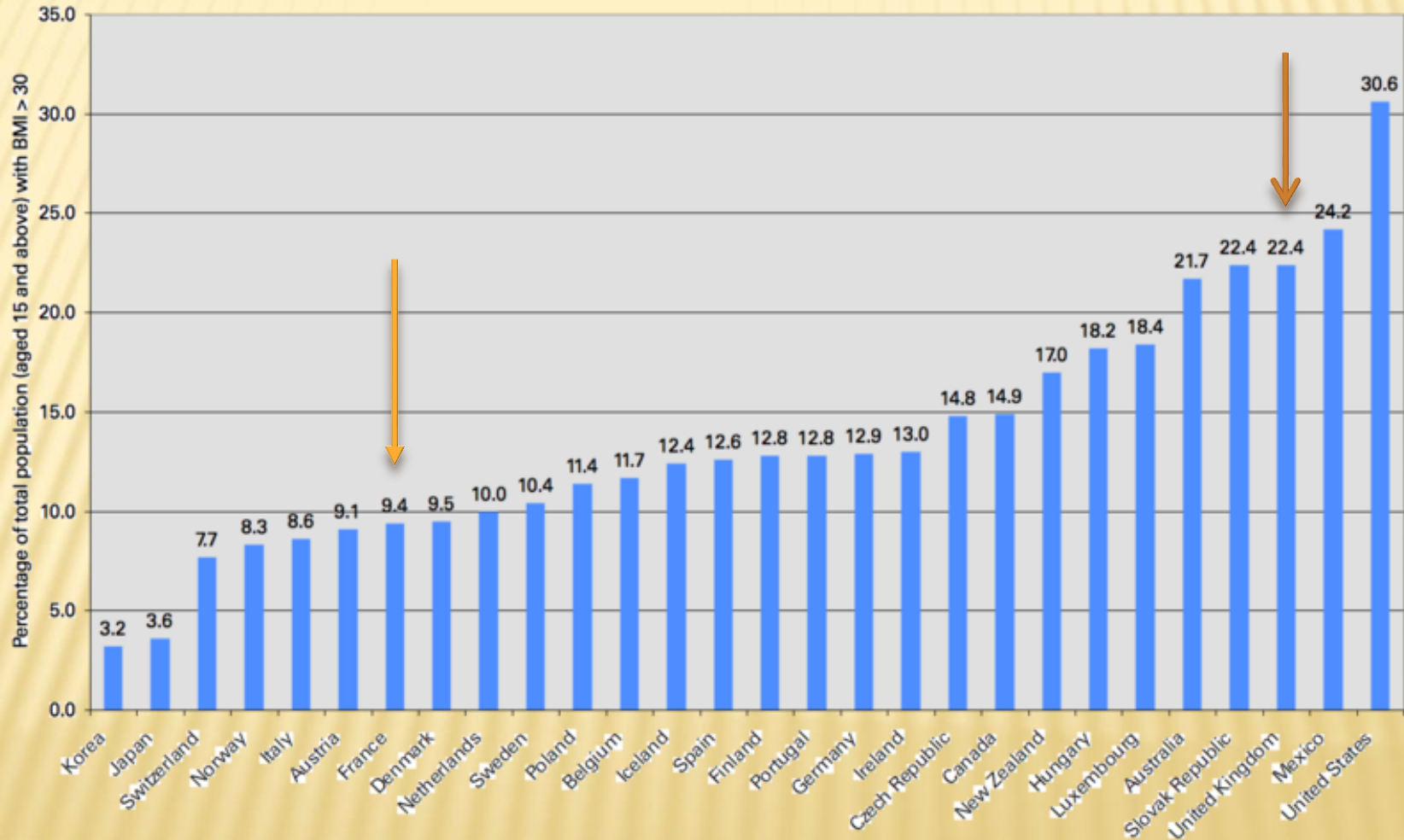


“ 17 Comments





# ENVIRONMENTAL FACTORS? - OBESITY IN DIFFERENT COUNTRIES



**15 PENCE PER 100 CALORIES**



**73 PENCE PER 100 CALORIES**

# 73 PENCE PER 100 CALORIES



# CAN WE HAVE OUR CAKE AND EAT IT?

Yes – if it small



...and it fills you up!



Llywodraeth Cymru  
Welsh Government

# HOW CAN WE REVERSE THIS TREND

---

- ✘ Increase awareness of where calories come from in our diet
- ✘ Reduce package sizes
- ✘ Reduce environmental cues
- ✘ Become “Foodies”
- ✘ Eat more slowly
- ✘ Understand satiety

# CONCLUSIONS

---

- ✘ The diabetes epidemic is a product of affluence
- ✘ It is driven by caloric intake excess to requirement
- ✘ Calorie reduction is more effective than exercise for weight reduction
- ✘ Need to re-engineer our diet and environmental clues to reverse current trends rather than conventional “diets”