

Obesity, Insulin Resistance, Diabetes and Disease Management

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We are fat...

- **66% of adults aged 20 years or older are overweight or obese**
 - 32% are obese
 - 4.8% are extremely obese
- **34% of children and adolescents are at risk of overweight or overweight**
 - 17.1% are overweight

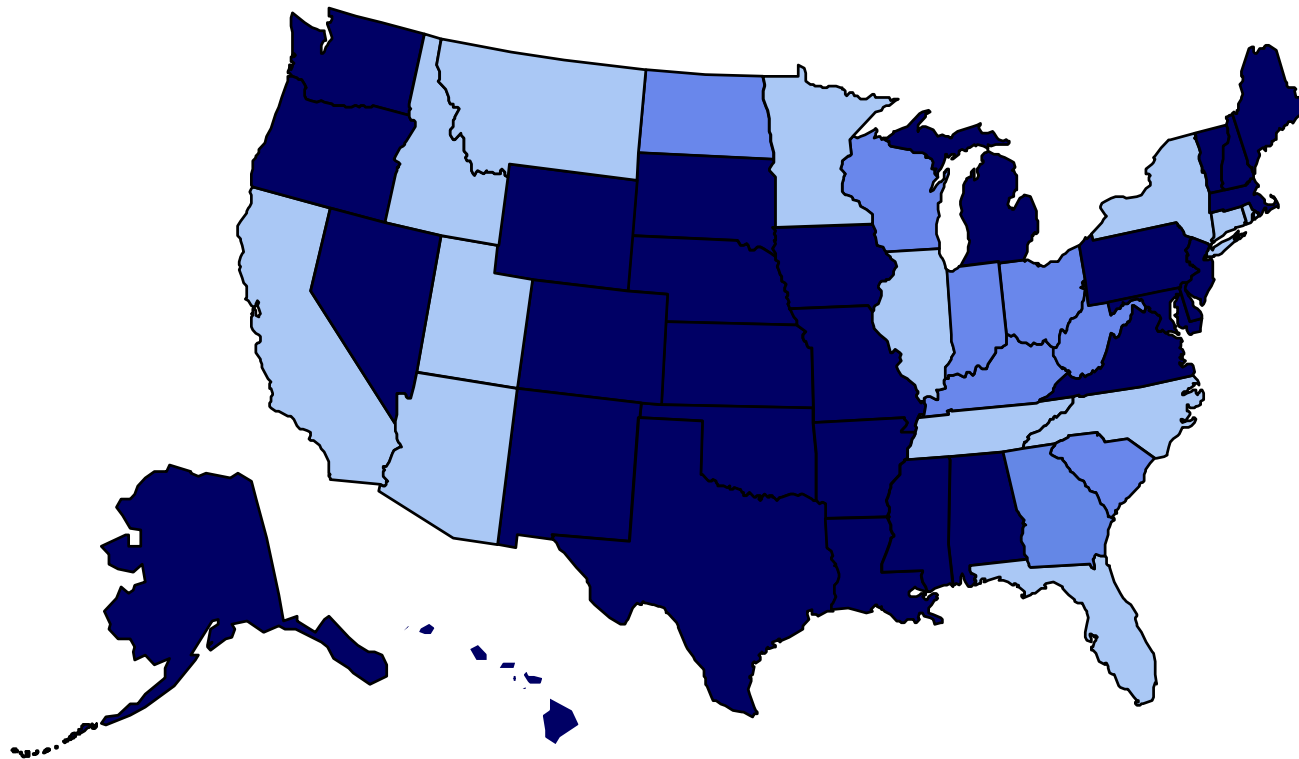
...and getting fatter

- Prevalence of overweight among children, adolescents and men has increased significantly since 1999
- Obesity in women has not increased, but remains high at ~33%



Obesity Trends* Among U.S. Adults

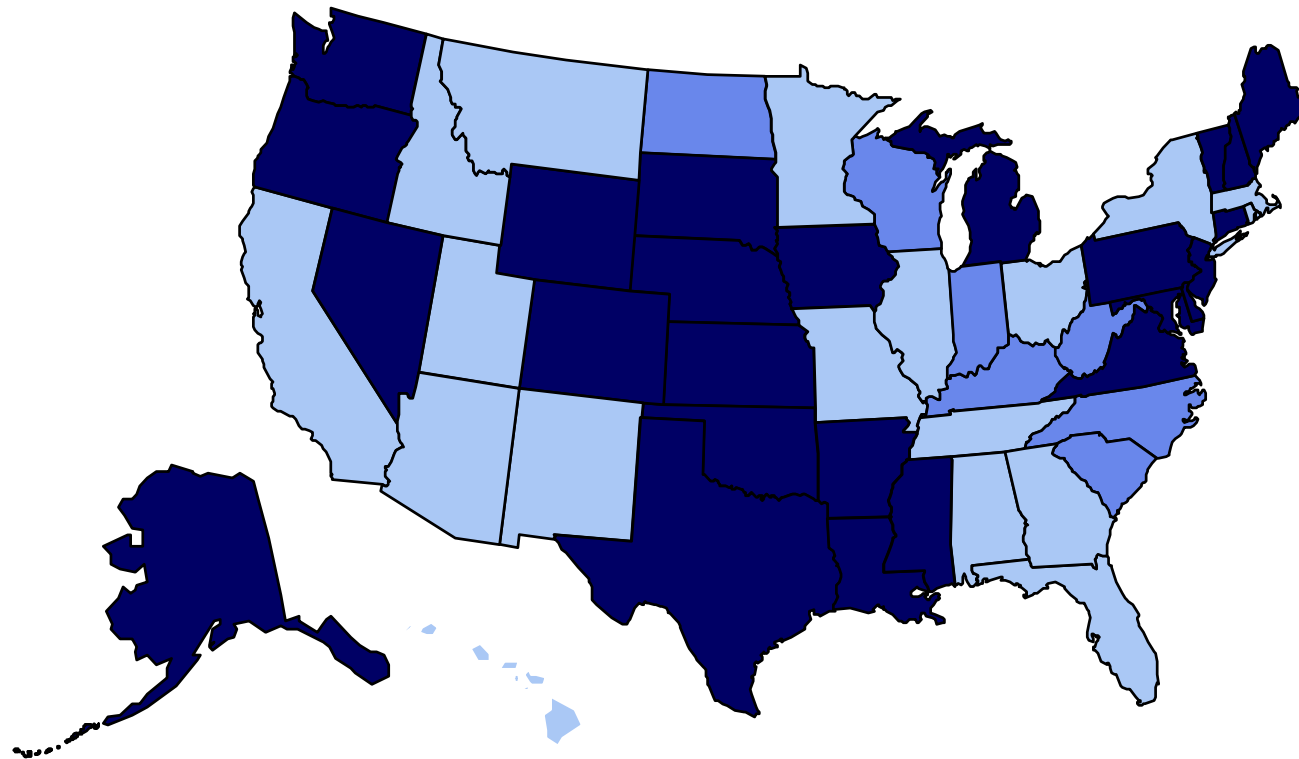
BRFSS, 1985



■ No Data ■ <10% ■ 10%–14%

Obesity Trends* Among U.S. Adults

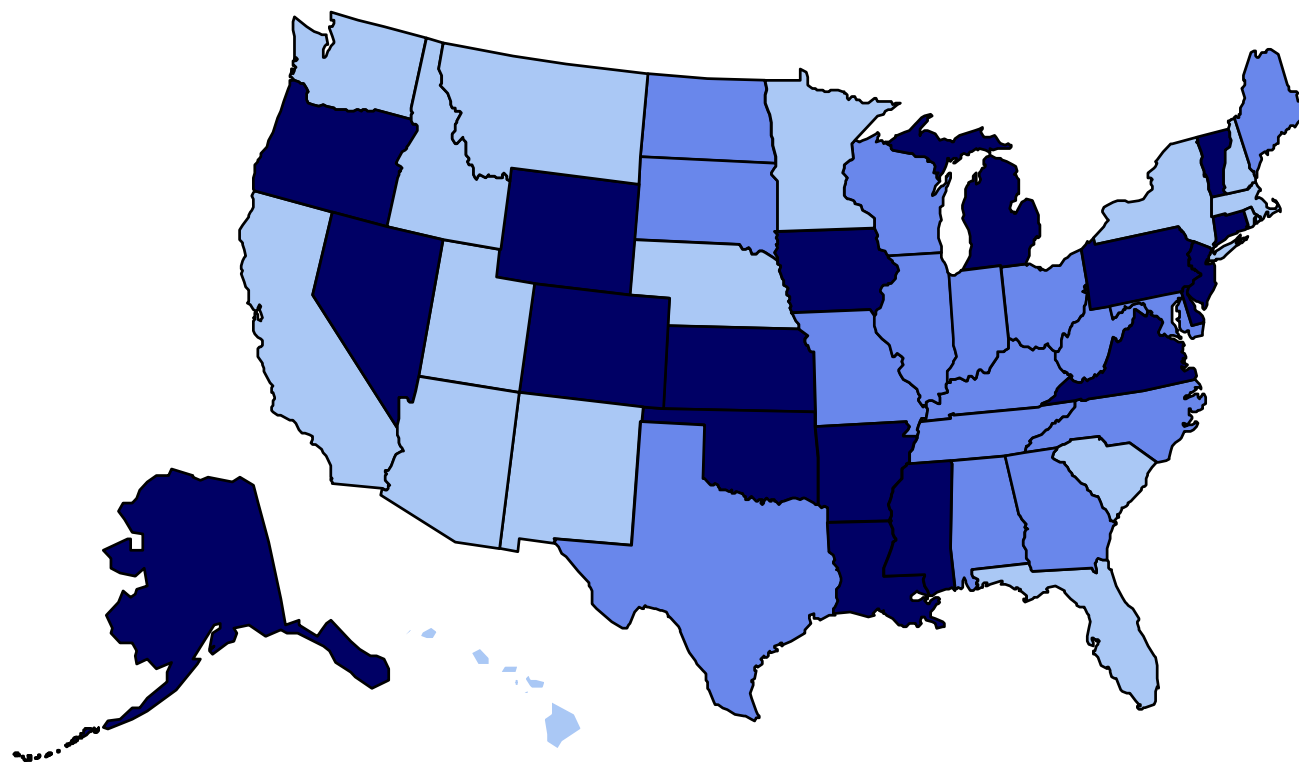
BRFSS, 1986



■ No Data ■ <10% ■ 10%-14%

Obesity Trends* Among U.S. Adults

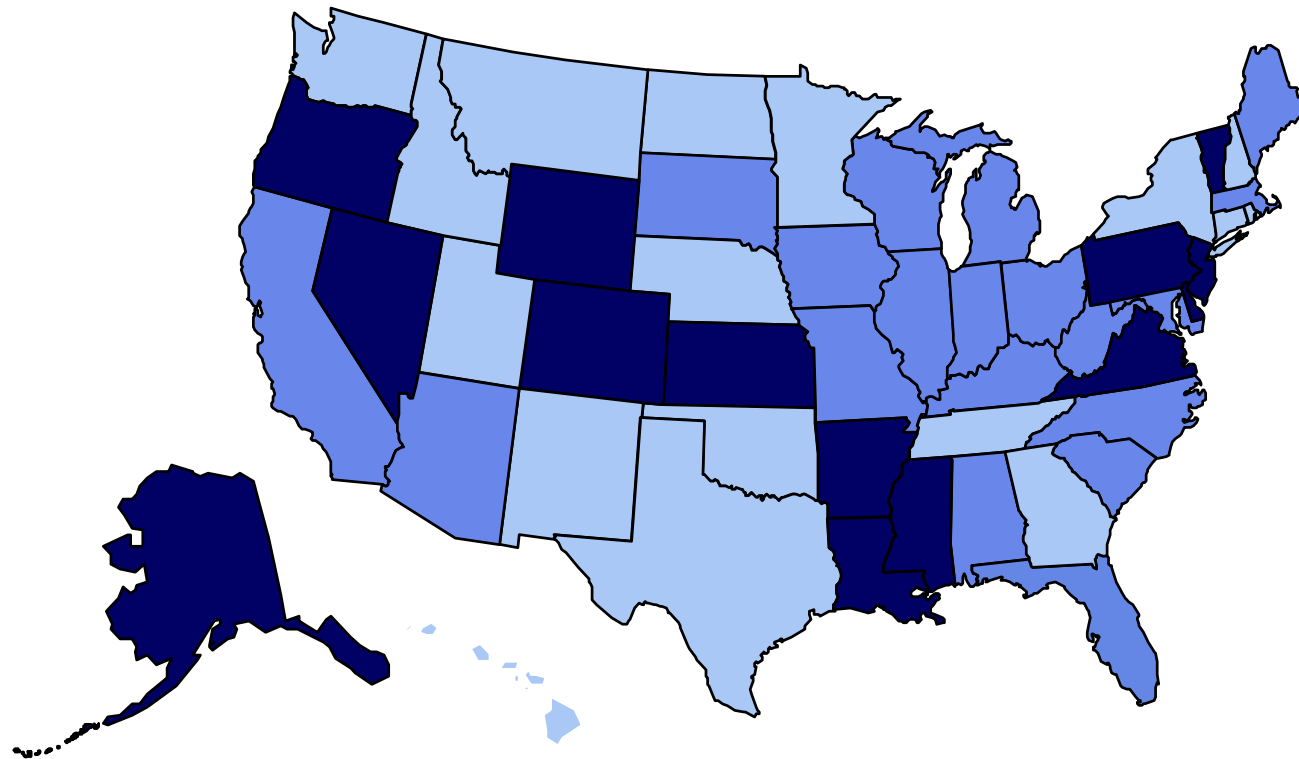
BRFSS, 1987



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Obesity Trends* Among U.S. Adults

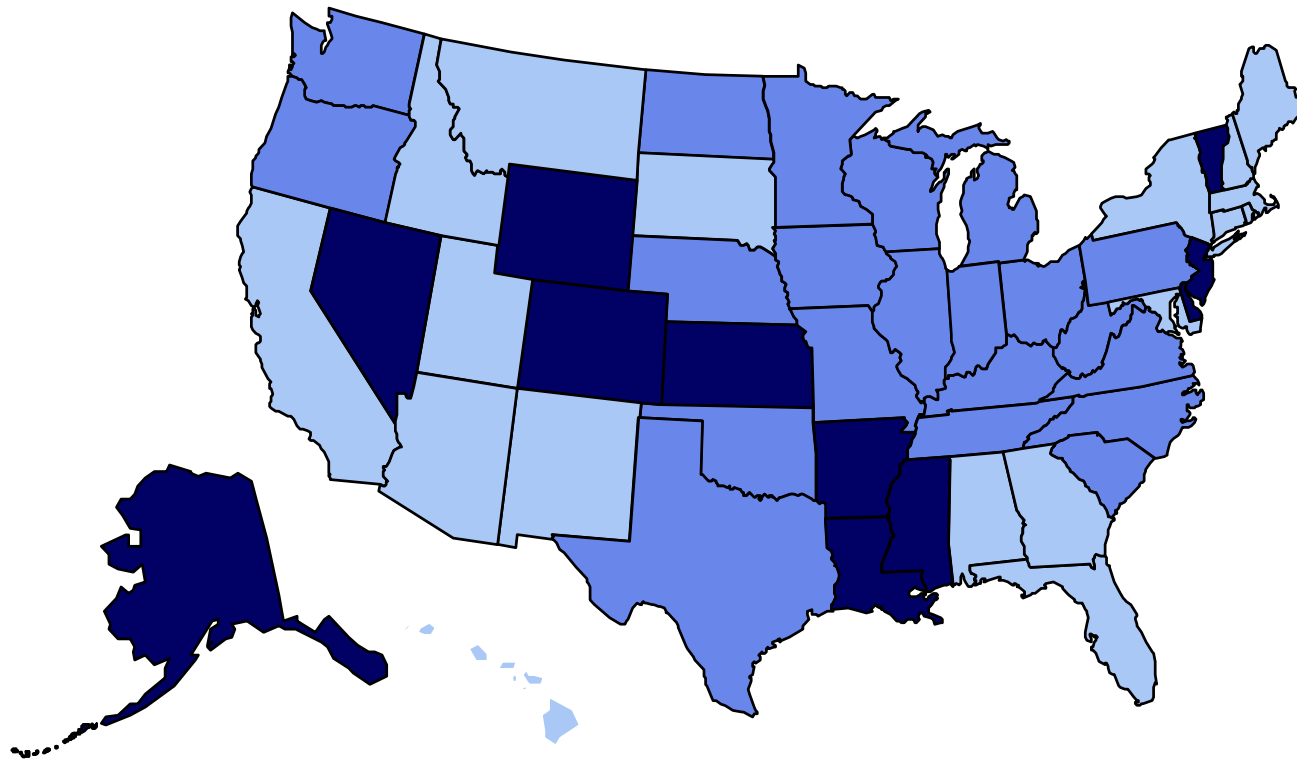
BRFSS, 1988



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Obesity Trends* Among U.S. Adults

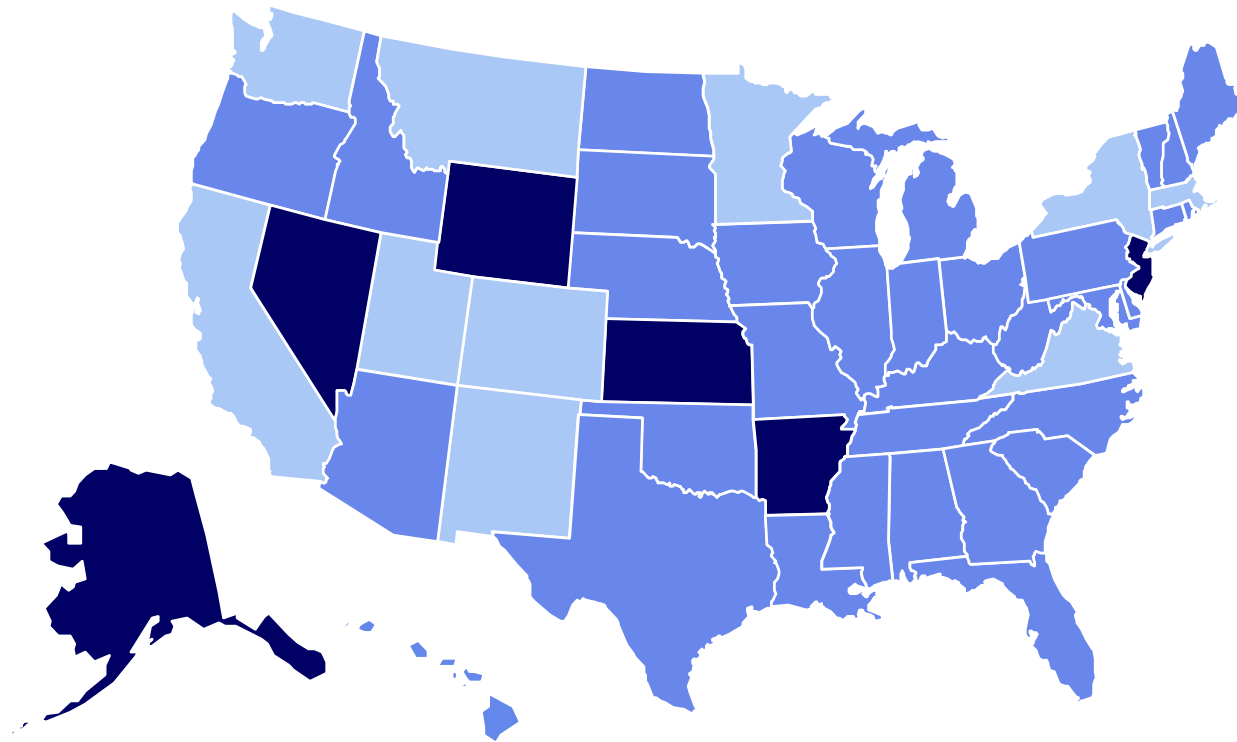
BRFSS, 1989



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Obesity Trends* Among U.S. Adults

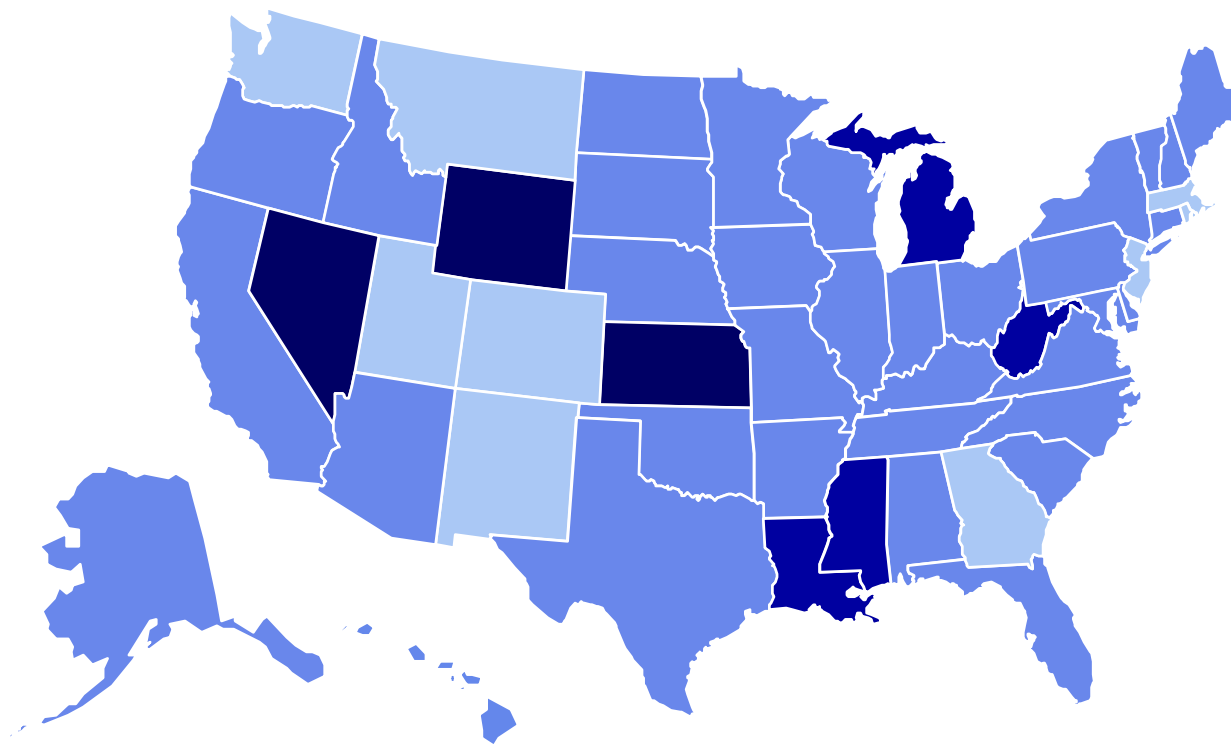
BRFSS, 1990



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Obesity Trends* Among U.S. Adults

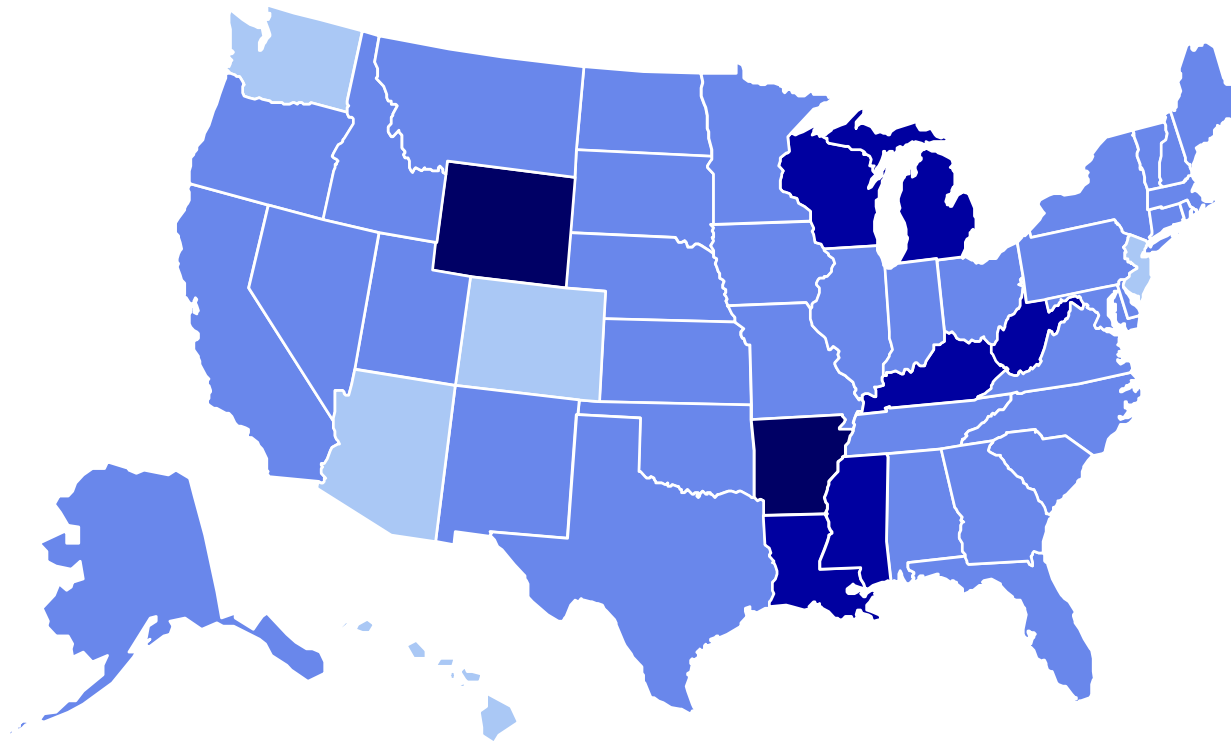
BRFSS, 1991



■ No Data ■ <10% ■ 10%-14% ■ 15%-19%

Obesity Trends* Among U.S. Adults

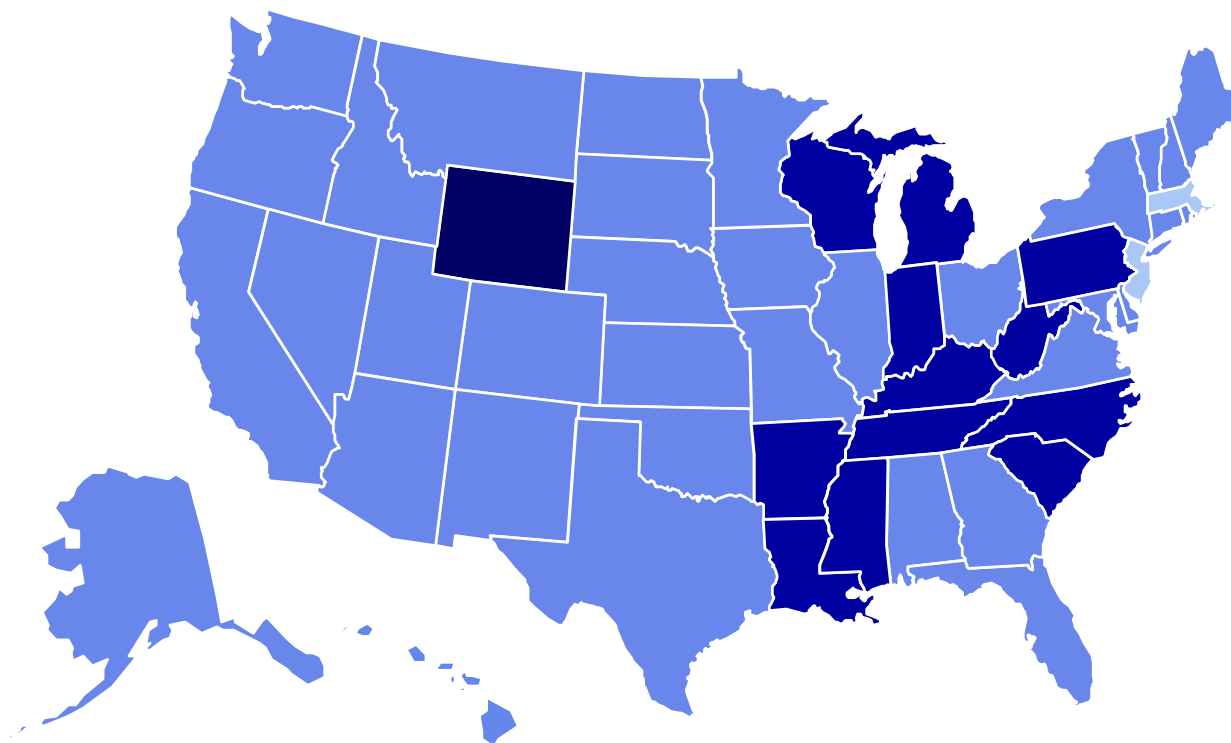
BRFSS, 1992



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Obesity Trends* Among U.S. Adults

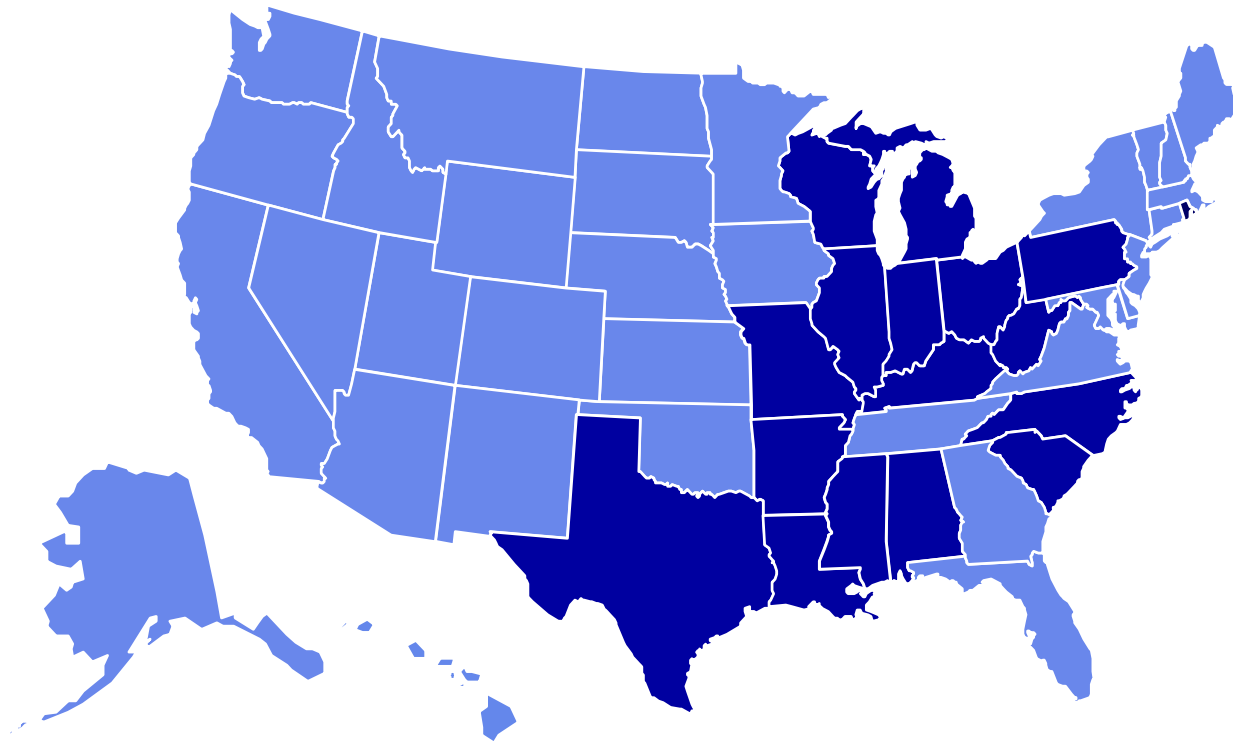
BRFSS, 1993



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Obesity Trends* Among U.S. Adults

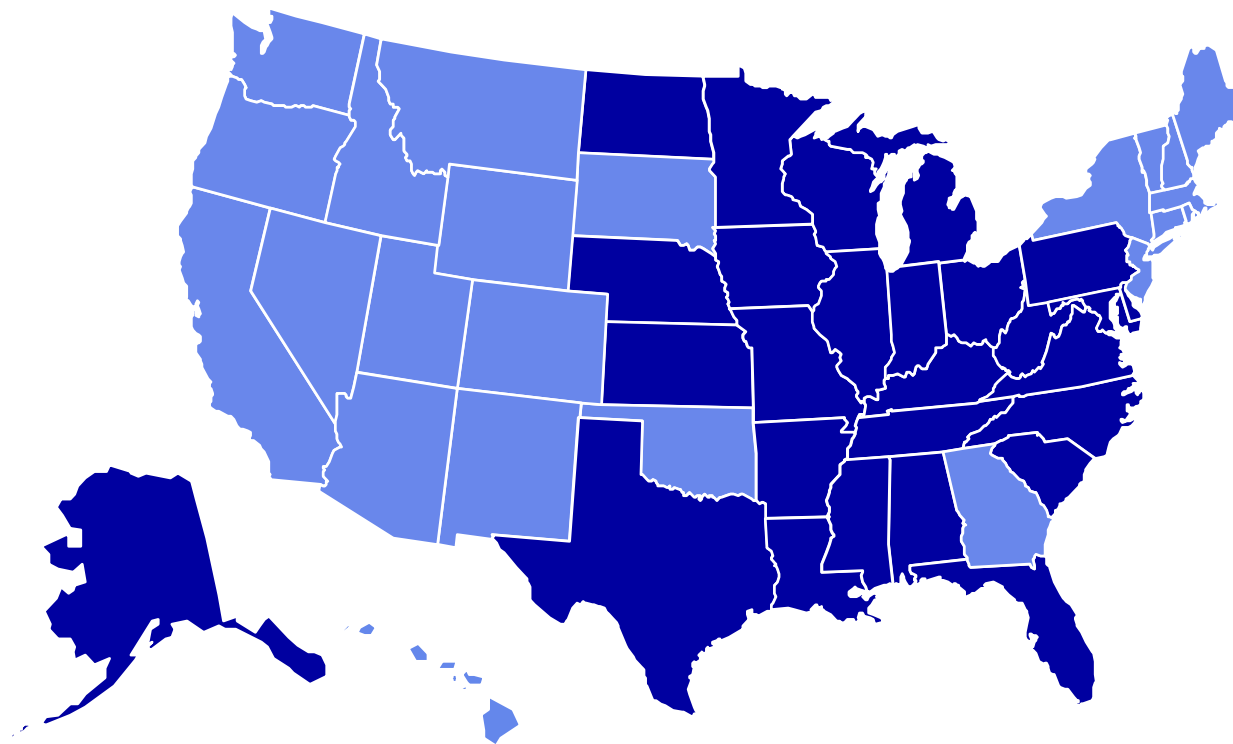
BRFSS, 1994



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Obesity Trends* Among U.S. Adults

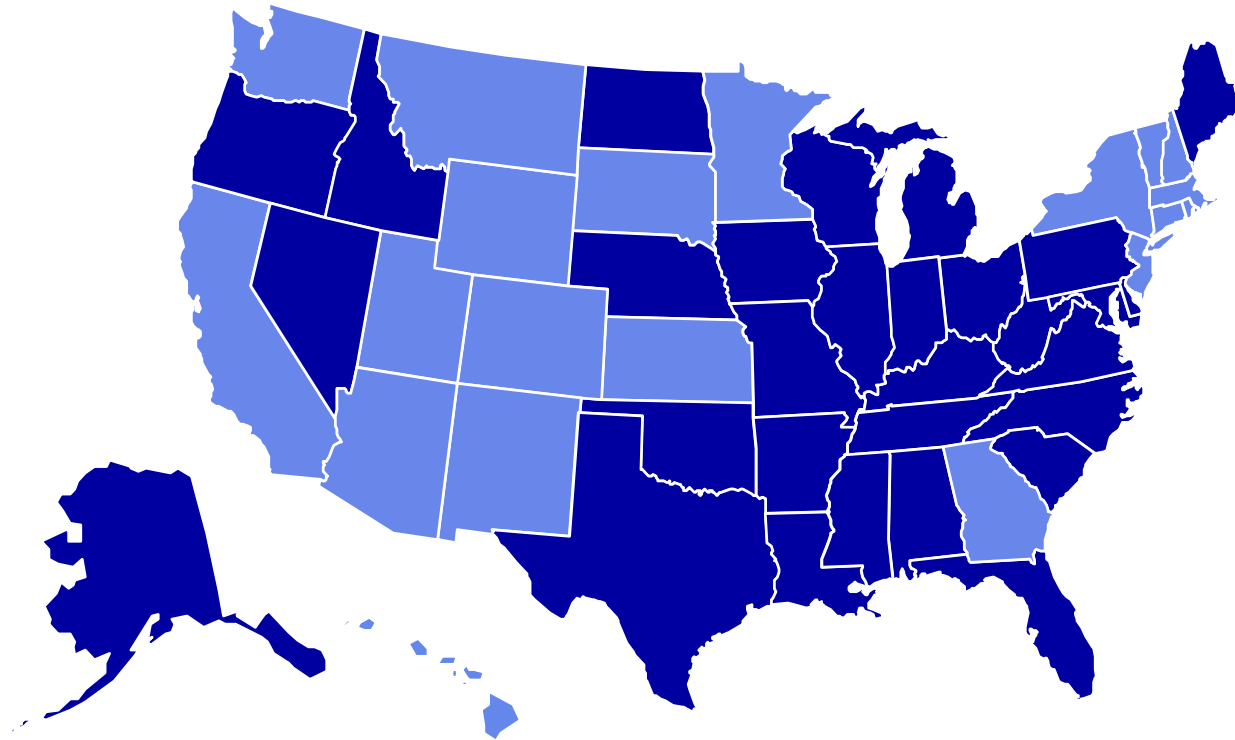
BRFSS, 1995



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Obesity Trends* Among U.S. Adults

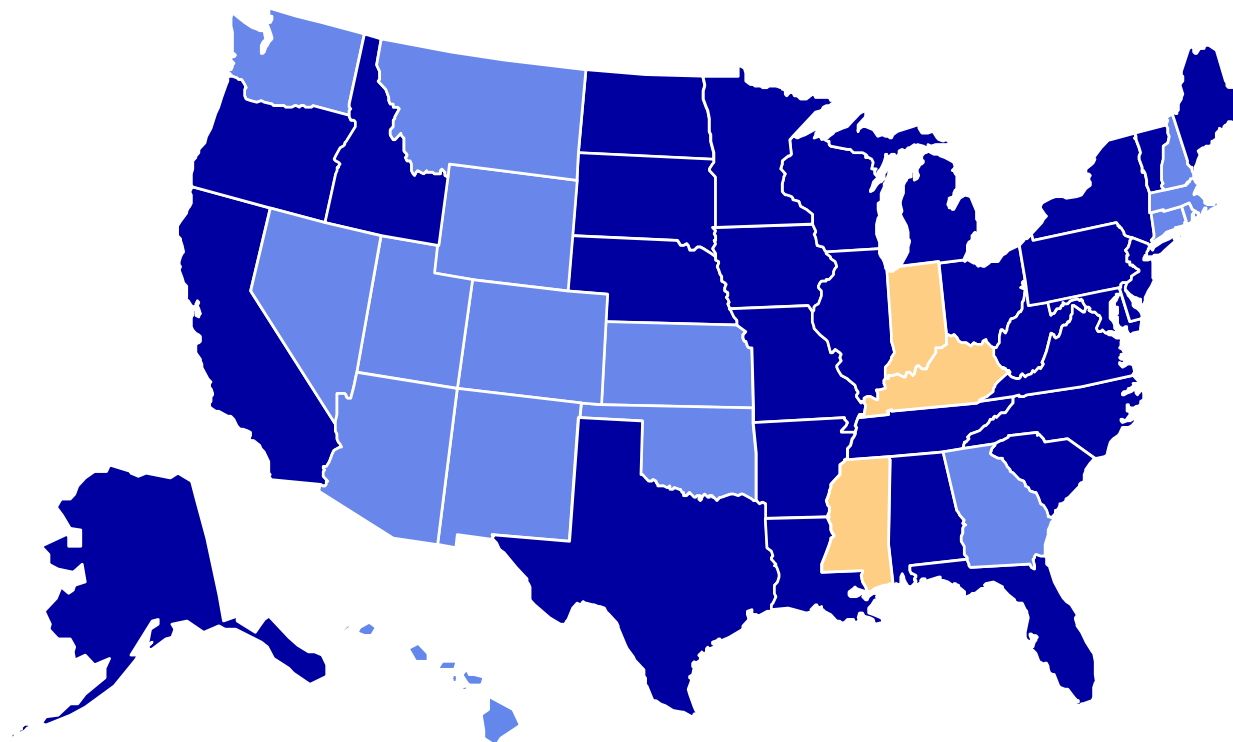
BRFSS, 1996



■ No Data ■ <10% ■ 10%–14% ■ 15%–19%

Obesity Trends* Among U.S. Adults

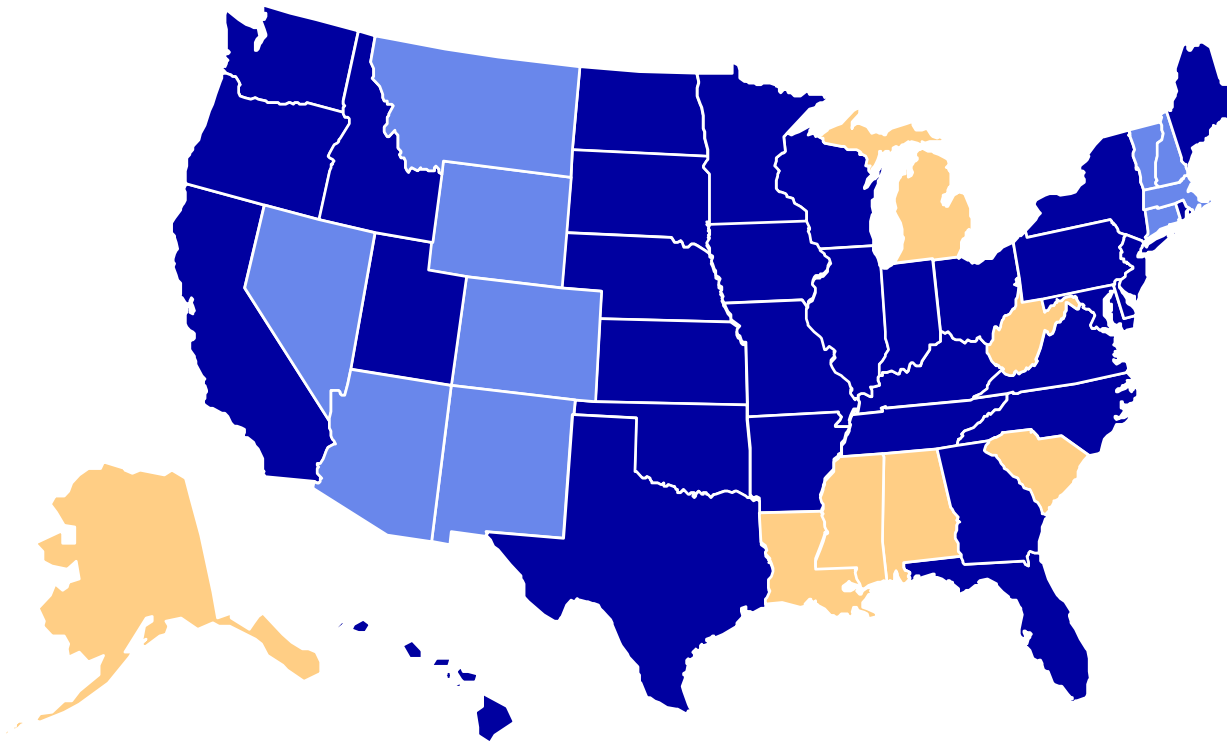
BRFSS, 1997



■ No Data ■ <10% ■ 10%-14% ■ 15%-19% ■ ≥20

Obesity Trends* Among U.S. Adults

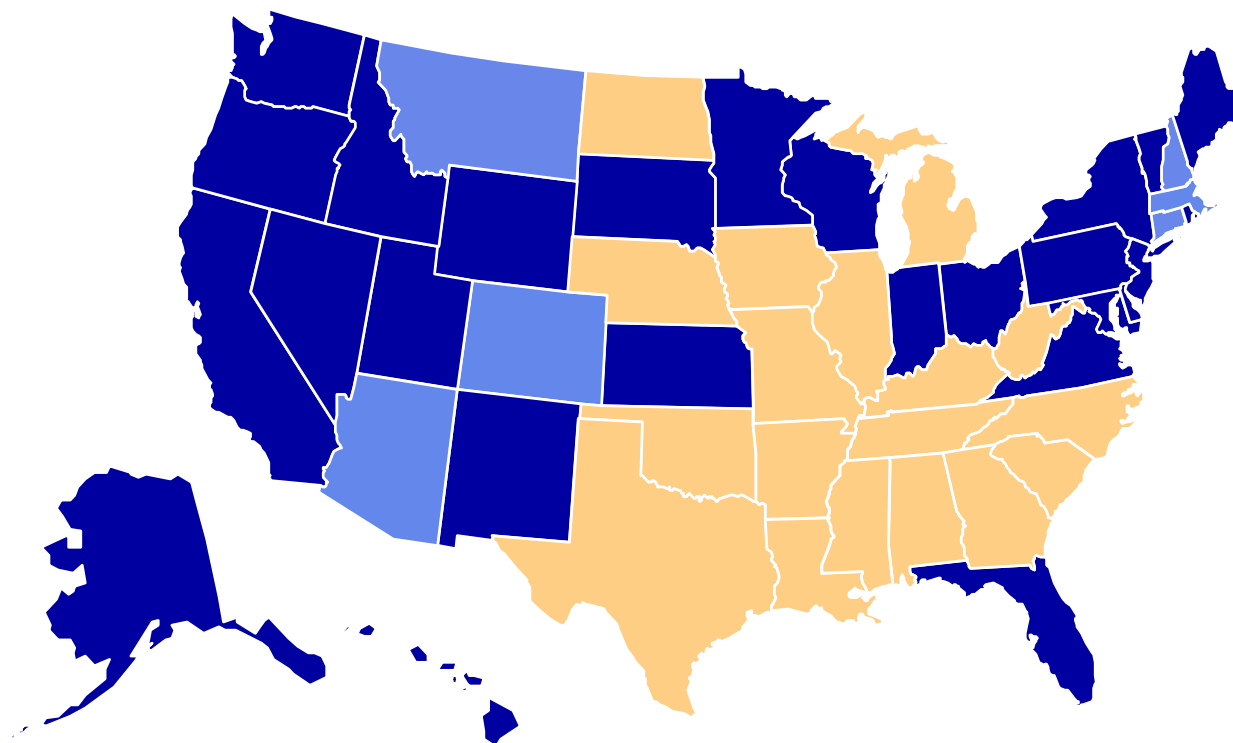
BRFSS, 1998



■ No Data ■ <10% ■ 10%–14% ■ 15%–19% ■ ≥20

Obesity Trends* Among U.S. Adults

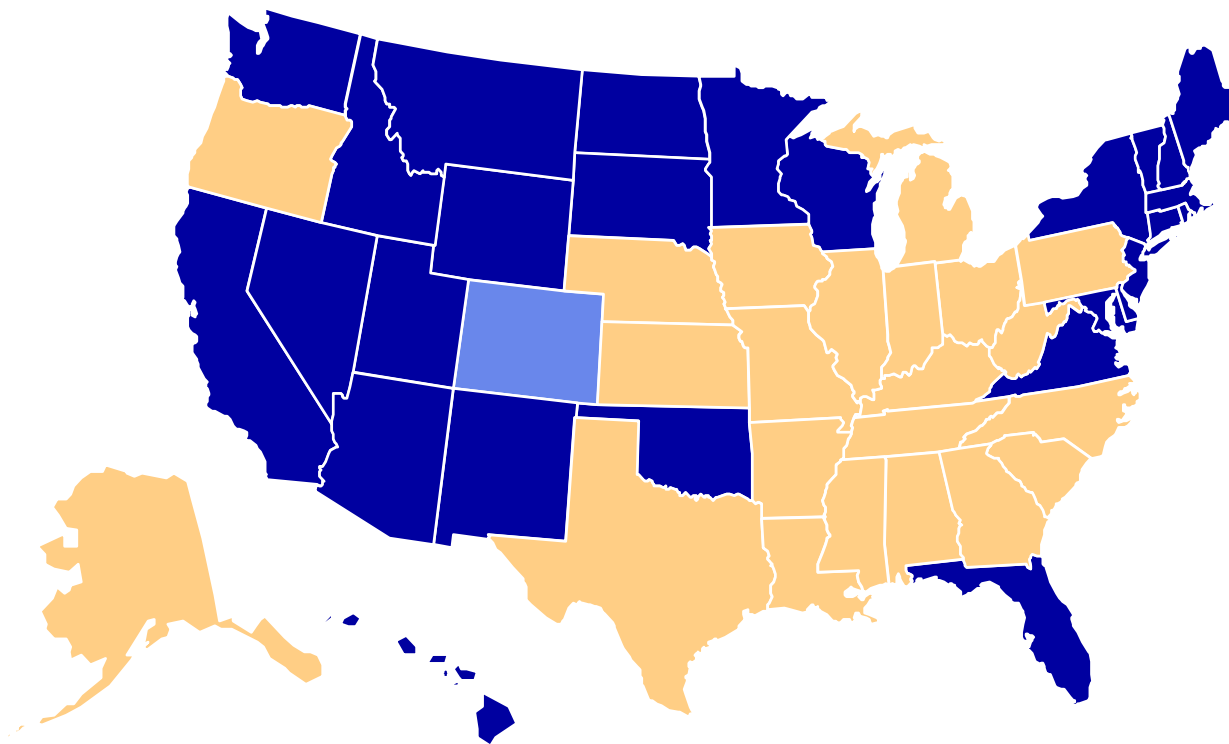
BRFSS, 1999



■ No Data ■ <10% ■ 10%-14% ■ 15%-19% ■ ≥20%

Obesity Trends* Among U.S. Adults

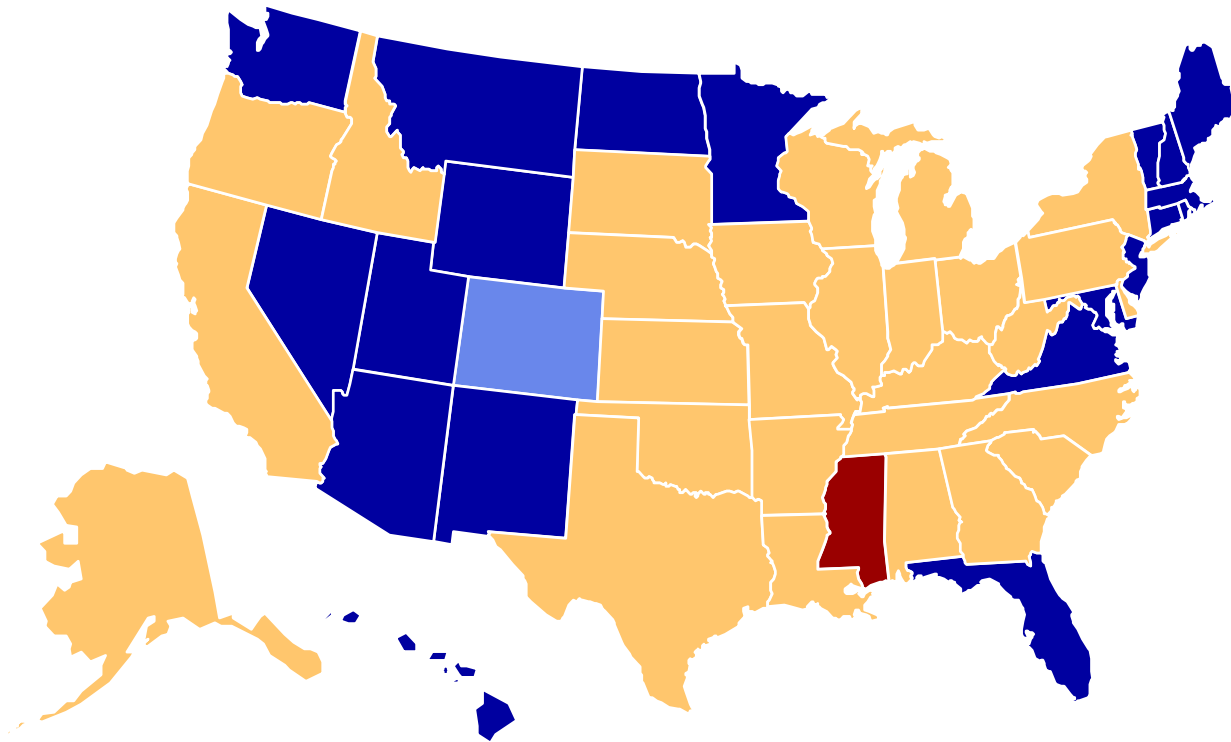
BRFSS, 2000



■ No Data ■ <10% ■ 10%–14% ■ 15%–19% ■ ≥20

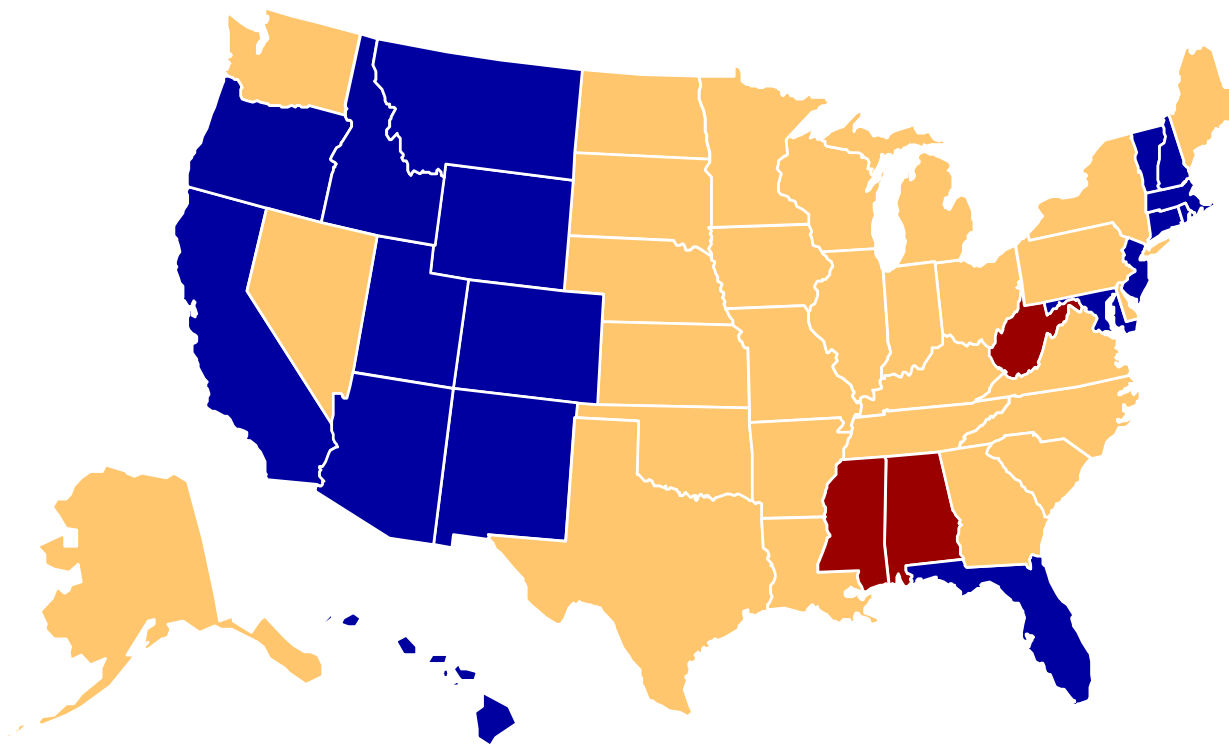
Obesity Trends* Among U.S. Adults

BRFSS, 2001



Obesity Trends* Among U.S. Adults

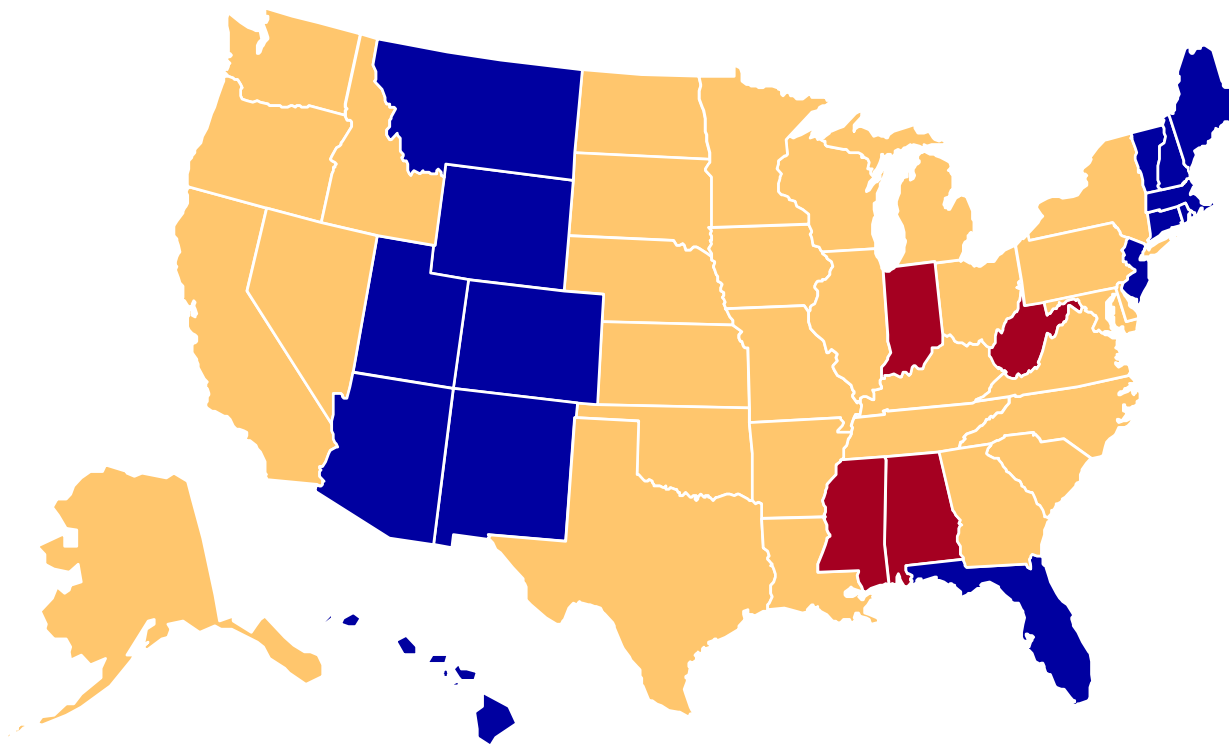
BRFSS, 2002



■ No Data ■ <10% ■ 10%–14% ■ 15%–19% ■ 20%–24% ■ ≥25%

Obesity Trends* Among U.S. Adults

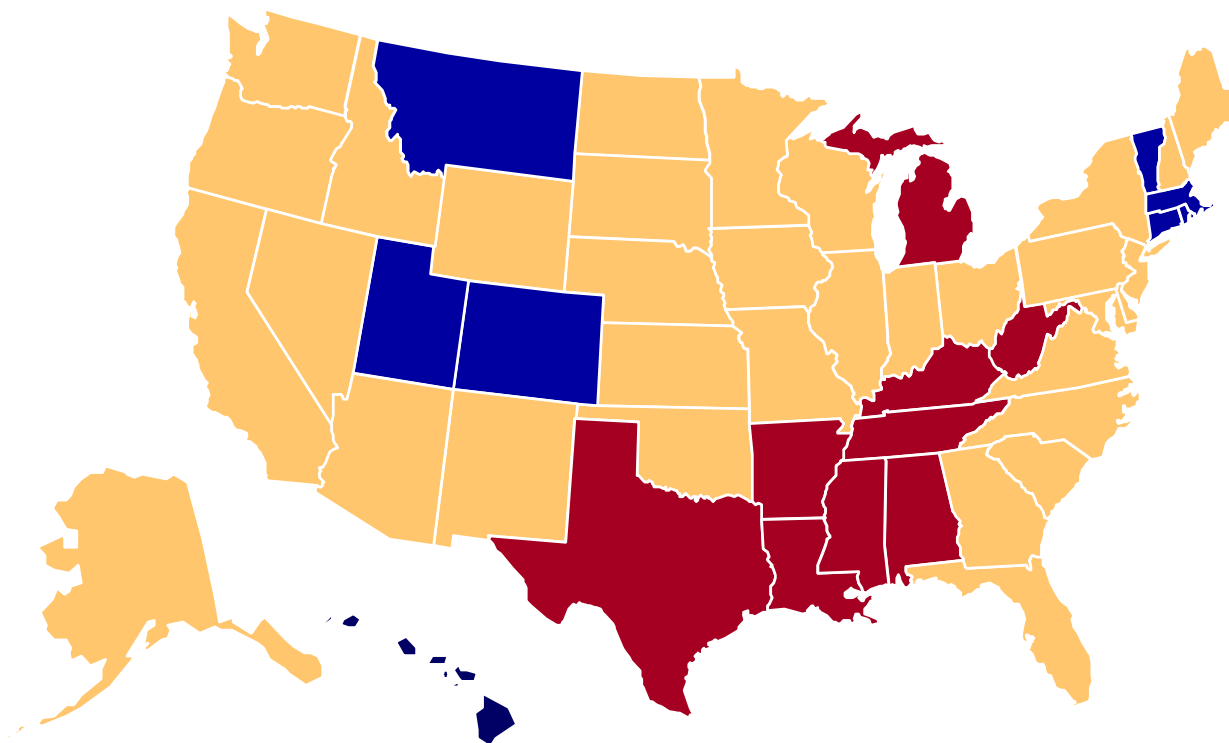
BRFSS, 2003



■ No Data ■ <10% ■ 10%–14% ■ 15%–19% ■ 20%–24% ■ ≥25%

Obesity Trends* Among U.S. Adults

BRFSS, 2004



■ No Data ■ <10% ■ 10%-14% ■ 15%-19% ■ 20%-24% ■ ≥25%

Obesity is associated with a variety of serious (and expensive) medical conditions

- **High blood pressure**
- **Atherogenic dyslipidemia**
 - low HDL, hi TG, increased small dense LDL particles, slow clearance of TG from the blood
- **Vascular disease**
 - Coronary artery disease, carotid artery disease, peripheral vascular disease
- **Glucose intolerance and type 2 diabetes**
- **Clotting problems**

Obesity is associated with a variety of serious (and expensive) medical conditions

- **Nonalcoholic fatty liver disease**
- **Sleep apnea**
- **Pro-inflammatory state**
- **Certain forms of cancer**
- **Polycystic ovary syndrome**
- **Gout**

**Obesity-related medical conditions
have a common denominator:**

*Insulin resistance and
compensatory hyperinsulinemia*

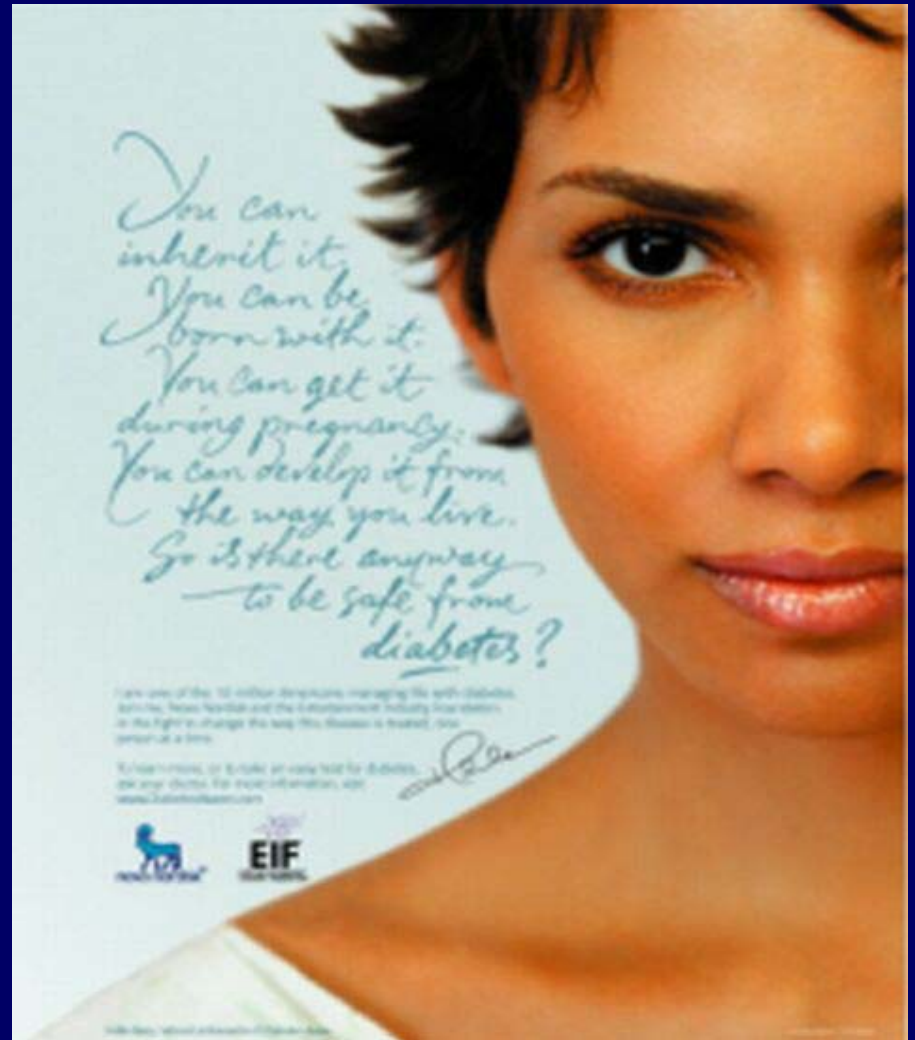
Key point:

Not all obese people are insulin resistant or at risk for these disorders and not everyone with these disorders is overweight

Some type 2 diabetics are normal weight

“Once you're a diabetic, you're pretty much a diabetic,” says Berry. “I have **adult onset diabetes**. I was diagnosed when I passed out one day. I've gotten my diabetes to a really manageable place. So I don't have really any complications due to it, but I still have to deal with it and check my blood many times a day.”

USA Today 10/21/02



And some obese people are insulin sensitive

“....substantial numbers of overweight/obese individuals remain insulin-sensitive, and not all insulin-resistant persons are obese.”

Gerald Reaven, MD

Insulin resistance and obesity

- **~ 75% of individuals in the most insulin-resistant tertile are overweight/obese**
 - That means 25% of insulin resistant individuals are not overweight/obese
- **30% of those in the most insulin-sensitive tertile are overweight/obese but are at low risk for IRS**
- **Metabolic benefit and decrease in risk of CVD following weight loss occurs primarily in those overweight/obese individuals that are also insulin resistant**

Metabolic Syndrome is the term used for clusters of CVD risk factors

- **Atherogenic dyslipidemia**
- **Elevated blood pressure**
- **Elevated glucose**
- **Central obesity**
- **Increased prothrombotic factors**
- **Increased proinflammatory factors**

Criteria for diagnosis of Metabolic Syndrome

	NCEP ATP III*	WHO***	ACE/AACE
Overweight/ obesity	Waist circumference: >40" (men) >35" (women)	Waist:Hip >0.9 (men) 0.85 (women) or BMI >30 kg/m ²	BMI $\geq$ 25
Trigl	$\geq$ 150 mg/dl	same	same
HDL	< 40 mg/dl (men) < 50 mg/dl (women)	<35 mg/dl (men) <39 mg/dl (women)	Same as ATP III
BP	$\geq$ 130/ $\geq$ 85 mmHg	$\geq$ 140/90	$\geq$ 130/85
IFG	$\geq$ 100 mg/dl**	$\geq$ 110 or IGT or glu uptake < lowest quartile	$\geq$ 110 and 126 mg/dl or 2 hr p glucose challenge $\geq$ 140 mg/dl;
Microalb	N/A	$\geq$ 20 microg/min or alb:creat $\geq$ 30mg/g	

*3 out of 5 needed to make dx **Original criteria defined IFG as $\geq$ 110 mg/dl ***Must have IGT, IFG, IR, or DM plus 2 of the other 4

International Diabetes Federation

- **Must have: central obesity (waist circumference ≥ 94 cm for Europid men and ≥ 80 cm for Eurpoid women, with ethnicity specific values for other groups**
- **Plus two of the following four:**
 - **Raised TG level: ≥ 150 mg/dL (or on treatment)**
 - **Reduced HDL cholesterol: <40 mg/dL in males and <50 in females (or on treatment)**
 - **Raised blood pressure: systolic ≥ 130 or diastolic > 85 U or on treatment**
 - **Raised fasting plasma glucose: ≥ 100 mg/dl or previously diagnosed type 2 diabetes**

Insulin Resistance Syndrome vs Metabolic Syndrome

- **Insulin resistance syndrome (the endocrinologists' view of the world)**
 - Unifying pathophysiology: insulin resistance & compensatory hyperinsulinemia
 - Loosens the link with obesity
- **Metabolic syndrome (the cardiologists' view of the world)**
 - Term widely used
 - Links clusters of conditions with risk of CVD
 - Obesity is often an defining element of the syndrome

Insulin resistance and compensatory hyperinsulinemia

- **Individuals vary in their sensitivity to insulin**
- **Insulin resistance leads to increases in insulin secretion in order to maintain normal blood glucose**

Insulin resistance and compensatory hyperinsulinemia

- **Compensatory hyperinsulinemia is responsible for most, if not all, of the abnormalities and clinical syndromes that constitute IRS/MetS***
 - **Syndrome X, insulin resistance syndrome, metabolic syndrome**
- **When the pancreas cannot keep up with demand, insulin insufficiency occurs (glucose intolerance, type 2 diabetes)**

Continuum of metabolic derangements related to insulin resistance

– Diabetes is a late manifestation

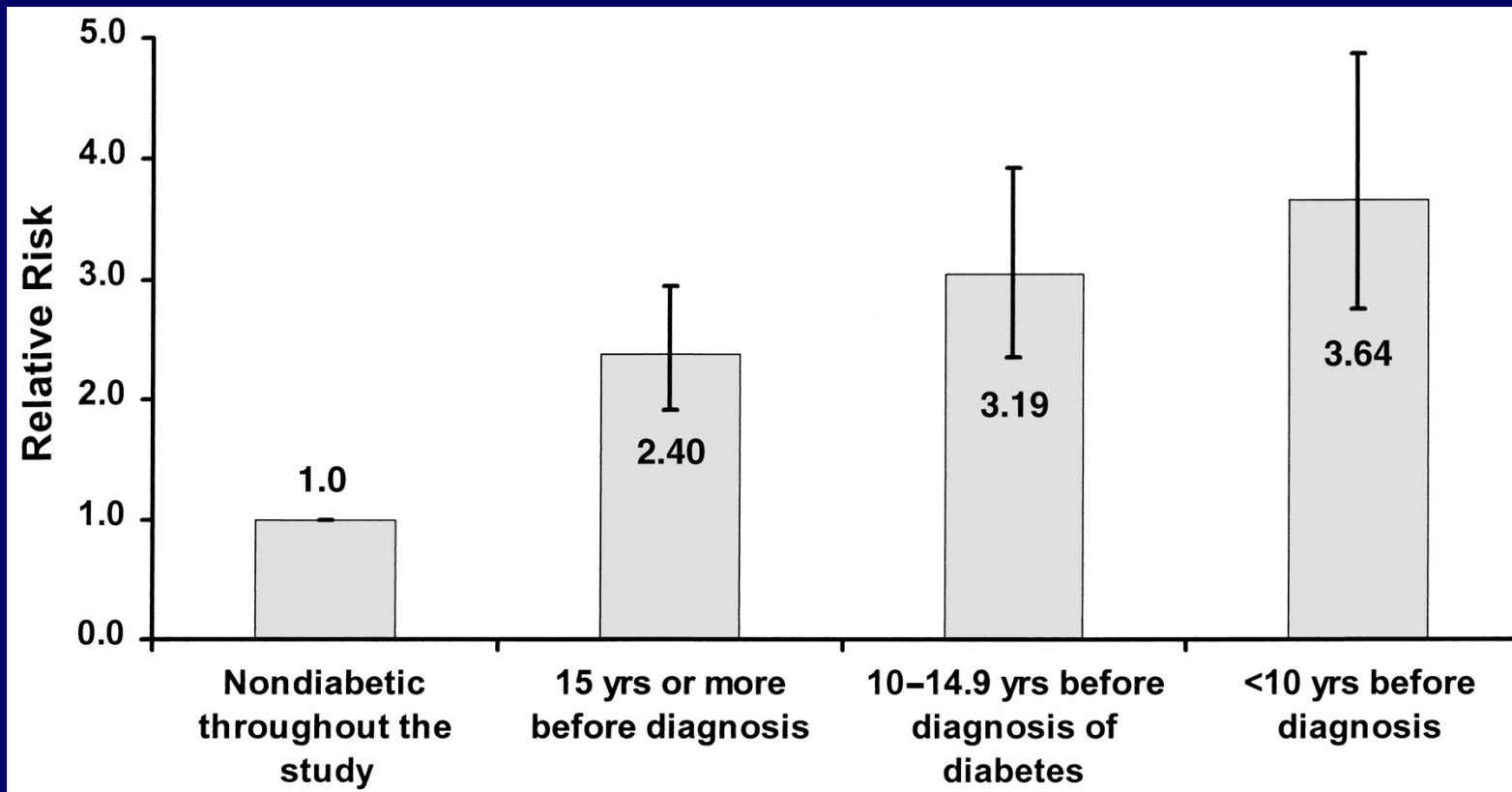


***70-80% meet criteria for metabolic syndrome, all have insulin resistance**

We need to stop thinking about type 2 diabetes in a binary mode

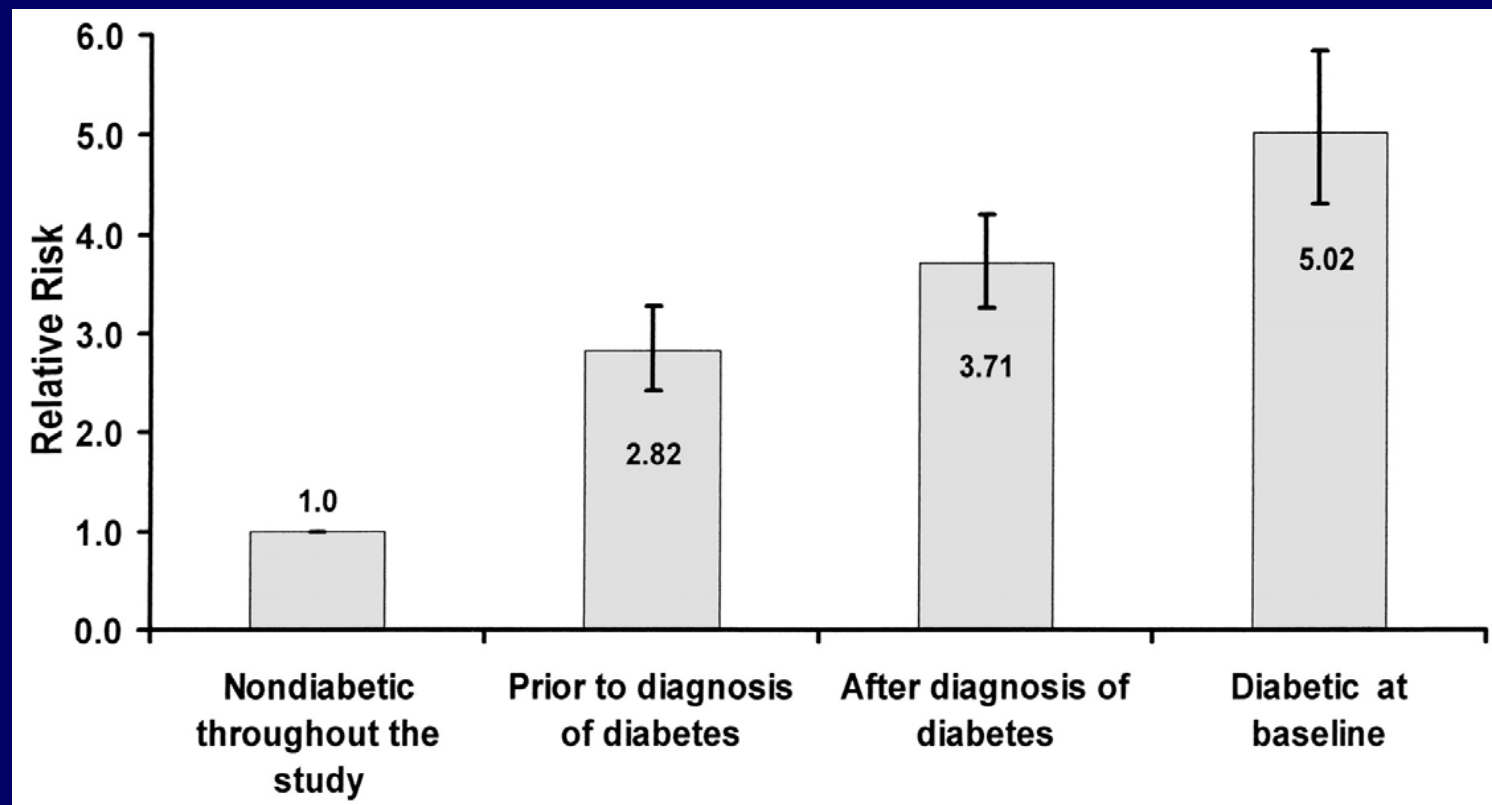
- Increased cardiovascular and stroke risk begin *before* the onset of clinical diabetes
- Progression to diabetes can be slowed or, perhaps, prevented
- Insulin resistance should be recognized and addressed before irreversible damage occurs

Increases in the risk of CAD & stroke precede the onset of diabetes



Multivariate RRs and 95% CIs of MI or stroke according to time before clinical diagnosis of diabetes.

Risk is almost as high in the prediabetic state as after the development of diabetes



**Multivariate RRs and 95% CIs of MI or stroke
according to diabetes status**

Risk of diabetes is increased even if baseline glucose tolerance is normal

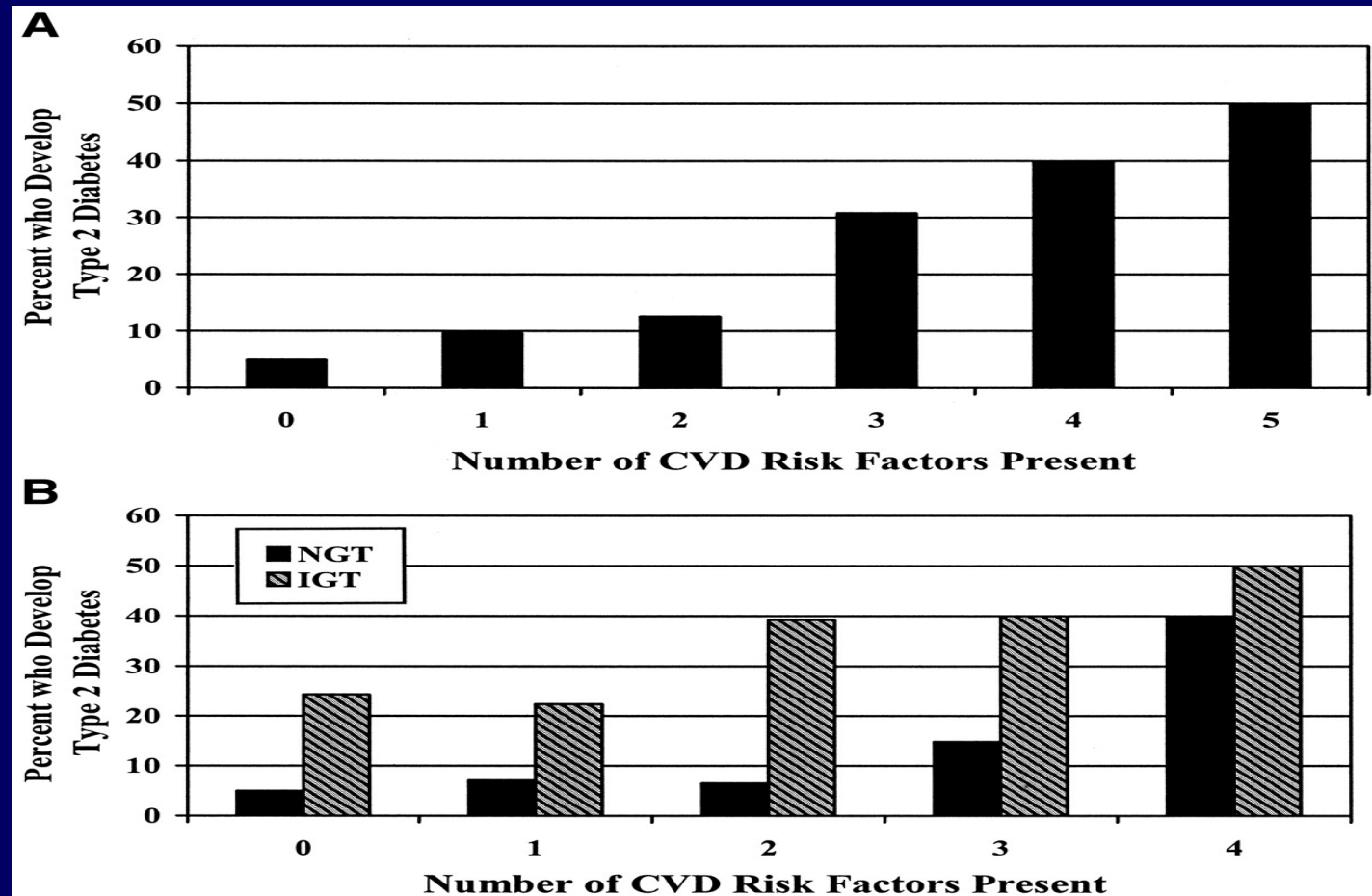


Figure 2— Five-year conversion rates for developing diabetes by the number of RFs present at baseline. *A*: Overall. *B*: Baseline glucose tolerance status.

D'Agostino et al, Diabetes Care, Sept. 2004

Applying DM Approaches to Obesity and/or Insulin Resistance Syndrome

- **Identification from claims data:**
 - **Diabetes (250.XX) or abnormal glucose (790.2X)**
 - **Overweight/obesity (278.00)**
 - **Dysmetabolic syndrome X (277.7)**
 - **Hypertension (multiple ICD9 codes) + dyslipidemia (272.XX)**
 - want to capture high TG, low HDL, small dense LDL)
 - **Nonalcoholic fatty liver (571.8)**
 - **Acanthosis nigricans (701.2)**
- **Other:**
 - **History of gestational diabetes (648.8) –increases lifelong risk diabetes of mother and child**
 - **PCOS (256.4)**

Identification (continued)

- **HRA**
 - **Self-reported overweight/obesity ($\text{BMI} \geq 25$)**
 - **Particularly, if high risk ethnic/racial group (Native American, Asian American, African American, Latino, Pacific Islander)**
 - **Self-reported history of giving birth to babies ≥ 9 lbs**
 - **Self-reported history of glucose intolerance or frank diabetes**

Suggested stratification of obese patients for DM

High risk

- **Overweight/obesity + CVD**
- **Overweight/obesity + glucose intolerance or frank diabetes**
- **Overweight/obesity + other evidence of insulin resistance**
 - **Metabolic syndrome**
 - **(TG:HDL ratio ≥ 3.0 highly likely to be both insulin resistant and at high risk of increased CVD risk)**
 - **Nonalcoholic fatty liver**
 - **Presence of acanthosis nigricans**
- **Evidence of normal weight, but evidence of insulin resistance**

Stratification (continued)

- **Moderate risk**
 - History of gestational diabetes (mother and child)
 - History of giving birth to babies > 9 lbs
 - Strong family history of type 2 diabetes
 - High risk ethnic group (Native American, Asian American, African American, Latino, Pacific Islander)
 - PCOS

Stratification (continued)

- **Low risk**
 - **Overweight/obese without evidence of insulin resistance, CVD or glucose intolerance**

Interventions

- **Weight loss**
- **Increase physical activity**
- **Ensure compliance with appropriate medications**
- **Surgery**

Weight loss

- **For many, this requires intensive support**
 - **One call a week or one call a month is usually not enough**
 - **Daily food diaries and daily weights are key tools**
 - **But keep it simple**
 - **Peer groups provide support and accountability**
 - **Online: PEERtrainer (www.peertrainer.com)**
 - **In person: Weight Watchers**
 - **Family support helpful, but it must not degrade into nagging**
 - **Some will benefit from nutritionist counseling**

www.peertrainer.com

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diet & fitness

LOGIN



buddy up. slim down.

Find groups. Lose weight.
Meet your goals.

PEERtrainer gives you the motivation & support you need to achieve your weight loss goals.

PEERtrainer is free. We offer:

- daily logs to record meals, workouts and goals
- small groups that keep you accountable
- Calorie Counter, Spotlight, Blogs and Community

join now ►



introducing:
PEERtrainer
text messaging

Update your log whenever you are! Get your daily tips. [Learn more about this service...](#)

latest group activity

[buldgebusters](#)

Want to reduce body fat %. Love tennis and skiing. Let's share workout ideas...

Last comment: 2hrs ago.

newest groups

- [20 somethings to lose 60lbs...](#)
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find a group in your zip code now:

Enter zip code...

GO

success stories

ALL STORIES



kissmekate02

I have ultimately lost 88 pounds, but I have lost almost 30 since joining PEERtrainer in May, and I think my biggest successes have been the good habits I have formed as a DIRECT RESULT of belonging to this community and being accountable to myself as well as others by maintaining my logs... [More...](#)



libbysnax

PeerTrainer has really worked for me. I've kept food logs before, with minimal success. But, being part of a community of people who share your same goals is a wonderful, positive motivator. I belong to five groups right now, and each one is unique... [More...](#)



jen

I have been a PEERtrainer user for 4 months and it has been an amazing experience!! Peer Trainer has changed some of my eating and exercise habits for life. [More...](#)

in the press

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fitness

The New York Times

USA TODAY

The JetBlue Card from American Express.

Earn free* flights on the airline that smiles back.



Carry the Love.™
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Physical activity

- **Exercise has an independent effect on insulin sensitivity**
 - **Aerobic**
 - **Strength training**
 - **Best results if exercise daily**
 - 1 hour of moderate intensity (brisk walking)
 - Or 30 minutes of high intensity (jogging)
 - **Personal trainers helpful, at least initially**
 - **Peer support (run with friends, log exercise on PEERtrainer) provides accountability**

Medications/Surgery

- **Metformin and acarbose have been documented to prevent progression of pre-diabetes to diabetes**
 - **Less effective than intensive lifestyle changes**
- **Specific insulin sensitizers may be indicated in some (glitazones)**
- **DM can play an important role in medication compliance**
- **Gastric bypass is an effective, but expensive alternative**
 - **Ghrelin levels do not increase after surgery-induced weight loss**
 - **This may be why surgery is more effective than dieting for some individuals**

Other interventions

- **Modeling demonstrates that treatment of component risk factors (e.g., HTN, dyslipidemia) can markedly reduce the expected rate of CAD**
- **DM programs should monitor and support participants and their physicians in reaching aggressive targets for BP and lipids**

CHD risk in IRS/MetS can be reduced significantly

- **Control of 3 risk factors (BP, HDL, LDL) to “normal” levels could prevent 51% of CHD events in men and 43% in women**
- **Control to “optimal” levels would prevent ~80% of CHD events**

Treatment of component risk factors is straightforward and cheap compared with treatment of CVD, MI, and stroke

Prevention of Type 2 Diabetes

- Prevention of Type 2 diabetes (or delayed progression) is possible with intensive lifestyle modifications (weight loss and increased physical activity).
- Some pharmacological interventions may also reduce diabetes
 - Acarbose
 - Metformin

Prevention of endovascular catastrophes and type 2 diabetes will save money, the question is when....

- **MI and stroke risk is increased 15 years or more before the onset of diabetes**
- **Conversion from IGT to diabetes occurs at a rate of ~5 %-10%/year**
- **Increased number of risk factors=increased risk**

Therefore, an appropriately designed and managed obesity/IRS/MetS DM program should yield a positive ROI

- Long term insurers
- Medical groups at risk
- Long-term employers
- Public-sector purchasers
- Patients and families

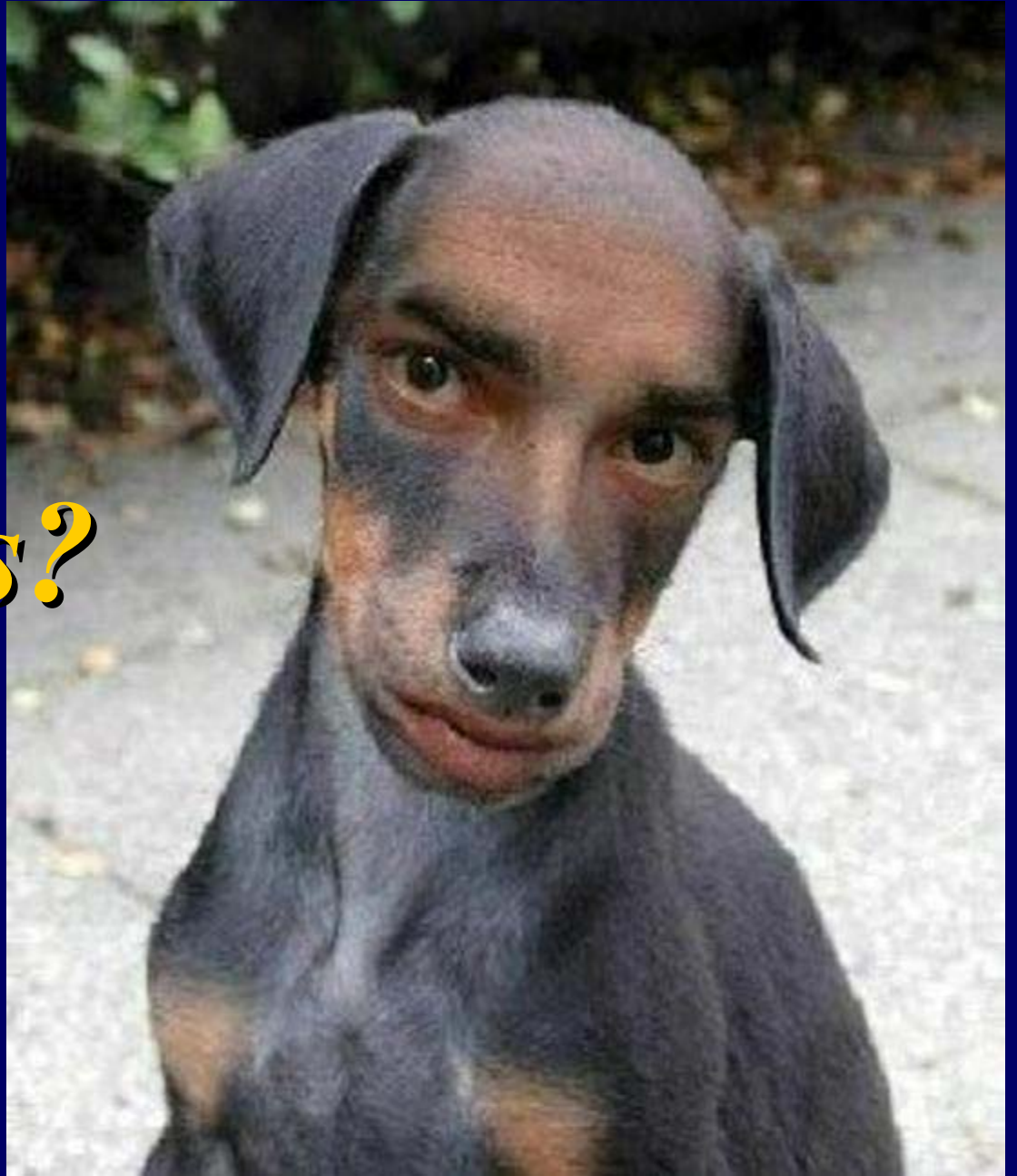
The clinical benefits are priceless

- **Fewer heart attacks**
- **Fewer MI deaths**
- **Fewer strokes**
- **Fewer stroke deaths**
- **? Fewer amputations**
- **Less progression to type 2 diabetes and its complications**
- **Less disability, improved function**
- **Less absenteeism; ? Improved presenteeism**
- **Improved quality of life for the patient and his/her family**

Take Home Messages

- **Insulin resistance and compensatory hyperinsulinemia, not obesity per se, leads to increased CVD risk and a whole spectrum of metabolic disorders**
- **Metabolic and CVD benefits resulting from weight loss occur in obese individuals who are also insulin resistant**
- **Physical activity has independent benefits on insulin sensitivity**
- **Aggressive treatment of component risk factors (high BP, abnormal lipids) must be a part of an obesity disease management program**

Questions?



Appendix: Definitions of Overweight and Obesity

Adults:

- **Overweight:** BMI 25.0 to 29.9
- **Obesity:** BMI ≥ 30
- **Extreme obesity:** BMI ≥ 40

Children and adolescents:

- **At risk for overweight:** $\geq 85^{\text{th}}$ percentile of age and sex specific BMI
- **Overweight:** $\geq 95^{\text{th}}$ percentile