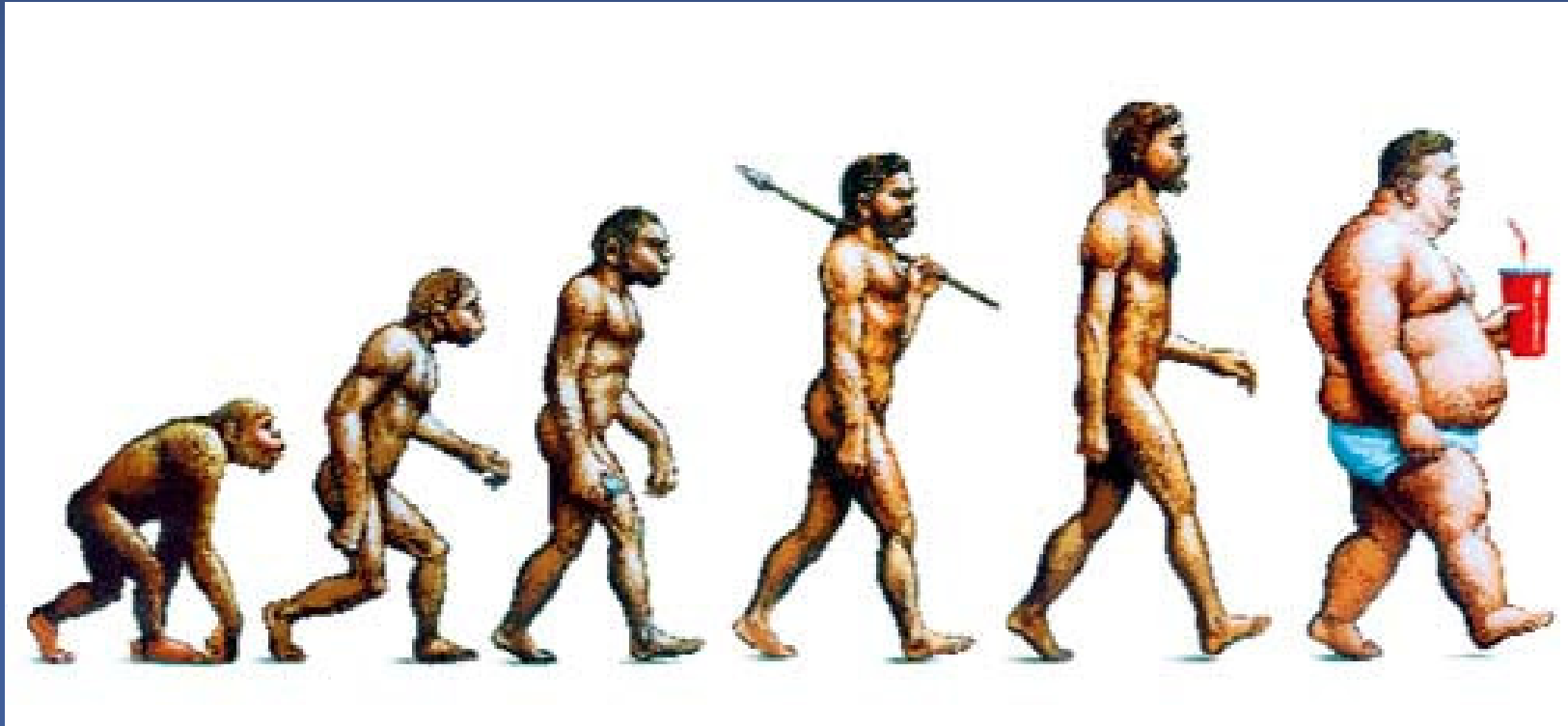


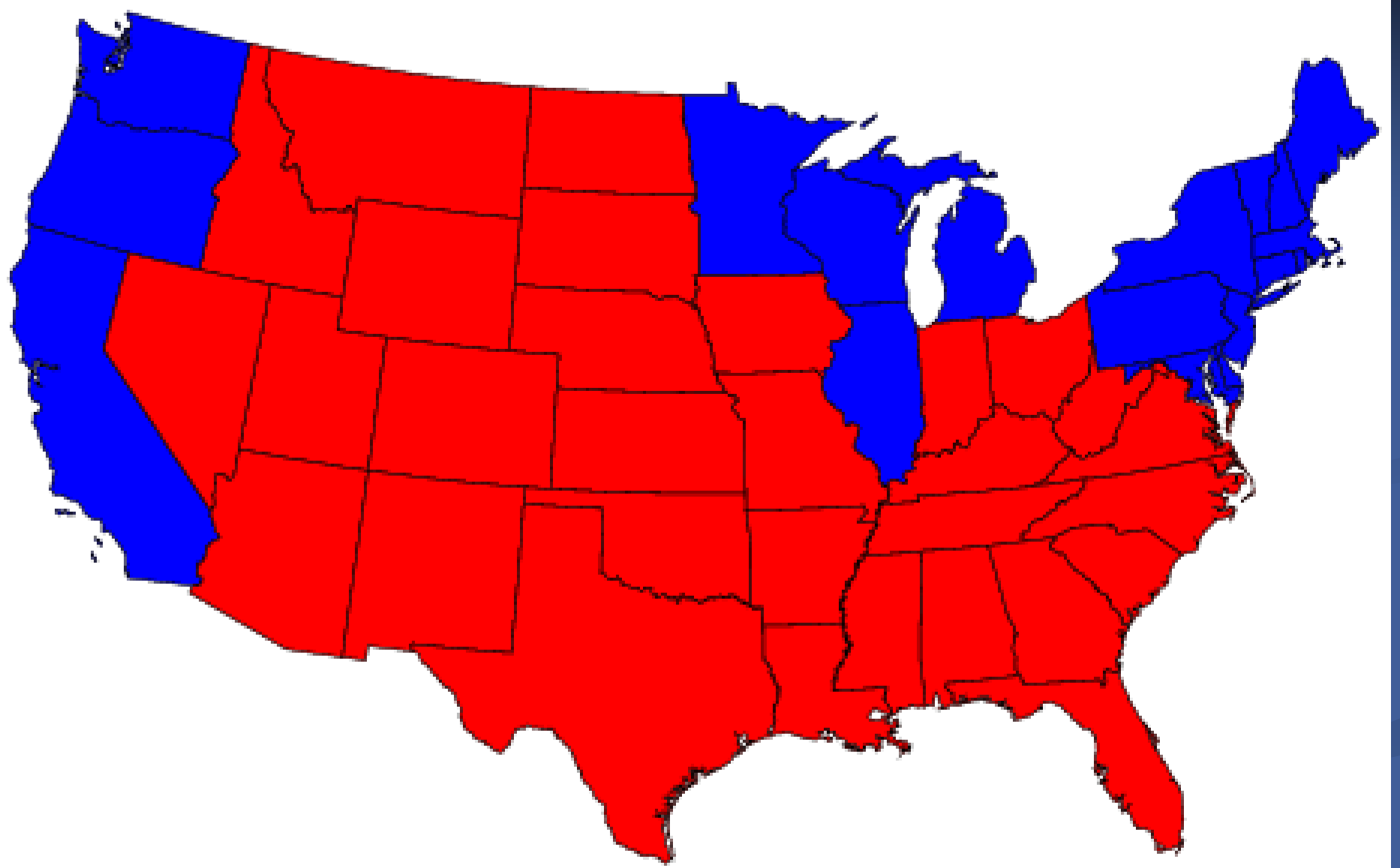
Obesity and Asthma: The evolution of a problem?



John F. McConville, M.D.
University of Chicago

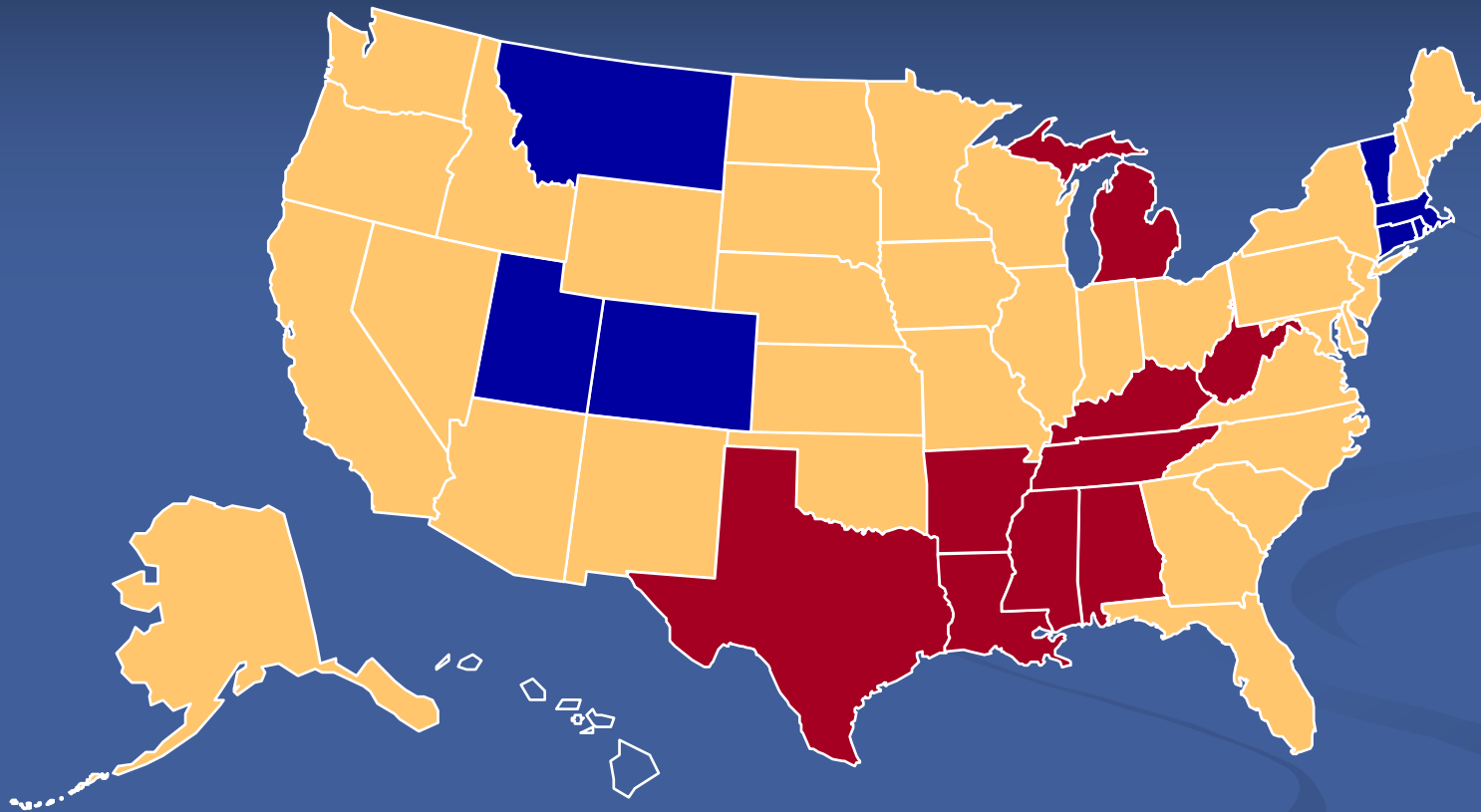
Obesity and Asthma

I have no existing conflict of information to disclose



Obesity Trends Among U.S. Adults

BRFSS, 2004



What defines obesity?

Body Mass Index (BMI): $Wt \text{ in Kg} / (\text{height in meters})^2$

< 18.5	Underweight
18.5 - 24.9	Normal
25 – 29.9	Overweight
30 – 34.9	Obese
> 35	Severe obesity

5' 6" and 186 lbs or 6' 0" and 221 lbs = obese

Obesity Trends Among U.S. Adults

During the past 20 years there has been a dramatic increase in obesity in the US.

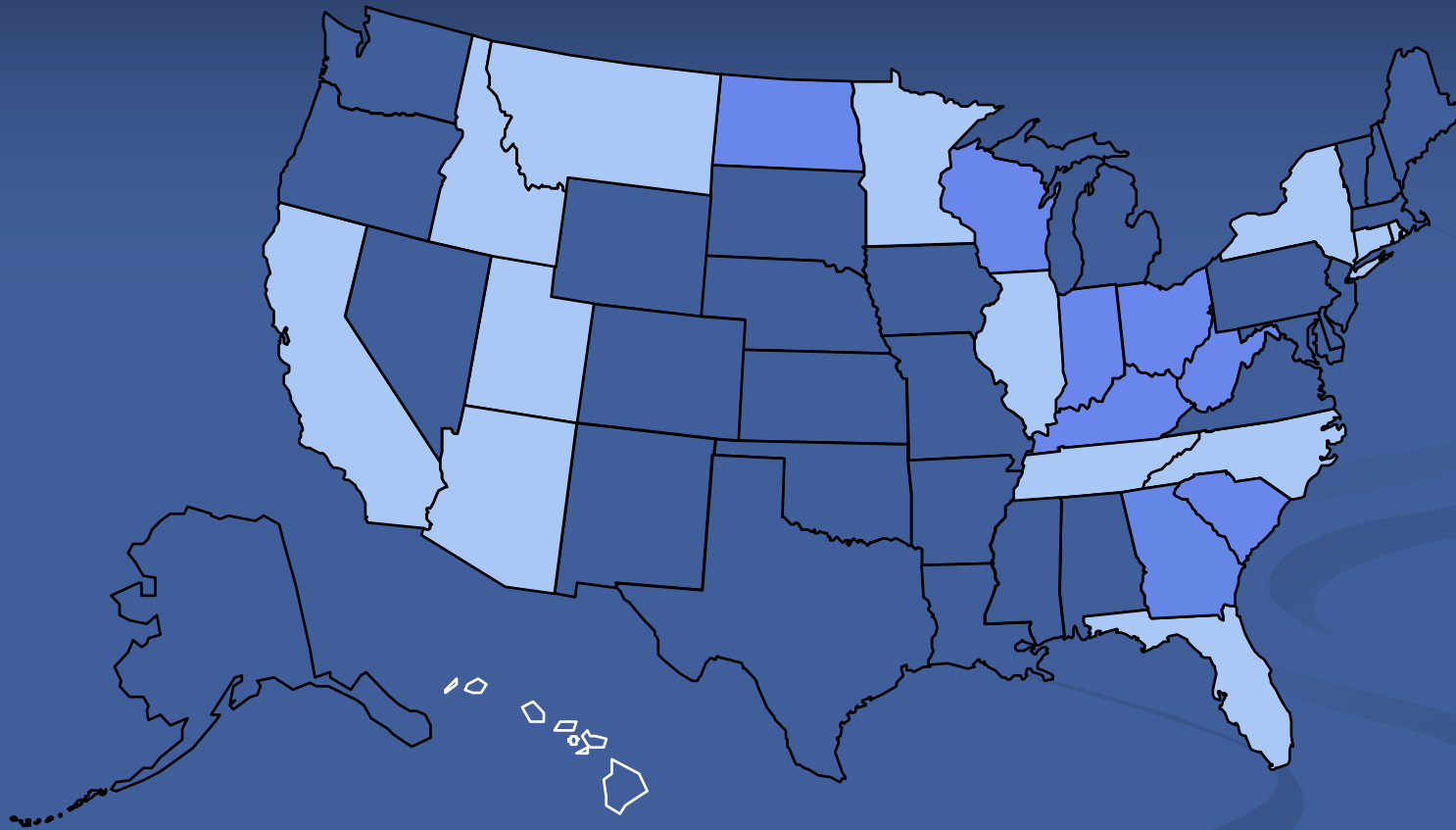
In 1991, 4 states had obesity prevalence rates of 15 - 19% and no states had rates at or above 20%.

In 2004, 7 states had obesity prevalence rates of 15 - 19%; 33 states had rates of 20-24% and 9 states had rates more than 25%.

More info on BRFSS at <http://www.cdc.gov/brfss>

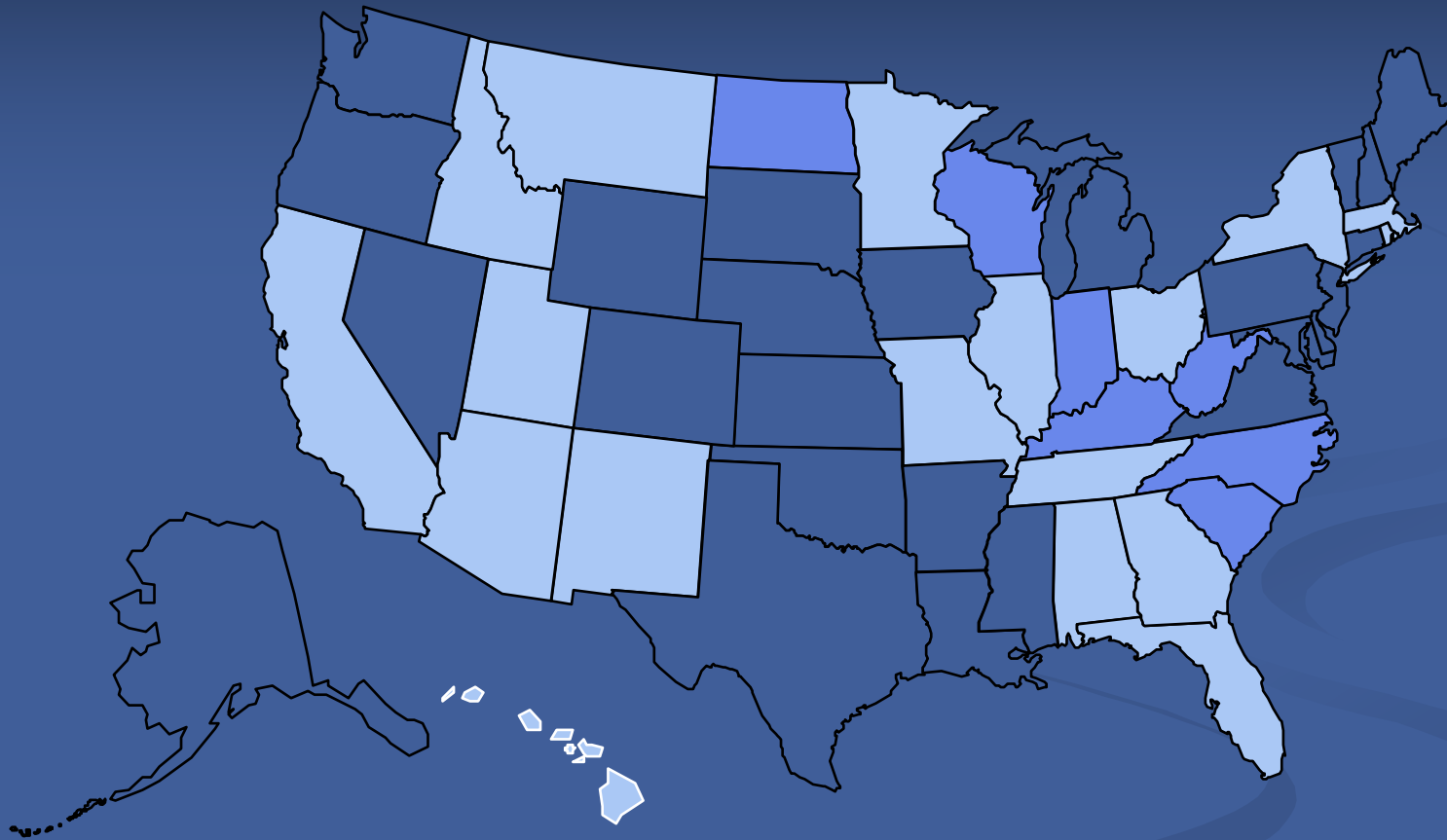
Obesity Trends Among U.S. Adults

BRFSS, 1985



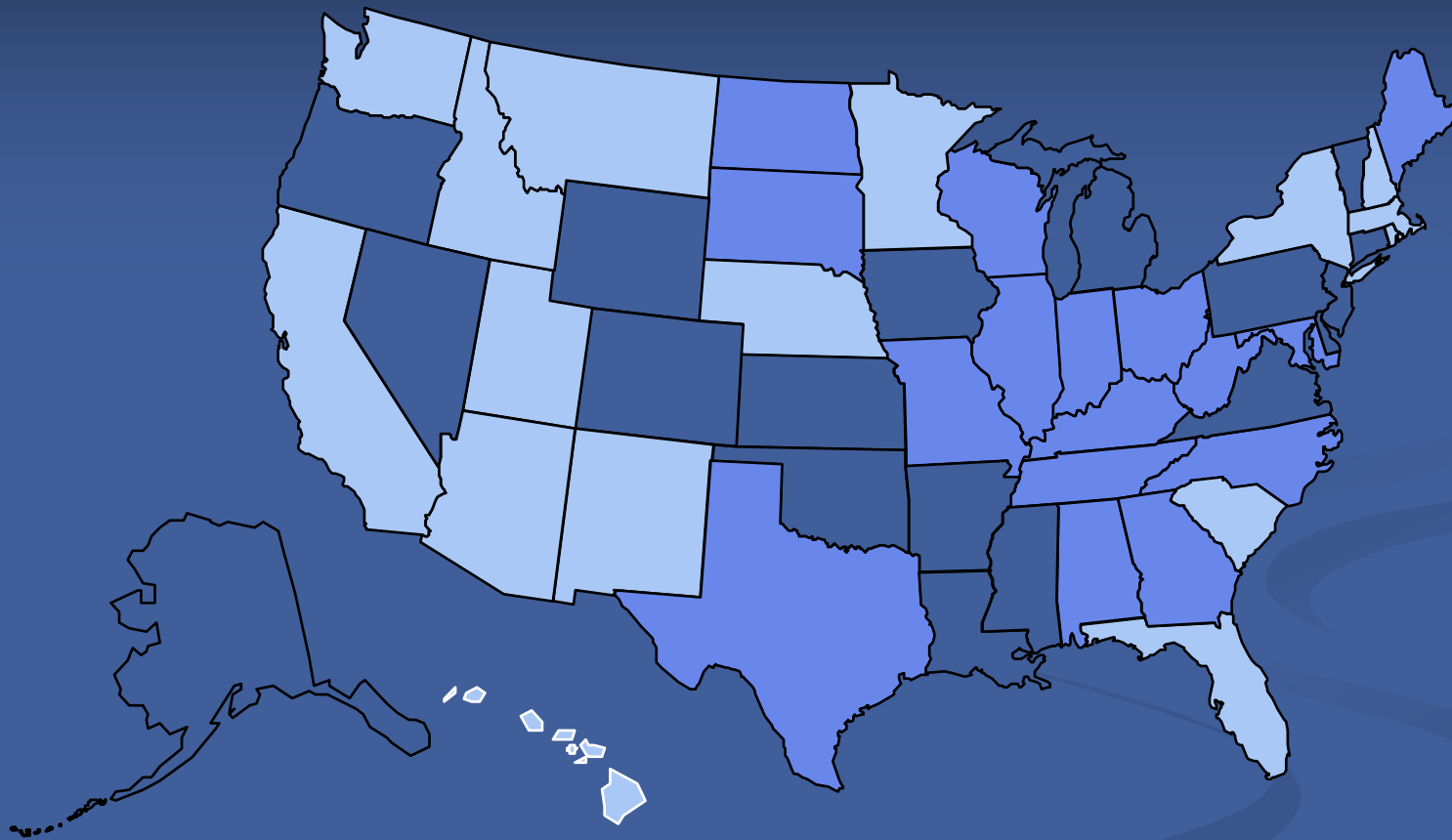
Obesity Trends Among U.S. Adults

BRFSS, 1986



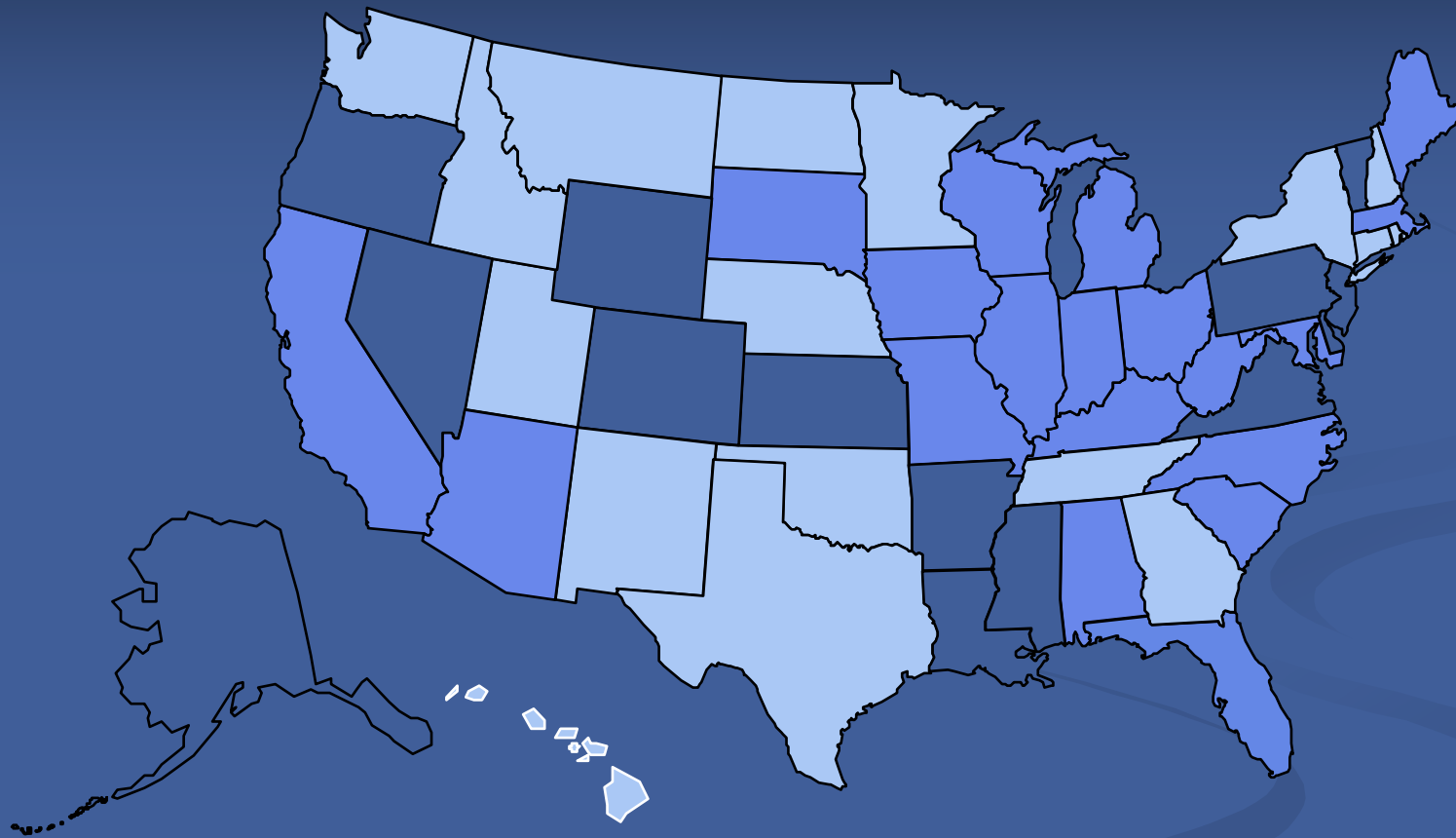
Obesity Trends Among U.S. Adults

BRFSS, 1987



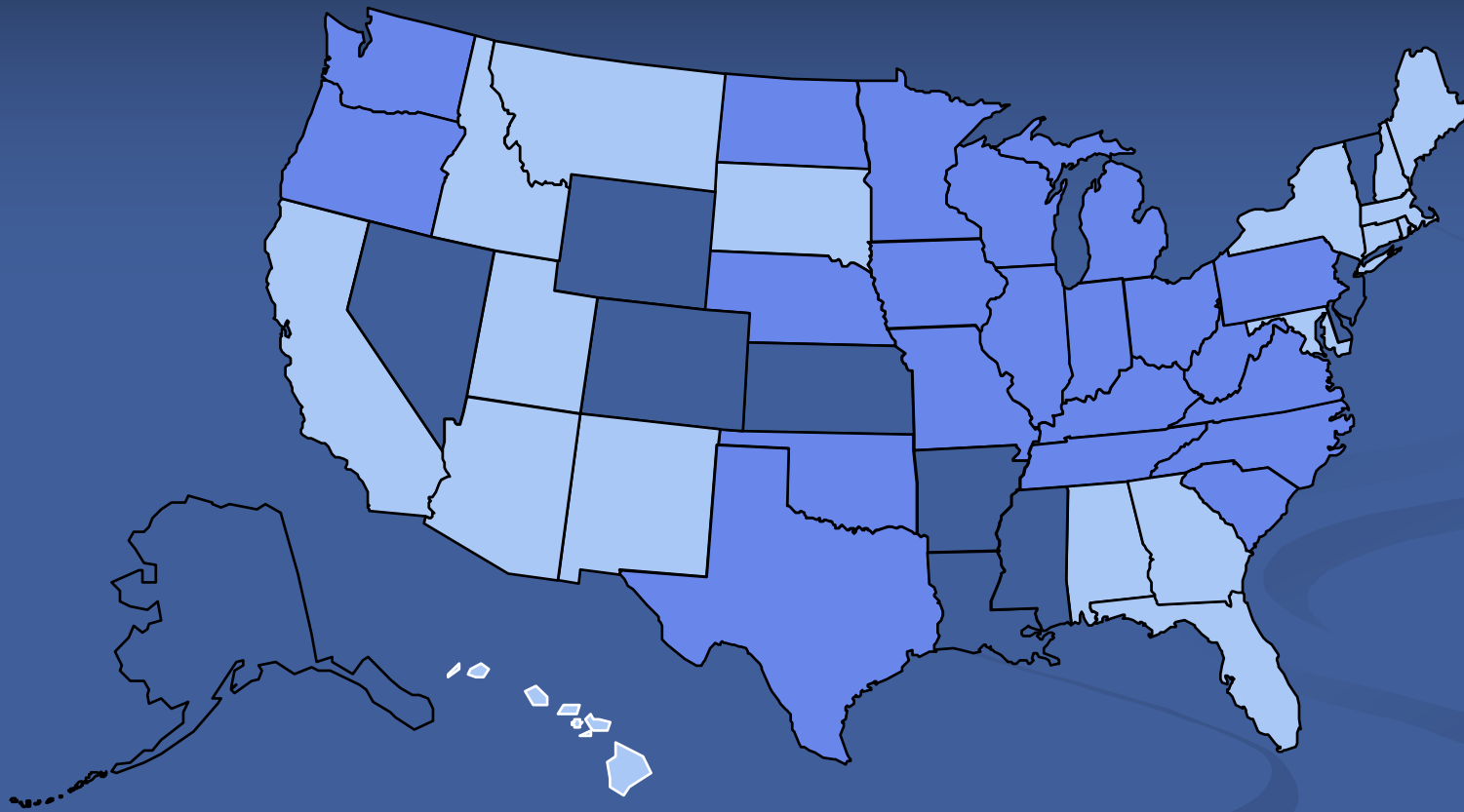
Obesity Trends Among U.S. Adults

BRFSS, 1988



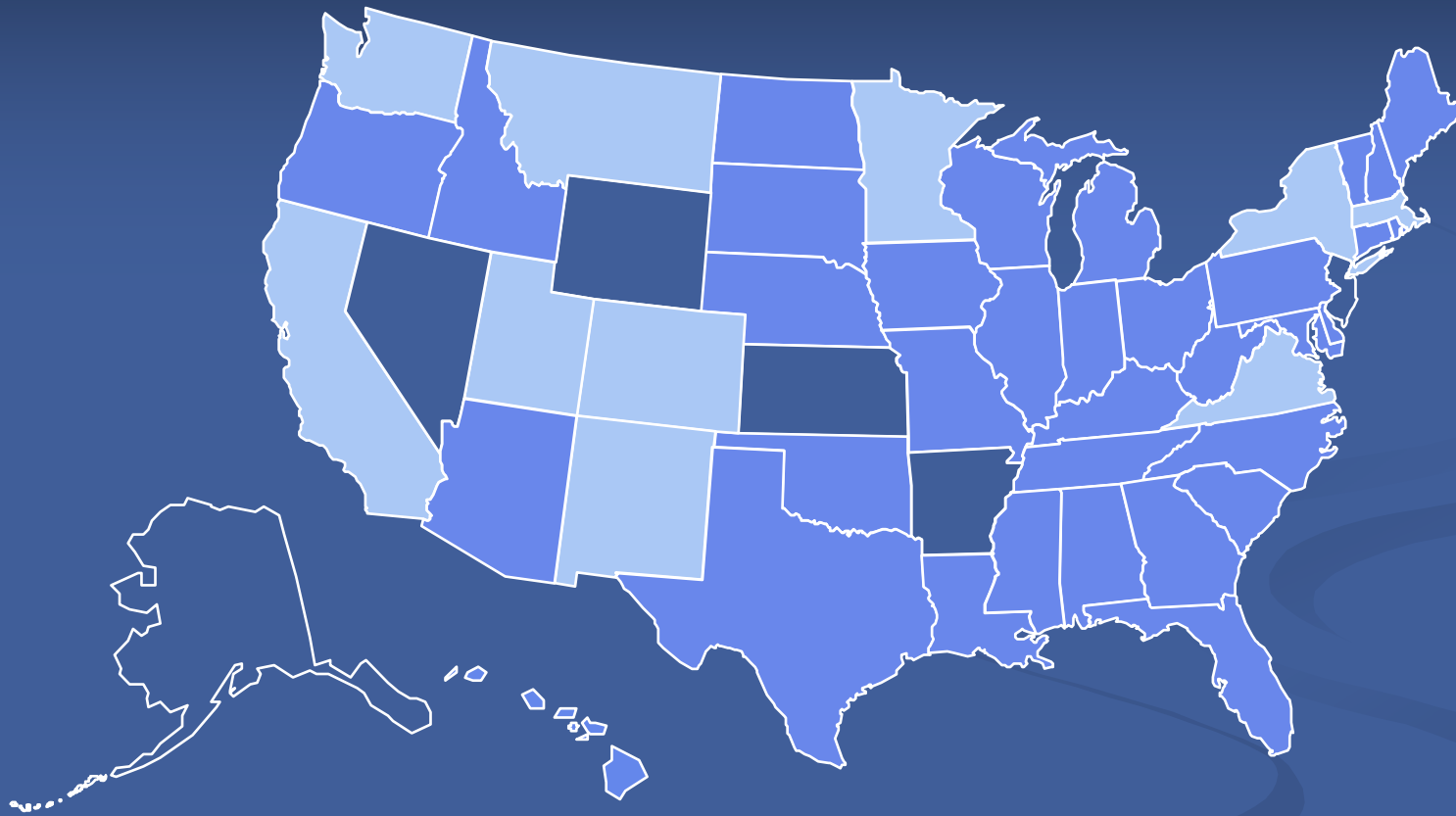
Obesity Trends Among U.S. Adults

BRFSS, 1989



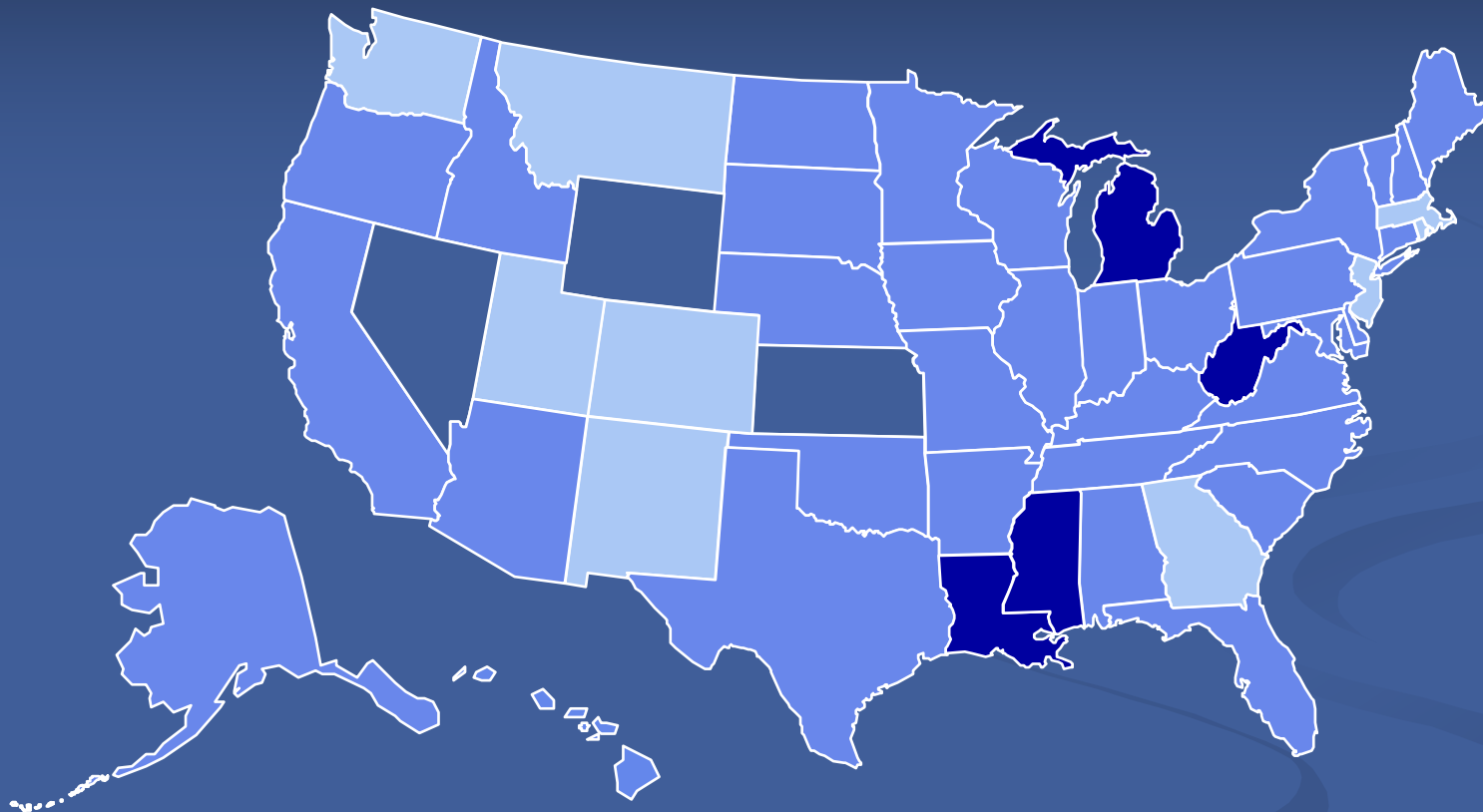
Obesity Trends Among U.S. Adults

BRFSS, 1990



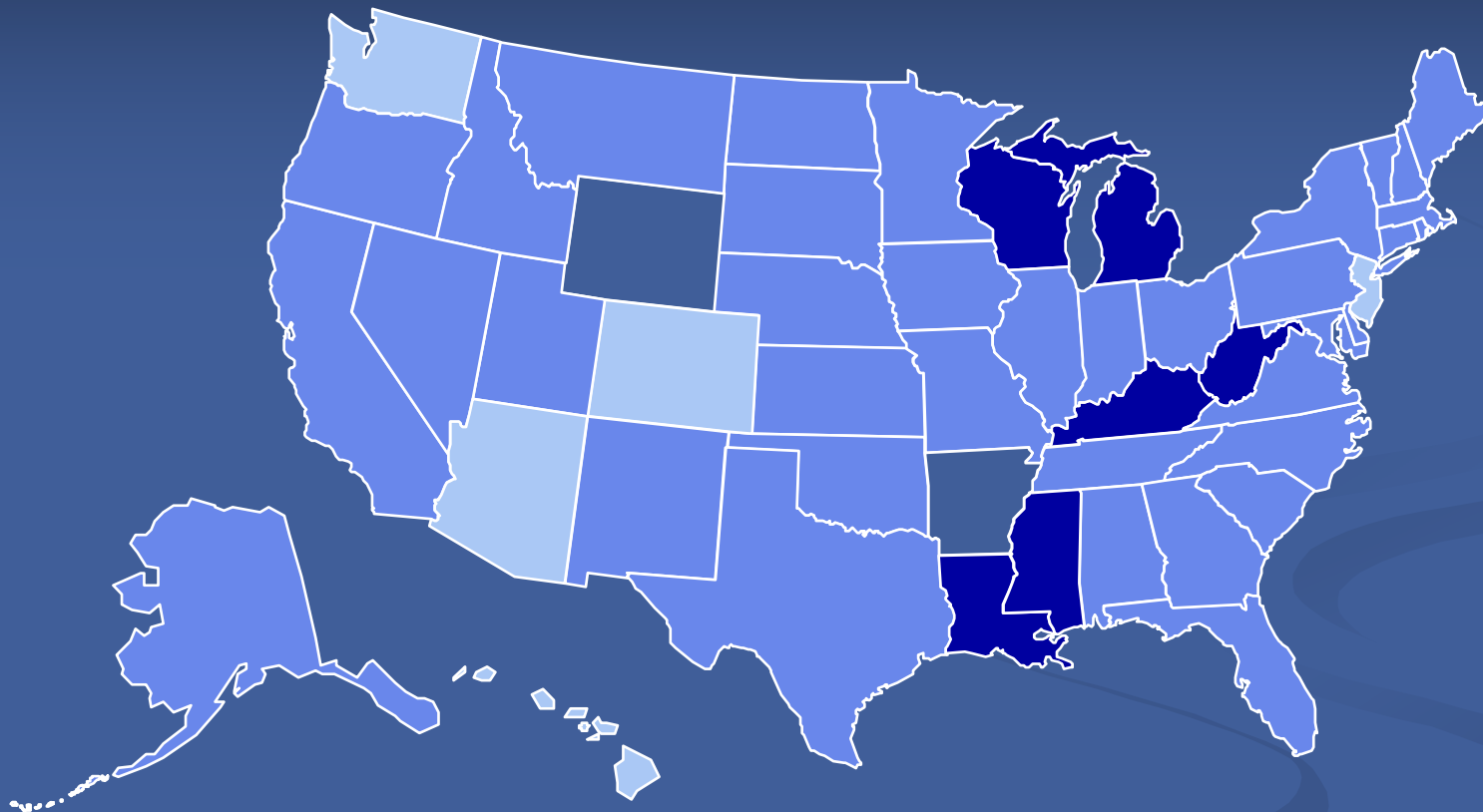
Obesity Trends Among U.S. Adults

BRFSS, 1991



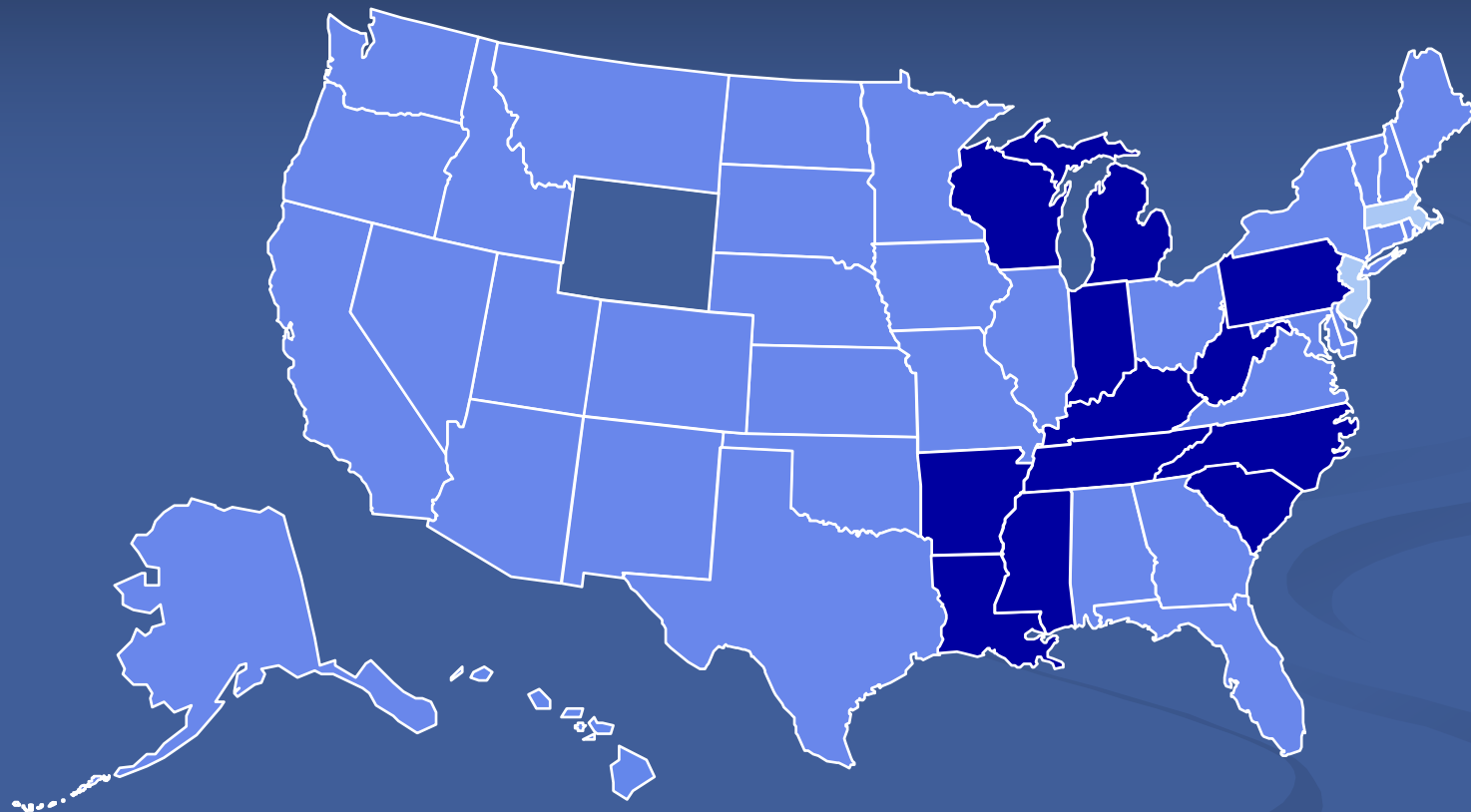
Obesity Trends Among U.S. Adults

BRFSS, 1992



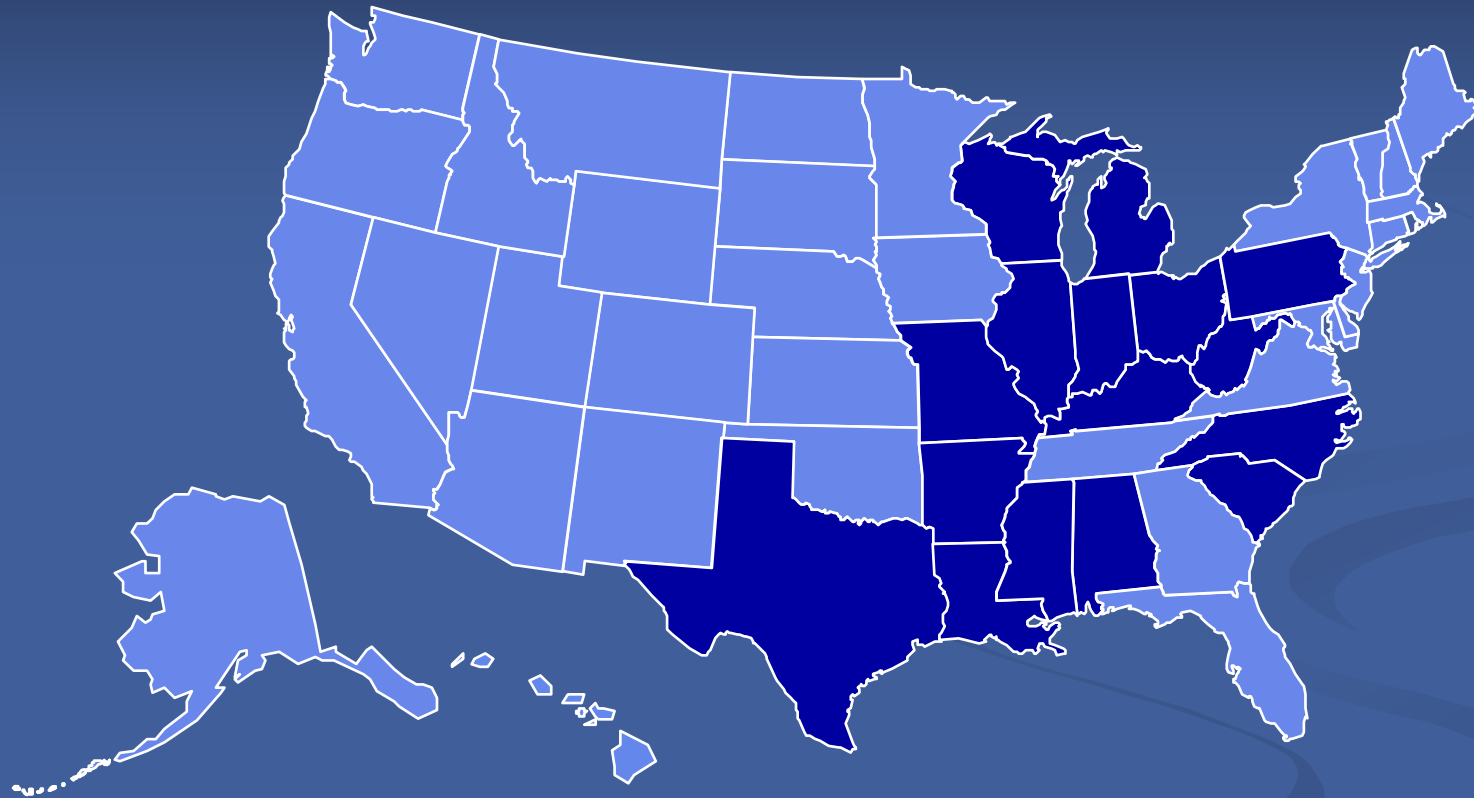
Obesity Trends Among U.S. Adults

BRFSS, 1993



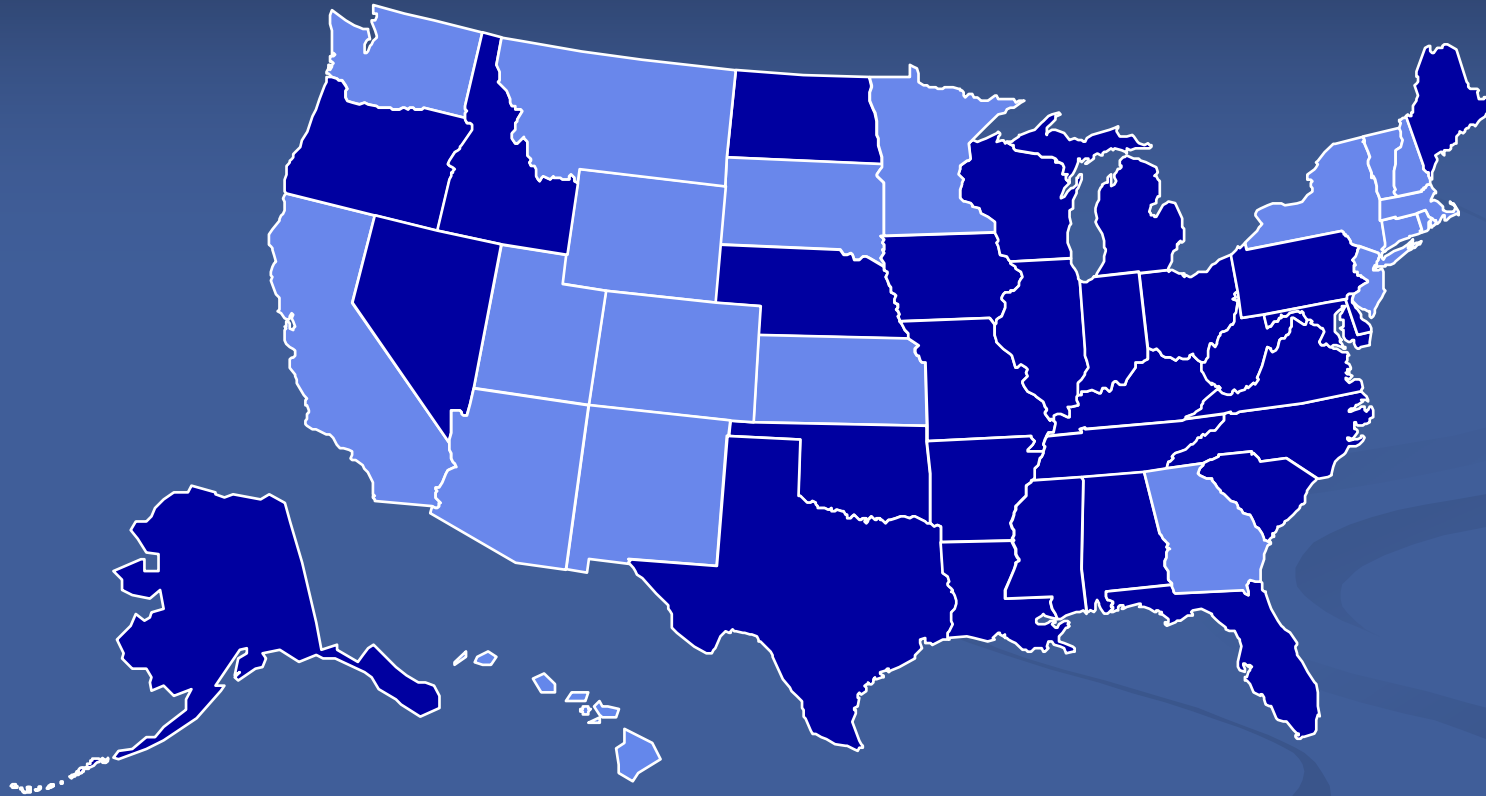
Obesity Trends Among U.S. Adults

BRFSS, 1994



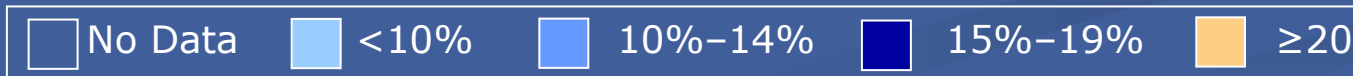
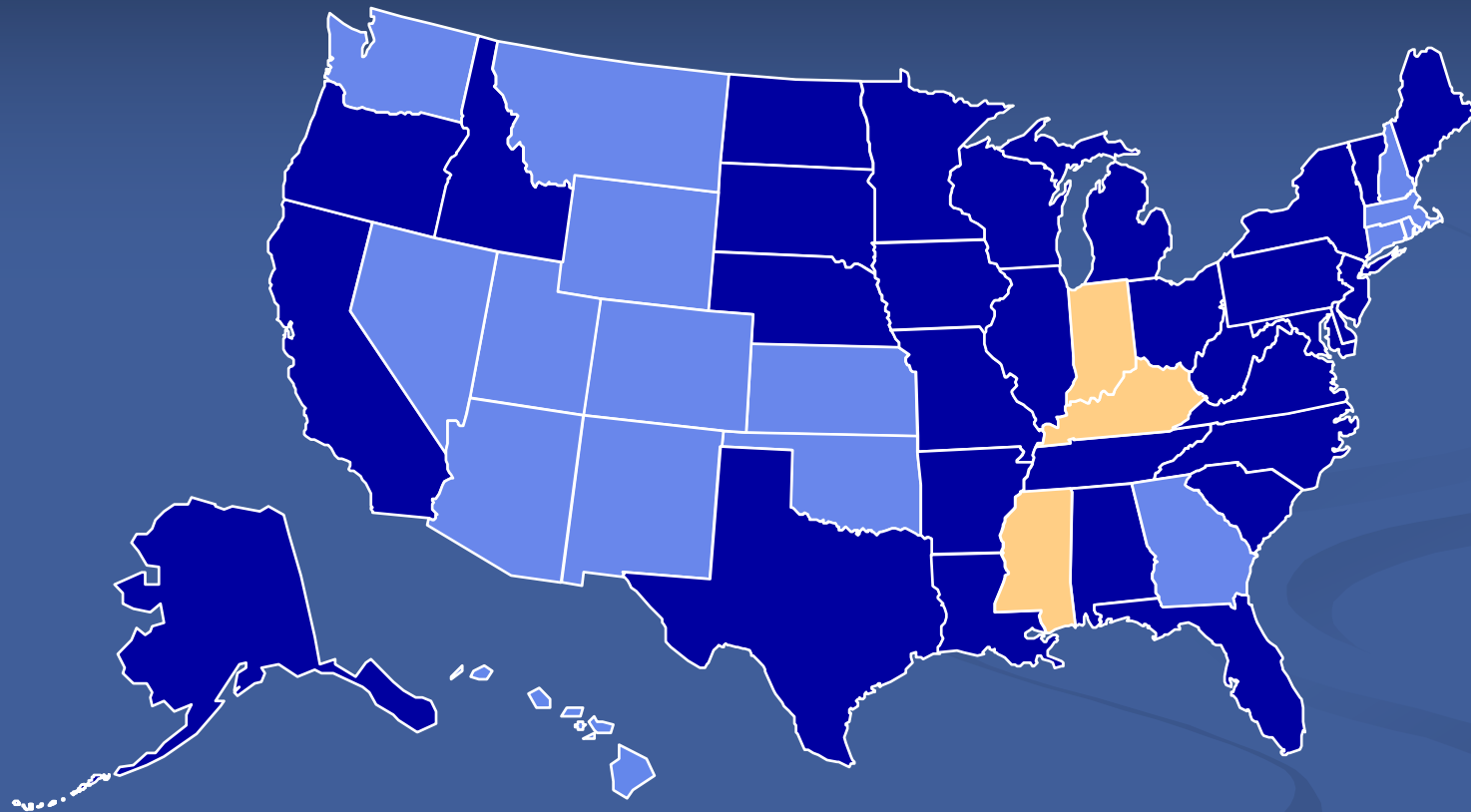
Obesity Trends Among U.S. Adults

BRFSS, 1996



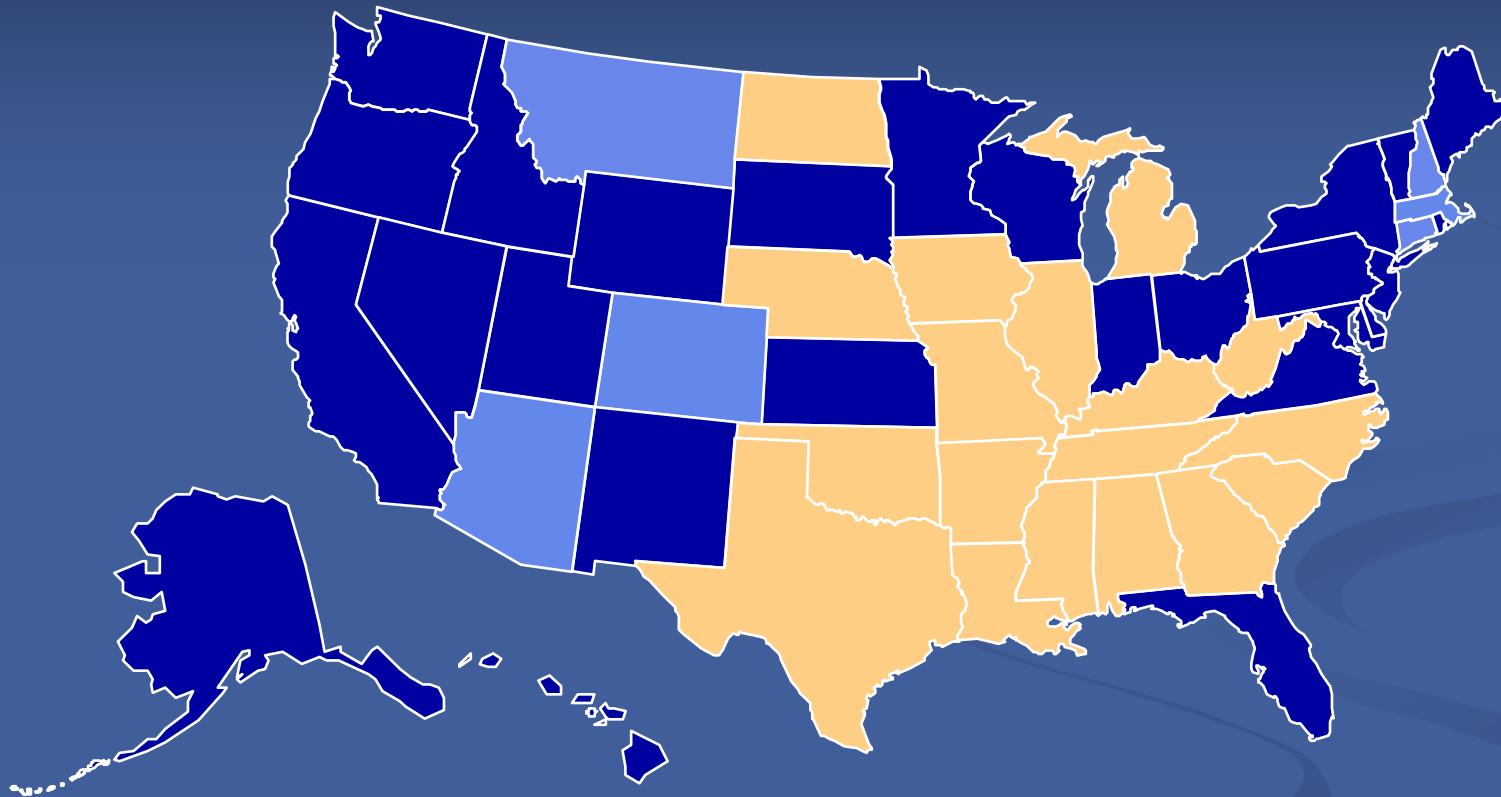
Obesity Trends Among U.S. Adults

BRFSS, 1997



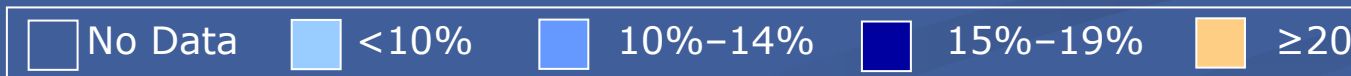
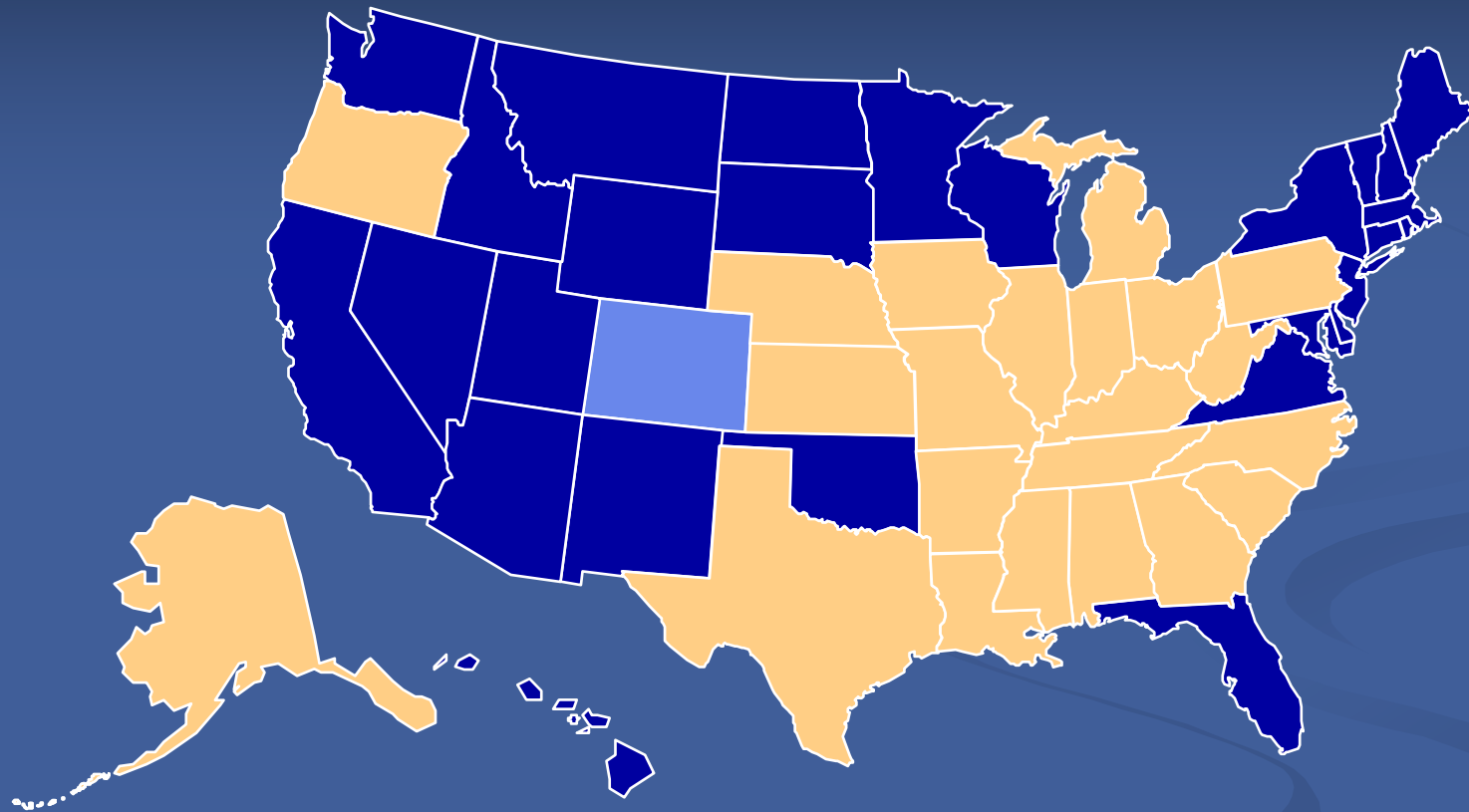
Obesity Trends Among U.S. Adults

BRFSS, 1999



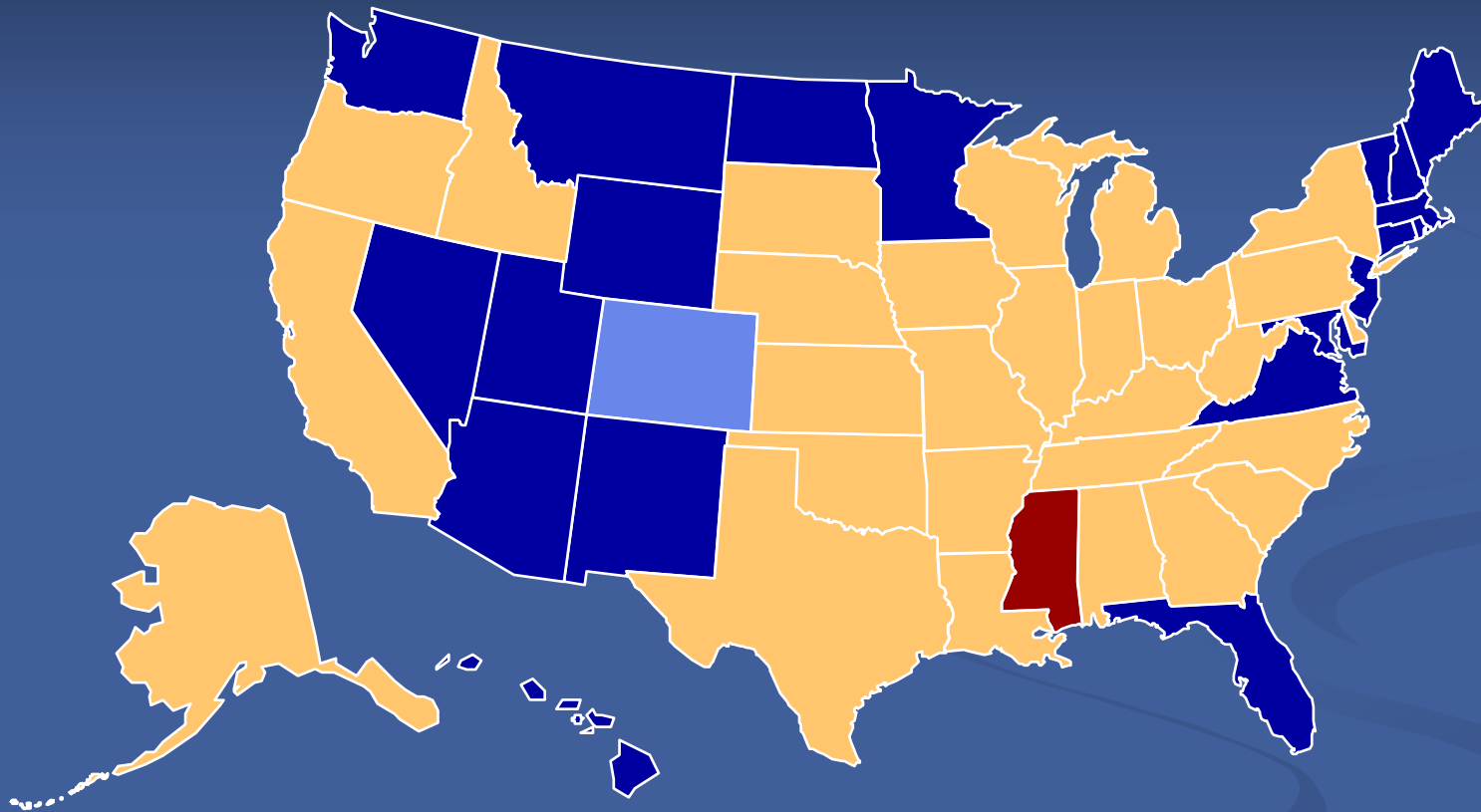
Obesity Trends Among U.S. Adults

BRFSS, 2000



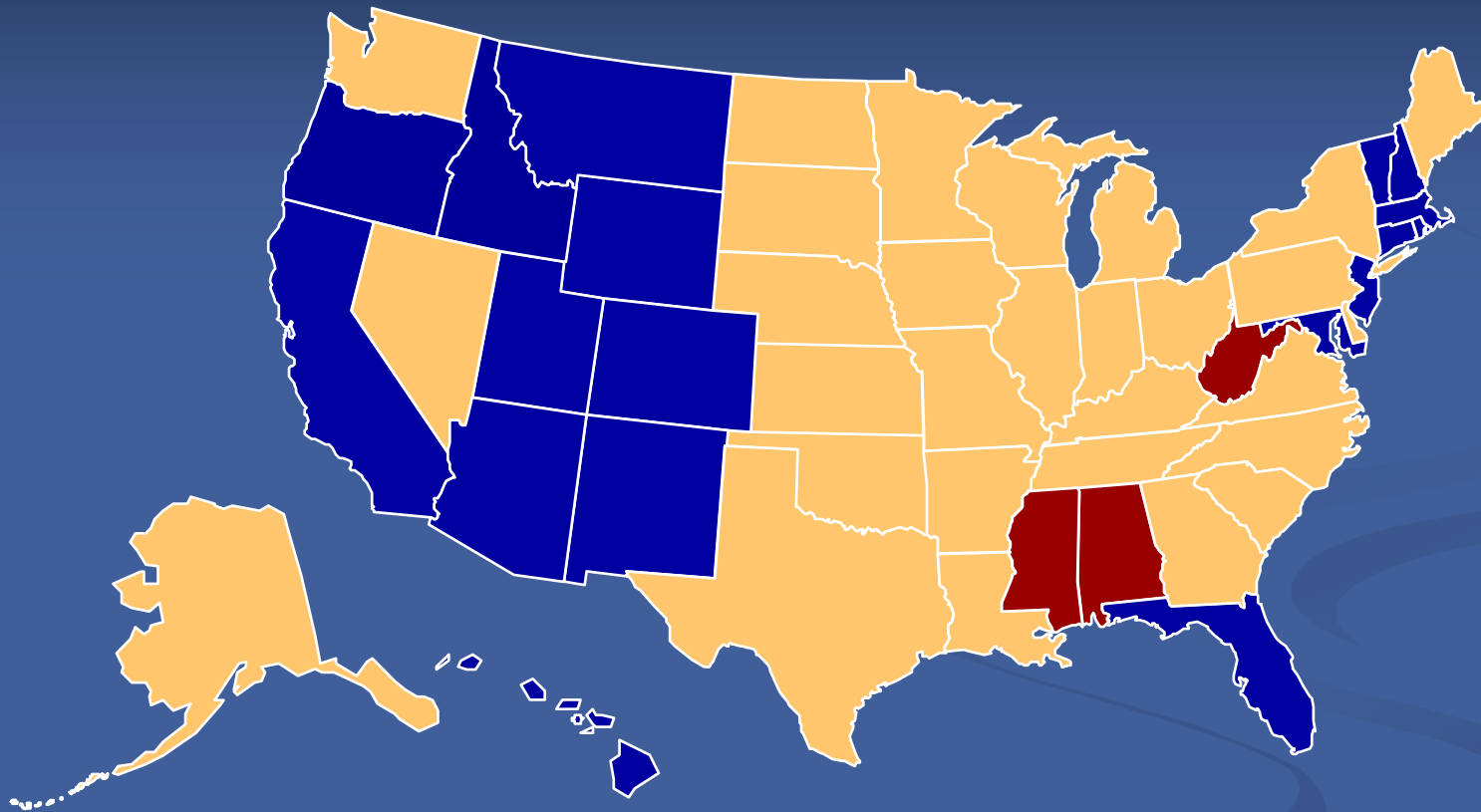
Obesity Trends Among U.S. Adults

BRFSS, 2001



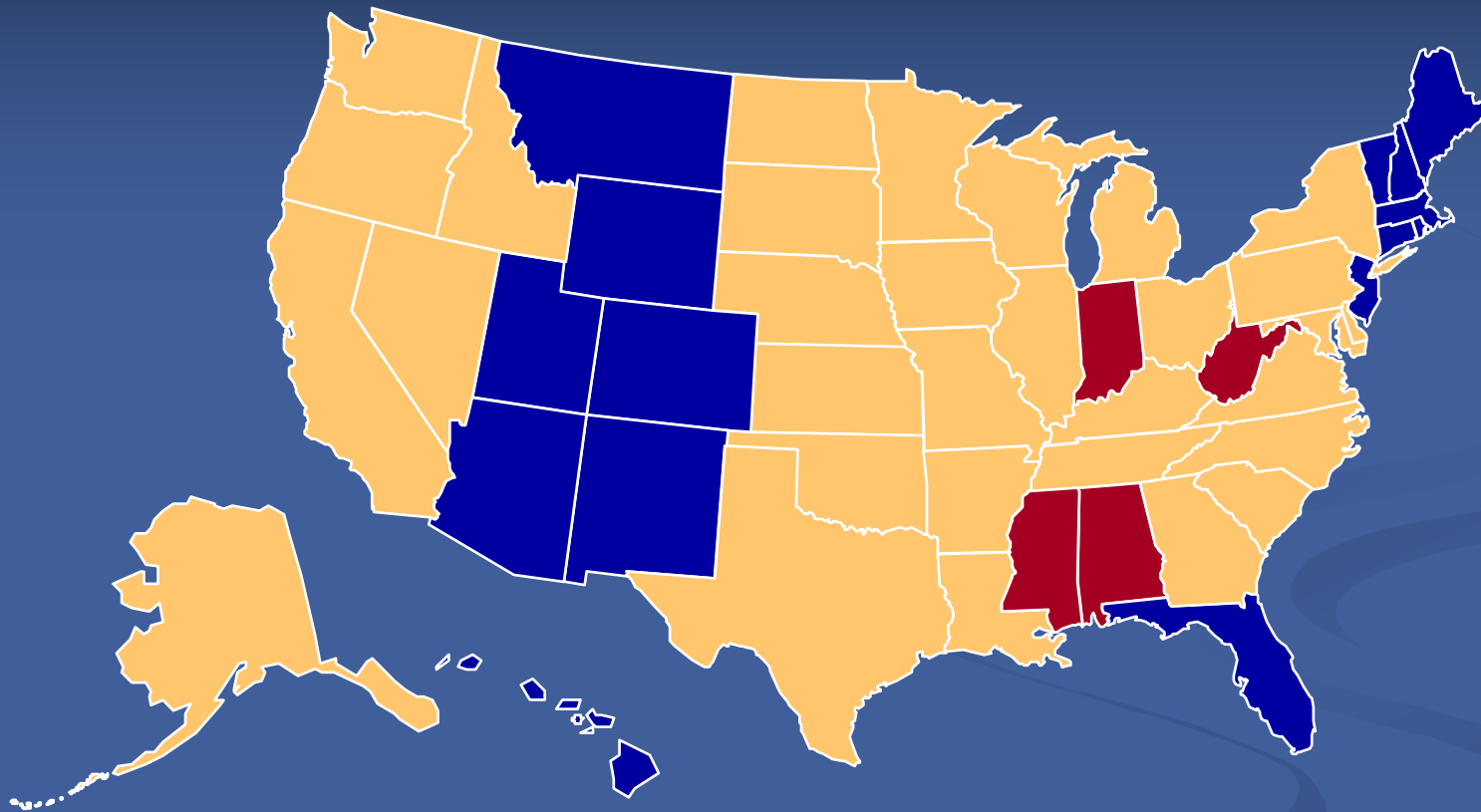
Obesity Trends Among U.S. Adults

BRFSS, 2002



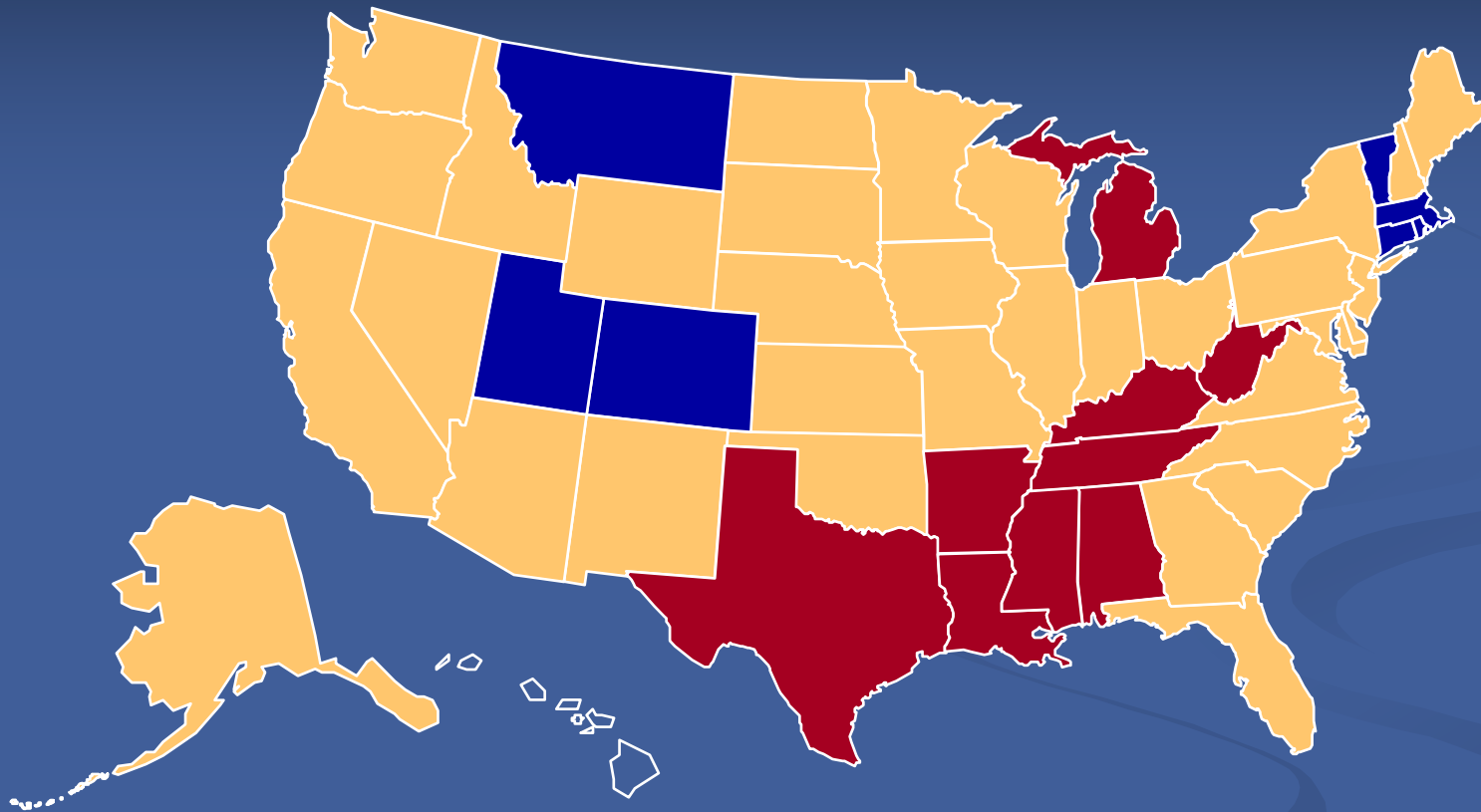
Obesity Trends Among U.S. Adults

BRFSS, 2003



Obesity Trends Among U.S. Adults

BRFSS, 2004



Behavioral Risk Factor Surveillance System (BRFSS)

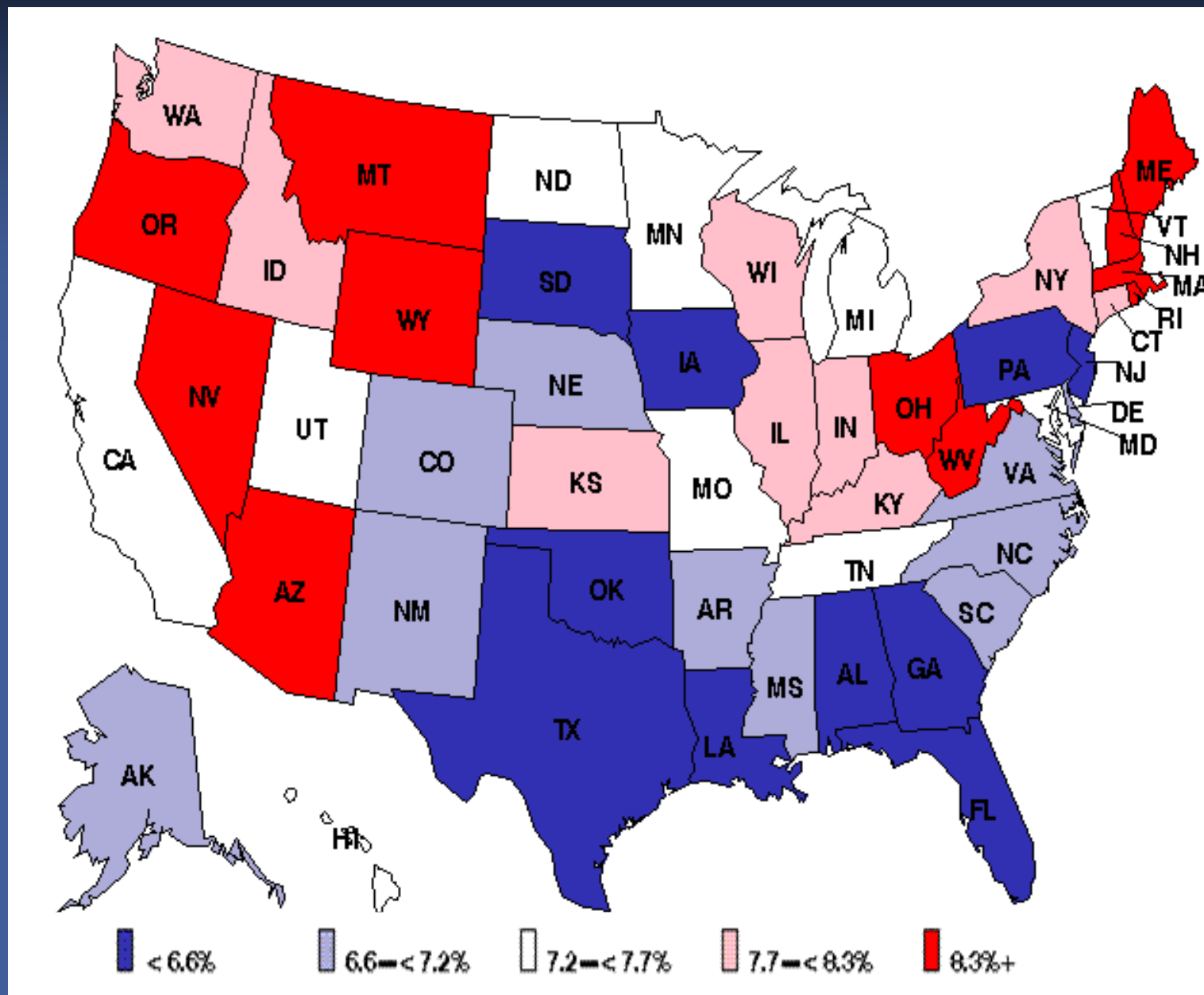
The BRFSS is a state-based, random-digit-dialed telephone survey of the non-institutionalized civilian population 18 years of age and older. It is designed to monitor the prevalence of the major behavioral risks among adults associated with premature morbidity and mortality.

By 1995, all states, and three territories were participating in the BRFSS. CDC develops standard core questionnaires for states to use to provide data that can be compared across states. States can choose to add additional questions of their own and can also choose among a number of optional modules that cover specific topics in greater detail.

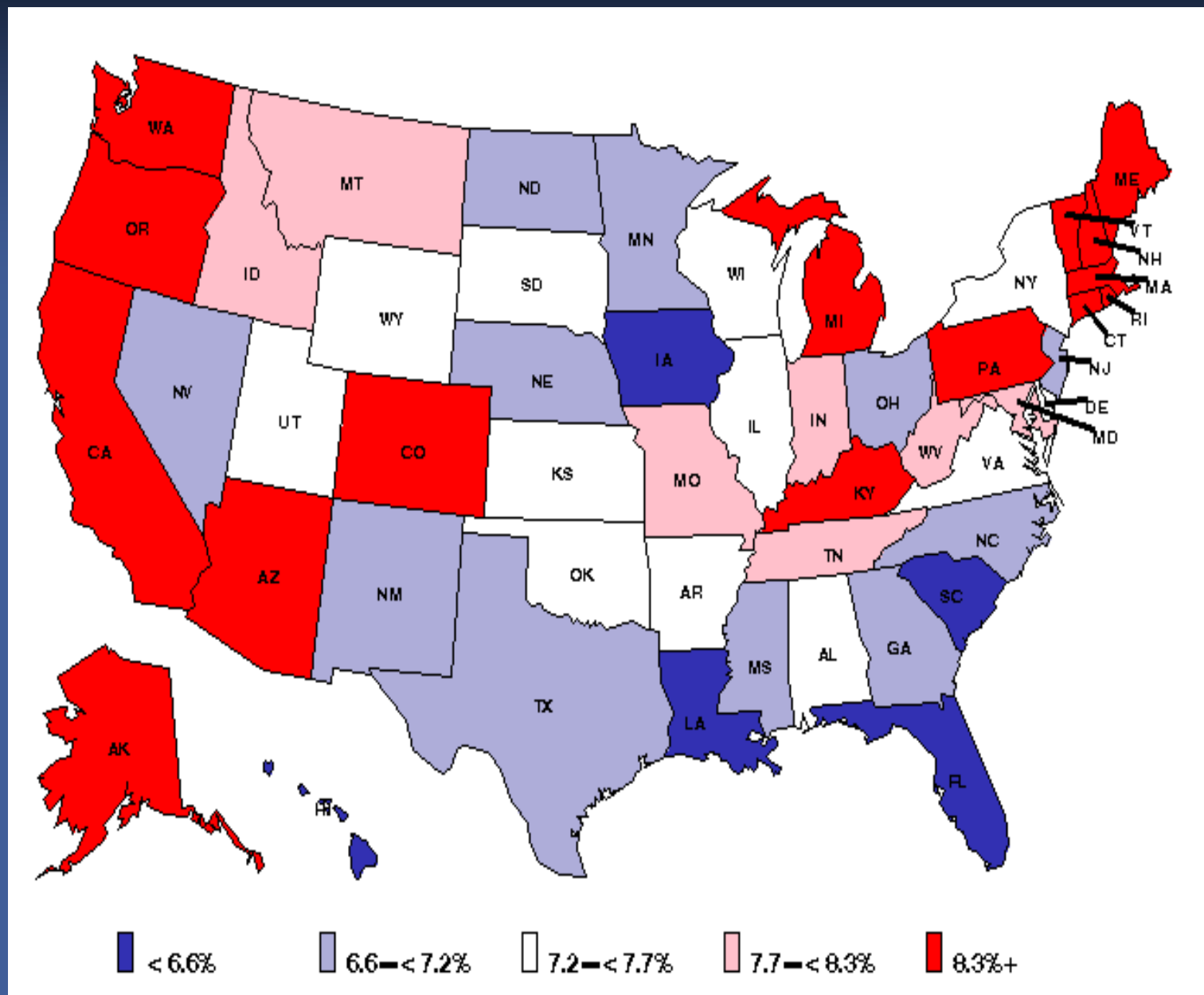
Before 1999, several states included questions about asthma on their BRFSS questionnaire, but the wording of the questions varied among those states. In 1999, an optional two-question asthma module was added to the BRFSS, representing the first effort to systematically collect state-based asthma prevalence data. In 2000, the two questions were included in the core of the BRFSS questionnaire and were asked in all participating states and territories. The two asthma questions will be included in the BRFSS in future years as well. In addition, beginning with 2001, nine questions on adult asthma history and two questions on child prevalence are available as optional modules.

For each year of BRFSS asthma data, two asthma prevalence measures were constructed. Lifetime asthma is defined as an affirmative response to the question “Have you ever been told by a doctor {nurse or other health professional} that you have asthma?”. Current asthma is defined as an affirmative response to that question followed by an affirmative response to the subsequent question “Do you still have asthma?”

2000 BRFSS: Prevalence of current asthma



2003 BRFSS: Prevalence of current asthma



Increased prevalence of obesity and asthma: coincidence or causal relationship?

572 pts presenting to 26 North American ERs with acute asthma → 3 of 4 patients were either overweight or obese

Obesity → Asthma ?????

OR

Asthma → Obesity ?????

Effects of obesity on pulmonary physiology

Increases the energy cost of breathing

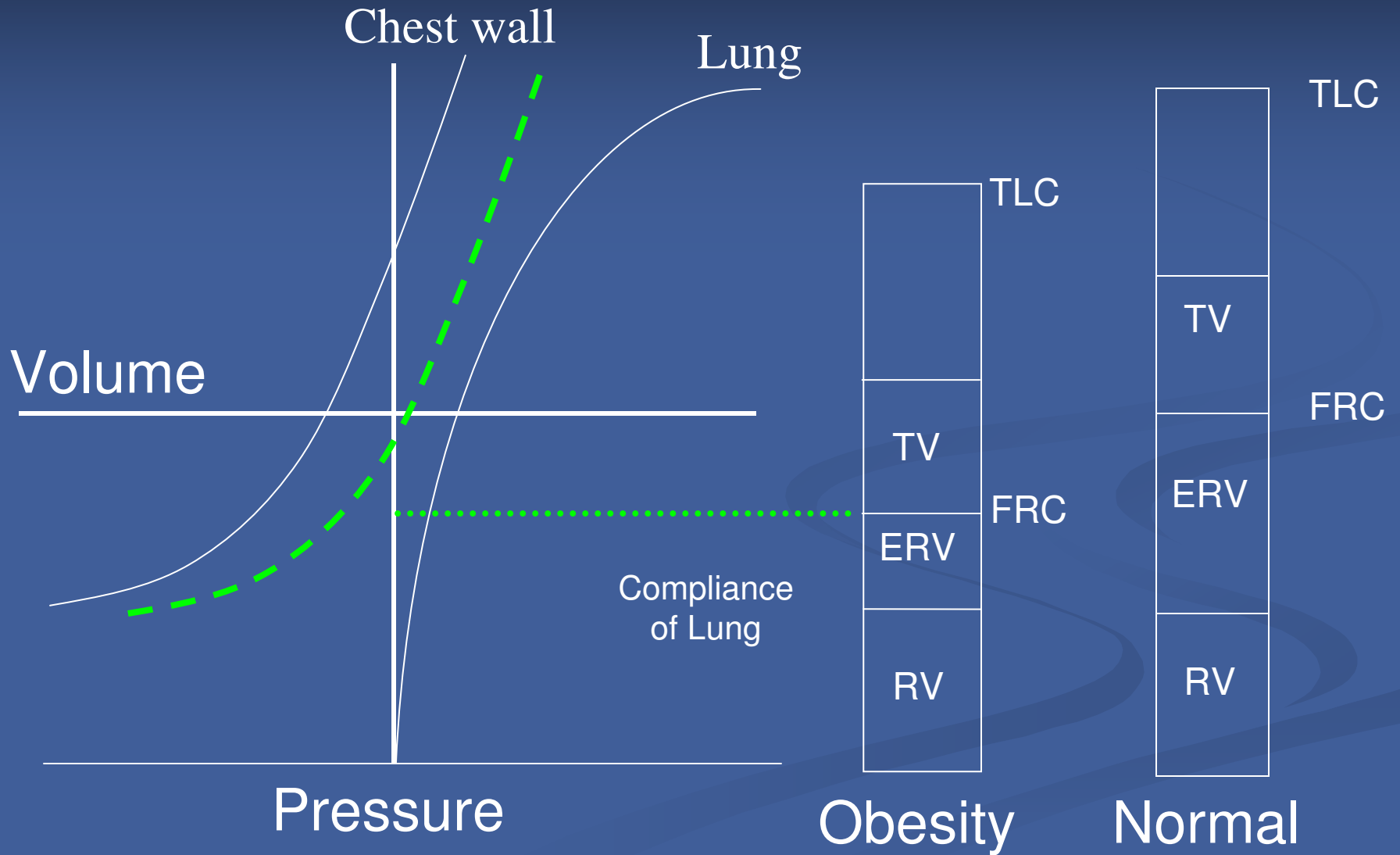
Δ in $\dot{V}O_2$ from spontaneous breathing to MV in obese patients (354.6 vs. 297.2 ml/min; $p = 0.0002$) and control patients (221.4 vs. 219.8 ml/min; $p = 0.86$).

Increases risk of sleep disordered breathing

Flow greatly affected by radius of airway: $\dot{V} = \left(\frac{\Delta P \cdot \pi \cdot r^4}{8 \cdot \eta \cdot L} \right)$

Kress JP, Pohlman AS, Alverdy J, Hall JB. The impact of morbid obesity on oxygen cost of breathing (VO_{2RES}) at rest. Am J Respir Crit Care Med. 1999;160:883-886.

Obesity effects on lung volumes



Cross sectional studies

Cross-sectional studies provide a "snapshot" of the frequency and characteristics of a disease in a population at a particular point in time.

Over 33 cross-sectional studies since 1999 looking at the relationship between asthma and obesity. Many include children, adolescents and multiple ethnic groups.

31 of 34 studies report increased prevalence of asthma in obese and/or overweight subjects

Prospective studies

A prospective study watches for outcomes, such as the development of a disease, during the study period. The study usually involves taking a cohort of subjects and watching them over a long period.

8 studies in adults and 5 in children/adolescents

12 of 13 report greater incidence of asthma in overweight and or obese subjects

Conclusion:

Obesity → Asthma

Nurses health study

Prospective cohort study of US registered nurses: age 26-46

Main outcome: self-report of new doctor-diagnosed asthma with use of asthma medication

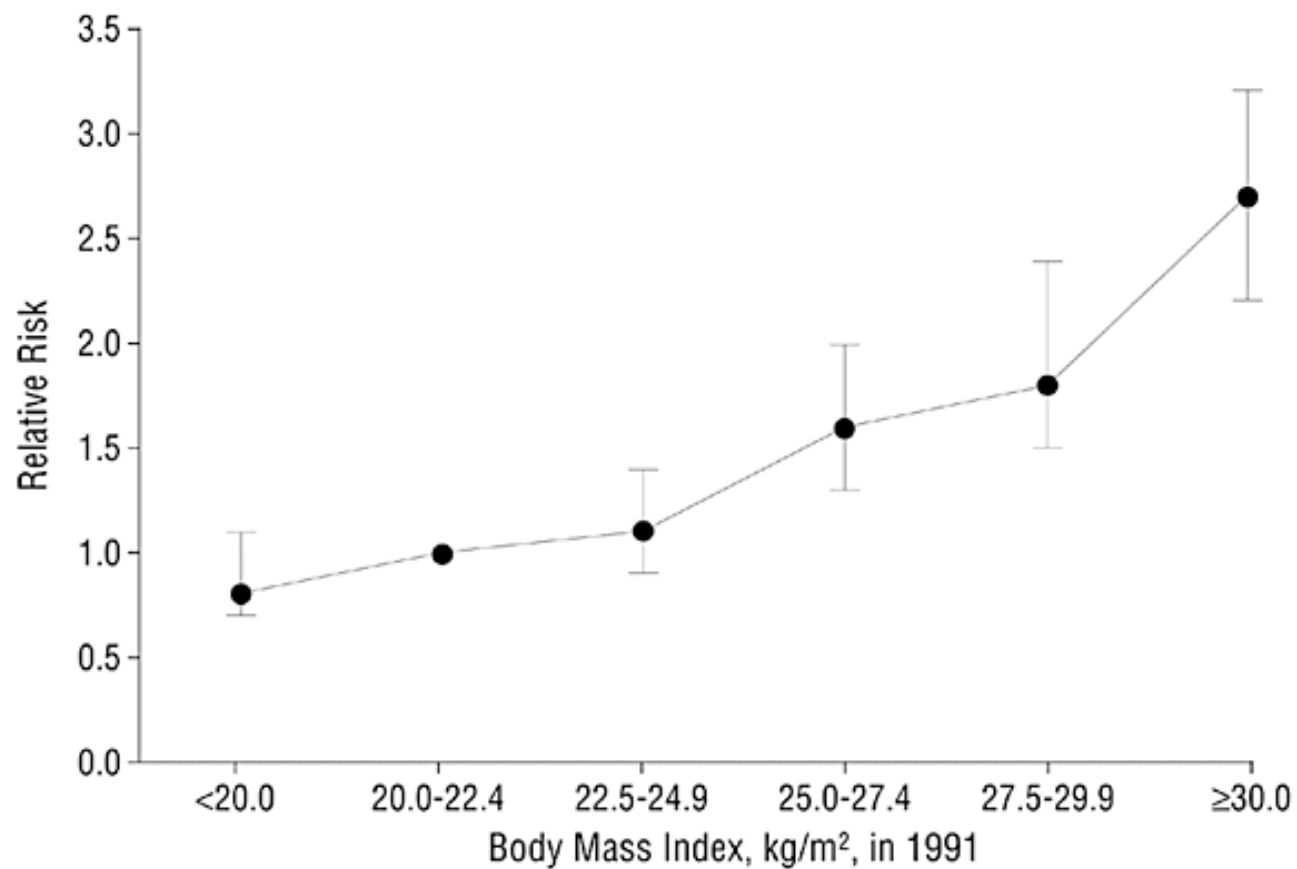
Multivariate model controlling for 9 variables: age, race, US region, hysterectomy status, birth weight, duration of breastfeeding, smoking, physical activity, energy intake

Analysis of 1596 new asthma diagnosis between 1991-95

Camargo CA, Weiss ST, Zhang S, Willett WC, Speizer FE. Prospective study of Body Mass Index, Weight Change, and Risk of Adult-onset Asthma in Women. *Arch Intern Med.* 1999; 159:2582-2588.

Body Mass Index, kg/m², in 1991

Case	Body Mass Index, kg/m ² , in 1991						P for Trend
	<20.0	20.0-22.4	22.5-24.9	25.0-27.4	27.5-29.9	≥30.0	
Definition 1†							
No. (n = 1596)	144	359	305	259	131	398	...
Age-adjusted RR (95% CI)	0.9 (0.7-1.1)	1.0 (reference)	1.1 (1.0-1.3)	1.6 (1.4-1.9)	1.7 (1.4-2.0)	2.6 (2.3-3.1)	<.001
Multivariate RR (95% CI)	0.9 (0.7-1.1)	1.0 (reference)	1.1 (1.0-1.3)	1.6 (1.3-1.9)	1.7 (1.4-2.0)	2.7 (2.3-3.1)	<.001
Definition 2‡							
No. (n = 1079)	100	227	217	164	92	279	...
Multivariate RR (95% CI)	1.0 (0.8-1.2)	1.0 (reference)	1.3 (1.0-1.5)	1.6 (1.3-2.0)	1.9 (1.5-2.4)	3.0 (2.5-3.6)	<.001
Definition 3§							
No. (n = 453)	28	94	87	65	31	148	...
Multivariate RR (95% CI)	0.7 (0.4-1.0)	1.0 (reference)	1.2 (0.9-1.6)	1.5 (1.1-2.1)	1.5 (1.0-2.3)	3.8 (2.9-5.0)	<.001

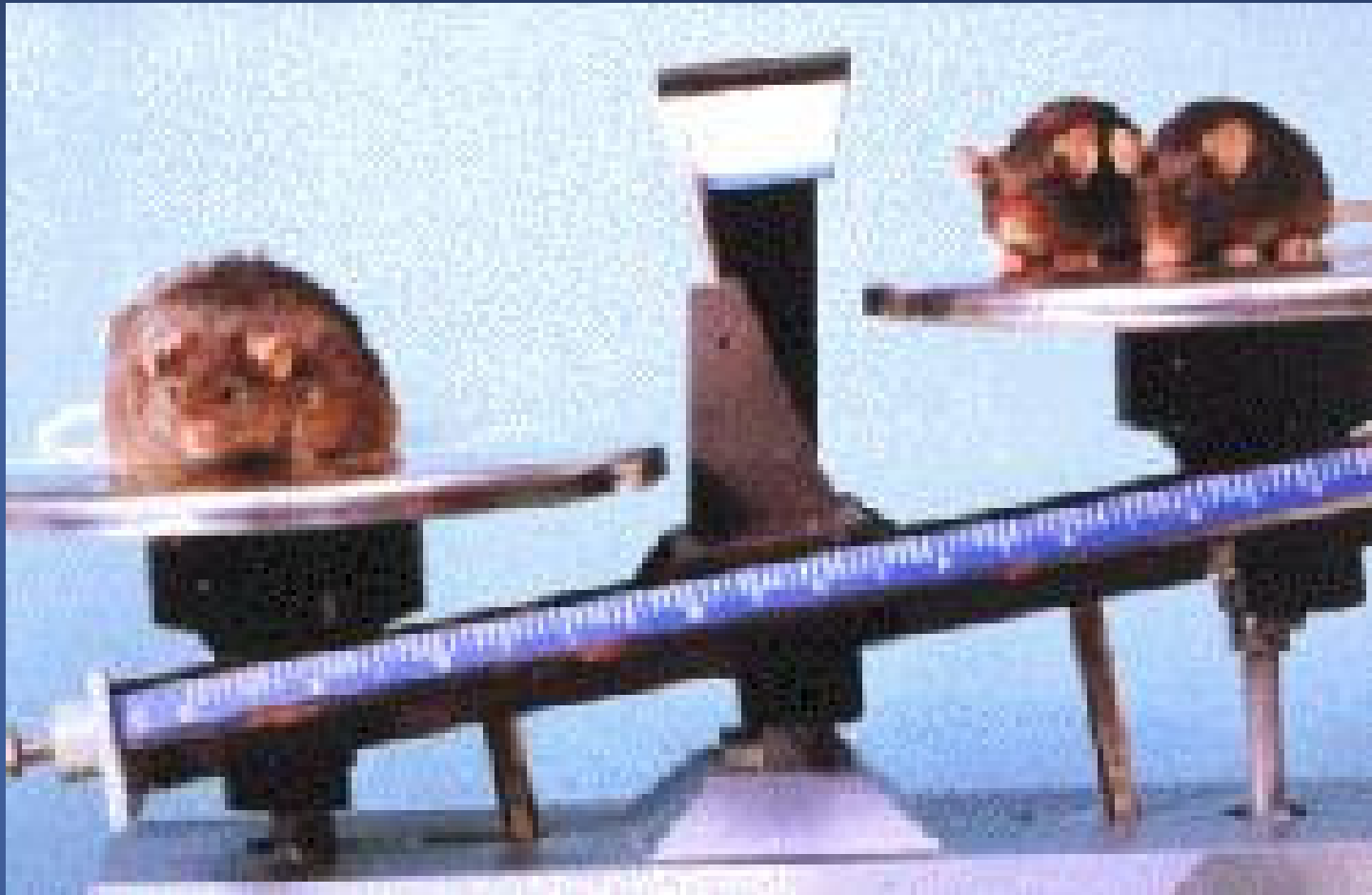


Obesity → Asthma: more supporting evidence?

Weight loss studies Aaron et al. Chest 2004; 125; 2046-2052.

Inconsistent studies on the relationship between obesity and bronchial hyper-responsiveness and obesity and atopy

What we've learned from animal models



What we've learned from animal models

Obese mice have increased airway responsiveness as compared with non-obese mice

Obese mice have increased airway inflammatory responses to common asthma triggers as compared with non-obese mice

Potential biological mechanisms to explain the obesity → asthma relationship

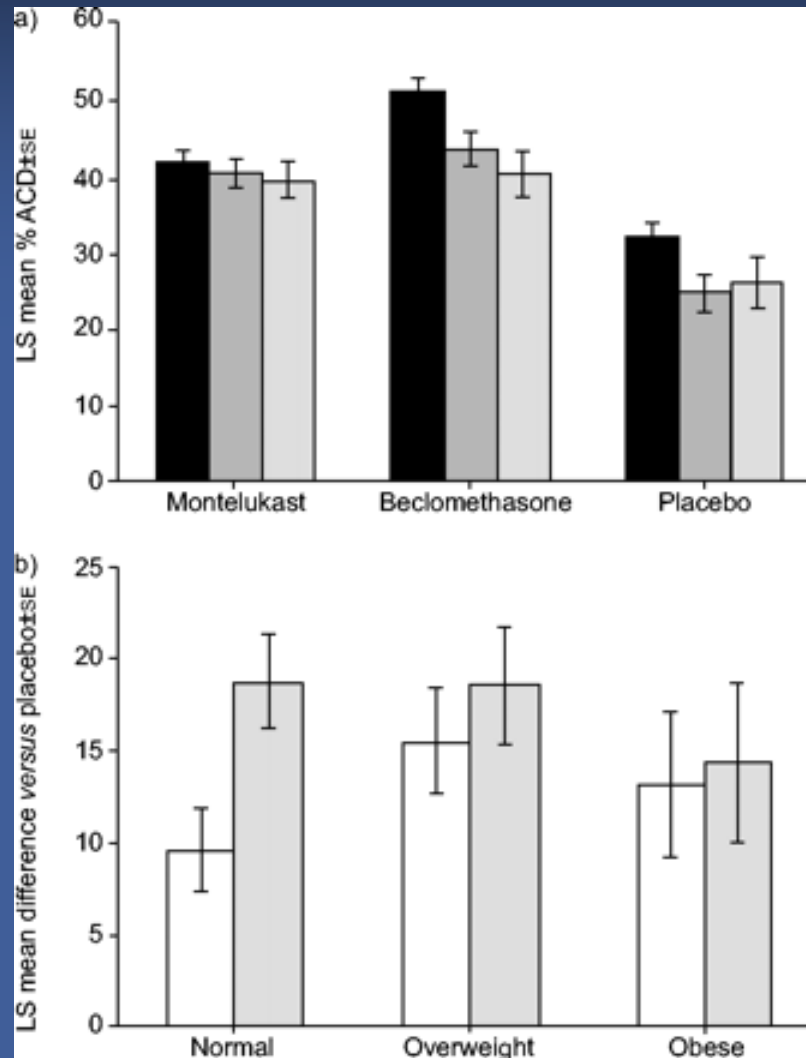
Obesity causes asthma via another disease: gastroesophageal reflux disease (GERD) or sleep apnea

Genetics

Smaller lung volumes in obese subjects leads to stiffer airway smooth muscle and more narrow airways

Increased inflammation in obesity

Do obese subjects respond to asthma medications differently than non-obese subjects?



Peters-Golden M, Swern A, Bied S.S., et al. influence of body mass index on the response to asthma controller agents. *Eur Respir J.* 2006;27:495-503.

Conclusions

Obesity appears to be a risk factor for developing asthma

- prospective studies
- weight loss studies
- dose-response relationship

The mechanism(s) of this causal relationship is/are unknown

Mice studies suggest obesity results in augmented airway inflammation to common asthma triggers

Evolving literature about the influence of BMI on response to asthma medications

Do obese subjects have more airway inflammation than non-obese patients?

Subjects w/ negative methacholine challenge and no Hx asthma

Wt reduction surgery

BMI > 35

A (20 pts)

Bronch at
surgery

Elective surgery

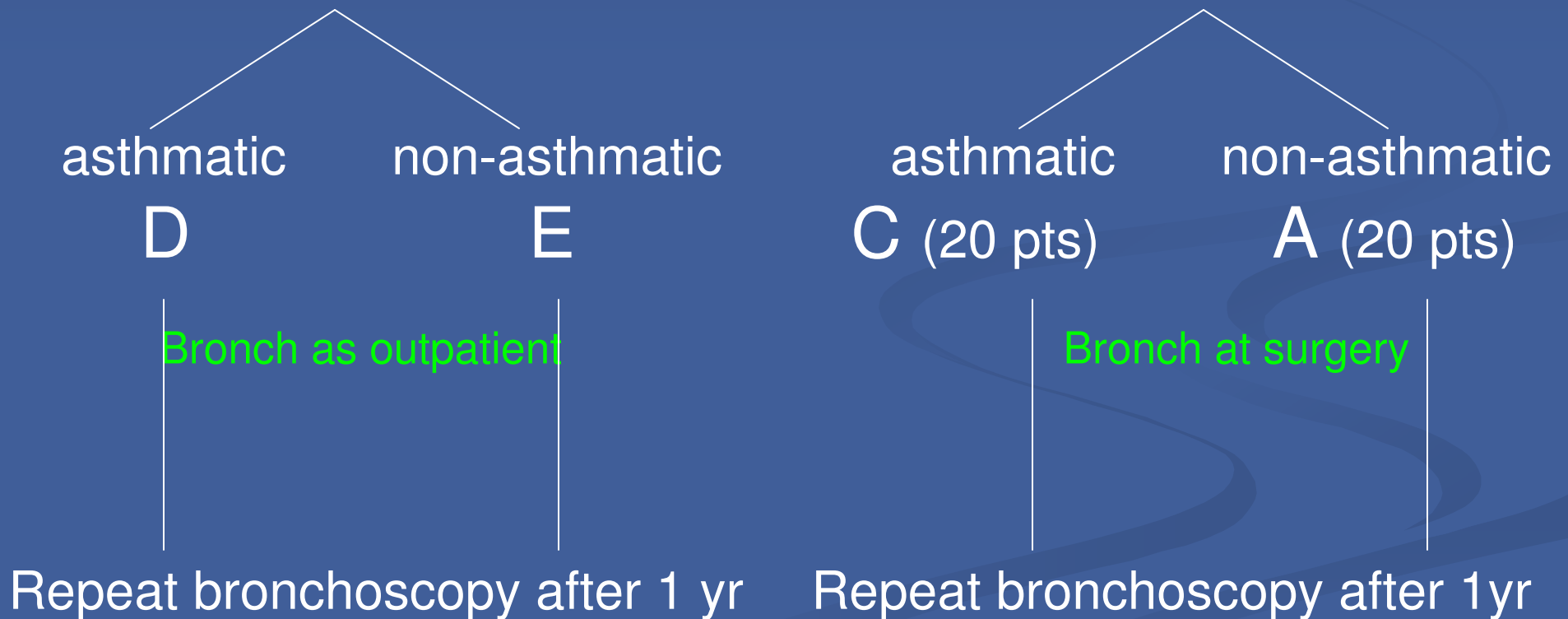
BMI 20-25

B (20 pts)

Does significant weight loss following weight reduction surgery alter airway inflammation?

Medical management of obesity

Surgical management of obesity



All subjects w/ initial BMI > 35

Compare airway inflammation in obese asthmatics with non-obese asthmatics?

Subjects w/ positive methacholine challenge and a Hx of asthma



Obese asthmatics

BMI > 35

C or D

Bronch at surgery

Non-obese asthmatics

BMI 20-25

F (20 pts)

Bronch at surgery (non-obesity related surgery)