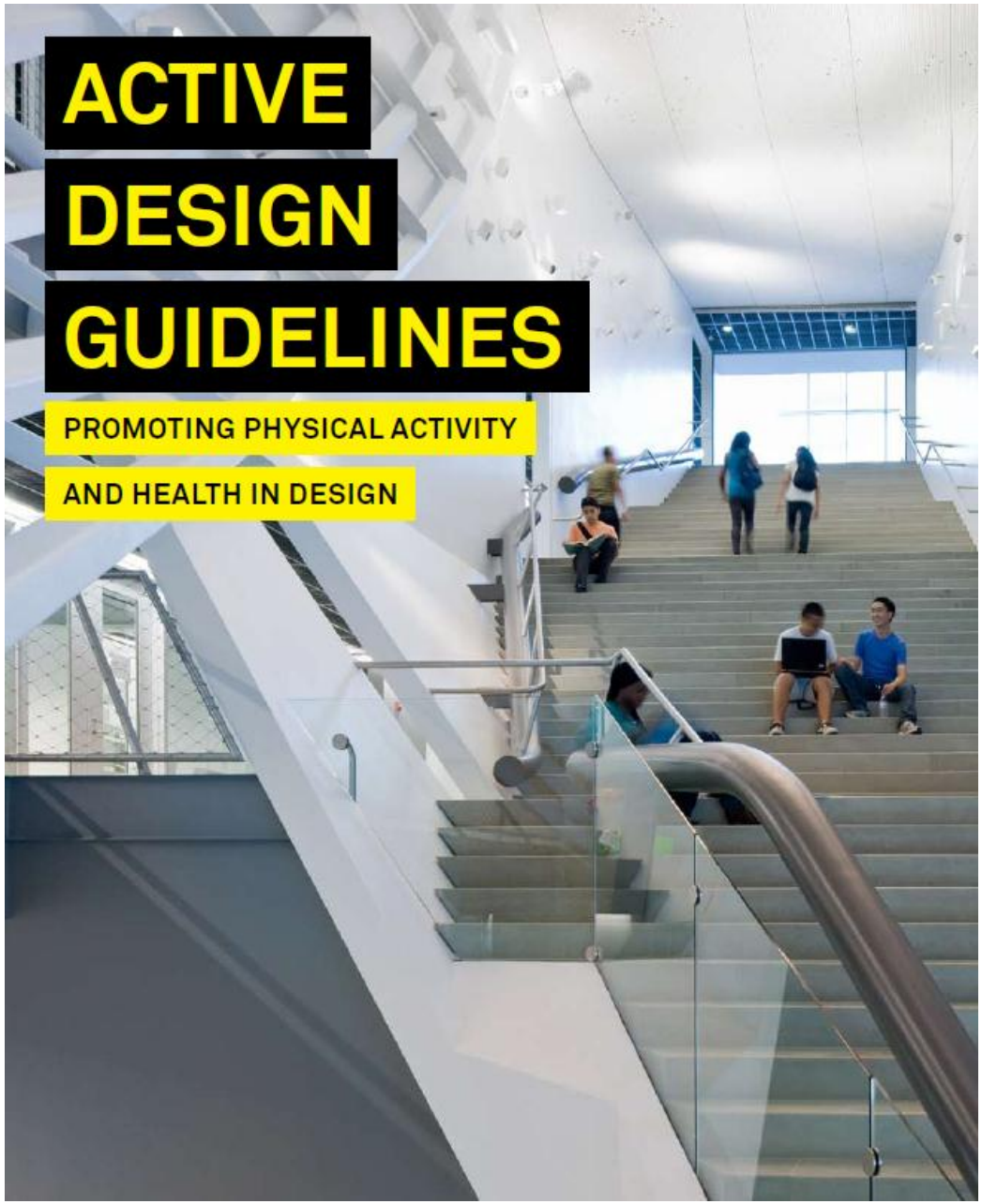
The Role of Design and Infrastructure in Addressing Cycling and Health

Karen K. Lee, MD, MHSc



THE 19th CENTURY:

Infectious Diseases

19th Century codes, planning and infrastructure as weapons in the battle against contagious disease

These strategies were built into the city fabric, and they were effective

THE 21st CENTURY:

Chronic Diseases,
many of which are
"Diseases of Energy"

The emerging design solutions for health parallel sustainable design solutions

Effective designs will have to be an invisible, pervasive, and inevitable part of life

100+ years ago, environmental conditions were a breeding ground for infectious disease epidemics

A PERPETUAL FEVER-NEST.
[Engraved from a Photograph by Anthony.]

Over-crowding
in Lower Manhattan

1910 density:
114,000 people/ sq. mi.

2011 density:
67,000 people/ sq. mi.

+

Inadequate systems
for garbage, water, and sewer, leading to pervasive filth and polluted water supplies

Major epidemics:

Air/droplet-borne diseases:
TB

Water-borne diseases:
Cholera

Vector-borne diseases:
Yellow-fever

The response was through infrastructure interventions

1842 New York's **water system** established – an aqueduct brings fresh water from Westchester.

1857 NYC creates **Central Park**, hailed as "ventilation for the working man's lungs", continuing construction through the height of the Civil War

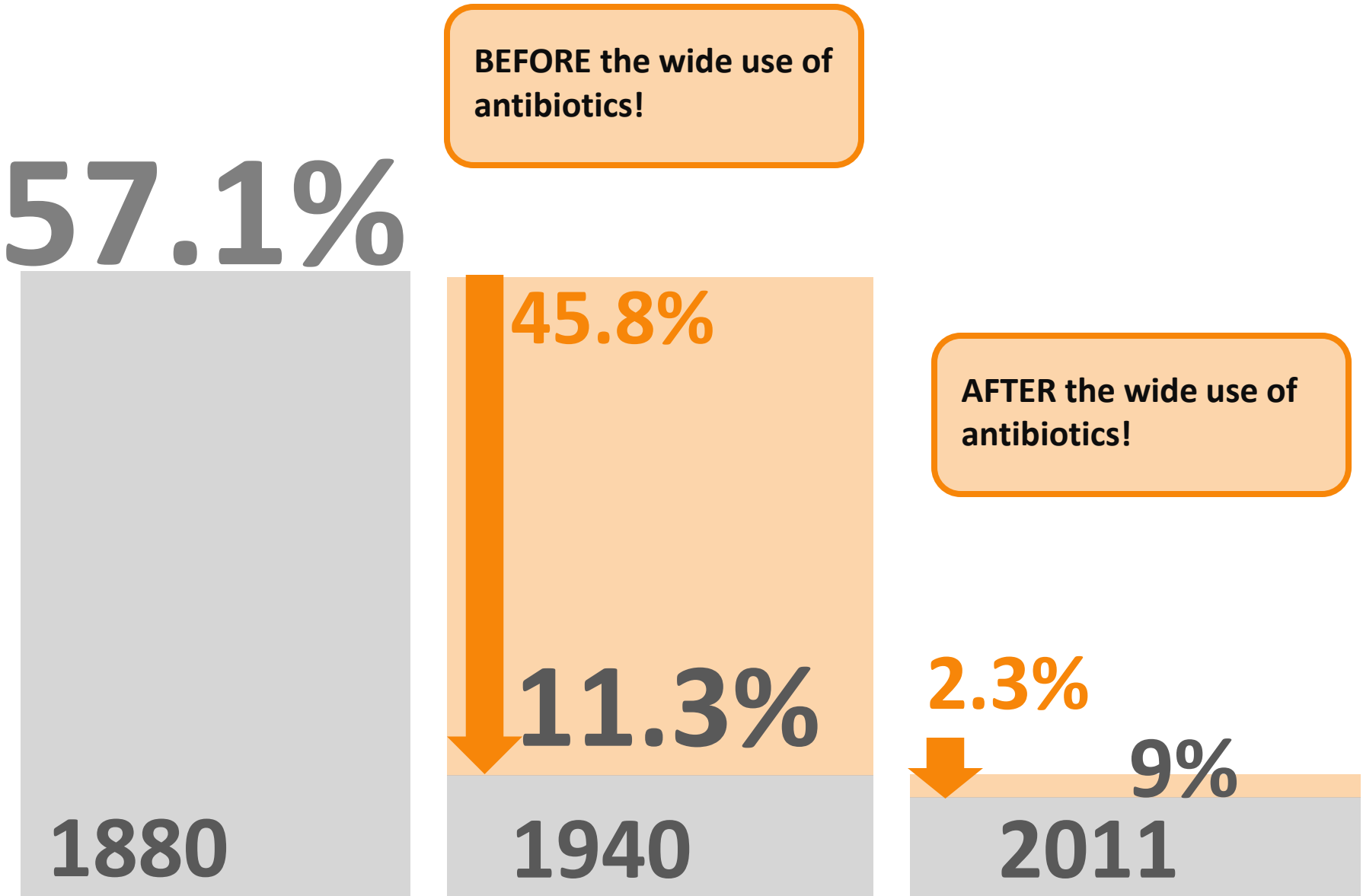
1881 Dept. of Street-sweeping created, which eventually becomes the **Department of Sanitation**

1901 **New York State Tenement House Act** banned the construction of dark, airless tenement buildings

1904 First section of **Subway** opens, allowing population to expand into Northern Manhattan and the Bronx

1916 **Zoning Ordinance** requires stepped building setbacks to allow light and air into the streets

The Results: Infectious disease successes



The epidemics of today are:

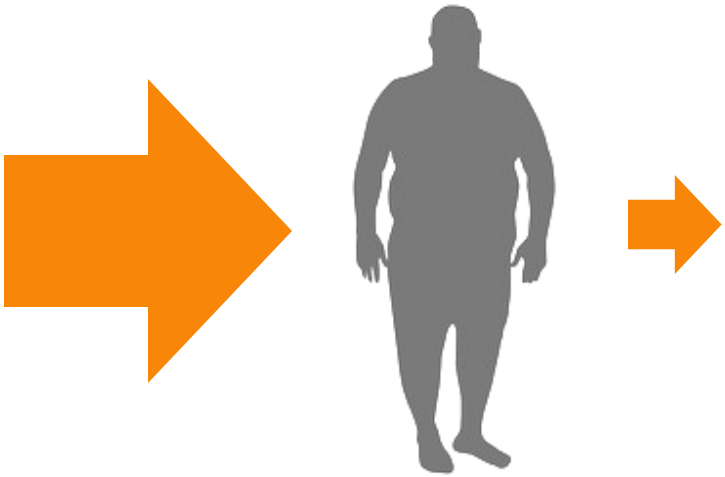
CHRONIC DISEASES
(obesity, diabetes, heart disease & strokes, cancers)

Chronic Diseases - #1 cause of death globally (36 million deaths/y).

Leading Risk Factors accounting for 80% of deaths (WHO 2011):

- Tobacco
- **Physical Inactivity**
- **Unhealthy Diets**
- Harmful Use of Alcohol

Energy in: Food

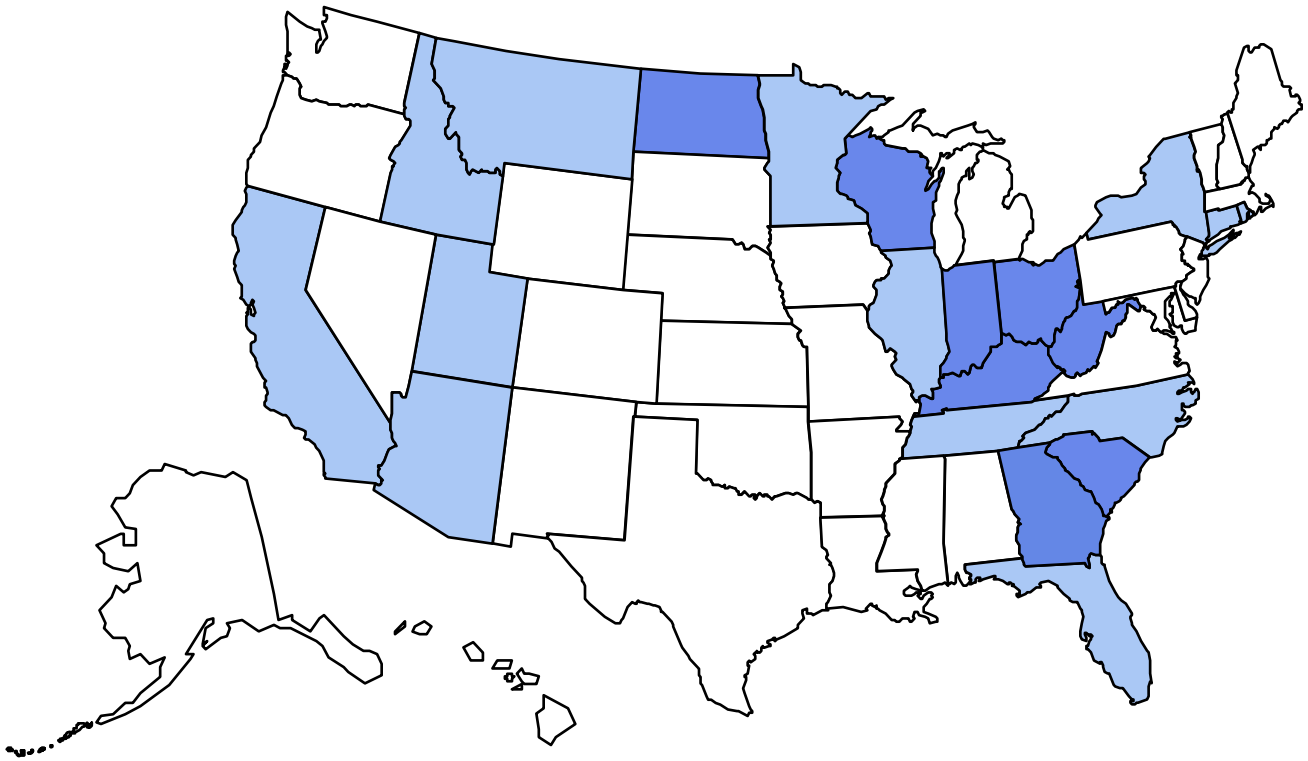


Energy out: Exercise

Obesity Trends* Among U.S. Adults

BRFSS, 1985

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



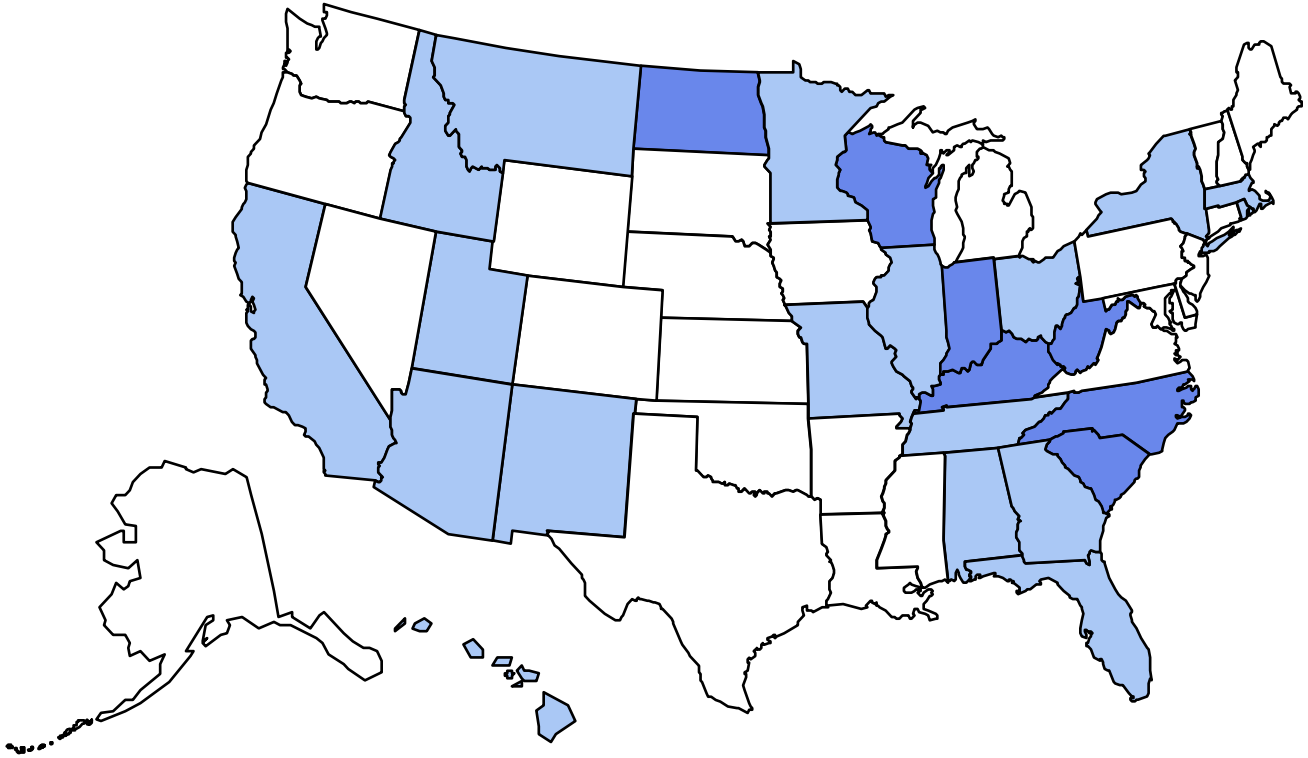
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1986

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



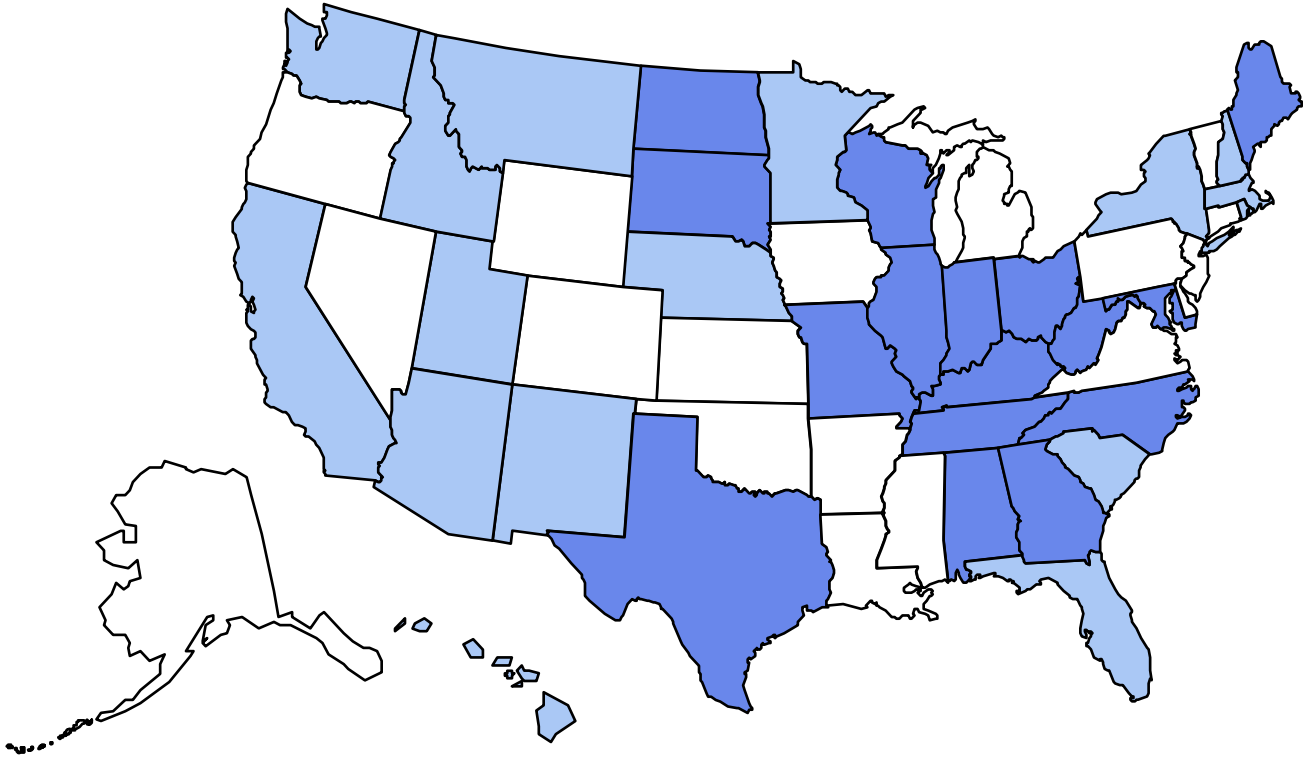
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1987

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



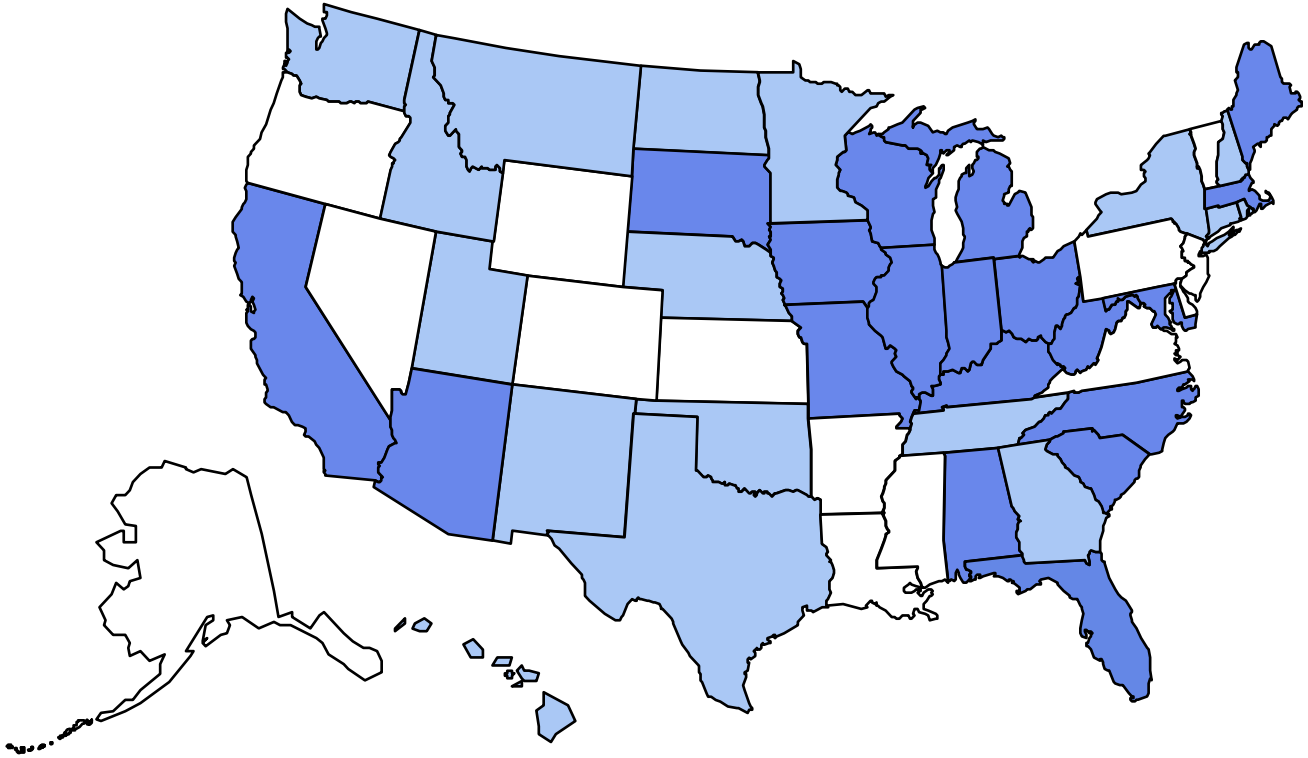
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1988

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



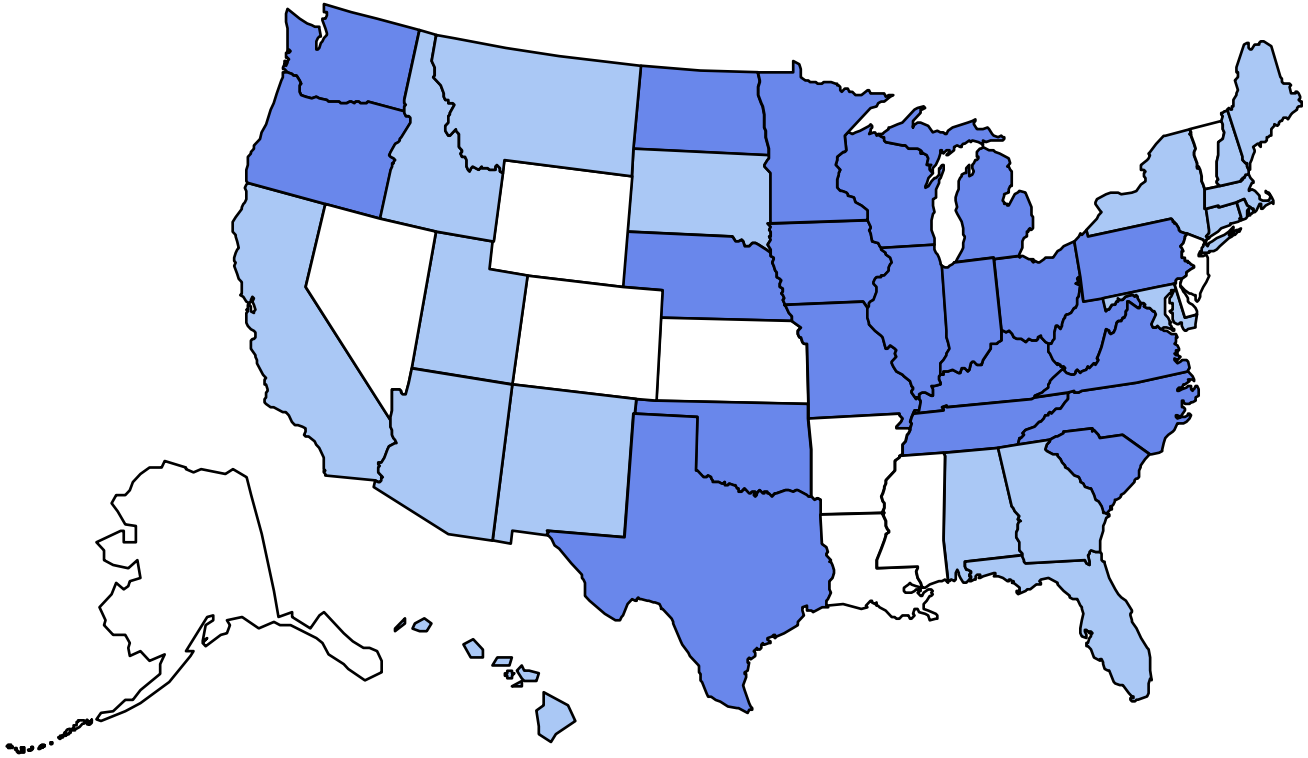
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1989

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



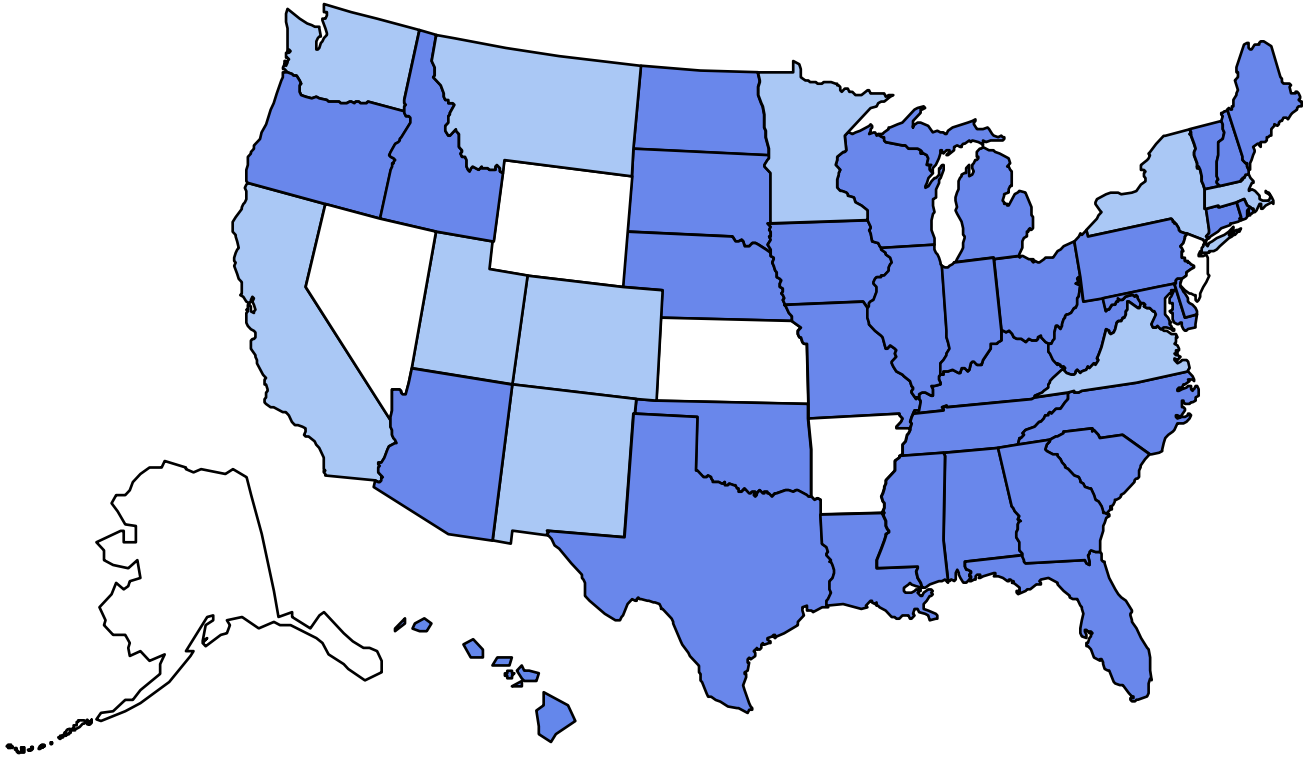
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1990

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



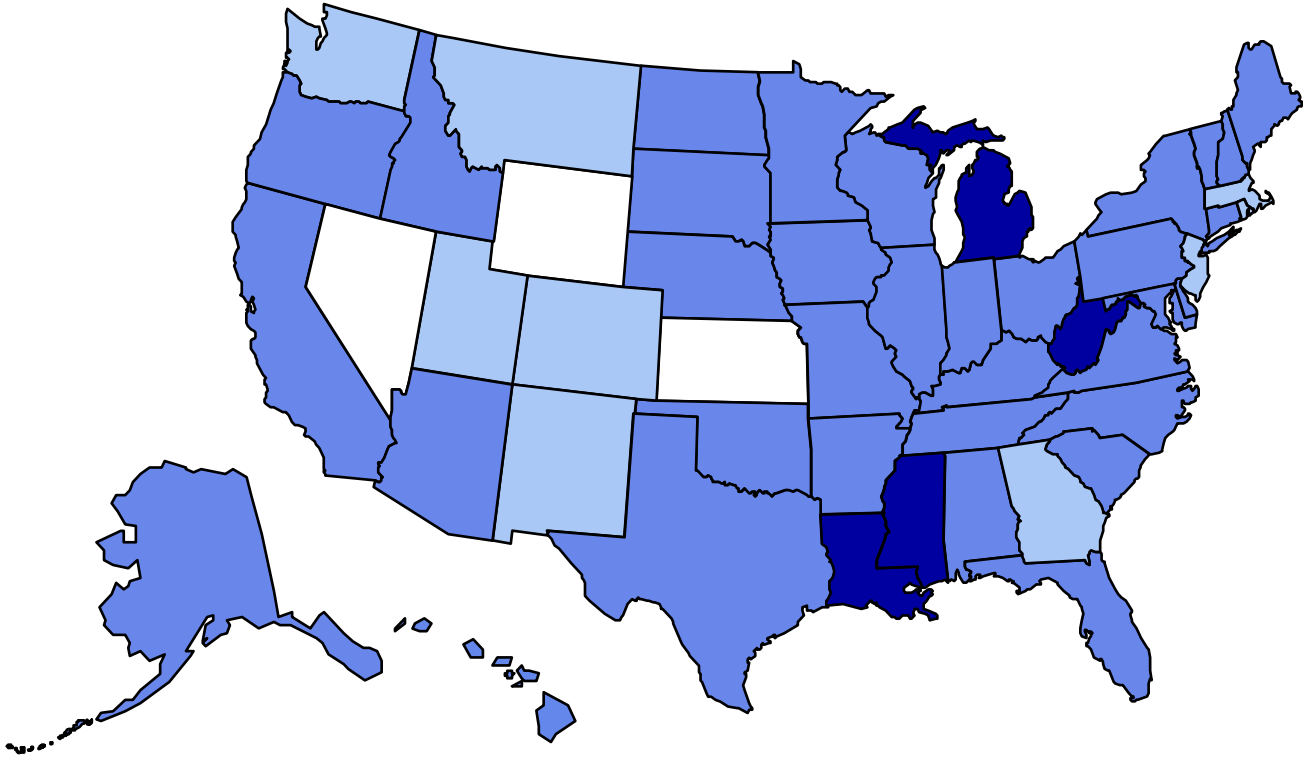
No Data | <10% | 10%–14%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1991

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



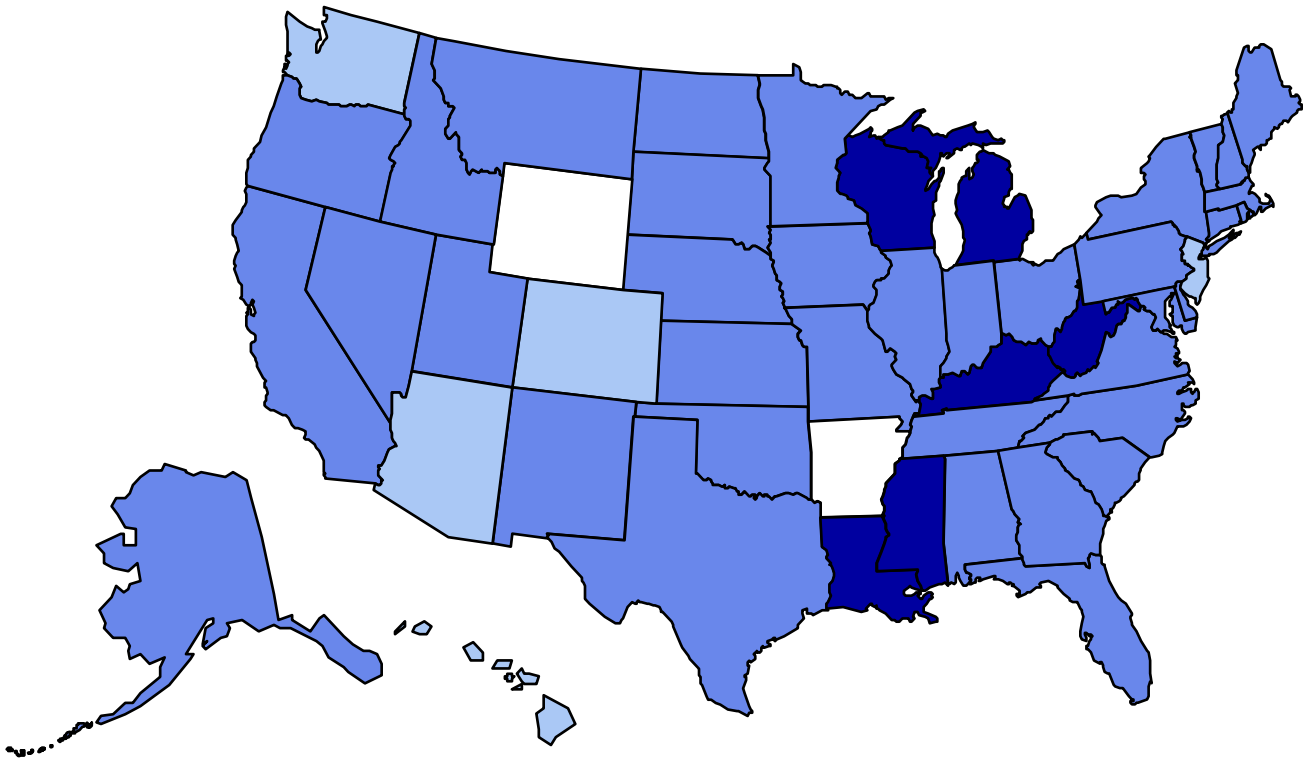
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1992

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



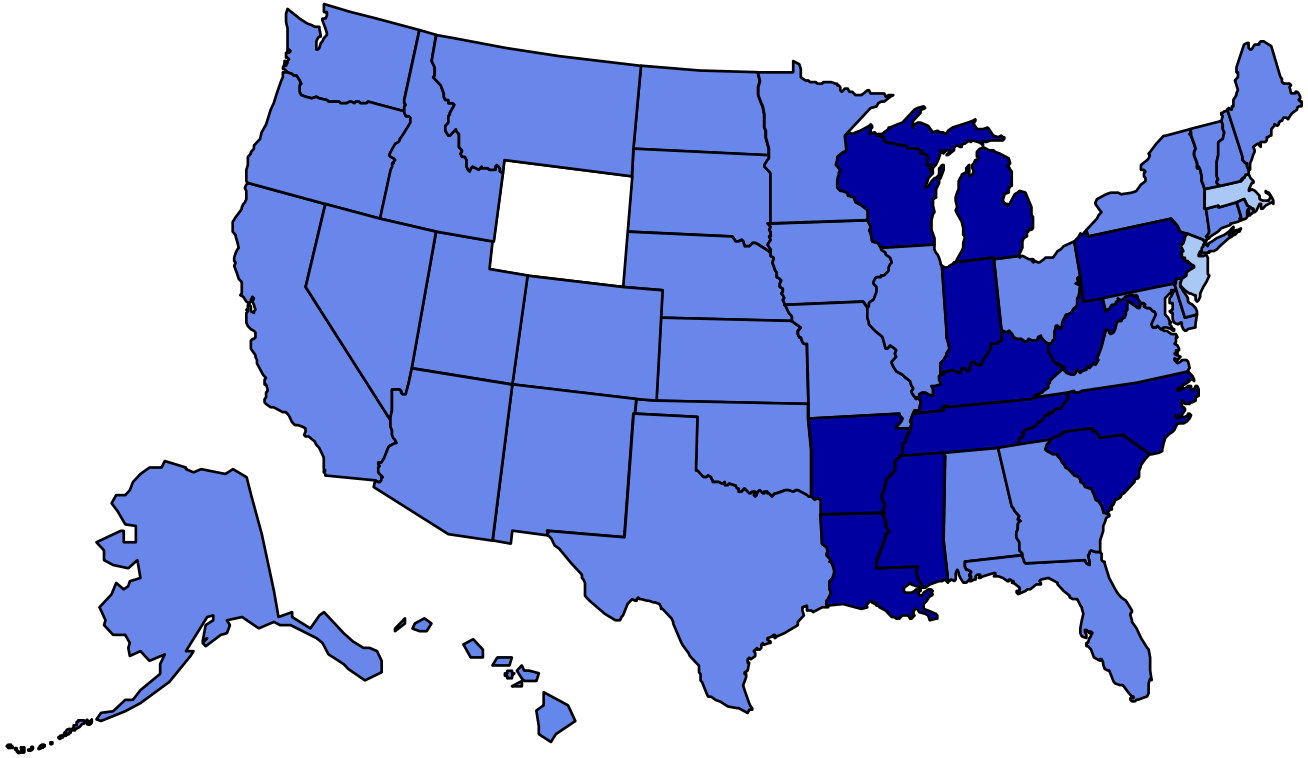
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1993

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



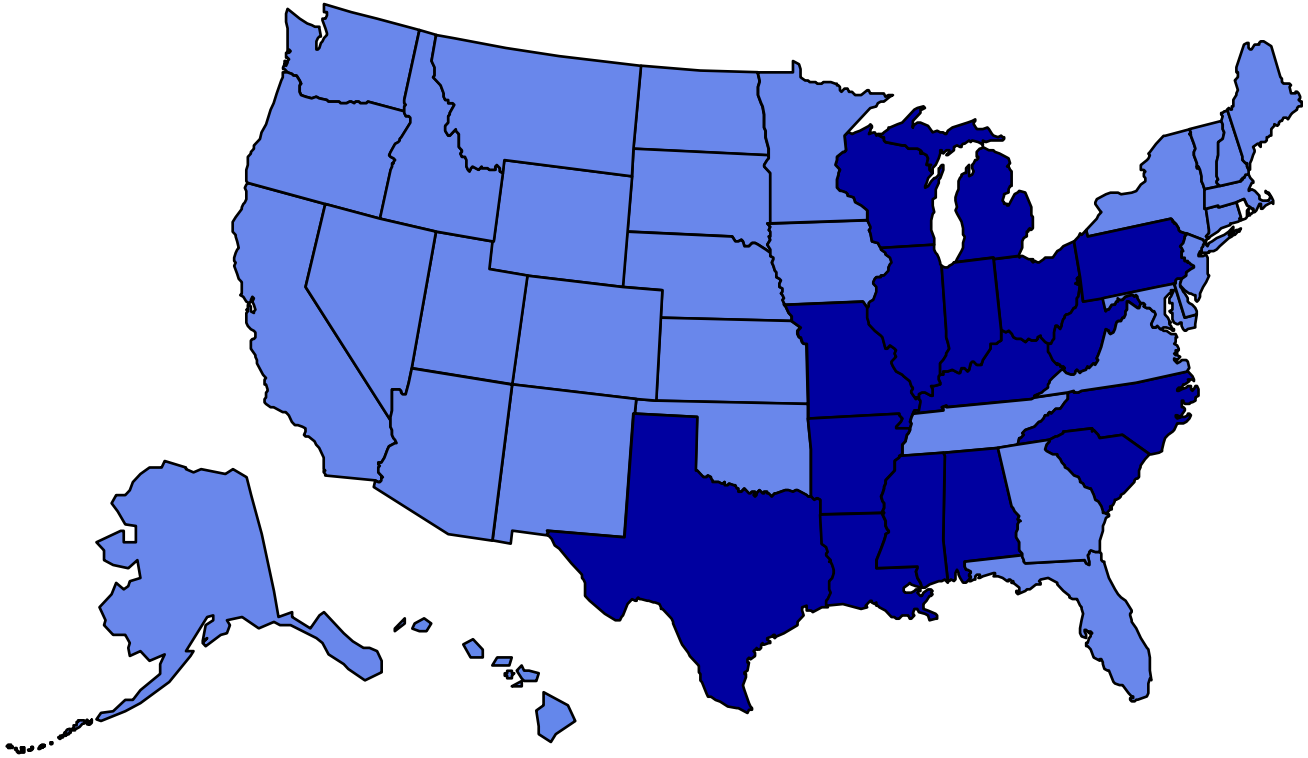
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1994

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



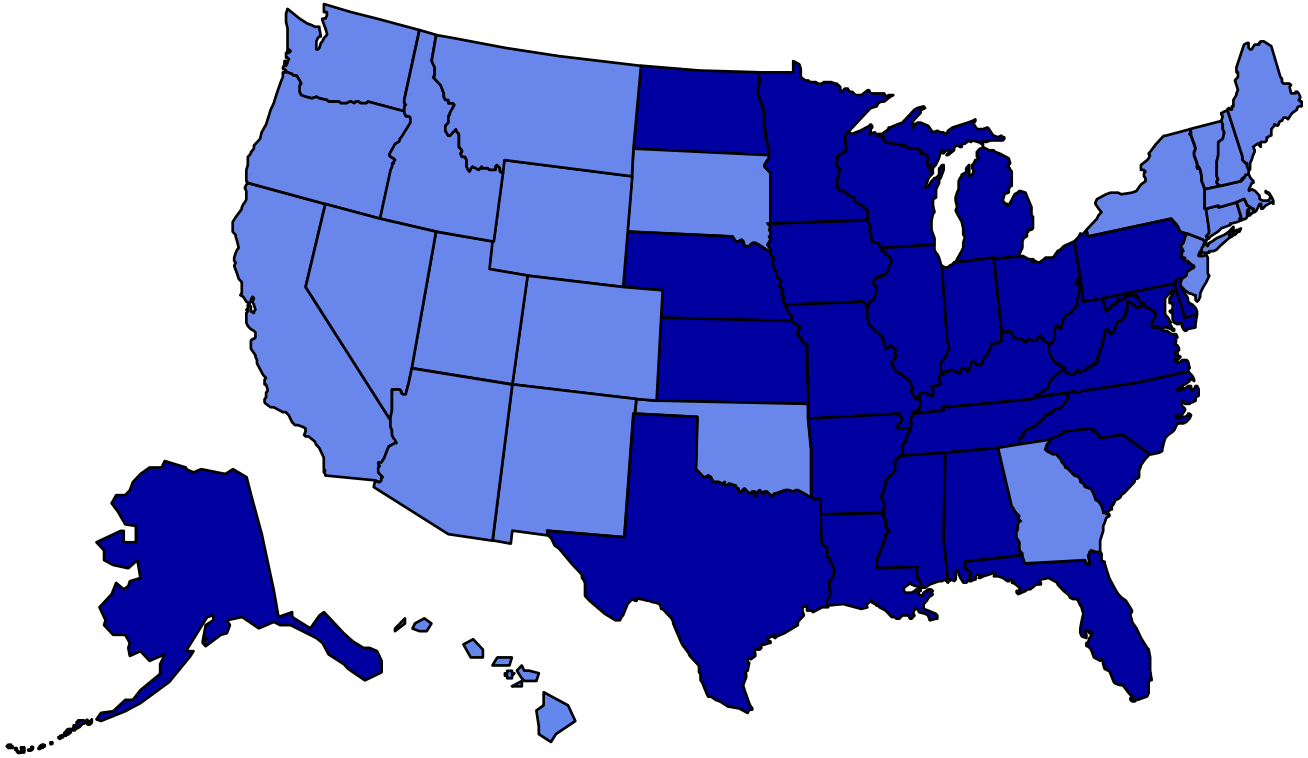
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1995

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



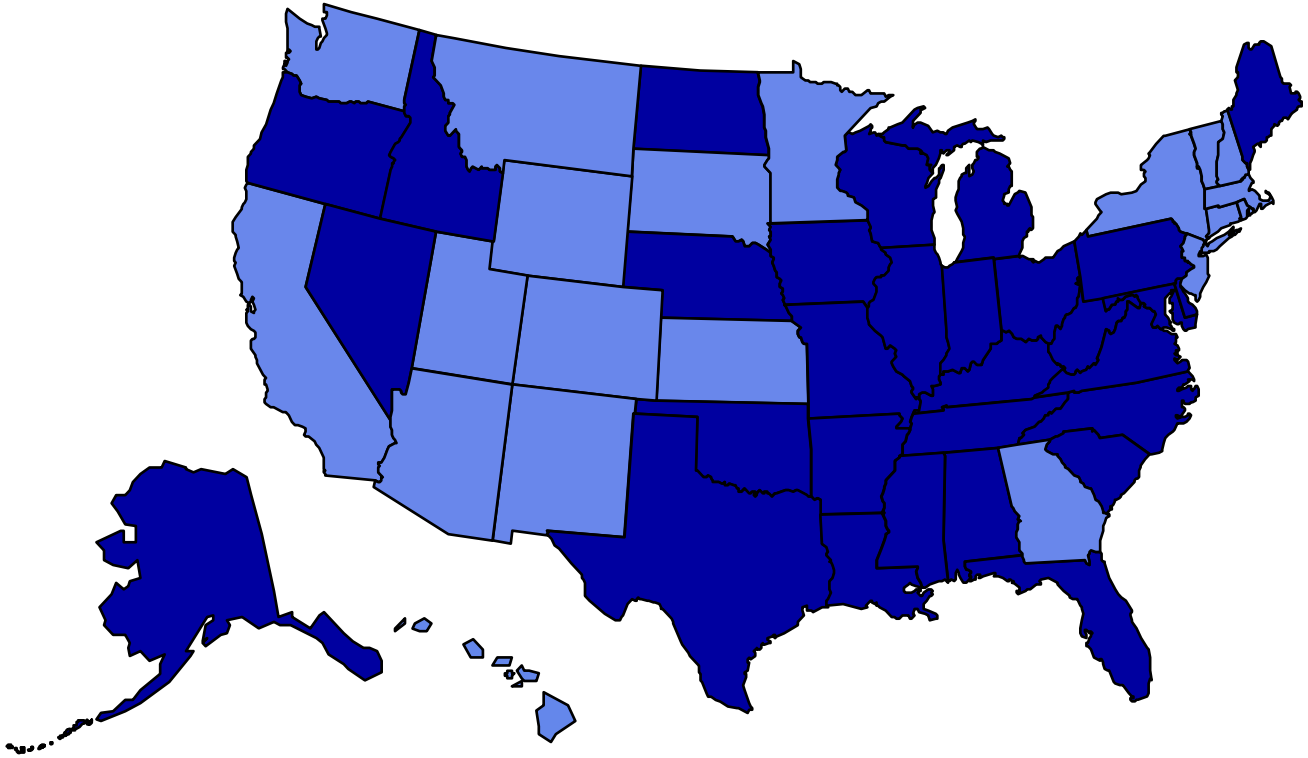
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1996

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



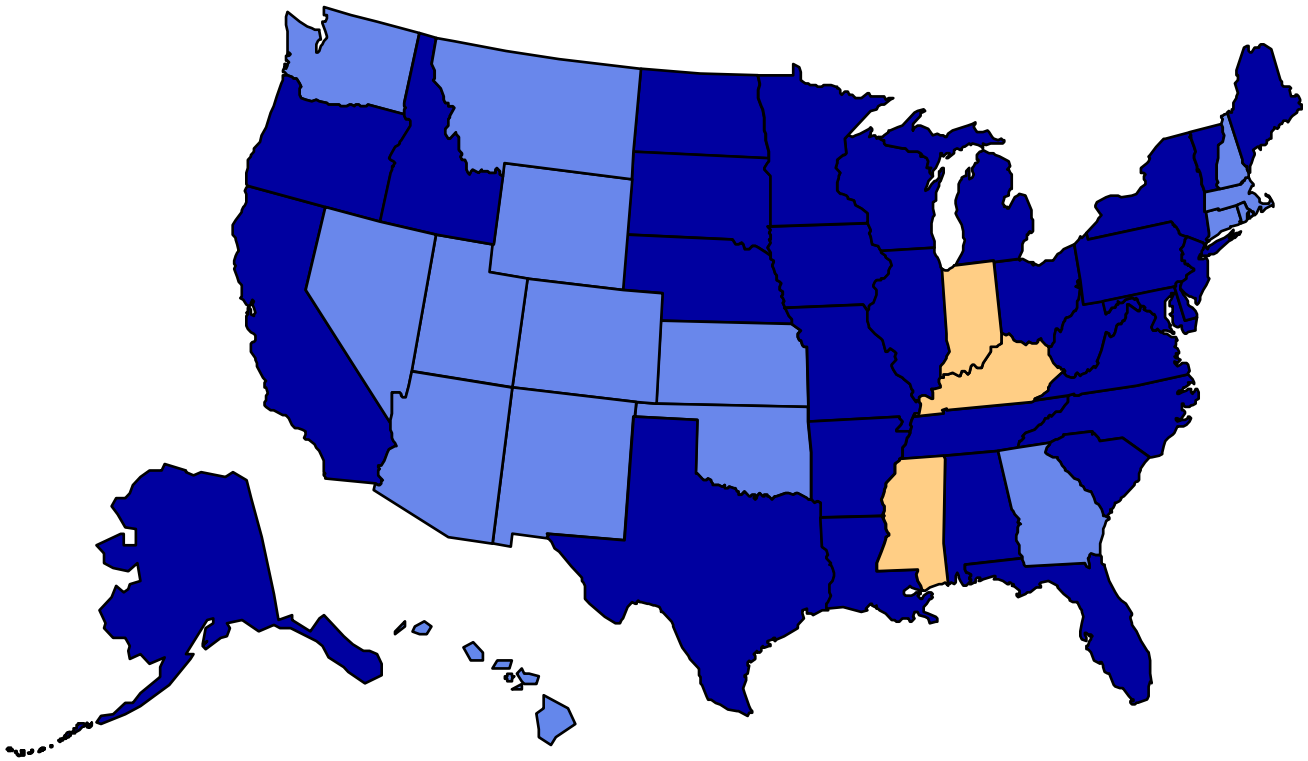
No Data | <10% | 10%–14% | 15%-19%

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1997

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



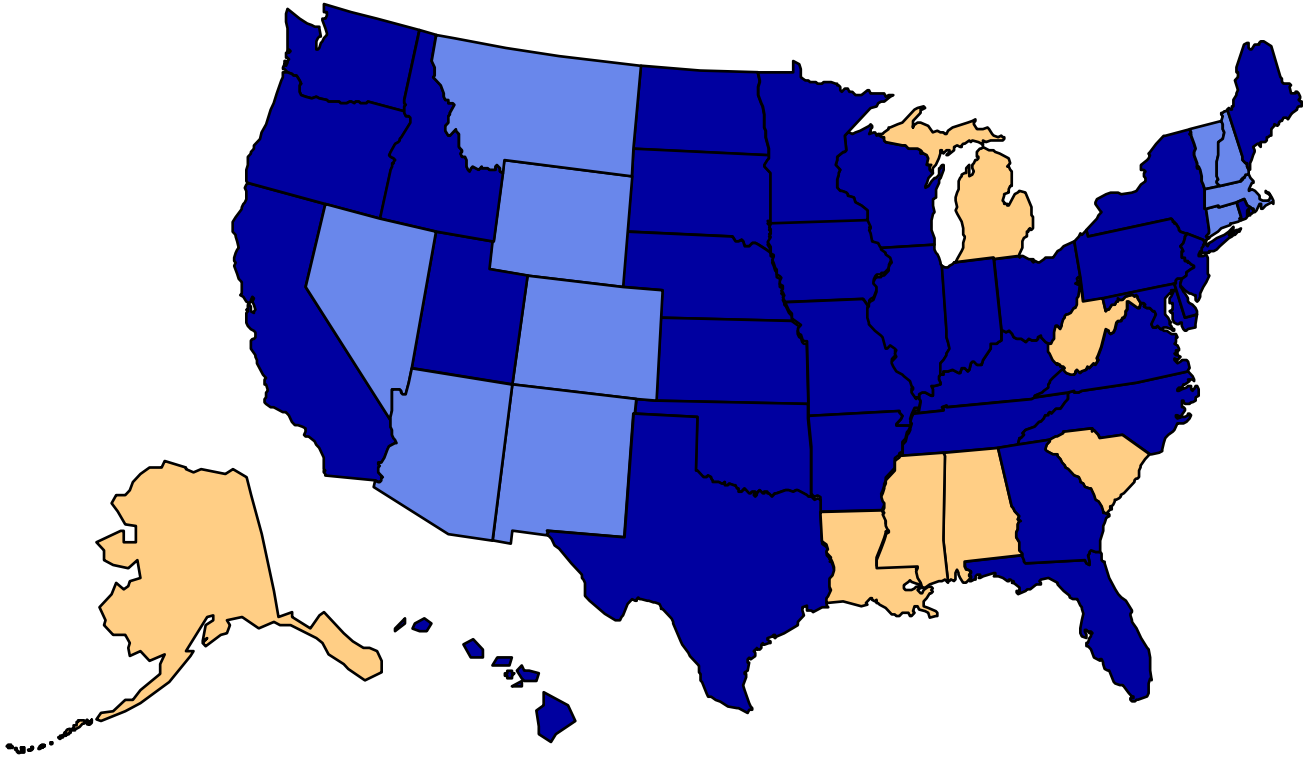
No Data | <10% | 10%–14% | 15%-19% | 20%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1998

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



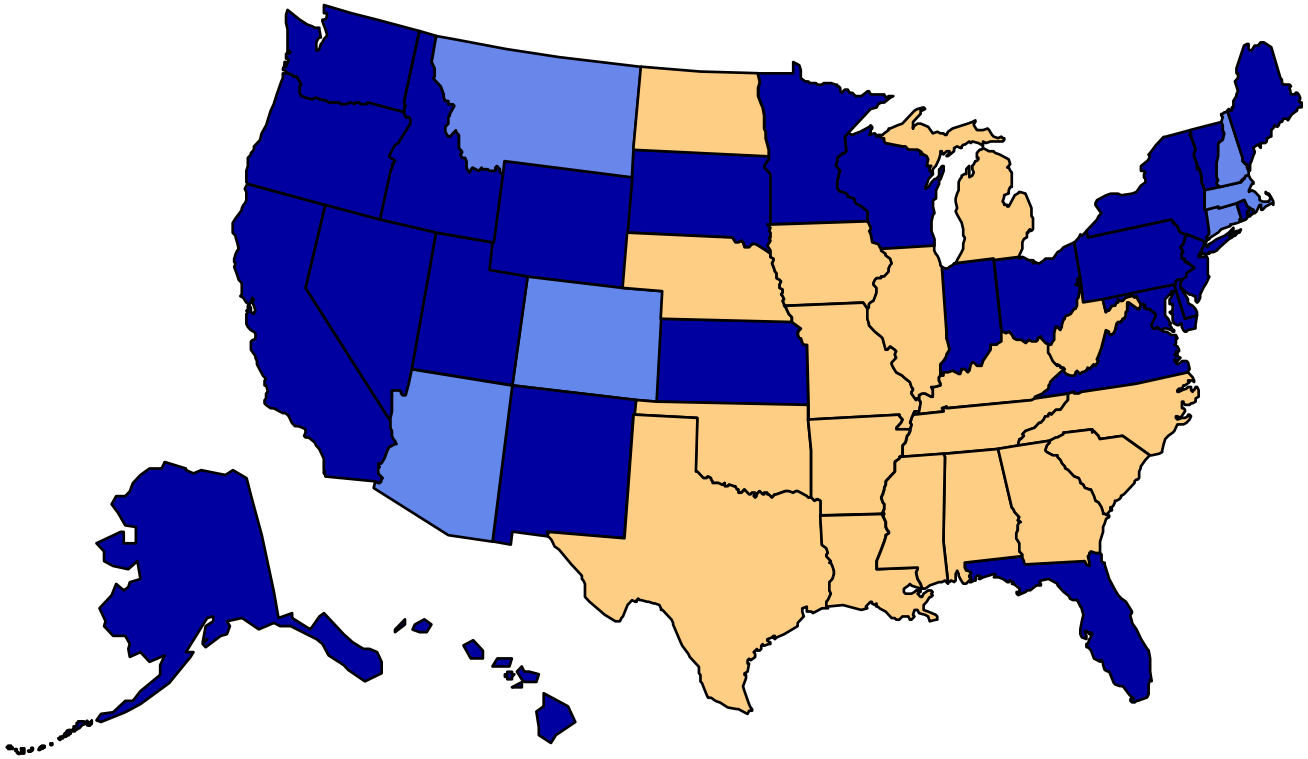
No Data | <10% | 10%–14% | 15%-19% | 20%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 1999

(*BMI ≥30, or ~ 30 lbs overweight for 5' 4" woman)



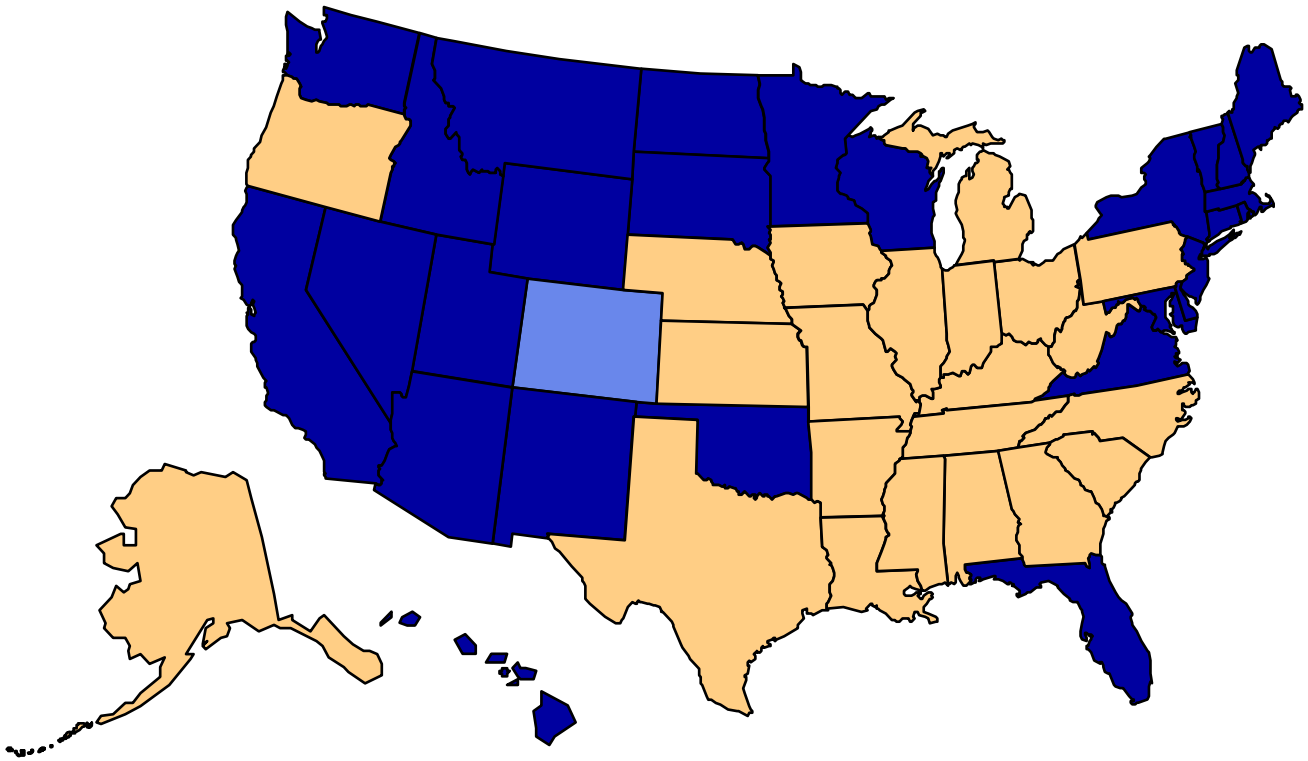
No Data | <10% | 10%–14% | 15%-19% | 20%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2000

(*BMI ≥30, or ~ 30 lbs overweight for 5' 4" woman)



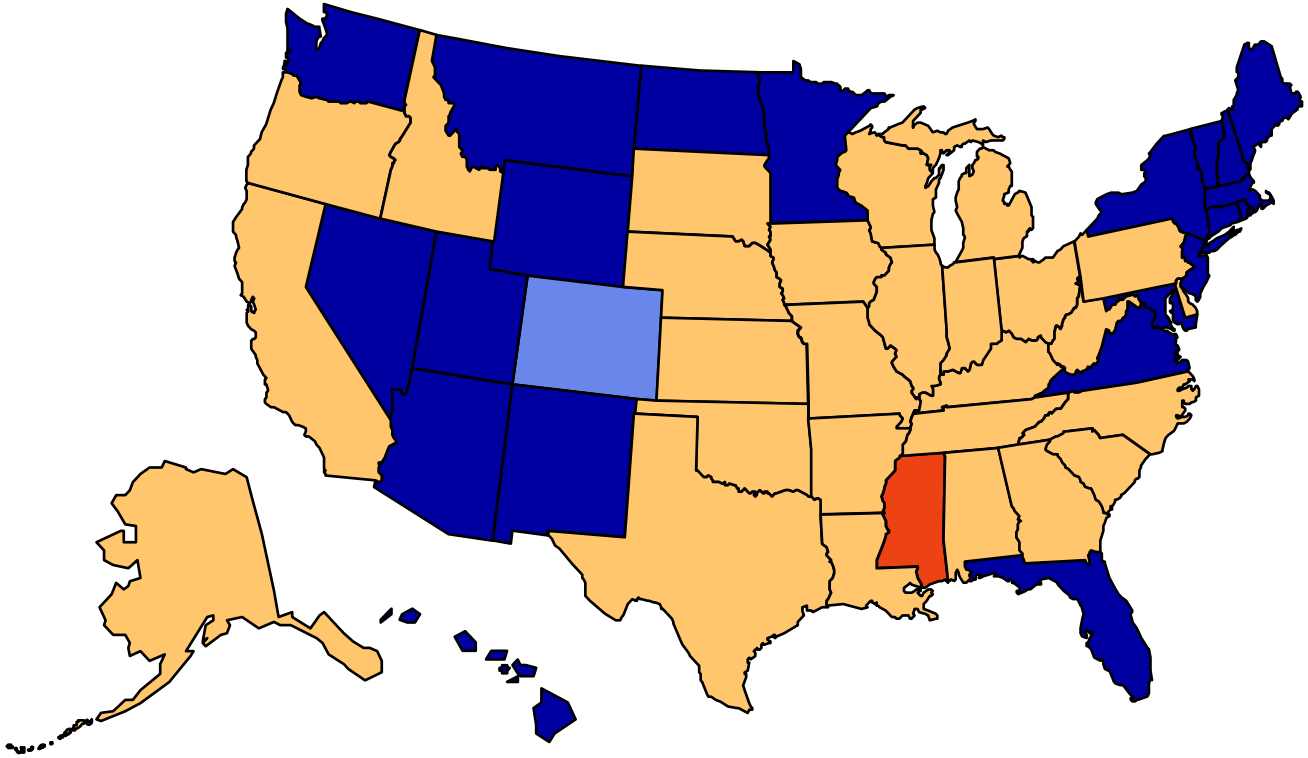
No Data | <10% | 10%–14% | 15%-19% | 20%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2001

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



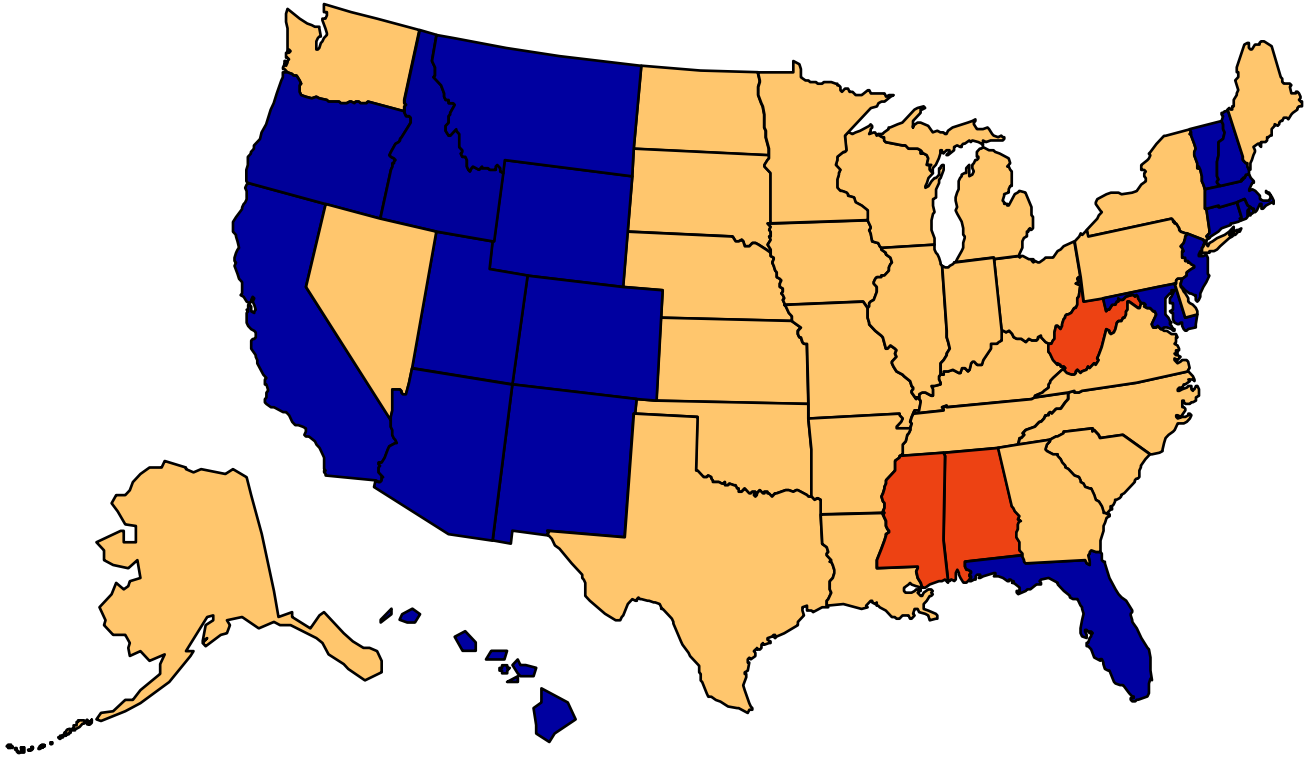
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2002

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



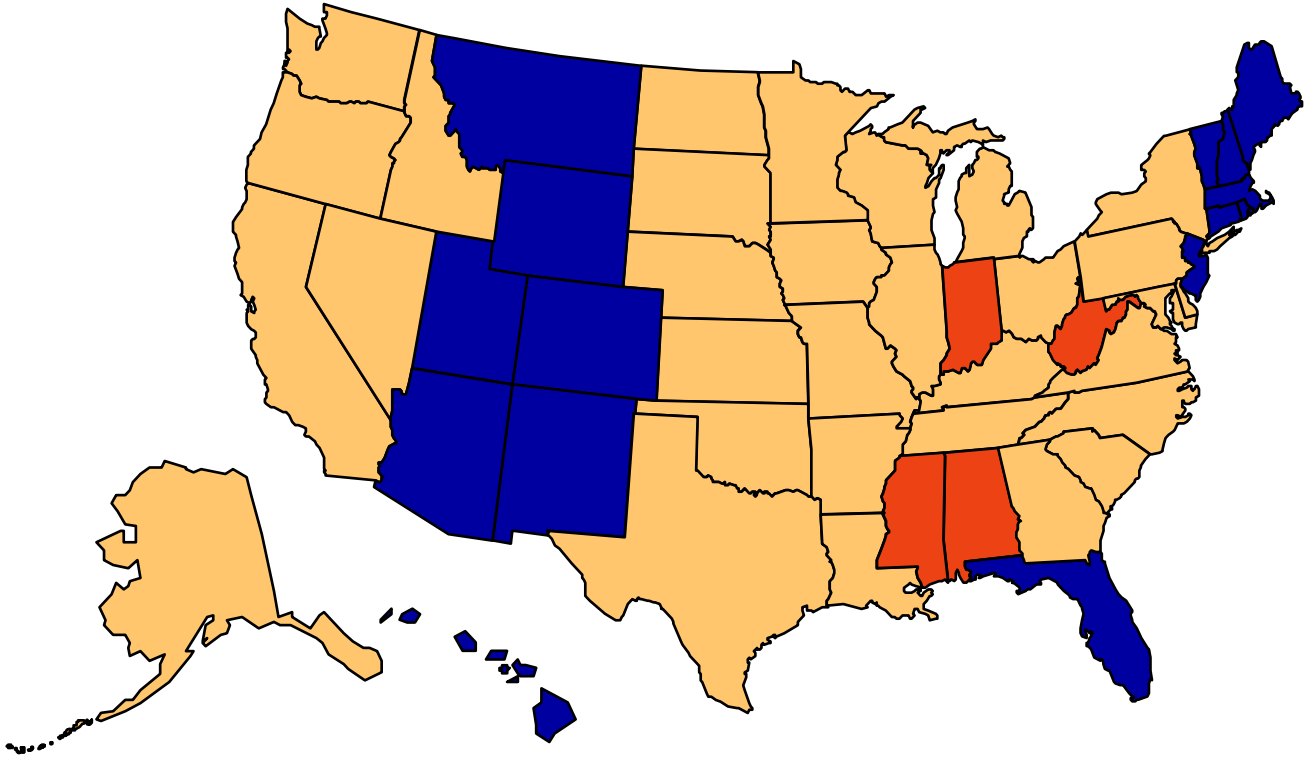
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2003

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



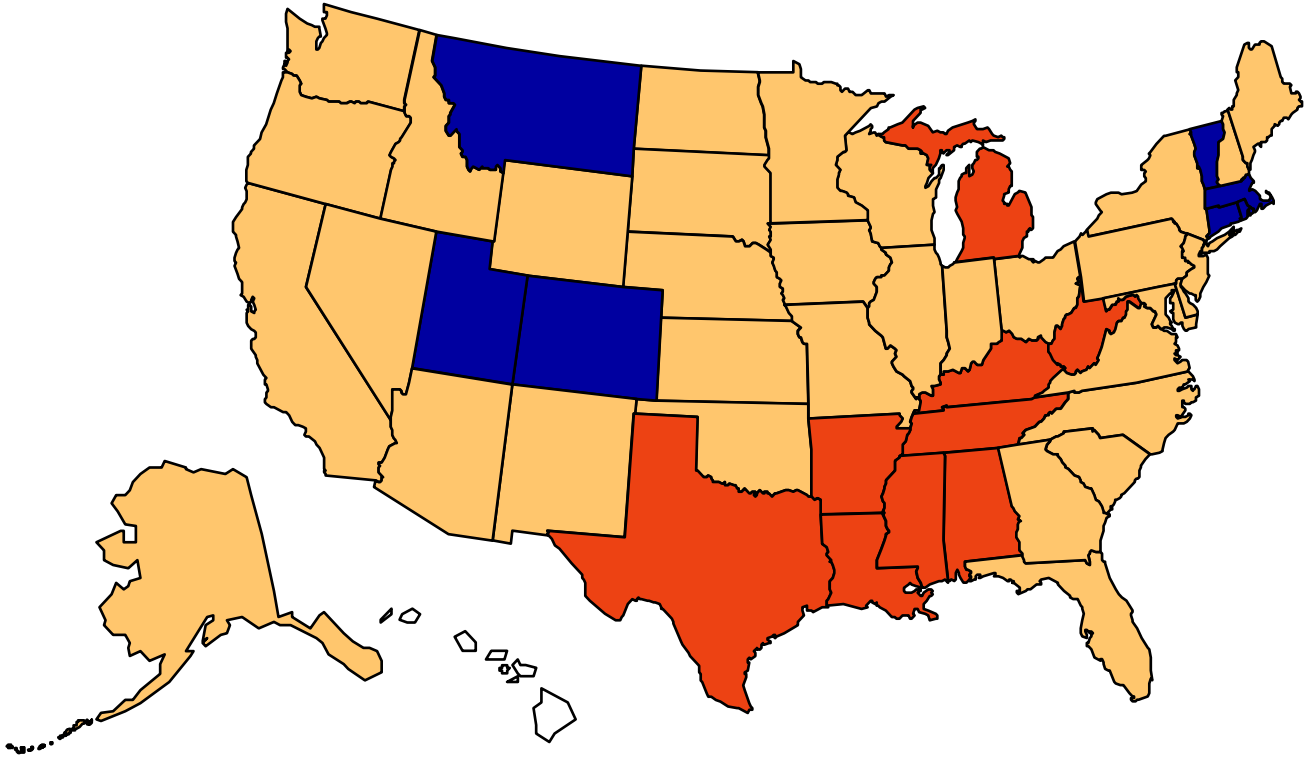
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2004

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



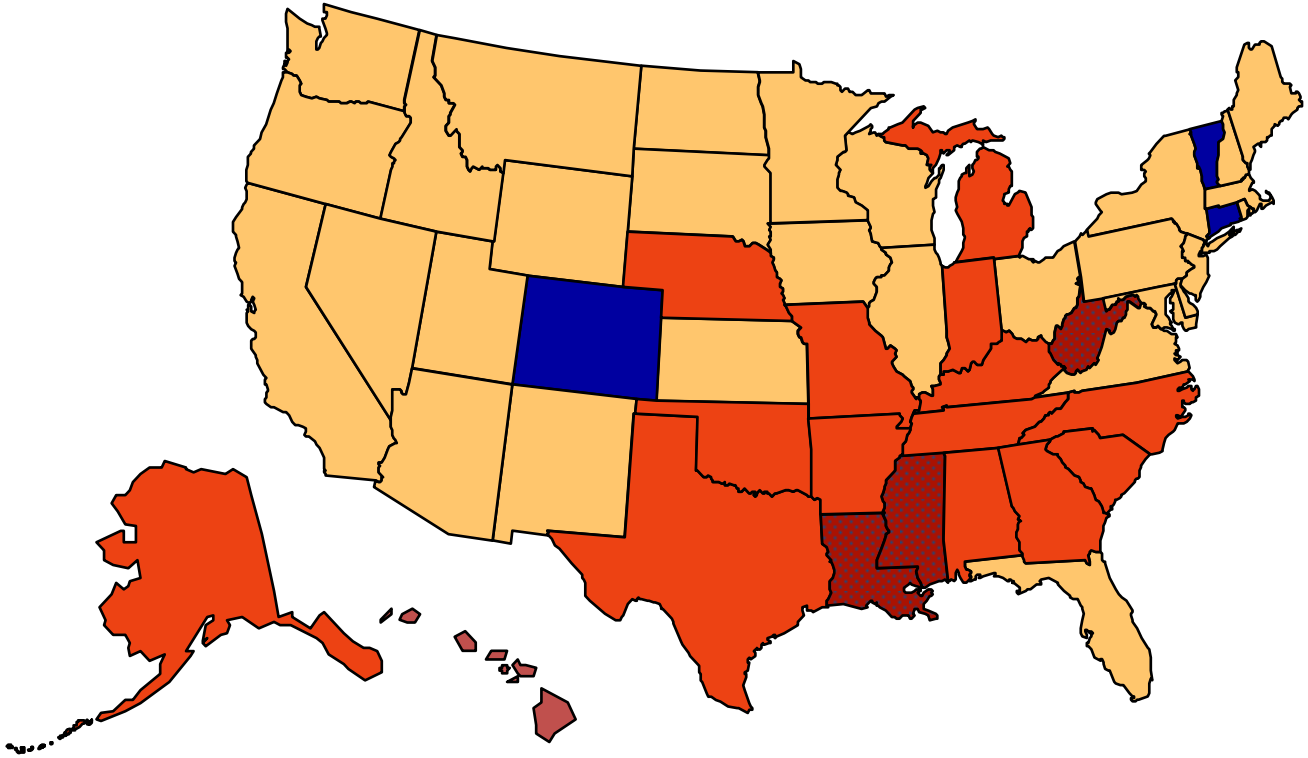
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2005

(*BMI ≥30, or ~ 30 lbs overweight for 5' 4" woman)



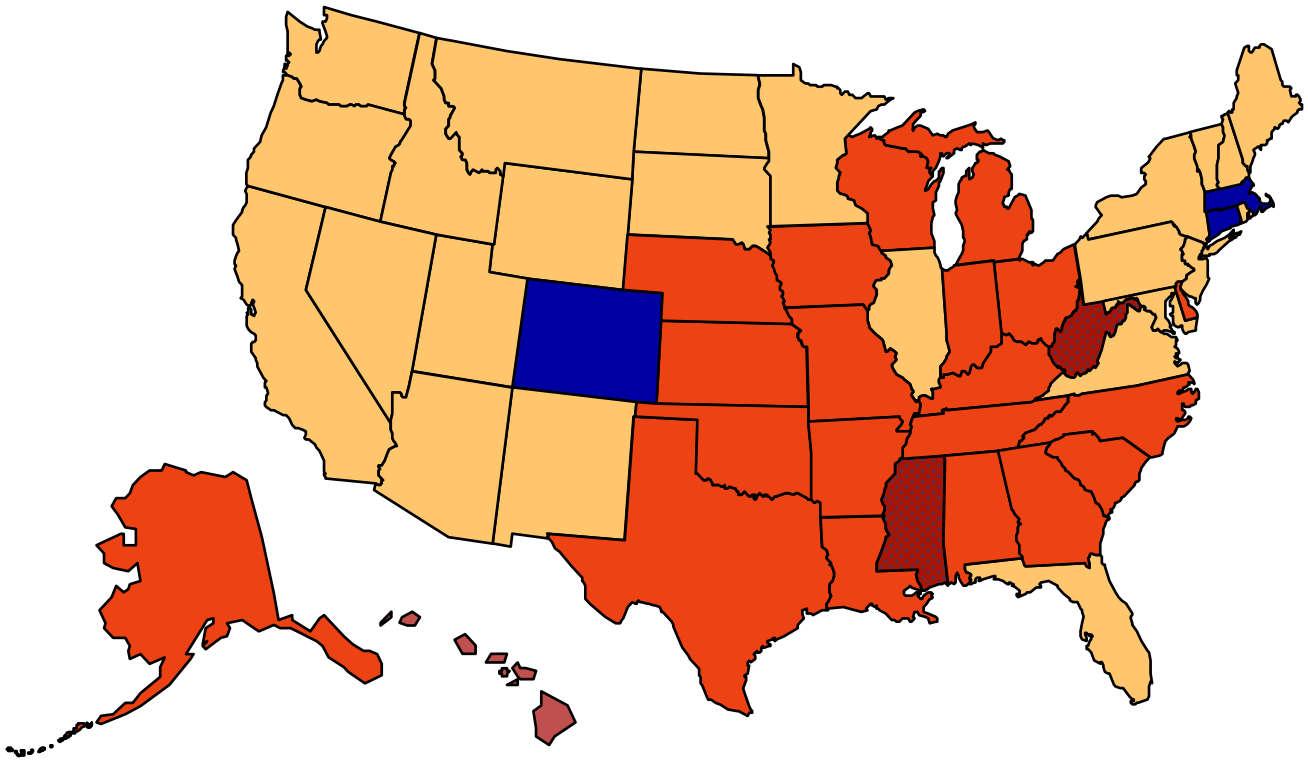
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%-29% | 30%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2006

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



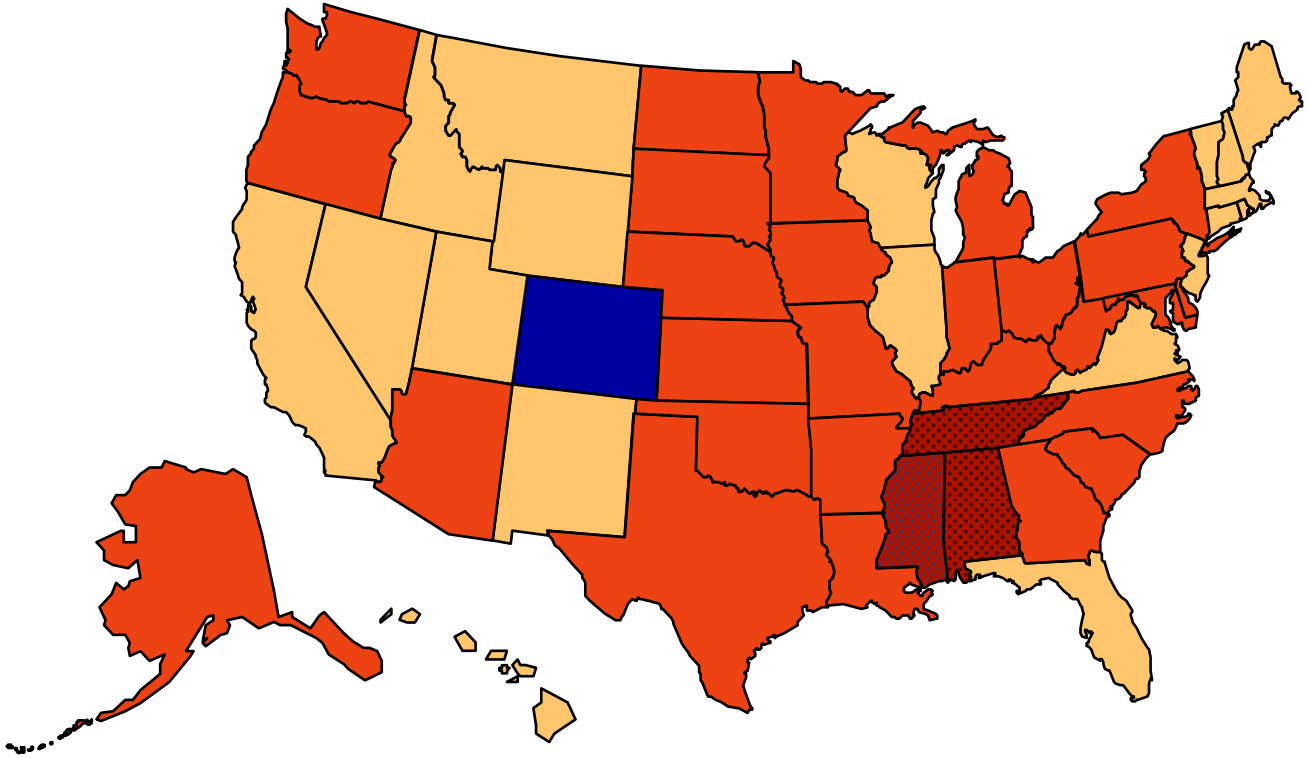
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%-29% | 30%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2007

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



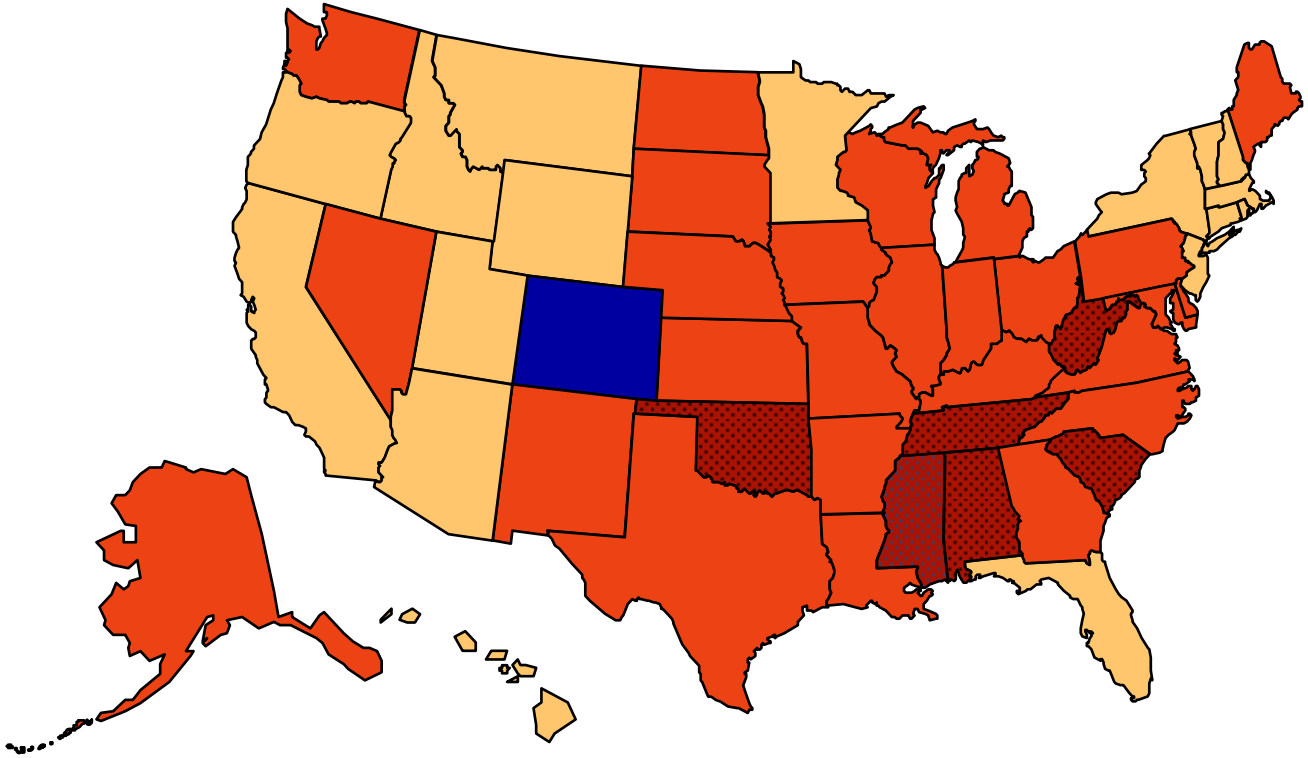
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%-29% | 30%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2008

(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



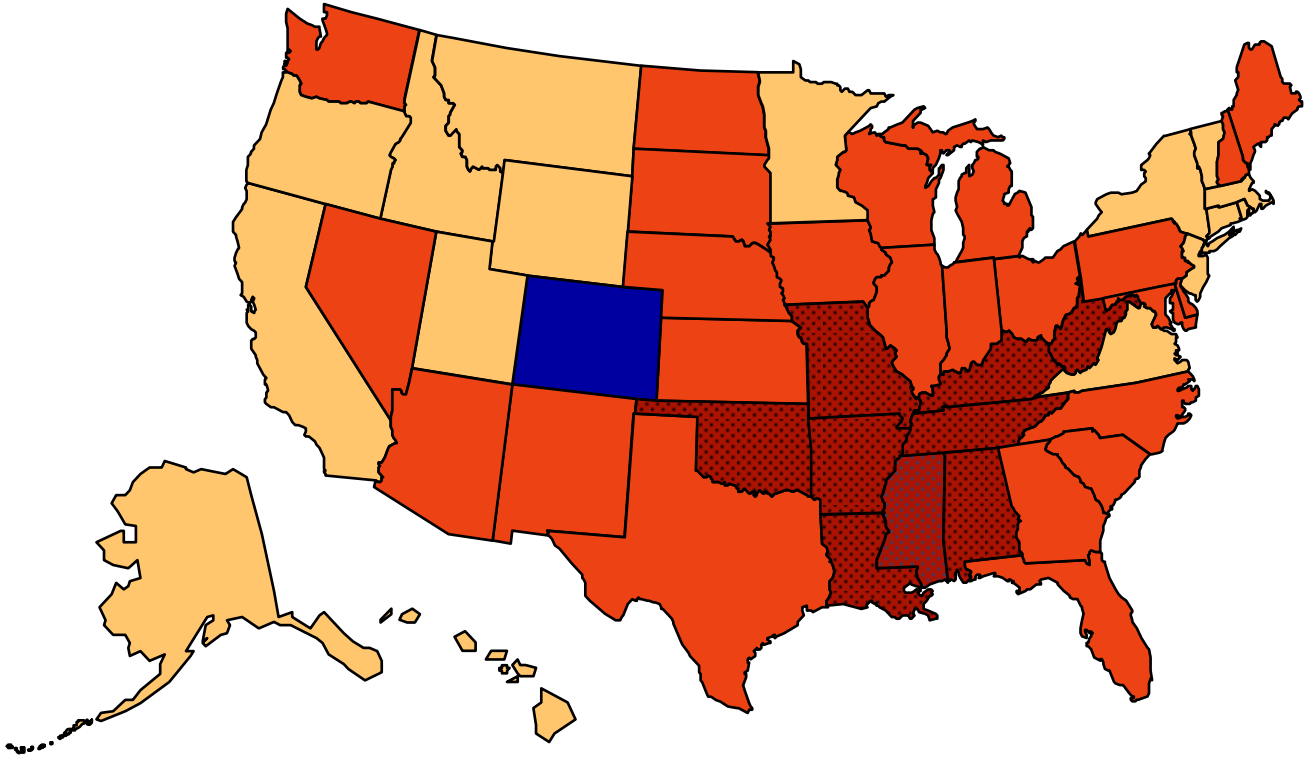
No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%-29% | 30%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Obesity Trends* Among U.S. Adults

BRFSS, 2009

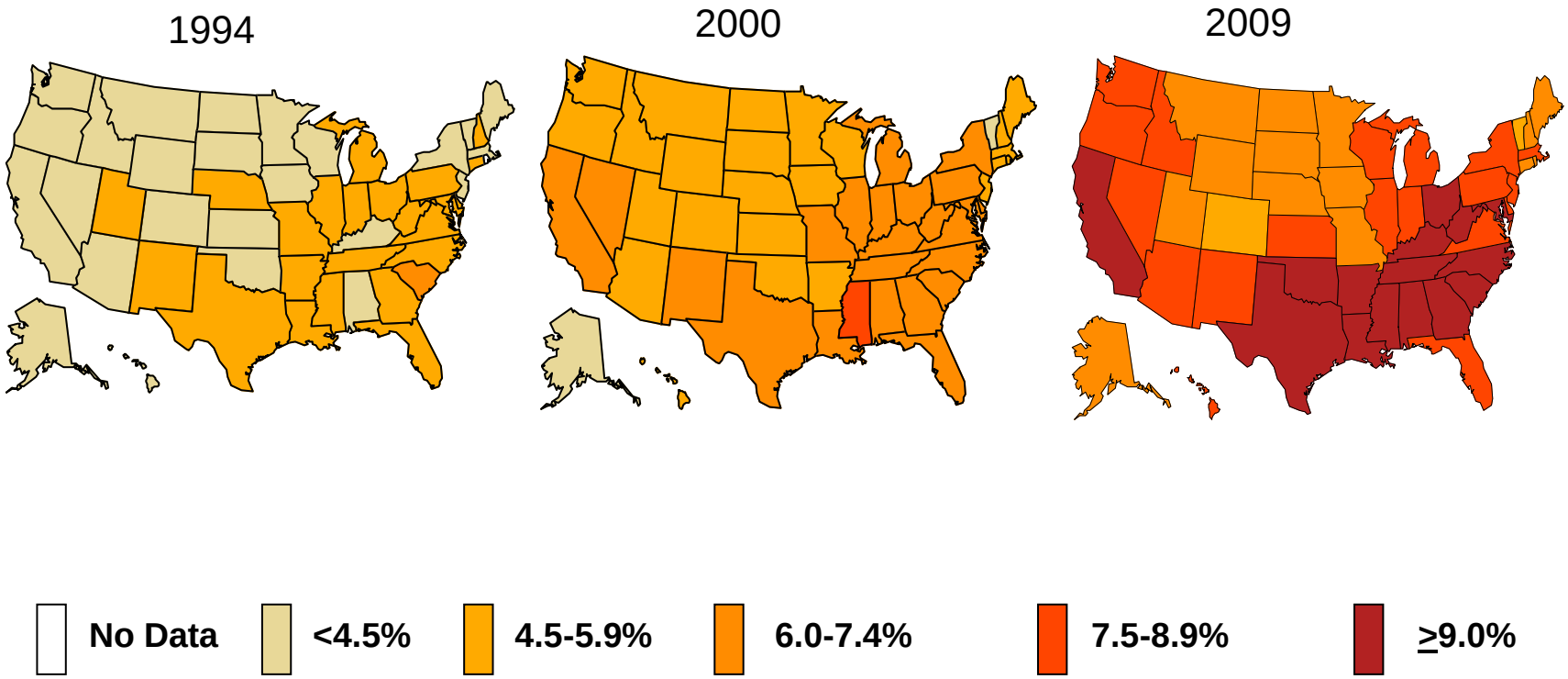
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” woman)



No Data | <10% | 10%–14% | 15%-19% | 20%-24% | 25%-29% | 30%+

Source: U.S. Centers for Disease Control and Prevention (CDC)

Diabetes trends among U.S. adults



Source: CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

According to the CDC……

the medical costs attributable to obesity today in the U.S. are estimated to be

$147 billion per year.

By 2030,

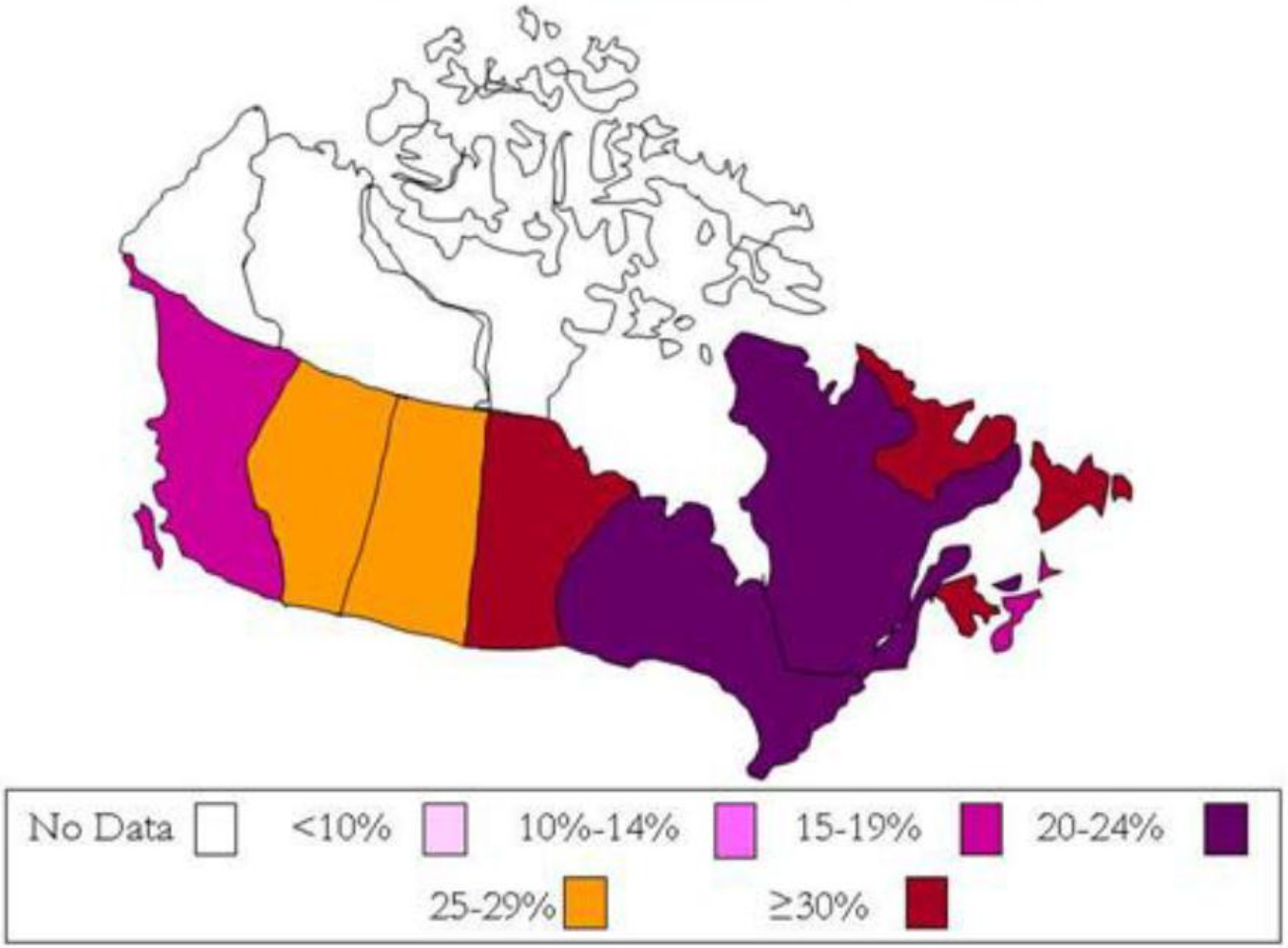
if obesity trends continue as shown,

the total attributable health-care costs will be

$860-$956 billion per year.

Obesity Trends Among Canadian Adults

CCHS, 2004 (MEASURED height & weight)



Source: M Tjepkema & M Shields, Statistics Canada. June 2005

Physical Inactivity

- 85% of Canadian Adults do <u>not</u> get the minimum 150 minutes of moderate-vigorous physical activity per week
- 91% of Canadian boys and 96% of Canadian girls (ages 6-19 years) do <u>not</u> get the 60 min of moderate-vigorous physical activity per day

- Physical Inactivity contributes to:
  - 21,000 premature deaths (Canada, 1995)

Obesity and Diabetes have increased rapidly. Our genetics have not changed in one generation, but our built environment has!

Evidence Base for Improving Health through Building, Street and Neighborhood Design

www.thecommunityguide.org/pa

Designing to increase active transportation

Walking, Bicycling and Transit-oriented development

Designs to improve street safety and aesthetics (less crime and traffic / more greening), having sidewalks and bike paths connected to destinations, mixed land use, high population density

Median increase in physical activity 35% to 161%

Designing to increase active recreation

Enhancing access to places for physical activity, such as creating walking trails or having onsite or nearby parks, playgrounds and exercise facilities (homes & worksites)

increases leisure-time activity and weight loss

Designing to increase stair use

Point-of-Decision stair prompts

Signs placed at elevators & escalators encouraging stair use, w/ info on benefits of stair use

Median 50% increase in stair use

Design and aesthetic interventions

Music & art in stairwells

Design stairs to be more convenient and visible

Skip-stop elevators

3300% increase in stair use

Co-benefits of Active Design: Improve the Environment

	Fuel / Electricity Use	Air Quality	Obesity/Diabetes/ Heart Disease
Biking or walking rather than automotive transport	√	√	√
Stairs rather than elevators and escalators	√	√	√
Active recreation rather than television	√	√	√
Safe tap water rather than bottled and canned beverages	√	√	√
Fresh produce rather than unhealthy processed foods	√	√	√

Co-benefits: Create more accessible places for all

- Creating safer places to walk, bicycle, take transit, & for wheelchair travel

Co-benefits: Reduce infrastructure costs

More compact development patterns save money on avoided infrastructure costs

	Water & Sewer Laterals Required	Water & Sewer Costs (billions)	Road Lane Miles Required	Road Land Miles Costs (billions)
Sprawl Growth Scenario	45,866,594	$189.8	2,044,179	$927.0
Compact Growth Scenario	41,245,294	$177.2	1,855,874	$817.3
Savings	**4,621,303**	**$12.6 (10.1%)**	**188,305**	**$109.7 (6.6%)**

Sprawl Costs: Economic Impacts of Unchecked Development, Robert W. Burchell, Anthony Downs, Barbara McCann and Sahan Mukherji, Island Press, 2005

Co-benefits: Create jobs

Project type	Road	Bicycle	Pedestrian	Off-street trail	Number of projects	Direct jobs per $1 million	Indirect jobs per $1 million	Induced jobs per $1 million	Total jobs per $1 million
Total, all projects					58	4.69	2.12	2.15	8.96
Bicycle infrastructure only		•			4	6.00	2.40	3.01	11.41
Off-street multi-use trails				•	9	5.09	2.21	2.27	9.57
On-street bicycle and pedestrian facilities (without road construction)		•	•		2	4.20	2.20	2.02	8.42
Pedestrian infrastructure only			•		10	5.18	2.33	2.40	9.91
Road infrastructure with bicycle and pedestrian facilities	•	•	•		13	4.32	2.21	2.00	8.53
Road infrastructure with pedestrian facilities	•		•		9	4.58	1.82	2.01	8.42
Road infrastructure only (no bike or pedestrian components)	•				11	4.06	1.86	1.83	7.75

Building bicycle and pedestrian infrastructure creates more jobs per dollar invested, compared to road infrastructure only

Source: Political Economy Research Institute: June 2011

Peterborough's Story: Then and Now

	1947	Now
Population	33,311	79,000
Age 0-4 (%)	8%	5%
Age 5-19 (%)	24%	18%
Age 20-64 (%)	60%	58%
Age 65+ (%)	9%	19%
Density	28 people/acre	11 people/acre
Avg. Household Size	4.2	2.4
% of Employment in Manufacturing Sector	54%	10%
% of Employment in Service Sector	18%	82%
% of City's Non-Food Retail Space in Downtown	100%	30%

City of Peterborough

U.S. - Built Environment & Health Initiatives

Boston MA ~ Cherokee Nation OK ~ Chicago IL ~ Cook County IL ~ Douglas County NE ~ Jefferson County AL ~ King County WA ~ Louisville KY ~ Miami-Dade County FL ~ Multnomah County OR ~ Nashville TN ~ Philadelphia PA ~ Pima County AZ ~ San Diego CA

Communities Putting Prevention to Work

Cross-Sector Partnerships in U.S. Cities

Key Intergovernmental Partners in Local Communities (n=15, incl. NYC):

- Public Health – 15
- Planning – 15
- Transportation – 14
- Education/School Construction – 12
- Parks and Recreation – 12
- Public Works – 8
- Housing Development or Management – 6
- Buildings – 3

The Canadian Context

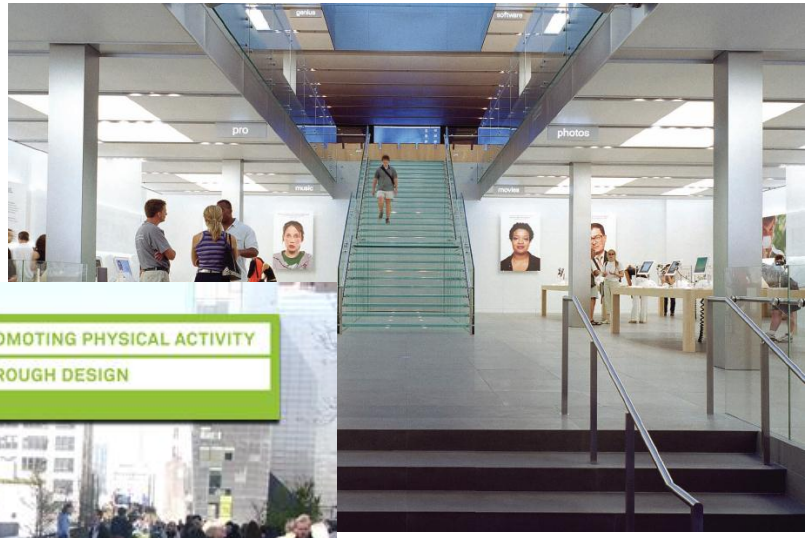
- Goal: creating healthy communities that support active transportation and physical activity

- Partnership: national health, planning and transportation organizations
  + non-governmental organizations + university researchers
  + regional and local health authorities in 8 of the 10 provinces:

  - B.C., Saskatchewan, Manitoba, Ontario, Quebec, Nova Scotia, New Brunswick, Newfoundland

THE CASE STUDY OF NEW YORK CITY

Fit City Conferences

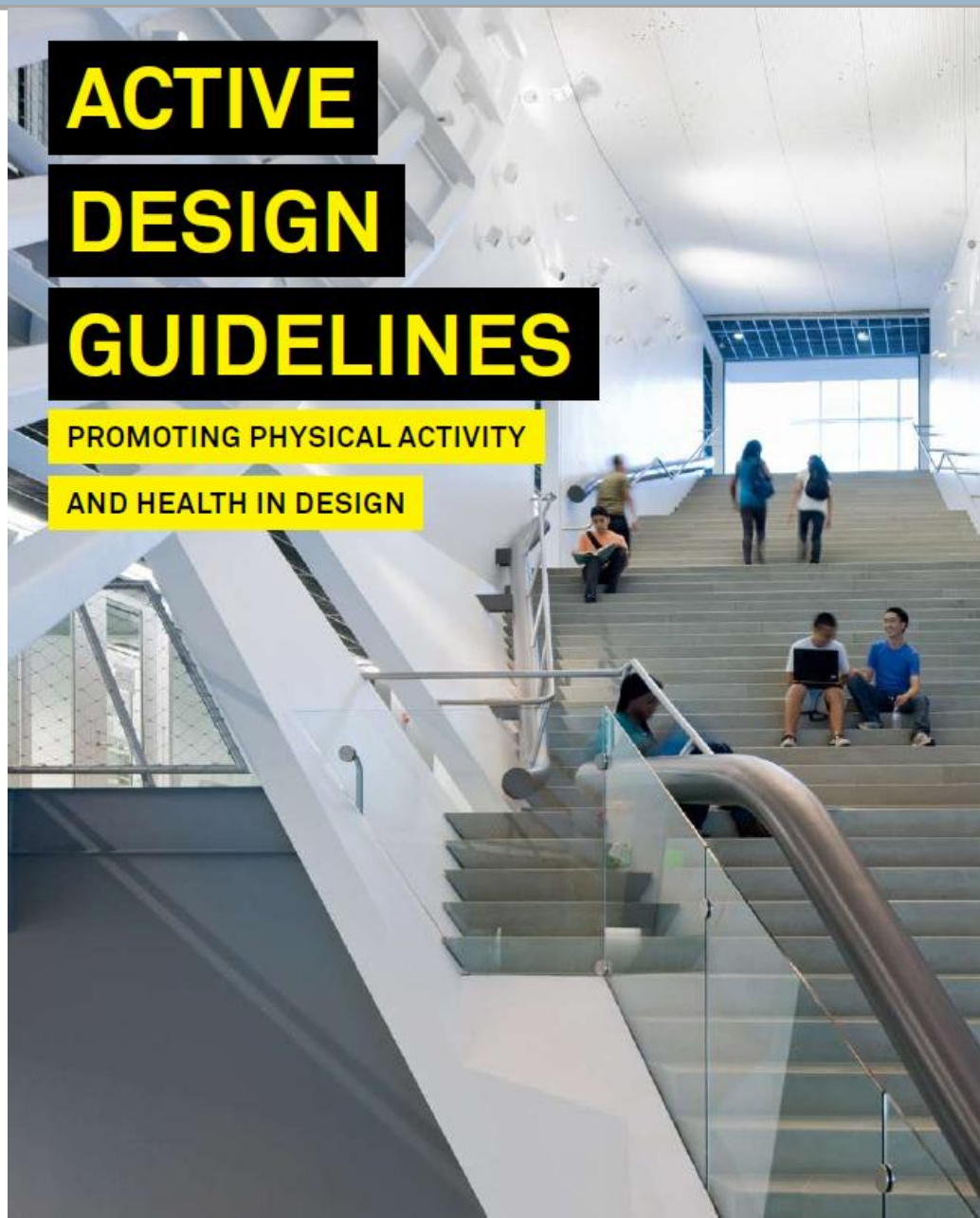


www.aiany.org/fitcity7

The Active Design Guidelines

Chapters

1) Environmental Design and Health: Past and Present
2) Urban Design: Creating an Active City
3) Building Design: Creating Opportunities for Daily Physical Activity
4) Synergies with Sustainable and Universal Design



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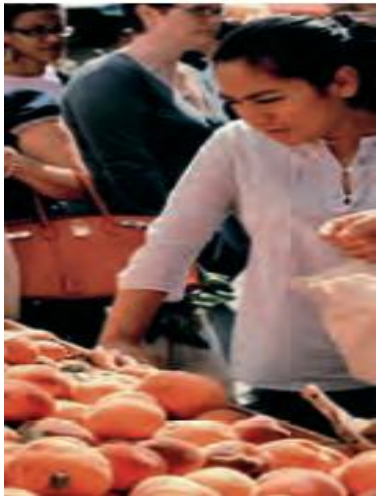
*We also thank the many city agencies that gave input including the Depts of Parks and Recreation, Buildings, Housing Preservation and Development, School Construction Authority, Aging, and Mayor's Offices of Long-Term Planning and Sustainability, and of People with Disabilities.



Community Design Strategies

- Land Use Mix
- Access to Supermarkets, Farmers Markets, Drinking Water
- Parks / Play Areas / Plazas
- Transit Access
- Pedestrian Friendly Environment
- Bicycle Network and Infrastructure

Building Design Strategies

- Bicycle Parking and Storage
- Active Recreation Spaces for Children + Adults
- Stairs: Accessibility, Visibility, Convenience
- Stairs: Aesthetics
- Stairs: Signage and Prompts
- Skip-Stop Elevators
- Improving Access to Drinking Water

General Approach

Added a Public Health Chapter:

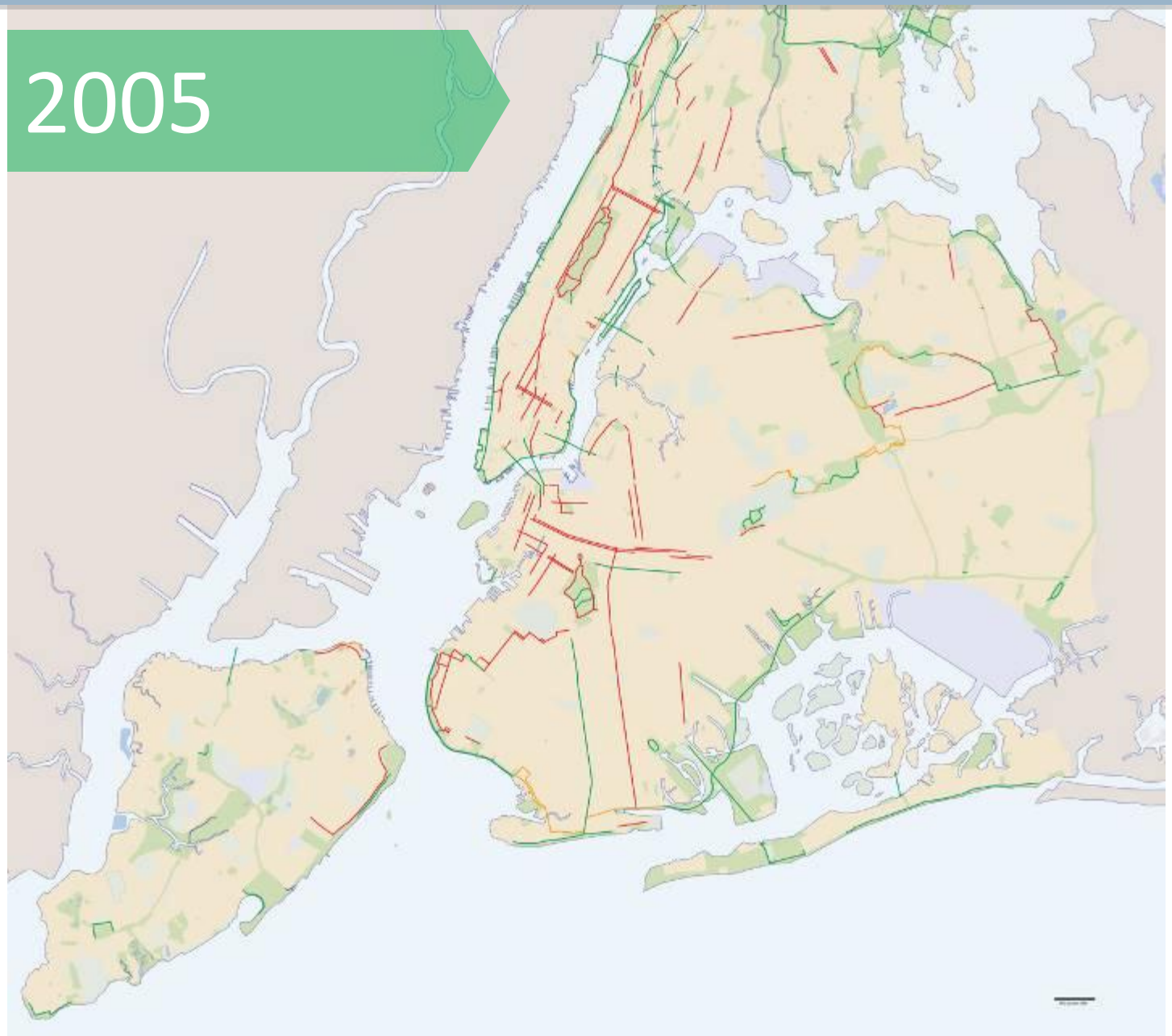
"New York City is one of the healthiest cities in the United States, with a life expectancy that exceeds the national average.

This achievement is the result of visionary planning and sustained investment……

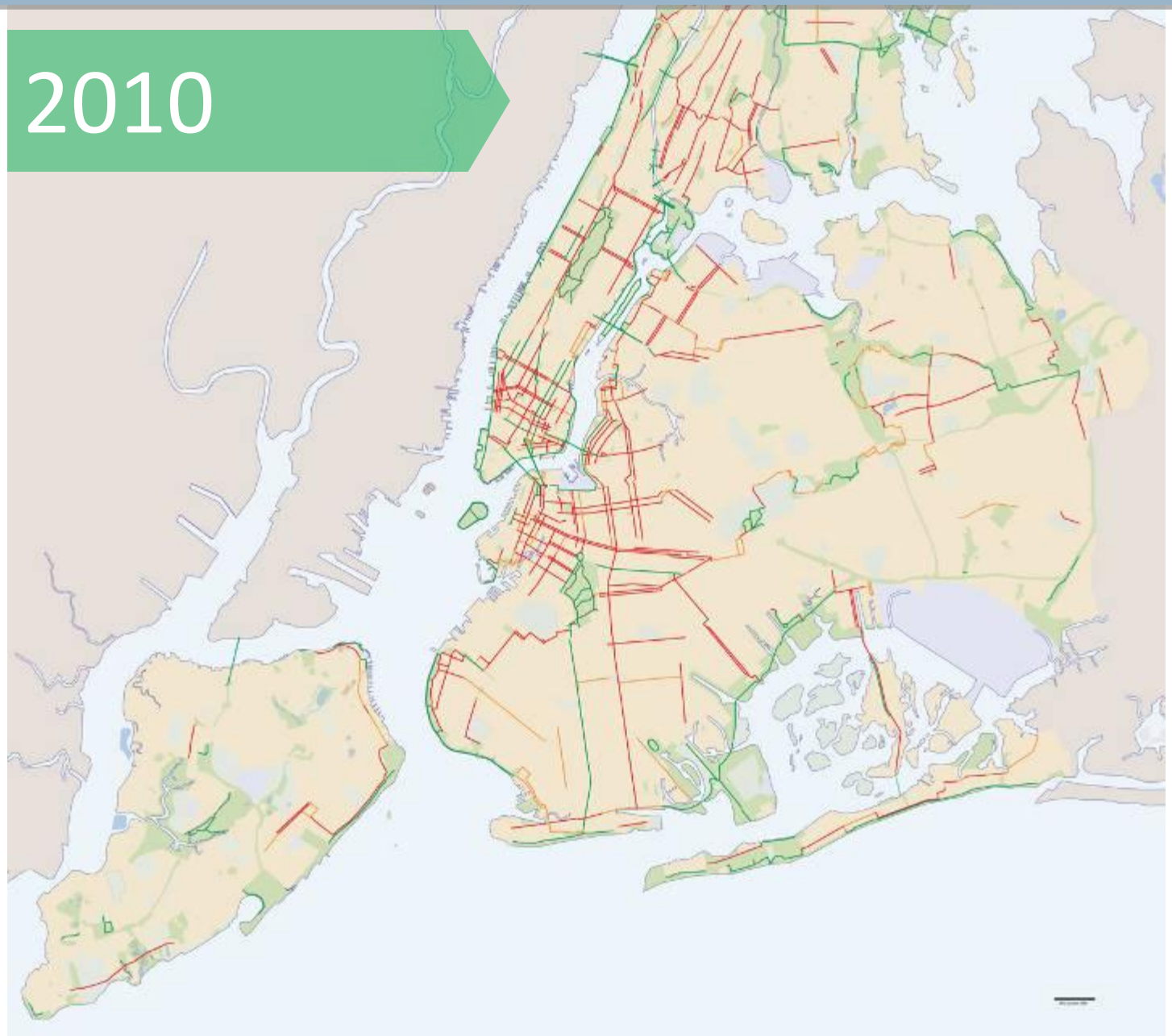
…..Despite these successes, health challenges remain—and new ones are emerging—that require creative, modern shifts in how the city operates."

Changing the form of the Public Right of Way

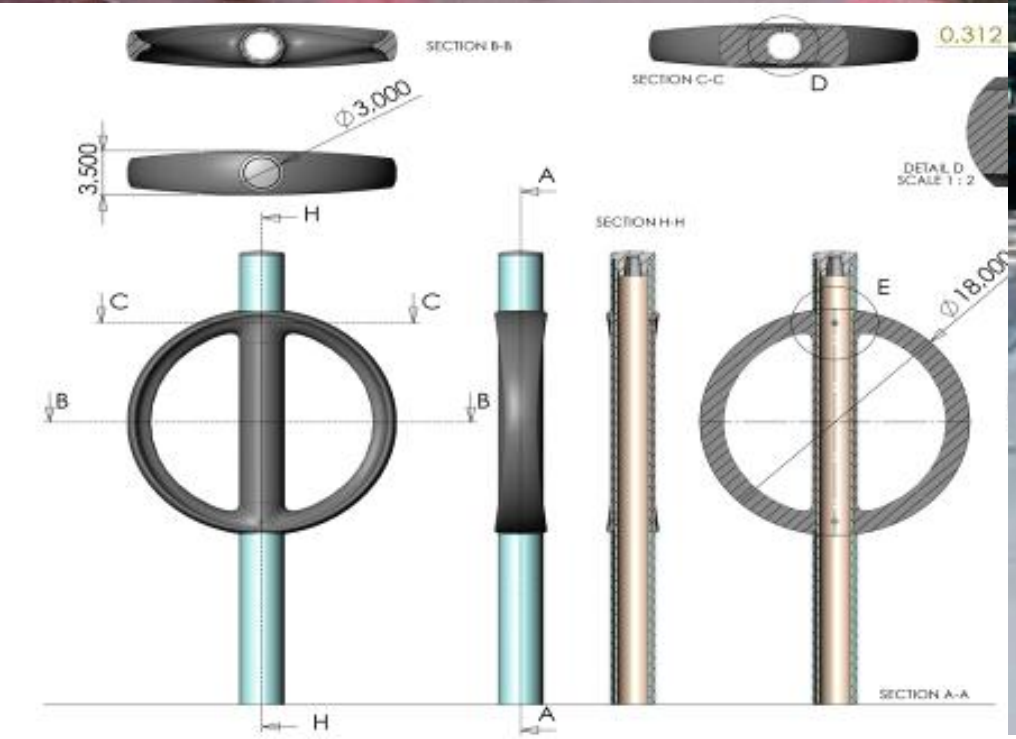
Bicycle Network



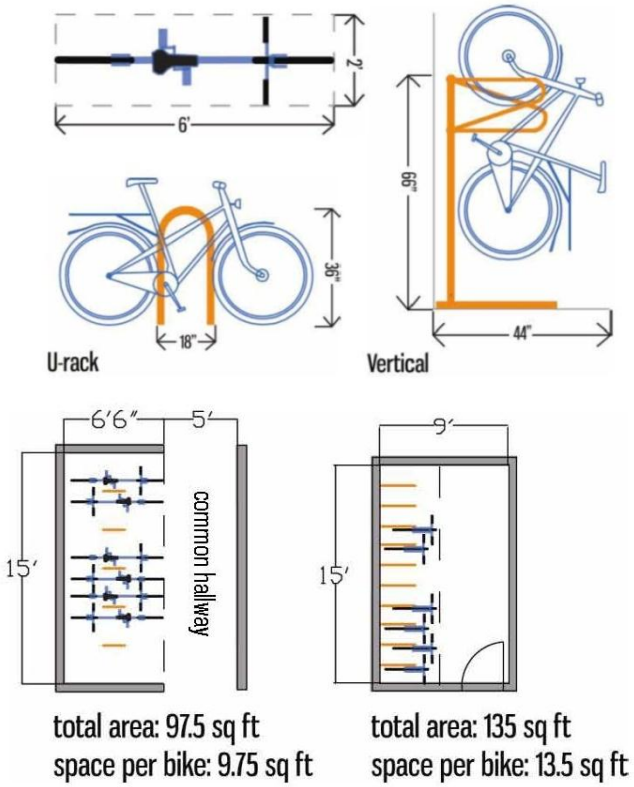
Bicycle Network

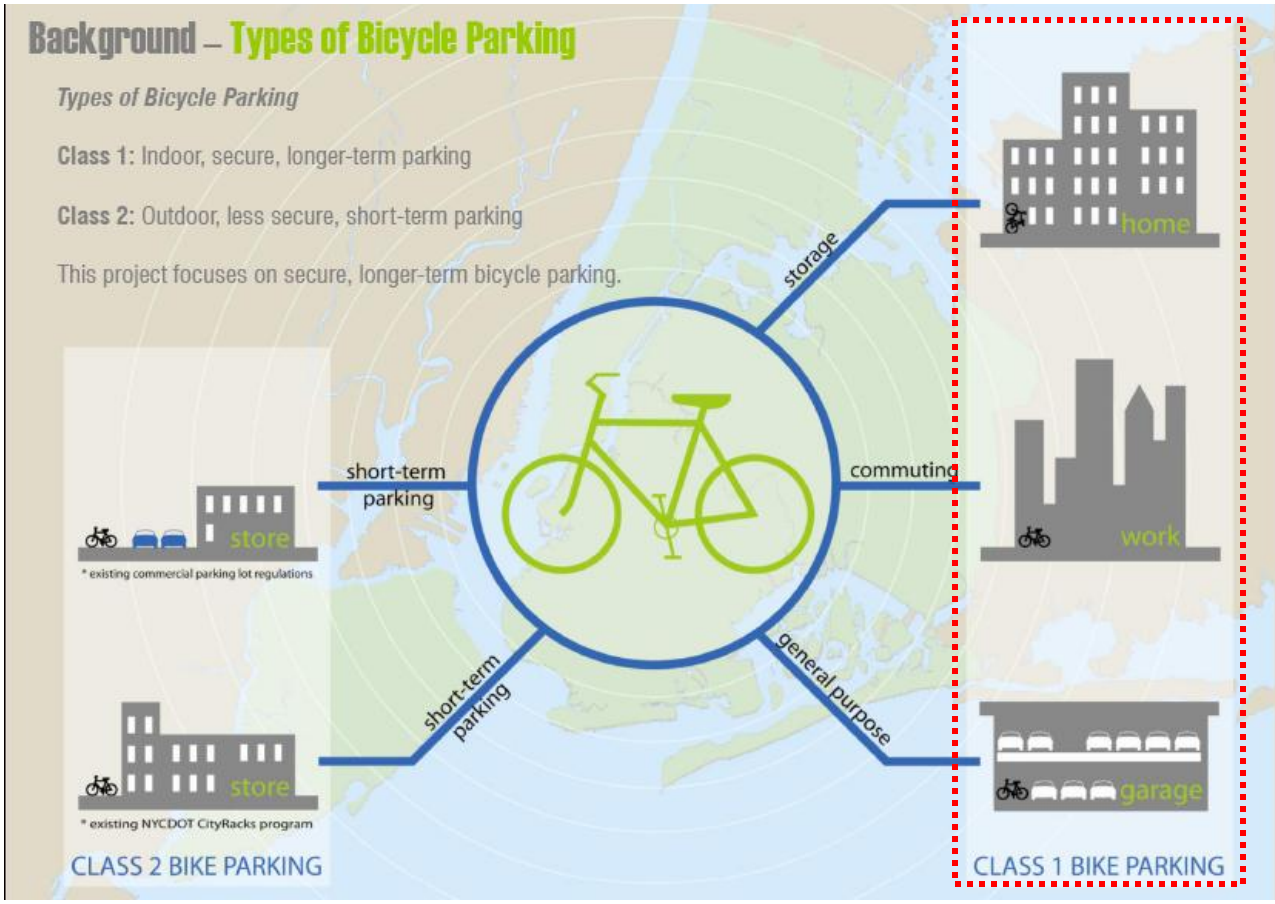


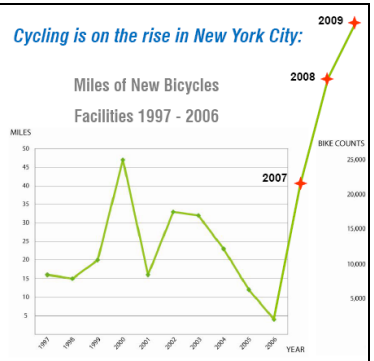
Bicycle Infrastructure



Zoning for Bicycle Parking







Bicycle parking now required for new buildings, enlargements, conversions and public parking garages
(floor area is discounted)

NYC Bike Share

- Started 2013
- 10,000 bicycles, 600 stations – Manhattan, Queens, Brooklyn (including Brooklyn DPHO) by 2014
- Bike Share Health Evaluation – Chronic Disease, Injury, Environmental Health

Public Plaza Program

89% OF THE ROAD SPACE FOR VEHICLES, 11% FOR PEOPLE


TOSHIBA
Helped in
oppone
Kodak
mer
FLEA
MARKET

Public Plaza Program

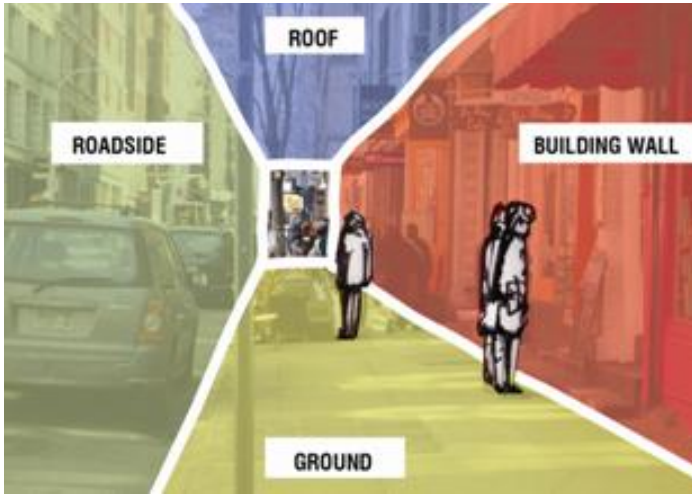
Pedestrian volumes up:

- 6% in Herald Square
- 11% in Times Square

Retail up:

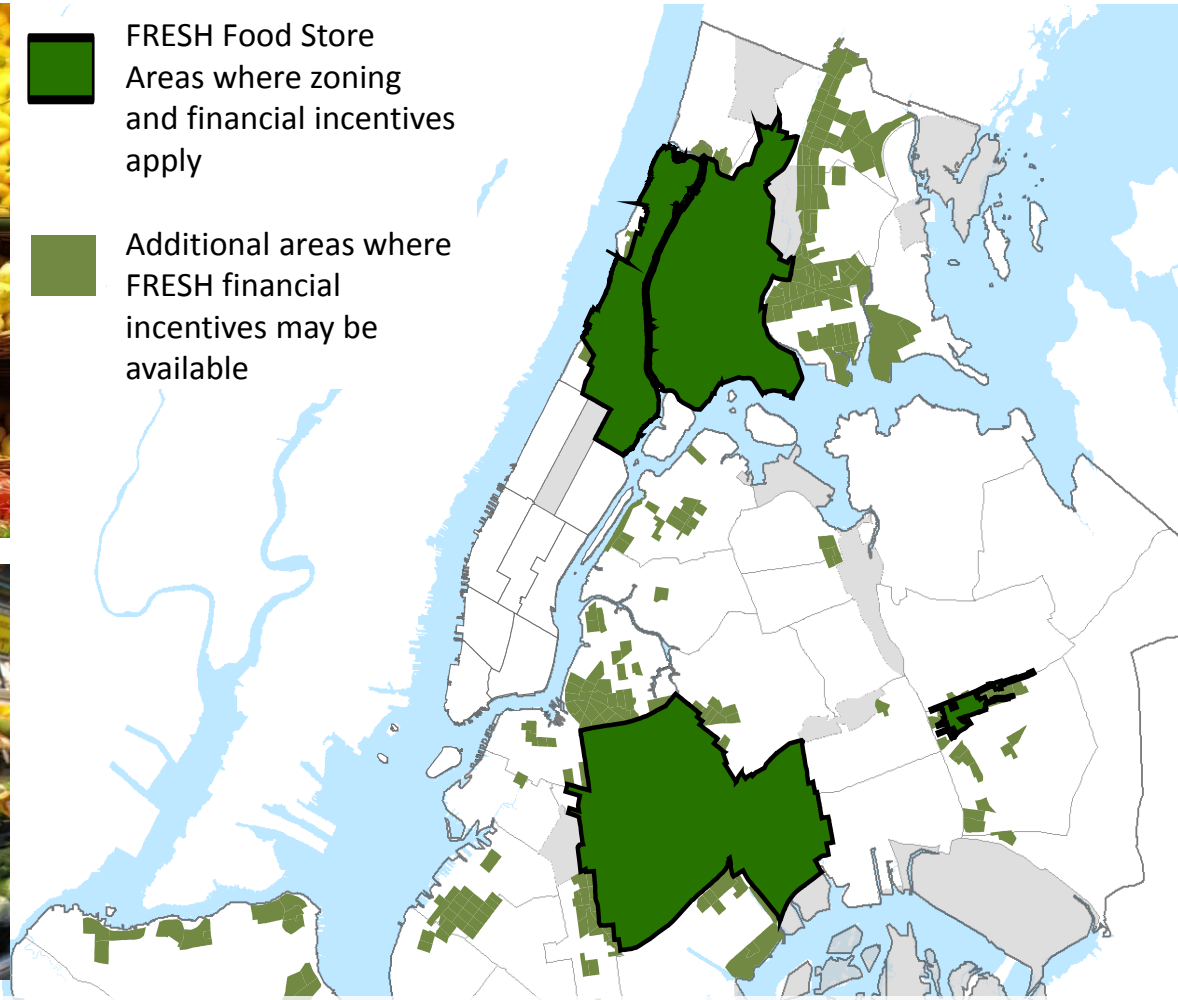
- in Times Square
- 49% drop in vacant storefronts in Union Square

Improving Sidewalks



http://www.nyc.gov/html/dcp/html/sidewalk_experience/index.shtml

Food Retail Expansion to Support Health (FRESH)

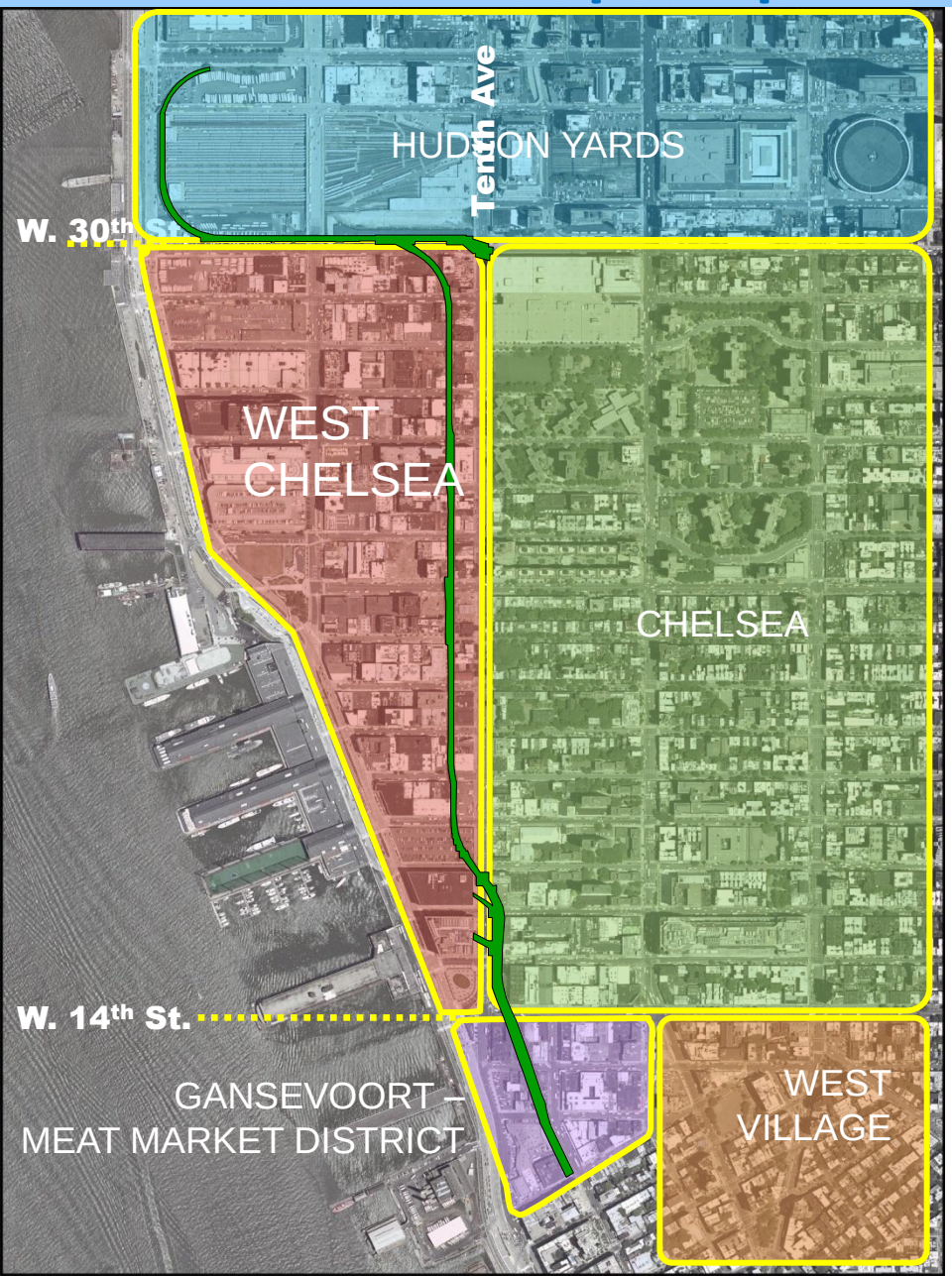


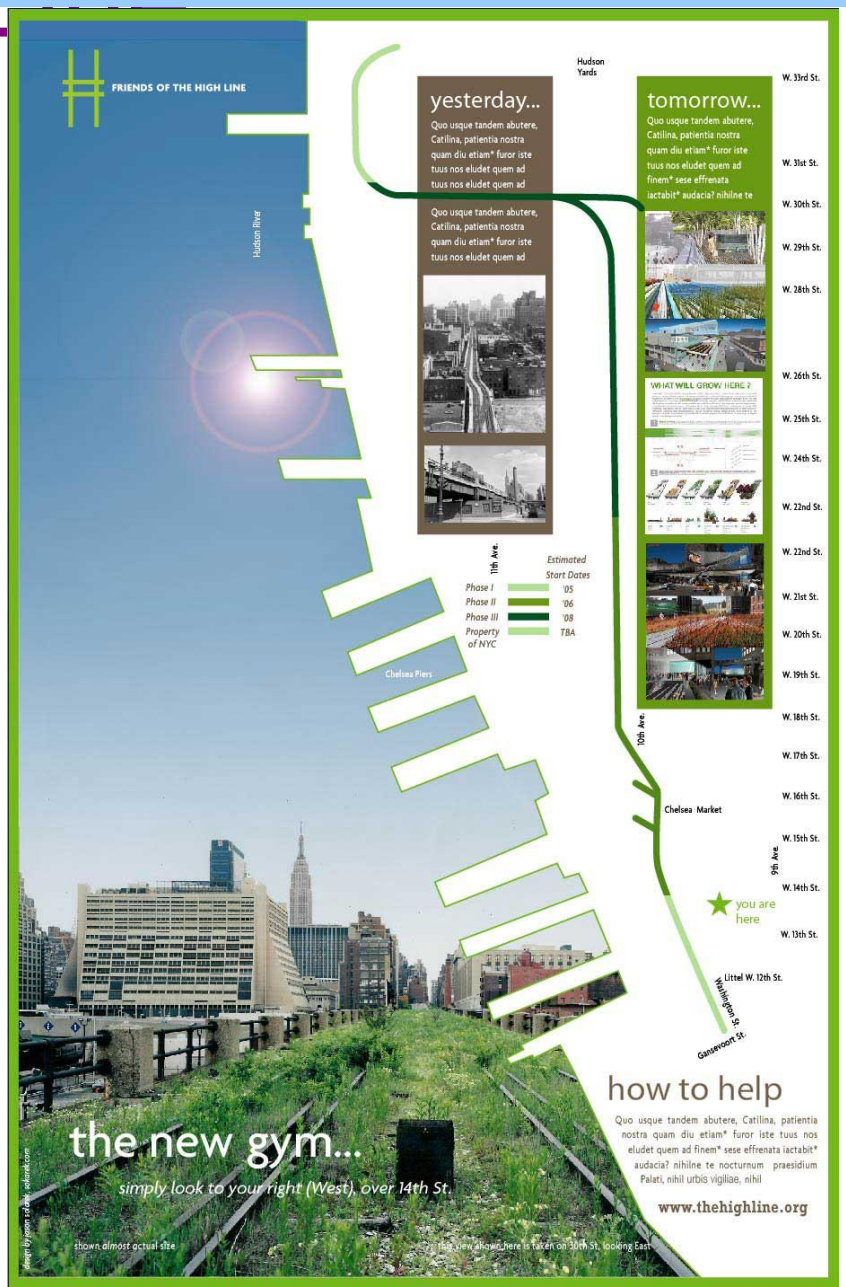
NYC FRESH Program:

Zoning and tax incentives for providing fresh food options in the city's underserved areas

www.nyc.gov/fresh

Public Parks and Open Spaces





Vision 2020: Comprehensive Waterfront Plan

Programming Streets for Active Recreation and Non-Car Mode Uses: Summer Streets and Play Streets

Improved Access to Tap Water - Public Realm & Buildings

Use of Green Building Rating Credits

- Existing points for site density, walkability, transit access and bike storage

- New LEED Pilot Credit "Design for Active Occupants" - Adult and children's active recreation spaces, gardening space, stair use promotion strategies (Being used in >30 NYC & U.S. buildings, incl. worksite buildings, public buildings, affordable housing developments) http://www.usgbc.org/node/2648813

Integrating Health Items into City Administrative Processes Across Sectors

- Public Sector Design & Construction RFPs and Contracts

- Design and Construction Guidelines and Standards in Different Agencies – Public Buildings, Streets, Schools, Housing

- Training of City staff in all relevant agencies

Impacts in NYC

- Increased:
  - Commuter cycling – up 289%
  - Pedestrian volumes through pedestrian plazas
  - Bus and subway ridership – up 10%
  - Places for children's play - >60 new Play Streets permitted; >180 schoolyards to playgrounds opened

- Decreased:
  - Traffic fatalities 37%
  - Traffic volumes 1.5%
  - Car registrations 5%

- Started Reversing Childhood Obesity (also in Philadelphia & San Diego!)

- Positive Environmental and Economic Impacts