

FEFPA 2023

The Role Of Wellness In Buildings

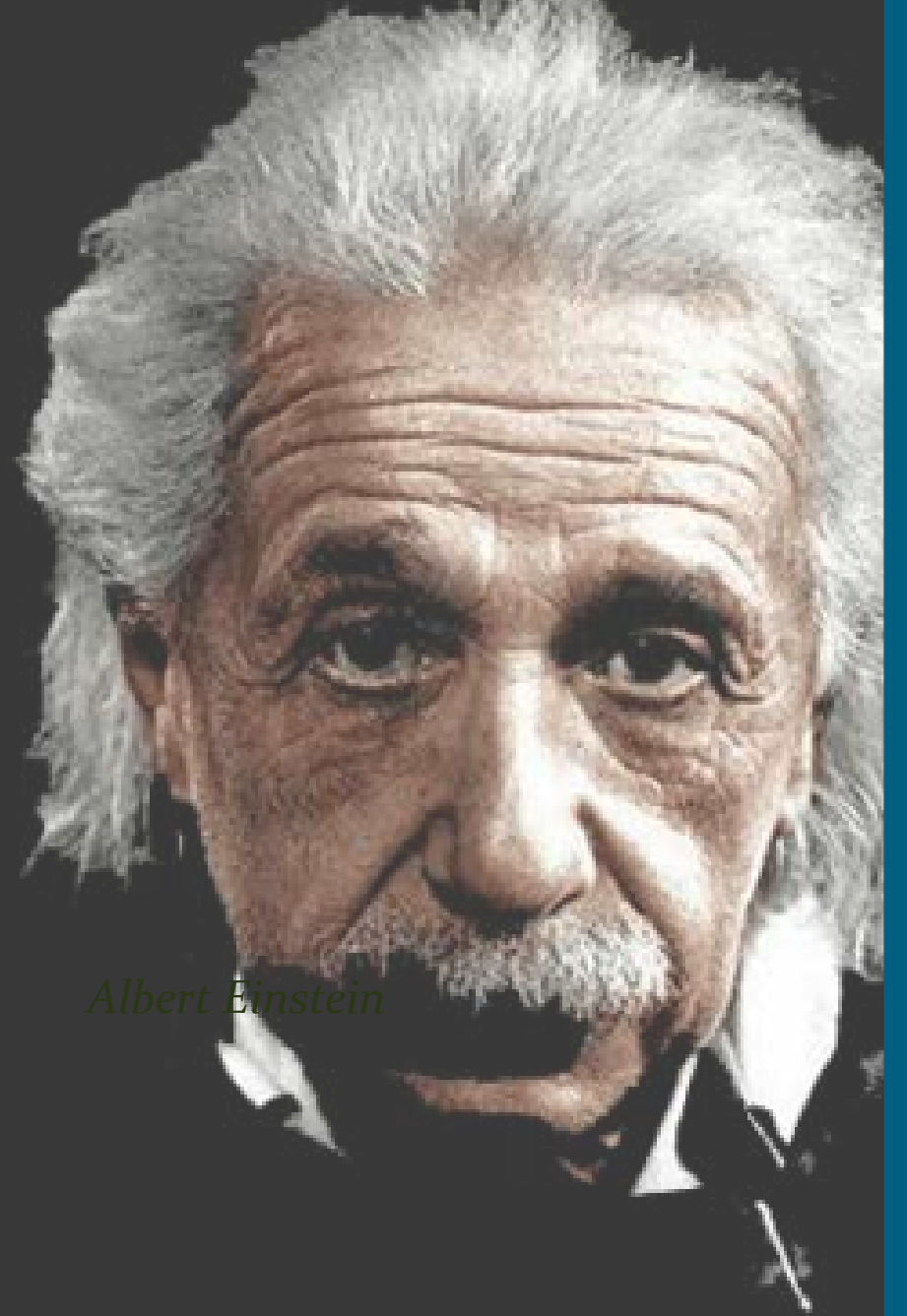


Al LaPera, EMP, CxA, LEED AP BD+C, LEED AP O+M
Energy Services

July 10, 2023

Insanity:
doing the same thing over
and over again and
expecting different results.


Albert Einstein





Albert Einstein

Learning Objectives

1 OBJECTIVE | Show connection between architecture and public wellness, including documentation of recent downward trend in public health. 

2 OBJECTIVE | Explain the various organizations approaches to improving wellness of building occupants. 

3 OBJECTIVE | Detailed review of design strategies like biophilic design, air and water filtration. 

4 OBJECTIVE | Discuss the current pandemic, a brief understanding 



New Vocabulary

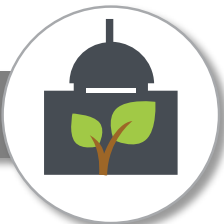
AIA Active Design & Fit City



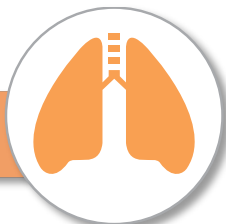
Biomimicry



ULI Building Healthy Places



Legionnaire's Disease



WELL certification and WELL APs,
and WELL Cx



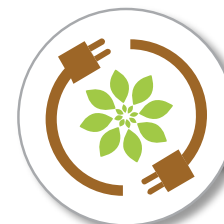
USGBC LEED certification, LEED APs,
and LEED Cx



Academy of Neuroscience
and Architecture



Biophilic Design & Biophilic Urbanism



Green/Sustainable



Fitwel/Center for Active Design (CfAD),



Why

do we need
buildings to play
a role in
Wellness?



Change

in our natural & built
environment
and
how it impacts us



THE 19TH CENTURY

Infectious Diseases

Codes, planning and infrastructure

Effective strategies built into the city's fabric



The 21st Century

Including
“Diseases of
Energy”

Chronic Diseases

Healthy design solutions parallel sustainable design solutions

Invisible, pervasive and an inevitable part of life



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



Urban Conditions-100+ Years Ago



OVER-CROWDING

Lower Manhattan

1910: 114,000 people per sq. mi.

2011: 67,000 people per sq. mi.



INADEQUATE SYSTEMS

Garbage Water Sewer

Pervasive Filth

Polluted Water Supplies



MAJOR EPIDEMICS

Air/droplet-borne diseases: **TB**

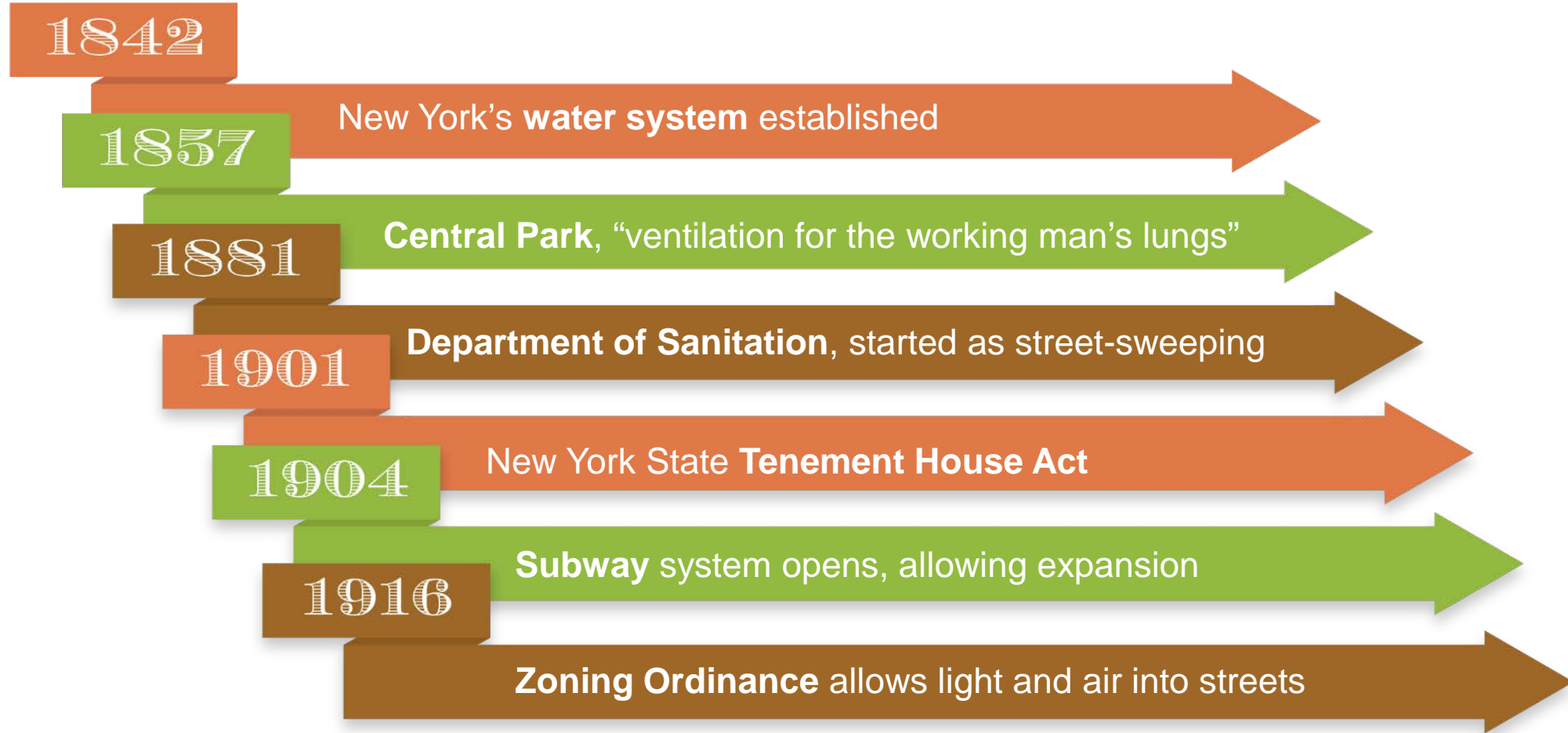
Water-borne diseases: **Cholera**

Vector-borne disease: **Yellow Fever**



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

Infrastructure Interventions

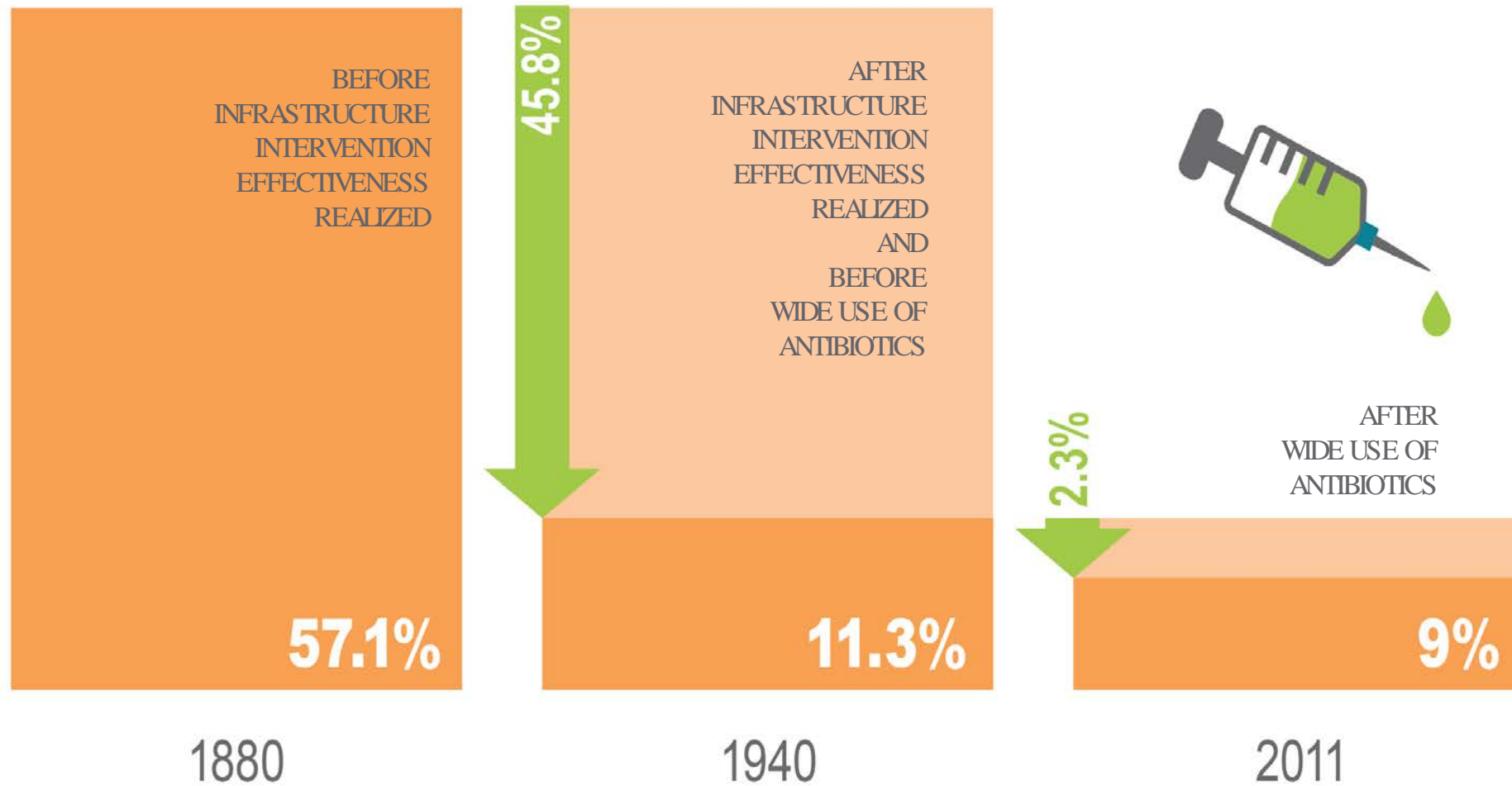


Source: U.S. Centers for Disease Control and Prevention (CDC)



The Results

- Infectious Disease Rates



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

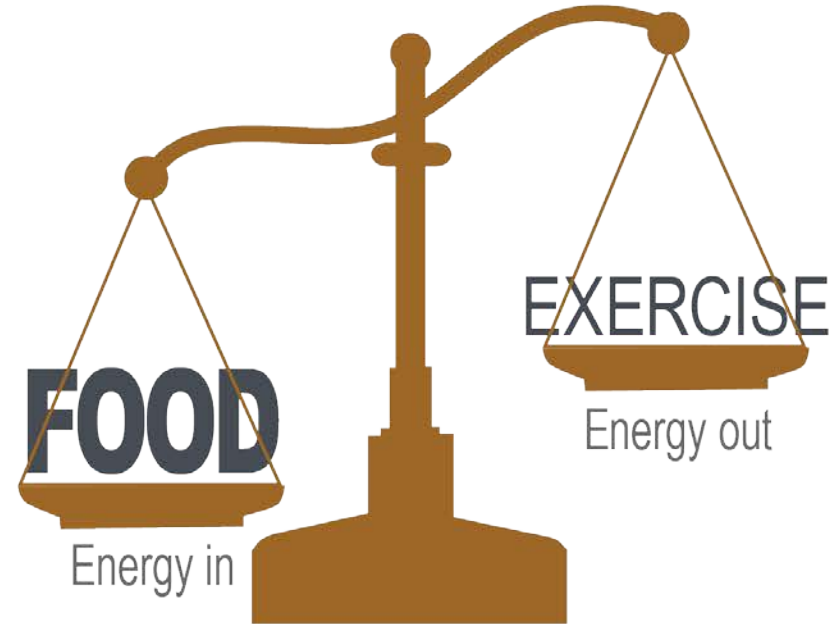
The Epidemics of Today

CHRONIC DISEASES

Obesity • Diabetes • Heart Disease • Strokes • Cancers

Top 5 Causes of Death in U.S.

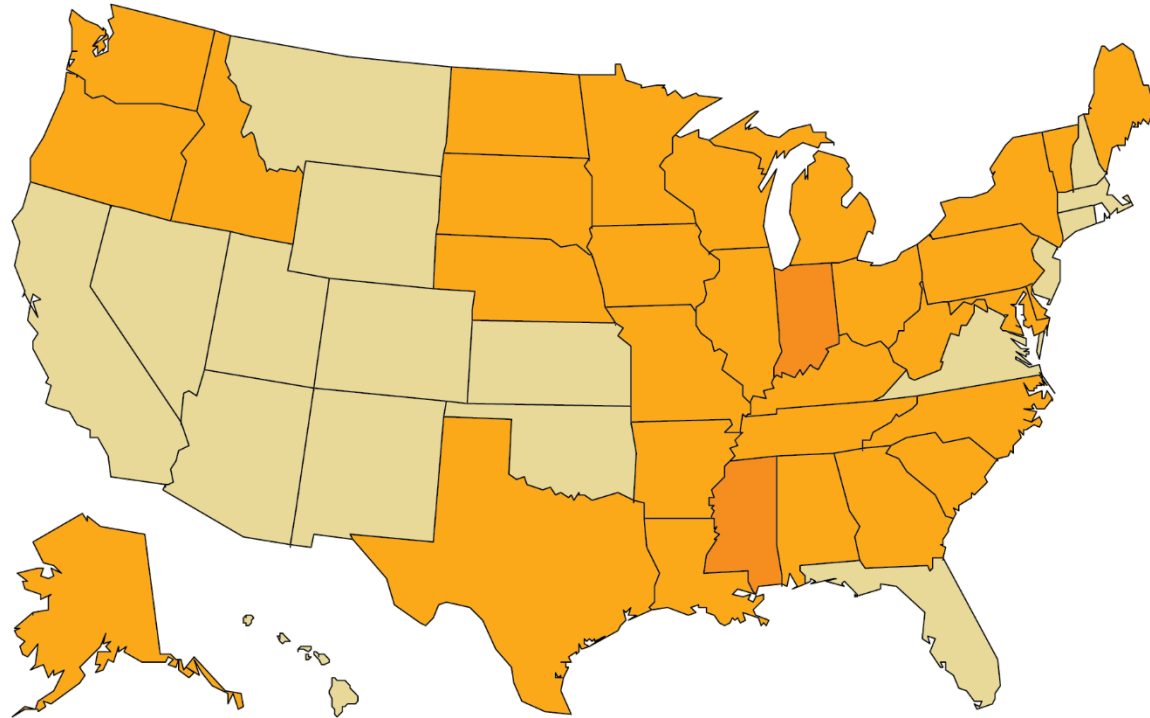
- 01 Tobacco
- Obesity 02
- 03 High Blood Pressure
- High Blood Sugar 04
- 05 Physical Inactivity



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

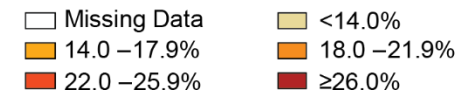


Obesity Among U.S. Adults



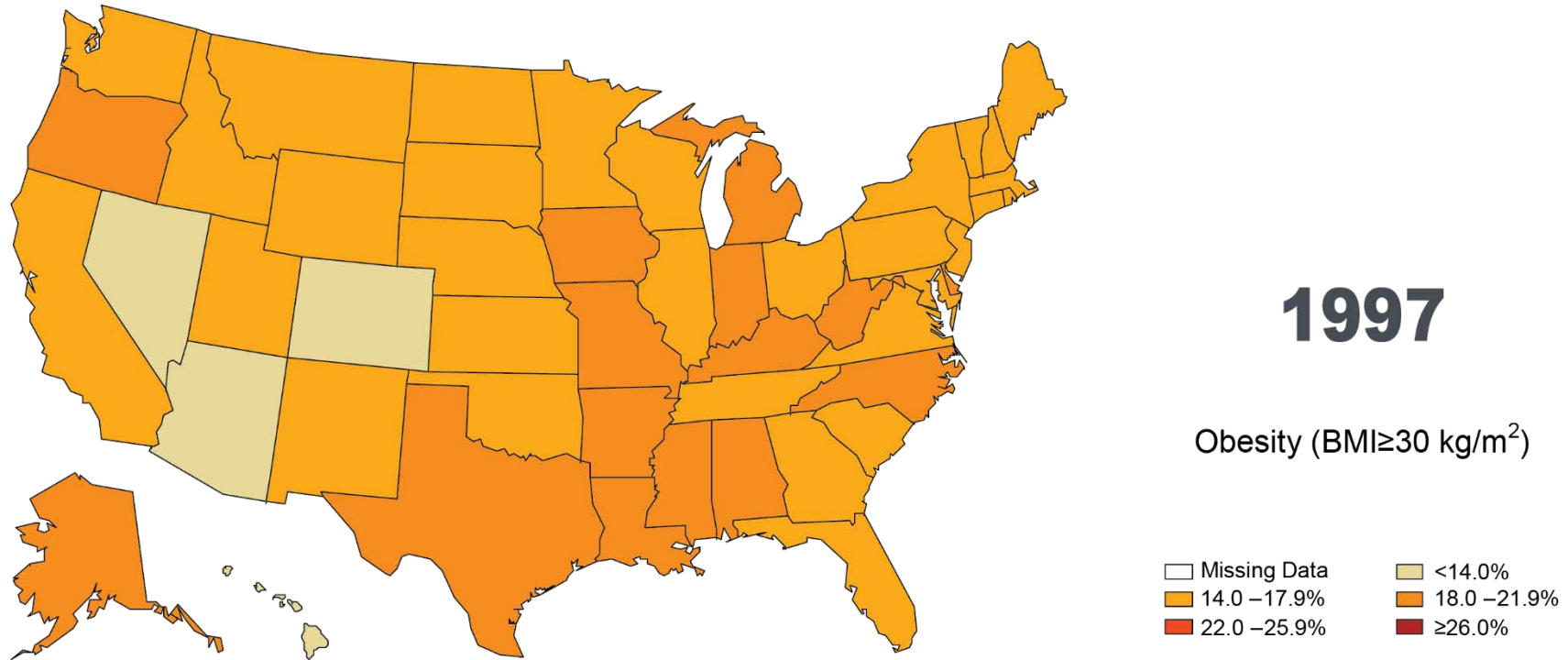
1994

Obesity (BMI ≥ 30 kg/m²)



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

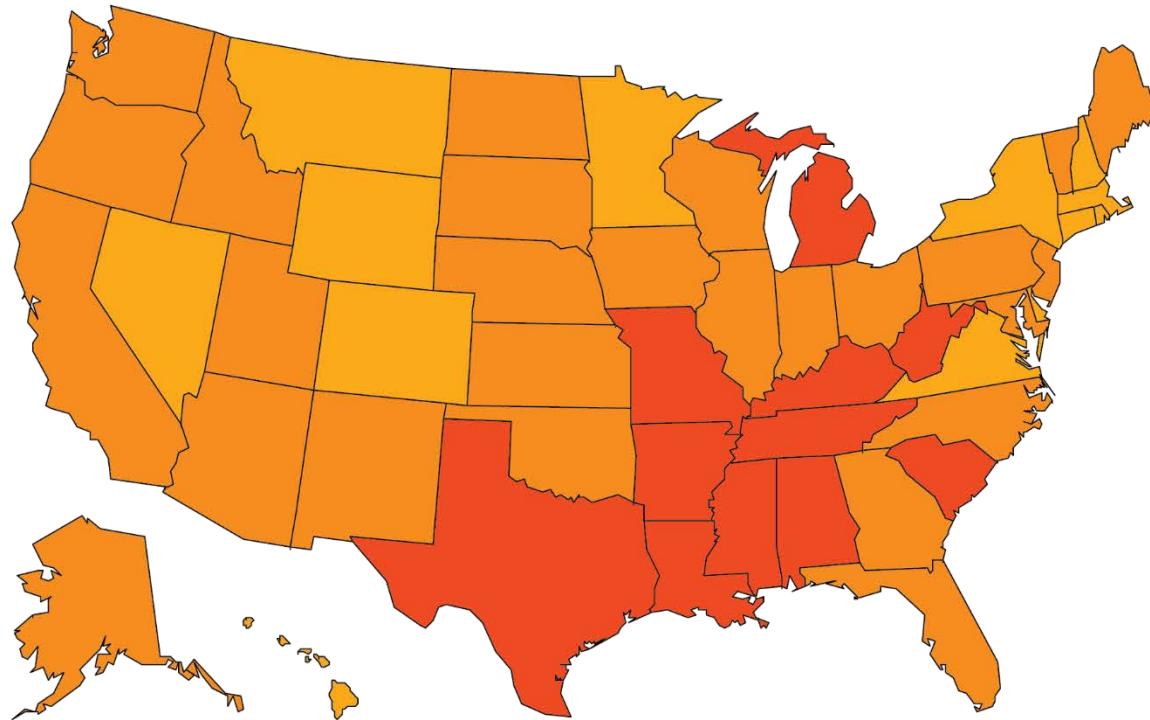
Obesity Among U.S. Adults



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

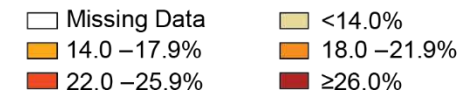


Obesity Among U.S. Adults



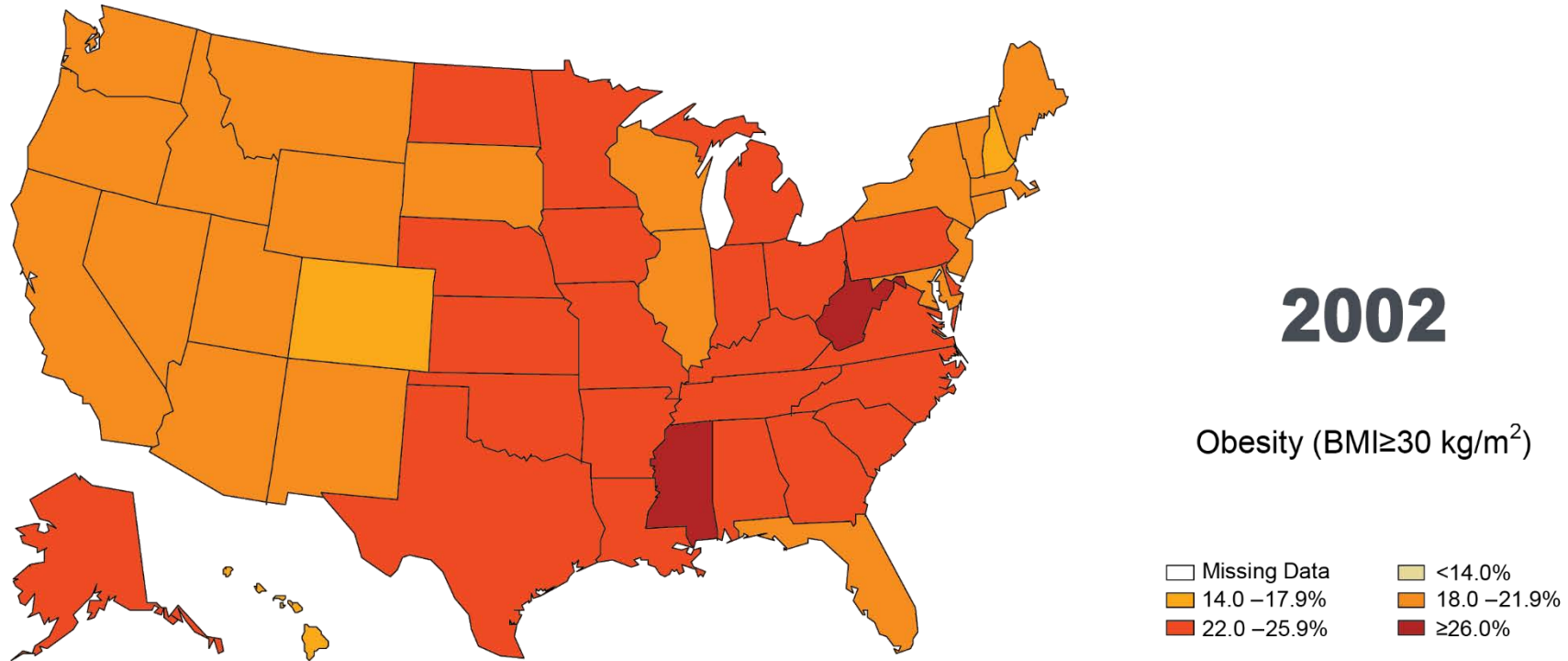
2000

Obesity (BMI ≥ 30 kg/m²)



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

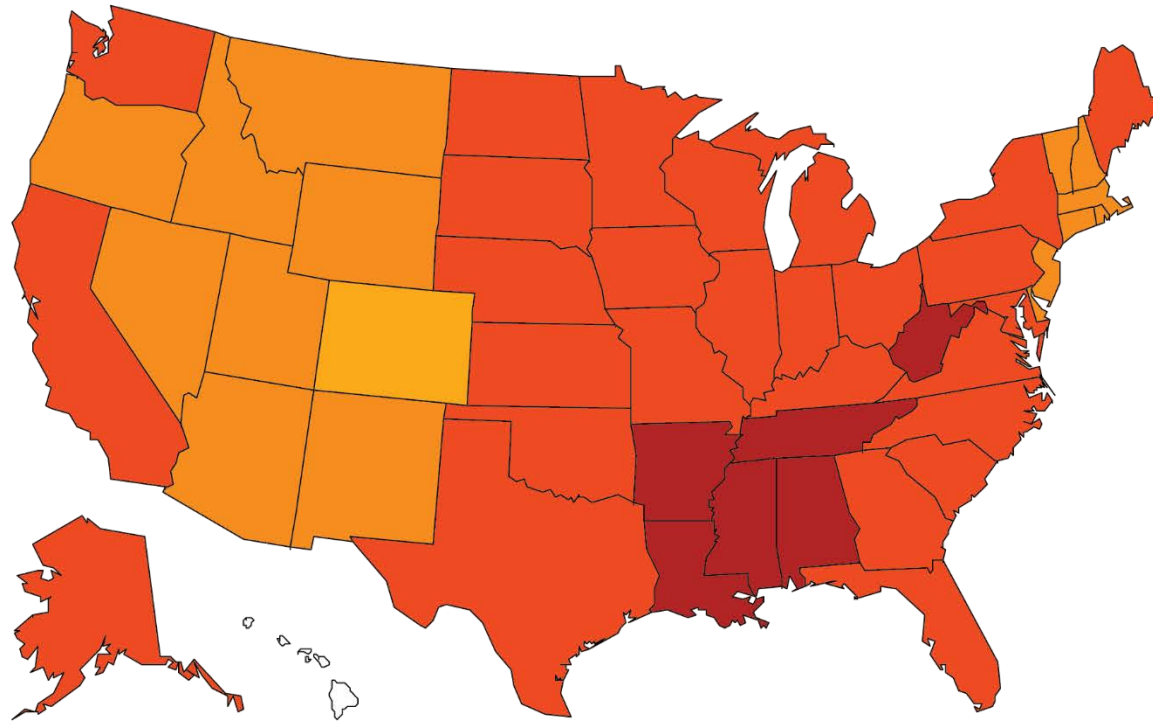
Obesity Among U.S. Adults



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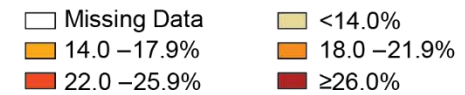


Obesity Among U.S. Adults



2004

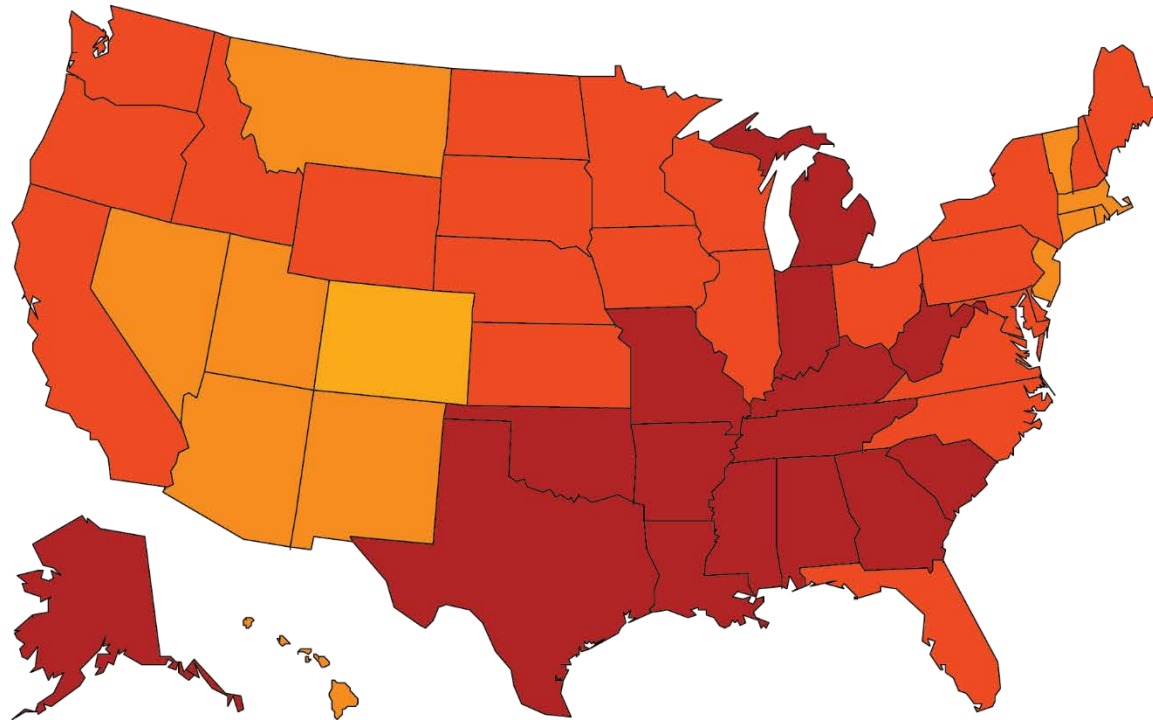
Obesity (BMI \geq 30 kg/m²)



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

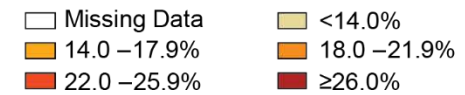


Obesity Among U.S. Adults



2005

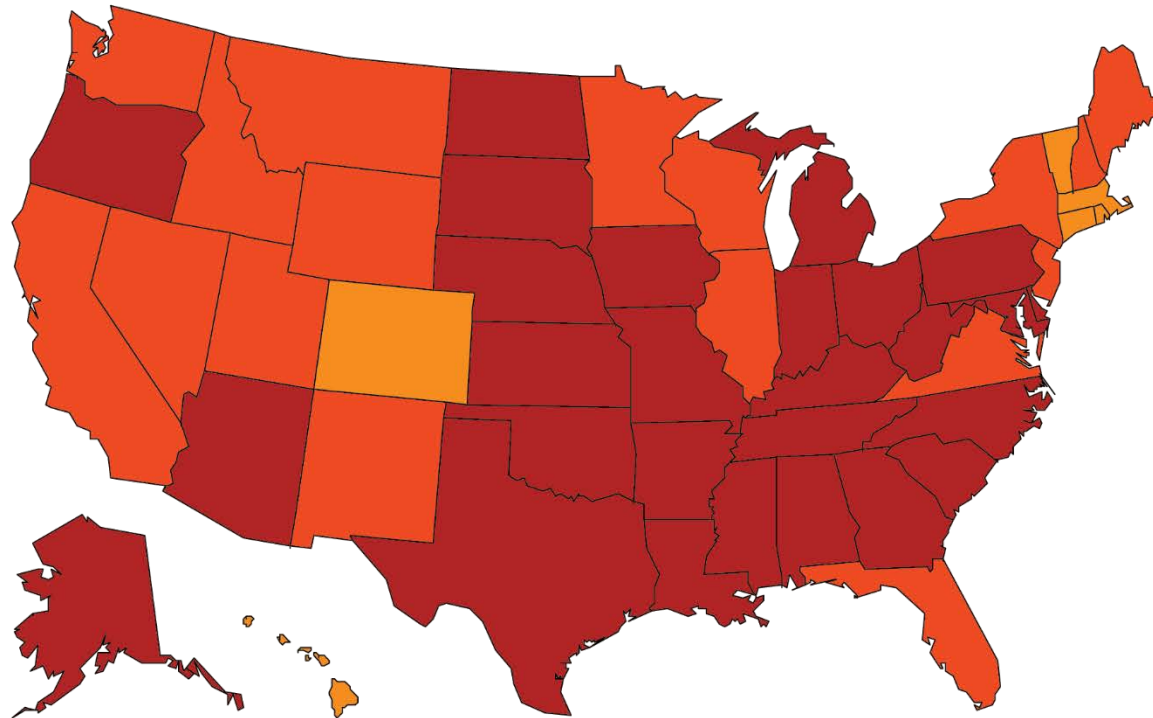
Obesity (BMI ≥ 30 kg/m²)



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

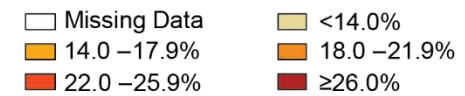


Obesity Among U.S. Adults



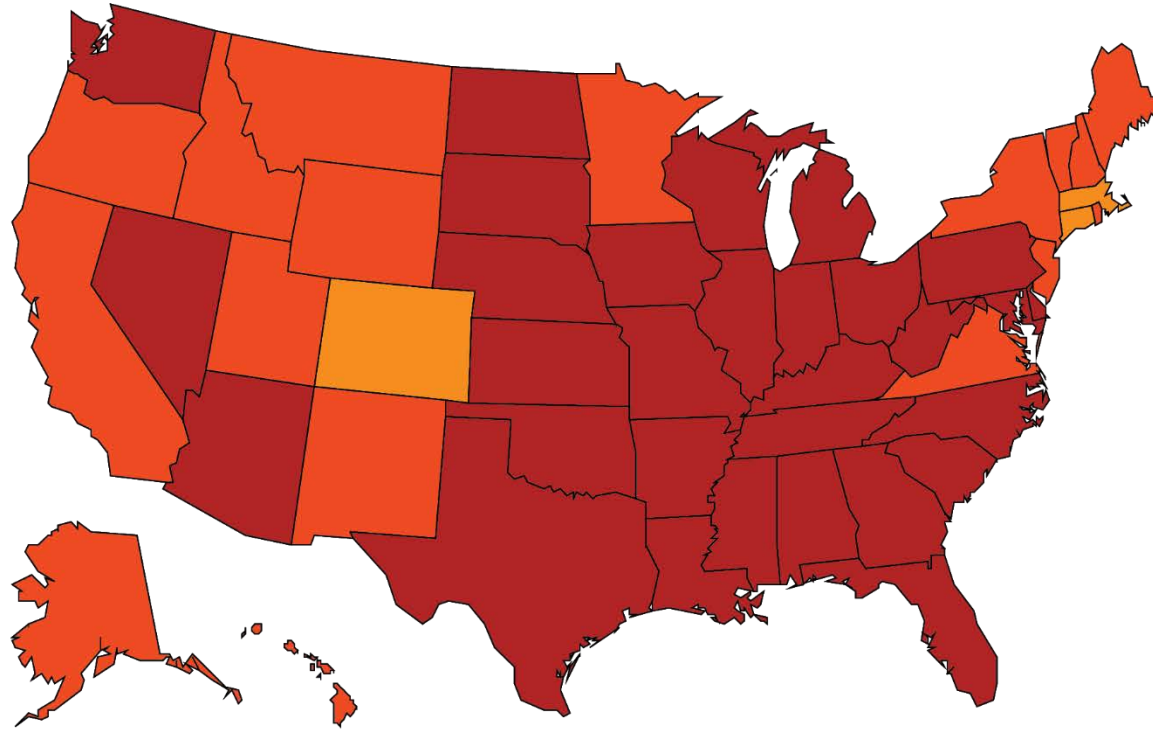
2007

Obesity (BMI ≥ 30 kg/m²)



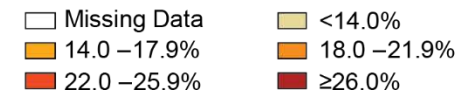
Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

Obesity Among U.S. Adults



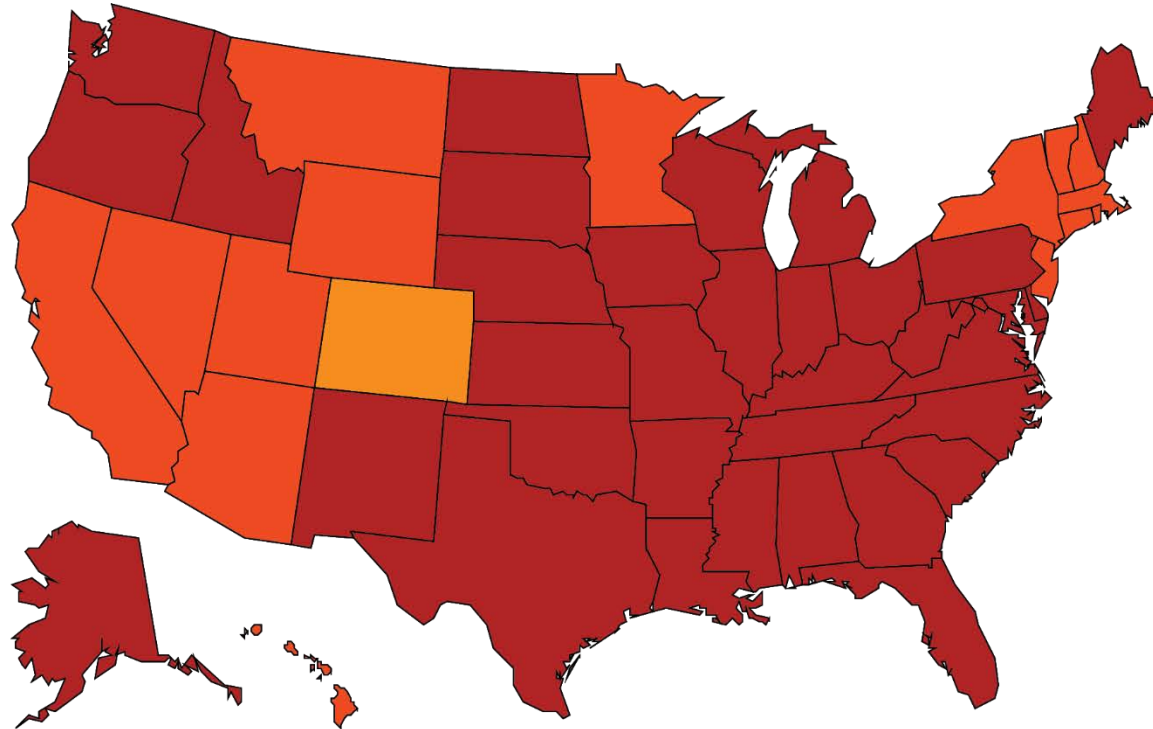
2009

Obesity (BMI ≥ 30 kg/m²)



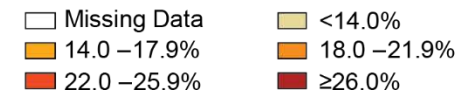
Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

Obesity Among U.S. Adults



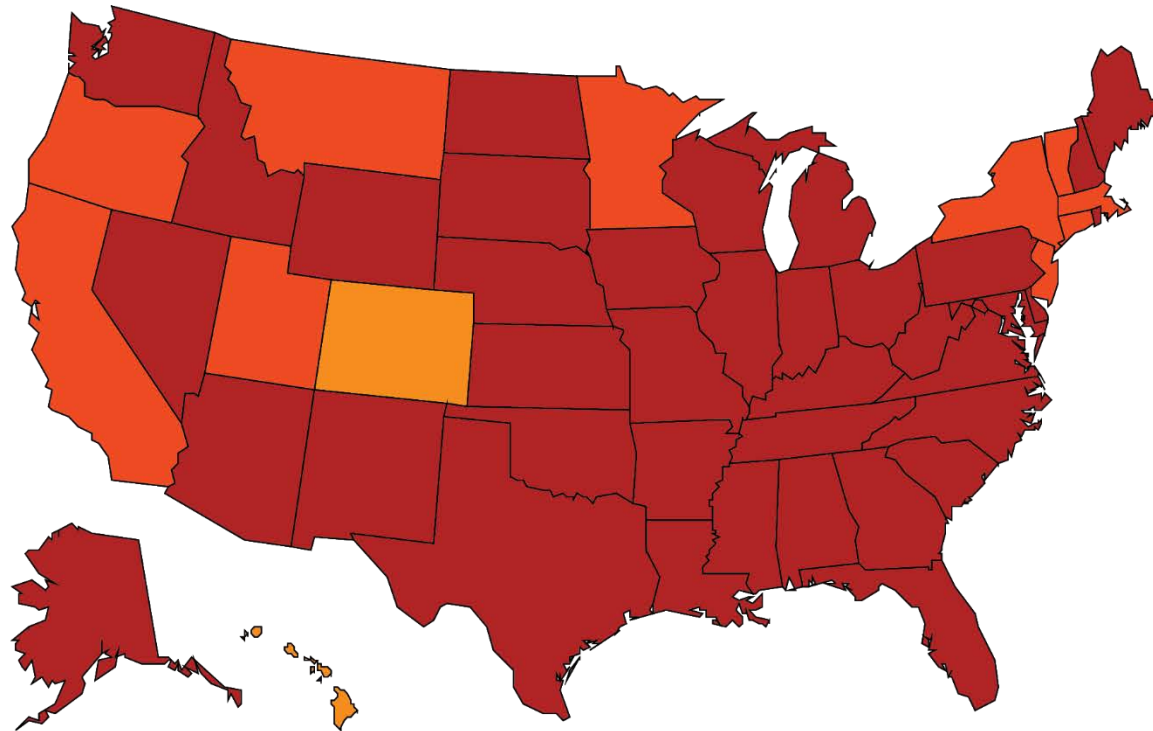
2011

Obesity (BMI ≥ 30 kg/m²)



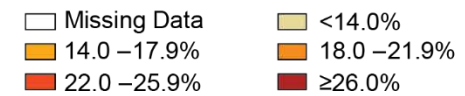
Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

Obesity Among U.S. Adults



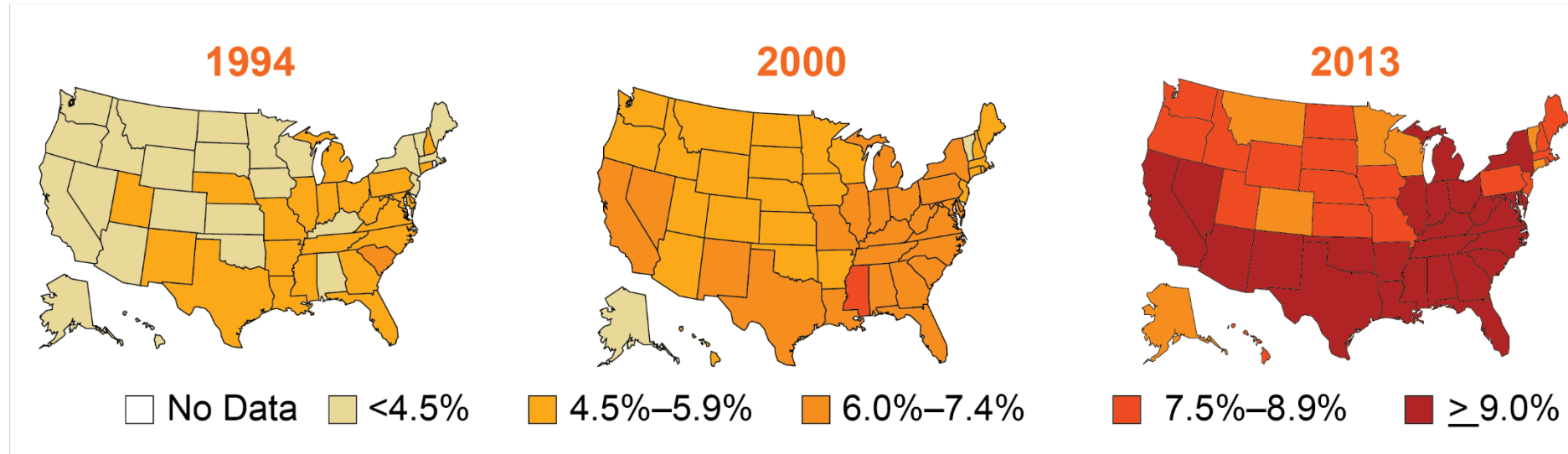
2013

Obesity (BMI \geq 30 kg/m²)



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>

Diagnosed Diabetes Among U.S. Adults



Source: U.S. Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/diabetes/data/center>





Built Environments Today



ACTIVE
DESIGN

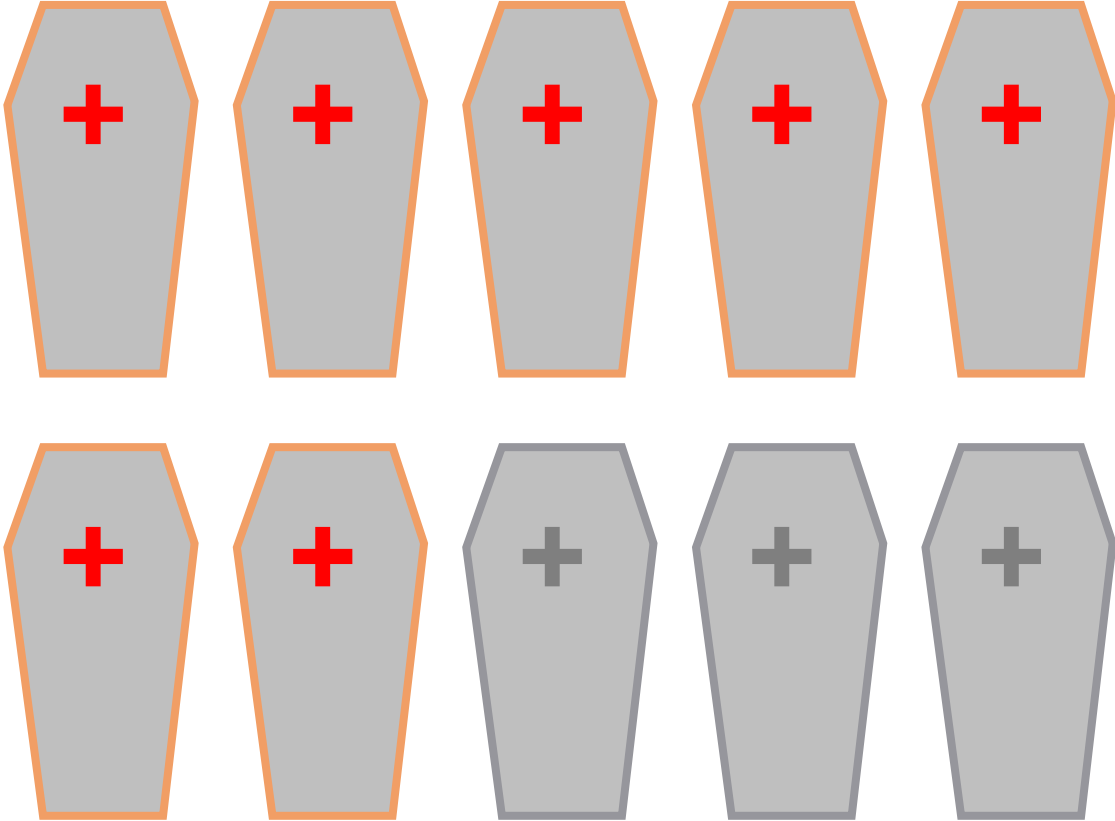


Medical Costs = \$147 Billion per year

70%

of deaths each year due to

Chronic Diseases



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



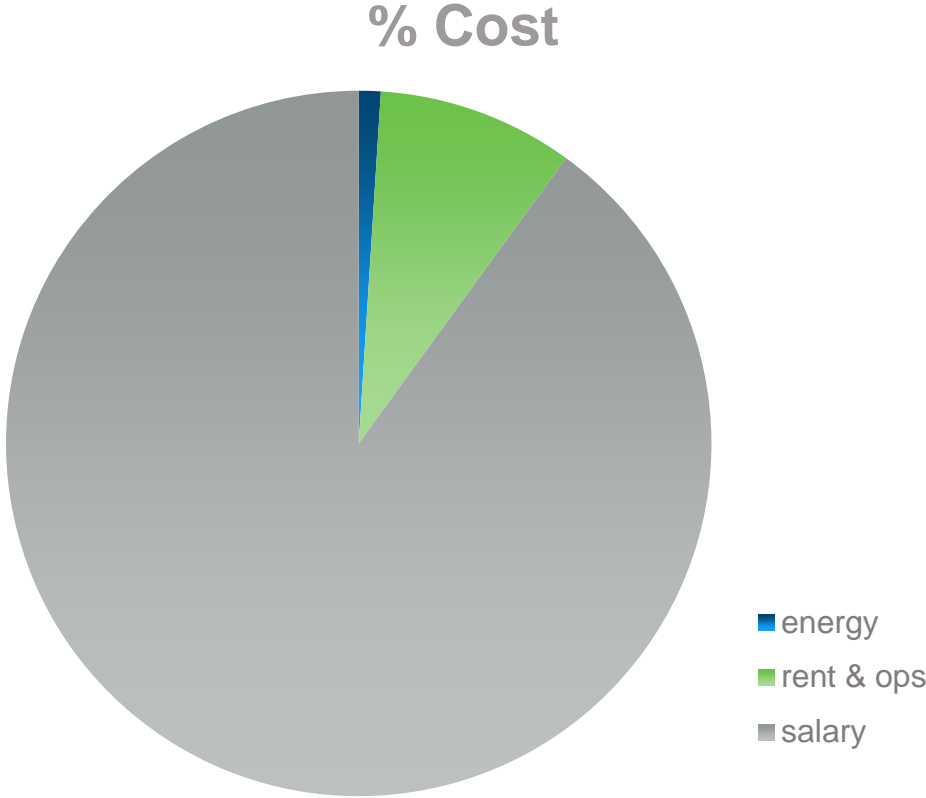
Financial Importance of Wellness

Operational Costs

1% Energy

9% Rent & Operations

90% Salary



Financial Importance of Wellness



- Energy: \$3/ft²
- Operations/Rent: \$30/ft²
- Salaries: \$300/ft²

Understanding the “3-30-300 Principle” is a paramount way that building professionals can explain the value of these solutions

- So a 10% increase in energy efficiency would yield \$0.30 savings per square foot
- A 10% decrease in rent would save \$3.00,
- And a 10% gain in productivity is worth \$30.

3-30-300 Principle



Nature in the Space

Visual Connections to Nature



299%

Return on
Investment



Sacramento Municipal Utility District



- *Increased Productivity*

Nature in the Space

Visual Connections to Nature

Building Cost @ \$200/sf
over 10 yrs = \$20/sf/yr

Energy Costs
\$3/sf/yr

People Costs
\$300/sf/yr



People Productivity @ 1%
improvement = \$3.0/sf/yr



Driving Forces



What is driving the need for Wellness in Design?

Driving Forces



How will we respond?



Active Transportation



Active Recreation



Active Buildings



Healthy Food Access



City Policy + Implementation



Land Use Mix: Public Parks and Open Spaces





ULI Urban Land Institute

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Membership | Councils | Events | Programs | **Research** | Publications

Home > Research > Centers & Initiatives > Building Healthy Places Initiative

Building Healthy Places Initiative

Centers & Initiatives
Building Healthy Places Initiative
About
Advisory Group
Local Programs
Healthy Corridors
Toolkit
Healthy Places Posts
Connect
Resources
Center for Capital Markets and Real Estate
Center for Sustainability
ULI Greenprint Center for Building Performance
Infrastructure Initiative
Rose Center for Public Leadership in Land Use
Terwilliger Center for Housing
Urban Resilience Program

Around the world, communities face pressing health challenges related to the built environment. For many years, ULI and its members have been active players in discussions and projects that make the link between human health and development; we know that health is a core component of thriving communities.



The ULI Building Healthy Places Initiative is building on that work with a multifaceted program—including research and publications, convenings, and advisory activities—to leverage the power of the Institute's global networks to shape projects and places in ways that improve the health of people and communities.

Through the Building Healthy Places Initiative, which launched in July 2013, ULI is working to promote health across the globe.

Leveraging the power of ULI's global networks to shape projects and places in ways that improve the health of people and communities.



BUILDING HEALTHY PLACES TOOLKIT

STRATEGIES FOR ENHANCING HEALTH IN THE BUILT ENVIRONMENT

ULI Urban Land Institute
Building Healthy Places Initiative





4

PROVIDE INFRASTRUCTURE TO SUPPORT BIKING

EVIDENCE-BASED STRATEGIES ▼

→ Where possible, provide bikeways within the street network.²⁸



→ Maximize connections to existing bicycle networks, including multiuse trails and greenways.¹⁵



“...No Gates, No Golf...”

“...Cycling is the new Golfing...”

CNN Money Business Markets Tech Media Personal Finance Small Biz Luxury stock tickers

For entrepreneurs, cycling is the new golf

By Parija Kavilanz @CNNMoney

Social Surge - What's Trending ⚡

- 16 stocks to buy no matter what the economy does
- Boeing says it created lightest metal ever
- China has a bigger middle class than America

VTB Capital
BEST INVESTMENT BANK IN RUSSIA
Think Global. Think VTB Capital

In Southern California, Michael Marckx spearheads a group of cyclists who regularly ride and network.

Across America, entrepreneurs and seasoned executives are



Academy of Neuroscience for Architecture



Follow @anfar

ANFA 2016 Connections: BRIDGESYNAPSES

ANFA 2016 will take place on September 22 - 24th, with a Pre-Conference program on September 21st, at the Salk Institute, La Jolla, California.

When Brains Design/Experience Buildings: Architectural Patterns for a Good Life

An article based off of Dr. Michael Arbib's talk in Singapore this past September.

michael arbib

When Brains Design/Experience Buildings: Architectural Patterns for a Good Life

Article is based off of Dr. Arbib's talk in Singapore last fall. A must read!



Academy of Neuroscience for Architecture




*“Changes in the environment
change the brain, and therefore
they change our behavior.”
- Fred Gage*




<https://anfarch.ucsd.edu/HomePage>

WELL Building Certification



AIR

14 FEATURES
4 preconditions
10 optimizations




WATER

8 FEATURES
3 preconditions
5 optimizations




NOURISHMENT

13 FEATURES
2 preconditions
11 optimizations



LIGHT

8 FEATURES
2 preconditions
6 optimizations




MOVEMENT

12 FEATURES
2 preconditions
10 optimizations




THERMAL COMFORT

7 FEATURES
1 precondition
6 optimizations




SOUND

5 FEATURES
1 precondition
4 optimizations




MATERIALS

14 FEATURES
3 preconditions
11 optimizations



MIND

15 FEATURES
2 preconditions
13 optimizations



COMMUNITY

16 FEATURES
3 preconditions
13 optimizations

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WELL Building Certification

Specific Preconditions and Optimizations



RESPIRATORY

INTEGUMENTARY

CARDIOVASCULAR

MUSCULAR

NERVOUS

DIGESTIVE

IMMUNE

REPRODUCTIVE

ENDOCRINE

URINARY

SKELETAL



Each feature of WELL is ascribed to the human body systems intended to be benefited

Medical Professionals:

Most Important Factors Affecting Patient Health

Pediatricians



Pediatric Patients

- Poor Diet
- Lack Of Exercise
- Obesity
- Poverty

General Practitioners



Adult Patients

- Poor Diet
- Lack Of Exercise
- Obesity
- Smoking

Psychologists/Psychiatrist



Pediatric Patients

- Poor Diet
- Lack Of Exercise
- Chronic Stress
- Family History



Adult Patients

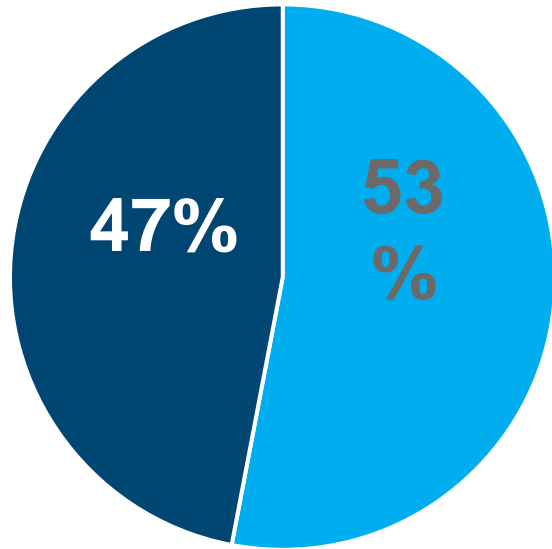
- Alcohol Use
- Lack Of Exercise
- Chronic Stress
- Drug Use

Alarming percentage of doctors not making the connection between health and buildings!

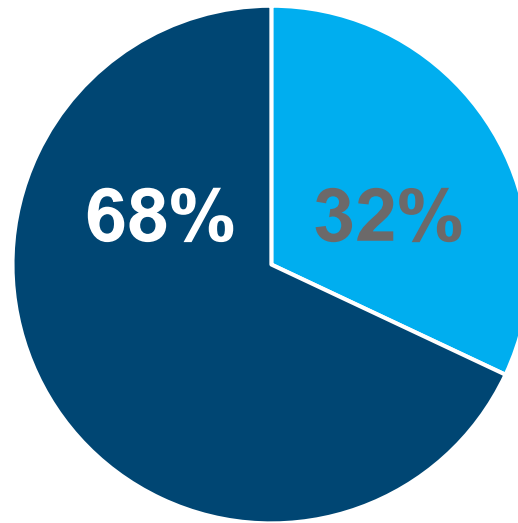


Medical Professionals:

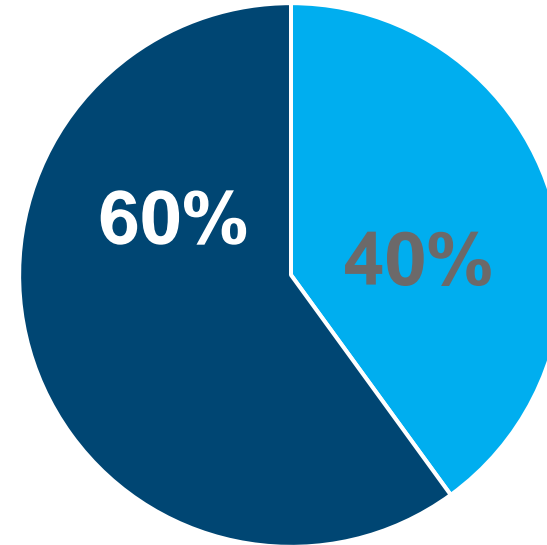
- NO, see no connection between buildings and health
- YES, believe that buildings impact patient health



Pediatricians



General Practitioners



Psychologists/Psychiatrist



Alarming percentage of doctors not making the connection between health and buildings!

Integrating Wellness Into A Building

Biophilic Design

Views, Sounds, Air Patterns

Daylight Harvesting

Circadian Rhythm

Clean Air

ASHRAE 62 – Air Quality

Clean Water

Legionnaires



Biophilia Hypothesis



Biophilia, “*the urge to affiliate with other forms of life.*”

- E.O. Wilson, 1984



The Science Behind Biophilic Design



Nature promotes positive emotions, psychological resilience and well-being.

Research shows, pleasant environments stimulate opioid receptors, so that we feel a sense of pleasure.



Biophilic Design

The Bodies Involuntary Response to Nature



Experiment A - involuntary body responses to a variety of environments.

- What is around the next corner?
- Fear
- Horizon
- Structure

Experiment B - Recovery time of the involuntary systems of the body to stress

Experiment C - How does productivity get affected by office design and proximity to nature views?



Biophilic Design



Experiment A-The Body's Involuntary Response To Nature



- What is around the next corner?
- Fear



Biophilic Design



Experiment A -The Body's Involuntary Response To Nature



- What is around the next corner?
- Fear
- Prospect - Horizon

Biophilic Design



Experiment A - The Body's Involuntary Response To Nature



- What is around the next corner?
- Fear
- Prospect – Horizon
- Refuge - Comforting



Biophilic Design

Experiment A



The combination of prospect and refuge had the best result!

Biophilic Design – Stress Response Test

Experiment B



- Patients were exposed to stress
- The recovery was monitored with respect to breathing, heart rate, electrical systems, ...



Stress Response Test

Experiment B



Room with NO view of nature



Stress Response Test



Experiment B



- Room with NO view of nature
- Room with a view



Stress Response Test

Experiment B



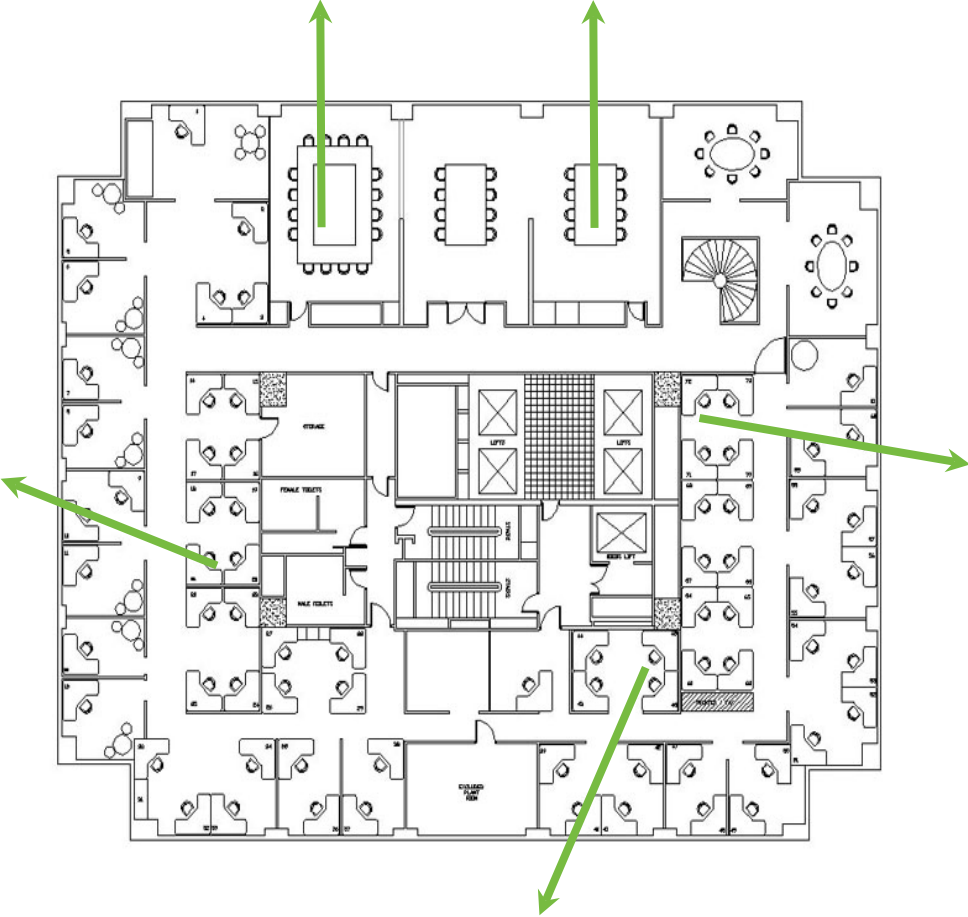
- Room with NO view of nature
- Room with a view
- Room with a picture/video view of nature



Biophilic Design



Experiment C



Biophilic Design



Other Data



- **Hospital:** Relative rankings of people near windows had lower symptoms by 15% to 20%
- **Processing center:** 6% to 7% improvement
- **San Raffaele Hospital Study:** 30% reductions in recovery time of bi-polar patients by staging them in the east, with early night
- 2.6 days less in hospital when naturally lit = 325% ROI
- Hospital in Singapore uses vegetated roof to restore native species



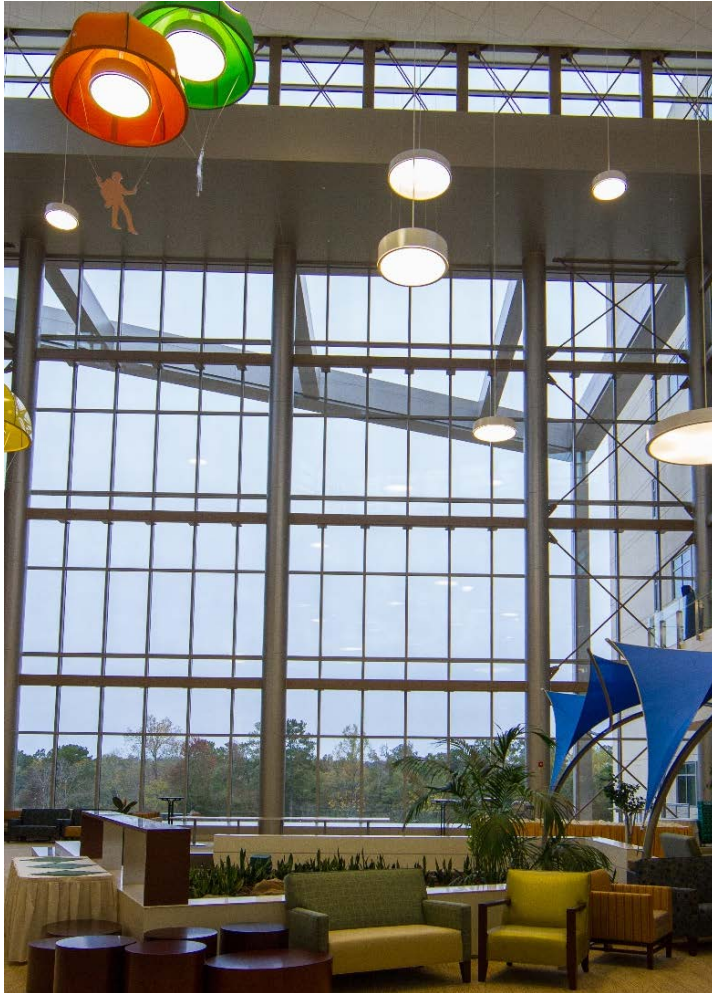
Healing Garden Courtyards



Martin Army Community Hospital - Fort Benning, Georgia



Internal Context



Martin Army Community Hospital - Fort Benning, Georgia

Why IEQ?



Because the Interior Environment Matters

Occupants in high-quality interior environments exhibit

- Increased Sense of Well-Being
- Improved Concentration
- Improved Engagement
- Reduced Stress



Nemours Children's Hospital – Orlando, Florida



Betterment to the Workers



Nemours Children's Hospital – Orlando, Florida



Elements of Biophilic Design



Nature in the Space

1. Visual Connection with Nature
2. Non-visual Connection with Nature
3. Non-rhythmic Sensory Stimuli
4. Access to Thermal & Airflow Variability
5. Presence of Water
6. Dynamic & Diffuse Daylight
7. Connection with Natural Systems

Natural Analogues

8. Biomorphic Forms & Patterns
9. Material Connection with Nature
10. Complexity & Order

Nature of the Space

11. Prospect
12. Refuge
13. Mystery
14. Risk/Peril



Courtesy of Terrapin Bright Green

These qualities and others are important for creating spaces that are comfortable and interesting to occupants, as well as conducive to employee productivity, satisfaction, and retention.



Space Variability

Motion and Fluidity



Florida Hospital Women's Pavilion – Orlando, Florida



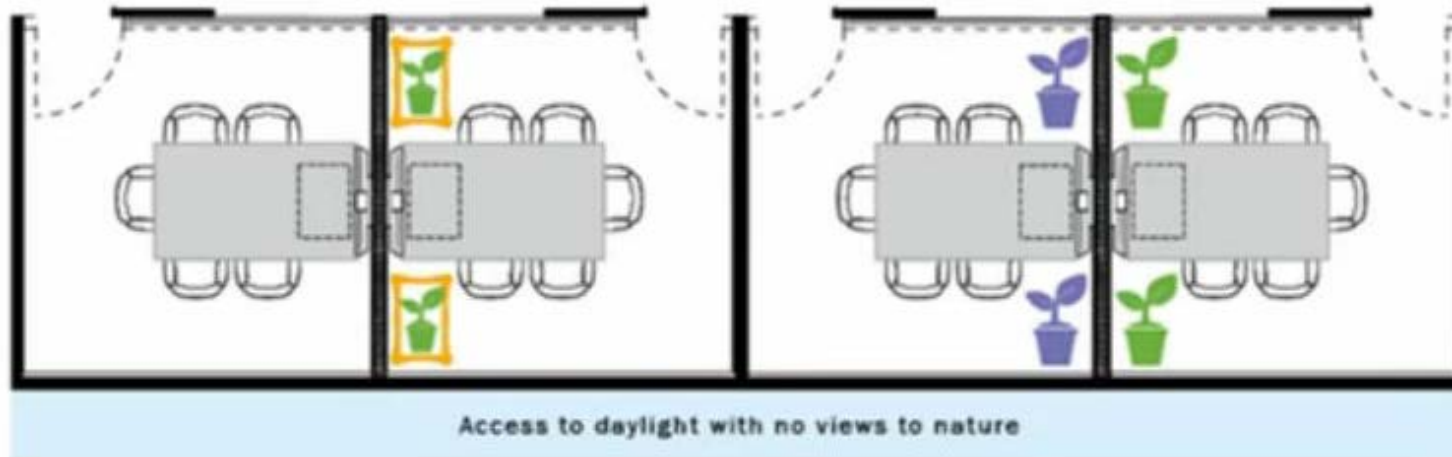
Biophilic Design

Voting



OPERATIONAL TEST OUTLINE

visual connection with nature: meeting spaces



SPACE & RESOURCE REQUIREMENTS:

- Adjacent meeting spaces with no visual connection to exterior views.
- Ability to track use of rooms as well as survey occupants.

TESTING OPPORTUNITIES:

- Living vs. Artificial vs. Pictorial
- Impact of quantity and visibility
- Position and Proximity



Biophilia Performance Metrics



Health Impacts

Physiological Stress Responses

- Musculoskeletal
- Visual
- Respiratory
- Endocrine System
- Aural
- Agility
- Alertness

Cognitive Functionality Creativity

- Logic
- Mental Agility
- Rote / Memory

Psychological Stress Responses

- Emotion / Mood
- Alertness
- Adaptability
- Attention
- Concentration



Integrating Wellness Into A Building

Biophilic Design

Views, Sounds, Air Patterns

Daylight Harvesting

Circadian Rhythm

Clean Air

ASHRAE 62 – Air Quality

Clean Water

Legionnaires



Light – Daylight Harvesting

Spatial Daylight Autonomy sDA

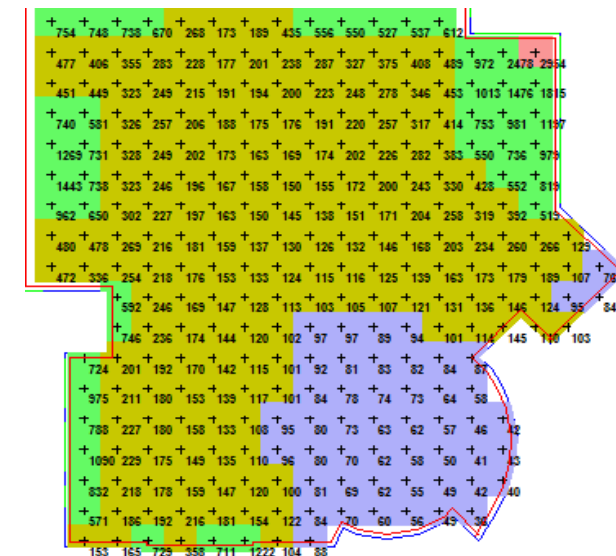
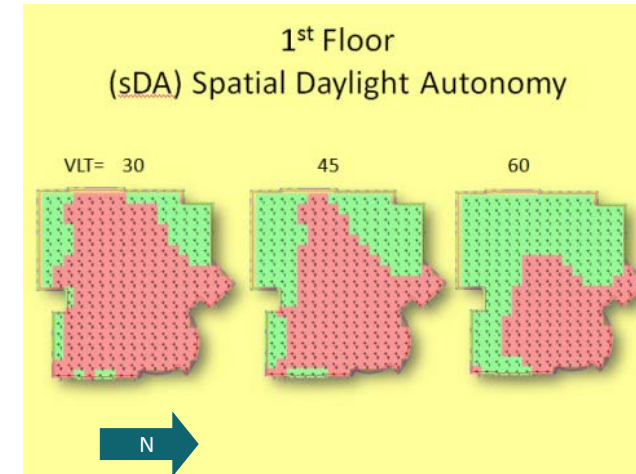
- *Do I have enough light?*

Annual Sun Exposure

- *Is there a glare problem*
- 1,000 lux for less than 250 occupied hr/yr

Average Annual Lux

- *Do I like the light quality in my space?*
- Circadian Rhythm



Light

Impacts Circadian Rhythm, which impacts Sleep Cycle, which impacts Melatonin production, which can lead to Cancer, Obesity, ...

INTENT

The objective of the Light Concept of the WELL Building Standard® is to provide room illumination that minimizes disruption to the body's circadian rhythm and provides appropriate illumination for all tasks.

HEALTH IMPACT

Of concern are multiple health related issues, which may include:

- » Seasonal Affective Disorder (SAD)
- » Serotonin regulation
- » Circadian rhythm
- » Melatonin management
- » Carbohydrate digestion
- » Antioxidant effects of melatonin
- » Healthy eye development
- » Age related macular degeneration
- » Chronotype
- » Delayed Sleep Phase Syndrome (DSPS)
- » Remediation of jet lag
- » Healthy sleep patterns
- » Vitamin D

OPTIMAL LIGHT CONDITION

A WELL Certified™ building must meet performance threshold and introduce select solutions, protocols and technologies:

- » Circadian Lighting Controls to adjust the color temperature and intensity over the course of the day to help with sleep, alertness and digestion
- » Adequate daylight during daylight hours and blackout shades at night to optimally manage outdoor sources of light
- » Gradually brightening lights in the morning to act as a dawn simulator
- » High-intensity light to help awaken and increase morning alertness, removing melatonin levels for optimal daytime energy
- » Great visual acuity to improve work performance and reduce eye strain
- » Ultraviolet light to allow the body to generate Vitamin D in settings that avoid risk of eye and skin damage



Light

WELL BUILDING STANDARD® FEATURES MATRIX

COMPLIANCE CERTIFICATION	PRECONDITION	OPTIMIZATION	Core & Shell	Tenant Improvement	New Construction
-----------------------------	--------------	--------------	-----------------	-----------------------	---------------------

Light

53	Visual lighting design			P	P
54	Circadian lighting design			P	P
55	Electric light glare control			P	P
56	Solar glare control		○	P	P
57	Low-glare workstation design			○	○
58	Color quality			○	○
59	Surface design			○	○
60	Automated shading and dimming controls			○	○
61	Right to light		○	○	○
62	Daylight modelling		○	○	○
63	Daylighting fenestration		○	○	○



Integrating Wellness Into A Building

Biophilic Design

Views, Sounds, Air Patterns

Daylight Harvesting

Circadian Rhythm

Clean Air

ASHRAE 62 – Air Quality

Clean Water

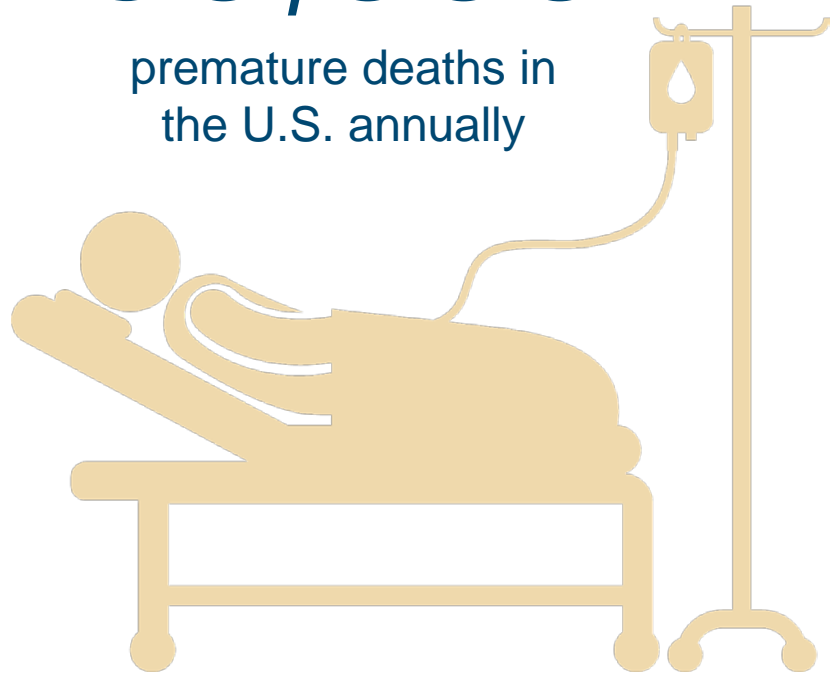
Legionnaires



Clean Air – Air Quality

50,000

premature deaths in
the U.S. annually



\$150 Billion

in illness related
economic costs



\$93 Billion

is headache, fatigue and
Sick Building Syndrome
related symptoms



Due to Poor Air Quality

Clean Air – Air Quality

If Ambient Air ppm
of CO₂ is < 350 Set-point
can be < 1050

1050 Corresponds to 15 Cfm per person

*If there is more external quality air, the
ventilation rate will be lower*



Clean Air – Ventilation

*Ventilation Rate is set
by ASHRAE Std 62,
adopted as code in
most municipalities*

MIAMI

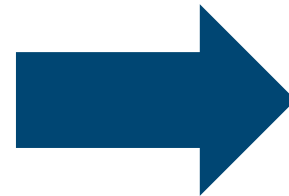
\$2 Cfm per
year

\$6 /Cfm
Capital Costs



2

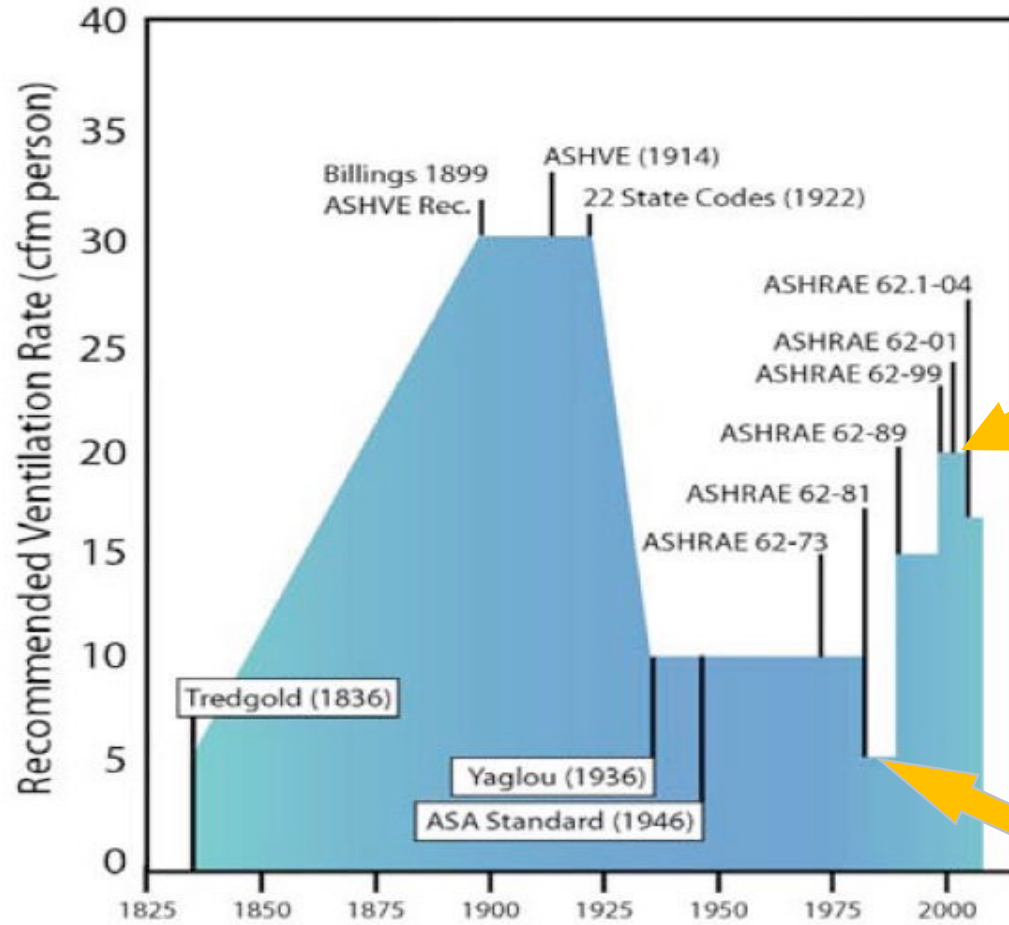
Methods
to meet code



Ventilation Rate
Air Quality



Evolution of ASHRAE 62.1



Ventilation Rate Procedure

Occupancy category		Required ventilation, cfm per 1,000 sq ft		Change ¹
		ASHRAE 62	ASHRAE 62.1	
Education	Art classroom	300	380	+27%
	Classroom, ages 5 to 8	375	370	-1%
	Classroom, ages 9 and up	525	470	-10%
	Lecture classroom	975	550	-44%
	Multiuse assembly	1,500	810	-46%
	Science laboratory	500	430	-14%
Food/beverage service	Bar, cocktail lounge	3,000	930	-69%
	Cafeteria/fast-food dining	2,000	930	-54%
	Restaurant dining room	1,400	705	-50%
General	Conference/meeting	1,000	310	-69%
	Corridor	50	60	+20%
Lodging	Barracks/sleeping area	300	160	-47%
Office	Office space	100	85	-15%
	Reception area	450	210	-53%

A *prescriptive* procedure in which outdoor air intake rates are determined based on space type/application, occupancy level and floor area.



Air Quality Method

A performance-based procedure in which outdoor air intake rates are determined based on ambient air quality and building interior conditions.



4.1 Regional Air Quality

Must determine NAAQS attainment status www.epa.gov

Air cleaning required in some cases of non-attainment

4.2 Local Air Quality

Conduct observational site survey to identify local sources of air contaminants



Ventilation Directly Relates to Energy Consumption

40% of total cooling load at peak design temperature for a typical office building would be ventilation without energy recovery

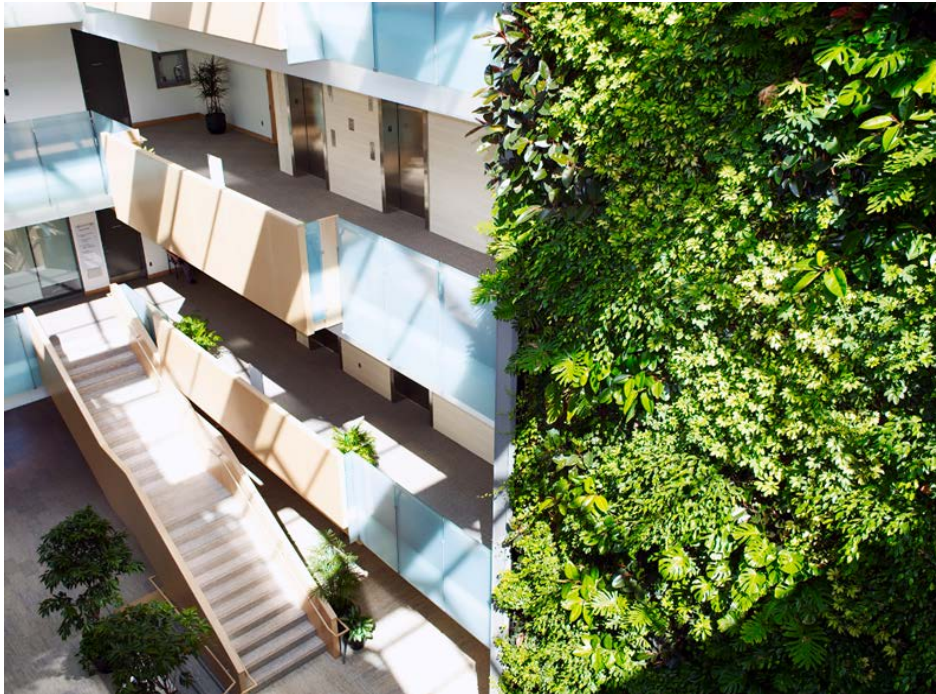
Reducing ventilation loads results in initial cost reduction and ongoing operation cost reductions.



Air Quality / Biophilia

Bringing Nature Inside

Biofiltration breaks down VOCs and cleans air, which allows lower ventilation rates, reducing costs.



Nedlaw Living Walls
www.naturaire.com



Air Quality Method

Electrostatic and Ionization not allowed for LEED innovation credit

Biofiltration reduces energy demand by reducing ventilation volume

LEED allows IAQ method but must be cleared in advance



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Water Quality

You can live without electricity.

You cannot live without water!

(2 liters/day)

- # of contaminants is increasing
- Using the same standard for all uses is a waste of resources
- Promoting drinking water
- Legionnaires Disease is still a problem



Water Quality

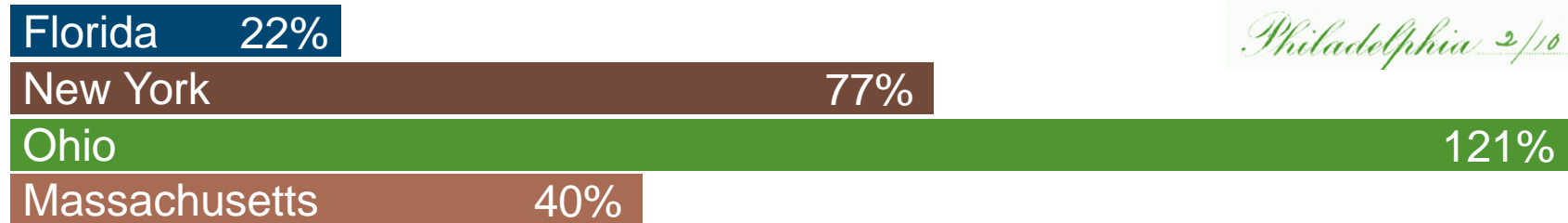
Legionnaire's Disease



History

1976 American Legion Convention
Bellevue Stratford Hotel
Philadelphia

34 DEAD
221 ILL



Rate increases between 2012-2013

After Identified, CDC traced multiple outbreaks dating back to 1947.
Because it is not a pathogen, CDC has no interest



Water Quality

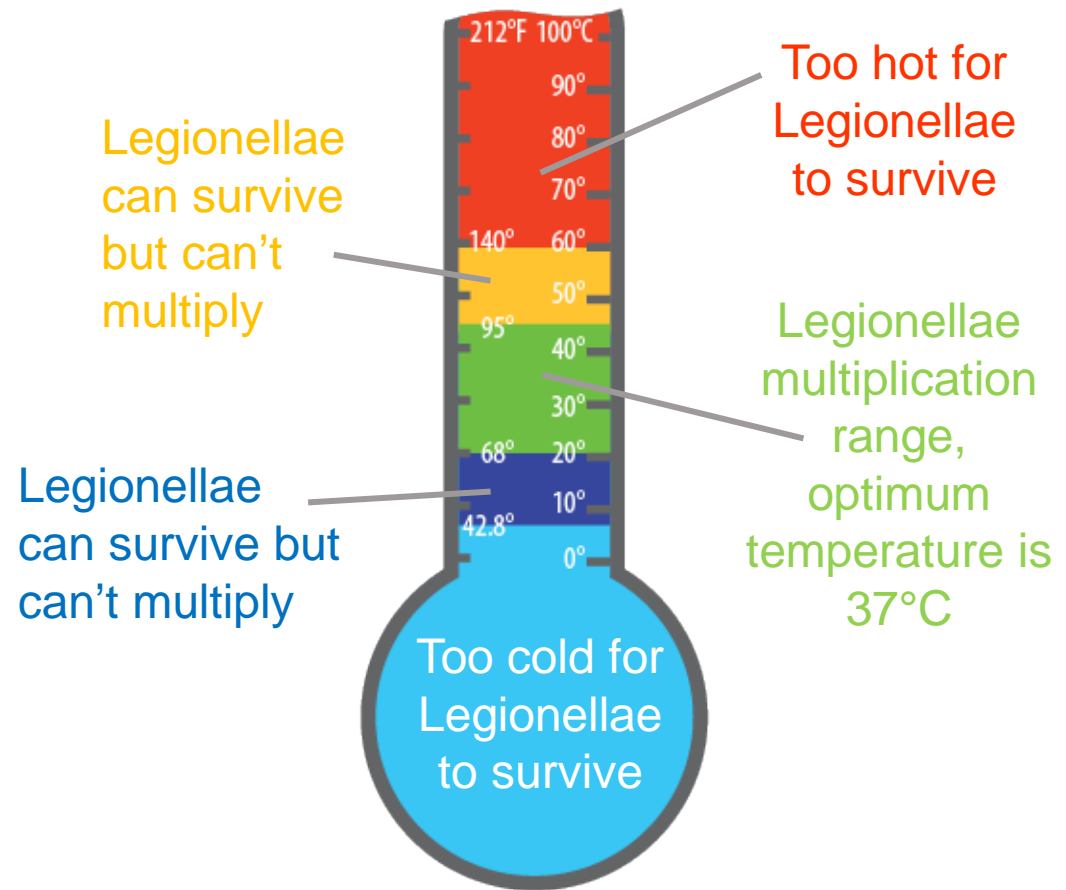
Legionnaire's Disease



8,000 - 18,000
cases annually*

4,000+
deaths annually

Must be taken in vapor
form or aspirated



* Current Estimate





Kimley»»Horn

Questions & Discussion