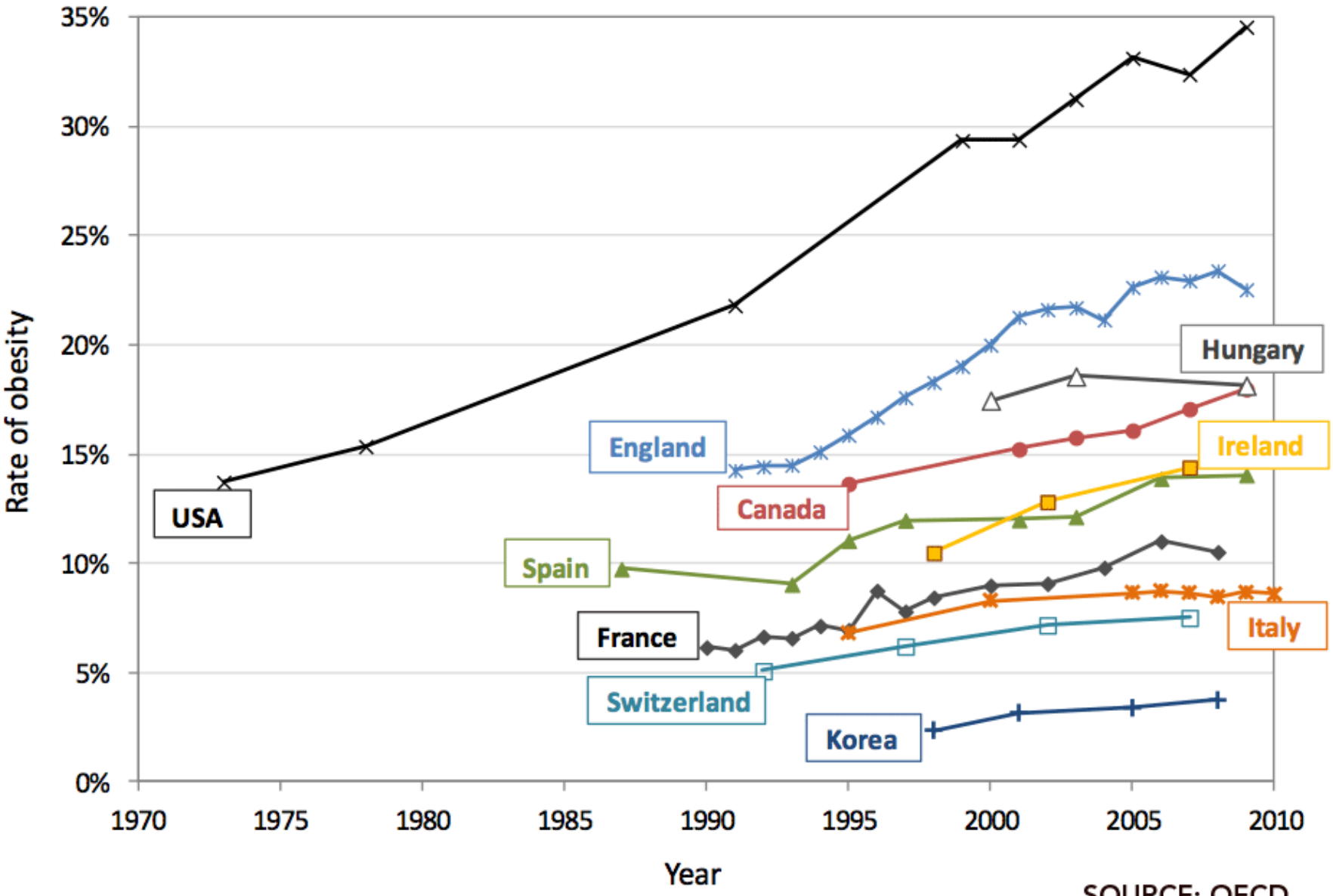
PUBLIC HEALTH
TEXAS A&M HEALTH SCIENCE CENTER

Improving Health through Nature

Jay Maddock, Ph.D., FAAHB
Co-Director, Center for Health & Nature

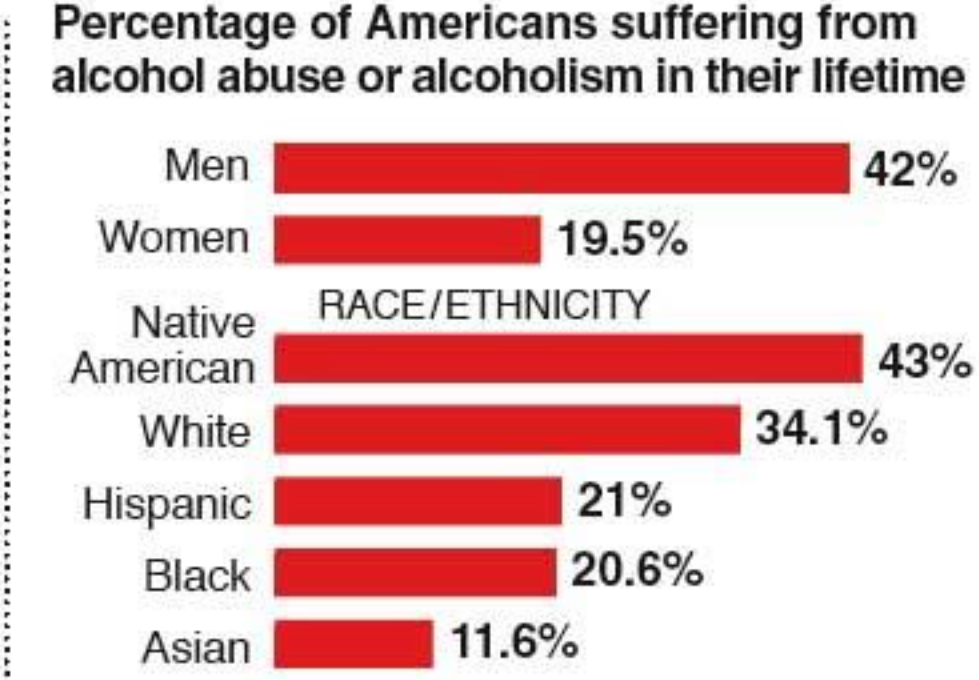
Obesity Rates



SOURCE: OECD

Alcohol abuse high

Rates for alcohol abuse and alcoholism were found to be highest in men and in Native Americans, as reported in a new government study.



SOURCE: American Medical Association

AP

SOURCE: THE AMERICAN PSYCHOLOGICAL ASSOCIATION

MORE THAN 8 IN 10 AMERICANS

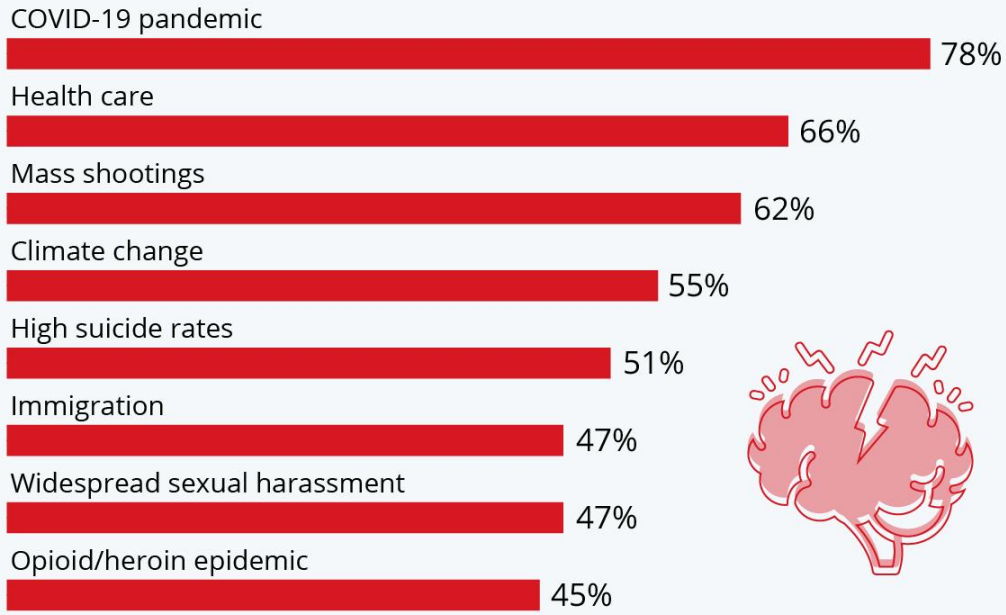
REPORT FEELING

STRESSED

IN THE LAST TWO WEEKS

What Is Stressing America Out?

Percent of U.S. adults who reported stress caused by the following topics

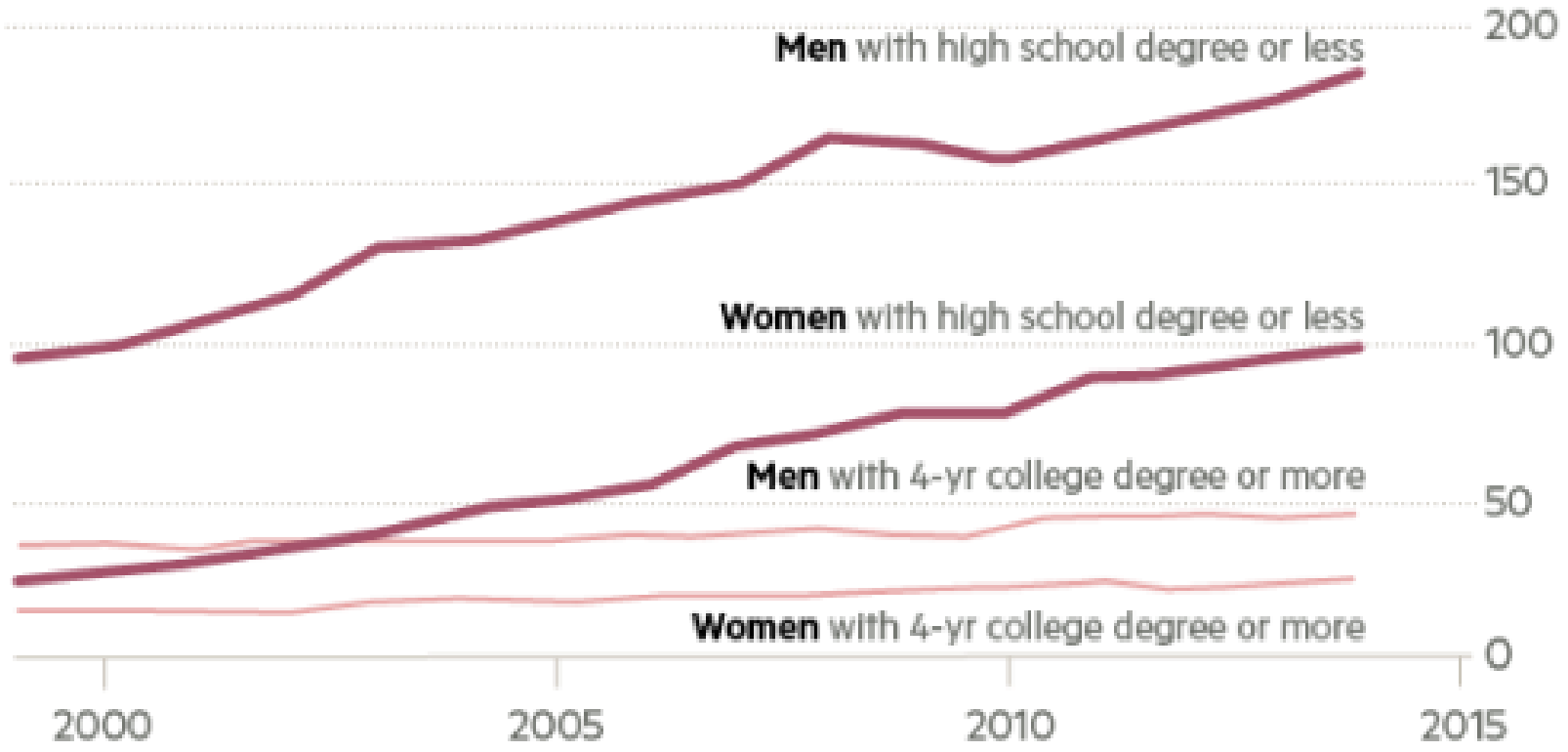


3,409 U.S. adults surveyed Aug 4-26, 2020
Source: APA Stress in America 2020

statista

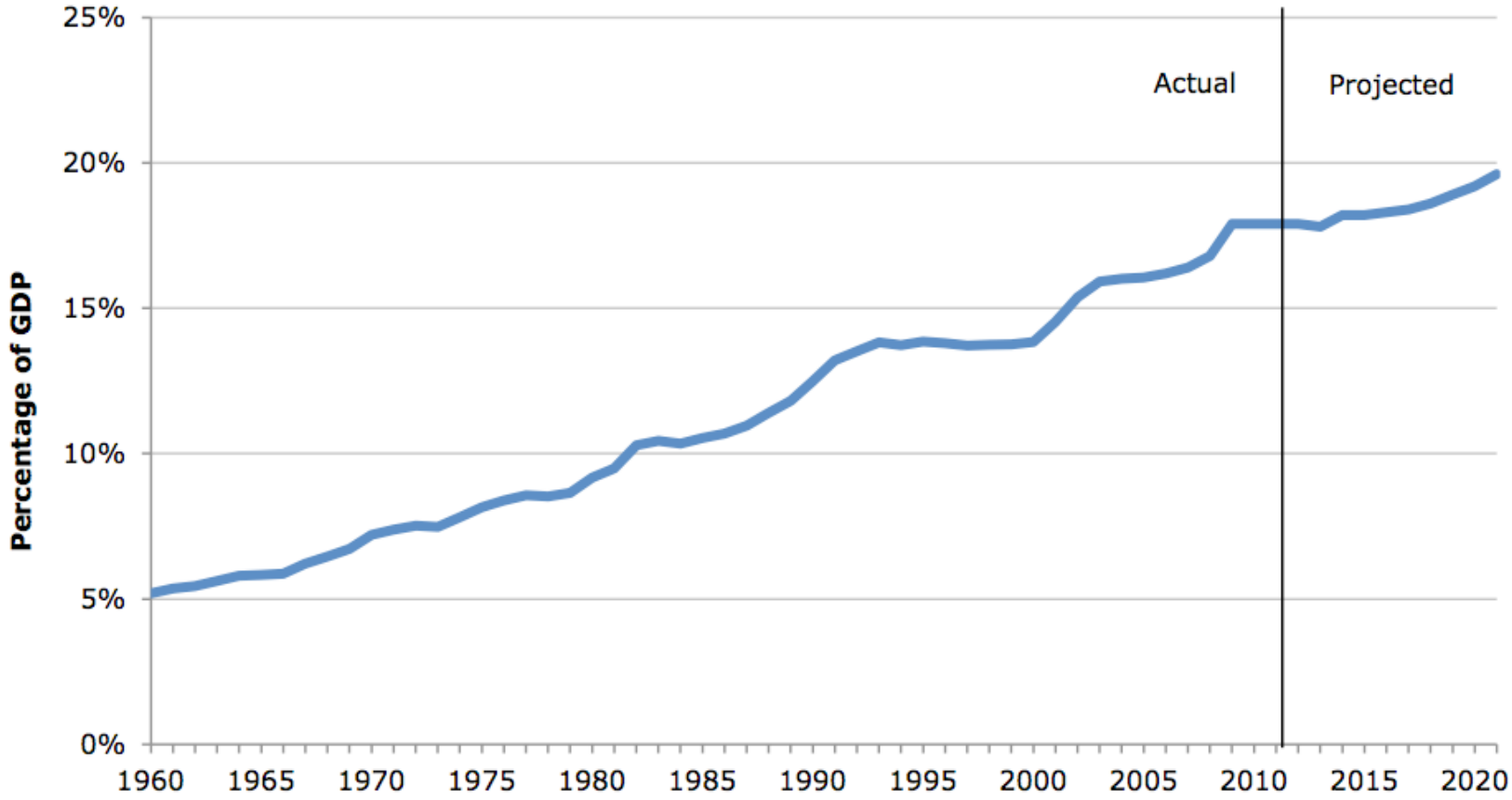
"Deaths of despair" have skyrocketed for less-educated whites

Deaths by drugs, alcohol and suicide per 100,000 white, non-Hispanic 50-54 year olds



Source: Anne Case and Angus Deaton, Brookings Papers

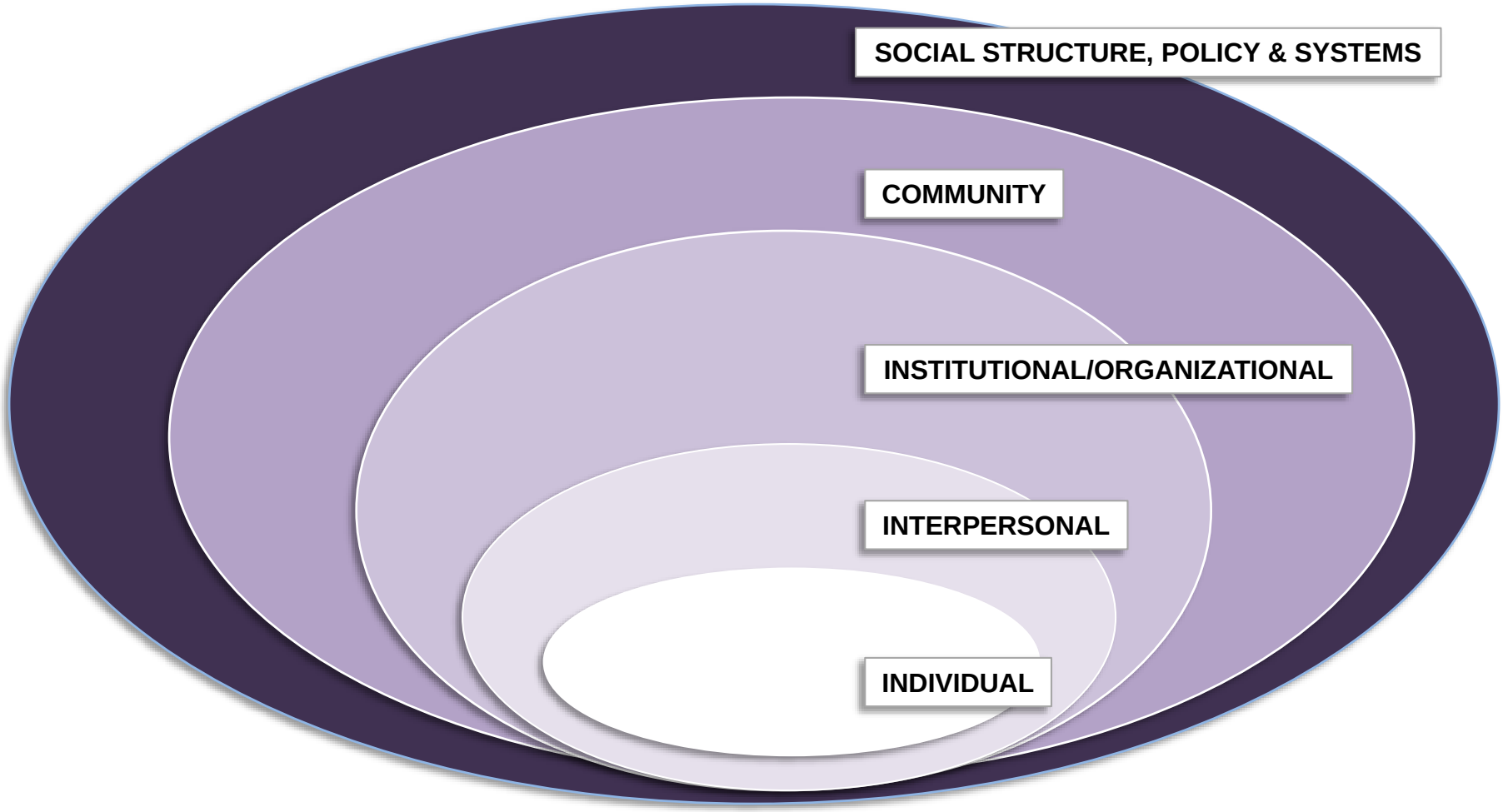
Figure 2: U.S. National Health Expenditures as a Share of GDP, 1960-2021



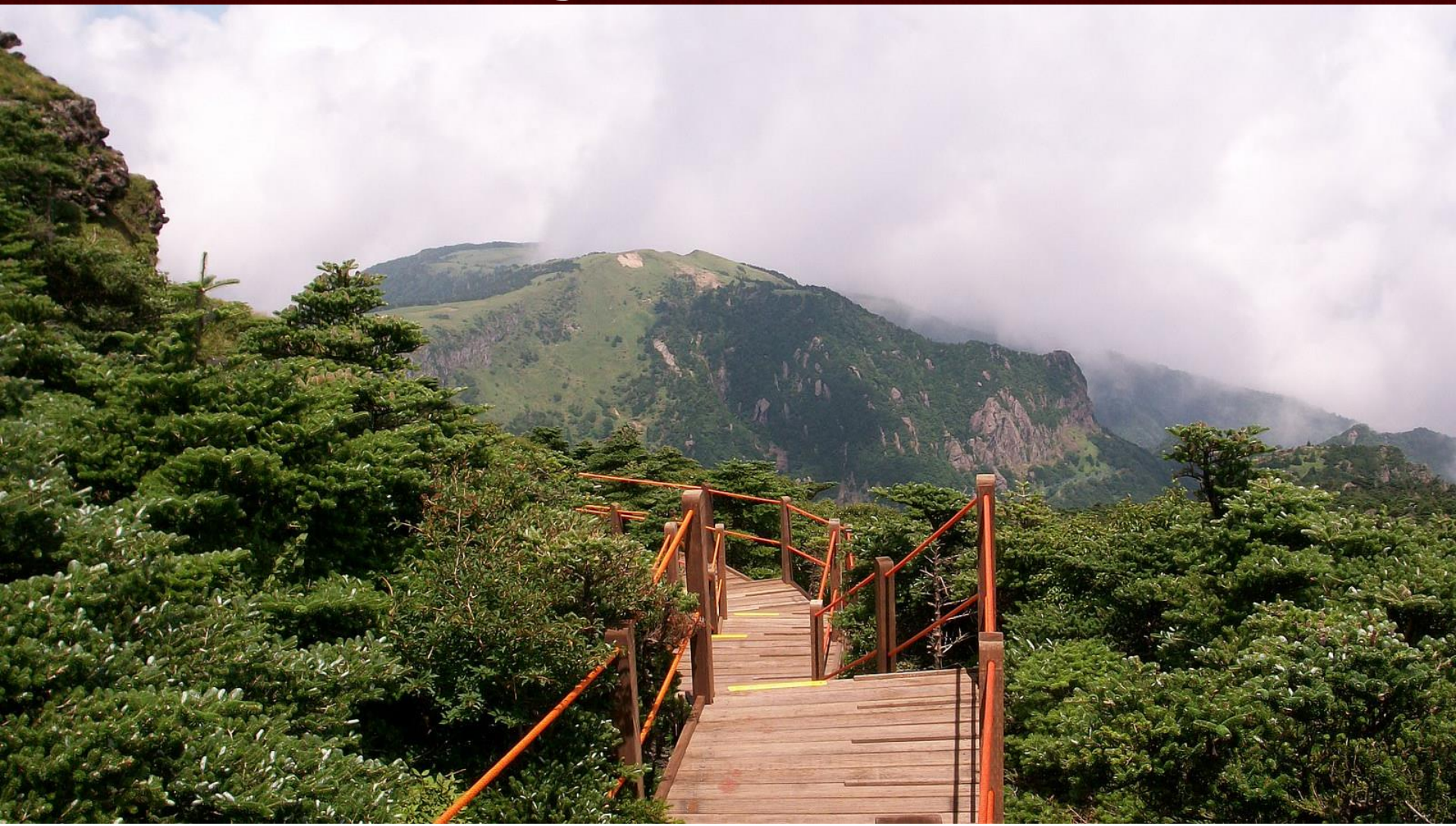
Source: Centers for Medicare and Medicaid Services.

What has changed in the past few decades that could be driving this?

Socio-Ecological Framework

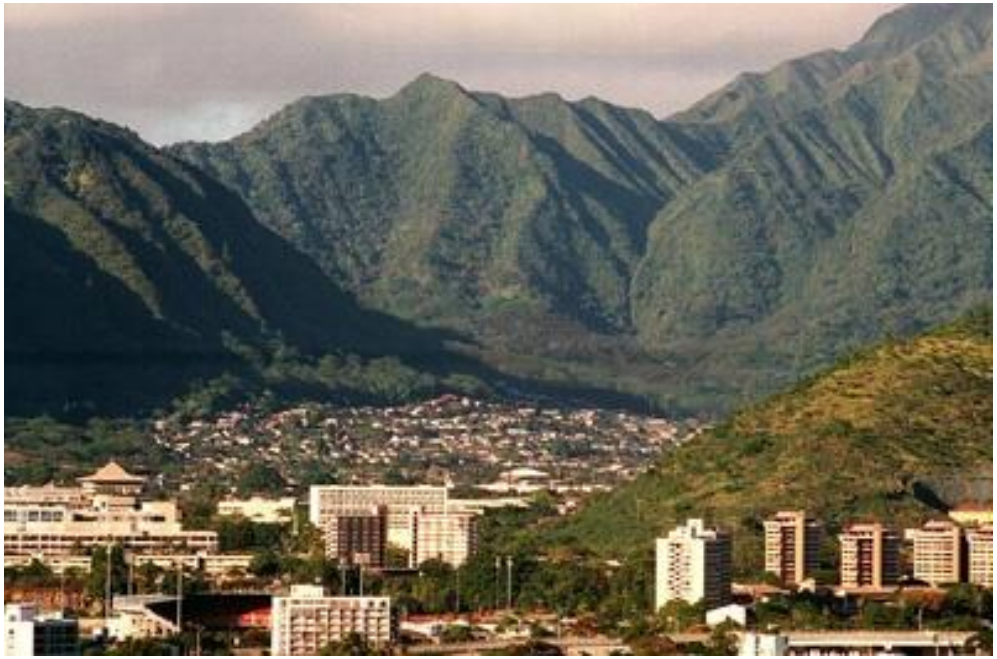


Jeju Olle Trail



2014

Hawaii to Texas - 2015



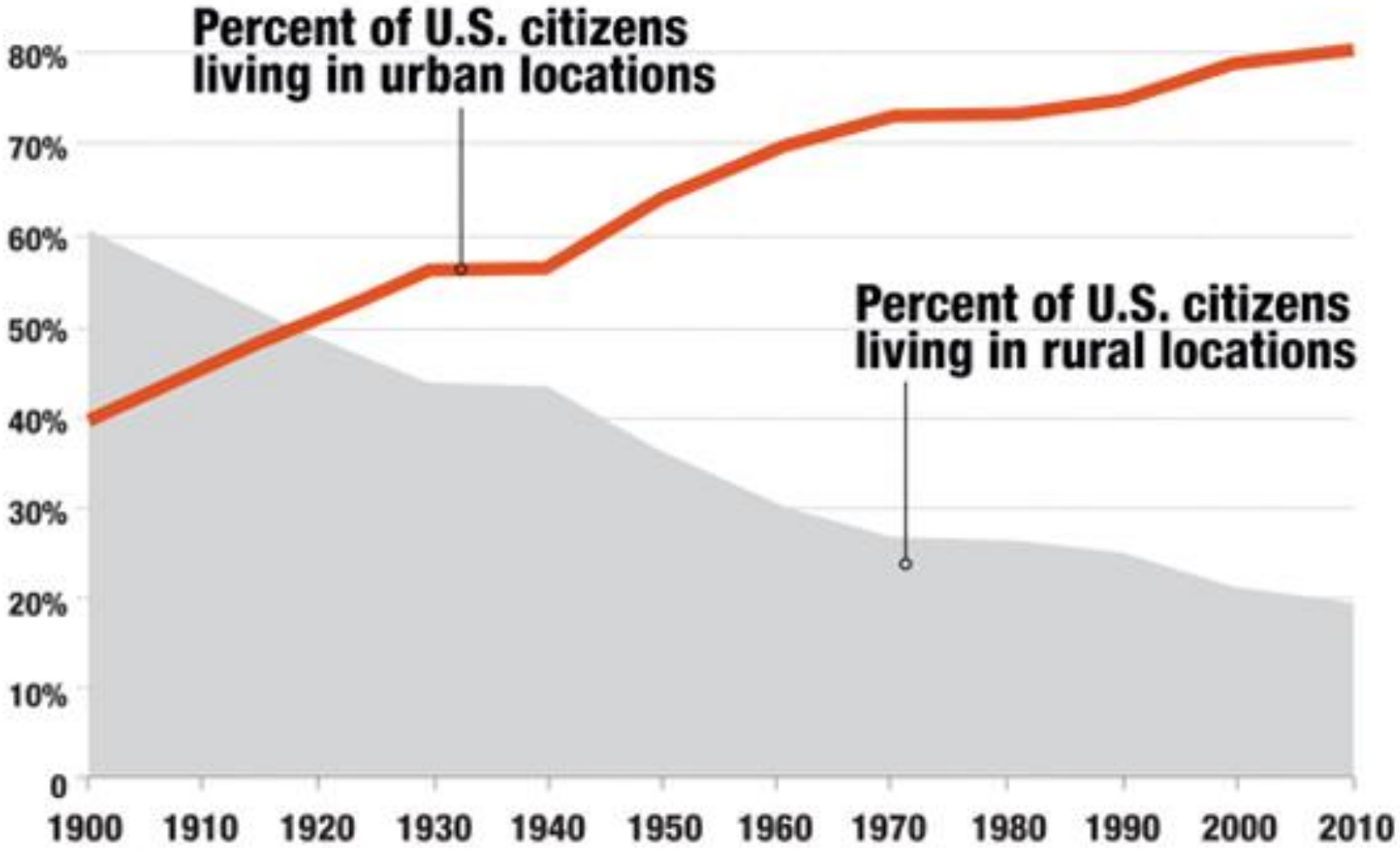
Average Time Spent with Media in the US, 2018-2022

hrs:mins per day among population

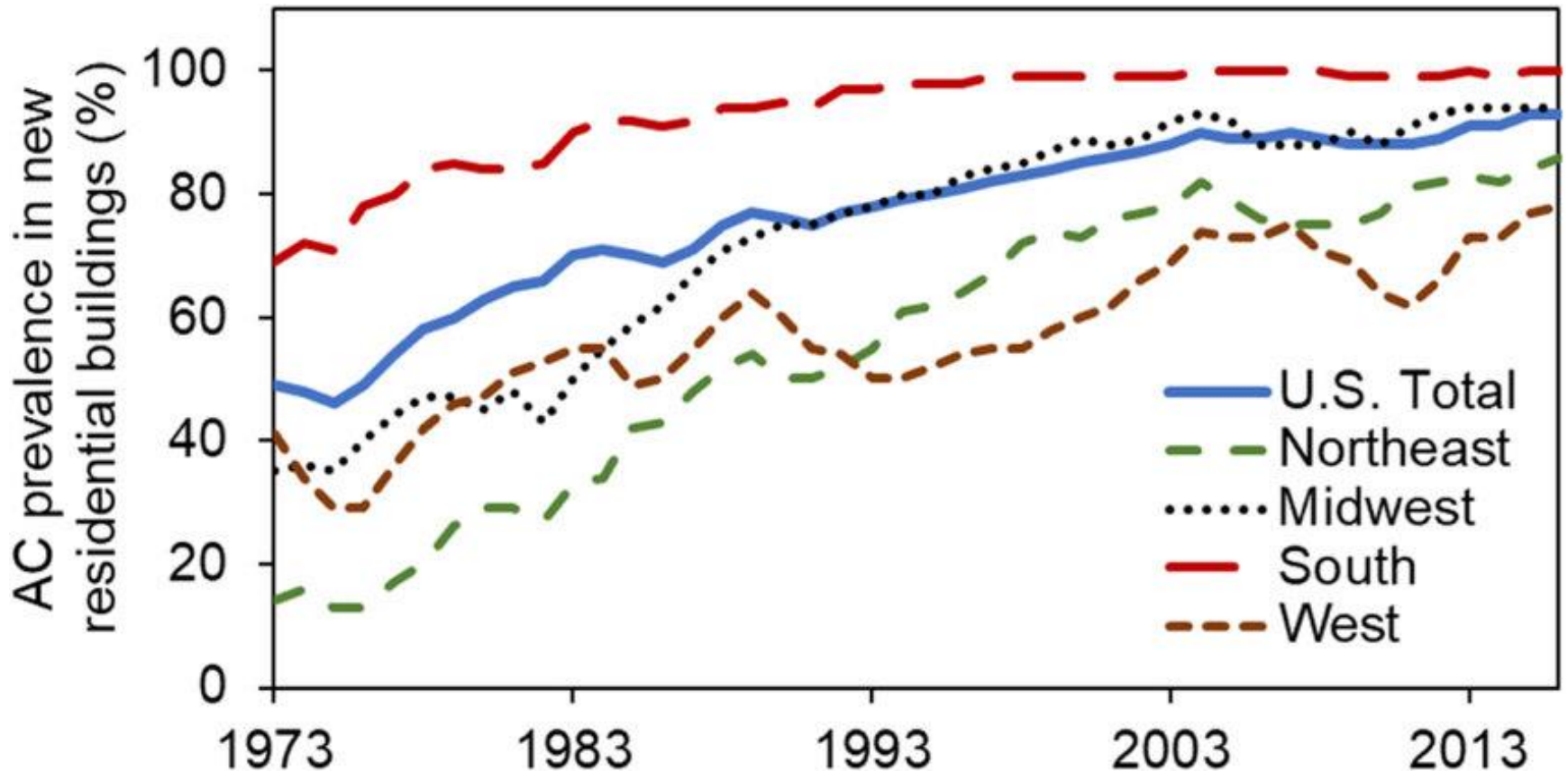
	2018	2019	2020	2021	2022
Digital	**6:20**	**6:49**	**7:50**	**7:57**	**8:02**
—Mobile (nonvoice)	3:36	3:57	4:31	4:36	4:41
—Audio	0:59	1:07	1:08	1:13	1:17
—Social networks	0:45	0:47	0:54	0:53	0:53
—Video*	0:38	0:43	0:50	0:52	0:54
—Other	1:06	1:12	1:31	1:30	1:30
—Desktop/laptop	1:57	1:54	2:02	1:58	1:56
—Video*	0:23	0:23	0:24	0:24	0:24
—Audio	0:07	0:07	0:07	0:07	0:07
—Social networks	0:08	0:06	0:06	0:06	0:05
—Other	1:19	1:18	1:25	1:21	1:20
—Other connected devices	0:47	0:58	1:17	1:22	1:26
TV* **	**3:42**	**3:27**	**3:34**	**3:19**	**3:07**
Radio* **	**1:41**	**1:39**	**1:32**	**1:31**	**1:31**
Print* **	**0:21**	**0:19**	**0:19**	**0:19**	**0:18**
—Newspapers	0:12	0:10	0:10	0:10	0:10
—Magazines	0:09	0:09	0:09	0:09	0:08
Other traditional media	**0:20**	**0:19**	**0:22**	**0:21**	**0:22**
Total	**12:24**	**12:33**	**13:38**	**13:27**	**13:21**

*Note: ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking; *excludes time spent with video via social networks; **includes all internet activities on desktop and laptop computers; ***excludes digital*
Source: eMarketer, Jan 2021

Out of the Countryside, Into the City

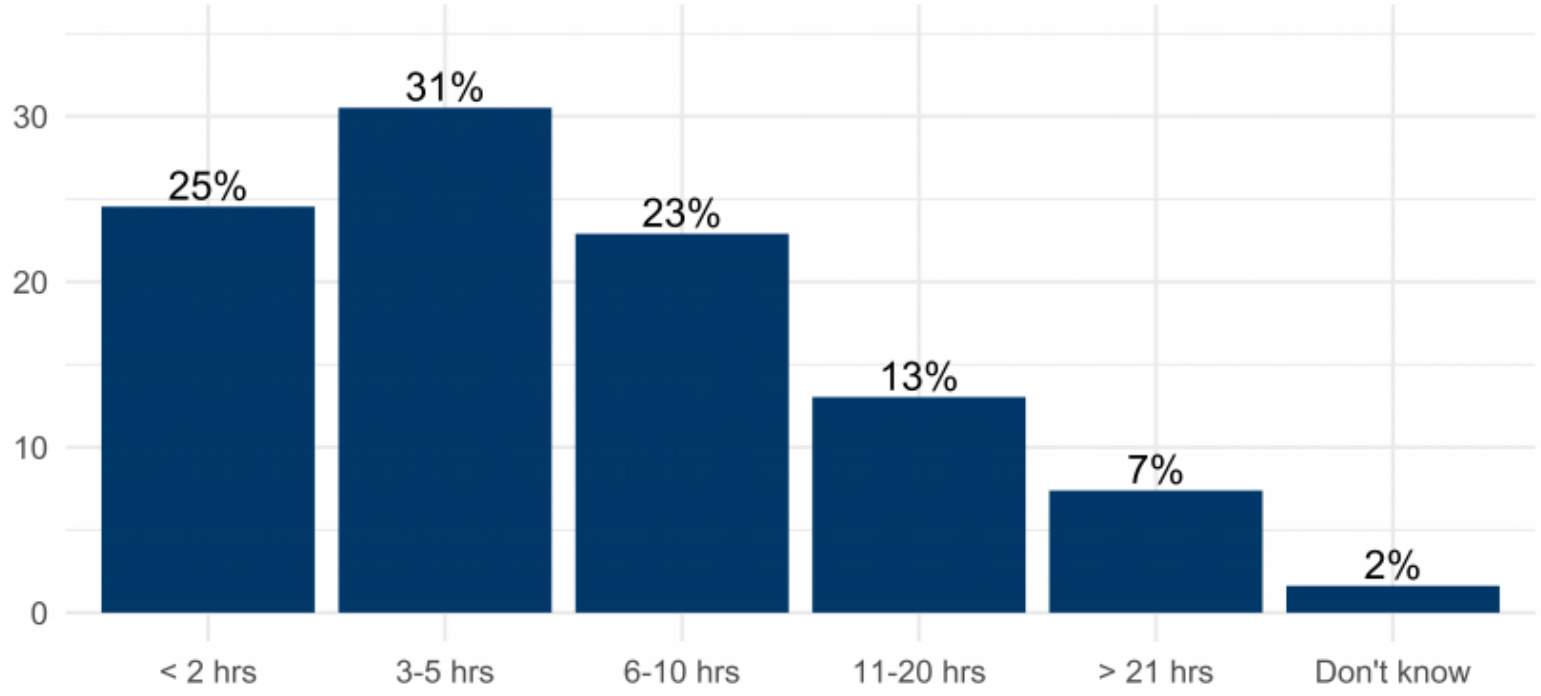


A/C Prevalence



American Adults Report Spending Little Time Outside Each Week

Over half of American adults report spending 5 hours or fewer outside in nature each week. Over three-quarters spend 10 or fewer hours.

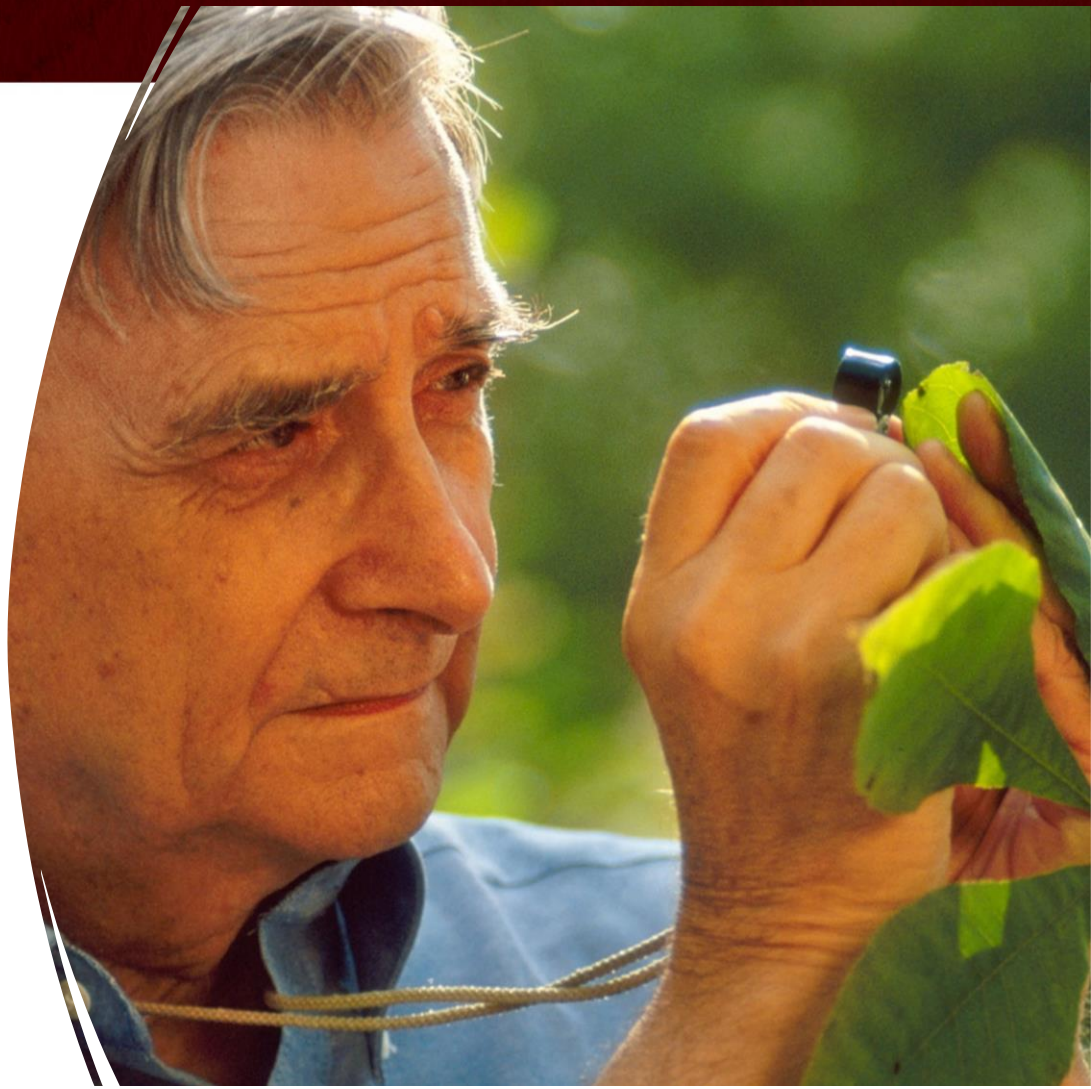


"In a typical week, when weather allows, about how many hours do you spend outside in nature?" Adults 18+. N = 5,550. Source: NatureofAmericans.org

Biophilia Hypothesis

- "The innately emotional affiliation of human beings to other living organisms"

- E. O. Wilson 2001



History of Center for Health & Nature (CHN)

Center for Health & Nature Celebration and Healing Design Presentation

Date: May 2, 2018

CHN Leadership

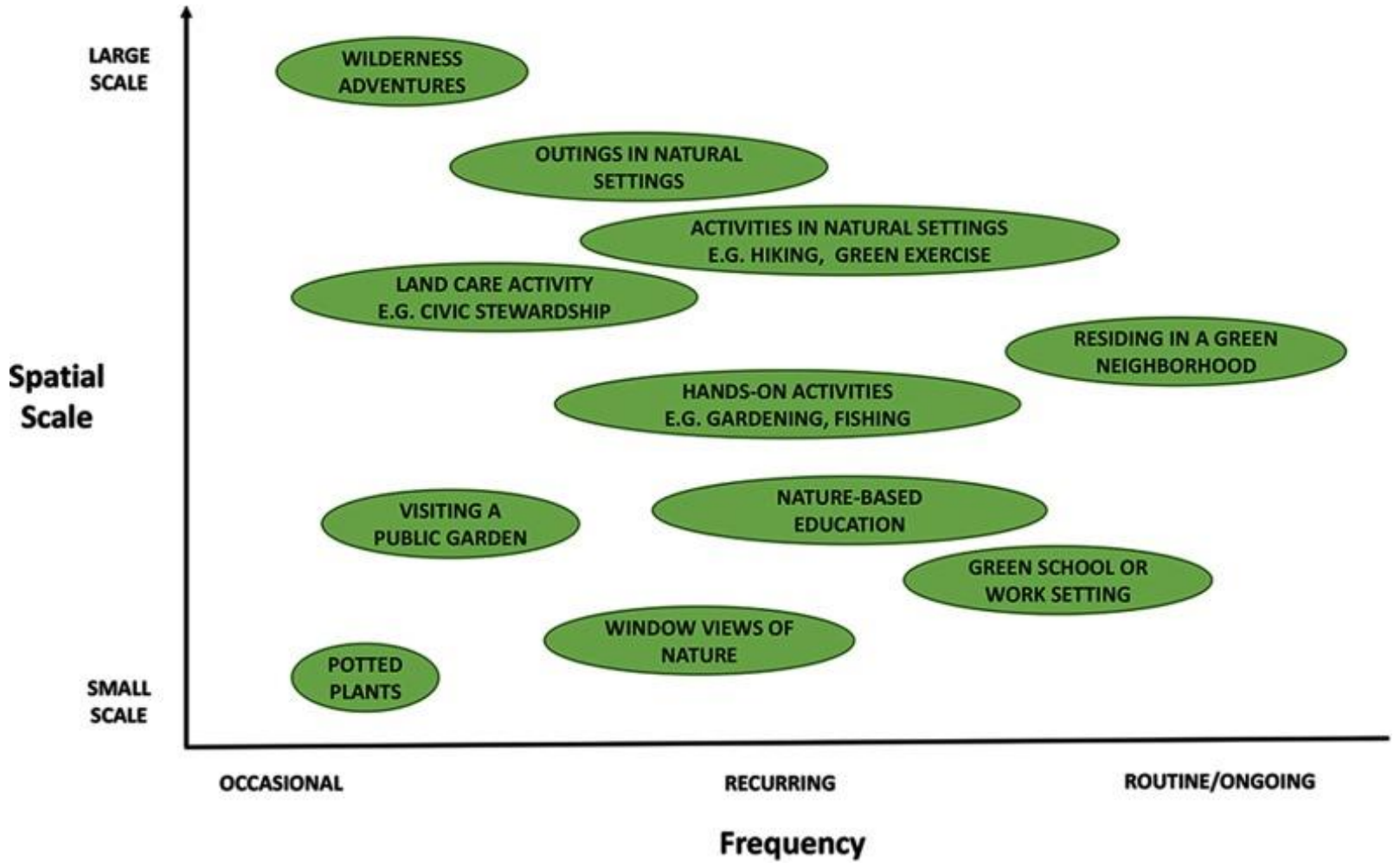
Bita Kash, PhD, MBA, FACHE
Co-Director

Jay Maddock, PhD, FAAHB
Co-Director

HOUSTON Methodist LEADING MEDICINE | TEXAN by NATURE™ | TAMU HEALTH

What is Nature?

Spectrum of nature contact



- Dr. Howard Frumkin – Hagler Fellow with CHN 2022-2025

What parts of nature do we need?

Virtual Nature?

scientific reports

Check for updates

OPEN

Effects of virtual reality v. biophilic environments on pain and distress in oncology patients: a case-crossover pilot study

L. Ashley Verzwyvelt[1], Ann McNamara[2], Xiaohui Xu[3] & Renee Stubbins[4]✉

This pilot study aimed to determine if a biophilic Green Therapy or Virtual Reality environment can decrease an oncology patient's pain and distress while receiving chemotherapy. A case-crossover pilot study was conducted in a comprehensive cancer infusion center. 33 participants with breast, gynecologic, gastrointestinal, pancreatic and prostate cancers were all included in three rooms in a random order at different cycles: control room, Green Therapy room, and Virtual Reality room to receive chemotherapy, respectively. Participants' pain, distress, heart rate, blood pressure, and saliva cortisol were measured before and after infusion in each room. No statistical significance differences were shown in the changes of heart rate, systolic, or diastolic blood pressure, saliva cortisol, pain, or distress before and after infusion between the control, Green Therapy, and Virtual Reality rooms. However, more patients reported the experience as "fun" and "enjoyable" when they were in Green Therapy or Virtual reality room as compared to in the control room. Additionally, since participating in the study, 14 patients reported spending at least 30 min or more outside in nature. In this study, we found that patients' heart rate, blood pressure, and self-reported distress levels were reduced after each biophilic intervention although results are not statistically significant. The study also suggested that biophilic interventions are safe and feasible and may complement the standard of care for oncology patients.

Oncology patients undergoing chemotherapy have a multitude of stressors impacting them during their infusions. These may include travel to appointments, side effects from treatments, anxiety, pain, and distress. Chemotherapy infusions can last up to eight hours and can be an emotionally daunting experience. Because these patients are already dealing with the chronic conditions resulting from their cancer, they are at an increased risk to experience distress compared to other patients. Moreover, 9 out of 10 oncology patients are on narcotics to control their pain; and 50–70% state that their pain is uncontrolled, and fear pain over death[1]. However, patients and providers are recognizing the value of safe complementary and alternative medicine (CAM) to control both distress and pain; especially since the opioid epidemic has made obtaining pain medication a difficult task[2]. Additionally, oncology patients often have unmet psychological concerns that can be difficult to assess[3]; however, several cancer centers use a distress screening tool as a first step. The distress screening tool is given to all new chemotherapy patients. Although we are proactively addressing both pain and distress in our oncology patients, we utilized the opportunity to use nature to manage both of these chronic conditions using safe CAM, specifically utilizing a biophilic Virtual Reality (VR) and Green Therapy (GT).

Virtual Reality allows users to experience computer-generated content and interact with it as they would in a real physical environment[4]. While VR has been around for a few decades now, recent advances have seen a resurgence in interest surrounding VR applications. The advantage of VR is that it enables users to interact with virtual environments in a manner that may not be possible in the real world. VR can create a realistic sense of "presence" within the computer-generated environment. The user is fully immersed in a three-dimensional (3D) virtual world that can be modeled to evoke a sense of place, including natural features and systems (e.g., forests, oceans, lakes, mountains). The use of VR as a treatment is growing. Research has shown improvements

[1]Houston Methodist Hospital, Cancer Center, 6445 Main St., 24th Floor, Houston, TX 77030, USA. [2]Department of Visualization, Texas A&M University, 3137 TAMU C108, College Station, TX 77840, USA. [3]Department of Epidemiology and Biostatistics, Texas A&M University, 212 Adriance Lab Road, College Station, TX 77843, USA. [4]Houston Methodist Hospital, Cancer Center Infusion, 6445 Main St., 21st Floor, Houston, TX 77030, USA. ✉email: restubbins@houstonmethodist.org

Hospital Patients

- Who viewed natural signs through their windows:
  - Recovered faster
  - Less time in hospital
  - Less pain killers
  - Less post-op complications

- Urlich, 1984

Effect of exposure to daylight on patients

- Patients experienced less pain, stress, and use of pain medication than patients who did not have exposure to natural light

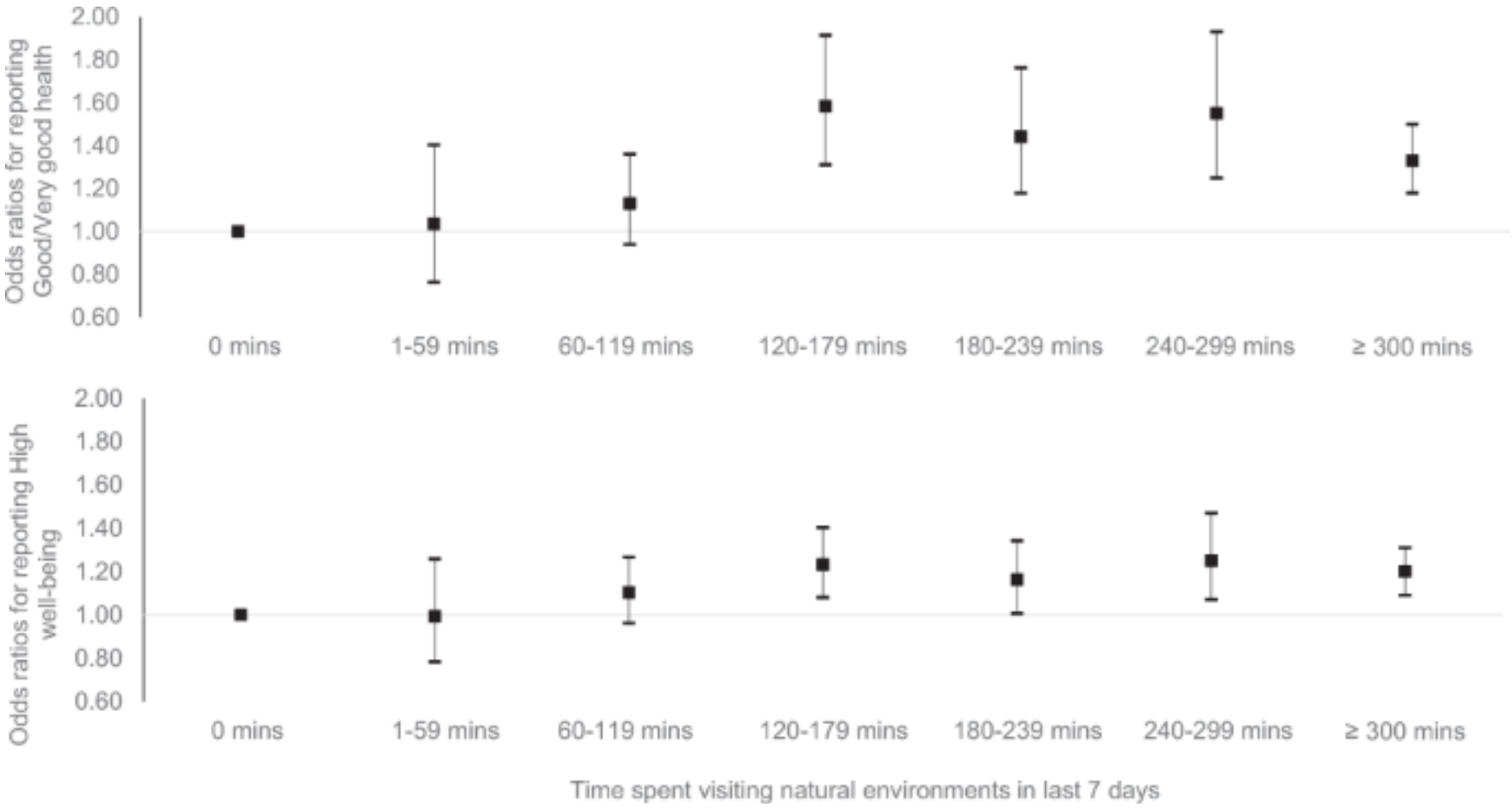
Hospital garden research

- Preliminary evidence that hospital gardens can alleviate stress in both patients and their families

Health care facility design research

- Evidence that exposures to natural environments have a positive effect on pain, stress, anxiety, blood pressure and heart rate

White et al., 2019



> High residential exposure to green spaces is associated with an 8% lower risk of all-cause mortality (Gascon et al. 2016)

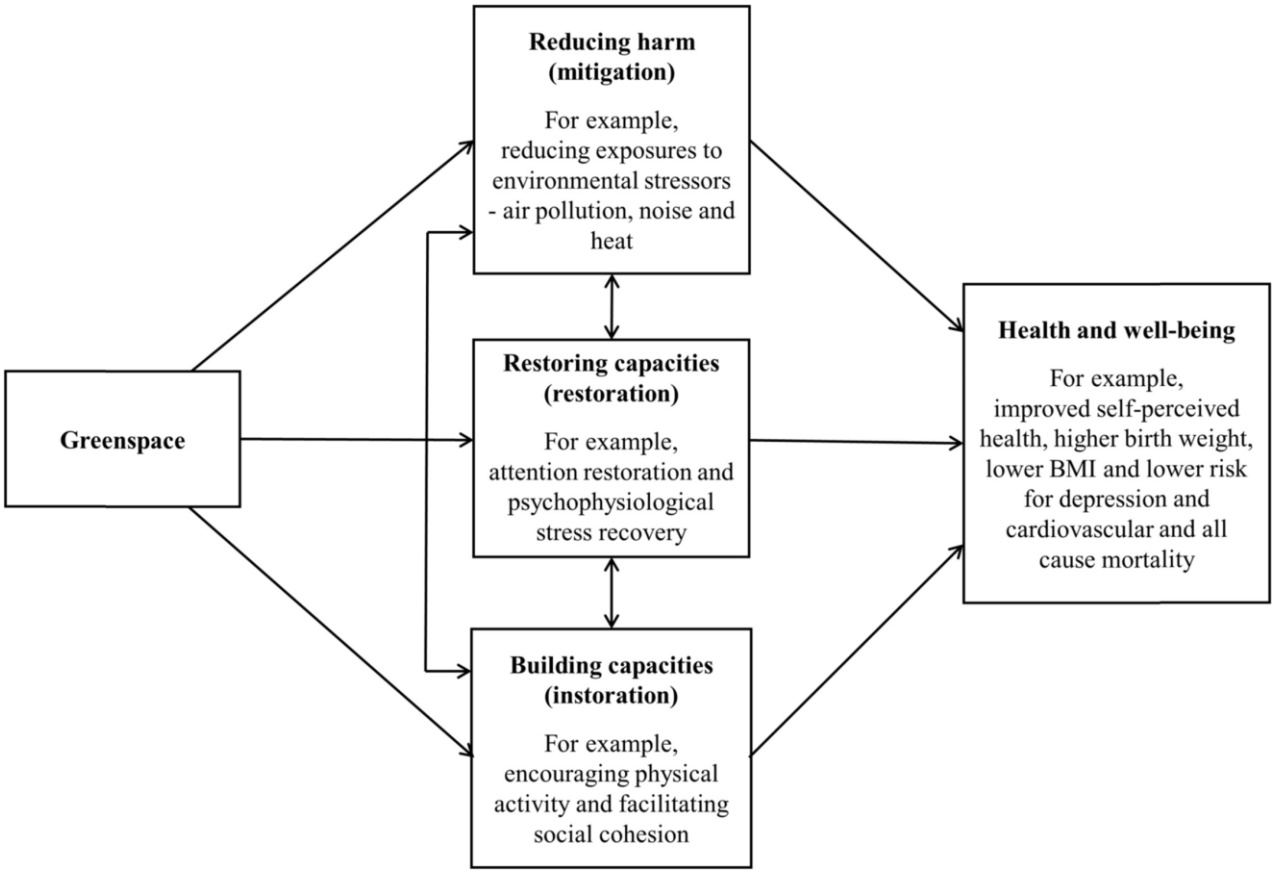
Benefits of nature on human health

- Reduced stress
- Better sleep
- Improved mental health (reduced depression and anxiety)
- Greater happiness, well-being and life satisfaction
- Reduced aggression
- Reduced ADHD symptoms
- Increased prosocial behavior and social connectedness
- Improved immune function
- Improved general health (adults, children, cancer survivors)
- Lower blood pressure
- Improved postoperative recovery
- Improved birth outcomes
- Improved congestive heart failure
- Improved child development
- Improved pain control
- Reduced obesity
- Reduced diabetes
- Better eyesight
- Reduced mortality

Frumkin et al., 2017


NatureDose™
Download on the App Store
GET IT ON Google Play
9:41
Welcome to NatureDose
Better Health. Right Outside.
A personalized nature prescription tracker to help you optimize the benefits of time outdoors.

Pathways linking nature to health



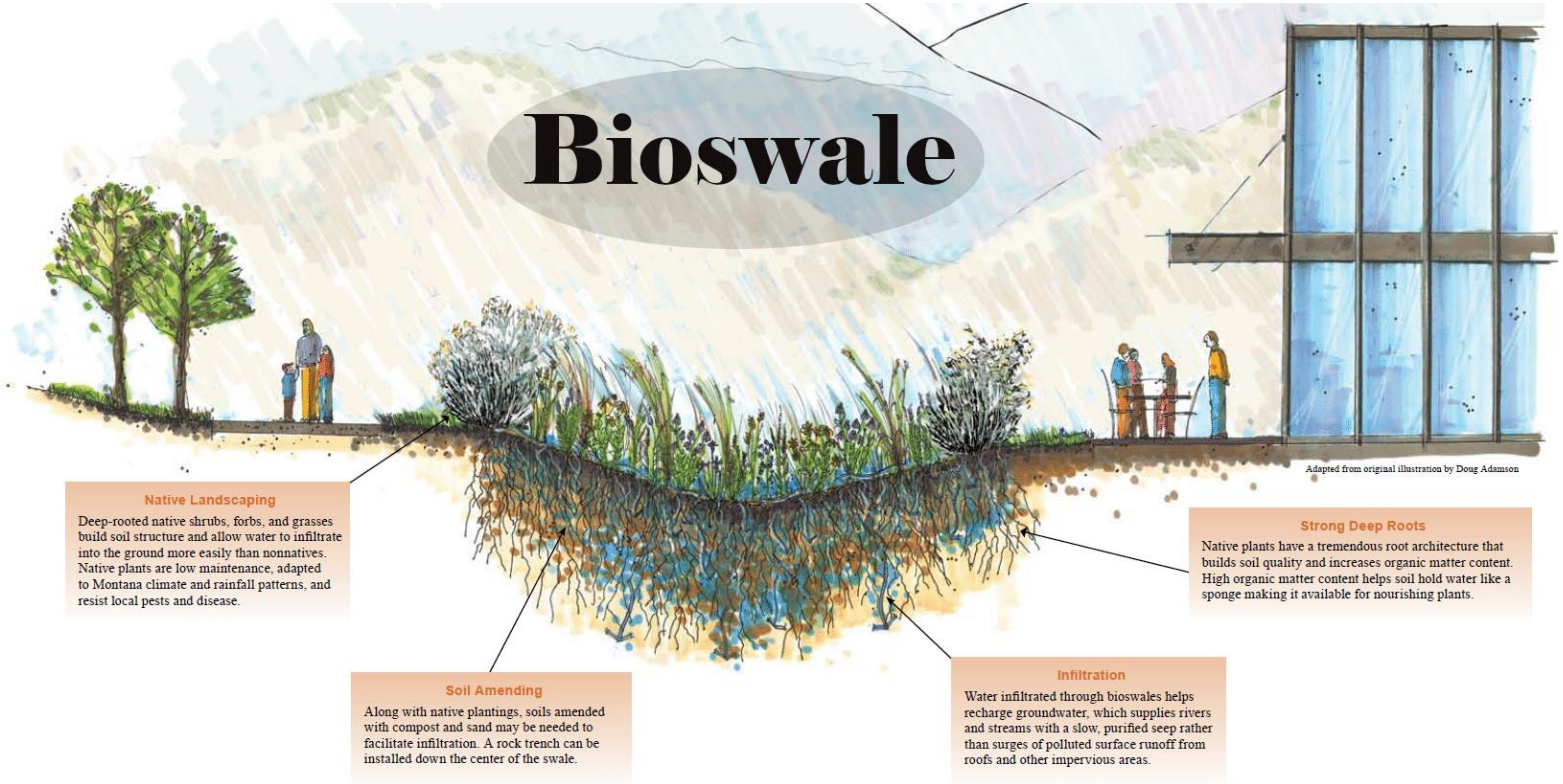
Markevych et al., 2017

Reducing Harm

- Increasing green spaces in our urban areas has a direct effect on improving the environment.
- Green spaces typically have lower air pollution levels than other urban areas and may help remove harmful particles from the air.
- Urban green space can also reduce the heat island effect making cities cooler and increasing airspeed. Green spaces can reduce noise levels by 5-10 dBs and supply psychologically beneficial natural sounds.
- Green infrastructure can help reduce flooding during hurricanes and other storm events.

Hurricane Harvey, Houston, TX 2017

Green Infrastructure



Trees and Degrees

DESIREE RIOS FOR THE NEW YORK TIMES

An open fire hydrant at 101st Street and First Avenue in East Harlem provided a little relief on a very hot day this month.

To Measure Inequality, Map the Trees in a City

By JOHN LELAND

On a Saturday in July, Octavia Jones recalled the day in June when the temperature hit 103 in the South Bronx, and her entire neighborhood seemed to take refuge in the spray from an open fire hydrant, staying until a thunderstorm swept the heat away.

It was that kind of summer, Ms. Jones said, when the weather changed so suddenly that she developed a novel hack for managing the heat. "Every time we drive past a fire hydrant," she said, "I try to open the windows so the kids get wet."

On this July afternoon, Ms. Jones, a Pentecostal minister, was driving along a computer-generated route — windows closed — as part of a "citizen scientist" project to map the way heat pooled in certain sections of New York. Nine cars drove simultaneously along different routes in Upper Manhattan and the South Bronx, each bearing a sensor that measured air temperature and humidity once per second.

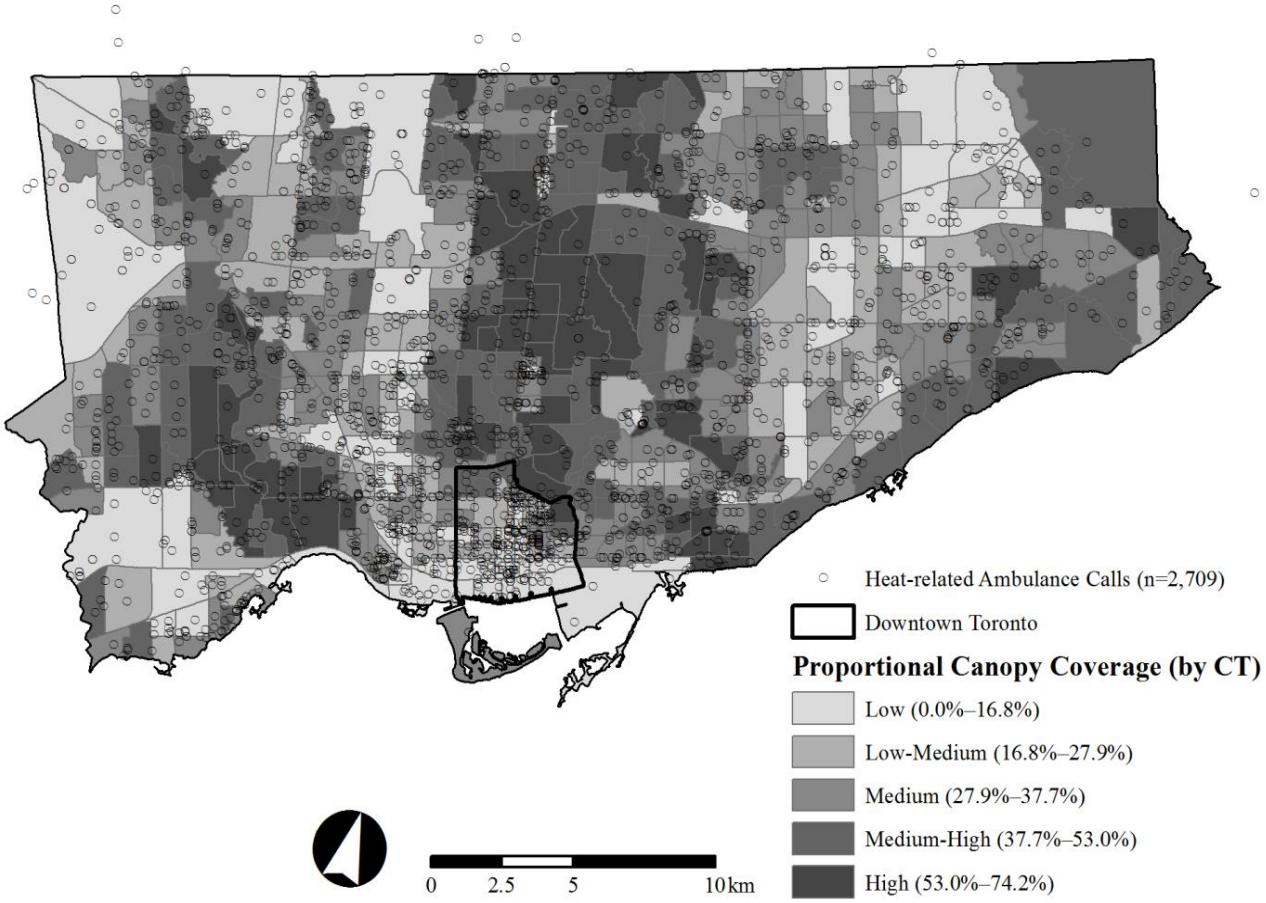
Data from the project, which an infrared thermometer to record surface temperatures on the Upper West Side of Manhattan, as well as in East Harlem and the South Bronx. On the tree-canopied block of West 94th Street near Central Park in Manhattan, the sidewalk temperature was 84.

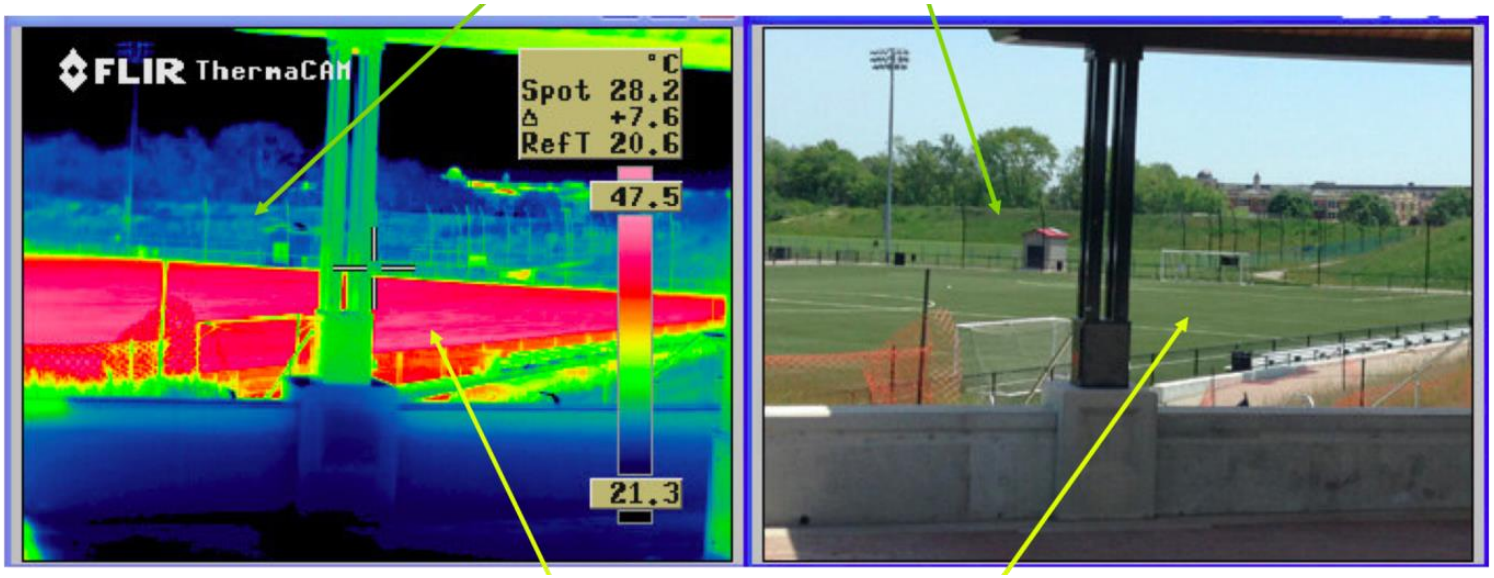
Plants and trees cool a neighborhood by providing shade, of course, but also by a process called transpiration: As water evaporates from the leaves, its transformation into vapor consumes heat from the atmosphere.

Just across town, at a treeless lot for sanitation trucks on First Avenue in East Harlem, the blacktop registered at 115 degrees, a full 31 degrees hotter.

Sonal Jessel, a public health specialist and the director of policy at We Act, an environmental justice organization in Upper Manhattan, often refers to the lot when conducting heat tours of East Harlem, pointing out the shortage of trees and green space compared with the neighboring Upper East Side. It was important to see heat as a multiplier of other health risk factors, Ms. Jessel

Health during extreme heat events

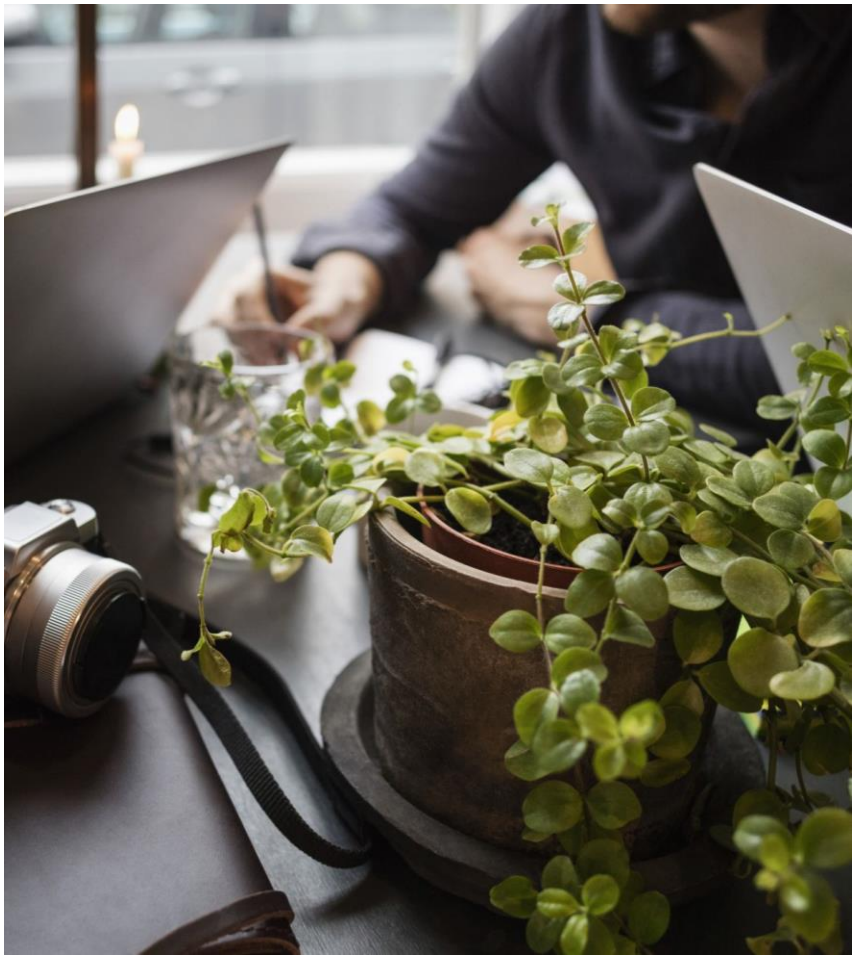




artificial turf

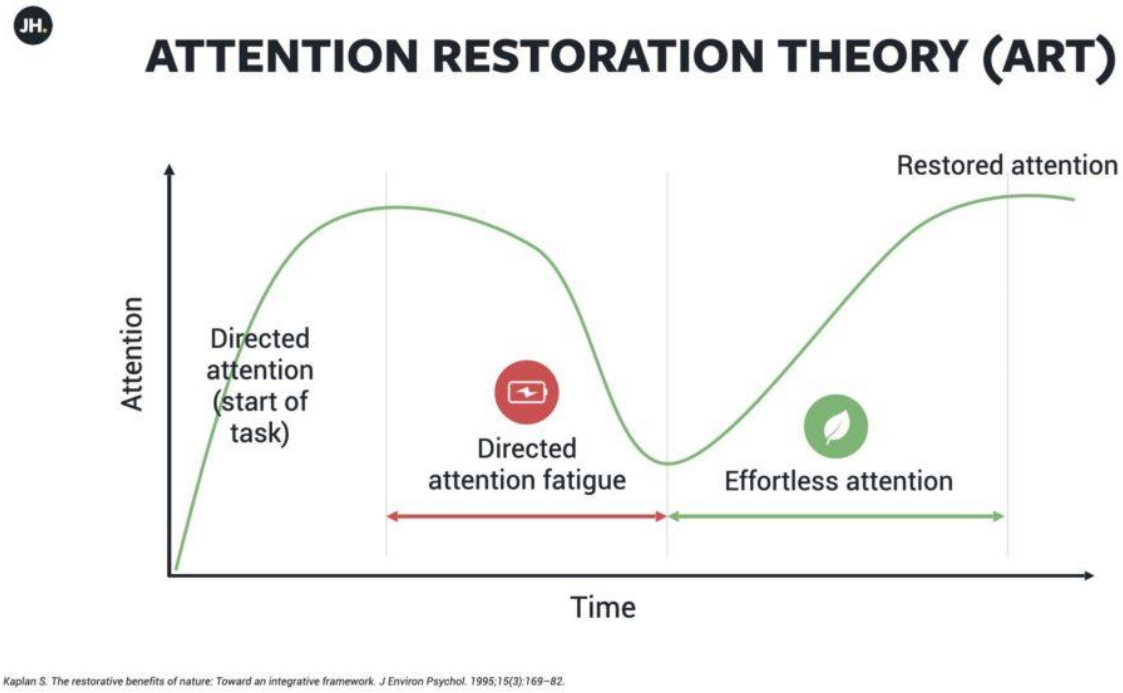
Terrestrial radiation is invisible but can make a person feel very hot. **47C = 115F**

Restoring Capacities

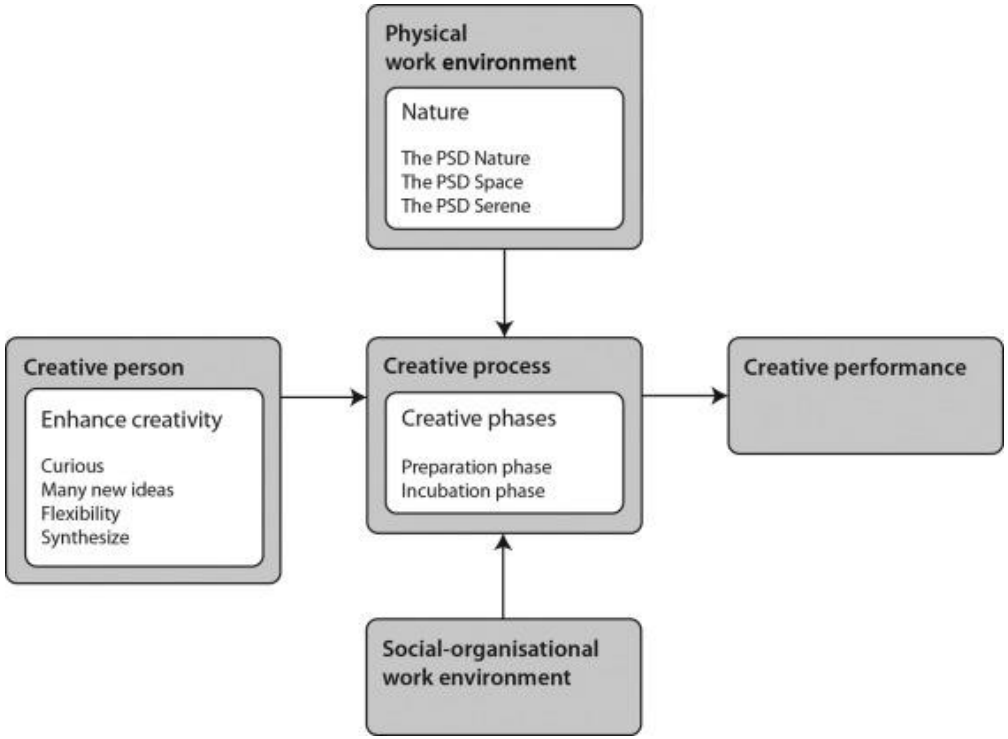


- Nature reduces stress and improves attention.
- Nature may reset our attention abilities – studies have examined office workers and students who have spent time in a natural environment and this exposure showed increased time on task and attention to detail, as well as improved cognitive functioning.
- Improvements in creative tasks have also been demonstrated.

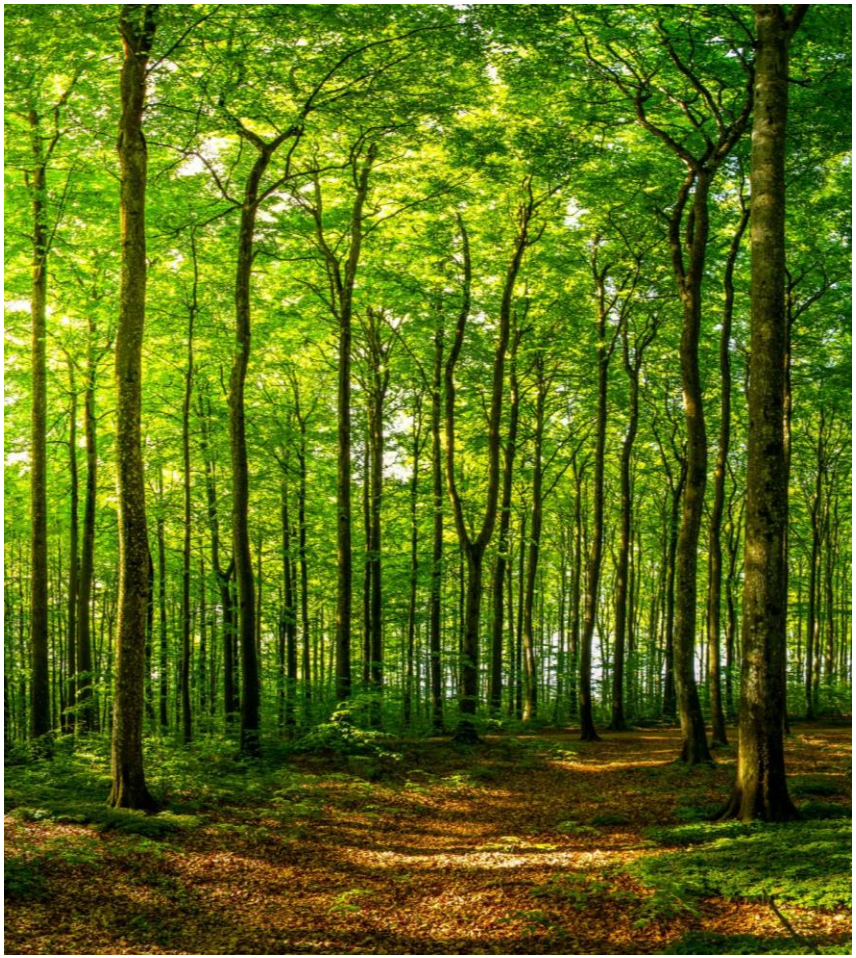
Attention Restoration Theory



Nature enhances creativity



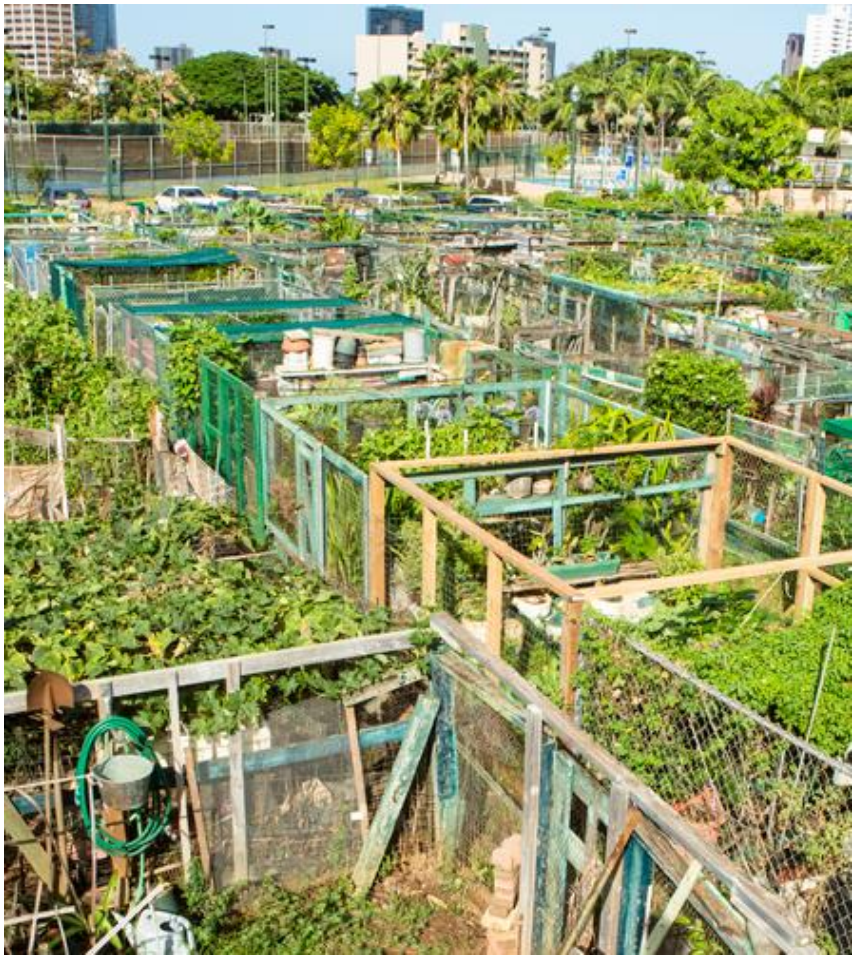
Building Capacities



- Not only can nature restore us, but it can also promote health by encouraging physical activity and improving relationships in our communities.
- Certain types of green space including parks, walking and hiking trails, and green schoolyards have been found to improve physical activity and potentially increase its benefits.
- Access to green spaces can increase social cohesion, a measure of neighbors knowing and trusting each other.

Community Gardens

- People who garden tend to eat more fruits and vegetables
- Reduce exposure to pesticides
- Increases physical activity & reduces stress
- Increase property value



Playground with greenspace for children

- Increased vigorous physical activity
- Decreased sedentary
- time
- Fewer fights

Leisure-time Physical Activity in Public Parks in Diverse Communities

Floyd, Spengler, Maddock et al., 2008

70% Sedentary in Tampa compared to 51% sedentary in Chicago

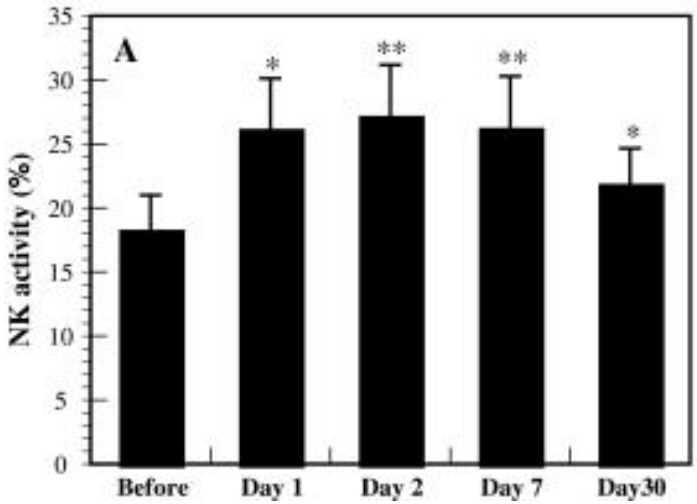
China and Park Use

- We observed 75,000 people in parks when the same amount of observations in Chicago yielded only 5,000 people
- More than half of park users were older adults compared to less than 10% in the US

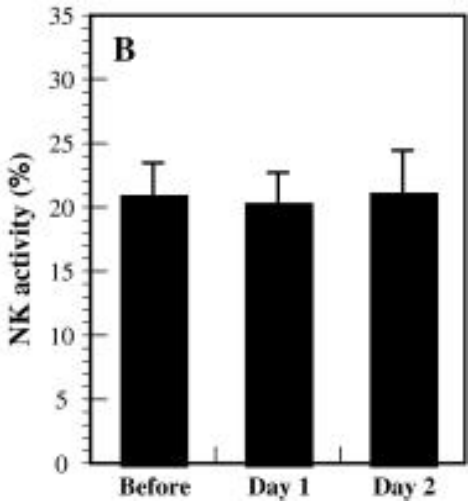
Hong et al., 2015

Forest Bathing and NK Cells

3 day, 2 night trip to the forest

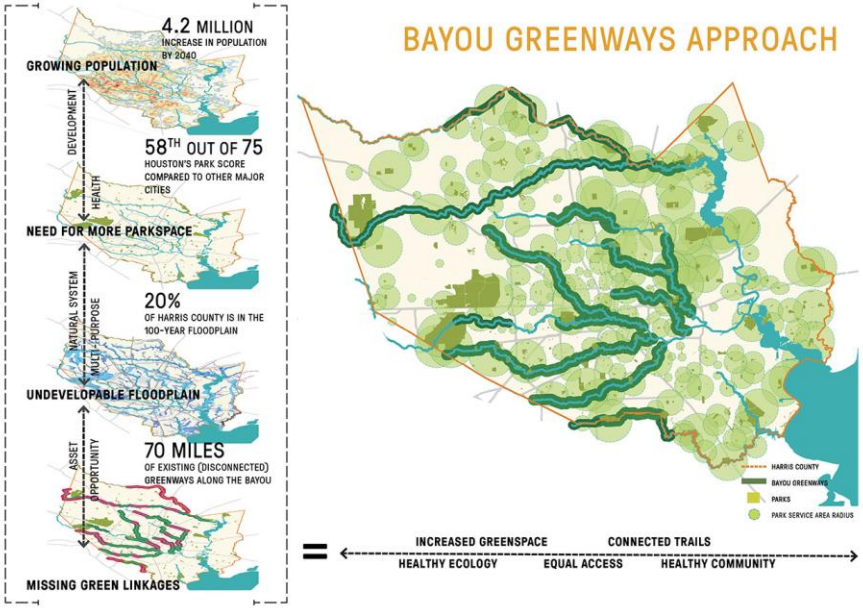


Trip to the City



Increasing Access to Nature

150 miles of trails. 3,000 acres of greenspace. A $220 million public-private partnership. One shared vision for parks that brings us closer to each other and creates equitable access for all.

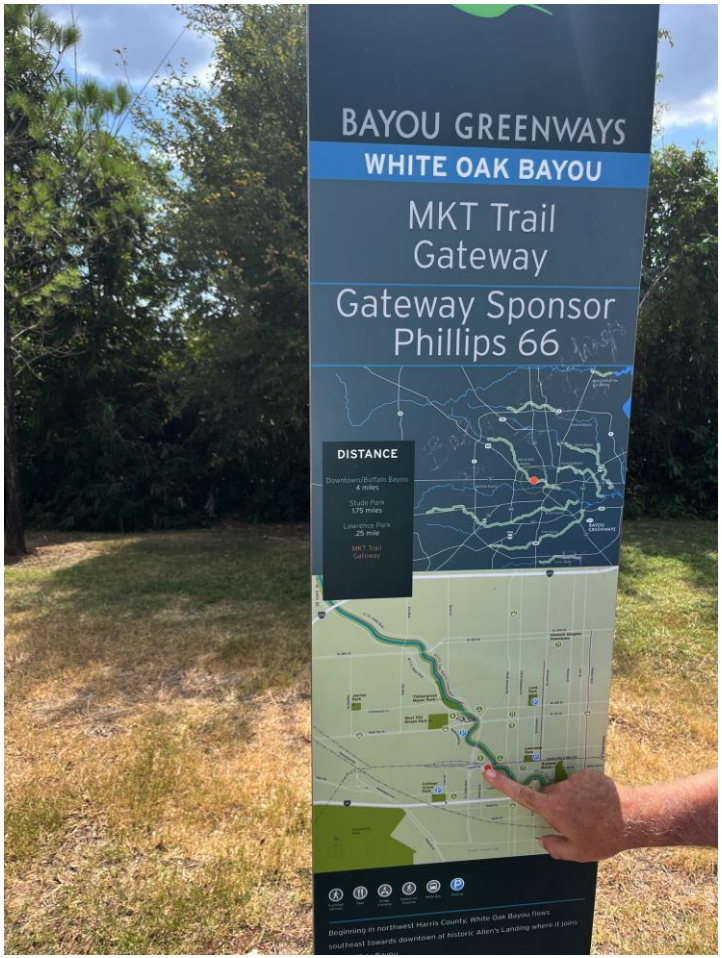


Bayou Greenways Trails

Zip codes > 30% of the population living within a 10-minute walk of the trail had:

- 93% reduction in obesity related admissions
- 77% reduction in Ischemic Heart Disease Admissions
- 71% reduction in heart attack admissions

Bayou-Greenways Phase II



- Focused on health equity
- Who uses the trails?
- Observations
- Intercept Surveys
- Cell Phone Tracking

Texas Landscapes

Inspiration Grove

Living Laboratory

Security cameras can be strategically located throughout the rooftop garden to not only provide safety measures, but to also broadcast a live feed of garden activity for patients who are not able to physically use the garden.

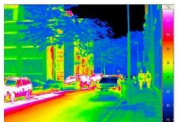
Patients with critical health conditions can still feel involved with what is going on in the garden by having the cameras displayed on the screens in their rooms.

Houston Methodist can find unique ways to involve these patients with special events throughout the year and the holidays.

The cameras can also serve another significant purpose by using infrared technology to scan the healing garden throughout each day to monitor which parts of the garden are being used the most or which areas are becoming too warm for patients.

This data can provide useful information for future healing gardens to show what specific features of the garden tends to be successful and attract more patients.

This technology could be combined with other data collection strategies to create a data base for recording how long users are in the garden, which users are going where, and what features are attracting them the most.



- Founded by Dr. David Sabgir

- With an aim to make hope and health accessible to everyone around the world, our doctor-led walking groups are a safe, fun, and FREE place to get some steps, learn about health, and meet new friends. Join us by attending a walk near you, or let us help you start a walking program with your local doctors, medical students, or health professionals.


Park Rx America
www.ParkRxAmerica.org
Ask your doctor for a park prescription today!
Obesity costs the U.S. $190 billion each year.
Being obese puts a person at greater risk for chronic illness, including coronary heart disease, high blood pressure, stroke, type 2 diabetes, cancer, and reproductive problems.
29 million Americans suffer from diabetes and are at higher risk of heart disease, stroke, blindness, kidney failure, and lower limb amputation.
Coronary heart disease is the leading cause of death for both men and women.
15.7 million adults reported having at least one major depressive episode in the past year.
GET IT FREE!
Outdoor activity improves both mental and physical well-being more than indoor activity.
Spending time in nature is associated with better cognitive development in schoolchildren.
The closer we are to green space, the less we suffer from cardiovascular, musculoskeletal, mental health, respiratory, neurological, and digestive diseases.
Diabetics who spend more time in nature are more physically active and show better blood sugar control.
Spending more time in parks translates to being more physically active.
Spending time in nature helps to decrease high blood pressure.
Spending time in nature decreases anxiety and negative thinking and lowers levels of depression and stress.
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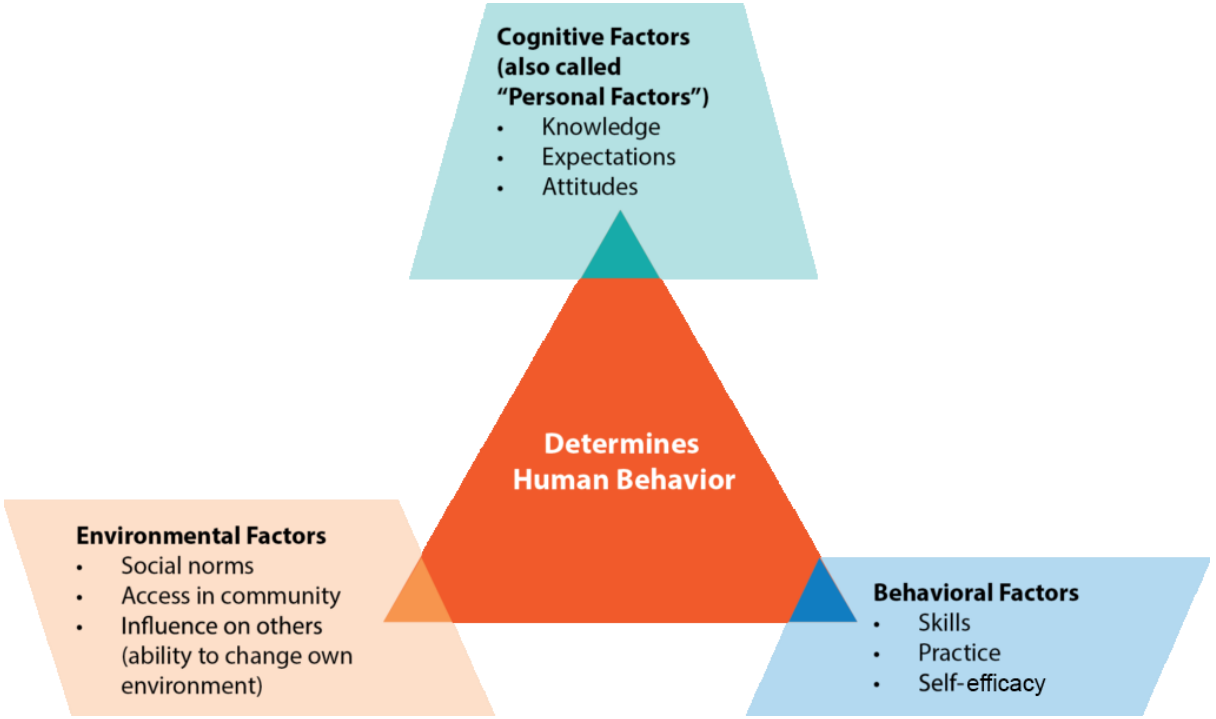
Social-Cognitive Theory



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BMC Psychology

RESEARCH Open Access

Development and validation of self-efficacy and intention measures for spending time in nature

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Abstract

Purpose: The purpose of this study was to develop and evaluate the reliability and validity of self-efficacy and intentions measures for time spent in nature (TSN). TSN is related to improvement in psychological well-being and health, yet most American adults spend very little time in such settings. Theory-based interventions have been effective in increasing physical activity, a related behavior, and may be one mechanism to increase TSN. Self-efficacy and intentions have been shown to be strong predictors of health behaviors and are used across several theories. However, scales to measure these factors have not yet been developed and are needed to facilitate effective interventions.

Methods: TSN self-efficacy and intentions scales were developed using a sequential nine-step procedure: identification of the domain and item generation; content validity; pre-testing of questions; sampling and survey administration; item reduction; extraction of factors; tests of dimensionality; tests of reliability; and tests of validity. The 14-member multidisciplinary, researcher and practitioner investigative team generated 50 unique items for self-efficacy and 24 unique items for intentions. After subjecting items to content validity and pre-testing, item sets were reduced to 21 assessing self-efficacy and nine assessing intentions. A nationwide sample of 2109 adult participants (49.7% female, Mean Age = 58.1; 59.8% White, 18.4% Hispanic, 13.3% Black) answered these items via an on-line survey.

Results: Using split-half measures, principal components analysis indicated a one-factor solution for both scales. The factor structure was upheld in confirmatory factor analyses and had high internal consistency ($\alpha = .93$ self-efficacy; .91 intentions). The scales were moderately correlated with each other ($r = .56$, $p < .001$) and were strongly related to TSN with large effect sizes ($eta^2 > .20$).

Conclusions: The study resulted in reliable and valid self-efficacy (14 items) and intentions (8 items) scales that can be used to develop future theory-based interventions to increase TSN and thereby improve population health.

Keywords: Social Cognitive Theory, Health promotion, Nature, United States

Introduction

Relationship of nature to health

A body of evidence from various disciplines has demonstrated the myriad ways in which nature contact is associated with physical and mental health [1–3]. These findings include investigations of visits to a variety of different types of nature, from urban greenspace to large forests outside of city limits, residential and community

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Greenspace and Child PA

- 2006-2008 Bristol, UK
- 10-11 years with accelerometers and GPS
- 13% time outside, 2% in greenspace
- 35% of MVPA while outside
- 9% of boys MVPA and 6% of girls while in greenspace

Wheeler et al., 2010

Older adults, greenspace & PA

Longitudinal study of 15,672 older adults across 7.5 years in the UK

Neighborhood greenspace was linked to a slower decline in PA

Dog walking may be an important mechanism

Dalton et al., 2016


COVID-19: SOCIAL DISTANCING IN PUBLIC PARKS AND TRAILS
Do not use parks or trails if you are exhibiting symptoms.
Be prepared for limited access to public restrooms or water fountains.
Share the trail and warn other trail users of your presence and as you pass.
Follow CDC's guidance on personal hygiene prior to visiting parks or trails.
Observe CDC's minimum recommended social distancing of 6' from other persons at all times.
NRPA

Remaining Questions

- Mechanisms - why does it work?
- Dose needed & dose response
- Promoting equity
- And many more!

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Howard Frumkin
Senior Vice President, Trust for Public Land
Hagler Fellow, Texas A&M University
Professor Emeritus, University of Washington

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