

# **Urban Sustainability and Health**

## The Search for Co-Benefits

Charles Branas

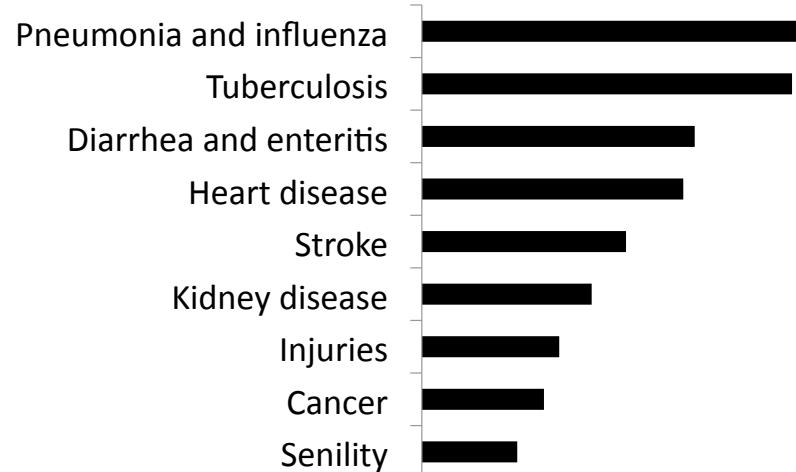
University of Pennsylvania

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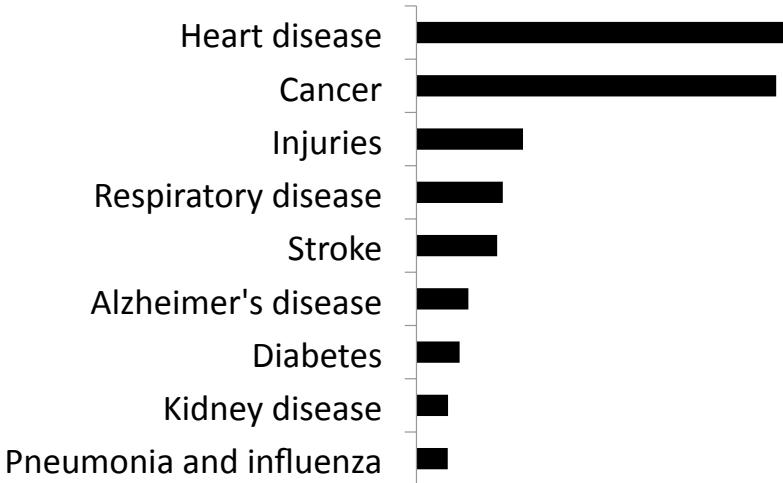


# “Health is not merely the absence of disease”

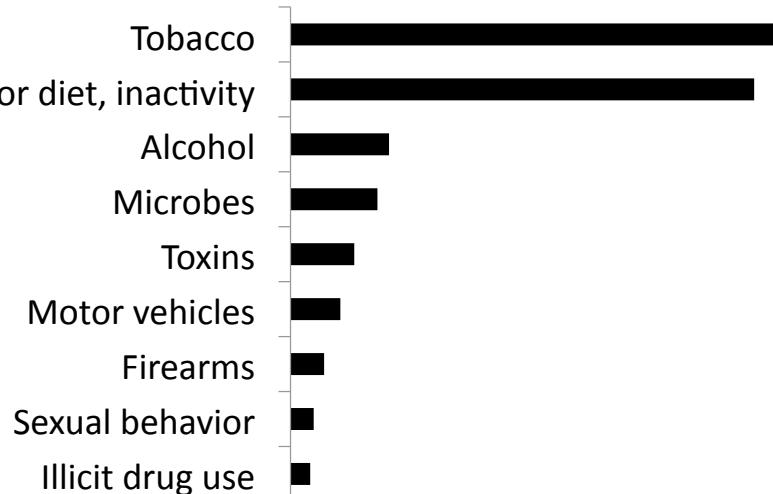
**Leading Causes of Death, 1900**



**Leading Causes of Death, 2010**



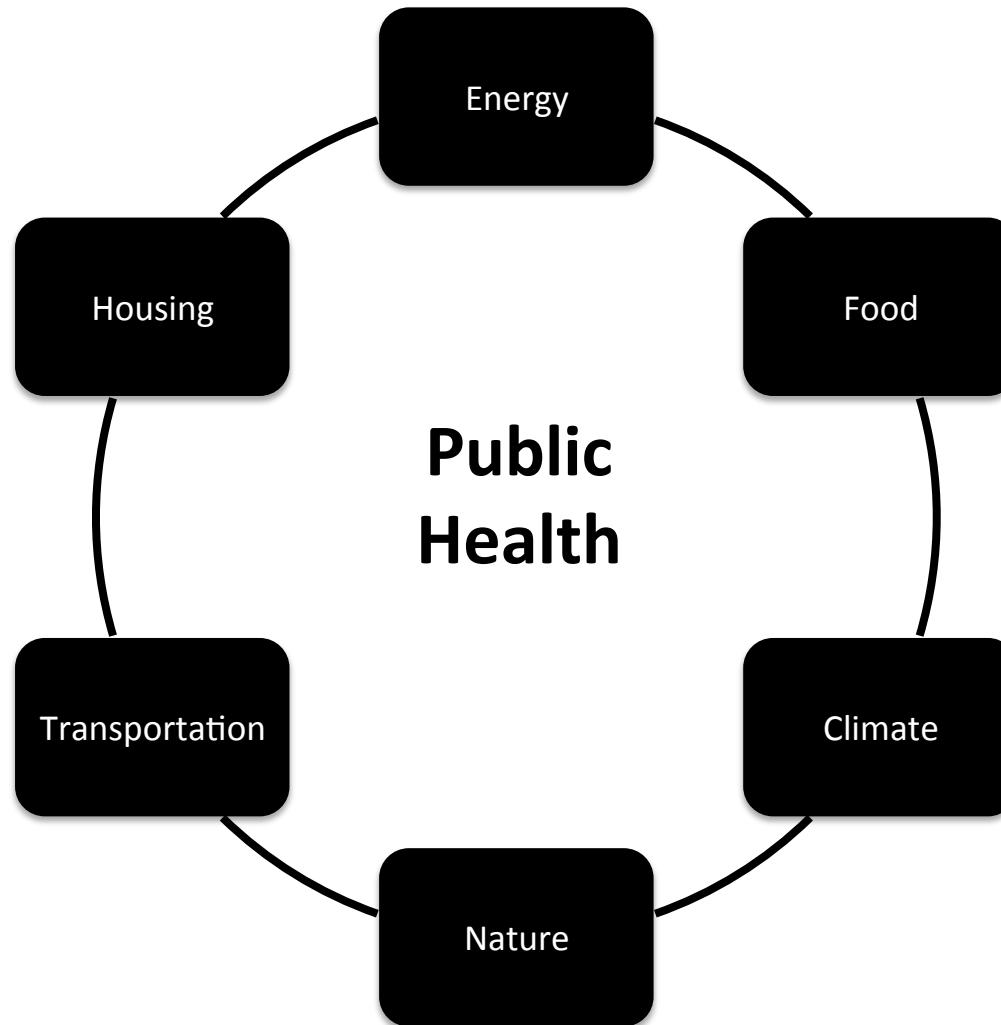
**Actual Causes of Death, 2000**



U.S. rates  
per 100K



# Dimensions of urban sustainability and potential health co-benefits



# Energy and health co-benefits

- Cities create 70% of global greenhouse gas emissions
- Electricity, particularly from coal combustion, is a large and increasing contributor to GHG emissions and air pollution
- Air pollution produces childhood pneumonia, asthma, COPD, cardiovascular disease, and lung cancer
- Electricity also one of the greatest contributors to health
- Potential Initiatives
  - Policies to reduce coal combustion
  - Energy-efficient buildings, land use, and transport systems also promote active living
  - Strategies to promote cool cities such as tree plantings to shade buildings and cool the air
  - Health facilities often have extremes of very high, inefficient energy consumption



# Food and health co-benefits

- Food production associated with overconsumption of saturated fat (largely from animal products), or the misuse of certain veterinary drugs may produce human obesity, coronary heart disease, stroke, cancer, and diabetes
- Animal products and processed foods affect health and environment via water, air pollution, and deforestation.
- Ruminant meat production generates substantially more greenhouse gas emissions per protein unit than plant or poultry-based protein sources, as well as excess methane emissions
- Potential Initiatives
  - Change the scale, concentration and manner in which food animals are produced, including including the use of antibiotics and arsenical drugs
  - Raise awareness of alternative, sustainable methods of food production and access for cities in the context of regional farmers, e.g. aquaculture, local produce
  - Improve community food systems via increased access to low-cost, healthy food
  - Alter food opportunities and rezone “fat traps” that are designed into daily urban living
  - Health benefits of urban farming has yet to be established

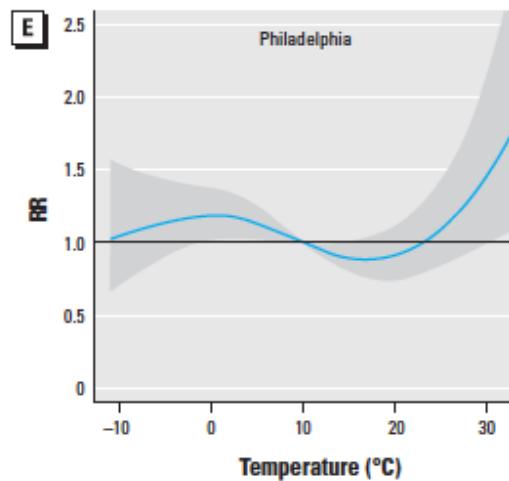
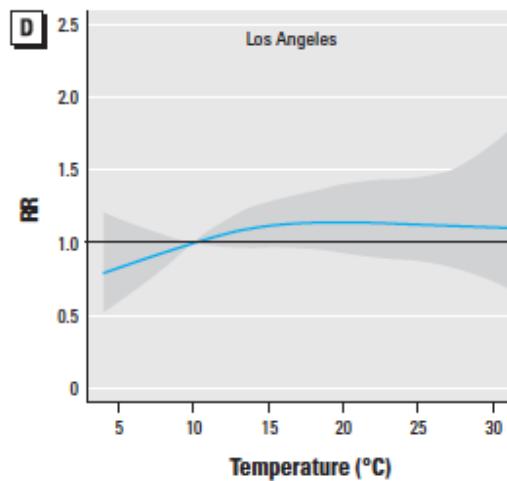
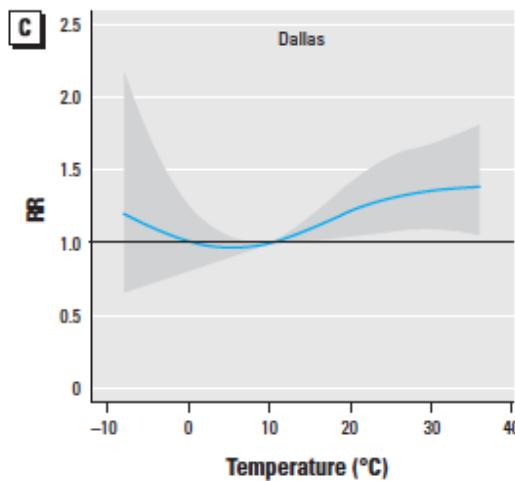
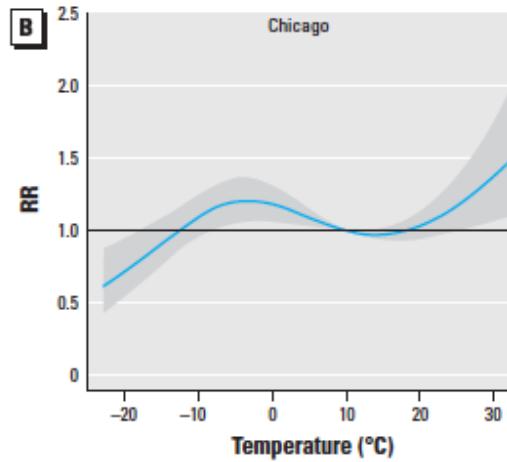
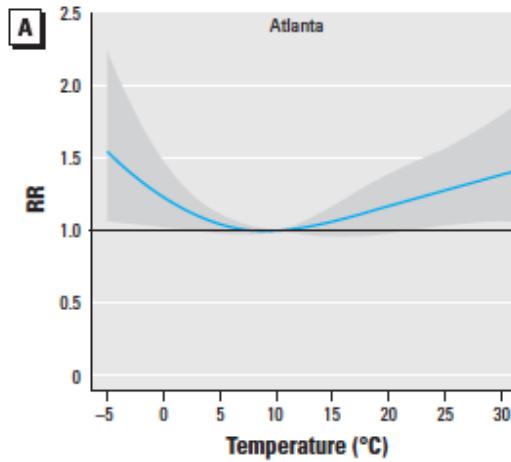


# Climate and health co-benefits

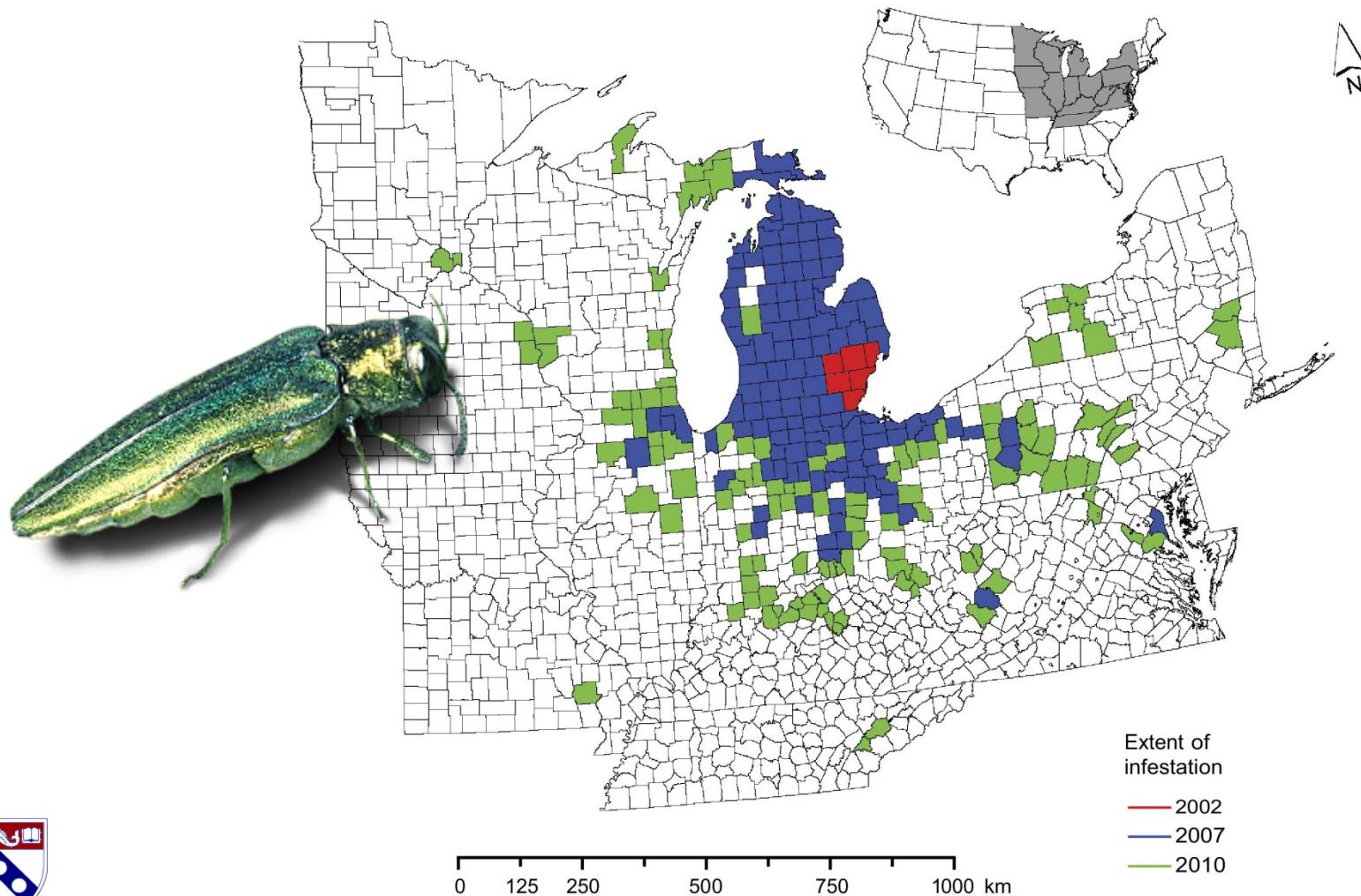
- Cities vulnerable to flooding due to impervious surfaces and sea level rise
- Cities also vulnerable to heatwaves, the biggest cause of US weather-related death, more than hurricanes, lightning, tornadoes, floods, and earthquakes combined
- About 700 US heat-related deaths a year expected to double by 2050 in cities
- Urban ‘heat islands’ - reduced vegetation, increased impervious, dark-color roads and rooftops add up to 10°F
- Higher temperatures may also increase kidney stone risks in cities
- “Cool Cities Initiative”
  - Roofs and pavements with reflective and lighter colored materials
  - Green roofs, pavement breaking, and tree plantings, aid in storm water management and provide shade
  - Reflective enhancements and new vegetation could reduce heat-related mortality by 40 – 99%
  - Also reduce exposure to UV radiation, skin cancer, eye disease
  - Also reduce certain crimes via beautification
  - Also reduce energy demand, greenhouse gas emissions, and air pollution



# Kidney stones and heat



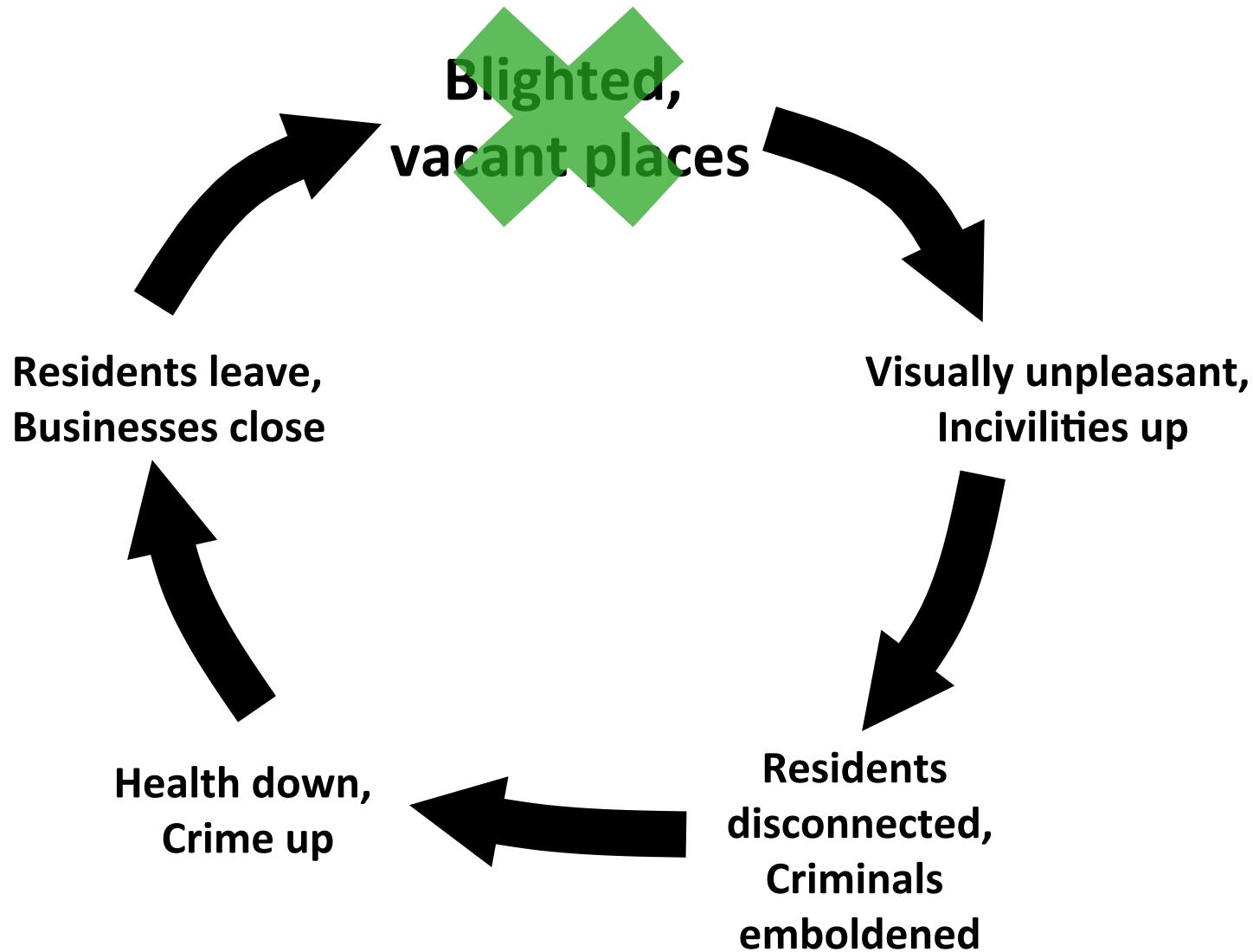
# EAB beetle kills 100 million trees, cardiovascular & respiratory deaths increase



# Nature and health co-benefits

- Urban ‘heat islands’ and heat-related deaths from reduced vegetation and impervious surfaces
- Correlational evidence that absence of nature and vegetation increases all-cause mortality and mortality from cardiovascular disease, respiratory illness, cognitive deficits, mental illness, and social anomie
- Natural experiments showing that exposure to nature and vegetation decrease stress, heart rate, inactivity, and violent crime
- Potential Initiatives
  - “Cool Cities Initiative” aid in storm water management, provide shade, reduce heat-related mortality, exposure to UV radiation, skin cancer, eye disease
  - Land banks and greening of blighted urban land lead to less stress, inactivity, and violence
  - Create appealing locations that encourage outdoor physical activity potentially increasing vitamin D, melatonin production, cognitive function, and social cohesion among members of local community
  - Land banks and greening of blighted urban land leads to local economic development
  - Potentially reduced energy demand, greenhouse gas emissions, and air pollution





# Vacant Lot Greening

## “Park of a Thousand Pieces”



Before



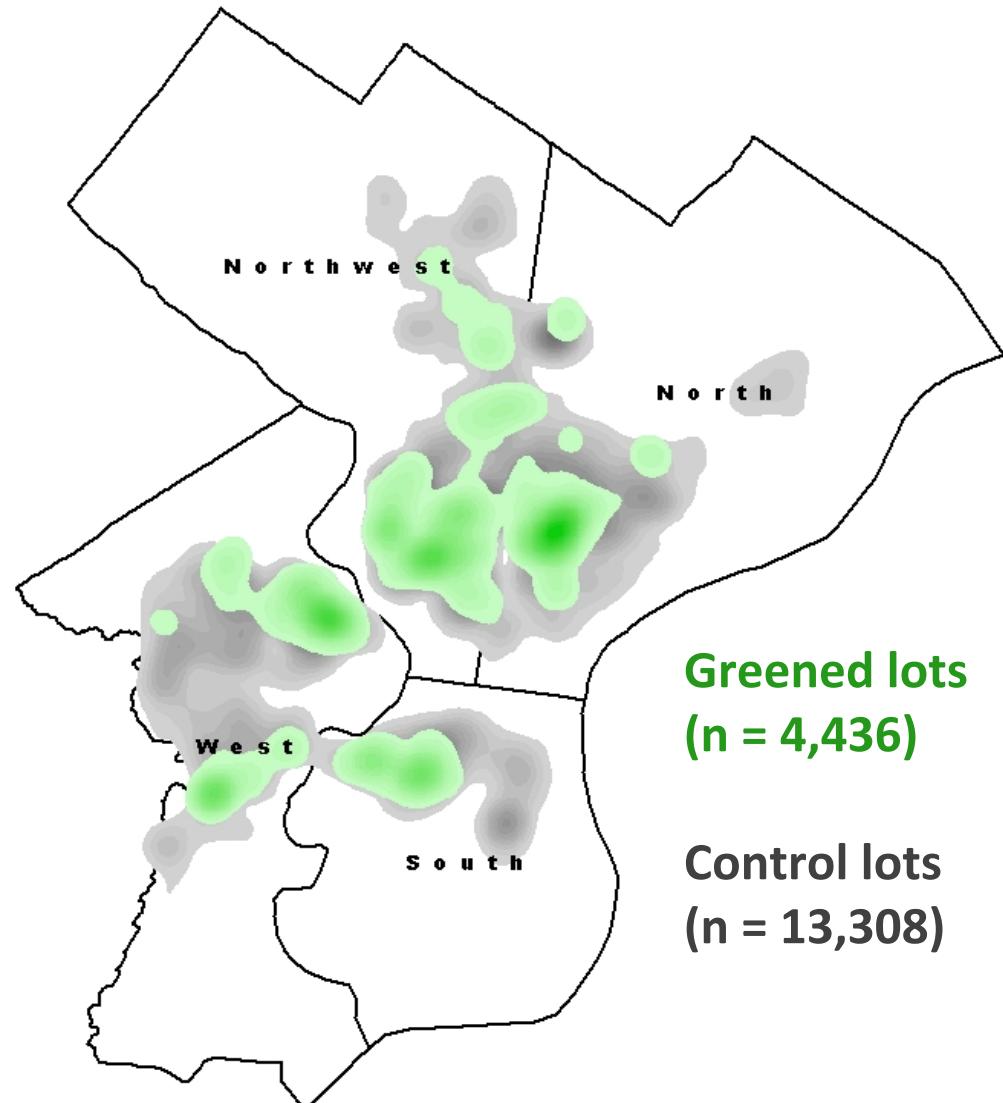
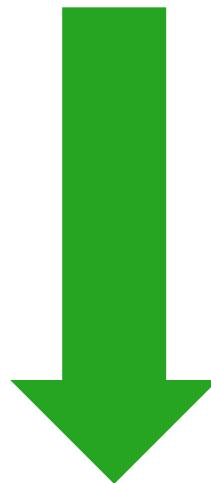
After



# Difference-in-differences:

## About 8 million ft<sup>2</sup> greened, 1999-2008

- Gun assaults
- Vandalism
- Stress
- Inactivity



# Walking Trial



**Significant drop in heart rate when in view of newly greened lots**



# Randomized community trial

many health outcomes

Random selection:

$\approx 600 / 30,000$   
vacant lots

Random assignment:

- Cleaning + Greening + Maintenance
- Cleaning + Maintenance
- Control lots



# Transportation and health

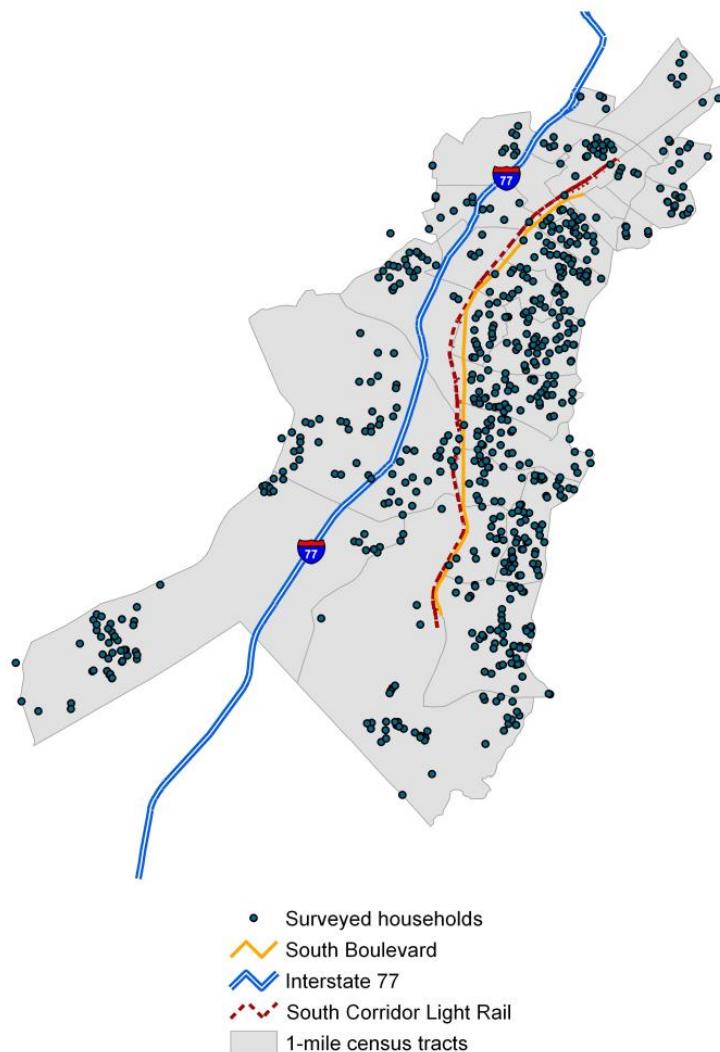
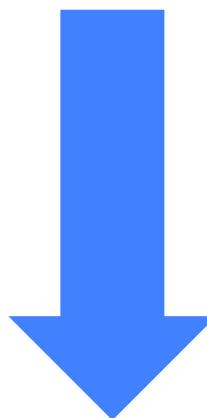
- “Cars are the new tobacco” - private cars linked to physical inactivity, obesity, death and injury from crashes, cardio-respiratory disease from air pollution, noise, community severance and climate change
- Bad metropolitan design decisions and horizontal expansion of cities (urban sprawl) have reinforced car dependence, with ownership and use greatly increasing in recent decades
- New employment opportunities typically in low-density edge-of-town business parks predicated on high car use
- Potential initiatives
  - Reduce GHG emissions and improve health through more compact, efficient co-design of housing, employment and transport, capitalizing on high urban population densities
  - Efficient public transport and safe walking and cycling networks, combined with regulatory restrictions on high-emission vehicles
  - Active travel - elimination of short car trips (<5 miles) by walking or bicycling could improve air quality, health, and safety and save billions \$ each year
  - Taking public transport is about one day of exercise a week and has been shown to reduce obesity and BMI
  - Roadway redesign, “road diets” greatest contributor to safety and injury prevention
  - “Driving ambivalence” among millennials who are returning to cities



# Light rail

660 rail riders and 660 car drivers, before-after installation

- BMI
- Obesity
- Inactivity

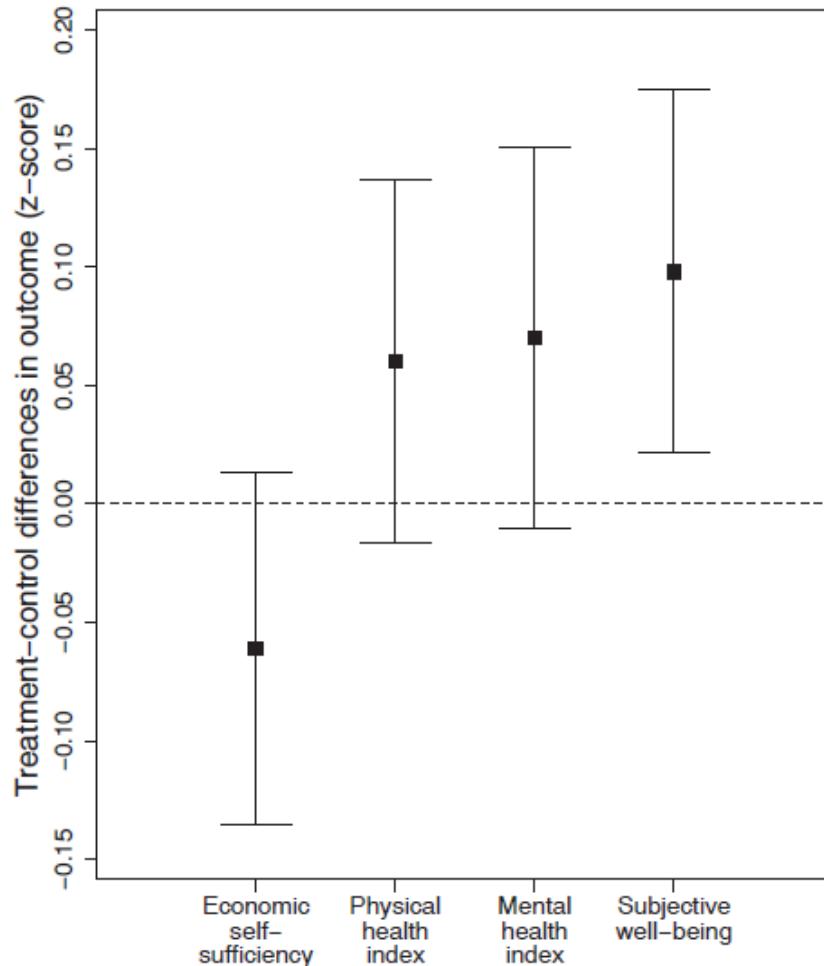


# Housing and health

- Horizontal expansion of cities (urban sprawl) may mean more driving, physical inactivity, obesity, and injury
- Poor urban housing design can exacerbate non-communicable and communicable diseases
- Dilapidated housing stock in many US legacy cities shown to increase obesity, diabetes, unhappiness, and violence for residents
- Potential initiatives
  - Reduce GHG emissions and improve health through more compact, efficient co-design of housing, employment and transport, capitalizing on high urban population densities
  - Energy-efficient, climate-adapted housing (including good lighting, noise control, and ventilation) can reduce indoor air pollution, dampness, and mould; airborne infectious disease transmission; heat and cold exposure; and poor sleep quality
  - Inexpensive abandoned housing remediation can reduce crime, violence, and illicit drug abuse
  - Mixed income, live where you work (LWYW) housing has potential health benefits



# Moving to Opportunity: Housing relocation experiment



- 3-arm, 5-city HUD randomized trial:
  - (1) **Experimental group** – family housing vouchers to move out of poverty (n=1700)
  - (2) **Comparison group** – family housing vouchers to move anywhere (n=1300)
  - (3) **Control group** – no vouchers (n=1400)
- Less obesity, diabetes, unhappiness
- More depression and conduct disorder for boys
- Landmark scientific work
- But are we really going to move people en masse as official policy?
- Cost and other considerations



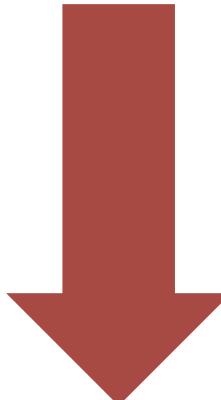
# Abandoned Housing Remediation

## “In Situ” Changes

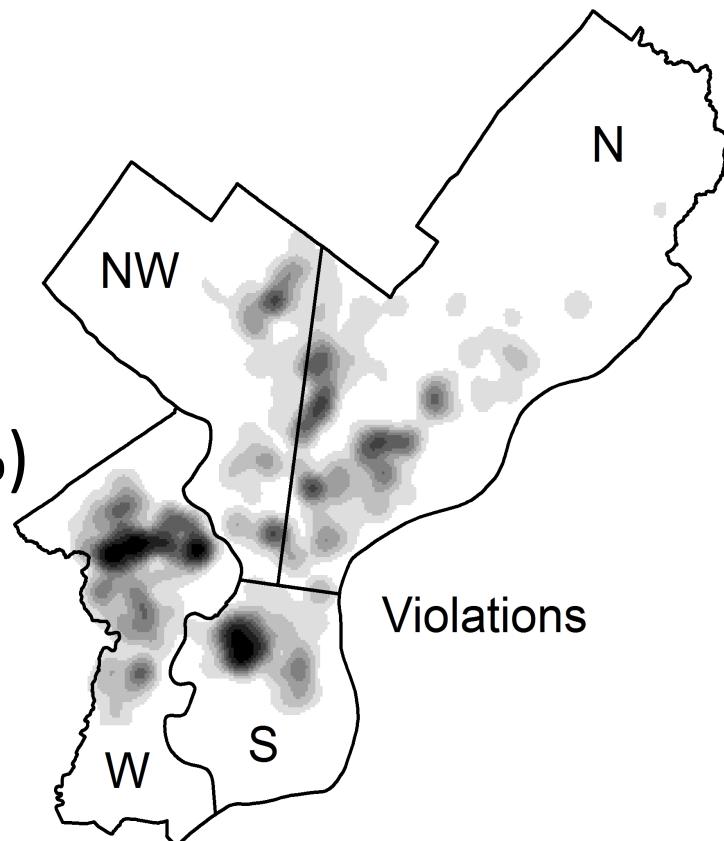


# Difference-in-differences:

**676 remediated buildings,  
676 wait-list control buildings**

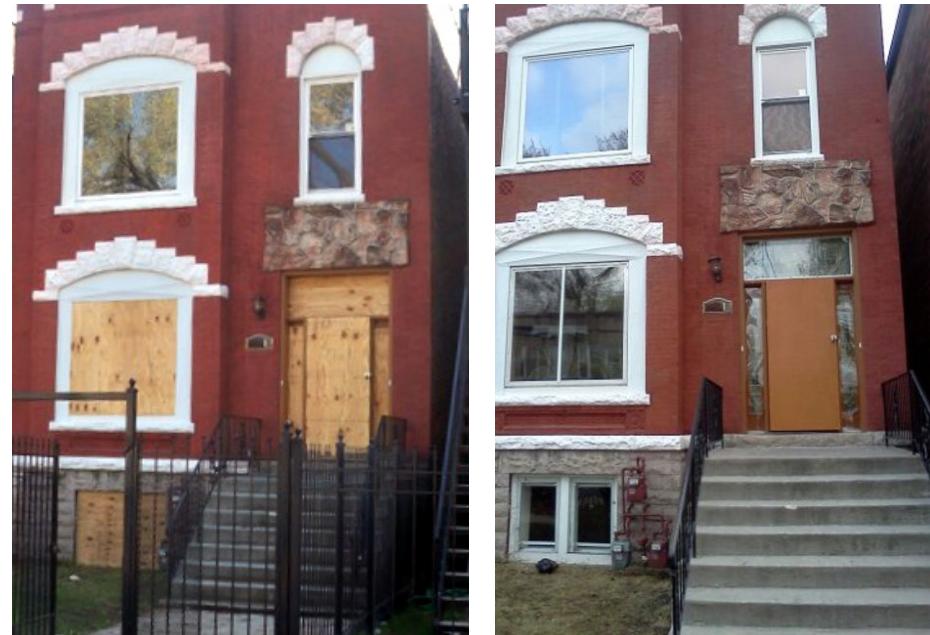


- Violent crime (-19%)
- Gun assaults (-39%)
- Nuisance crime (-16%)





- Three-way mechanism:
  - (1) Visual cue that space is cared for
  - (2) Appearance of “eyes on street” looking out, and looking in
  - (3) Forced entry difficult: need to break glass or polycarbonate



<http://secureviewusa.com/videos>

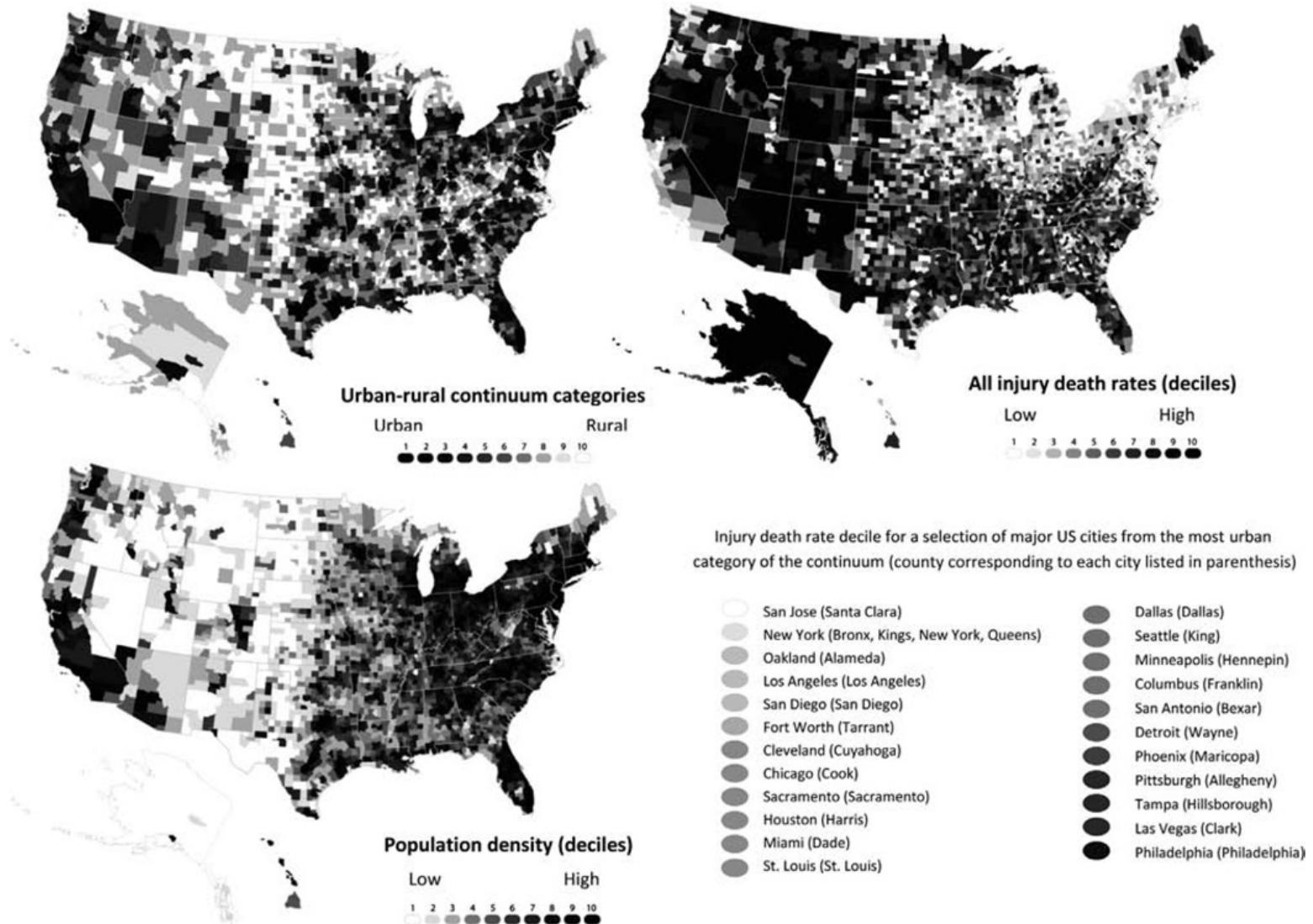
- Trials forthcoming – Philadelphia and perhaps Chicago, Cleveland, Detroit, etc.



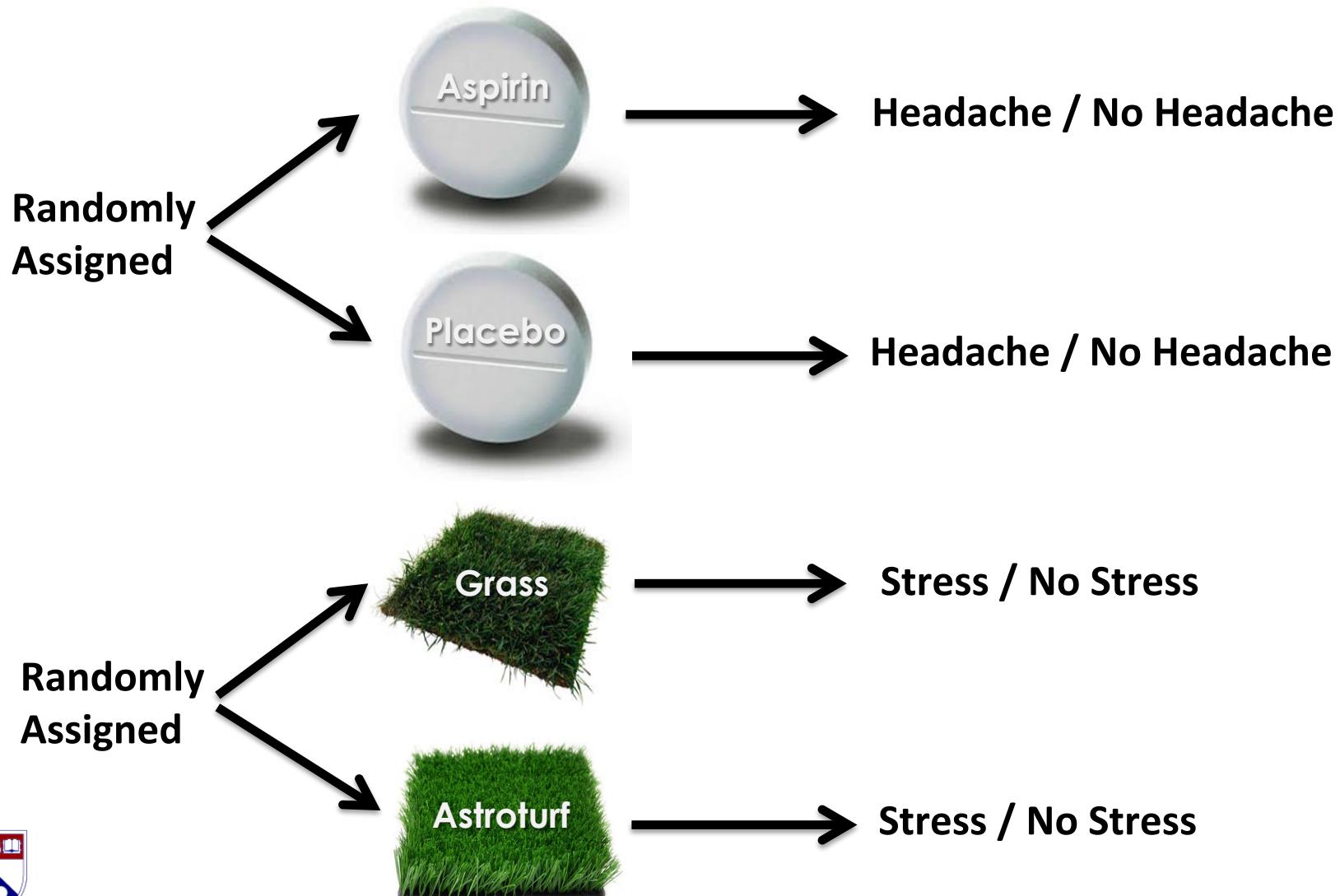
# Mixed income LWYW housing



# Promote repopulation - cities safest places in US



# Need better, causal evidence for initiatives





# Urban Health Lab.

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