Correlates of health, sustainability and environmental criteria among 50 of the most populous US cities

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First World Sustainability Forum

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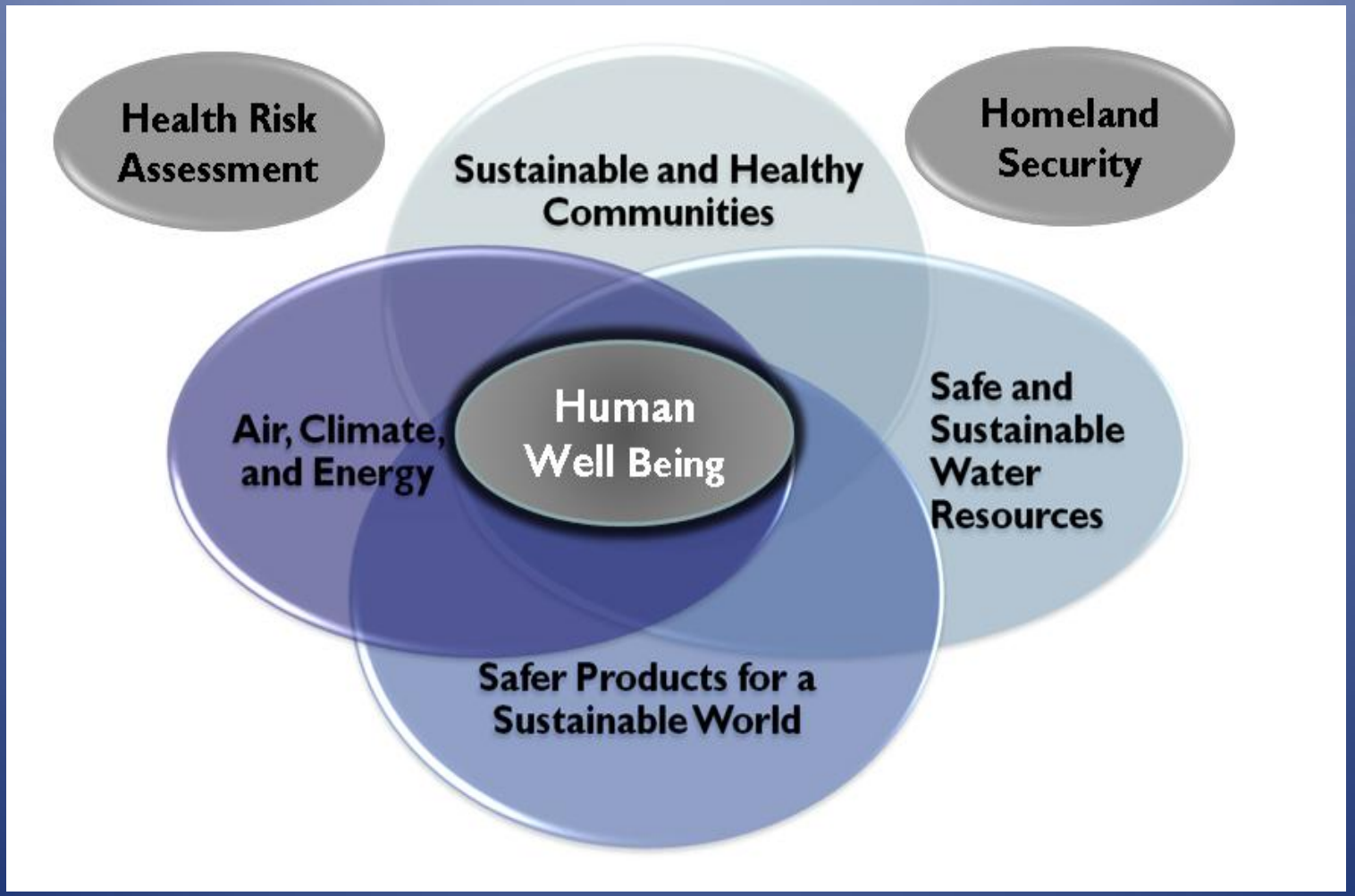
EPA's Office of Research and Development Research framework in six priority areas



Background

Measurable health consequences have a wide variety of root causes.

- **Socioeconomic circumstances**
- Adler et al. 2007), education (Backlund et al. 1999; Din-Dzietham et al. 2000; Fleishman 2005; Lleras-Muney 2005; Kawachi et al. 2010),

- **Environmental (C**ummings and Kreiss 2008; Ferrie et al. 2008; Clougherty et al. 2010),

- **Physical and Social features of c**ommunities or neighborhoods (Clougherty et al. 2007; Diez-Roux and Mair 2010). (NAS HIA 2011)

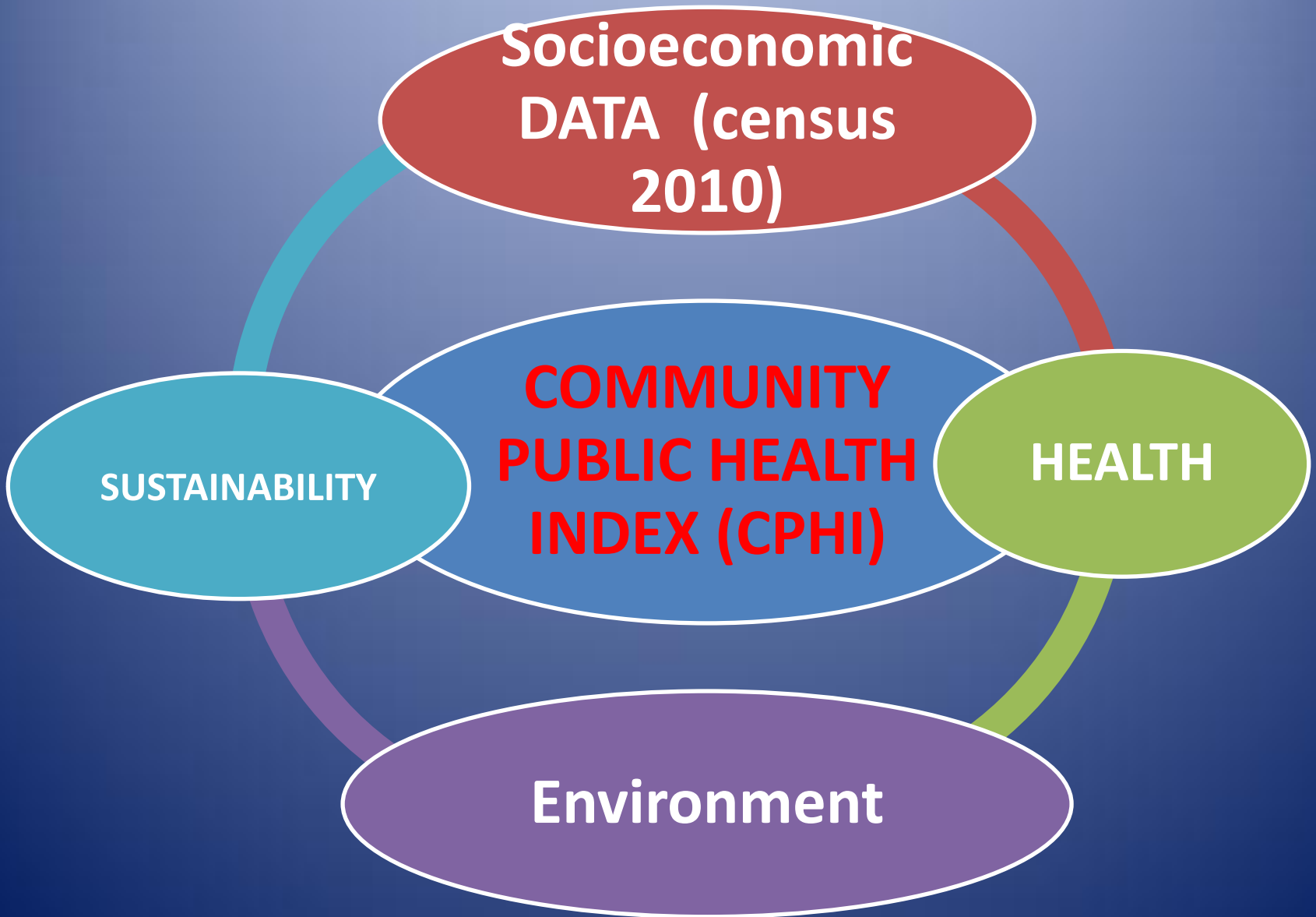
Improving health in the US role of health impact assessment 2011

Approach

Derive an integrated community health index (ICHI) for 50 of the most populous US cities (representing over 43 million persons) using extant measures of

- Environmental
- Health /Public Health
- Sustainability
- Sociodemographic (2010 census)

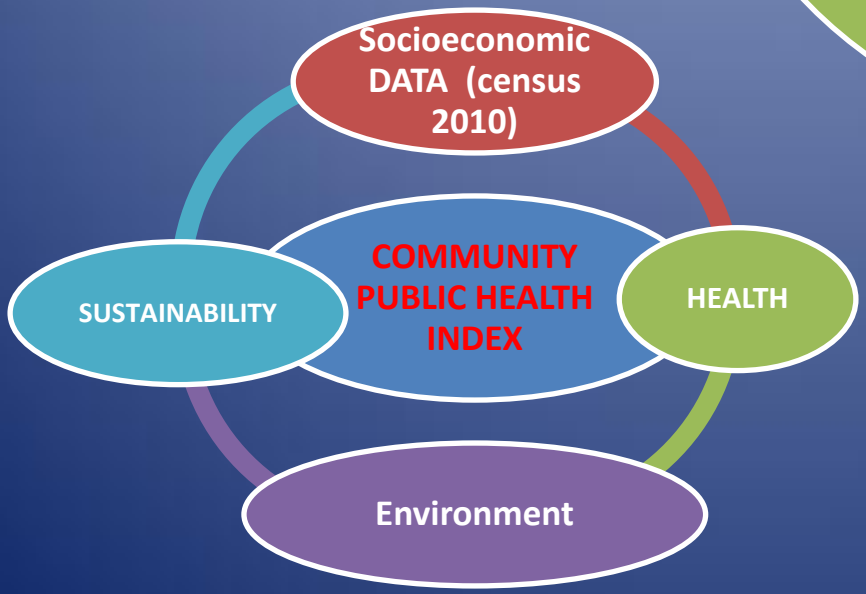
Integrated data across multiple domains -for a broader definition of community public health



HEALTH/Public Health

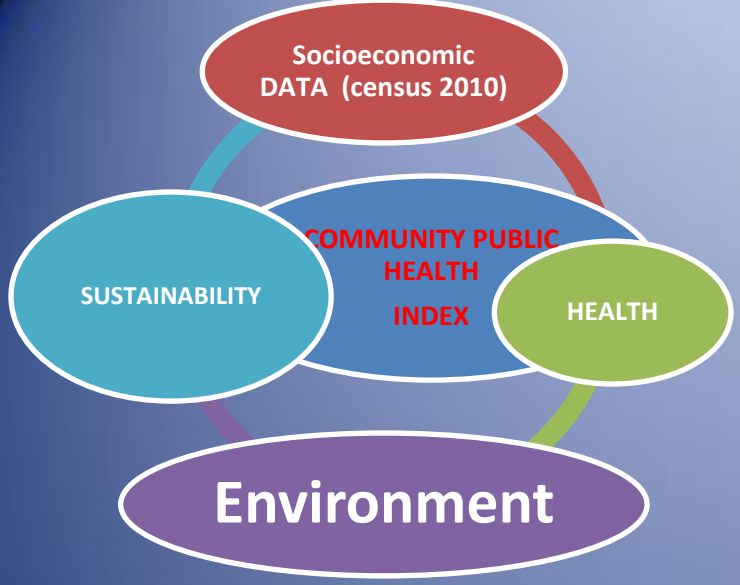
From Urban Environment Report --

www.earthday.net



HUMAN & PUBLIC HEALTH variables considered

- Pediatric Asthma, rate (%)
- Adult Asthma, rate (%)
- Chronic Bronchitis, rate (%)
- Emphysema, rate (%)
- Cardiovascular Disease, rate (%)
- Diabetes, rate (%)
- % of Adults with Obesity
- Change in % of Adults with Obesity (1991 - 2001)
- Lung Cancer Deaths/100,000 Men, by county (1999-2003)
- Lung Cancer Deaths/100,000 Women, by county (1999-2003 DC Obesity Trends U.S. Adults Behavioral Risk Factor Surveillance System
- Prevalence Rate (1992)
- CDC Obesity Trends U.S. Adults Behavioral Risk Factor Surveillance System
- Prevalence Rate (1997)
- CDC Obesity Trends U.S. Adults Behavioral Risk Factor Surveillance System
- Prevalence Rate (2003)
- % of Adults Lacking Healthcare Insurance, ages 18 -65 (2001)
- Infant Mortality Rate (2002)
- Number of Cancer Deaths per 100,000
- people (2002)
- Cost of Living:
- % of People without Health Insurance Coverage by State (2003-04 Average)
- % of People without Health Insurance Coverage by State (2004-05 Average)
- Rate of Change in People without Health Insurance Coverage, between 03-04 and 04-
- 05
- Change in People without Health Insurance Coverage, between 03-04 and 04-05
- Number of small, local, sustainable food sources: Farms
- Number of small, local, sustainable food sources: Farmers' Markets
- Number of small, local, sustainable food sources: Restaurants
- Number of small, local, sustainable food sources: Groceries
- Number of small, local, sustainable food sources: Other
- Cost of Living: Food



Environment

Urban Environmental report

Averages mean scores for

- **AIR QUALITY**
- **TOXICS & WASTE**
- **DRINKING & SURFACE WATER Quality**

AIR QUALITY variables considered

- Sulfur Dioxide (SO2) Released, Tons (2002)
- Nitrogen Oxides (NOx) Released, Tons (2002)
- Carbon Dioxide (CO2) Released, Tons (2002)
- Mercury Released, Pounds (2002)
- High Ozone Days, Annual # of, Weighted Average (2001-2003) (Not Available)
- Short-term Particle Pollution Weighted Average, 24 Hour (2001 - 2003)
- Year-Round Particle Pollution - Pass/Fail (2001 - 2003)
- High Ozone Days - Grade (2002 - 2004) SCORE (Not Available)
- Short-term Particle Pollution Grade (2002 - 2004)
- Year-Round Particle Pollution - Pass/Fail (2002 - 2004)
- EPA Ambient Carbon Monoxide (CO) (8-hr ppm)
- EPA Ambient Lead (PB) Q Max (ug/m3) SCORE (Not Available)
- EPA Mean Ambient Nitrogen Dioxide (NO2 ppm)
- EPA Larger Particle (PM10) 24-hr (ug/m3)
- EPA Mean Ambient Sulfur Dioxide (SO2 ppm)
- EPA Days Over 100 AQI (Warning Level)
- «

TOXICS & WASTE variables

Overall Toxics Rank

- Cumulative Cancer-Causing Chemical Releases by State
- Cumulative Developmental Toxicant Releases by State Cumulative Reproductive Toxicant Releases by State
- Cumulative Suspected Neurological Toxicant Releases by State
- Cumulative Suspected Respiratory Toxicant Releases by State
- Dioxin Releases by State
- Number of Superfund Sites in County
- Municipal Solid Waste Generation, State Average, tons/person (1997)
- Recycling Rate (1997)
- Municipal Solid Waste Generated by state, tons/person (2004)
- Municipal Solid Waste Recycled by state (2004)
- % Municipal Solid Waste to Waste-to-Energy (2004)
- % Change in Municipal Solid Waste Generated (1997 to 2004)
- % Change in State Recycling Rate (1997 to 2004)

DRINKING & SURFACE WATER QUALITY

DRINKING WATER QUALITY

- Tap Water Quality & Compliance
- Right to Know Report, What's in your Tap Water
- Drinking Water Source Protection
- % of Watershed Units Assessed as Impaired or Threatened
- % of Watershed Units Not Assessed
- U.S. Census Annual Rainfall, inches (1961-1990)
- Average # of Days with Precipitation of .01 Inch or More to 1998, Annual
- Snow & Ice Pellets thru 1998, Annual inches

WATER WITHDRAWN

- Fresh Water Withdrawn - Per capita, million gallons/day
- Ground Water, million gallons/day
- Surface Water, million gallons/day
- Irrigation, million gallons/day
- Public Supply, million gallons/day
- Industrial, million gallons/day
- Thermo-Electric, million gallons/day
- Fresh Water Consumption, million gallons/day

WATER POLLUTION SUMMARY

- Total Contaminants Detected
- Contaminants Detected, Over Health-Based Limits
- Agricultural Pollutants Detected
- Agricultural Pollutants Detected, Over Health-Based Limits
- Sprawl and Urban Pollutants Detected
- Sprawl and Urban Pollutants Detected, Over Health-Based Limits Industrial Pollutants Detected
- Industrial Pollutants Detected, Over Health-Based Limits
- Water Treatment & Distribution Byproducts Detected
- Water Treatment & Distribution Byproducts Detected, Over Health-Based Limits
- Naturally Occurring Contaminants Detected
- Naturally Occurring Contaminants Detected, Over Health-Based Limits SCORE 5

WATER HEALTH & TESTING SUMMARY

- Contaminants in Tap Water 5
- Contaminants in Tap Water, Above Health-Based Limits
- Contaminants Reported as Tested by this Water Supplier
- Regulated Contaminants Tested
- Unregulated Contaminants Tested

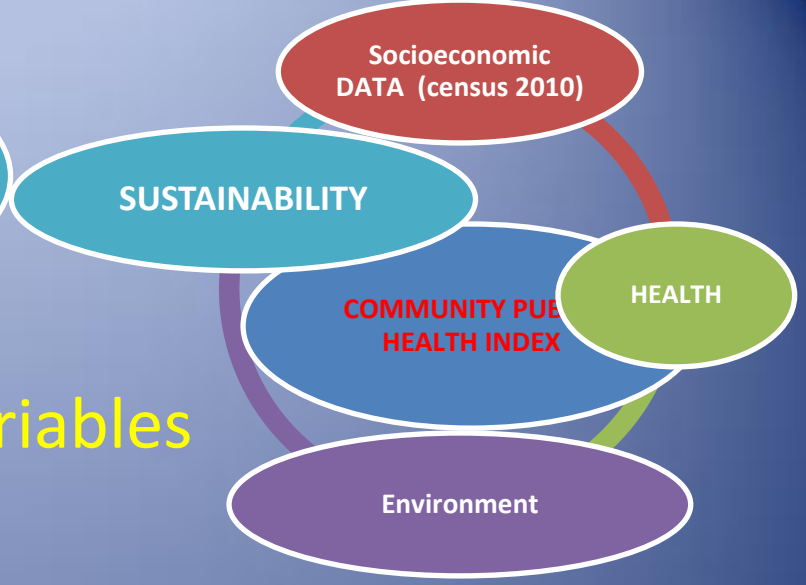
WATER VIOLATION SUMMARY

- Total Violations
- Health Violations
- Monitoring Violations
- Reporting Violations

SUSTAINABILITY

Sustainlane

www.sustainlane.com



Averages ranking across these variables

- water supply,
- waste management,
- metro congestion,
- metro transit ridership,
- Commute to work
- housing affordability,
- City innovation,
- natural disaster risk,
- knowledge base and communication
- land use planning
- energy and climate change policy
- green buildings,
- green economy
- access to local agriculture

Analysis

Compare (means and significance) across all variables using CPHI median as the basis for the t-tests)

Top 25th percentile/bottom 25th

Community Public Health Index (CPHI) --- (mean of 3 indices)

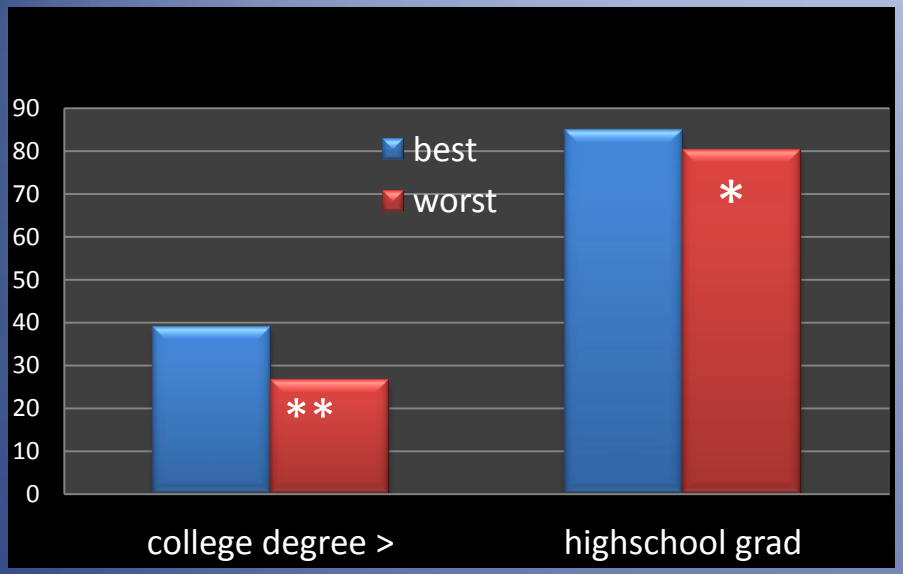
- Sustainability
- Health
- Environmental

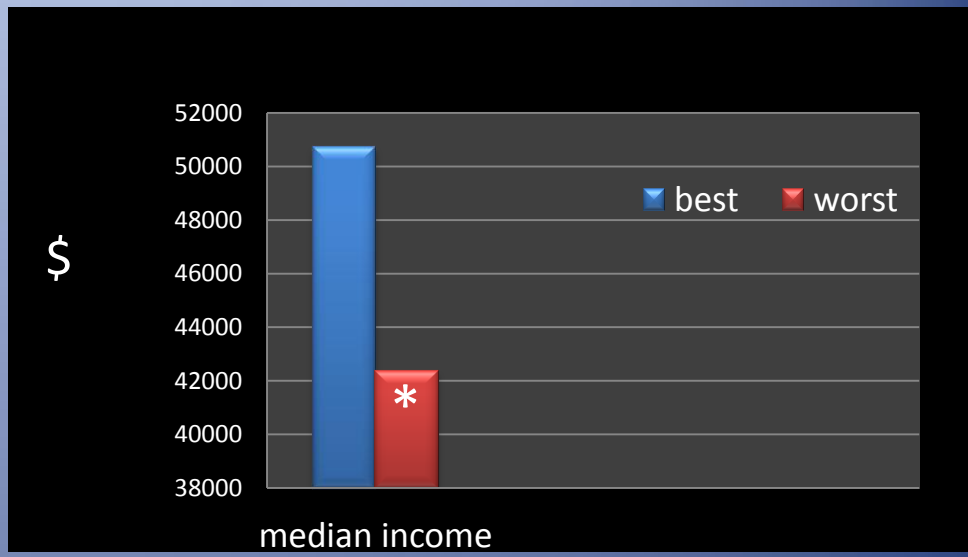
Higher SCORE OR RANKING IS WORSE than a Lower

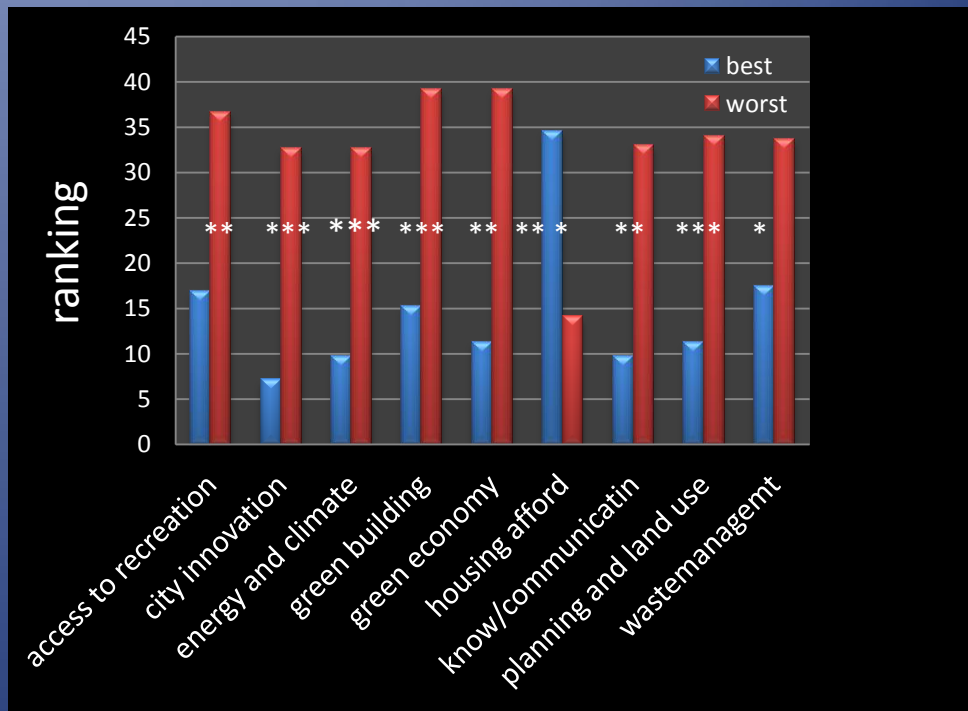
Significance levels noted by

* <.05
** <.005
*** <.0005

COMMUNITY PUBLIC HEALTH INDEX

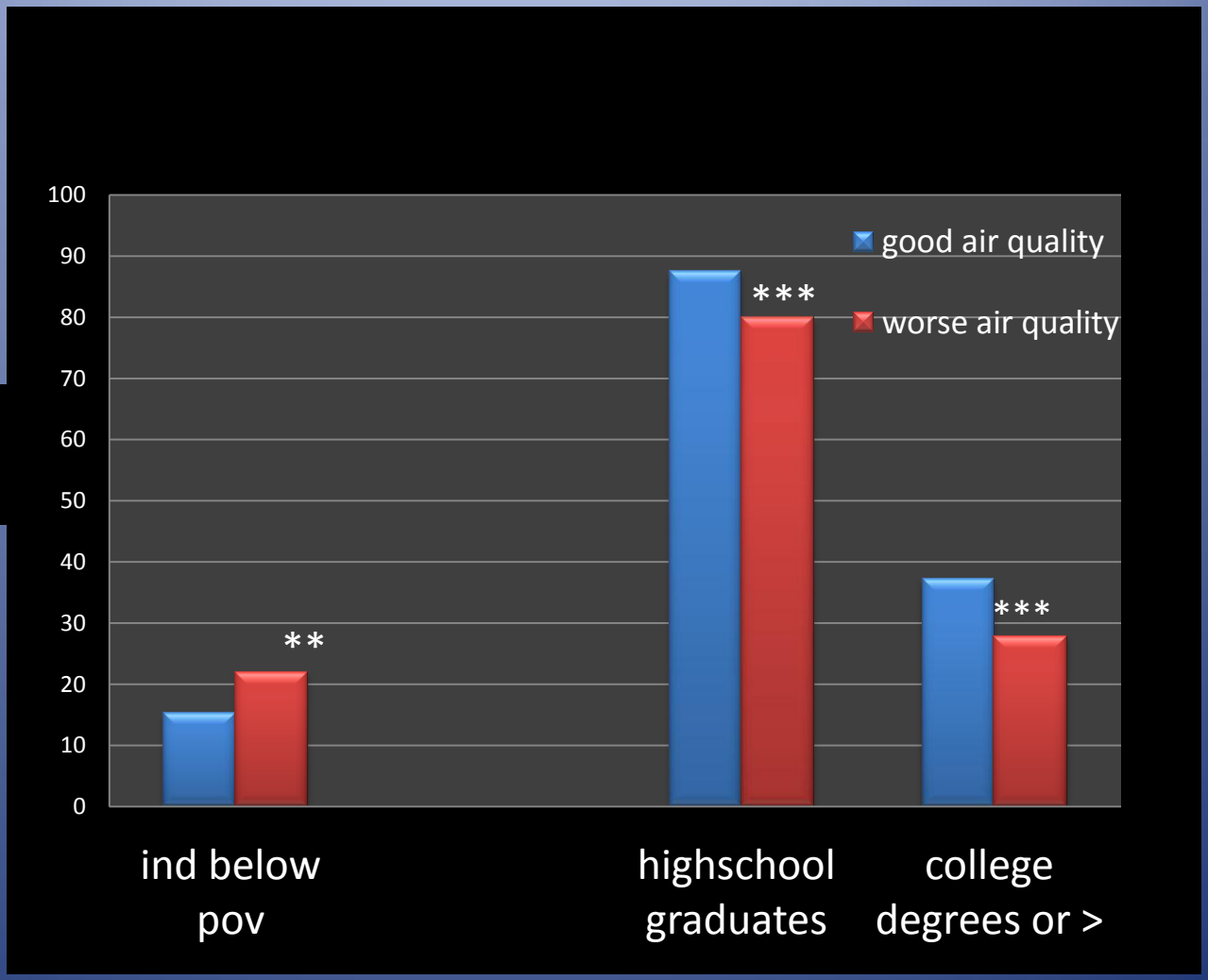




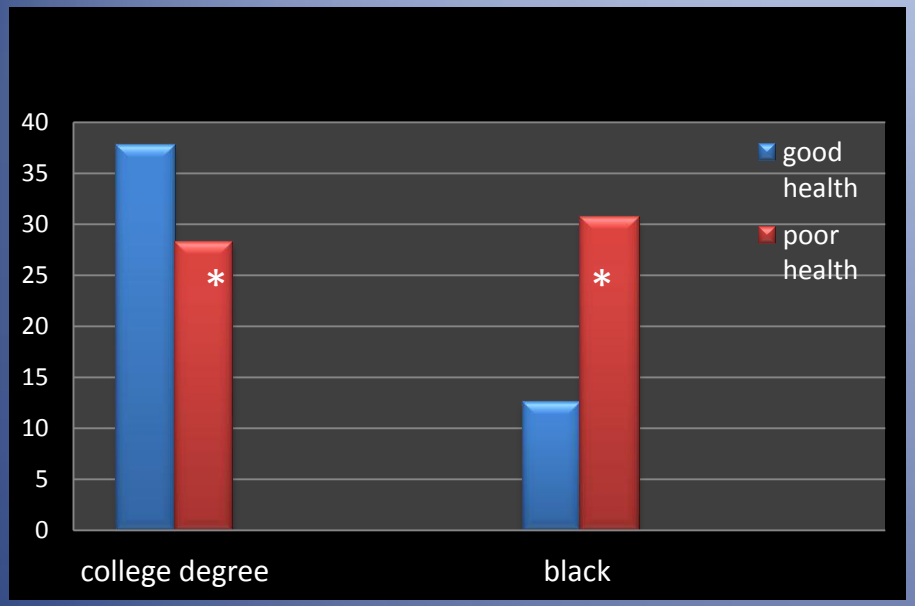


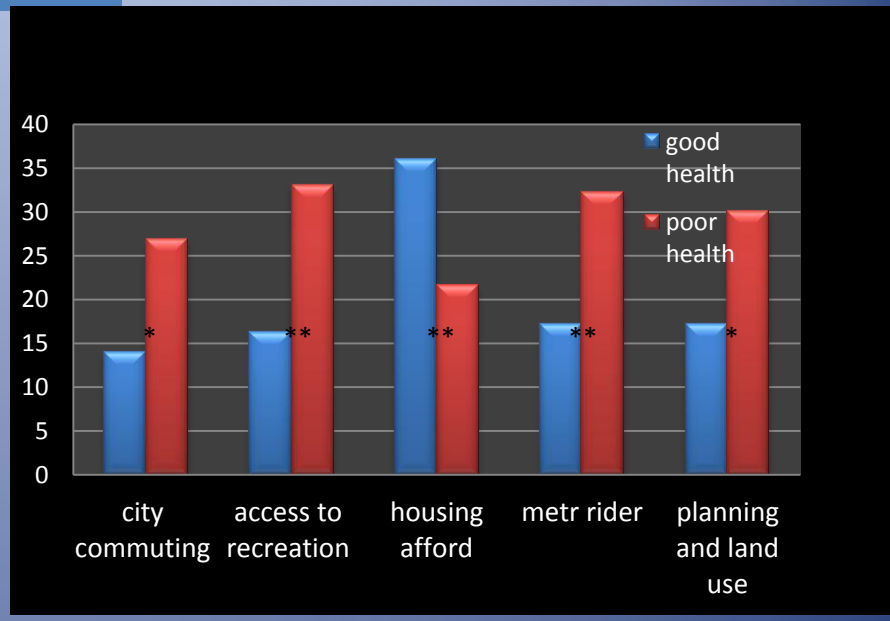
AIR QUALITY

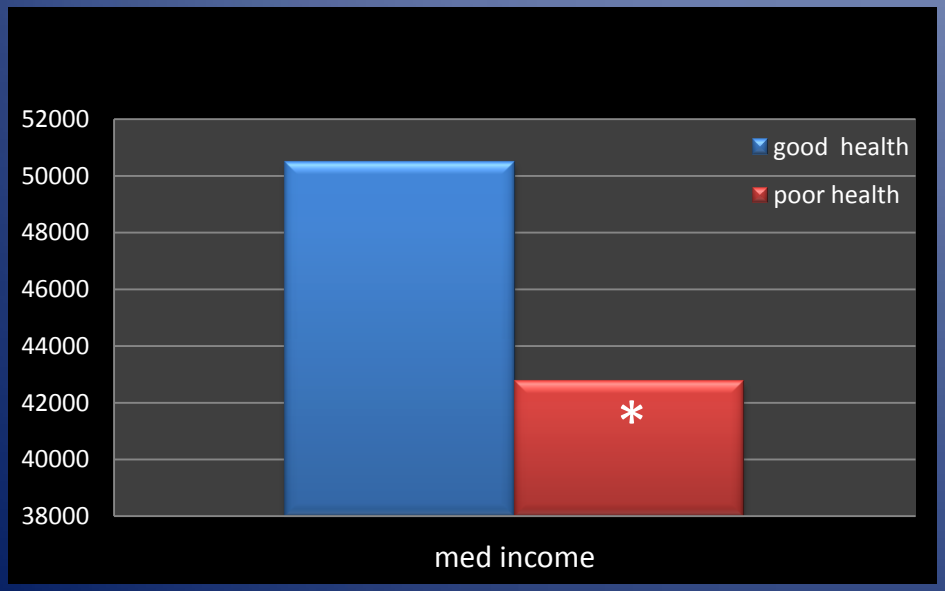
%

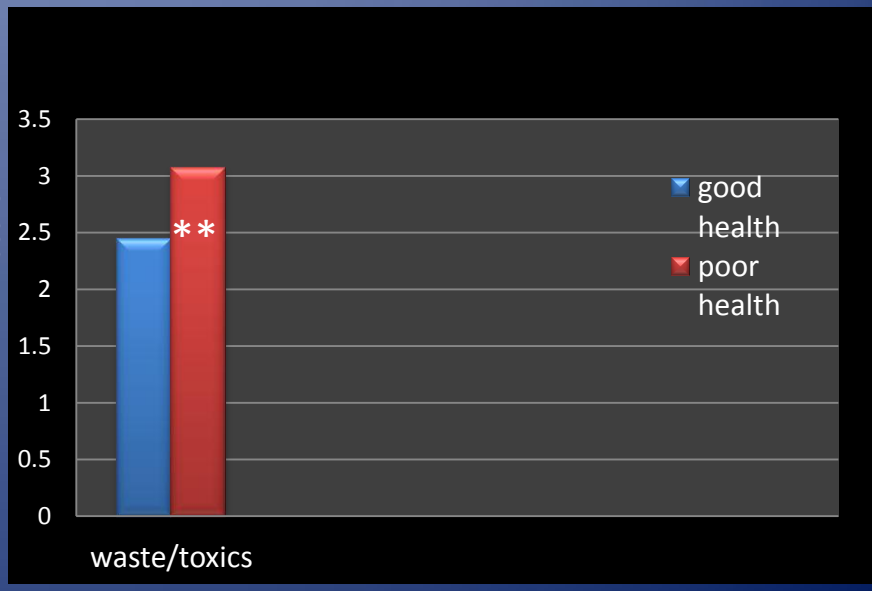

100
90
80
70
60
50
40
30
20
10
0
good air quality
worse air quality
**
***
***
ind below pov
highschool graduates
college degrees or >

HEALTH

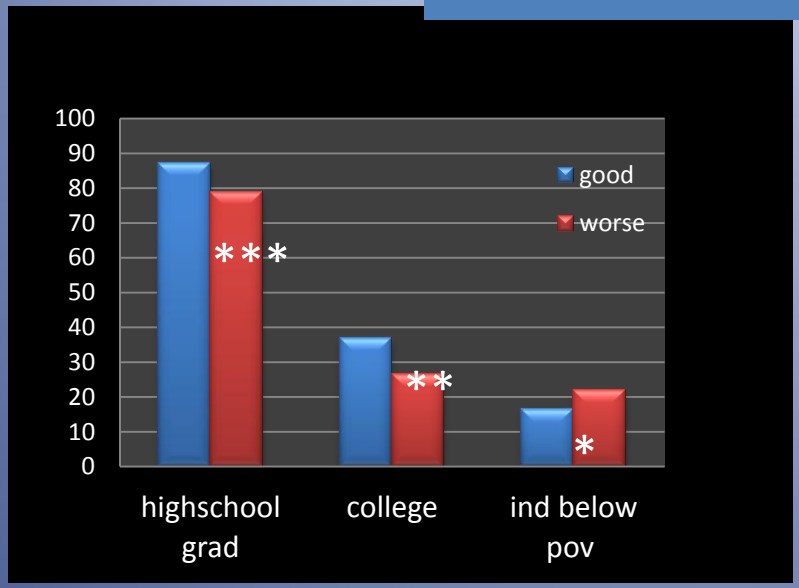

%
40
35
30
25
20
15
10
5
0
good health
poor health
*
*
college degree
black

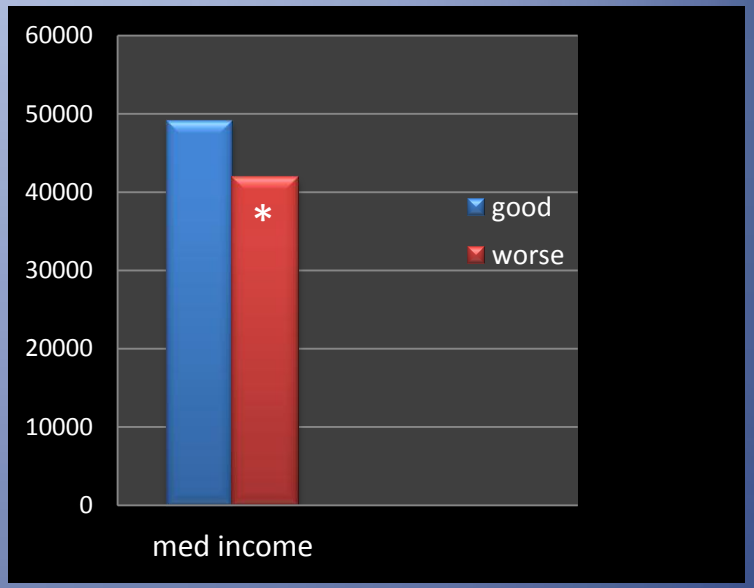

score
40
35
30
25
20
15
10
5
0
good health
poor health
*
**
**
**
*
city commuting
access to recreation
housing afford
metr rider
planning and land use

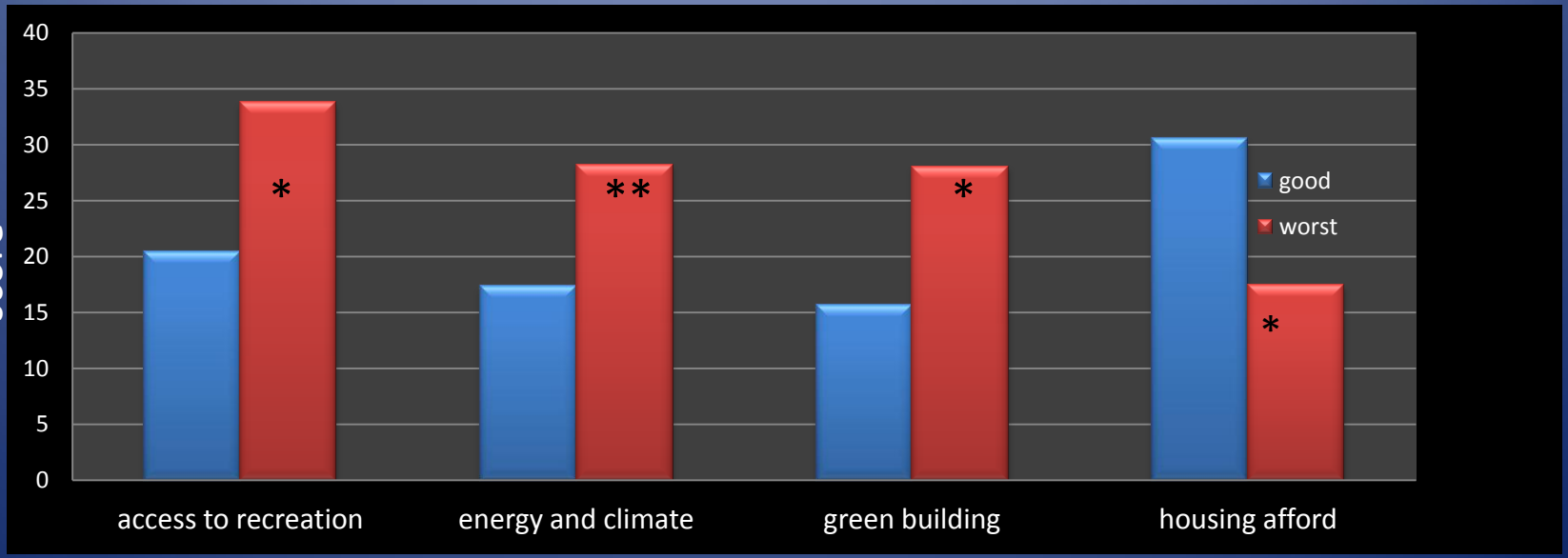

$
52000
50000
48000
46000
44000
42000
40000
38000
good health
poor health
*
med income


score
3.5
3
2.5
2
1.5
1
0.5
0
good health
poor health
**
waste/toxics

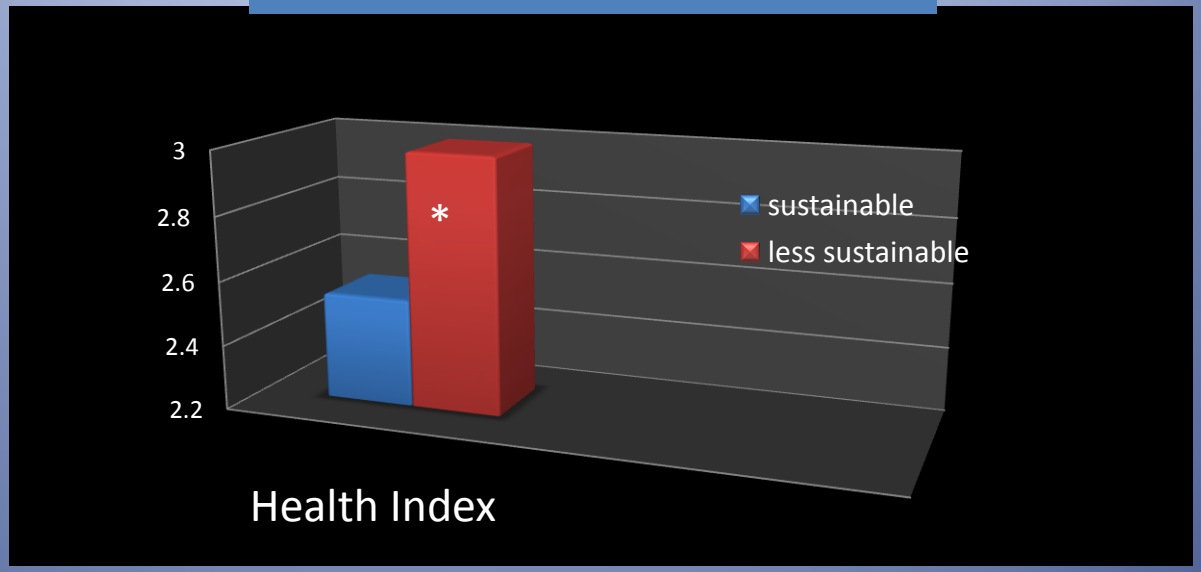
Environmental

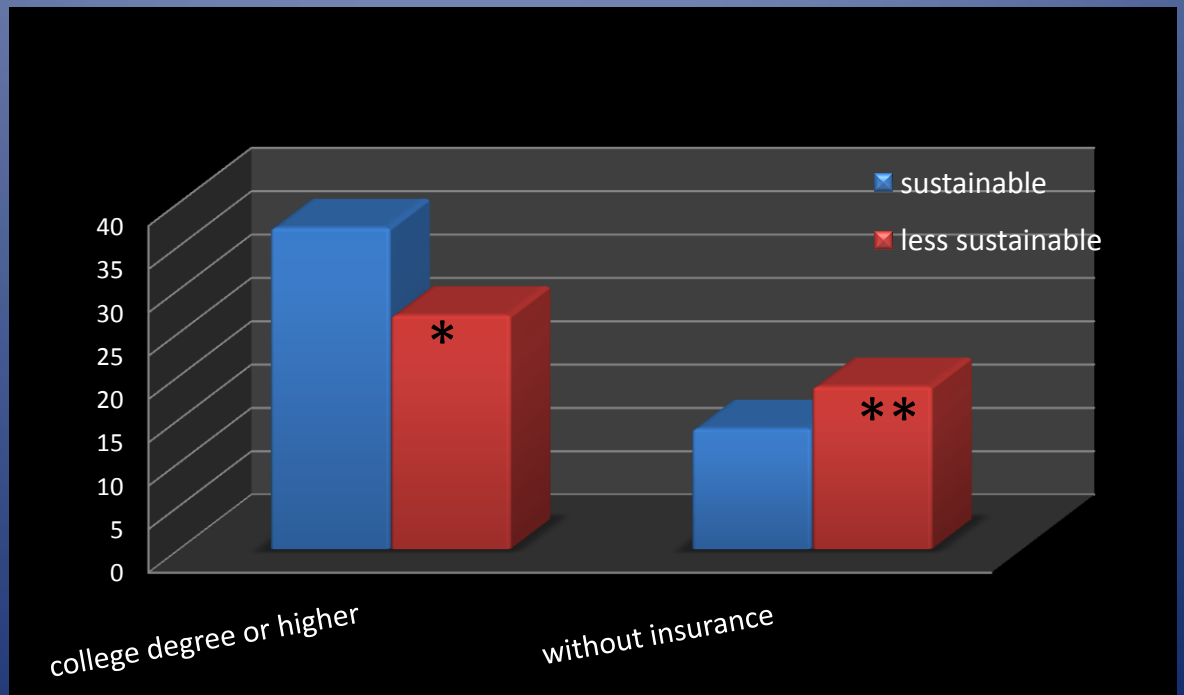






SUSTAINABILITY

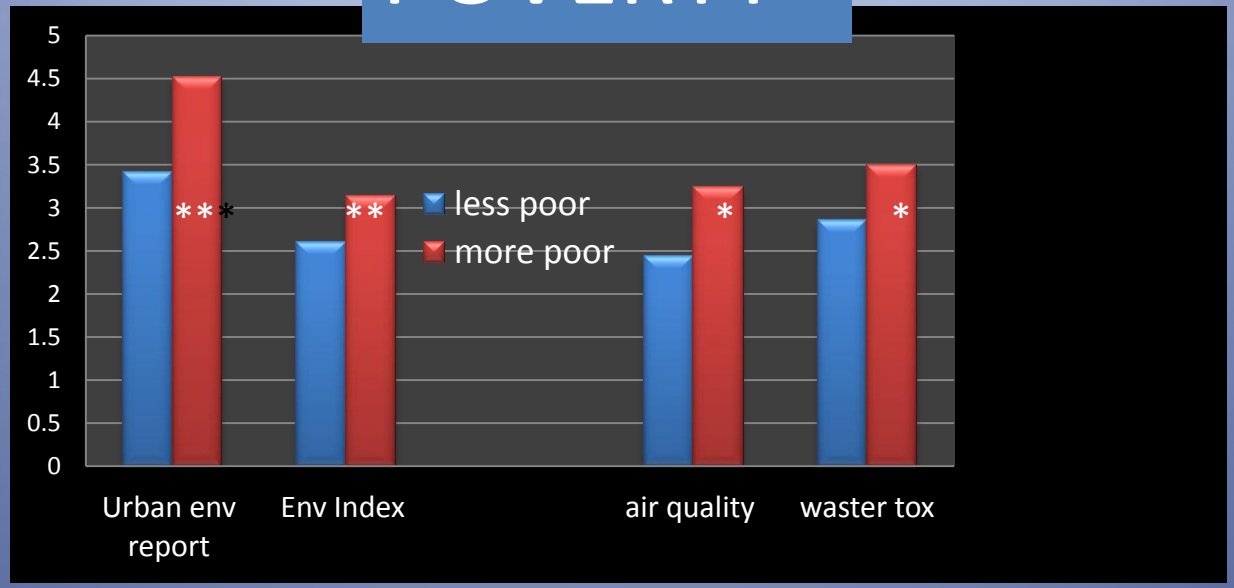




POVERTY

Socioeconomic data from census 2010

score



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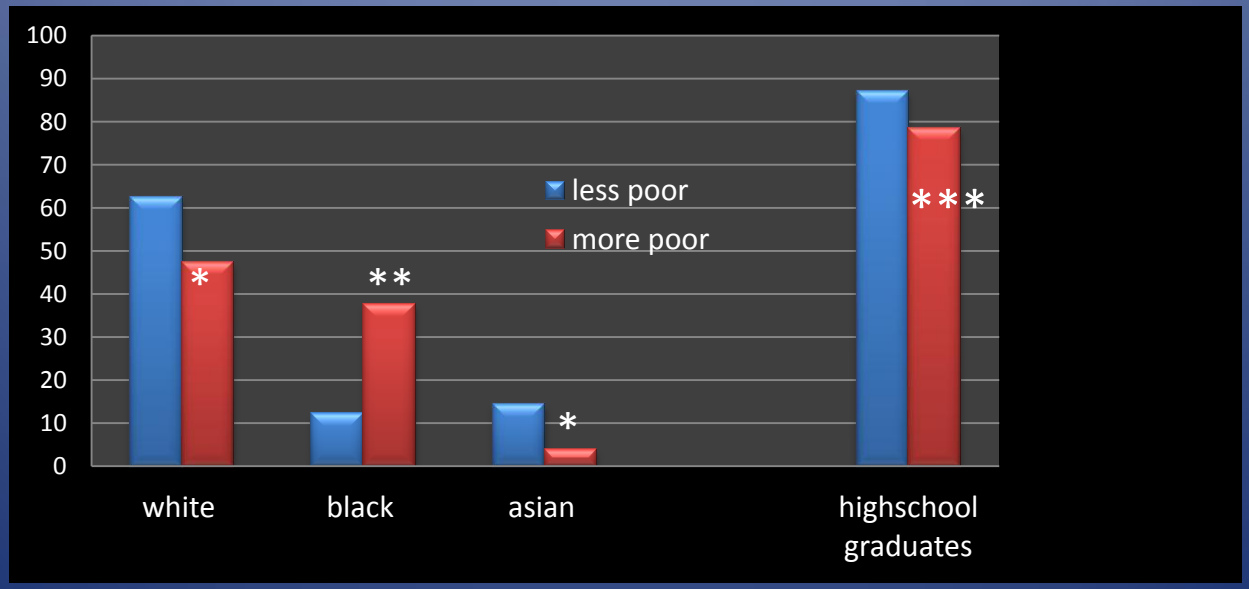
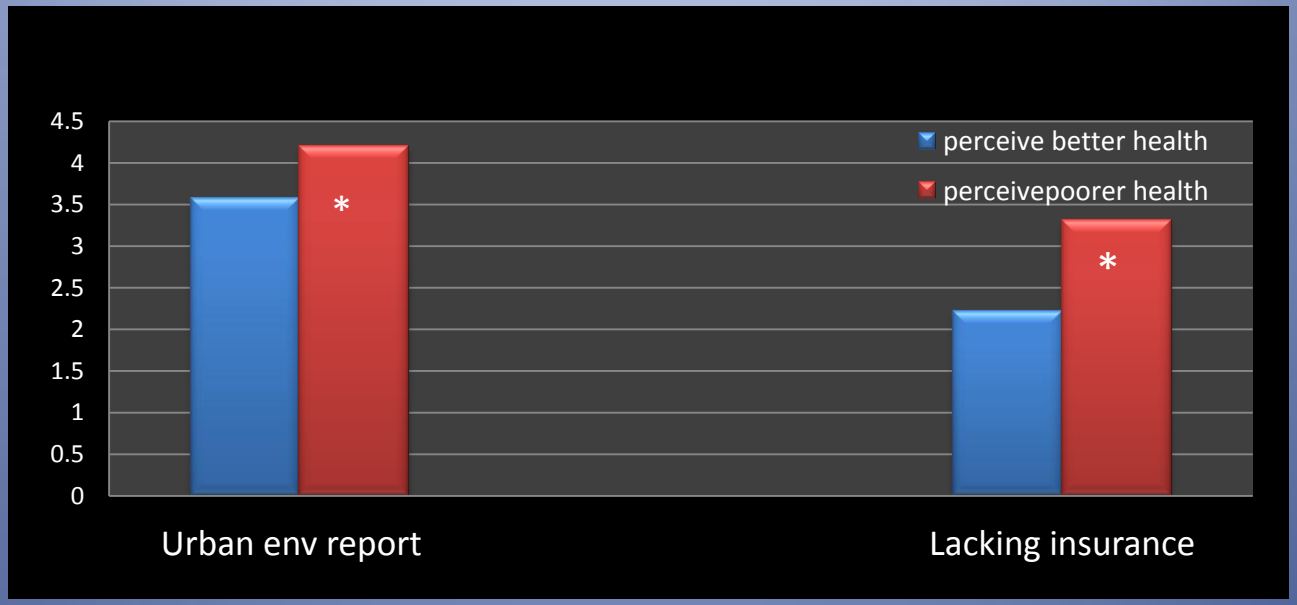


PERCEPTION OF HEALTH

CDC

score



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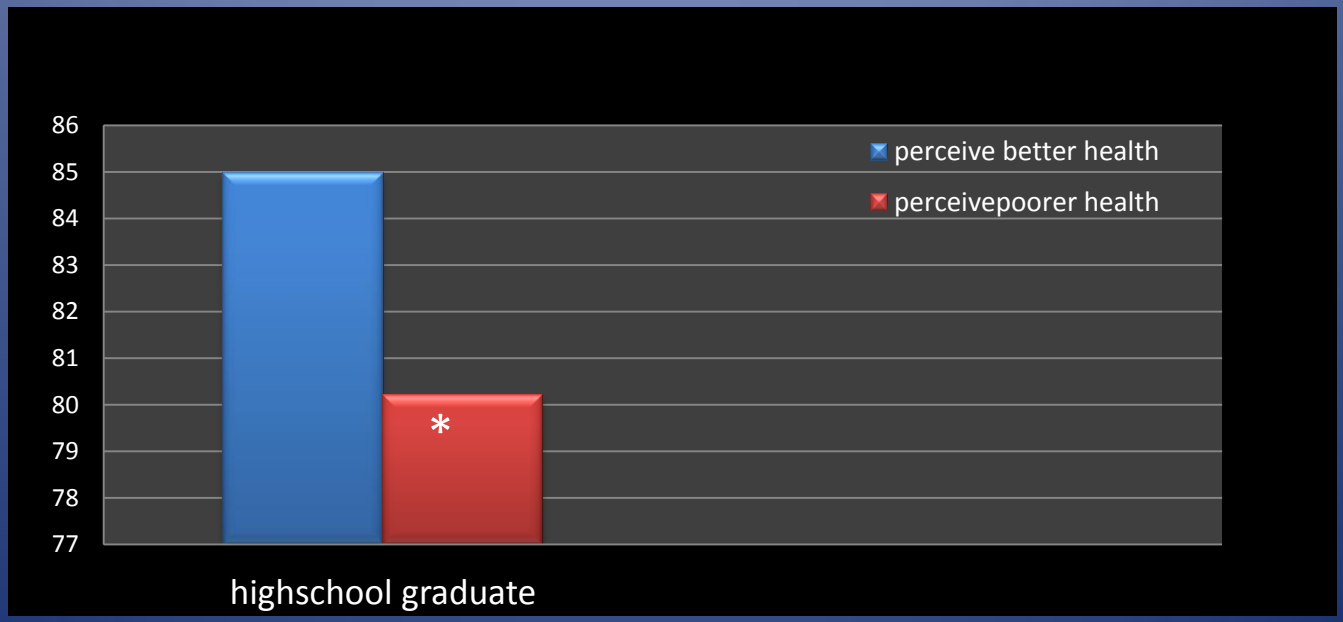

Results

Cities with the "better" ICHI ---

- a higher % of persons with health insurance (20.1 vs 13.4 %; $p<0.001$),

- a lower (better) green economy score (13.7 vs. 36.8; $p< 0.00001$)

- a lower toxic and waste score (2.4 vs.3.5; $p<0.001$) and

- a higher % of persons with college degrees (38.7 vs. 28.2%; $p< .005$)

Cites with a lower % of individuals below the poverty level (highest 25th percentile) compared to cities with higher percentages of people below the poverty level (lowest 25th percentile)

- a lower (better) score for toxic and waste generation (2.85 vs. 3.48; $p<.005$)

- higher % of high school graduates (87.0 vs.78.3%; $p< .0005$

- Greater access to recreation opportunities (2.91vs.3.54; $p<.005$

SUMMARY

Integration and evaluation of diverse data

- Reveals important inter-relationships between health, environmental and sustainability metrics

- Taken together the integrated community metrics and simple approach provide a framework that promotes the communication and collection of information needed to implement policies that promote healthy and sustainable communities