



## **Underserved Rural Populations: The Missing Puzzle of Healthy U.S.**

Xinzhi Zhang, MD, PhD, FACE

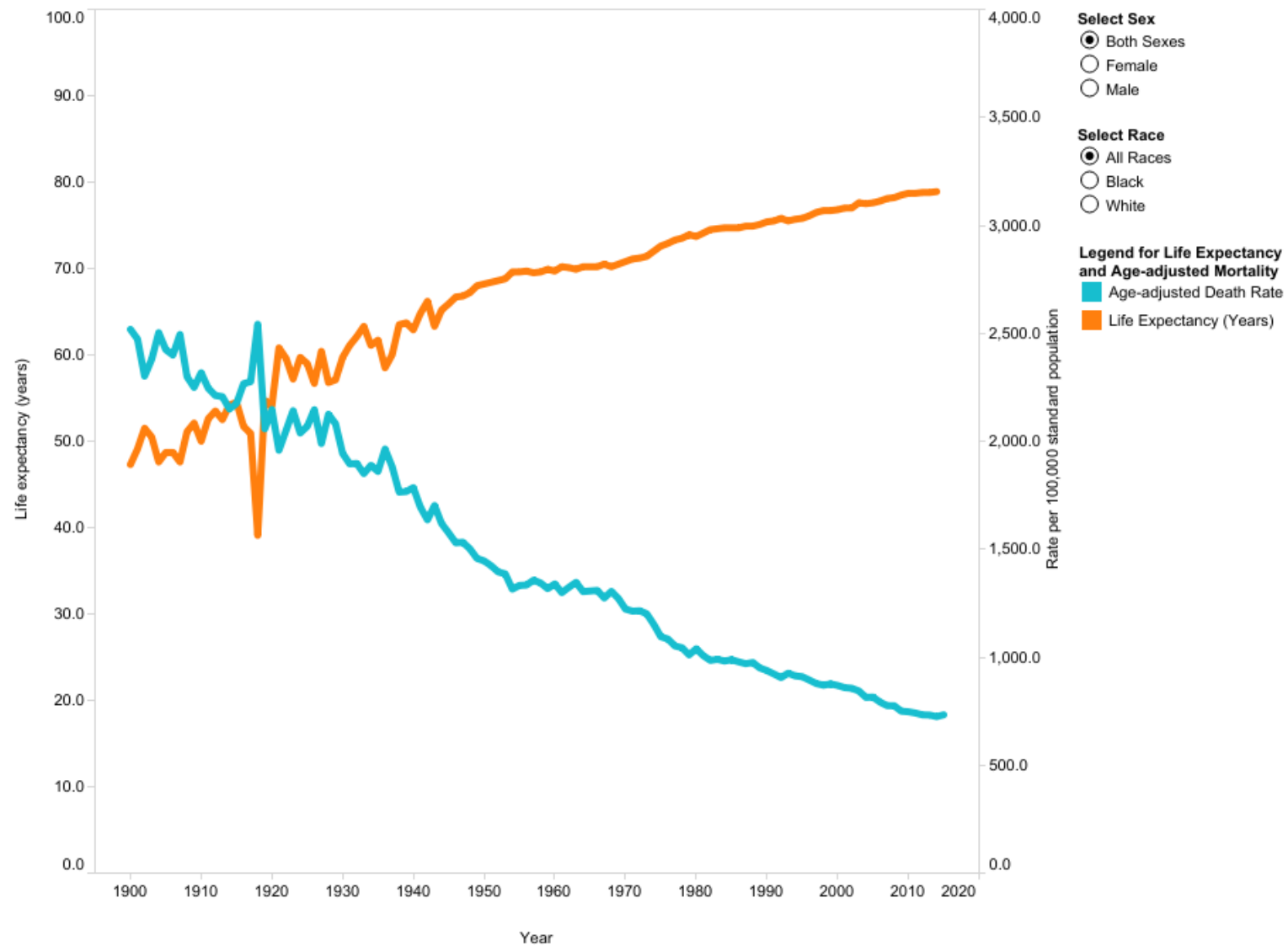
September, 2018

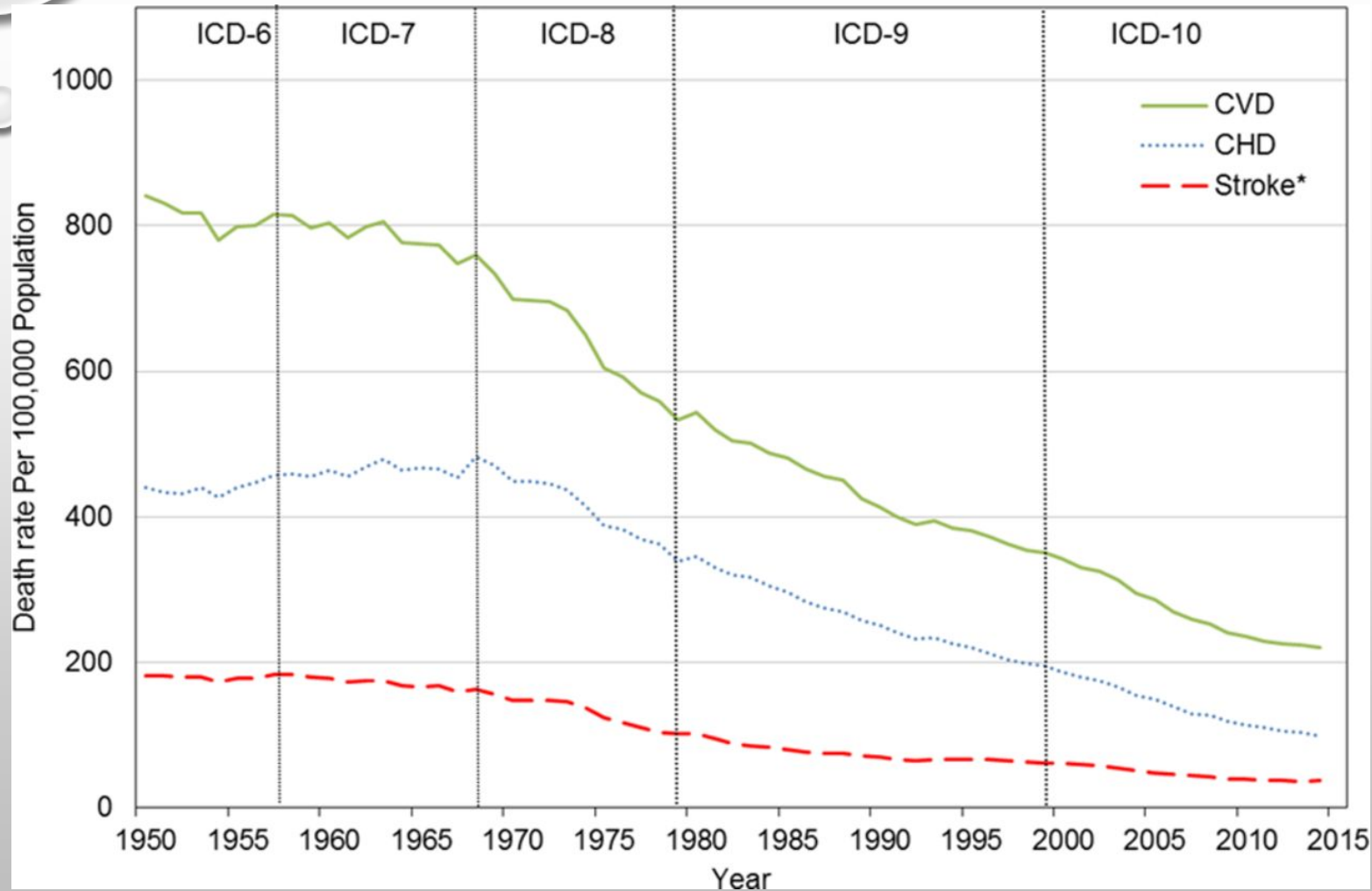
# Disclaimer

- The findings and conclusions in this presentation are those of the author and do not necessarily represent the official position of the National Institutes of Health.
- Financial Disclosure:

I have no relevant commercial entity relationships or financial interests to disclose.

Age-adjusted Death Rates† and Life Expectancy at Birth (Both Sexes, All Races): United States, 1900–2015‡





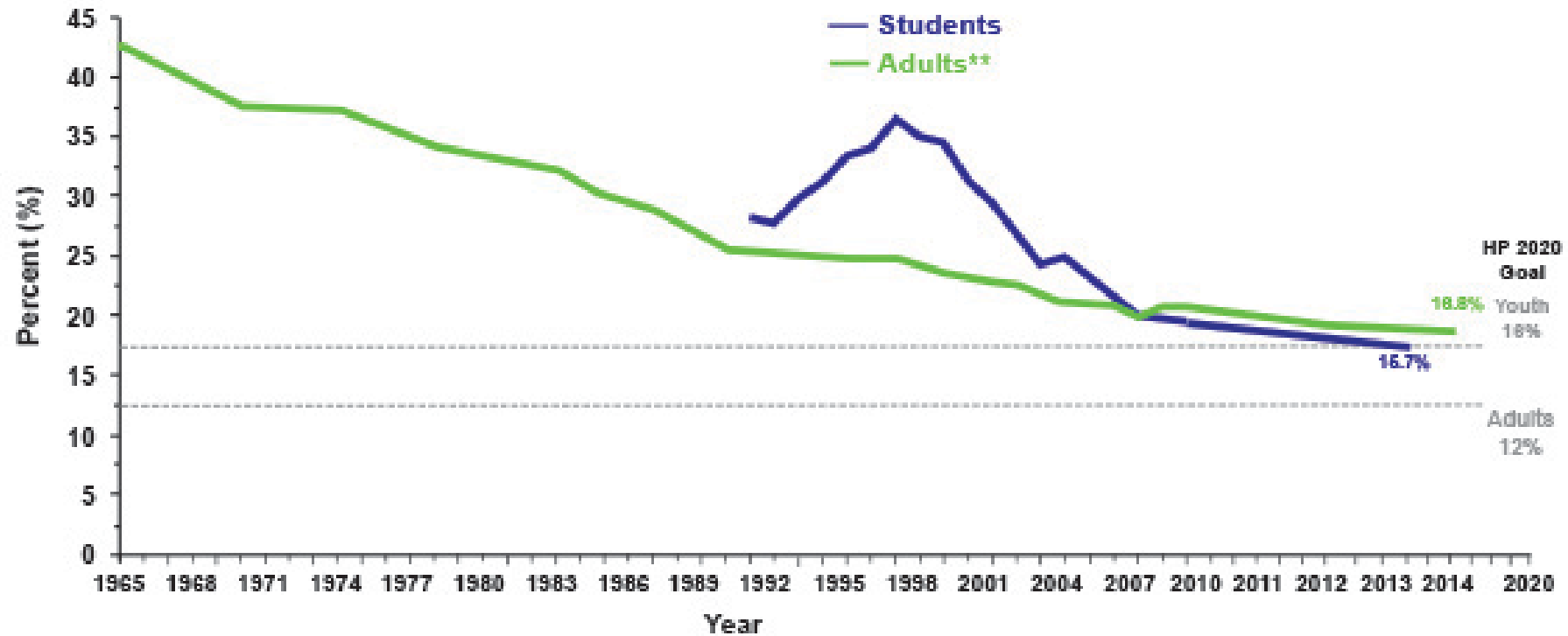
# Decline of the Heart Disease Epidemic



- Smoking
- High BP
- High Blood Cholesterol
- Physical Inactivity
- Poor Diet
- Obesity
- Diabetes

Age-adjusted cardiovascular disease (CVD) mortality rates, 1950 to 2014.  
 Mensah GA, Wei GS, Sorlie PD et al. Circ Res. 2017

## Trends in Current Cigarette Smoking by High School Students\* and Adults\*\* — United States, 1965-2014

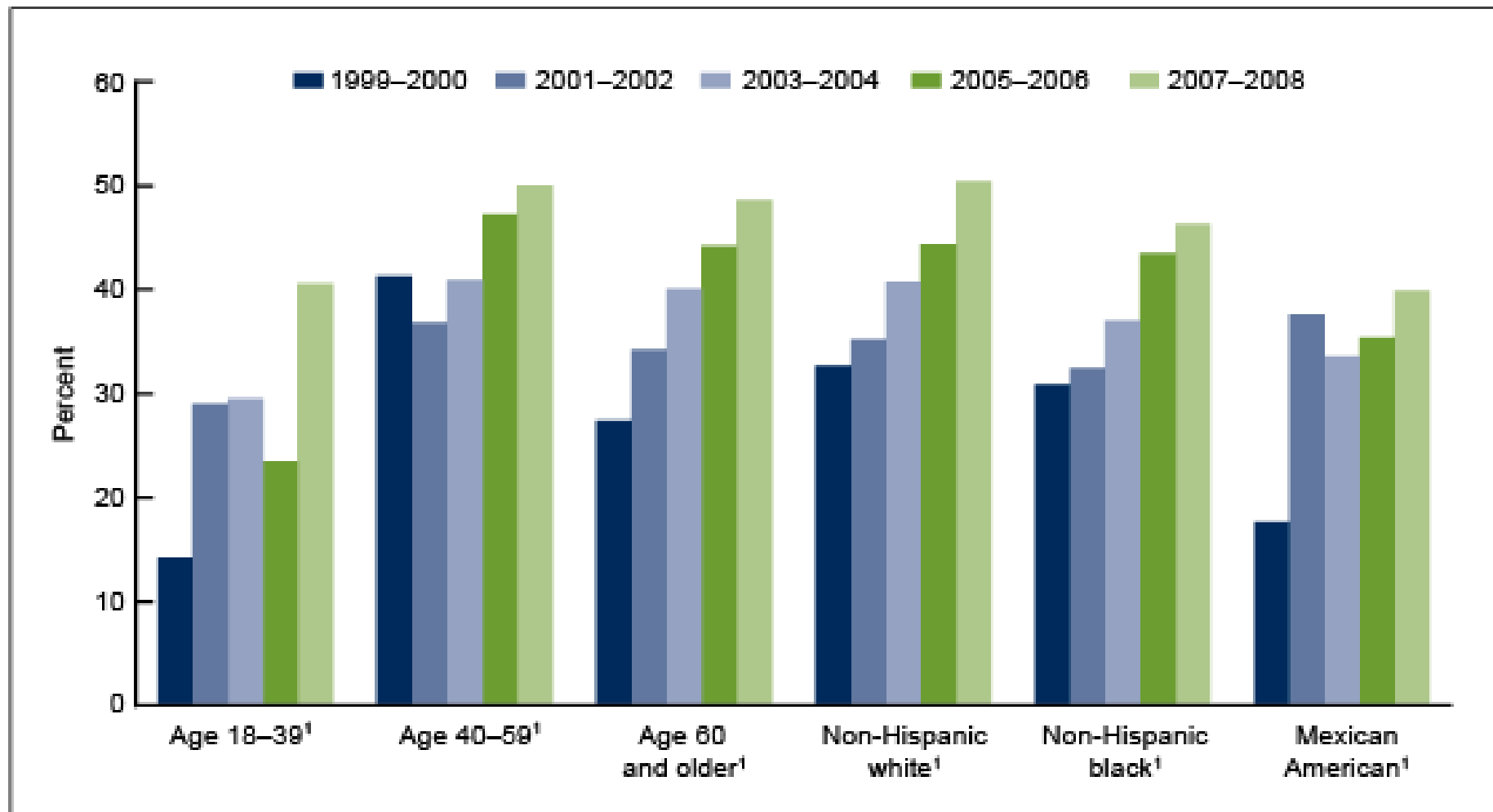


\*Percentage of high school students who smoked cigarettes on 1 or more of the 30 days preceding the survey (Youth Risk Behavior Survey, 1991-2013).

\*\*Percentage of adults who are current cigarette smokers (National Health Interview Survey, 1965-2014).

Source: [https://www.cdc.gov/tobacco/data\\_statistics/tables/trends/cig\\_smoking/index.htm](https://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm)

Figure 5. Age-specific and age-adjusted control of high blood pressure among U.S. adults with high blood pressure: 1999–2000 through 2007–2008



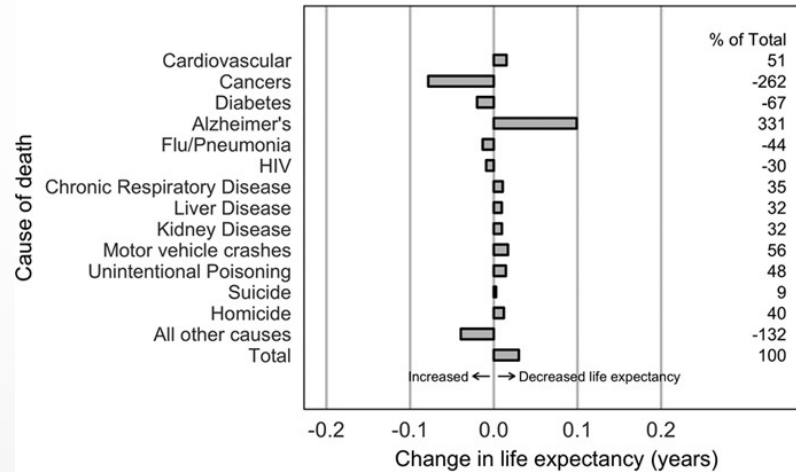
<sup>1</sup> Statistically significant in trend:  $p \leq 0.05$ .

SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

# Declining US Life Expectancy

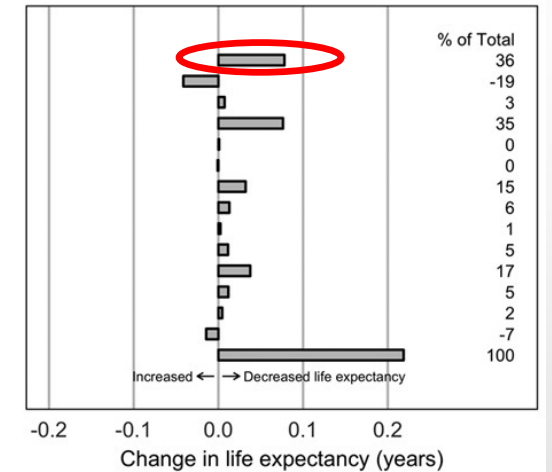
Non-Hispanic Black Women (9% of population)

Life expectancy in 2014: 78.8; in 2015: 78.8



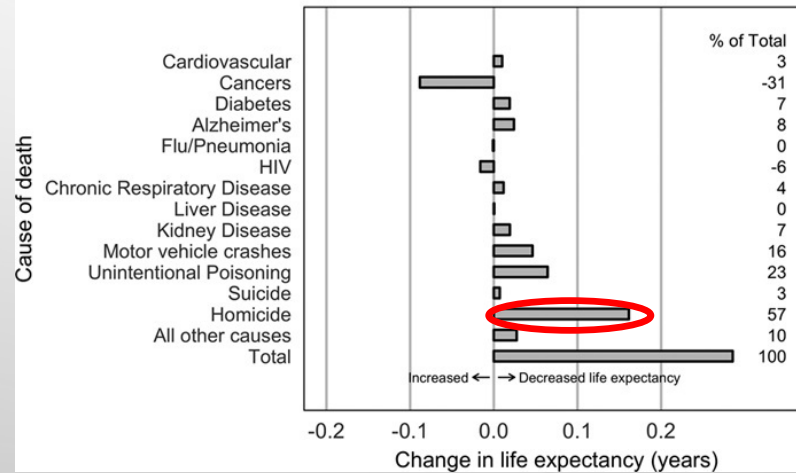
Non-Hispanic White Women (42% of population)

Life expectancy in 2014: 81.3; in 2015: 81.1



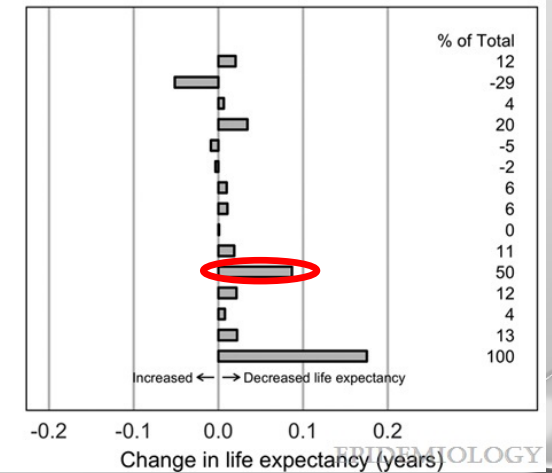
Non-Hispanic Black Men (8% of population)

Life expectancy in 2014: 72.7; in 2015: 72.4

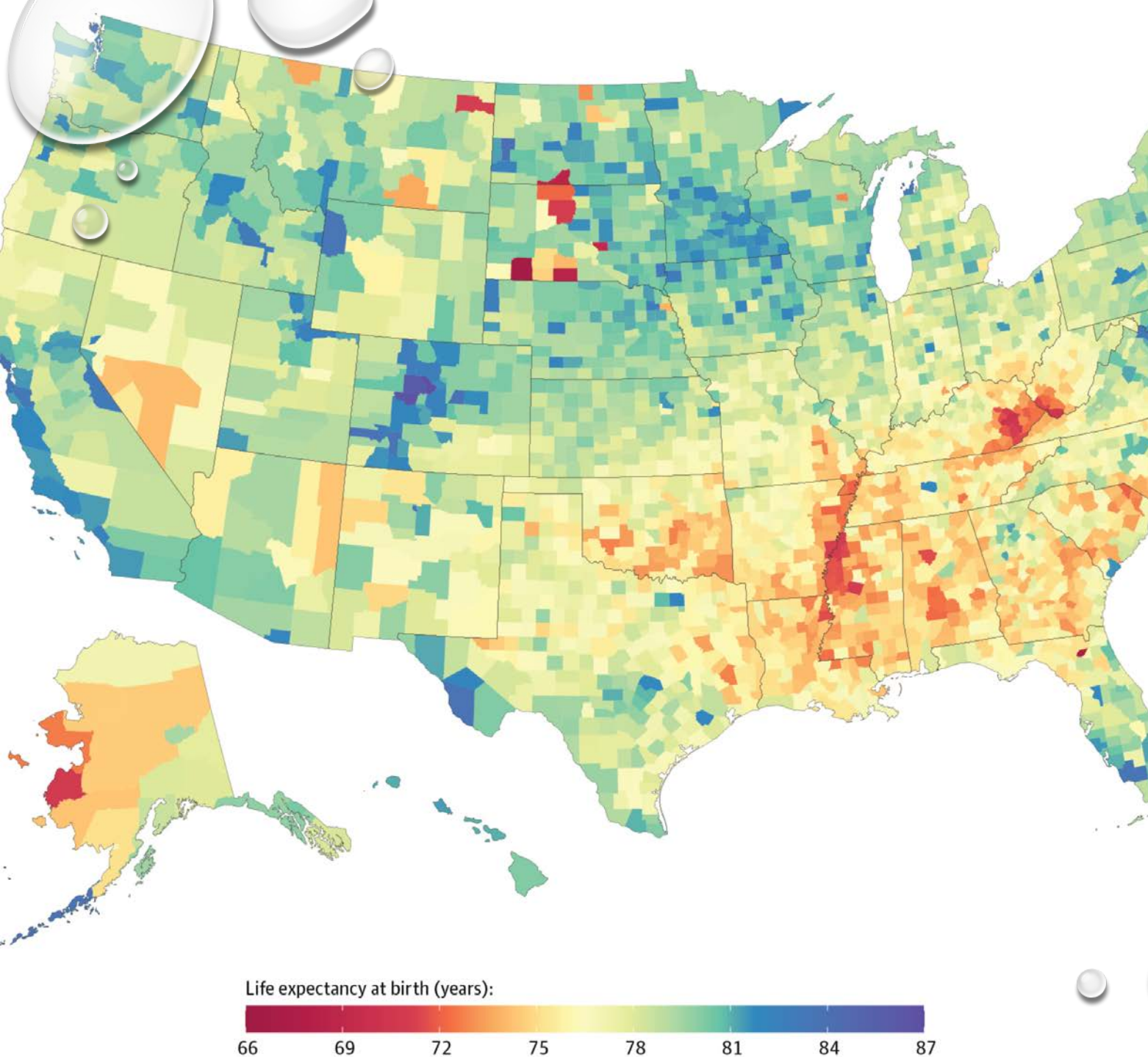


Non-Hispanic White Men (41% of population)

Life expectancy in 2014: 76.6; in 2015: 76.5







## Inequalities in Life Expectancy Among US Counties, 1980 to 2014

- Geographic disparities in life expectancy among US counties are large and **increasing**.
- Difference in life expectancy between the lowest ranking county and the highest ranking county is 20.1 years
- Socioeconomic and race/ethnicity factors, behavioral and metabolic risk factors, and health care factors explained **74%** of this variation.
- Most of the association between socioeconomic and race/ethnicity factors and life expectancy was mediated through behavioral and metabolic risk factors.

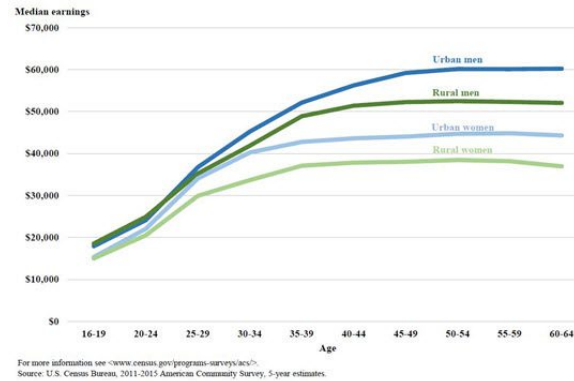


# Rural Residents and Rural Health

## Residents of Rural Areas

- Approximately 17% of Americans
- 65% of all U.S. counties
- 445 “frontier” counties
- Rurality Matters

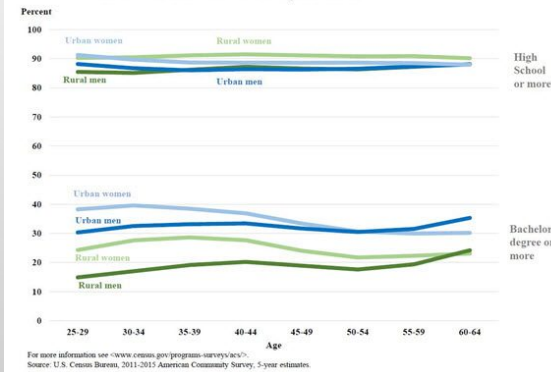
Figure 4. Median Earnings Among Full-Time, Year-Round Workers by Age and Sex for Urban and Rural Populations



## Health Issues in Rural Areas

- Older (51 vs. 45)
- Less education
- Sicker
- Lower life expectancy (76.7 vs 79.1)
- Fewer health care providers

Figure 6. Educational Attainment by Age and Sex for Urban and Rural Populations

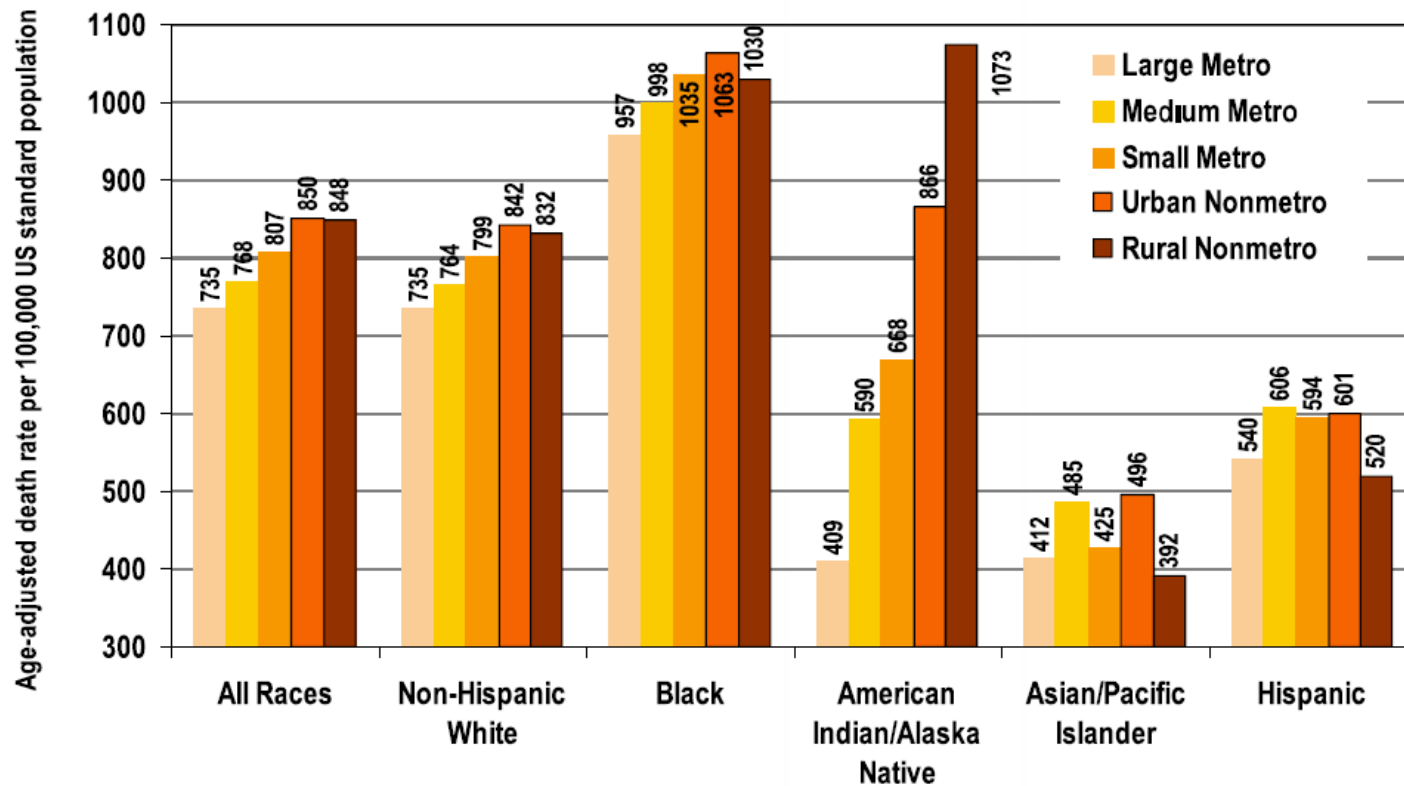


# Health Care Facilities in Rural Areas

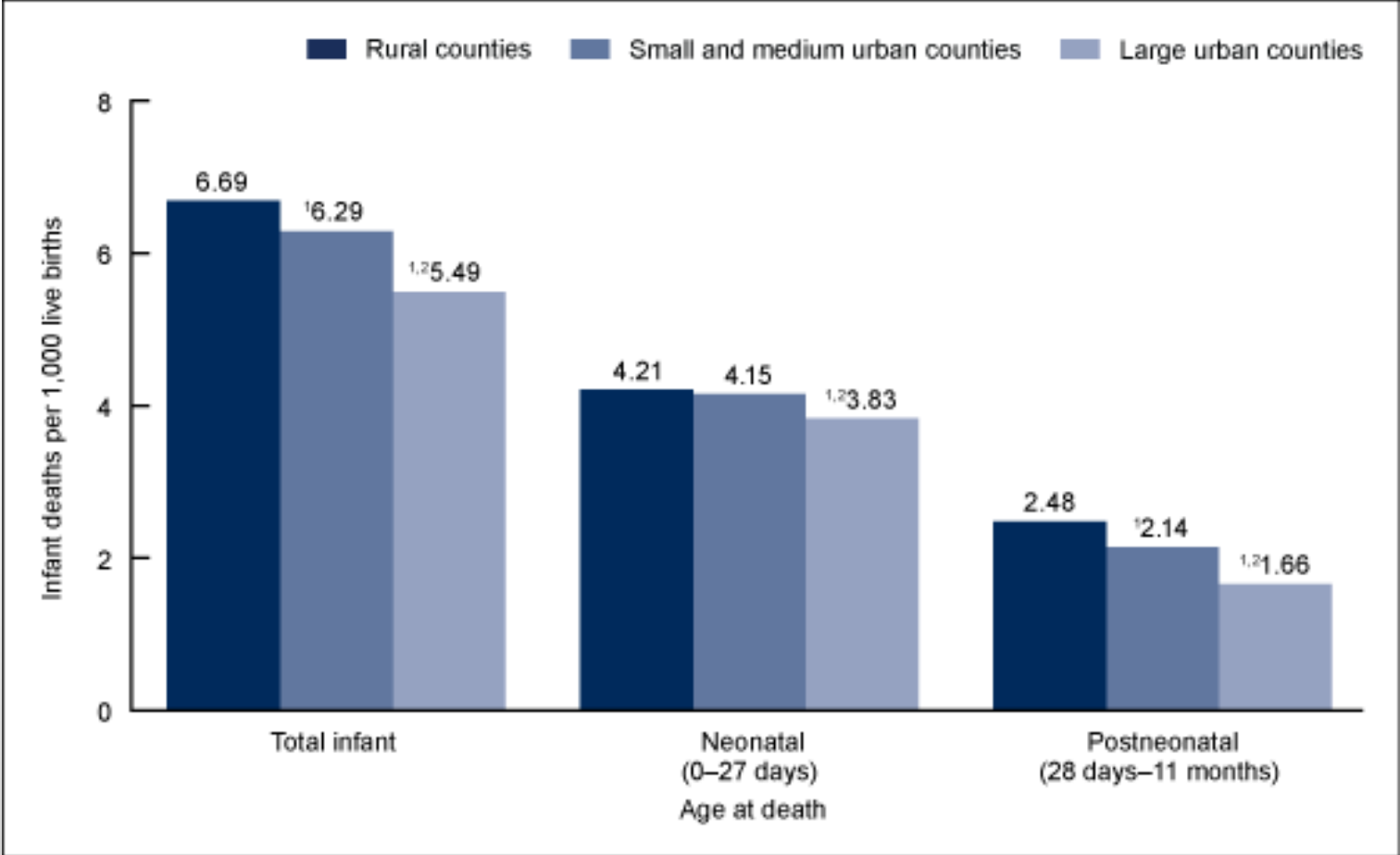
- 2,300 rural hospitals
- 71% have 50 or fewer beds.
- Increase closure due to finance
- Rural hospitals typically do not include:
  - Intensive care
  - Skilled nursing facility
  - Psychiatric
  - Rehabilitation
  - Hospice services, home health services, chemotherapy services, dental services, or outpatient drug/alcohol abuse care

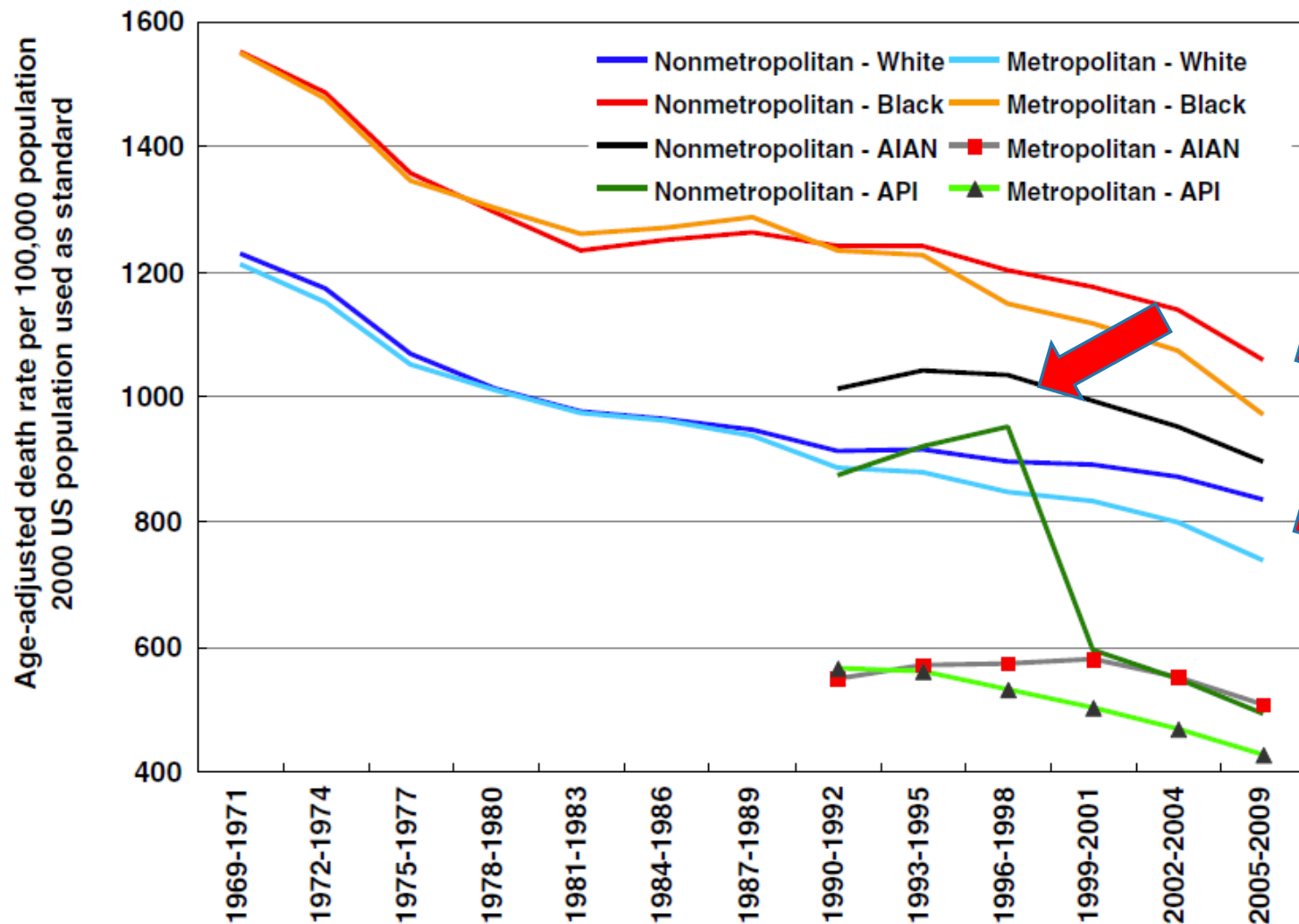
# Widening Rural–Urban Disparities in All-Cause Mortality and Mortality from Major Causes of Death in the USA, 1969–2009

RURAL–URBAN TRENDS IN US MORTALITY



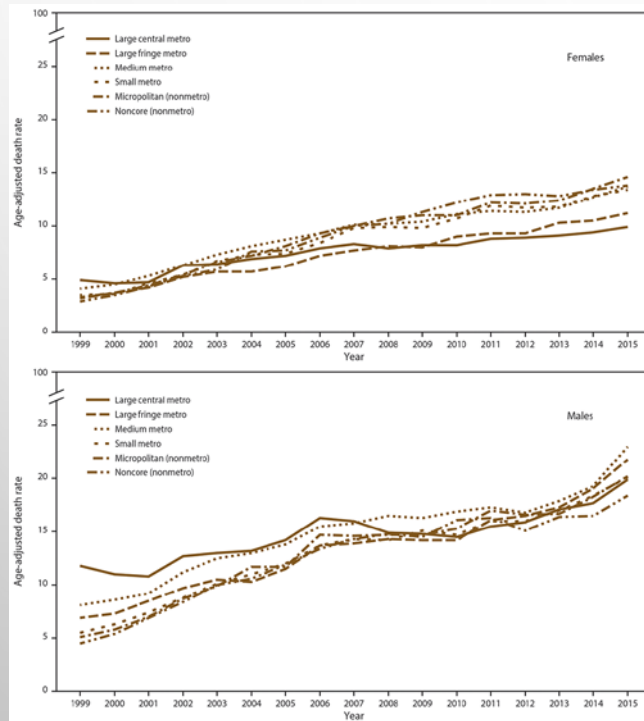
Total infant, neonatal, and postneonatal mortality rates, by urbanization level: United States, 2013–2015





**FIGURE 1.** All-cause mortality rates in metropolitan and non-metropolitan areas by sex and race, USA, 1969–2009 (API Asians and Pacific Islanders, AIAN American Indians and Alaska Natives).

# #1 Opioid Epidemic



- CDC Reports Drug overdose death rates are higher in rural areas than in urban areas
- 4.0 vs 6.4 in 1999; converged in 2004; 17.0 vs 16.2 in 2015



## Four Factors That Explain Increases in Nonmedical Prescription Opioid Misuse in Rural More Than Urban Areas

1. Increased sales of opioid analgesics in rural areas lead to greater availability for nonmedical use through diversion.
2. Out-migration of upwardly mobile young adults from rural areas increases economic deprivation and creates an aggregation of young adults at high risk for drug use.
3. Tight kinship and social networks allow faster diffusion of nonmedical prescription opioids among those at risk.
4. Increasing economic deprivation and unemployment create a stressful environment that places individuals at risk.

Understanding the Rural–Urban Differences in Nonmedical Prescription Opioid Use and Abuse in the United States. Katherine M. Keyes et al. Am J Public Health. 2014.



# #1 Opioid Epidemic



America's Hidden H.I.V. Epidemic  
By Linda Villarosa, June 6, 2017  
The New York Times Magazine - The New York Times

## #2 Unprecedented HIV and Hepatitis outbreak

The New York Times | <https://nyti.ms/1lbpyAC>

U.S.

### Rural Indiana Struggles to Contend With H.I.V. Outbreak

By ABBY GOODNOUGH MAY 5, 2015

### Indiana community's HIV outbreak a warning to rural America

Laura Ungar and Chris Kenning, USA TODAY Published 3:29 p.m. ET May 13, 2015 | Updated 7:25 p.m. ET May 17, 2015



(Photo: Darren Cummings, AP)

AUSTIN, Ind. — This small, close-knit community is a picture of rural America, with stubble-filled cornfields and a Main Street lined by churches, shops and sidewalks. It's also the unlikely epicenter of the largest outbreak of HIV, the AIDS virus, in Indiana's history — and a warning to the rest of the nation.

Public health experts say rural places everywhere contain the raw ingredients that led to Austin's tragedy. Many struggle with poverty, addiction and doctor shortages, and they lag behind urban areas in HIV-related funding, services and awareness. And the same lack of anonymity that gives rural towns their charm foments a strong stigma that discourages testing and treatment.

- 45,000 new H.I.V. infections each year
- 65 percent with H.I.V. are not on treatment

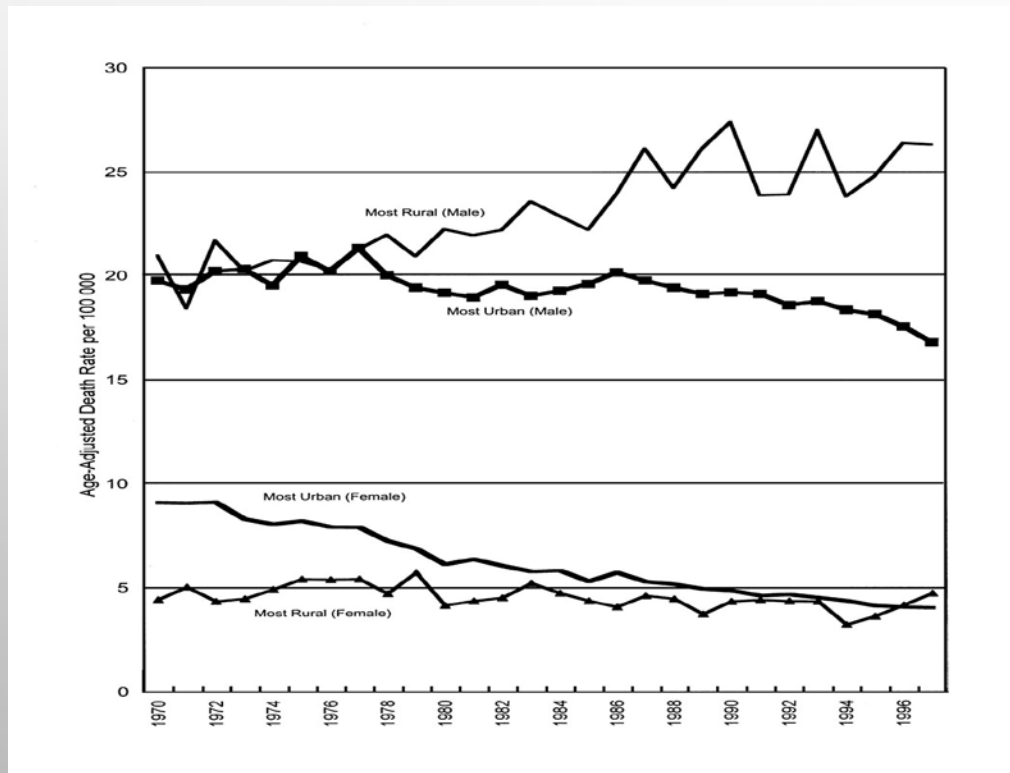
CDC identified 220 US counties in 26 states potentially vulnerable to HIV and HCV infections





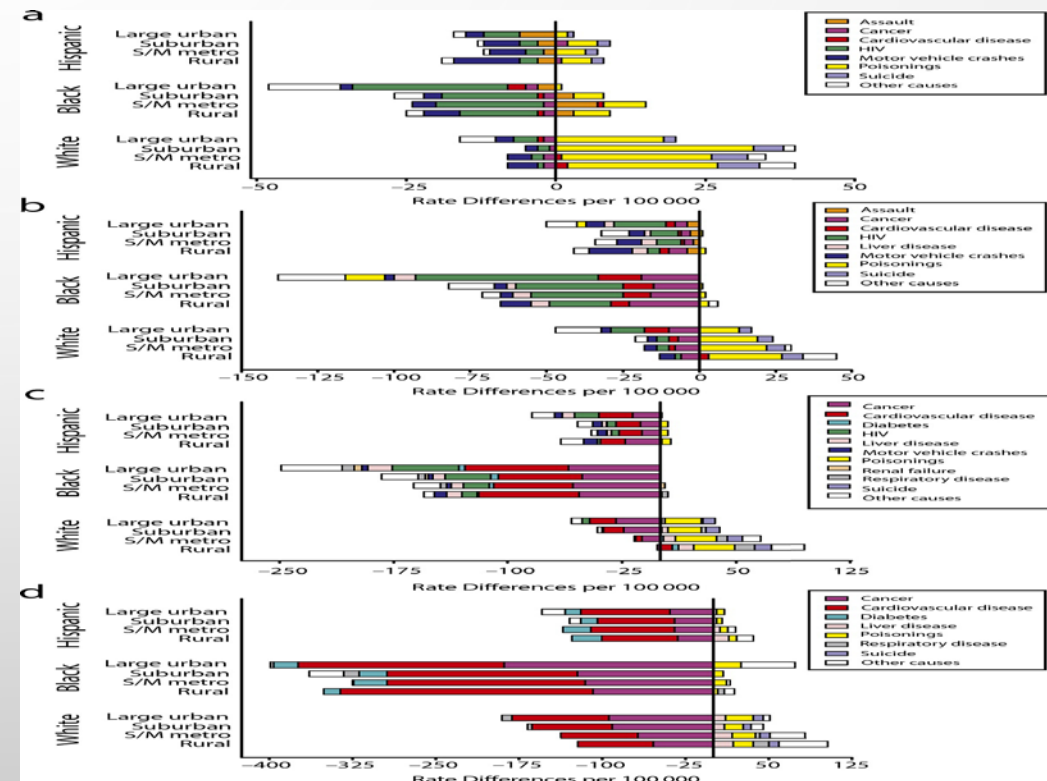
# #3 Suicide

Increasing Rural–Urban Gradients in US Suicide Mortality, 1970–1997



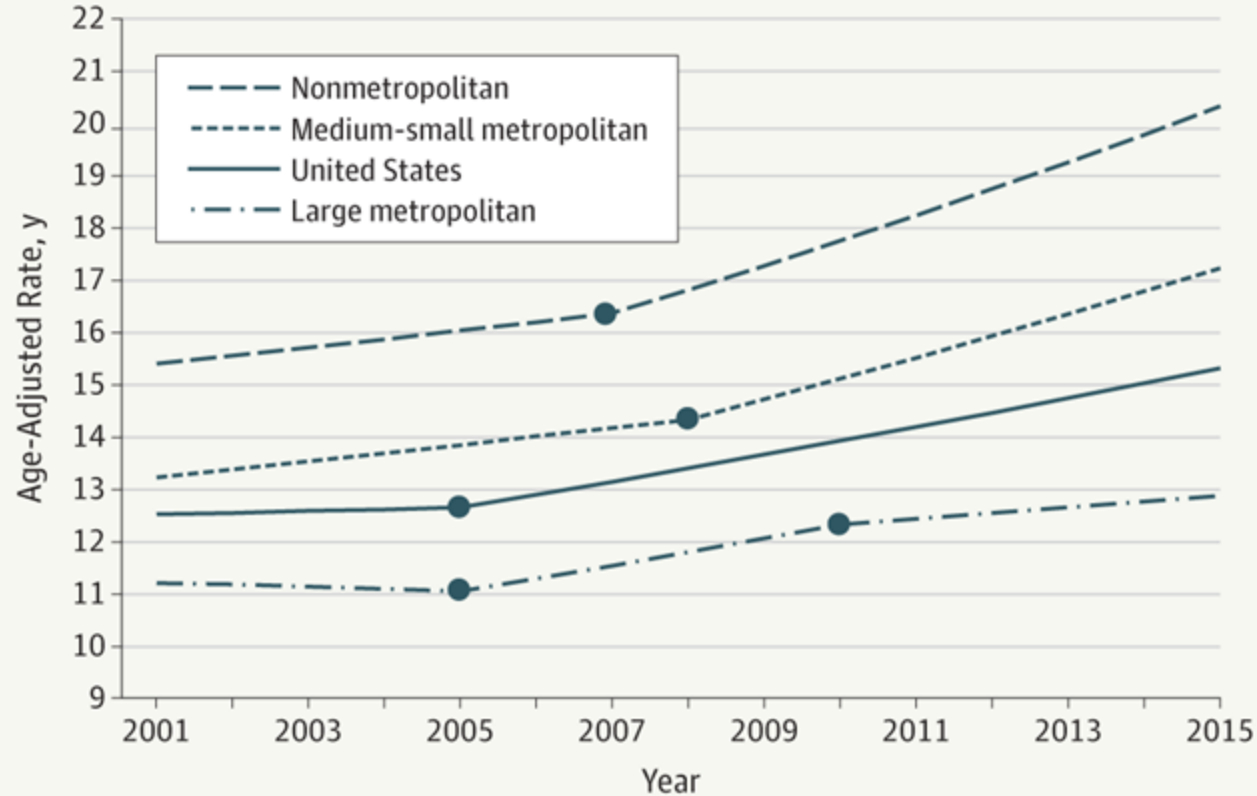
Gopal K. Singh, Mohammad Siahpush  
Am J Public Health. 2002

The Epidemic of Despair Among White Americans: Trends in the Leading Causes of Premature Death, 1999–2015



Elizabeth M. et al. Am J Public Health. October, 2017.

### Suicide Rates Among Persons Aged 10 Years or Older, by County Urbanization Level—United States, 2001-2015<sup>a</sup>



<sup>a</sup>Suicide rates are per 100 000 residents aged 10 years or older, age adjusted to the 2000 US standard population. Levels of urbanization were collapsed using the 2006 National Center for Health Statistics urban classification scheme. Joinpoint regression analysis was used to determine annual percentage change with statistically significant trend ( $P < .05$ ). Circles indicate the joinpoints.

Source: *Morb Mort Wkly Rep (MMWR)*. 2017;66(18):1-16.

## #4 Chronic Diseases and Risk Factors in Rural Areas

TABLE 1—National, Rural, and Urban Weighted Prevalences of Adult Tobacco Product Use: Population Assessment of Tobacco and Health (PATH) Study, United States, 2013–2014

Category	Traditional Tobacco Product Use, % (SE)						Emerging Tobacco Product Use, % (SE)			Dual or Polytabacco Use, % (SE)		
	Cigarettes (Daily)	Cigarettes	Menthol Cigarettes	Smokeless Tobacco	Cigars	Pipes	E-Cigarettes	Cigarillos	Hookah	Traditional Only	Emerging Only	Mixed
Overall	14.4 (0.25)	22.5 (0.31)	6.6 (0.14)	3.0 (0.10)	3.6 (0.10)	0.9 (0.05)	6.7 (0.15)	4.4 (0.10)	2.2 (0.09)	1.4 (0.05)	0.4 (0.03)	8.5 (0.17)
Rural	18.3 (0.73)	24.6 (0.91)	5.8 (0.41)	6.3 (0.31)	3.2 (0.19)	0.9 (0.11)	6.2 (0.31)	3.8 (0.19)	0.9 (0.09)	2.2 (0.14)	0.2 (0.04)	7.8 (0.35)
Urban	13.4 (0.23)	22.0 (0.30)	6.9 (0.15)	2.1 (0.11)	3.6 (0.11)	0.9 (0.05)	6.8 (0.16)	4.6 (0.12)	2.5 (0.11)	1.2 (0.05)	0.4 (0.03)	8.7 (0.19)
Difference test P	< .001	.005	.03	< .001	.07	.74	.08	< .001	< .001	< .001	.005	.02





## #4 Chronic Diseases: West Virginia

- West Virginia ranked 1st highest in the nation in the prevalence of heart attack (7.5%) and coronary heart disease (8.0%).
- West Virginia ranked the 7th highest in the nation in the prevalence of stroke (4.4%).
- The overall cardiovascular disease prevalence was 1st highest in the nation at 14.6%.
- The prevalence of cardiovascular disease was highest among men, those aged 65 and older, those with less than a high school education, and those with an annual household income less than \$15,000.
- The prevalence of cardiovascular disease was significantly higher in Grant, Logan, McDowell, Mingo, and Wyoming counties than the state as a whole.
- More than half of West Virginia adults (50.8%) are currently watching or reducing their sodium intake.





National Institute  
on Minority Health  
and Health Disparities

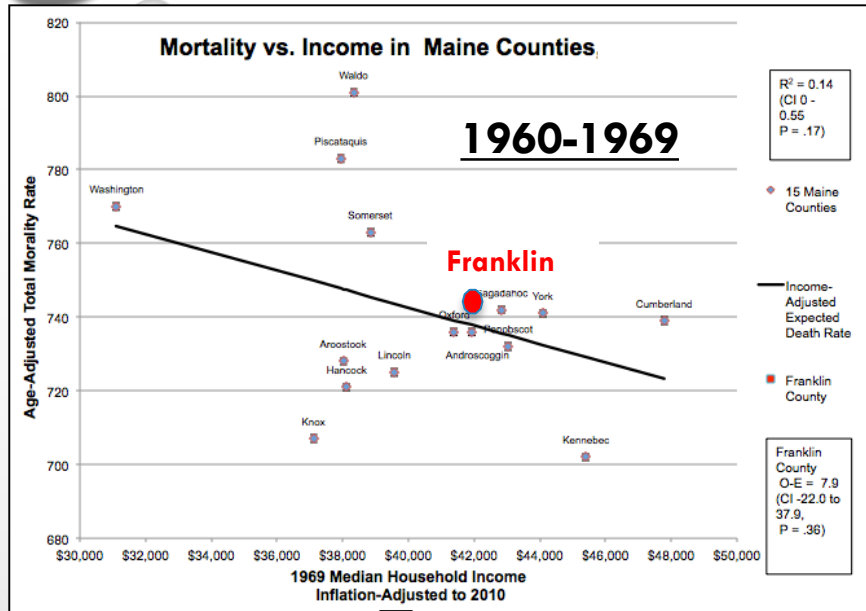
## NIMHD Workshop on the Science of Prevention and Health Promotion to Address Health Disparities

*"Preventing Disparities in Chronic Diseases:  
Community-based Multilevel Interventions"*

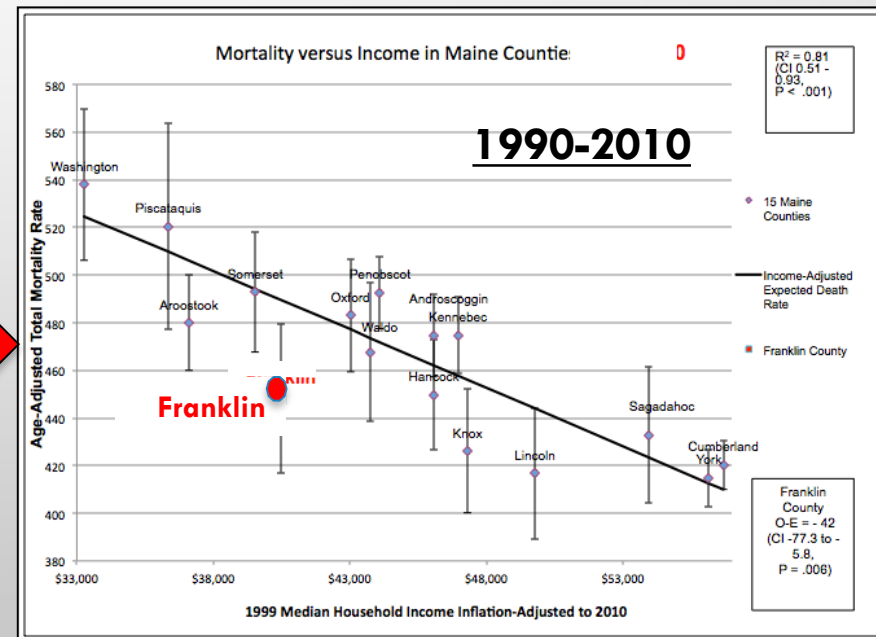
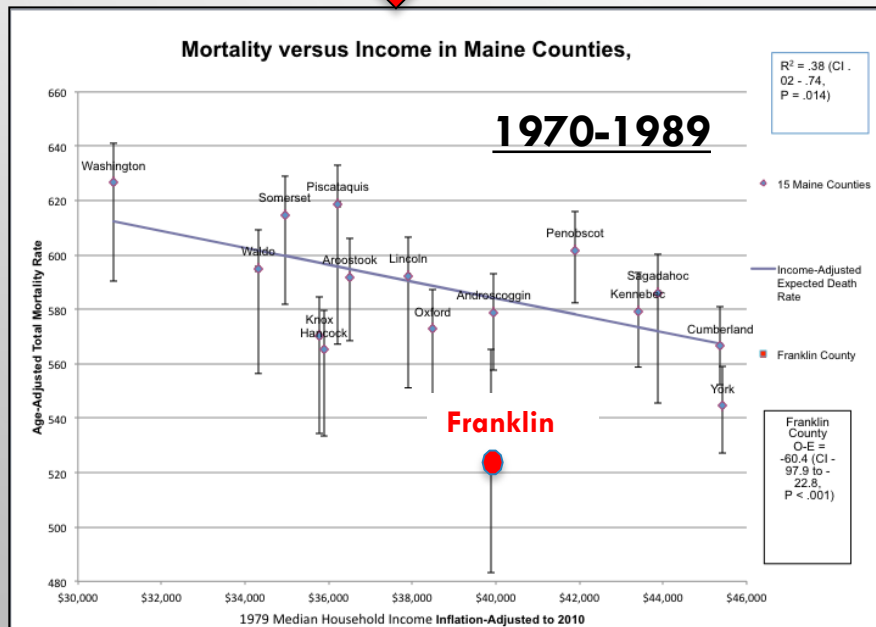
March 30 & 31, 2015  
Natcher Building 45, Room E1/E2  
National Institutes of Health, Bethesda, Maryland



# Mortality vs. Income in Maine Counties, 1960-2010



1960-1969: Franklin death rate is not different than predicted by income.  
 1970-1989: Franklin rate is lowest in Maine, significantly less than predicted by income.  
 1990-2010: Franklin County has significantly lower mortality than predicted by income.



N. Burgess  
Record, et al  
JAMA. 2015.  
Slide by  
Pearson TA.



National Institutes of Health  
Office of Disease Prevention

Spotlight on the Pathways to  
Prevention Program

Newsletter | Summer 2018

Pathway to Prevention (P2P):  
*Achieving Health Equity in Preventive Services*

By Amanda Borsky, Chunliu Zhan, Therese Miller, Quyen Ngo-Metzger, Arlene S. Bierman, and David Meyers

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**DATAWATCH**

# Few Americans Receive All High-Priority, Appropriate Clinical Preventive Services

*As of 2015, only 8 percent of US adults ages thirty-five and older had received all of the high-priority, appropriate clinical preventive services recommended for them. Nearly 5 percent of adults did not receive any such services. Further delivery system-level efforts are needed to increase the use of preventive services.*

**DOI:** 10.1377/hlthaff.2017.1248  
HEALTH AFFAIRS 37,  
NO. 6 (2018): 925-928  
©2018 Project HOPE—  
The People-to-People Health  
Foundation, Inc.



**Percentages of US adults ages thirty-five and older receiving individual high-priority, appropriate clinical preventive services, by sex, 2015**

<b>Service</b>	<b>All</b>	<b>Women</b>	<b>Men</b>
<b>SCREENING</b>			
Blood pressure	87.3%	89.6%	84.7%***
Cholesterol	82.3	85.0	79.3***
Breast cancer	73.9	73.9	— <sup>a</sup>
Colon cancer	63.6	64.9	62.1
Cervical cancer			
Women ages 35–64	75.5	75.5	— <sup>a</sup>
Women ages 75 and older <sup>b</sup>	68.3	68.3	— <sup>a</sup>
Osteoporosis	63.2	63.2	— <sup>a</sup>
PSA (men ages 75 and older) <sup>b</sup>	50.2	— <sup>a</sup>	50.2
<b>SCREENING AND COUNSELING</b>			
Tobacco use	61.9	63.7	59.8
Obesity	64.2	68.9	59.2****
Alcohol use	41.1	42.8	39.2
Depression	41.0	45.1	36.5****
<b>VACCINATIONS</b>			
Flu	48.7	51.0	46.3
Zoster	37.9	38.9	36.6
Pneumococcal	65.9	67.3	64.3
<b>PREVENTIVE MEDICATION</b>			
Aspirin use	45.7	40.9	50.7****



# 2014 IOM Report

## Capturing Social and Behavioral Domains and Measures in Electronic Health Records

### PHASE 2

Committee on the Recommended Social and Behavioral Domains and  
Measures for Electronic Health Records

Board on Population Health and Public Health Practice

INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES

<http://nationalacademies.org/HMD/Activities/PublicHealth/SocialDeterminantsEHR.aspx>

# Health Equities Common Data Elements

- PhenX Measures for Research in Health Equities (Administrative Supplement)
- Convene a Health Equities Research and Scientific Panel (ERSP).
- Establish a Health Equities Working Group (WG).
- Identify and include Health Equities-related measures in the PhenX Toolkit.
- Identify Core measures for health equities.

Grant #: Genomic Resource Grant for the PhenX Toolkit - expansion and sustainability/U41 HG007050 (PAR-14-191 Genomic Resource Grants for Community Resource Projects)

Program Contact: Xinzhi Zhang, MD, PhD

Institution: Research Triangle Institute

Funding: \$ 399,771



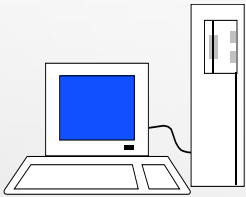
Vital statistics



Hospitals



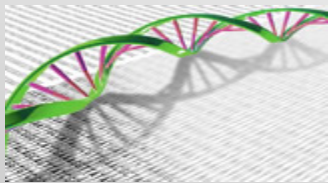
Household Surveys



Registries/Cohorts



Telephone Surveys



Genomic Data

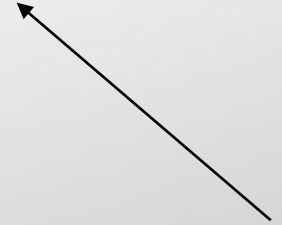
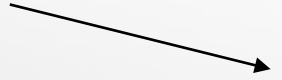
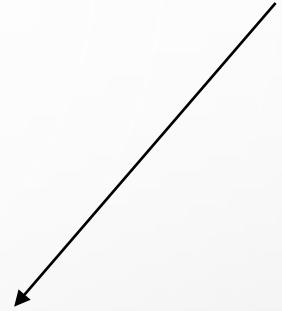
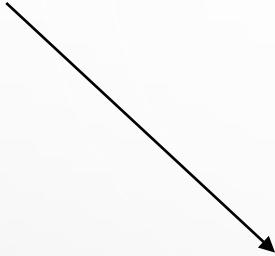


Mobile Data



Social Media

# Big Data System



Original Report:  
Big Data

## **BIG DATA SCIENCE: OPPORTUNITIES AND CHALLENGES TO ADDRESS MINORITY HEALTH AND HEALTH DISPARITIES IN THE 21ST CENTURY**

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Xinzhi Zhang, MD, PhD<sup>1</sup>; Eliseo J Pérez-Stable, MD<sup>1</sup>; Philip E. Bourne, PhD<sup>2</sup>;  
Emmanuel Peprah, PhD<sup>3</sup>; O. Kenrik Duru, MD, MSHS<sup>4</sup>; Nancy Breen, PhD<sup>1</sup>;  
David Berrigan, PhD, MPH<sup>5</sup>; Fred Wood, DBA, MBA<sup>6</sup>; James S Jackson, PhD<sup>7</sup>;  
David W.S. Wong, PhD, MA<sup>8</sup>; Joshua Denny, MD, MS<sup>9</sup>

*Ethnicity & Disease*, Volume 27, Number 2, Spring 2017

Original Report:  
Big Data  
and its Application  
in Health Research

## **ENHANCING DIVERSITY IN BIOMEDICAL DATA SCIENCE**

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Judith E Canner, PhD<sup>1</sup>; Archana J. McEligot, PhD<sup>2</sup>;  
María-Egléc Pérez, PhD<sup>3</sup>; Lei Qian, PhD<sup>4</sup>; Xinzhi Zhang, MD, PhD<sup>5</sup>

*Ethnicity & Disease*, Volume 27, Number 2, Spring 2017



## Department of Health and Human Services Part 1. Overview Information

Participating Organization(s)	National Institutes of Health (NIH)
Components of Participating Organizations	National Institute on Minority Health and Health Disparities (NIMHD) National Cancer Institute (NCI) National Heart, Lung, and Blood Institute (NHLBI) National Institute on Aging (NIA) National Institute on Deafness and Other Communication Disorders (NIDCD) National Institute on Drug Abuse (NIDA) National Institute of Mental Health (NIMH) National Library of Medicine (NLM) Division of Program Coordination, Planning and Strategic Initiatives, Office of Disease Prevention (ODP) Office of Behavioral and Social Sciences Research (OBSSR)
Funding Opportunity Title	Simulation Modeling and Systems Science to Address Health Disparities (R01Clinical Trial Not Allowed)
Activity Code	R01 Research Project Grant
Announcement Type	New
Related Notices	None
Funding Opportunity Announcement (FOA) Number	PAR-18-331
Companion Funding Opportunity	None



# Addressing the Challenges of the Opioid Epidemic in Minority Health and Health Disparities Research in the U.S. (R01/R21)

- PA-18-747 and PA-18-745
- The purpose of this Funding Opportunity Announcement (FOA) is to encourage developmental and exploratory research focused on determining the mechanisms for the variation in the prevalence of Opioid Use Disorder (OUD), and understanding and reducing disparities in opioid care in minority health and health disparity populations in the U.S. This initiative will also seek to identify multi-level intervention strategies at the institutional and systems level for addressing OUD in these populations.
- Scientific Program Officers Contact
  - Dr. Andrew Loudon, [Andrew.Louden@nih.gov](mailto:Andrew.Louden@nih.gov)
  - Dr. Benyam Hailu, [Benyam.Hailu@nih.gov](mailto:Benyam.Hailu@nih.gov)





2018 Health Disparities  
Research Institute (HDRI)

Scholars

@ The John Edward  
Porter Neuroscience  
Research Center / NIH  
August 23- 27, 2018





**THANKS!**