



Cardiovascular Disease in Appalachia: Disparities & Role of Psychological Health

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**Healthcare in Appalachia: Practical Approaches to
Addressing the Unique Needs of our Region**

Faculty Disclosure

- No relevant disclosures

Educational Need/Practice Gap

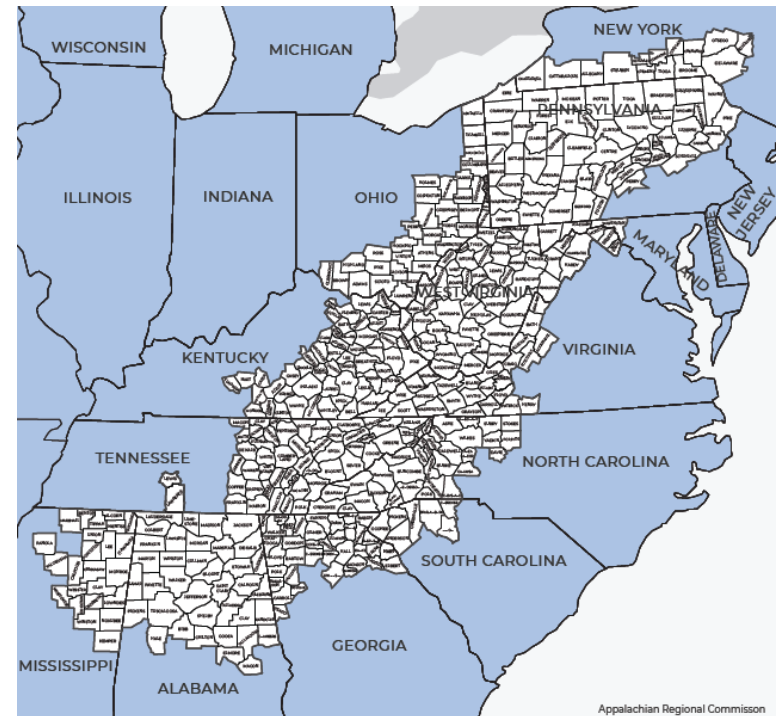
Gap = The burden of cardiovascular disease is high in the Appalachia Region, and the role of psychological health in contributing to this burden may be underrecognized.

Need = There is a need to understand the contribution of psychosocial determinants to cardiovascular health.

Objectives

Upon completion of this educational activity, you will be able to:

- Describe epidemiologic trends in cardiovascular disease and risk factors in Appalachia
- Review association of psychosocial factors and cardiovascular disease
- Understand the potential impact that COVID may have to worsen cardiovascular disease



Expected Outcome

- The expected outcome is that health care providers and public health leaders will implement change, that includes addressing psychosocial needs, to promote cardiovascular health in Appalachia

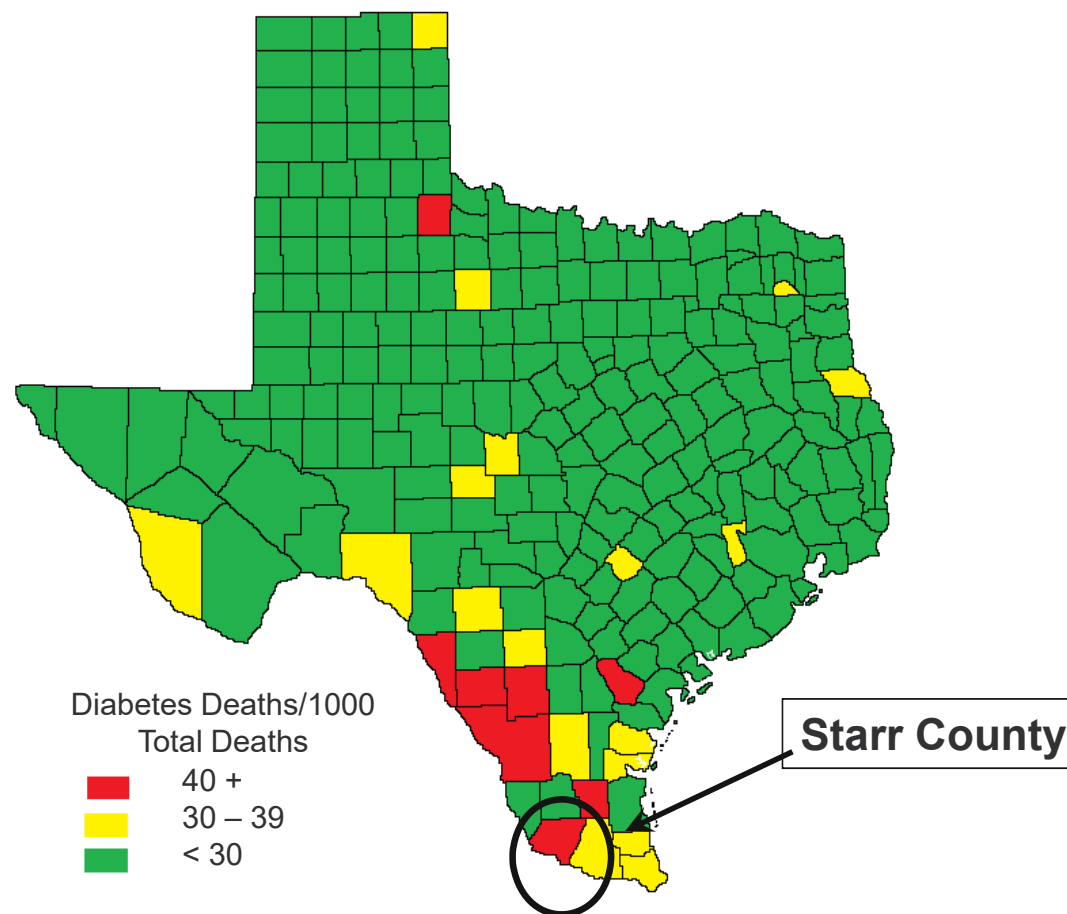
Personal Disclaimers

- I'm relatively new to Kentucky
- My direct work in Appalachia has been limited.



Starr County, Texas

- One of poorest counties in Texas
- Approximately 30% live below the poverty line
- Very high rates of diabetes & obesity (50%)
- Very strong sense of community, family ties & kinship, self-reliance



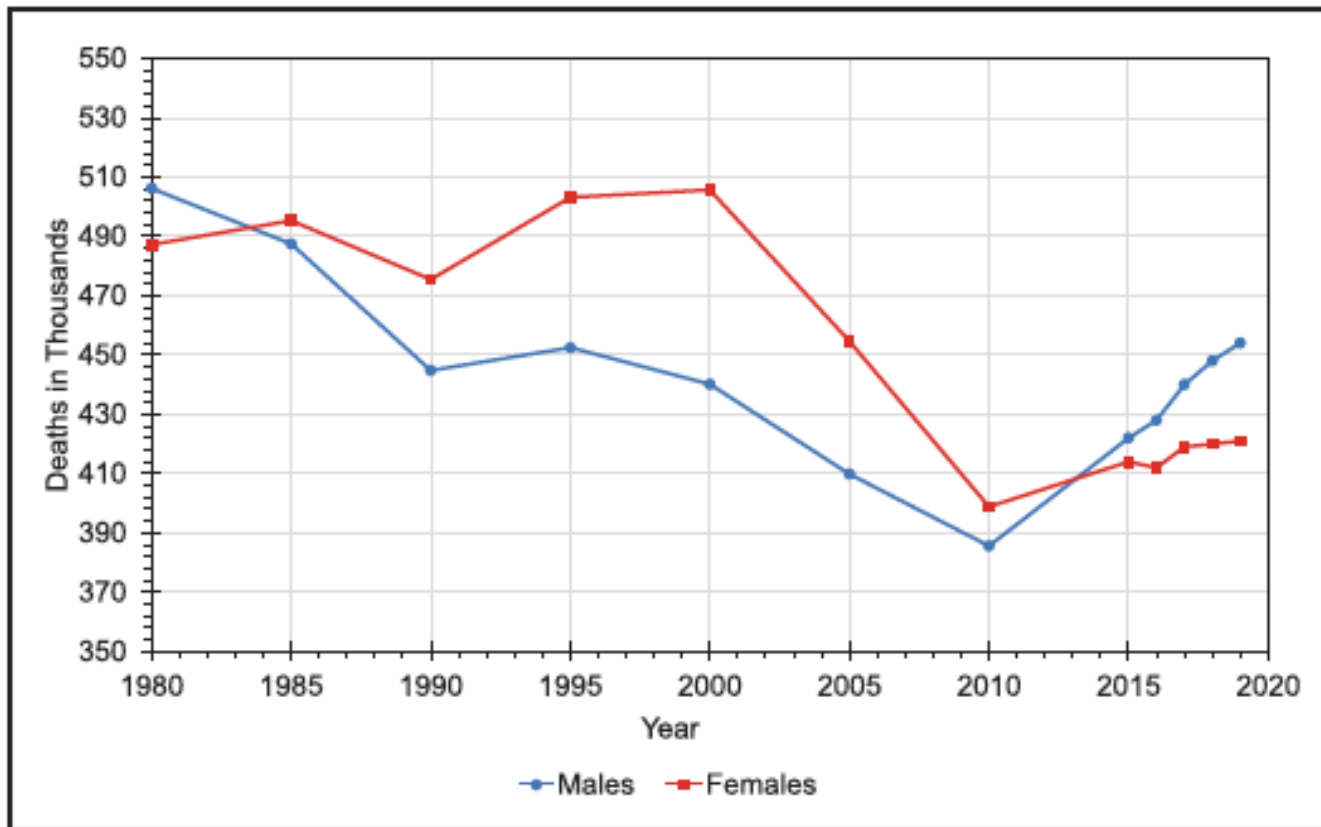
Outline

- Burden of heart disease & CV risk factors in Appalachia
- Influence of psychosocial and social determinants on CV disease
- Potential impact of COVID on CV risk factors & CVD

The Burden of Cardiovascular Disease

- Cardiovascular disease (CVD) is the leading cause of death for men, women, and people of most racial and ethnic groups in the US
- Among CVD, coronary heart disease (41.3%) was leading cause of CV death, followed by stroke (17.2%), high blood pressure (11.7%), heart failure (9.9%)
- Between 2017-2018, direct & indirect costs of total CVD were \$378 billion
- CVD accounts for 12% of total US health expenditures
- ~35% of the life changing adverse CV events occur in adults aged 35-64 years

CVD Mortality Trends for US Males & Females (1980 to 2019): Losing Ground

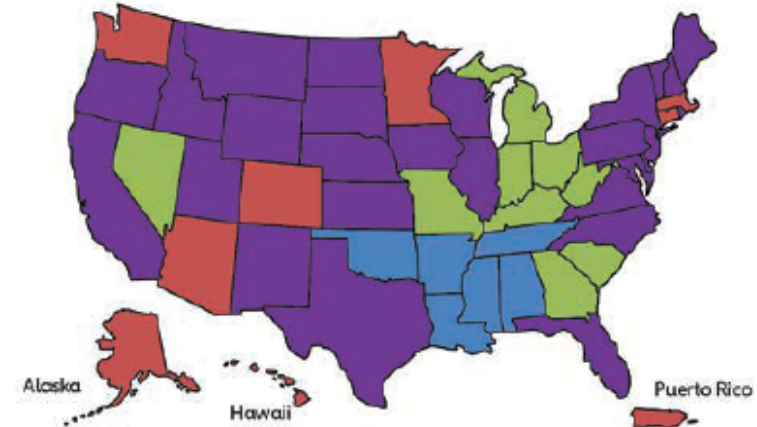
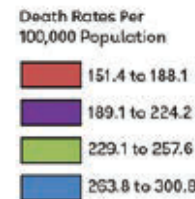


Remarkable Variation of CVD Across the US

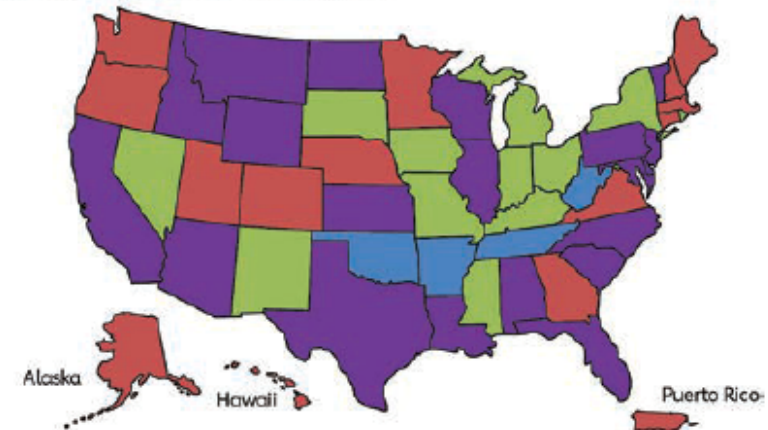
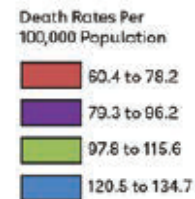
CVD Age-adjusted Death Rates (rank):

- 45. Kentucky
- 46. West Virginia
- 47. Tennessee
- 48. Louisiana
- 49. Arkansas
- 50. Oklahoma

Major Cardiovascular Disease Age-Adjusted Death Rates by State

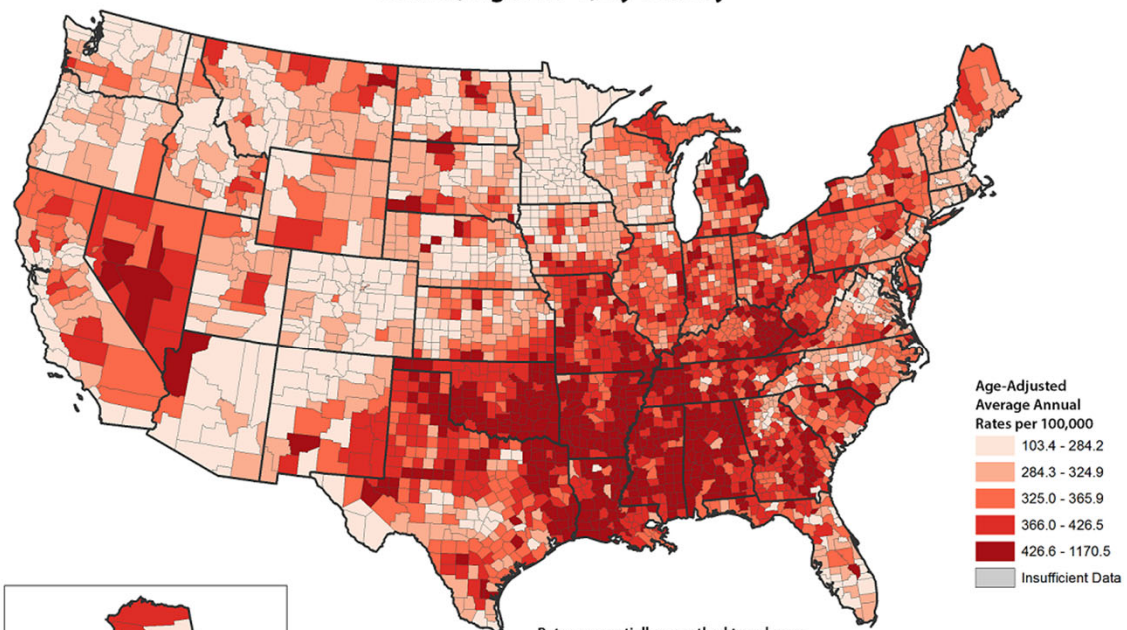


Coronary Heart Disease Age-Adjusted Death Rates by State



Remarkable Variation in CVD Across the Country (by County)

Heart Disease Death Rates, 2014-2016
Adults, Ages 35 +, by County



Age-Adjusted
Average Annual
Rates per 100,000

- 103.4 - 284.2
- 284.3 - 324.9
- 325.0 - 365.9
- 366.0 - 426.5
- 426.6 - 1170.5
- Insufficient Data

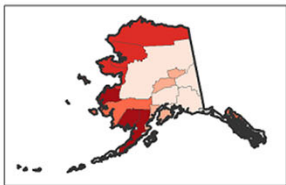
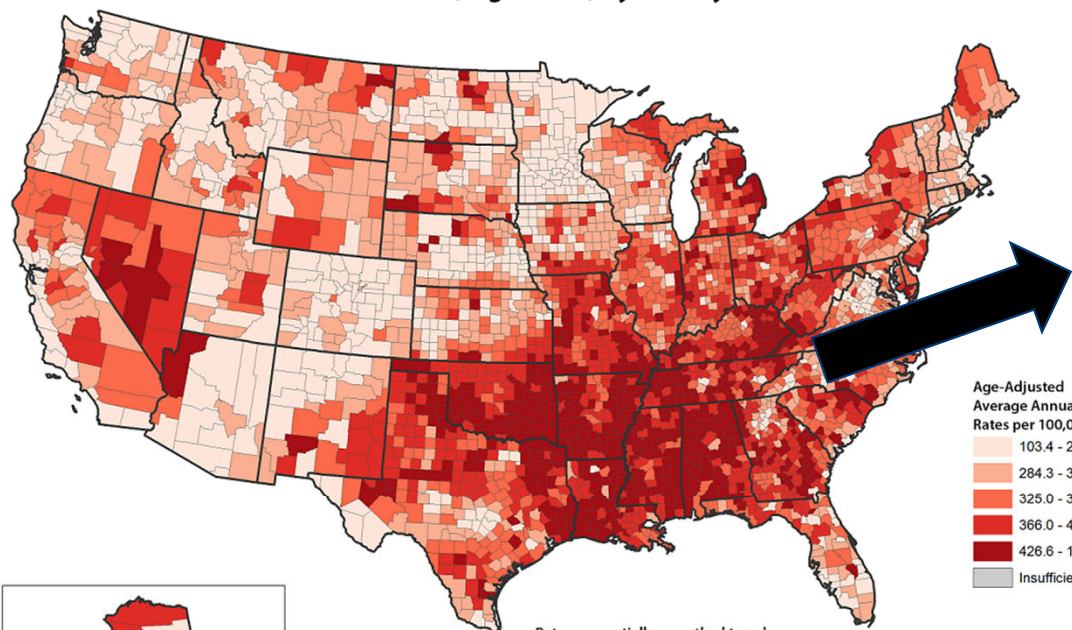
Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

Data Source:
National Vital Statistics System
National Center for Health Statistics
www.cdc.gov/dhdsp/maps



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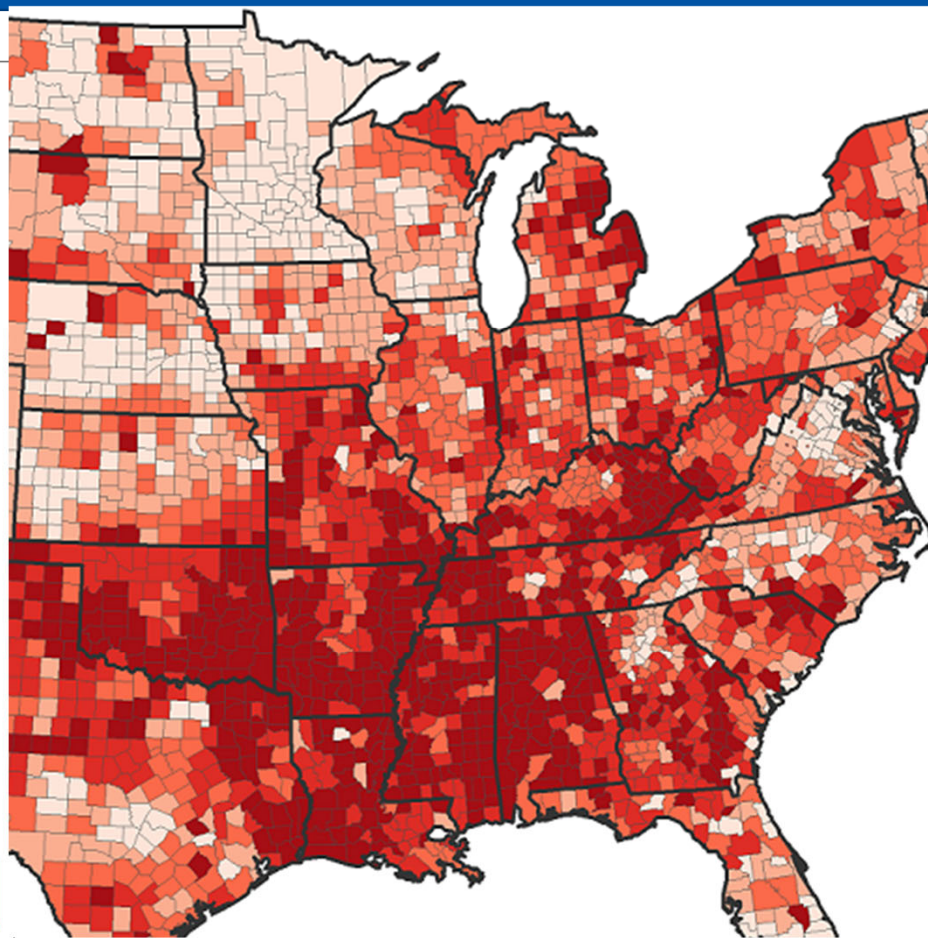


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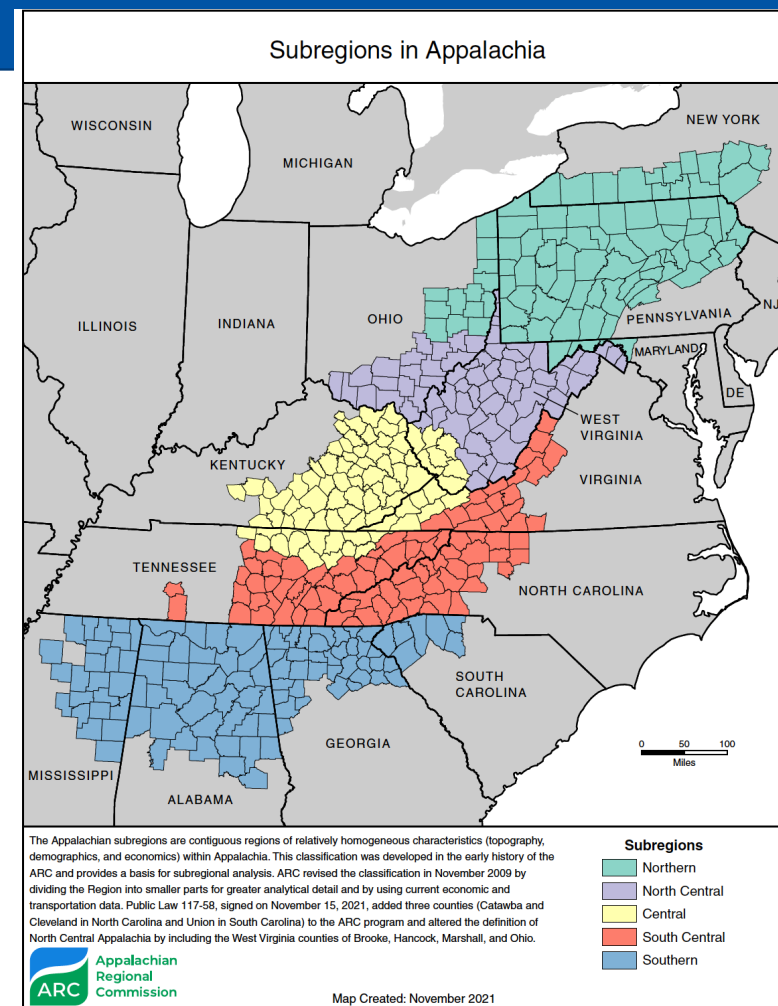


CVD in Appalachia

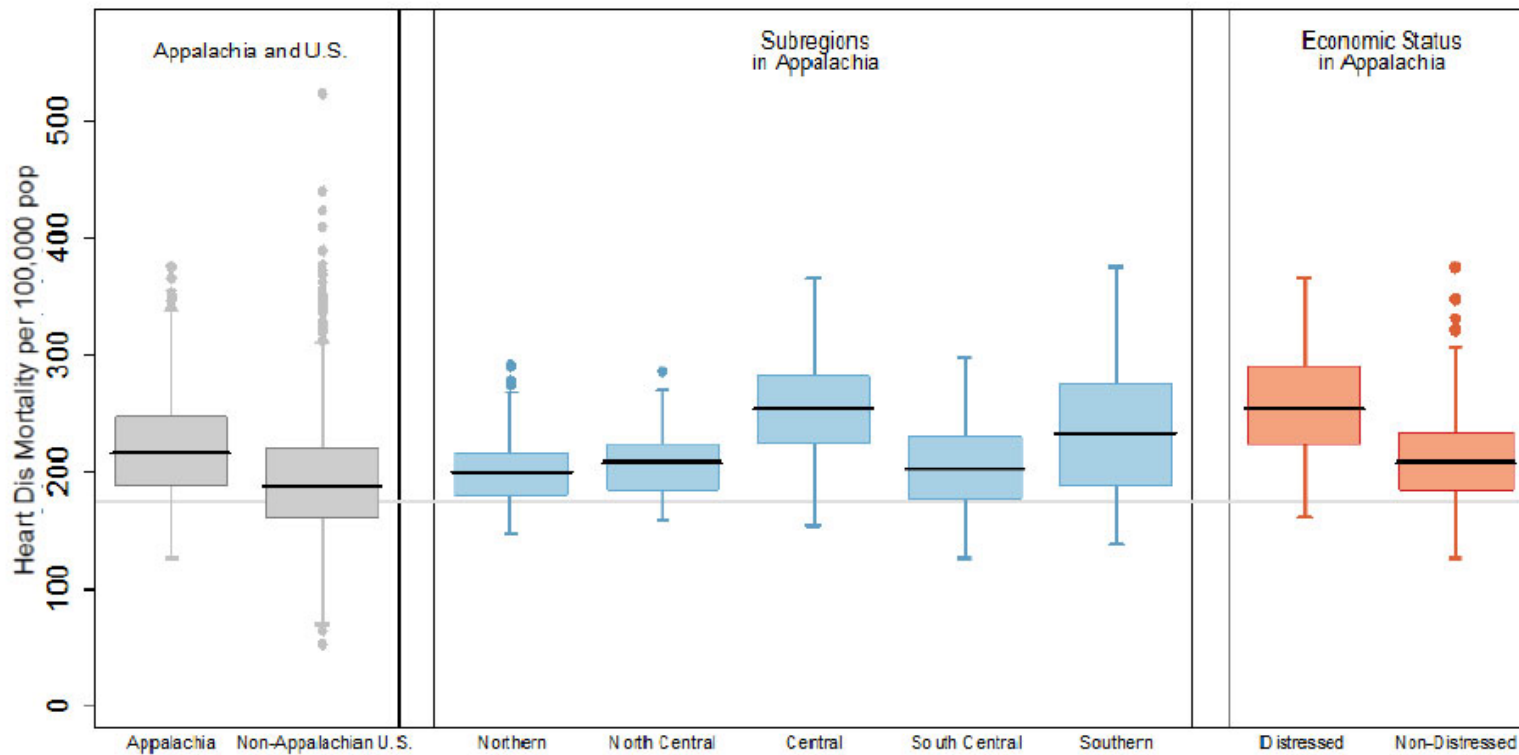
- CVD Mortality is 17% higher than the national average
- Central Appalachian nearly 50% higher than national rate. South Central Appalachia has lowest rate among subregions (still 10% higher than national average).
- CVD mortality in rural counties is 27% higher than large metro counties
- Heart disease mortality rate for economically distressed counties 29% higher than non-distressed counties



https://www.arc.gov/wp-content/uploads/2021/02/Health_Disparities_in_Appalachia_Mortality_Domain.pdf



Heart Disease Mortality Rates by Geography & Economic Status



Grey line denotes national average. 4 of 3113 counties have a missing value for this indicator. For this indicator, higher values are associated with worse health.

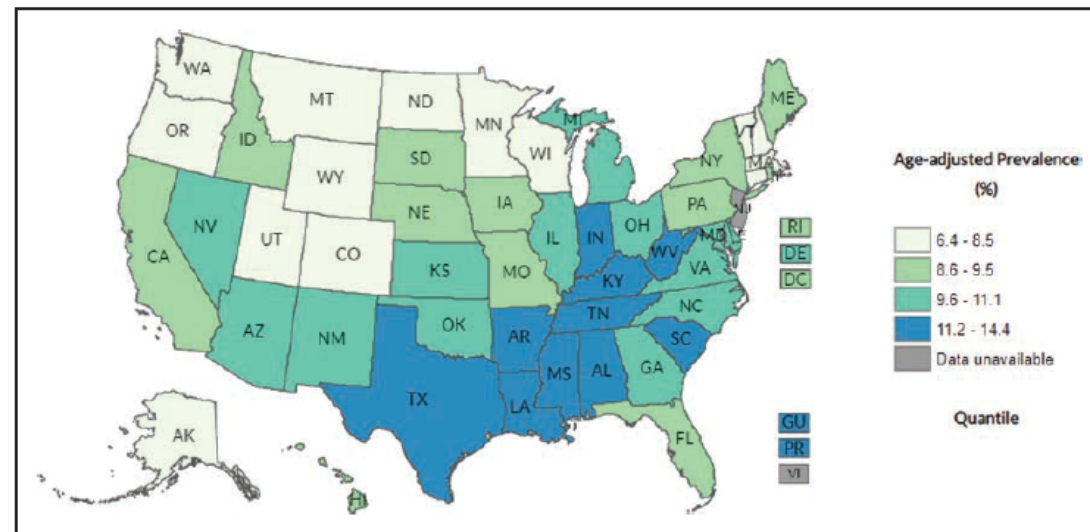
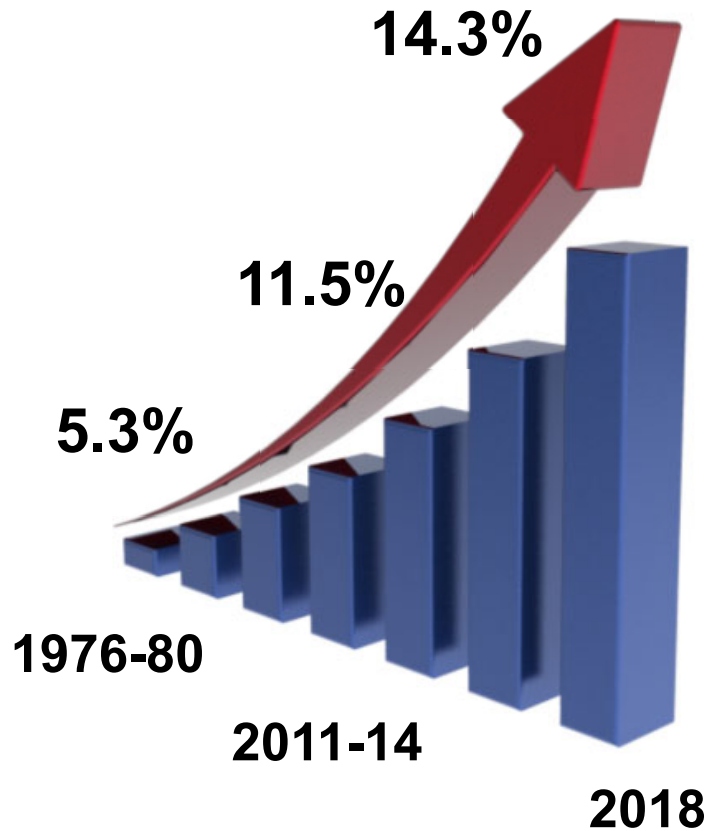
Cardiovascular Risk Factors/Health Behaviors



Figure. AHA's My Life Check–Life's Simple 7.

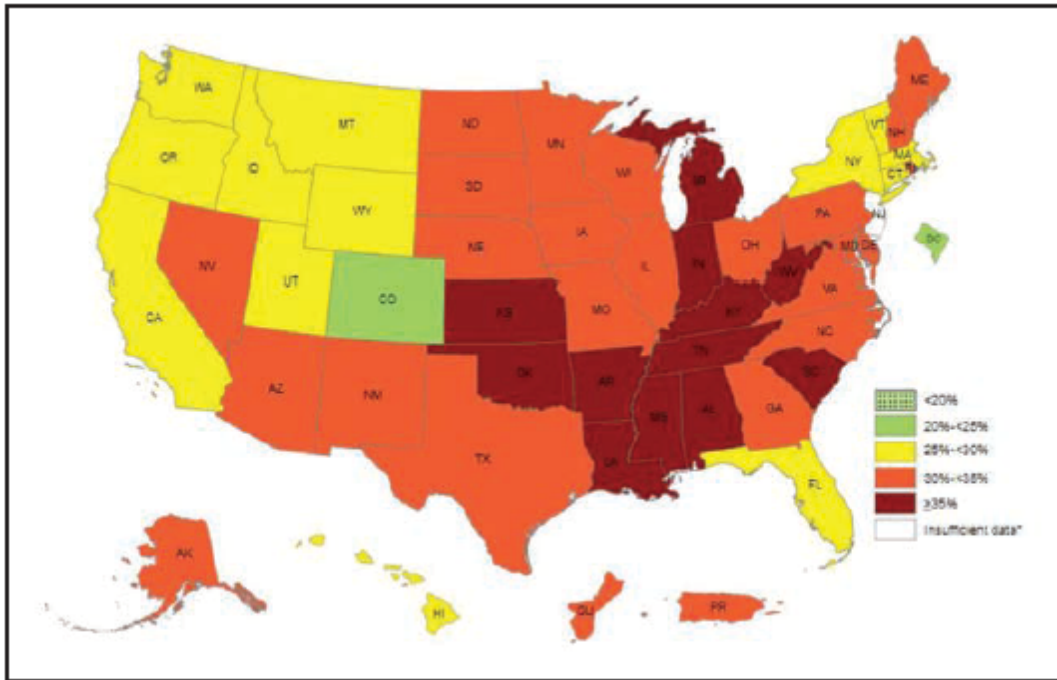
Seven approaches to staying heart healthy: be active, keep a healthy weight, learn about cholesterol, do not smoke or use smokeless tobacco, eat a heart-healthy diet, keep blood pressure healthy, and learn about blood sugar and diabetes.¹ AHA indicates American Heart Association; HDL, high-density lipoprotein cholesterol; and LDL, low-density lipoprotein cholesterol.

Prevalence of Diabetes among US Adults



Age-Adjusted Diabetes Prevalence, 2019

Prevalence of Obesity among US Adults



Age-Adjusted Obesity Prevalence, 2019

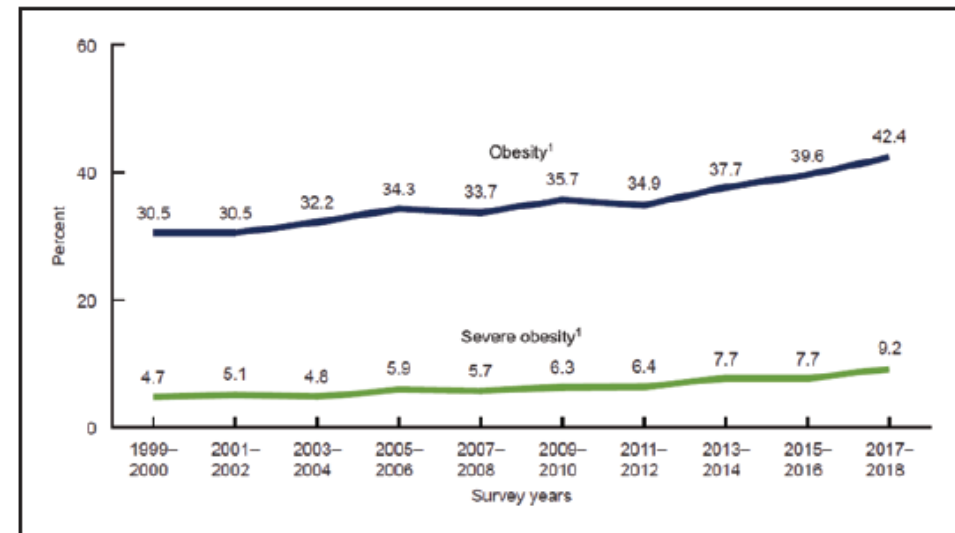


Chart 6-8. Trends in age-adjusted obesity prevalence among US adults ≥ 20 years of age, 1999 to 2000 through 2017 to 2018.

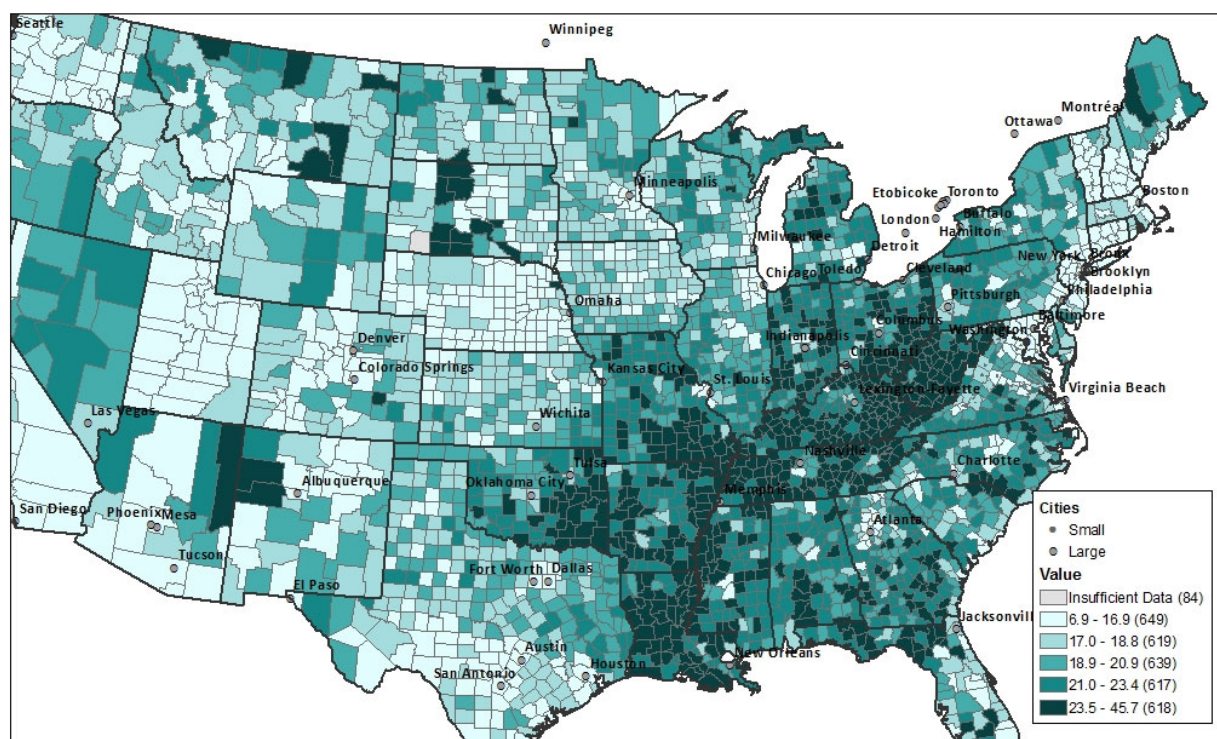
Trends in Age-adjusted obesity prevalence in US adults (1999-2018)

Current Smoking Status Among Adults (18+)

Appalachia Region

- Nearly 20% of adults in the Appalachian Region report being cigarette smokers
- Central Appalachia ~ 25%
- Urban-rural divide: 22.5% vs 17.3%
- Economically distressed 24.7% vs 19.4%

Current Smoker Status Among Adults Ages 18+, 2018

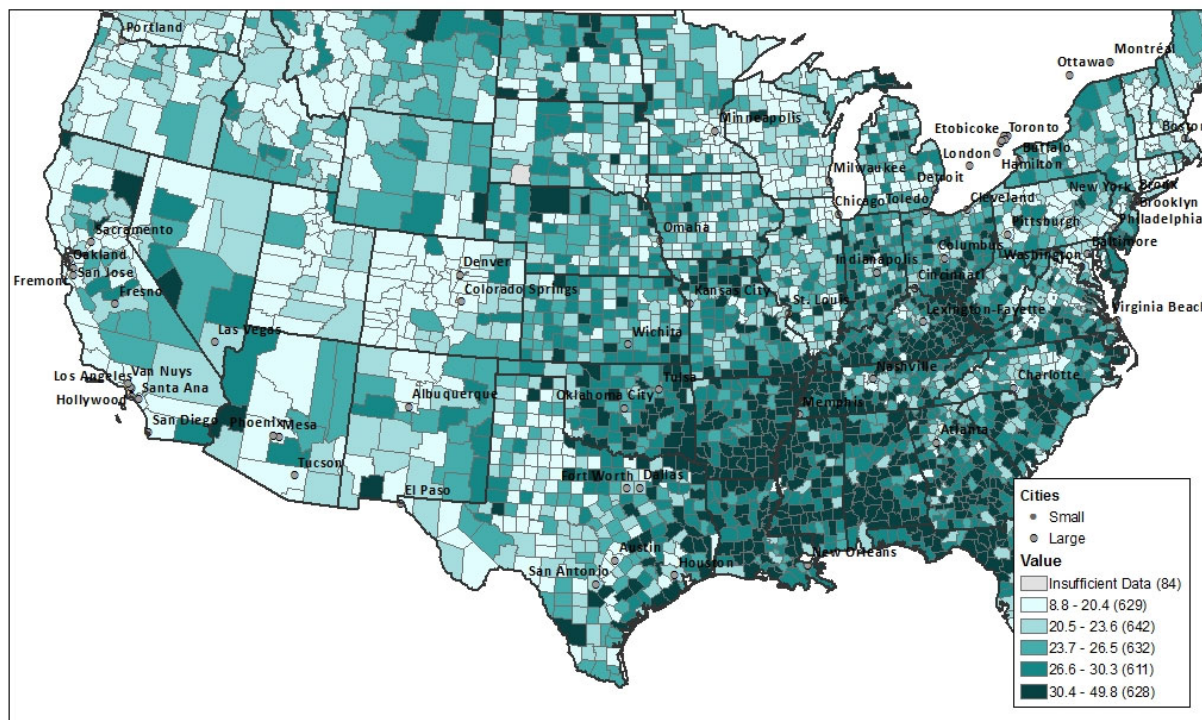


Physical Inactivity

Appalachia Region

- Over 28% of people report being physically inactive (compared with 23% in US)
- Physical inactivity in subregions range from 26% percent in Northern Appalachia to 33.8% in Central Appalachia
- Urban-rural divide: 31.8% vs 25.2%

Leisure-Time Physical Inactivity, Age Adjusted Percentage, 20+, 2017



This map was created using the Interactive Atlas of Heart Disease and Stroke, a website developed by the Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention.
<http://www.cdc.gov/dhdsp/maps/atlas>

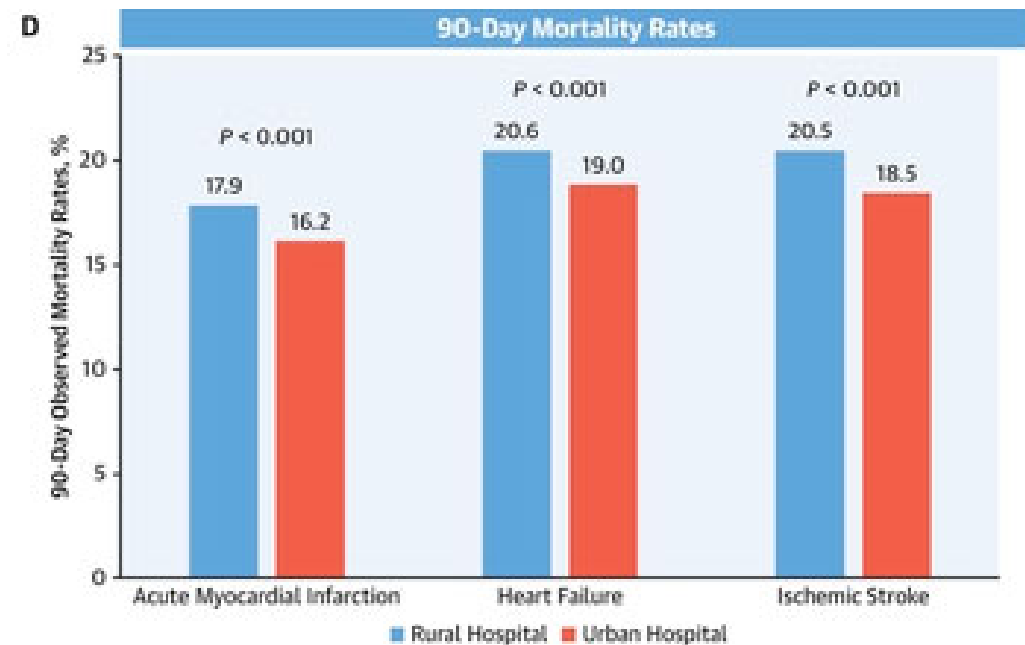
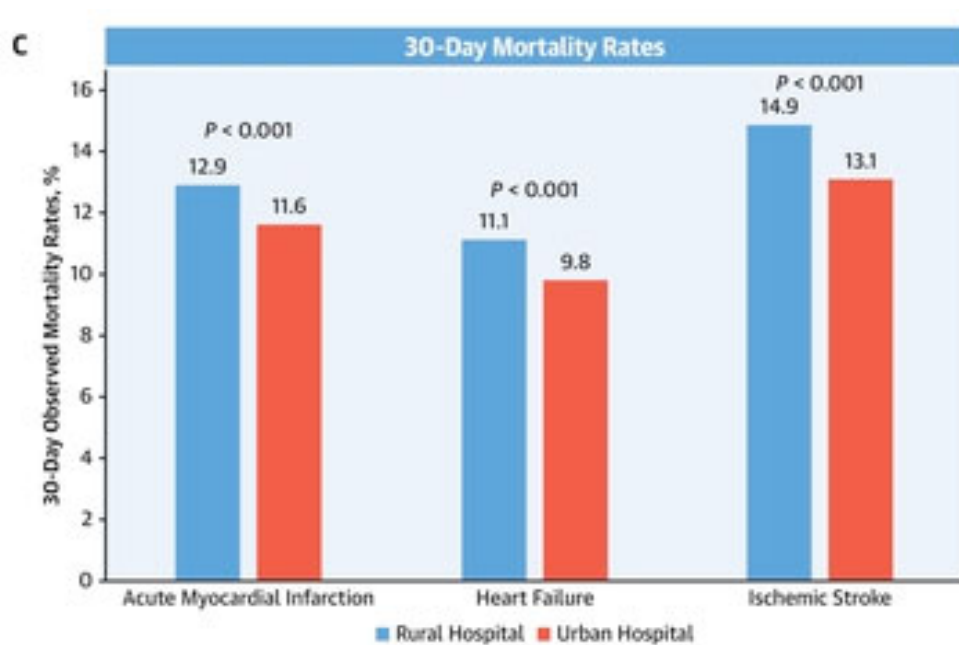


Marked Disparities Exist in CVD and Risk Factors in Appalachia

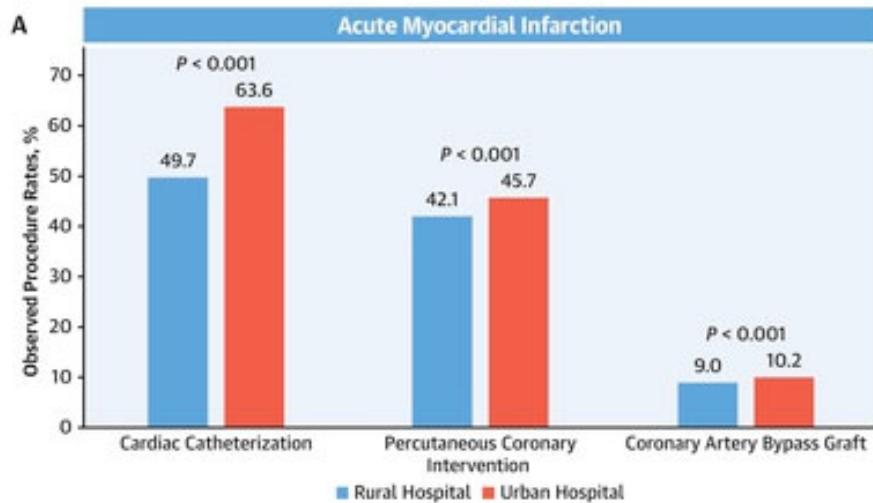
- CVD event rates are higher
- Risk factors (tobacco, physical inactivity, obesity, DM, BP) are increased in Appalachia
- Many people have more than 1 risk factor
- Those with established CVD are at increased risk of adverse outcomes
- Disparities that exist among the Appalachia Region (geographic, urban-rural divide, and economically distressed)

Rural-Urban Disparities in Outcomes of MI, Heart Failure, and Stroke in the US

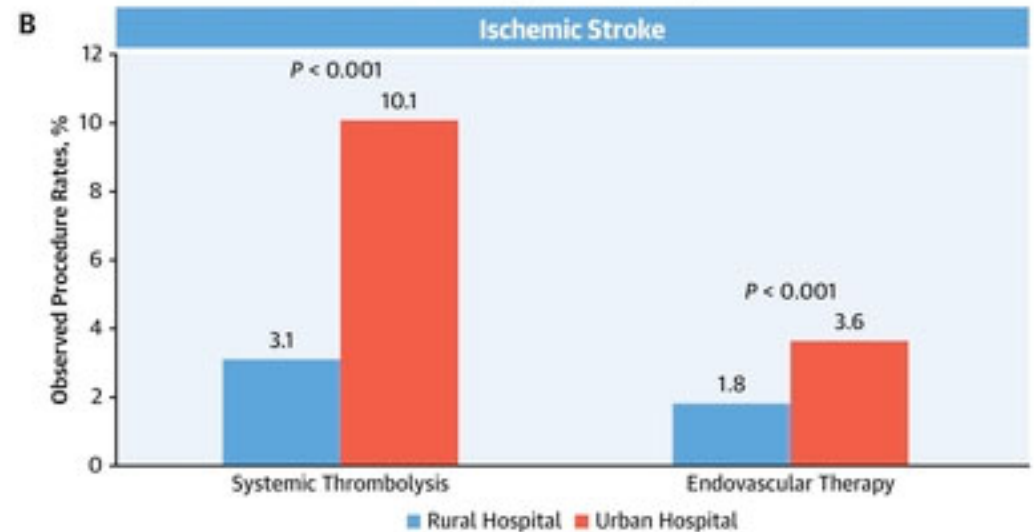
>2 million Medicare beneficiaries (4488 hospitals, 53% urban) hospitalized for AMI, HF, Stroke between 2016-2018



Rural-Urban Disparities in Treatments for MI and Stroke



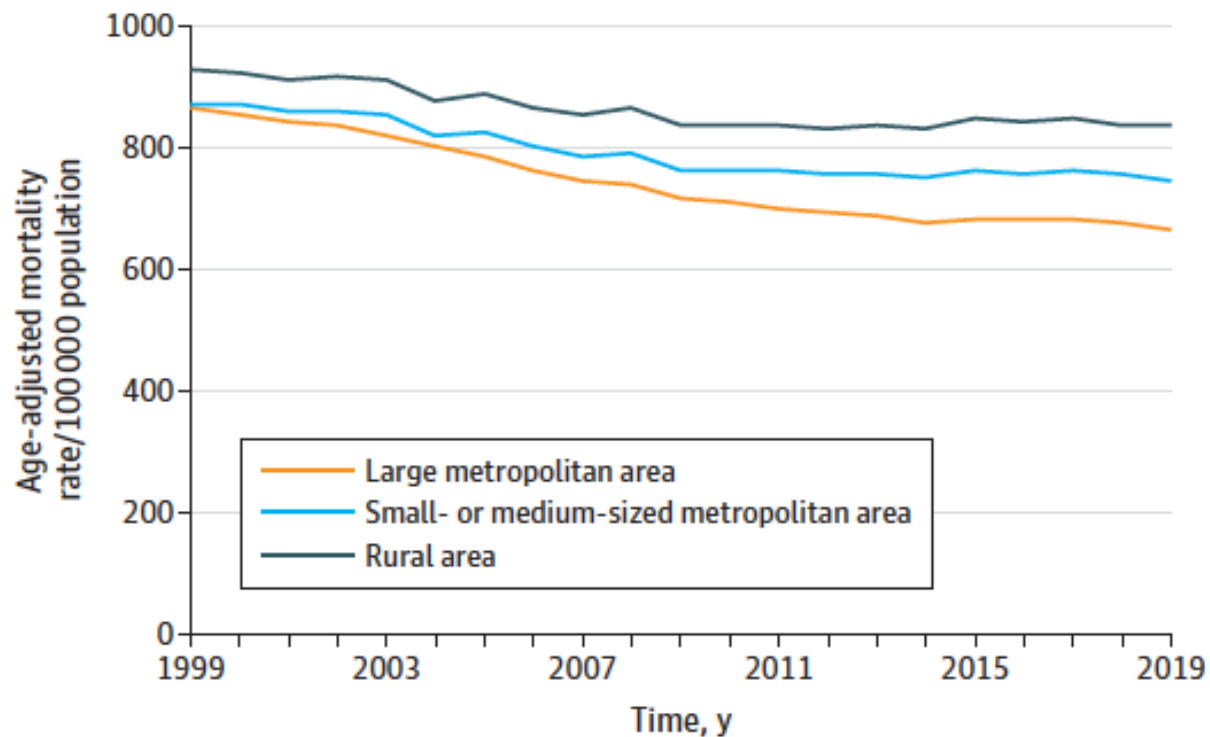
Acute MI Treatment



Stroke Treatment

Rural Urban Disparities Increasing over Time

Figure. Mortality Trends in the US From 1999 to 2019



↑ 12.1% age-adjusted mortality rate for rural residents aged 25-64 years

Social Determinants of Health

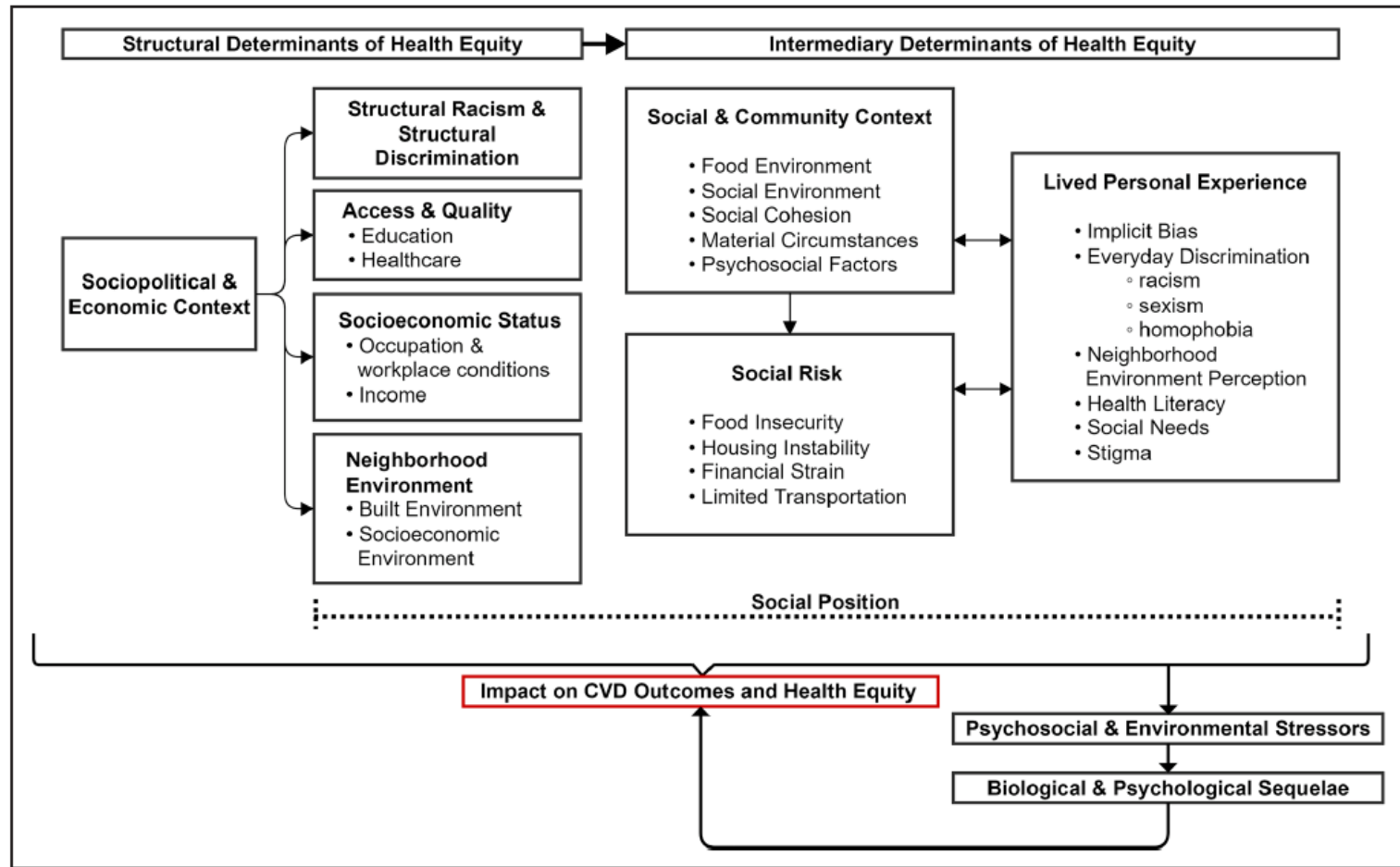


Figure 1. A critical framework of social determinants of health.

Powell-Wiley T.M. et al.
 Circulation Research.
 2022;130:782–799

Social Vulnerability Index Correlates with CVD Mortality

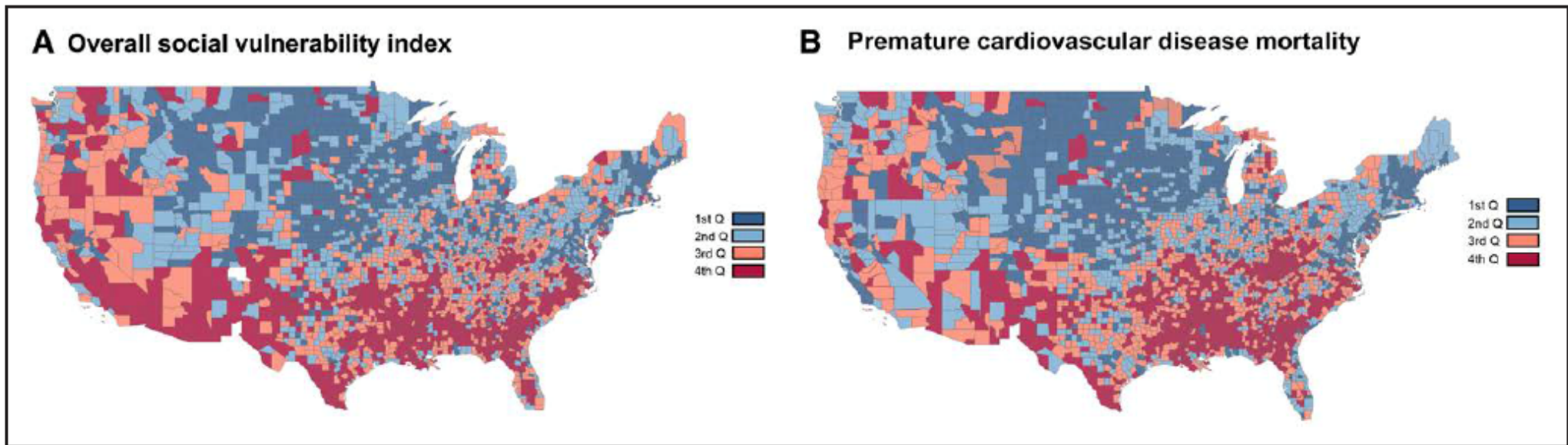
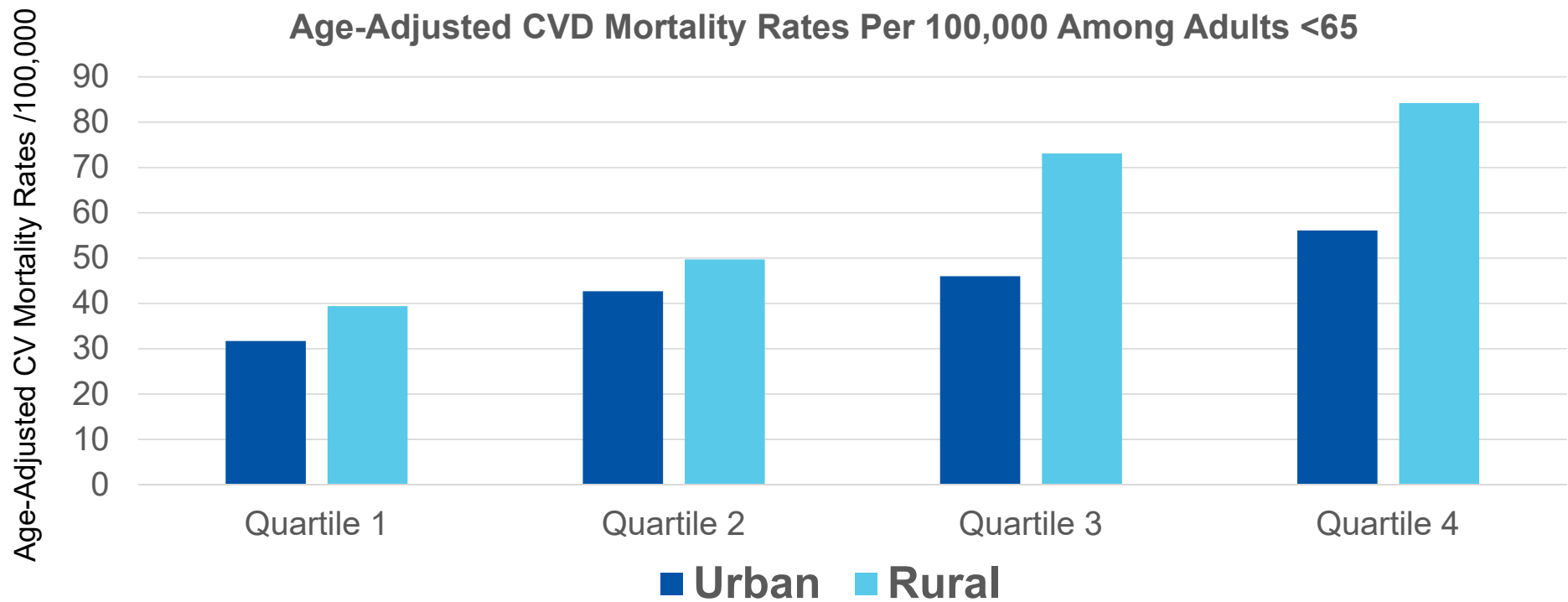


Figure 1. Social vulnerability index and premature cardiovascular disease mortality in the US, 2004–2018.

A, Counties by social vulnerability index quartiles, and **(B)** by age-adjusted cardiovascular disease mortality rates per 100 000 among adults <65 years of age, by social vulnerability index quartiles. Q indicates quartile.

SVI included socioeconomic status, household composition and disability, minority status and language, and housing typing and transportation

The Association of Social Vulnerability Index & CVD is Greater in Rural Counties



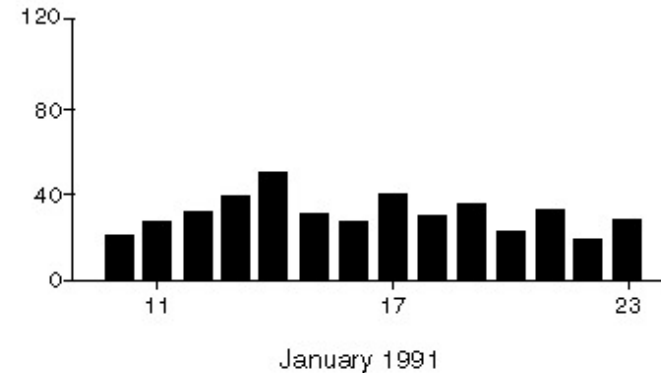
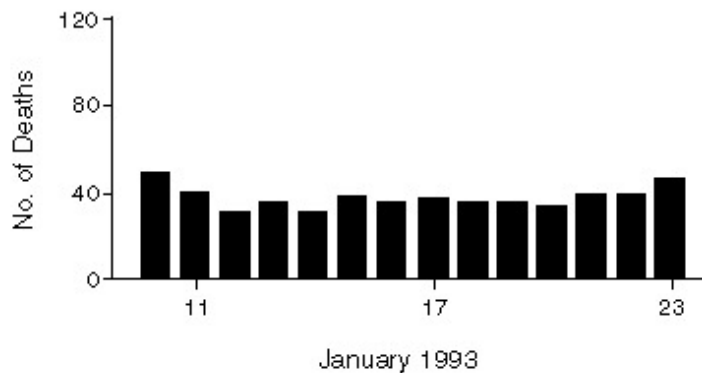
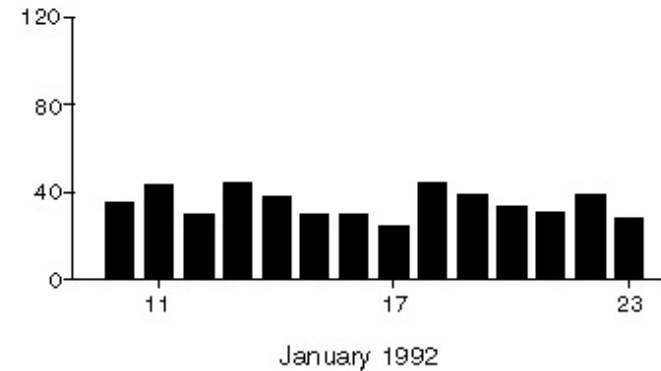
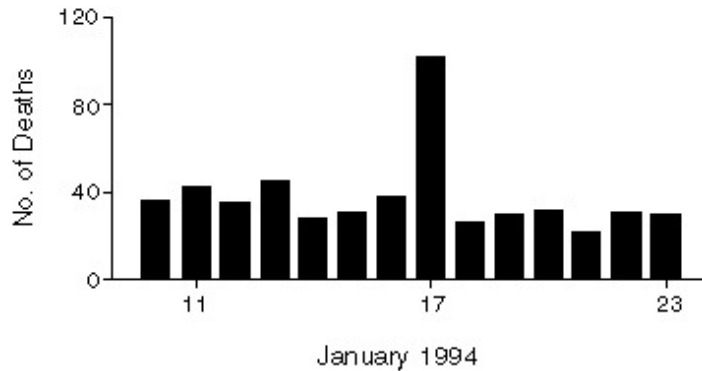
Mind-Heart Body Connection: Psychological Health & Cardiovascular Disease

- Data show clear associations between CVD and risk
- Increasing evidence that psychological health may be causally linked to biological processes and behaviors that contribute to and cause CVD
- Preponderance of data suggest that interventions to improve psychological health can have a beneficial impact on CV health
- Consideration of psychologic health (screening) is recommended in the evaluation and management of patients with or at risk for CVD.

Chronic Stress and Social Stressors

- Stressful life events, chronic daily stressors, and high levels of perceived stress have all been shown to affect CV health
- Stress can result from numerous sources such as work challenges, poor-quality or insufficient relationships, loneliness or isolation, financial hardship, and discrimination
- Acute events (PTSD) and cumulative exposure to stress are linked to CV risk factors (hypertension, obesity) and CVD

Acute Stress & Sudden Cardiac Death



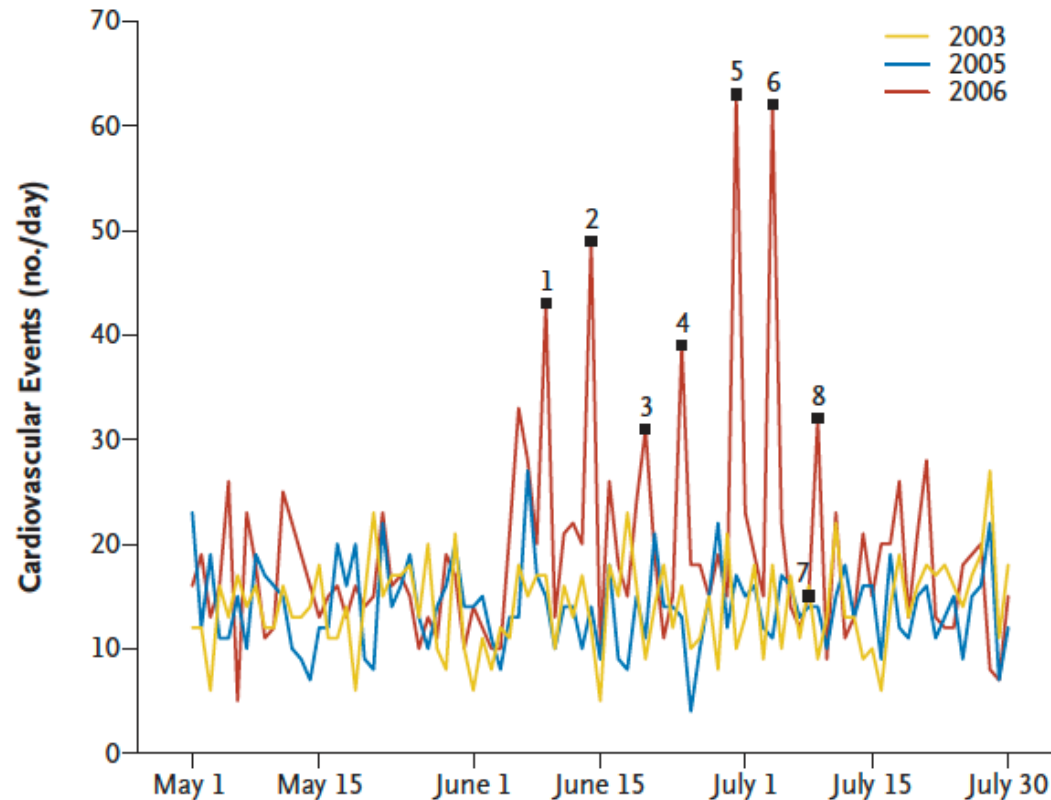
Daily numbers of Deaths Listed by the Department of Coroner of Los Angeles County from January 10 through 23, 1991, 1992, 1993, and 1994



Leor N, et al. N Engl J Med 1996; 334:413-419 1996

Cardiovascular Events during World Cup Soccer in Germany

- FIFA World Cup 2006 in Germany Started June 9 and ended July 9, 2006
- Spikes (numbers on figure) represent German World Cup matches
- Incidence of CV events was 2.6 times higher during German games



Daily CV Events from May 1-July 31 in 2003, 2005, and 2006

Wilbert-Lampen U, N Engl J Med 2008; 358:475-83

Chronic Psychosocial Stress associated with CHD: Interheart

- Study of 11,119 MI cases and 13,648 non-MI controls from 52 countries
- PAR=% attributable to risk factor if causal
- Combined adjusted PAR of psychosocial stressors-33%
 - Permanent work stress: OR=2.1, PAR 9%
 - Permanent stress at home: OR=2.1, PAR 8%
 - Permanent general stress: OR=2.1, PAR 12%
 - Financial stress= OR 1.3, PAR 11%
 - Stressful life effects= OR 1.48; PAR 10%
 - Depressed mood: OR 1.55, PAR 9%

Depression & Cardiovascular Disease

- Multiple studies have demonstrated a link between CVD and depressive symptoms/depression
- Depression has strong associations with both CV Risk factors and incident CVD
- Studies suggest a dose-response relationship (the more severe depression, the greater the risk of CVD)
- In patients with CVD, depression increases the risk of recurrent events and mortality
- AHA recommends that depression be considered a risk factor for recurrent cardiovascular events in patients with acute coronary syndromes (heart attack)

Effect Estimates for Depression and CV Risk Factors and CVD

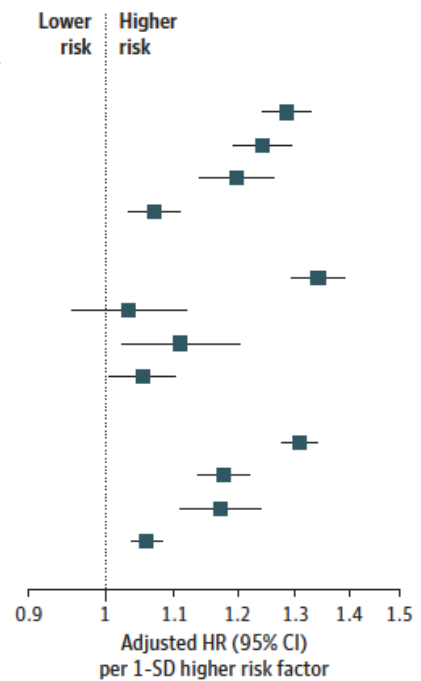
End Point/Parameter	Effect Estimates (95% CI)
Incident MI	RR 1.30 (1.22-1.40)
Incident CHD	RR 1.30 (1.18-1.44)
Stroke	RR 1.45 (1.31-1.61)
Obesity	RR 1.37 (1.17-1.48)
Hypertension	RR 1.42 (1.17-1.48)
Diabetes	RR 1.32 (1.18-1.47)

Hazard Ratio per 1-SD Higher Depressive Symptoms

Figure 4. Adjusted Hazard Ratios for Coronary Heart Disease, Stroke, and Cardiovascular Disease per 1-SD Higher Depressive Symptoms in Comparison With Established Cardiovascular Disease Risk Factors

A Emerging Risk Factors Collaboration results (CES-D)

Risk factor	No. of studies	No. of participants	No. of events	No. of person-years	Events per 10000 person-years		HR (95% CI)
					First quintile	Second quintile	
CHD							
Systolic blood pressure	18	158 234	4820	1 586 396	13.9	28.0	1.29 (1.24-1.33)
Non-HDL cholesterol	13	64 115	1629	563 922	15.9	28.3	1.24 (1.19-1.29)
Body mass index	15	151 388	4434	1 510 055	22.5	37.0	1.20 (1.14-1.26)
Depression score	21	162 036	5078	1 629 450	29.0	36.3	1.07 (1.03-1.11)
Stroke							
Systolic blood pressure	16	150 487	3666	1 558 980	10.4	28.0	1.34 (1.29-1.39)
Non-HDL cholesterol	11	56 618	1099	537 929	15.5	15.7	1.03 (0.95-1.12)
Body mass index	13	143 674	3386	1 482 630	21.2	24.3	1.11 (1.02-1.20)
Depression score	19	154 099	3922	1 600 603	24.7	28.0	1.05 (1.01-1.10)
CVD							
Systolic blood pressure	18	158 234	8496	1 586 396	24.2	55.6	1.31 (1.28-1.34)
Non-HDL cholesterol	13	64 115	2737	563 922	31.2	44.8	1.18 (1.14-1.22)
Body mass index	15	151 388	7830	1 510 055	43.5	61.0	1.17 (1.11-1.24)
Depression score	21	162 036	9010	1 629 450	53.5	62.8	1.06 (1.04-1.08)



Depression in Patients following Acute MI

- The risk of depression increased following MI (may be up to three times greater)
- Estimated prevalence of depression following MI ranges from 20-30%
 - ~40-70% of these remain depressed ~ 1 year after discharge
- Depression associated with increased risk following acute myocardial infarction including increased all-cause mortality (OR 2.3), cardiac mortality (OR 2.7), and cardiac arrest or recurrent MI (OR 1.6)
- Depression associated with reduced quality of life and increased healthcare costs following ACS

AHA Elevated Depression to "Risk Factor" for Adverse Outcomes in Patients with Acute Coronary Syndrome

AHA Scientific Statement

Depression as a Risk Factor for Poor Prognosis Among Patients With Acute Coronary Syndrome: Systematic Review and Recommendations

A Scientific Statement From the American Heart Association

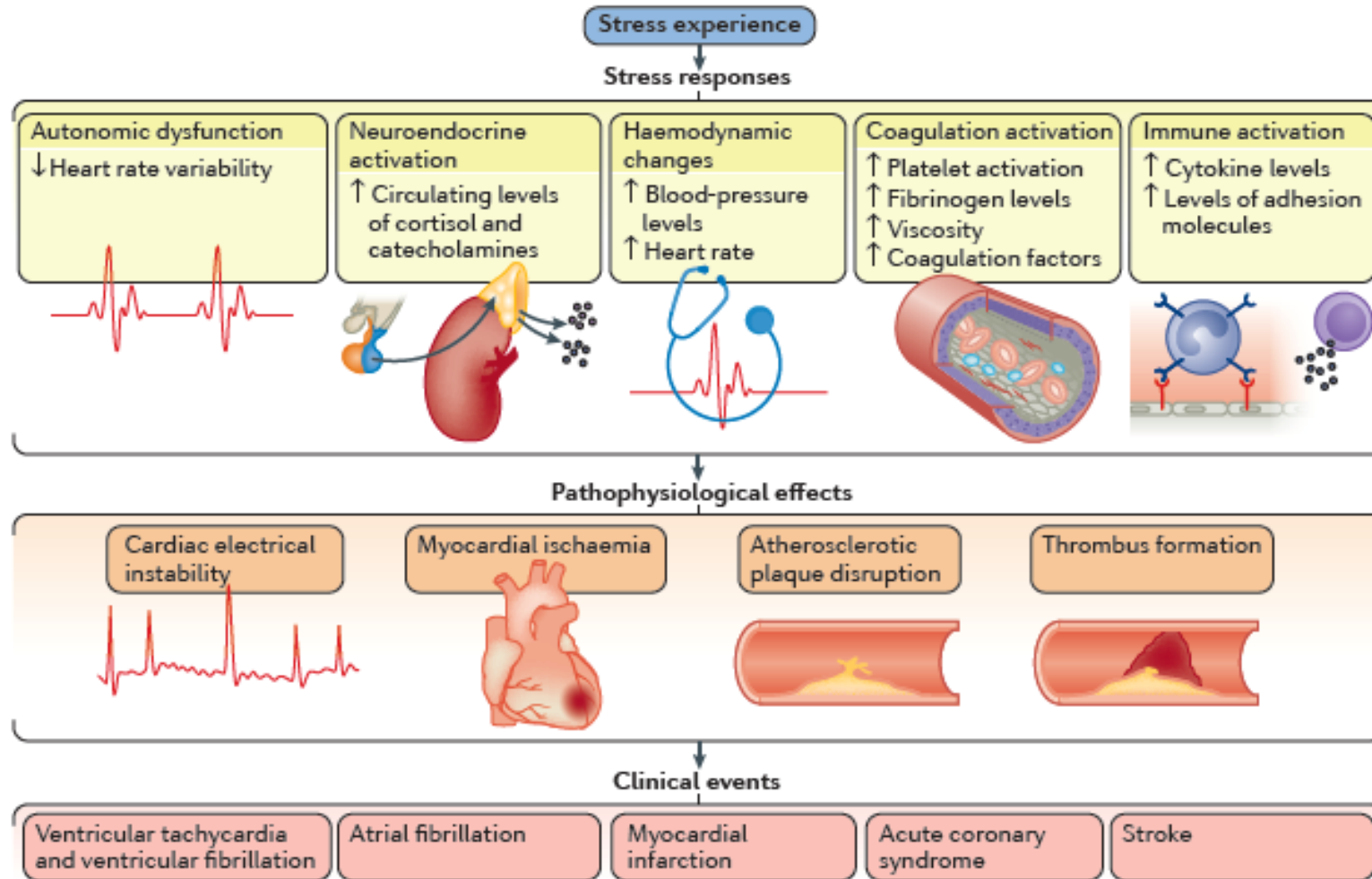
Judith H. Lichtman, PhD, MPH, Co-Chair; Erika S. Froelicher, RN, MA, MPH, PhD, FAHA, Co-Chair;
James A. Blumenthal, PhD, ABPP; Robert M. Carney, PhD; Lynn V. Doering, RN, DNSc, FAHA;
Nancy Frasure-Smith, PhD; Kenneth E. Freedland, PhD; Allan S. Jaffe, MD;
Erica C. Leifheit-Limson, PhD; David S. Sheps, MD, MSPH, FAHA; Viola Vaccarino, MD, PhD, FAHA;
Lawson Wulsin, MD; on behalf of the American Heart Association Statistics Committee of the Council
on Epidemiology and Prevention and the Council on Cardiovascular and Stroke Nursing

Conclusions—Despite the heterogeneity of published studies included in this review, the preponderance of evidence supports the recommendation that the American Heart Association should elevate depression to the status of a risk factor for adverse medical outcomes in patients with acute coronary syndrome.

Pathways linking Psychological Health & CVD

- Direct biological alterations (inflammation, endothelial dysfunction, platelet activation, autonomic dysregulation)
- Indirect effects on behaviors that influence cardiovascular health (smoking, obesity, diabetes control, sedentary lifestyle, non-adherence to preventive measures, treatment delays)
- Promoting or impairing psychosocial resources that protect health or buffer detrimental effects of stressful experience (social support)

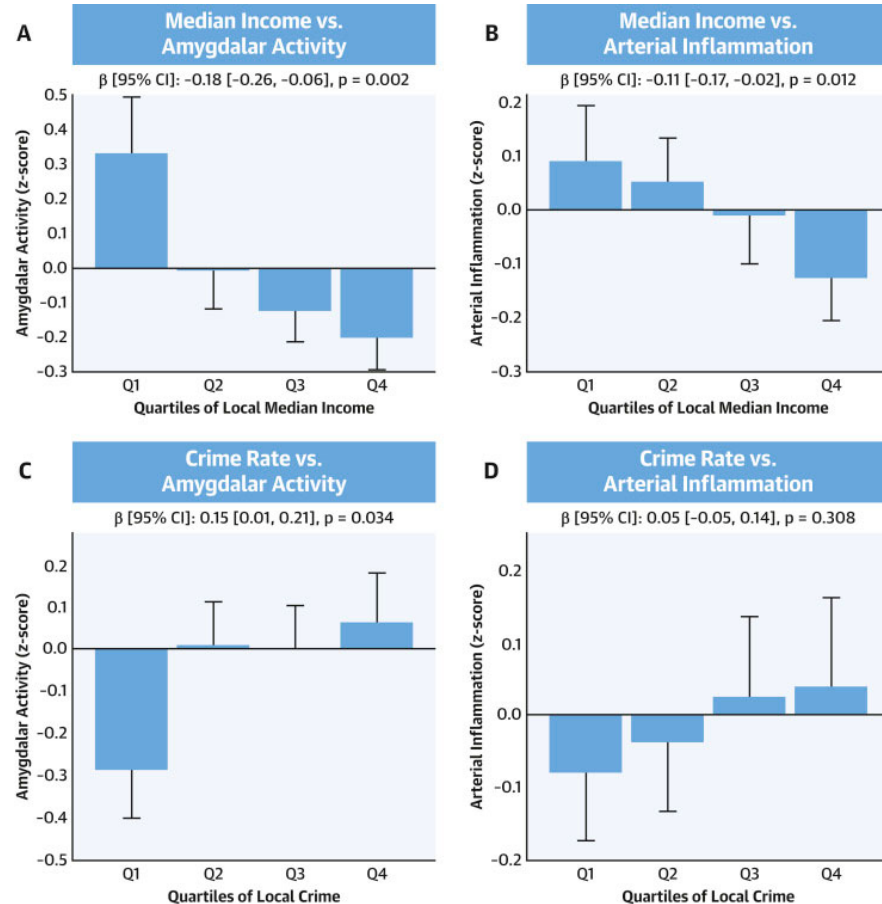
Physiologic Responses and Pathophysiological Effects of Stress & CVD



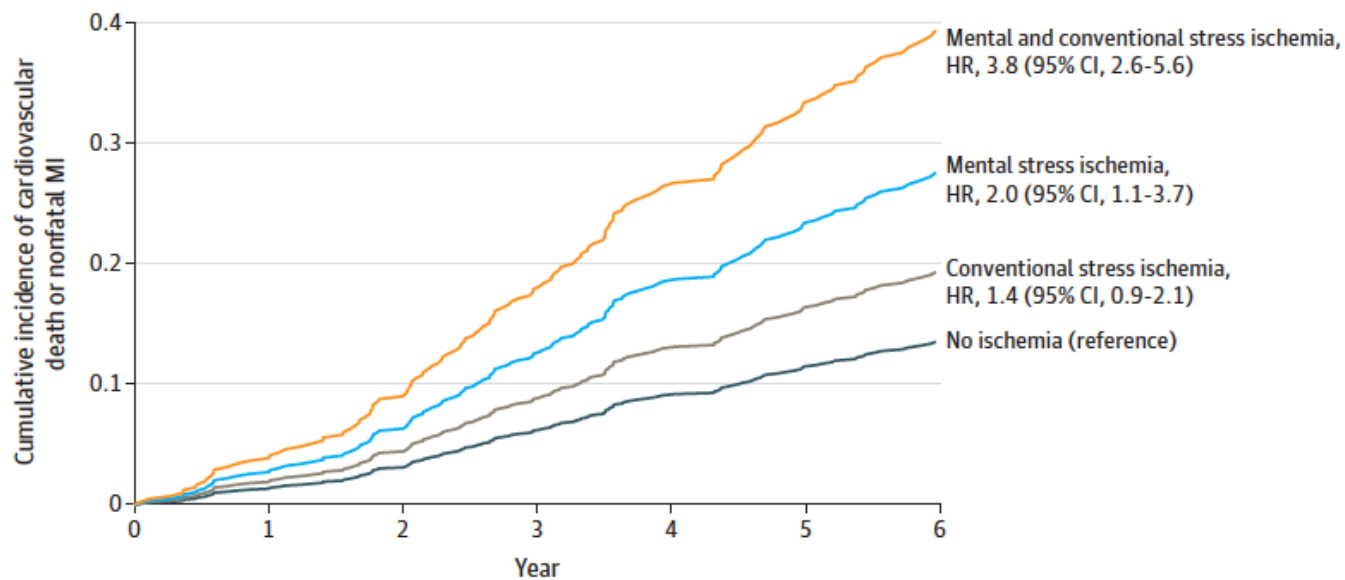
Kivamaki M, et al. Nat Rev Cardiol 2018; 215

Biologic Mediators between Stress, lower socioeconomic status, & CVD

- Tested whether stress-associated neurobiological pathways involving up-regulated inflammation in part mediates the link between SES and risk of CVD events
- 509 patients underwent clinically indicated whole-body ^{18}F -fluorodeoxyglucose positron emission tomography/computed tomography imaging



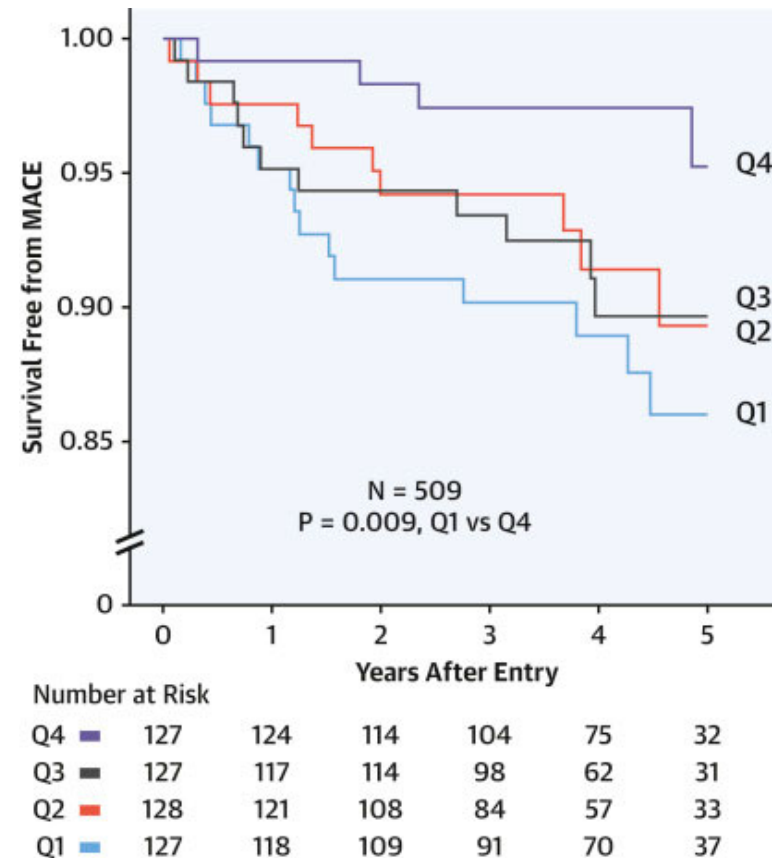
Mental Stress ischemia Associated with Adverse Outcomes in Patients with CAD



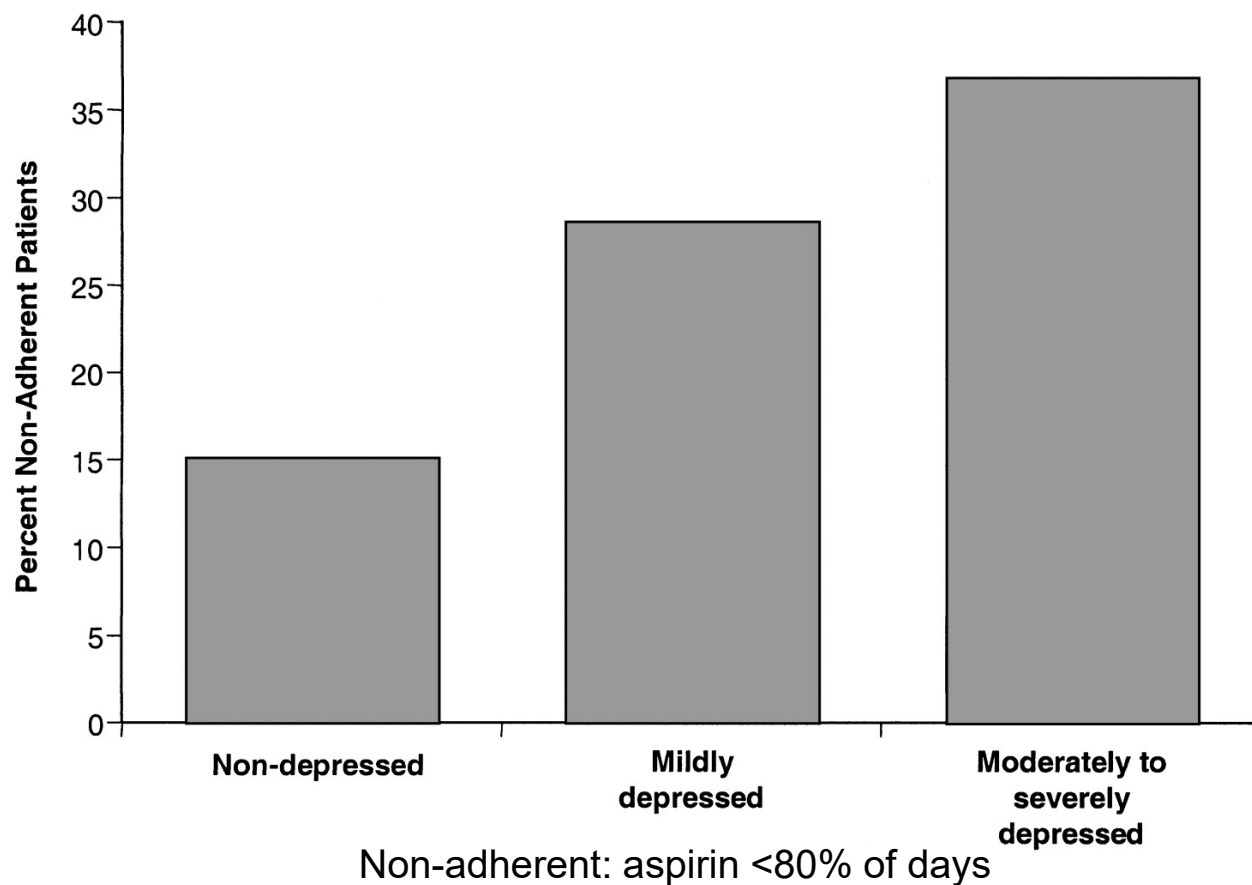
No. at risk	0	1	2	3	4	5	6
Ischemia							
Mental and conventional stress	96	95	91	88	79	67	56
Mental stress	49	48	47	45	41	30	19
Conventional stress	185	184	180	172	158	137	102
No stress	569	564	549	518	469	396	280

Lower SES associated with increased CV risk and appears to be mediated by biologic stress pathways

- The lowest SES quartile experienced a nearly 4-fold higher CV risk than highest quartile (HR 3.91, 95% CI 1.30-11.77)
- Mediation analysis demonstrated that the path of: ↓ neighborhood income to ↑ amygdalar activity to ↑ bone marrow activity to ↑ arterial inflammation to ↑ MACE was significant



Association of Depression and Adherence to Aspirin After Acute Coronary Syndrome



Interventions for Psychiatric Disorders or Symptoms

- Consider screening
 - Screening for depression following ACS recommended by several guidelines
- Services need to be in place to ensure follow-up for diagnosis and treatment.
- Treatment options
 - Psychotherapy (cognitive behavioral therapy) and/or antidepressants
 - Placebo controlled trials of medical therapy for depression demonstrate safety (predominantly SSRIs such as escitalopram or sertraline) and improve depressive symptoms. Avoid citalopram (QT prolongation) and tricyclics
 - Collaborative care management
 - Cardiac rehab
 - Exercise

Screening Tools

Short Patient Health Questionnaire (PHQ-2)

Name:		Date:			
Over the past 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day	
	0	1	2	3	
	0	1	2	3	
	_____	_____	+ _____	+ _____	+ _____

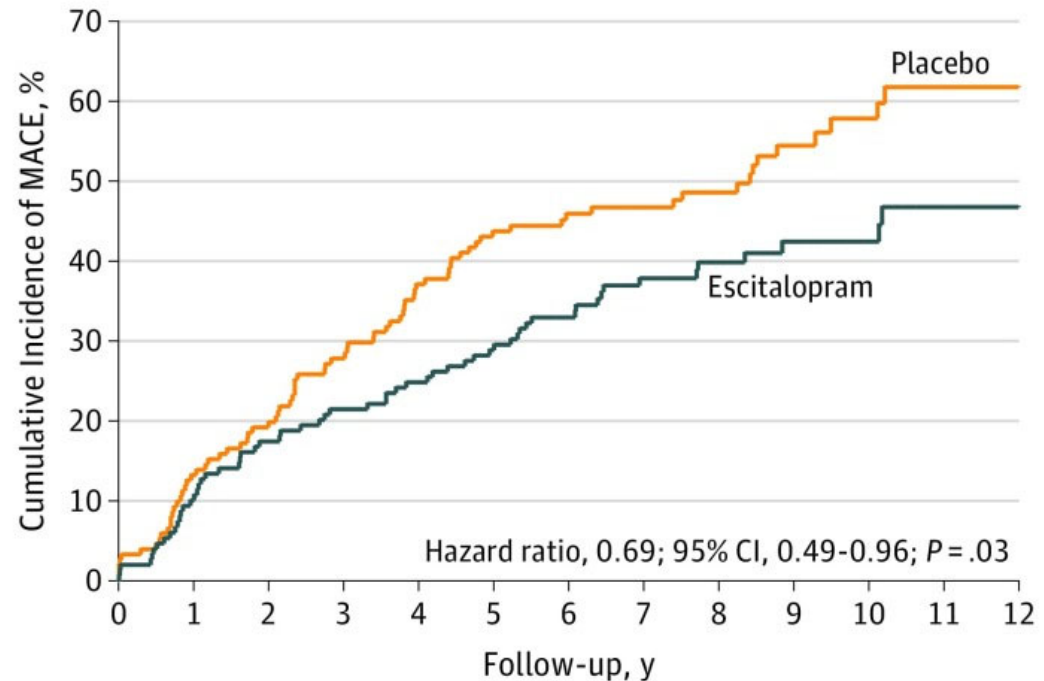
Total score of ≥ 3 warrants further assessment for depression

Sample Statements to Address Psychological Health in Clinical Encounters

- Sample statements to address depression: “It seems like feeling down or even a little hopeless might be affecting the way you are taking care of yourself. Let’s think about how we can tackle this problem together.”
- Sample statements to address anxiety: “It seems like your level of anxiety and worry is really wearing on you, and that can really affect your health and the way you take care of yourself. Let’s think about how we can tackle this problem together.”

Effect of Escitalopram Treatment for Depression on Long-term Cardiac Outcomes in Patients After ACS

- Randomized study enrolled 300 patients with recent ACS and depression
- 6 months treatment
- Escitalopram associated with a 31% reduced risk of MACE
- Not all studies consistent



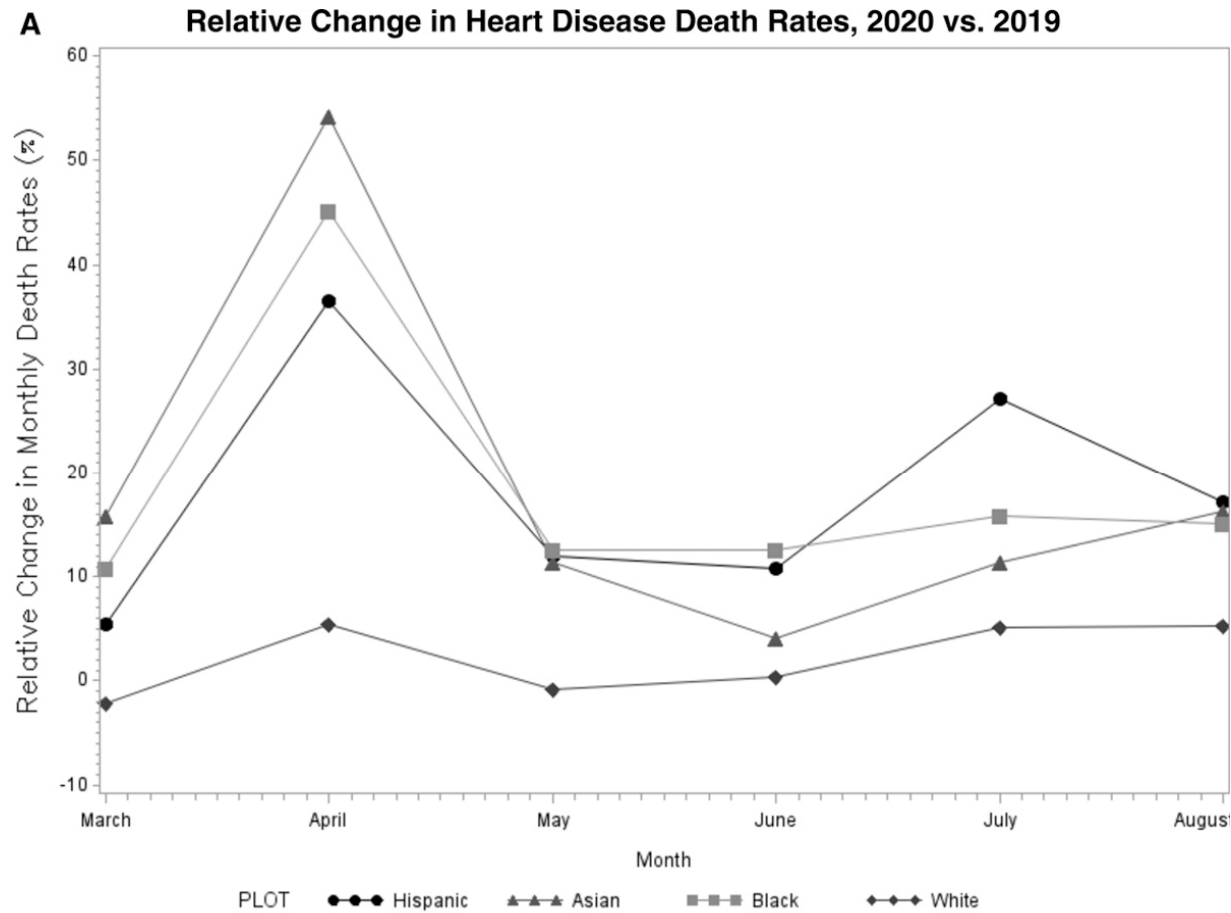
No. at risk

Placebo	151	131	122	109	95	85	71	60	48	34	23	12	11
Escitalopram	149	134	123	117	112	106	87	68	54	40	29	16	15

COVID-19 and CVD: Potential Future CV Risk

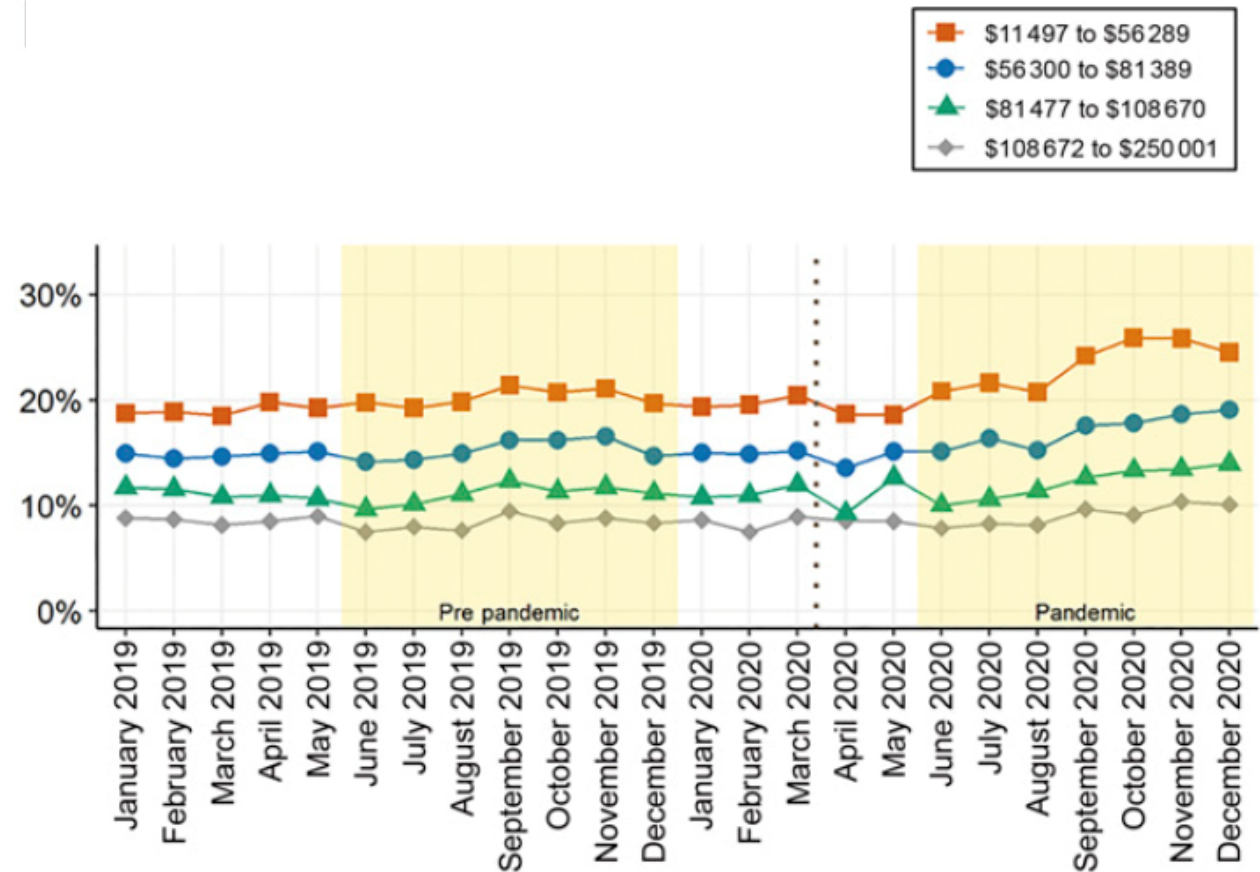
- Direct effects of COVID-19 infection on CVD risk factors and CVD
- Indirect effects of COVID-19 on CV
 - Increases or worsened control in CV risk factors (physical activity, diabetes, obesity, worsening diet, blood pressure)
 - Delayed healthcare
 - Role of social determinants and mental health

Racial/Ethnic Disparities in Heart Disease Deaths During the COVID-19 Pandemic in the US

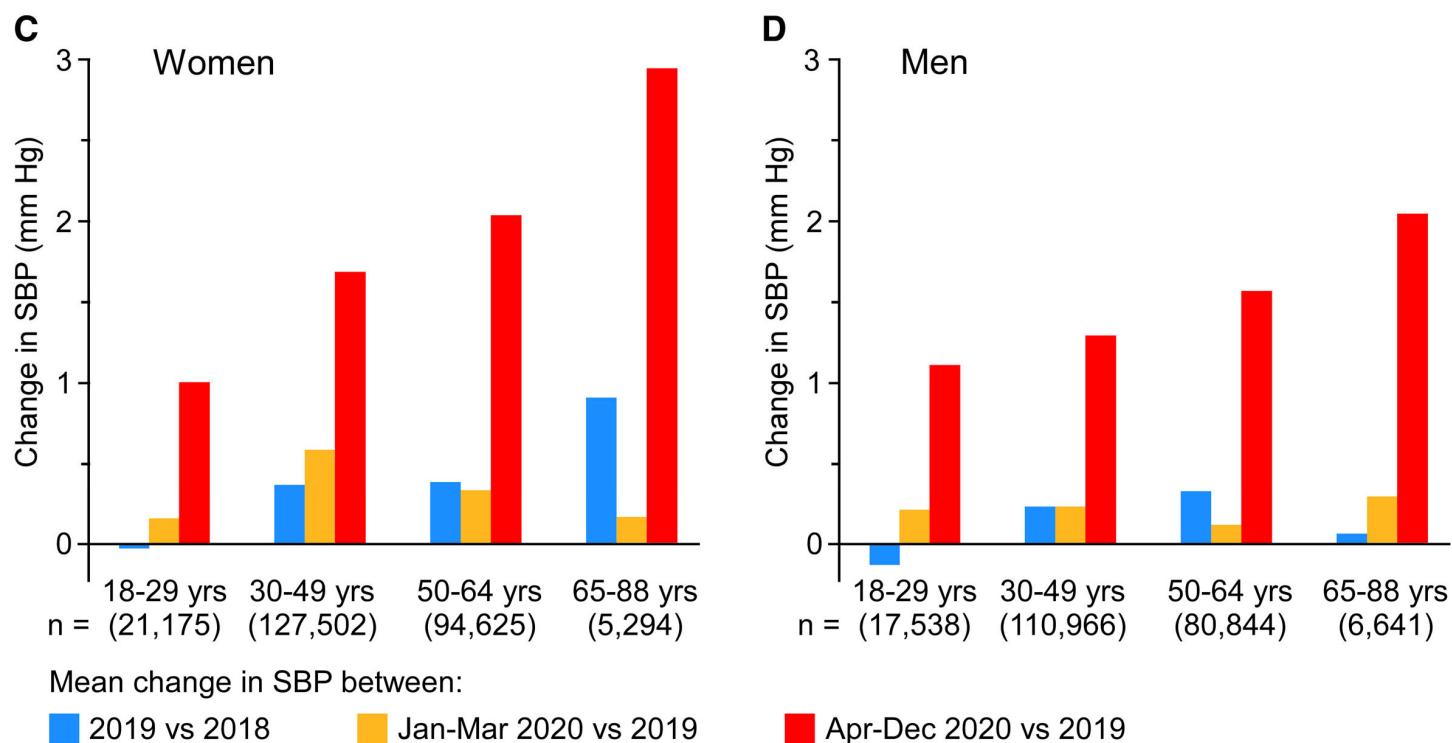


Obesity Rates by Neighborhood Median Household Income in Children (Age 2-17)

- The Children's Hospital of Philadelphia Care
- 300,000 patients
- Pandemic worsened ethnic, insurance disparities



Relationship between COVID-19 Pandemic & Blood Pressure

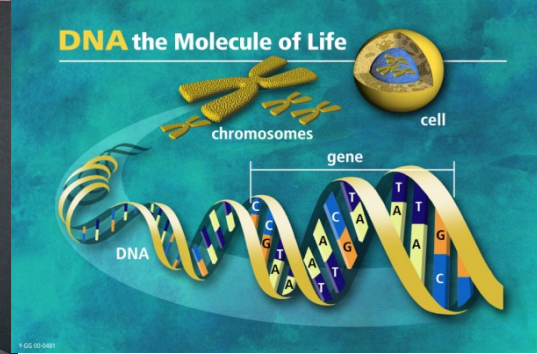


Starr County Health Studies

Field Studies



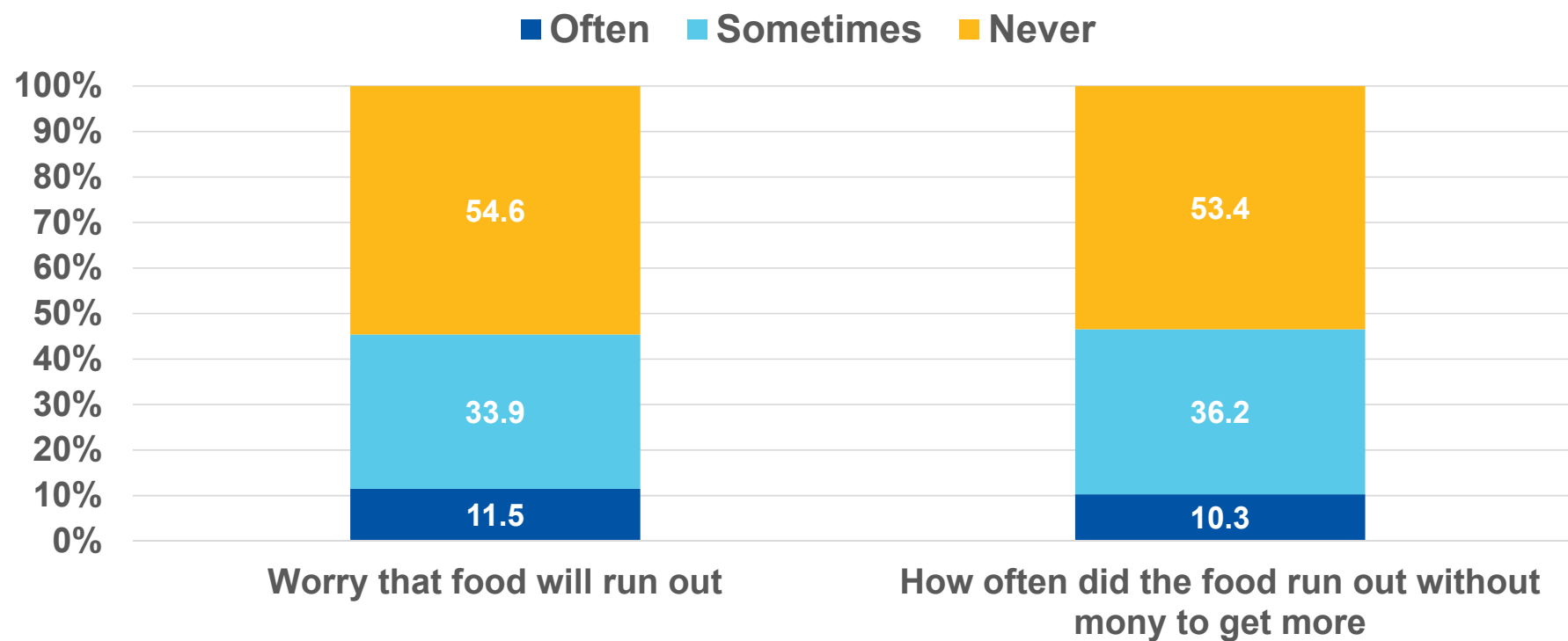
Education Interventions



Sample Collection

-Omics Efforts

Food Insecurity During COVID



Approximately 44-46% of participants had food insecurity

Food Insecurity & Associations Between Depression/Stress and Food Insecurity

	PHQ9 \geq 10 (n=41, 6.8%)		Increased Stress (n=230, 38.4%)	
	Sometimes	Often	Sometimes	Often
Worry that food will run out	OR 1.17, p=0.7	OR= 5.9, p<0.001	OR 2.1, p<0.001	OR 5.9, p=0.002
Food did not last without money to buy more	OR 1.1, p=0.4	OR 5.3, p<0.001	OR 5.9, p<0.001	OR 5.8, p<0.001

OR=Odds Ratio



The class abruptly stopped practicing. Here was a chance to not only employ their skills, but also to save the entire town.

The
Far Side[®]
April
20
Wednesday



Conclusion

- The burden of cardiovascular (CV) risk and disease in the Appalachia Region is high and contributes substantially to premature death
- Social determinants play a key role in health & disease
- Poor psychological health (stress, depression) is associated with incident CV and worse outcomes in individuals with CVD
- The mechanisms are likely multifactorial including direct biological and behavioral
- COVID-19 pandemic have the potential to worsen these issues
- Healthcare and community interventions are needed to reduce this burden

Thank you



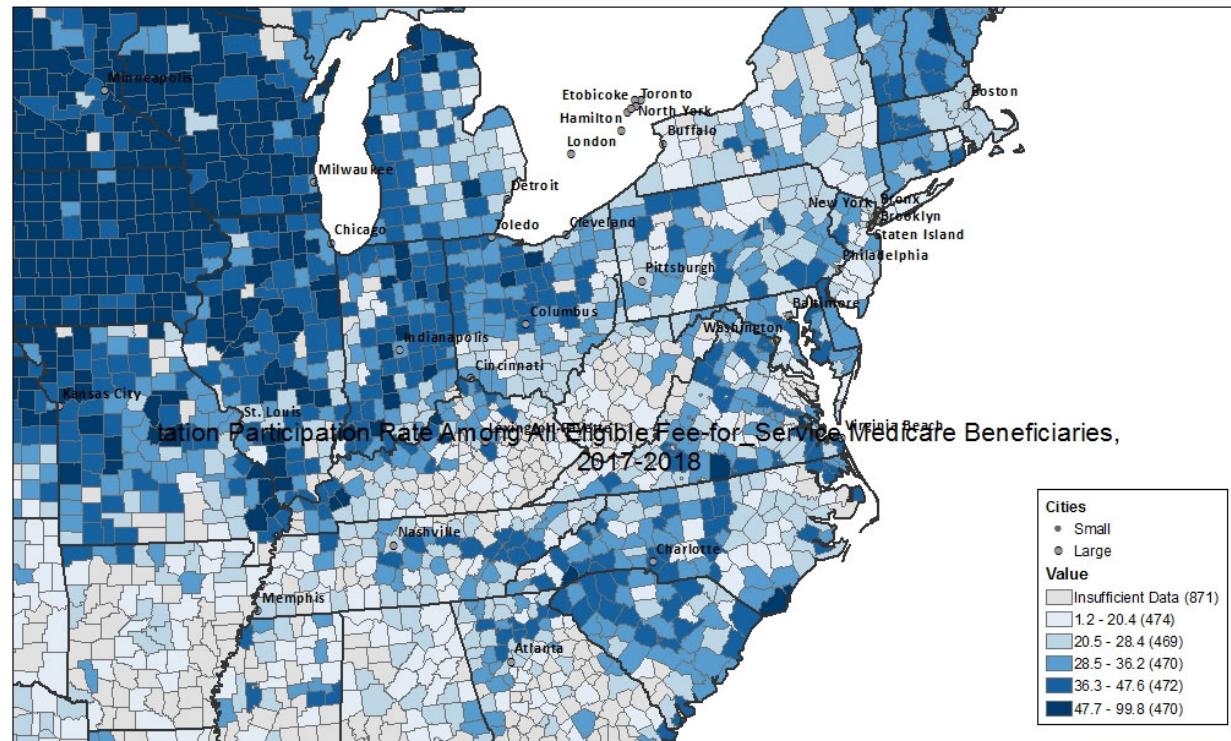
Back-up slides

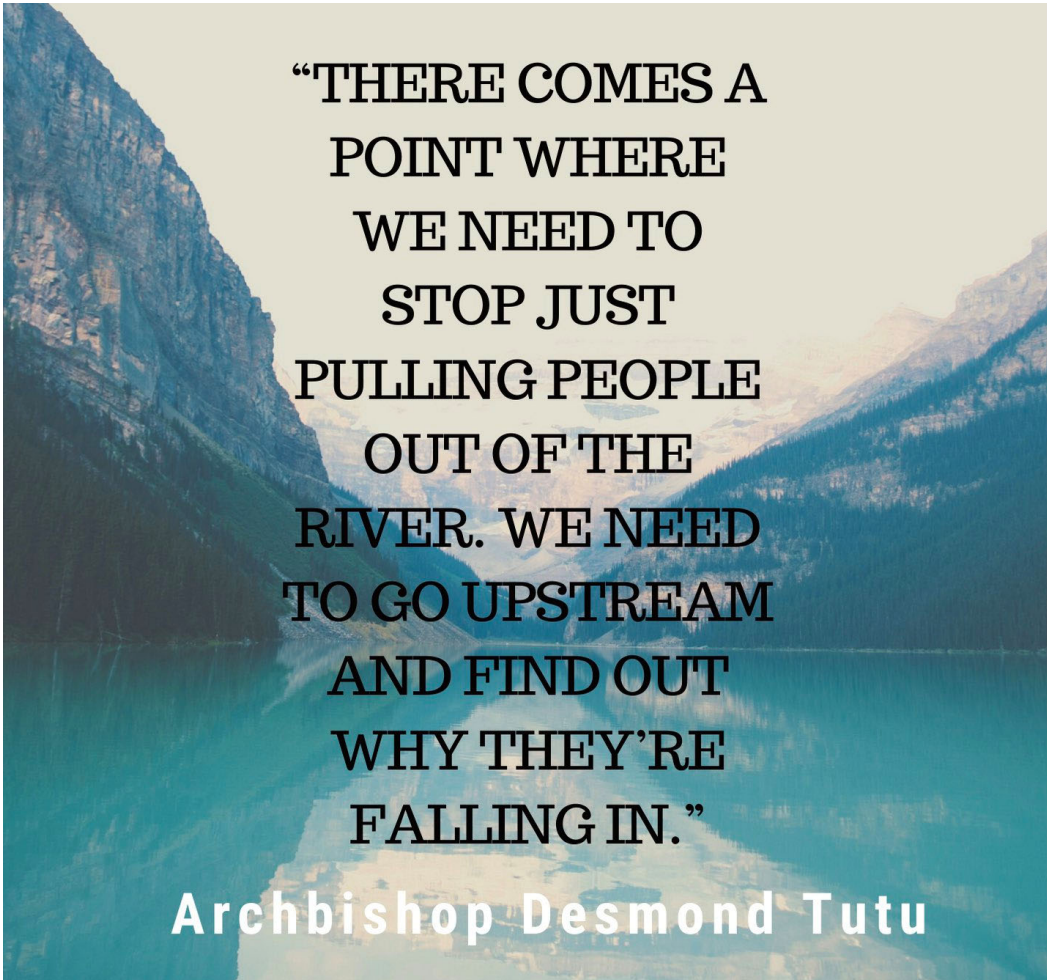
What can we do?

- Collaborations within the community
 - Involve communities to identify solutions (business owners, community members, church leaders, healthcare providers)
 - School districts/churches/food pantries
 - Community advisory boards
 - Develop local champions
- Increase access to healthy choices
 - Locally grown food
- Interventions promoting self care
 - Giving patients the tools to engage in self-care and that individualized approaches are more effective

- Address Barriers
 - Poverty
 - Access to health care
 - Improving health literacy
 - Address lack of easy access to healthy, affordable foods, and safe places to exercise
- Focus on whole health and not individual CV risk factors

Participation Rate for Cardiac Rehab Among Eligible Medicare Participants





**“THERE COMES A
POINT WHERE
WE NEED TO
STOP JUST
PULLING PEOPLE
OUT OF THE
RIVER. WE NEED
TO GO UPSTREAM
AND FIND OUT
WHY THEY’RE
FALLING IN.”**

Archbishop Desmond Tutu

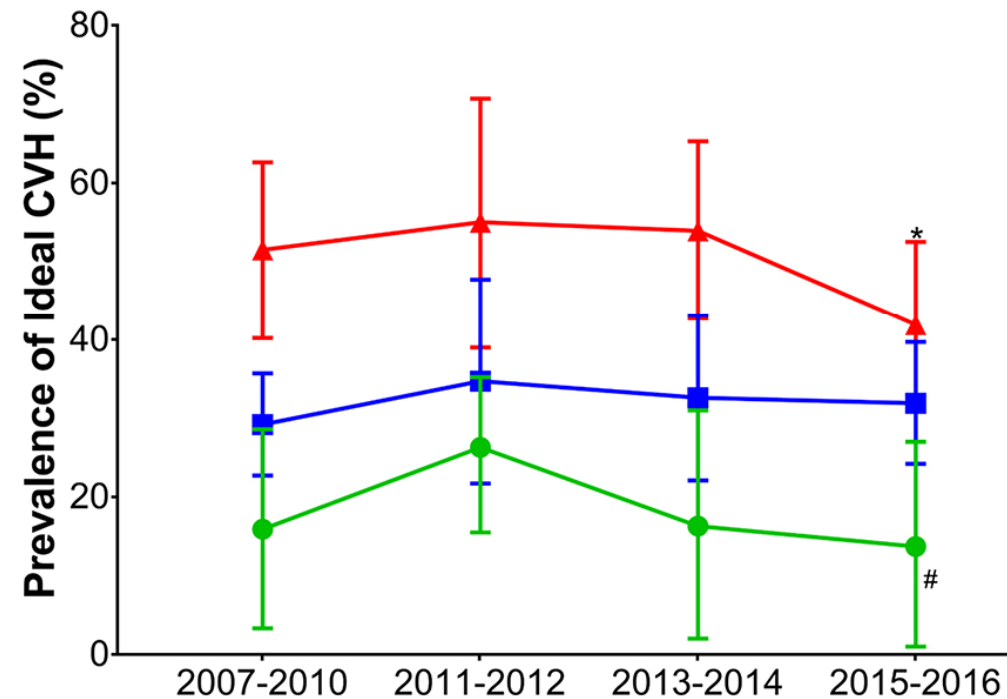
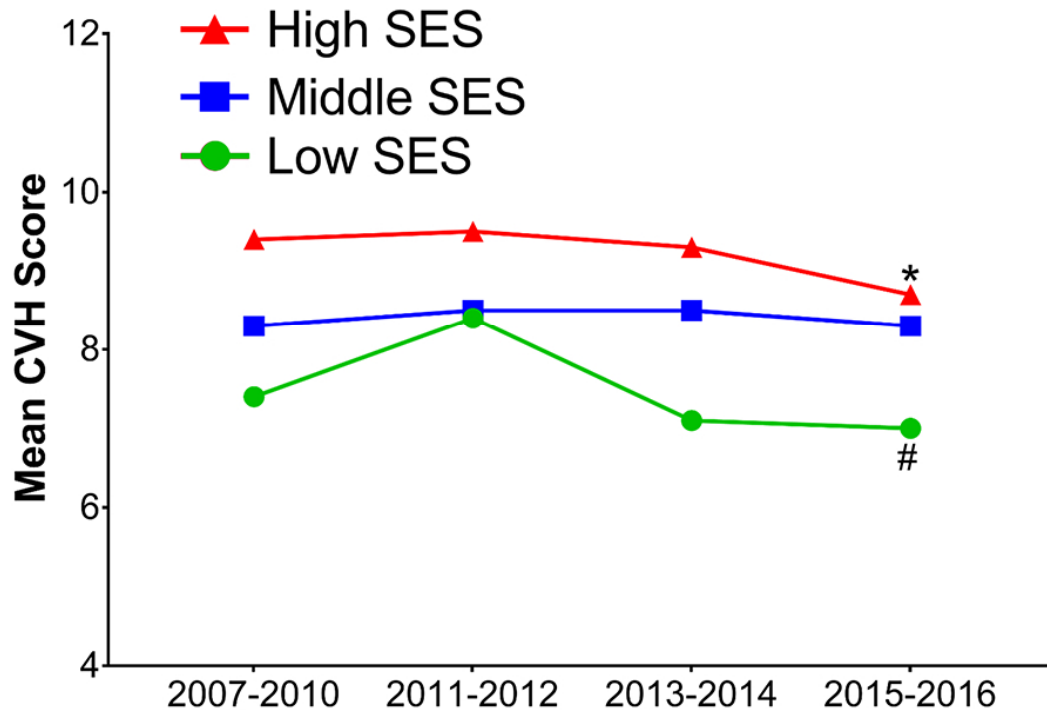
The relationship between Rural Setting & Health: Factors that Influence Individuals with or at risk for CV

- <https://www.heart.org/-/media/files/about-us/policy-research/policy-positions/social-determinants-of-health/rural-health-policy-guidance.pdf>

Role of the recession on Cardiovascular Health

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7048007/>

Socioeconomic Status



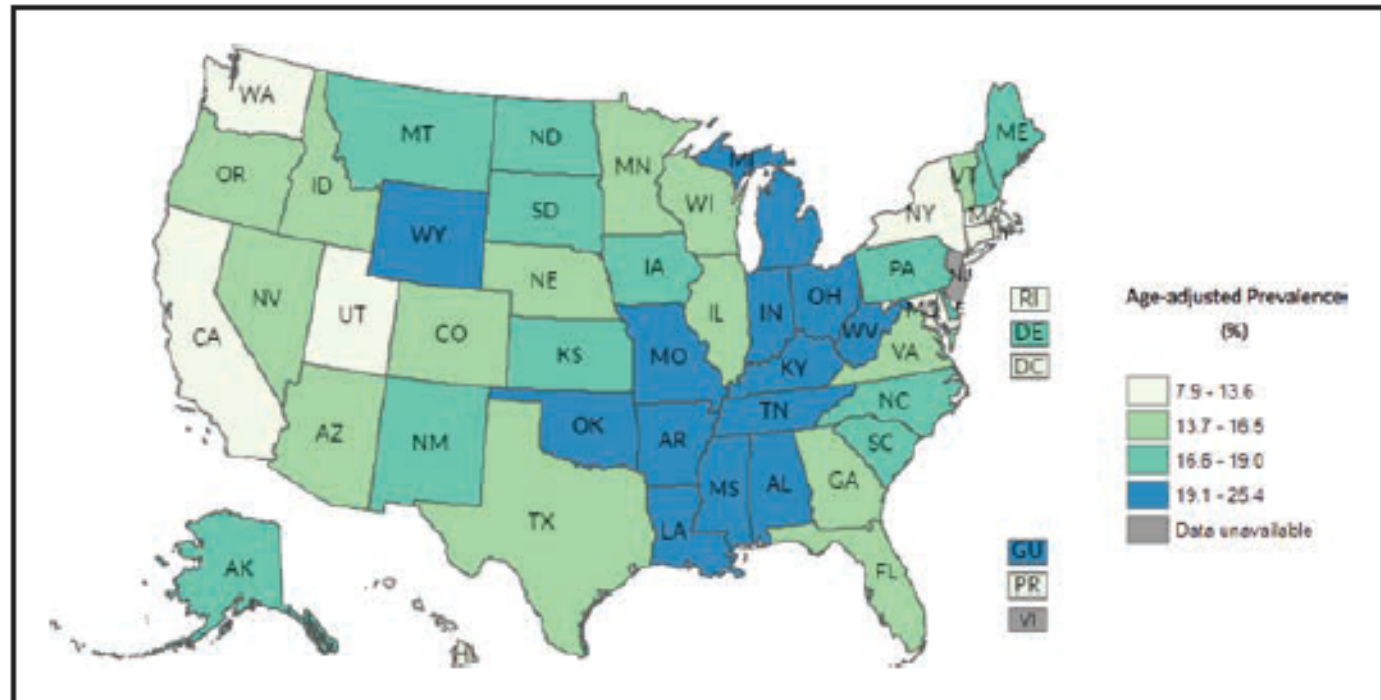


Chart 3-2. Age-adjusted prevalence (percent) of current cigarette smoking for US adults by state (BRFSS, 2019).

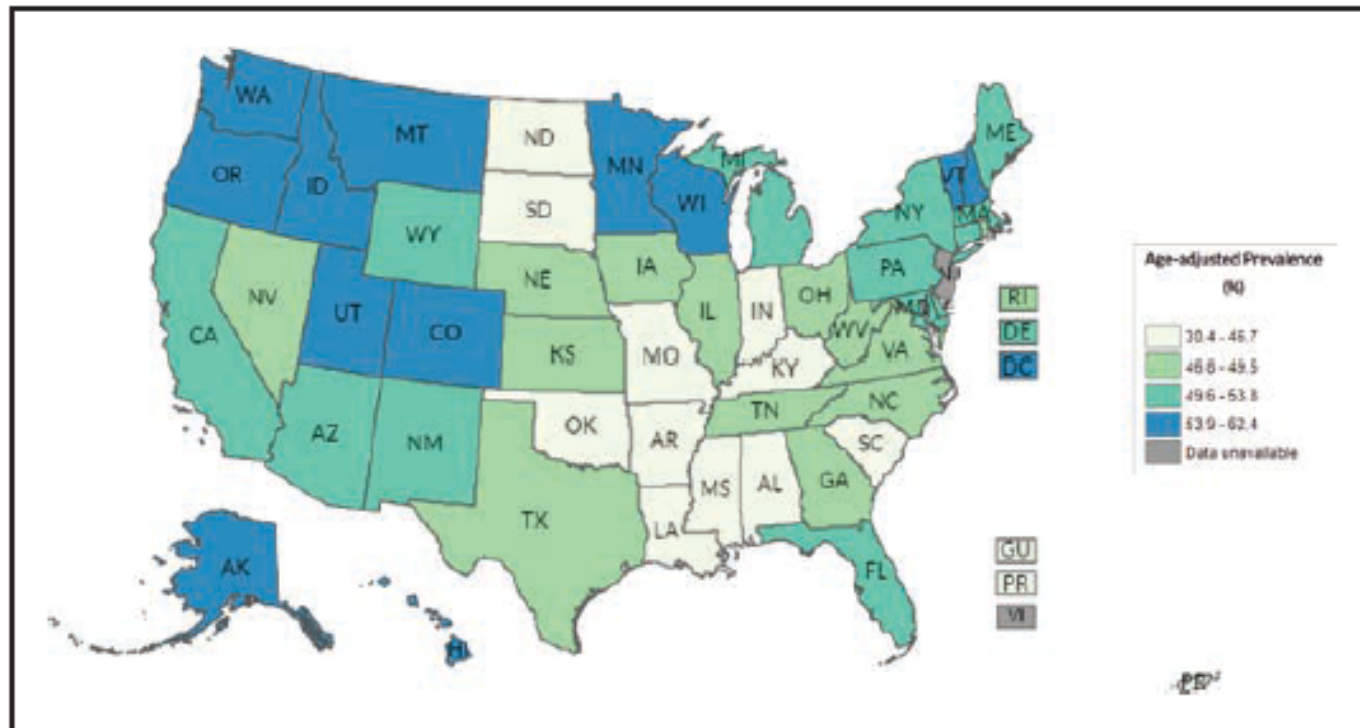
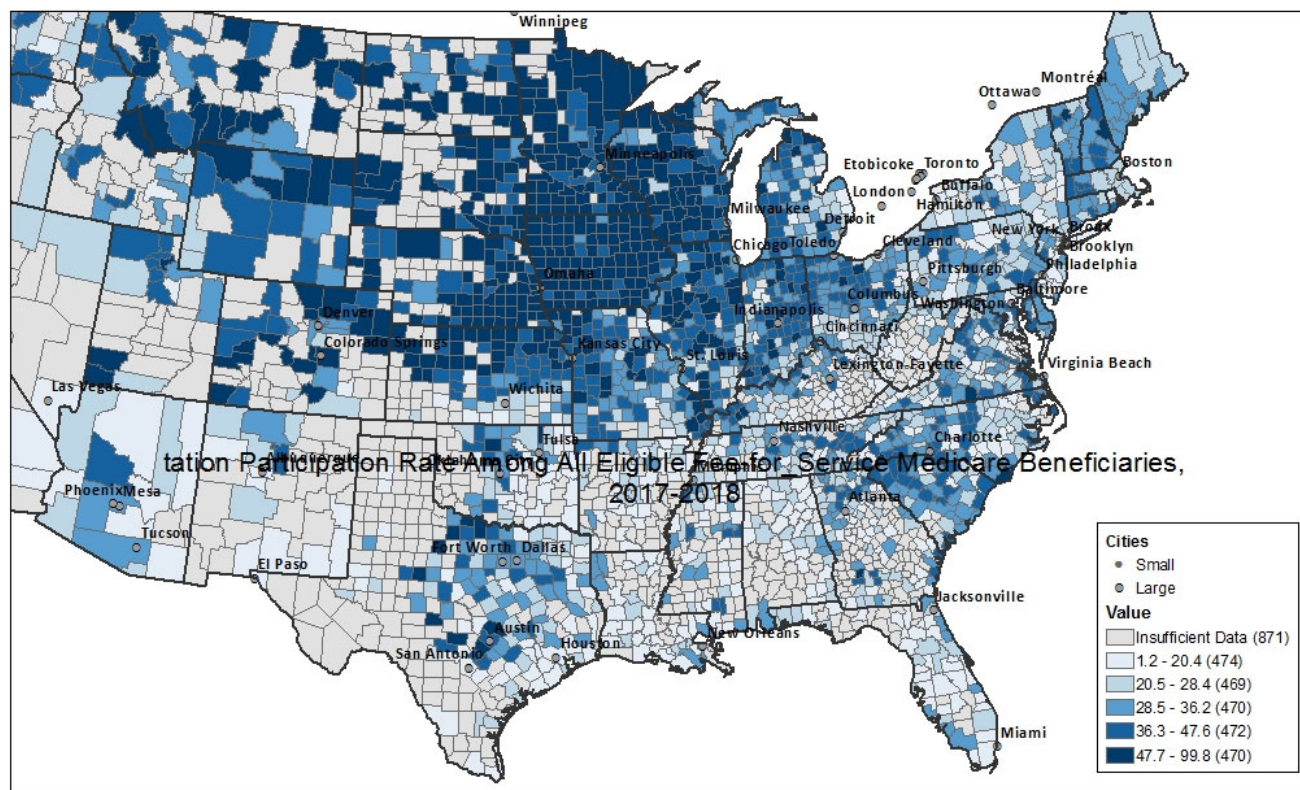


Chart 4-6. Age-adjusted prevalence of meeting the aerobic PA guidelines among US adults ≥ 18 years of age, by state, 2019.

Participation Rate for Cardiac Rehab Among Eligible Medicare Participants



What can be done

- Screen patients for high blood pressure and make blood pressure control a quality improvement goal
- Encourage physical activity and healthy eating to reduce obesity
- Promote smoking cessation