Achieving Health Equity to eliminate Tuberculosis (TB):
the true pathway for ending TB in Colorado

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Denver Metro Tuberculosis Program

Denver Public Health

- Discuss the definition of health equity
- Review health inequities and health disparities in the U.S.
- Review the global and U.S. burden of Tuberculosis (TB)
- Discuss health inequities and disparities among individuals with TB
- Identify the challenges of TB elimination in the U.S.
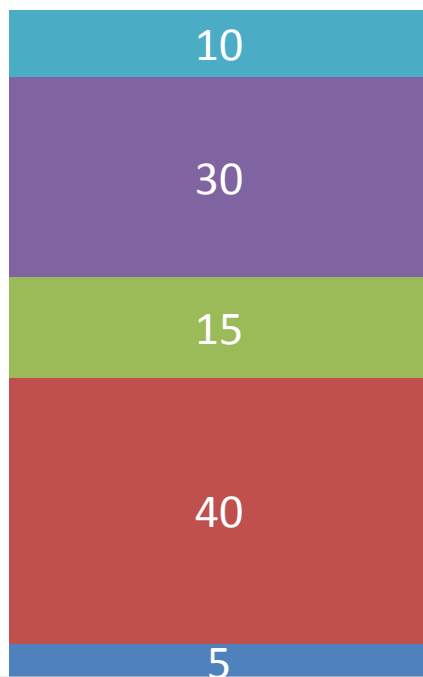- Achieving health equity to eliminate TB

- Health equity: every person has the opportunity to "attain his or her full health potential"

- Health inequities: unequal health differences closely linked with social, economic or environmental disadvantages that adversely affect groups of people
  - Health inequities can lead to health disparities

http://sgba-resource.ca/en/concepts/equity/distinguish-between-equity-and-equality/

PROPORTIONAL CONTRIBUTION TO PREMATURE DEATH

- ■ health care
- ■ genetics
- ■ social circumstance
- ■ behavior
- ■ environment

10	health care
30	genetics
15	social circumstance
40	behavior
5	environment

PERCENTAGE

© 2017 Denver Public Health

Social Determinants of Health

Economic Stability	Neighborhood and Physical Environment	Education	Food	Community and Social Context	Health Care System
Employment	Housing	Literacy	Hunger	Social integration	Health coverage
Income	Transportation	Language	Access to healthy options	Support systems	Provider availability
Expenses	Safety	Early childhood education		Community engagement	Provider linguistic and cultural competency
Debt	Parks	Vocational training		Discrimination	
Medical bills	Playgrounds				
Support	Walkability	Higher education			Quality of care

Health Outcomes
Mortality, Morbidity, Life Expectancy, Health Care Expenditures, Health Status, Functional Limitations

THE HENRY J. KAISER FAMILY FOUNDATION

McGinnis JM et al., *Health Affairs* 21, no.2 (2002):78-93
Schroeder SA et al. NEJM 2007;357:1221-8

- Provider to patient: "Has anything interfered with your ability to take your HIV medications?"

- Patient to provider: "I want to take my HIV medications BUT…."

https://www.shutterstock.com/

- Health inequities compared to other HIV patients:
  - Homeless (no place to store her medications)
  - Competing priorities
    - Searching for a job and caring for her children
  - Food insecurity
  - Physically limited in her ability to get to a clinic
- Health disparity results:
  - Progression towards AIDS and ultimately death

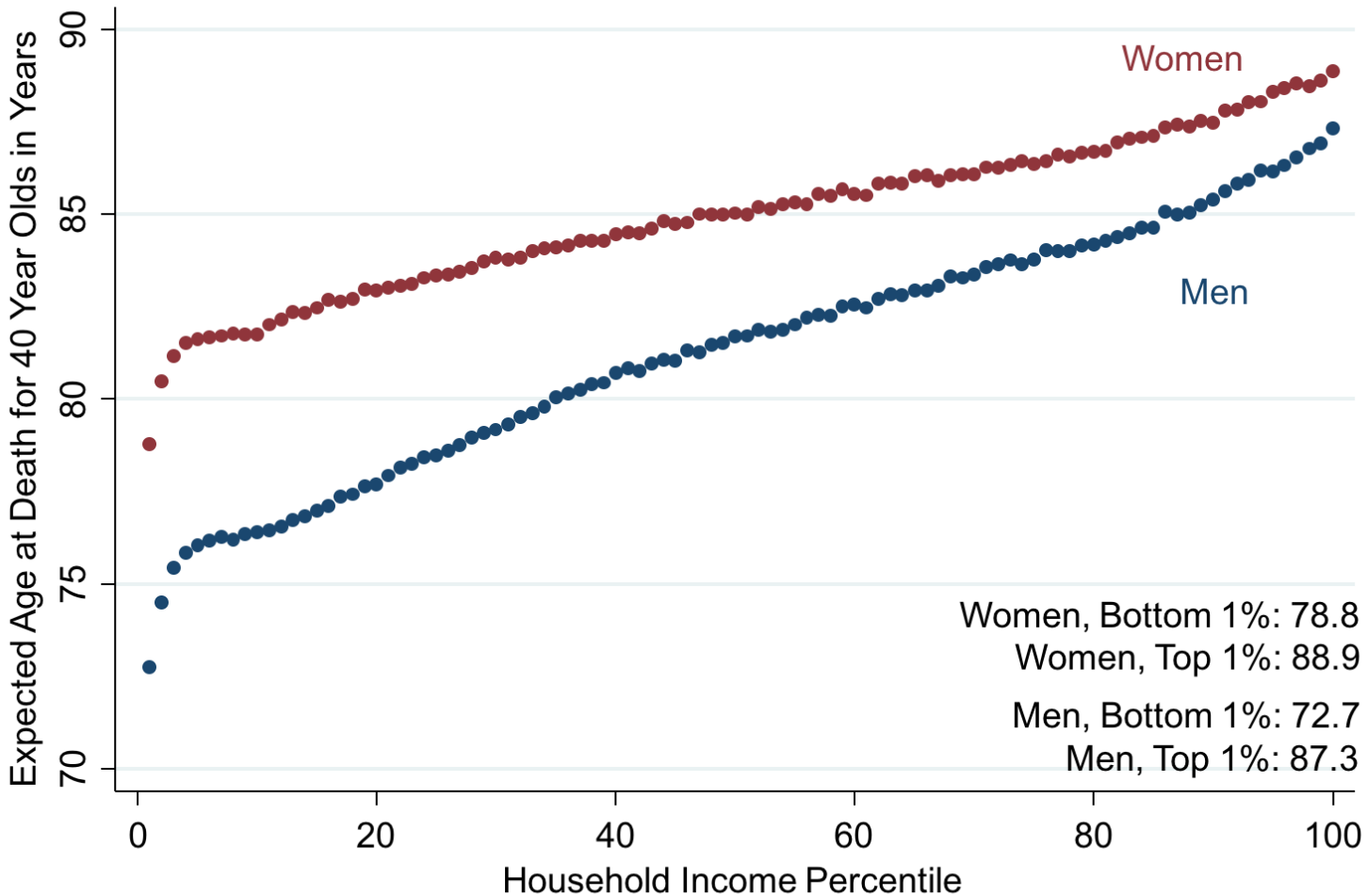# How can we measure health disparities?

- Identifying differences in the following:
  - Life expectancy
  - Infant mortality
  - Disease outcomes
  - Incidence of infectious diseases
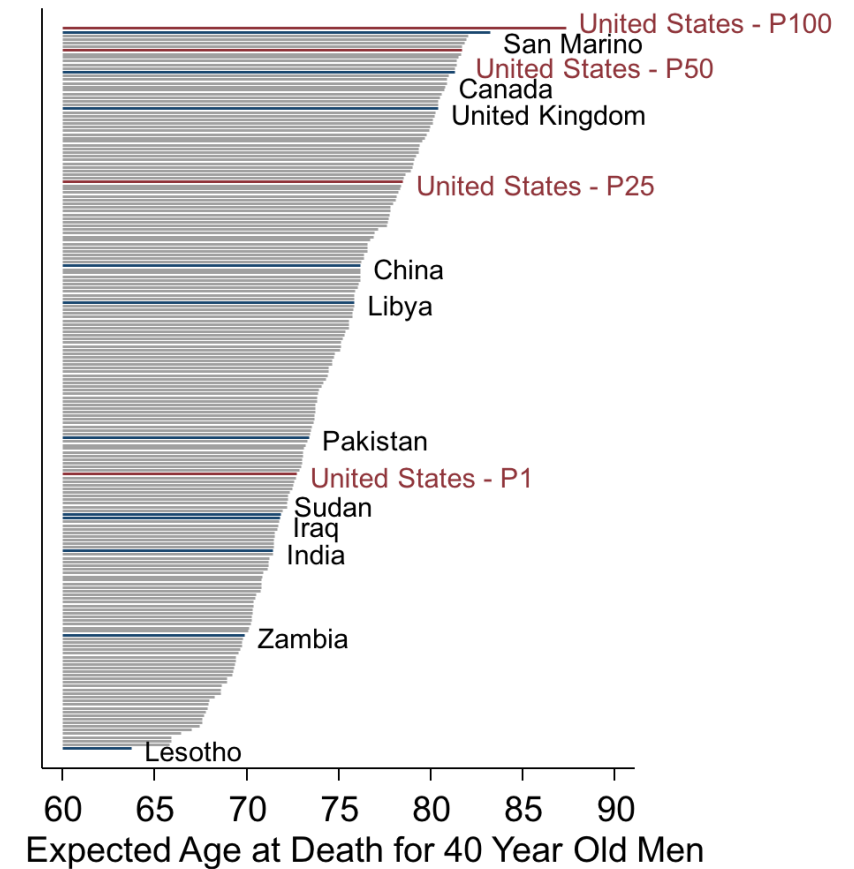- Across different socio-economic strata, racial/ethnic groups and gender
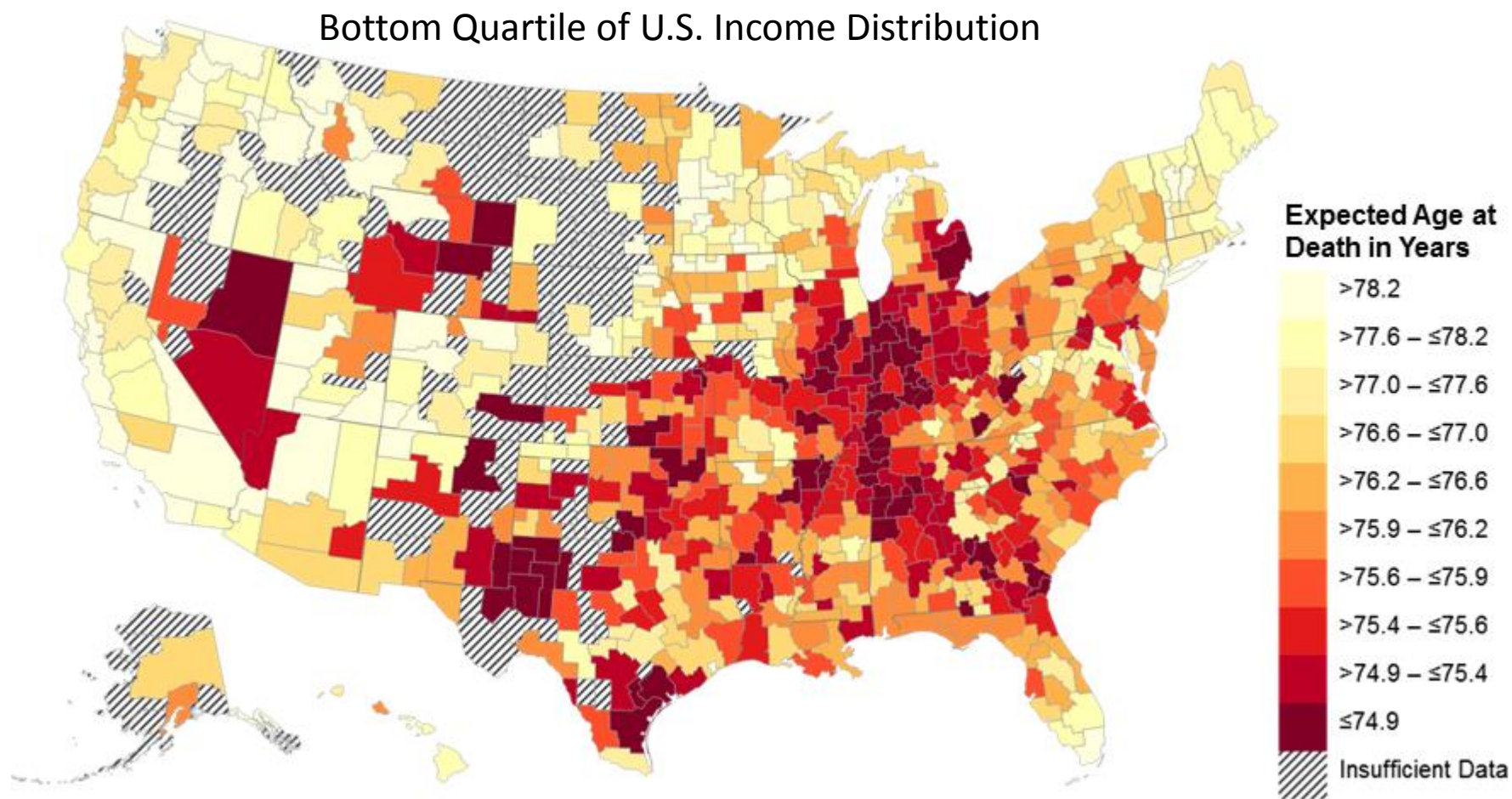
Life Expectancy by Income in the U.S.

**Expected Age at Death vs. Household Income Percentile
By Gender at Age 40**

Women

Men

Women, Bottom 1%: 78.8
Women, Top 1%: 88.9

Men, Bottom 1%: 72.7
Men, Top 1%: 87.3

Expected Age at Death for 40 Year Olds in Years

Household Income Percentile

**U.S. Life Expectancies by Percentile in Comparison to
Mean Life Expectancies Across Countries**

United States - P100
San Marino
United States - P50
Canada
United Kingdom

United States - P25

China
Libya

Pakistan
United States - P1
Sudan
Iraq
India

Zambia

Lesotho

Expected Age at Death for 40 Year Old Men

Chetty R, et al. JAMA. 2016 April 26; 315(16): 1750–1766

https://healthinequality.org/documents/

Bottom Quartile of U.S. Income Distribution

Expected Age at Death in Years

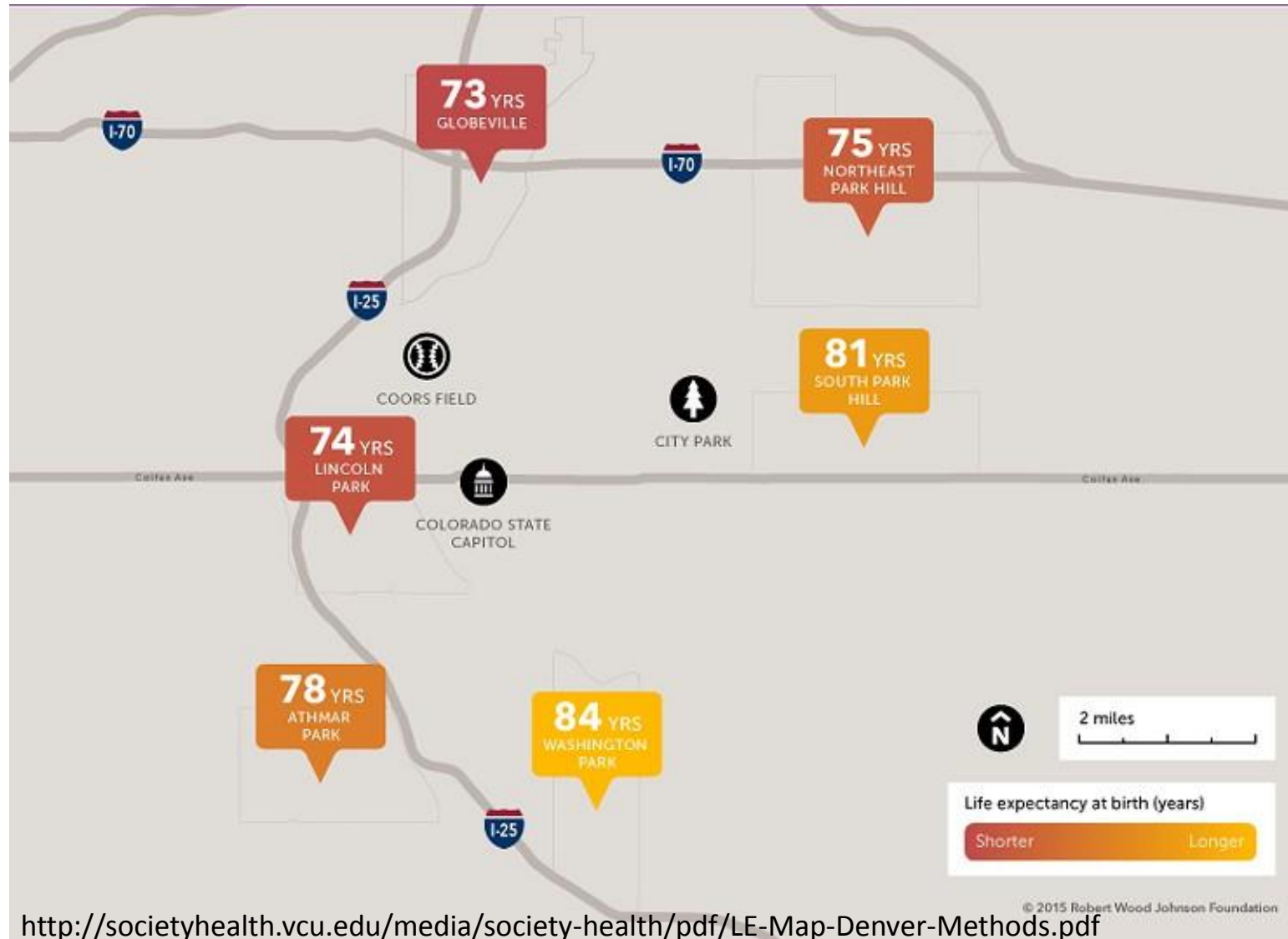|	
	>78.2
	>77.6 – ≤78.2
	>77.0 – ≤77.6
	>76.6 – ≤77.0
	>76.2 – ≤76.6
	>75.9 – ≤76.2
	>75.6 – ≤75.9
	>75.4 – ≤75.6
	>74.9 – ≤75.4
	≤74.9
	Insufficient Data

Note: Lighter Colors Represent Areas with Higher Life Expectancy

Chetty R, et al. JAMA. 2016 April 26; 315(16): 1750–1766

https://healthinequality.org/documents/

Map of Denver neighborhoods and life expectancy

http://societyhealth.vcu.edu/media/society-health/pdf/LE-Map-Denver-Methods.pdf

Income inequality life expectancy: associated factors

- General pattern: low-income people in affluent, educated cities with higher local government expenditures per capita, live longer (and have healthier behaviors)

https://healthinequality.org/documents/

Chetty R, et al. JAMA. 2016 April 26; 315(16): 1750–1766

Correlations of expected age at death: health and social factors
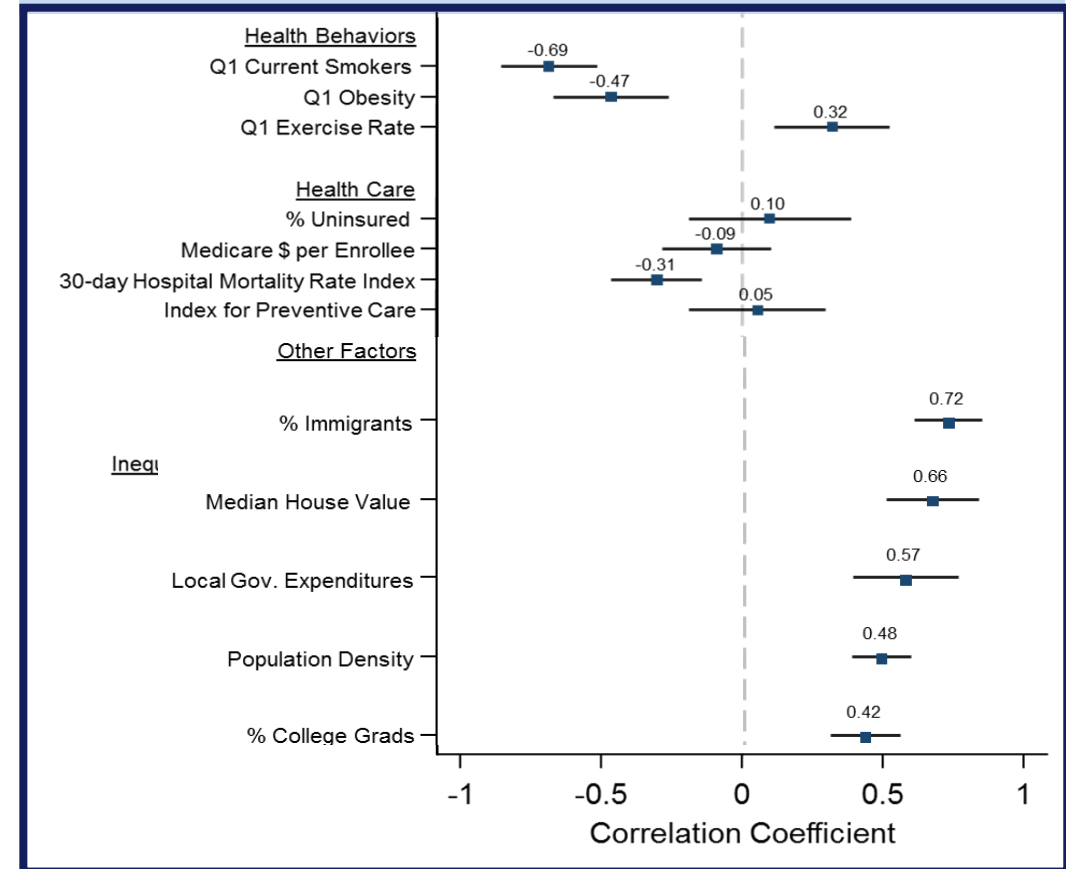
Individuals in Bottom Quartile of Income Distribution

Higher life expectancy

# Medicaid expansion associated with reduced Mortality in New York, Maine and Arizona

Variable	Baseline mortality	Net change in mortality after Expansion	P value for differences
	# deaths/100,000	# deaths/100,000 (95% CI)	
Entire cohort	320	-19.6 (-27.3 to 11.9)	N/A
Race			
White	309	-14.0 (-19.8 to -8.2)	0.04
Non-white	361	-41.0 (-64.7 to -17.3)	reference
Age			
20-34 yr	83	1.0 (-12.8 to 14.8)	0.006
35-64 yr	446	-30.4 (-41.0 to -19.9	reference
Level of poverty in county			
High	334	-22.2 (-31.0 to -13.5)	0.01
Low	283	-11.3 (-19.2 to 3.3)	reference
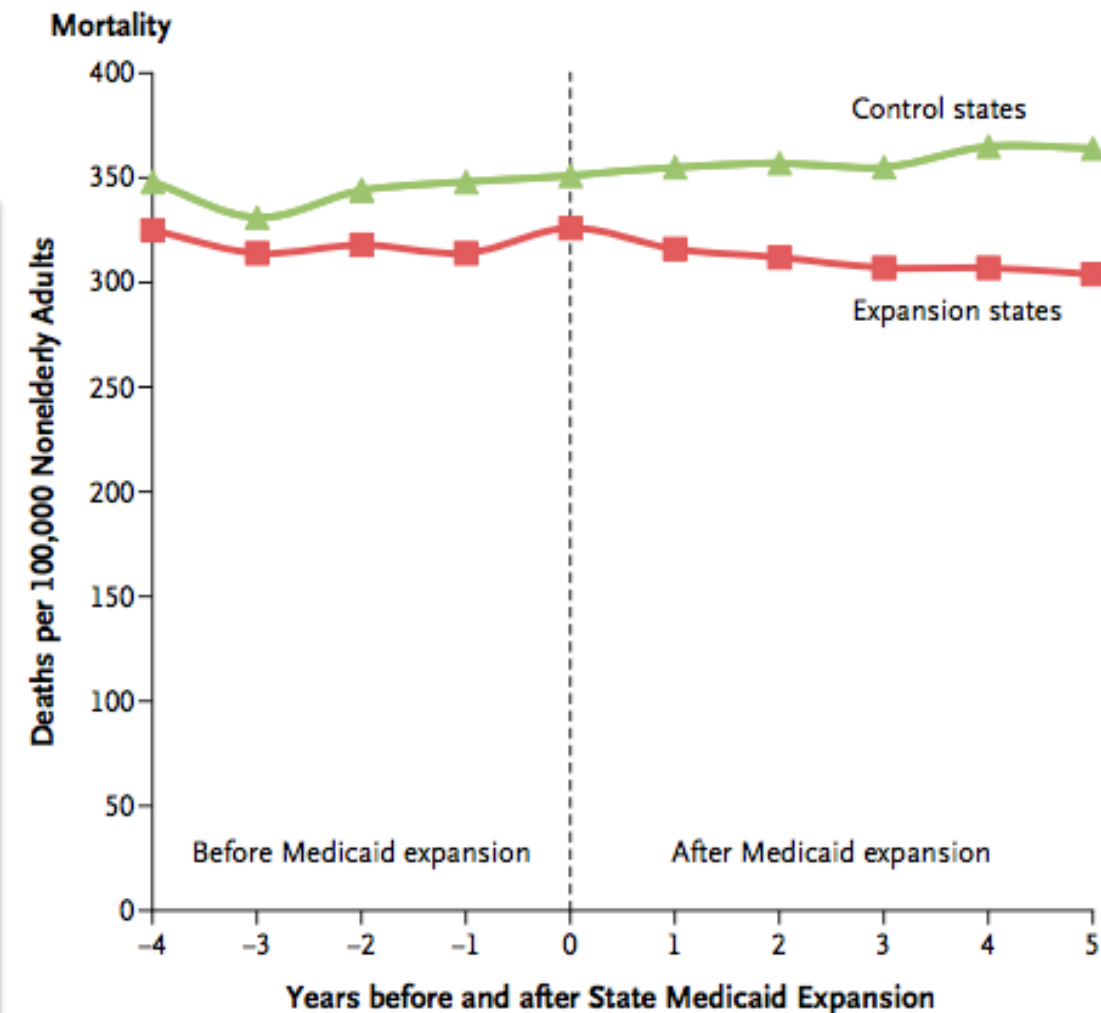
Significant decrease in all-cause mortality in expansion states, compared with control states (−25.4 deaths per 100,000 population; 95% CI, −46.0 to −4.8; P=0.02)
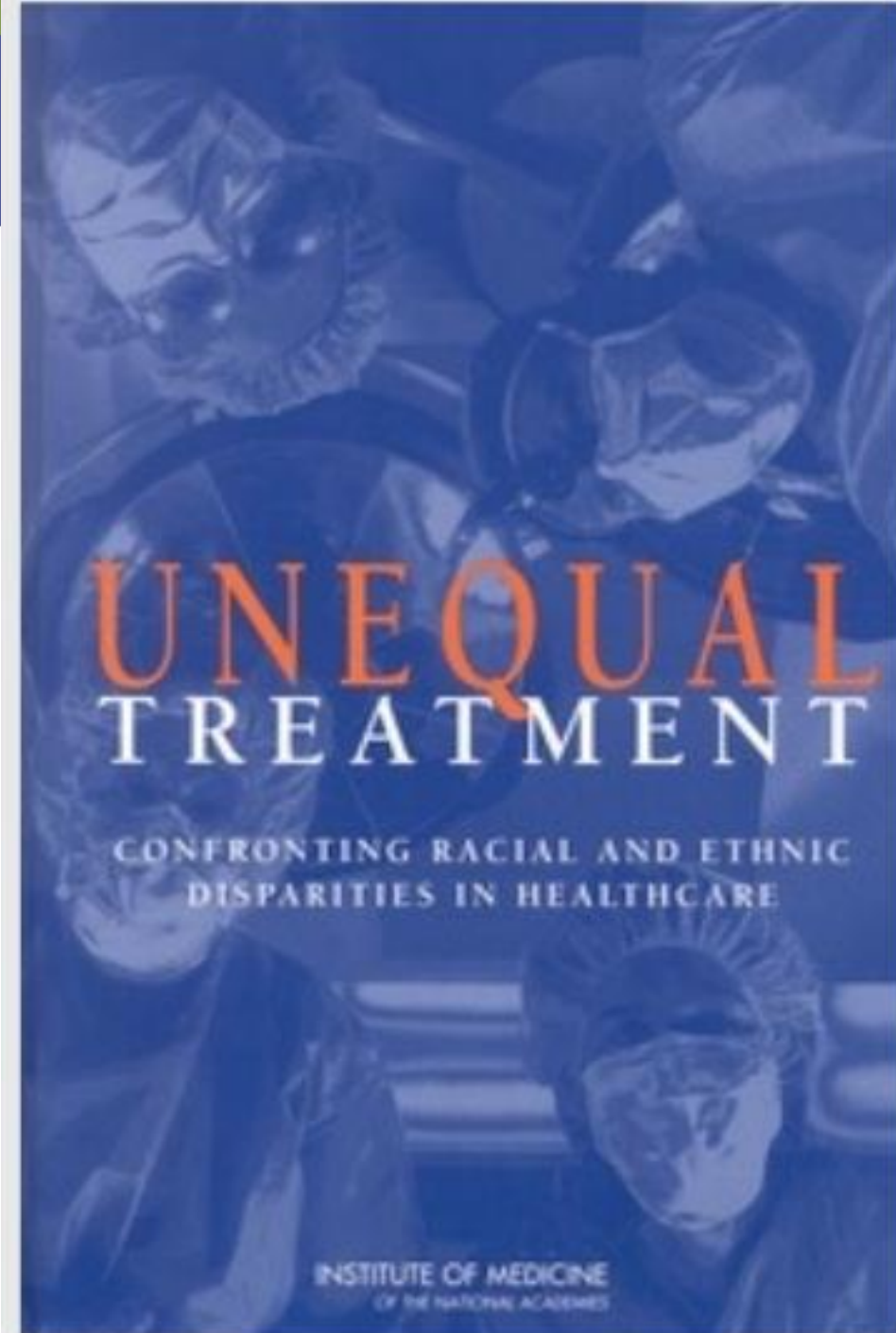
Mortality rate in the U.S.

- Estimates using 2002 data:
  - If the black-white mortality gap could be eliminated we would save an estimated 83,570 lives **each year**
- Heart disease is the leading cause of death

SOURCE: CDC/NCHS, National Vital Statistics System, Mortality.
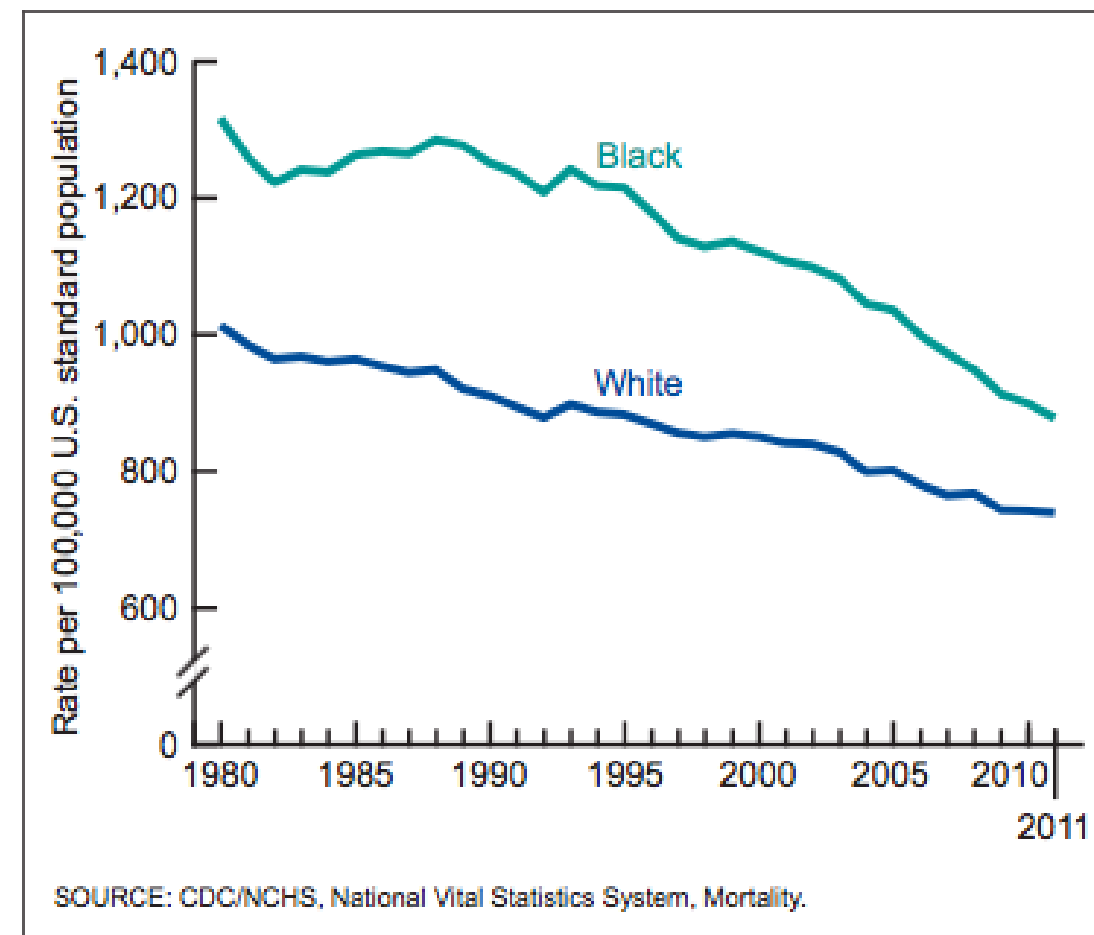
Kochanek, KD et al. National Vital Statistics Reports, Vol. 63, No. 3, July 27, 2015
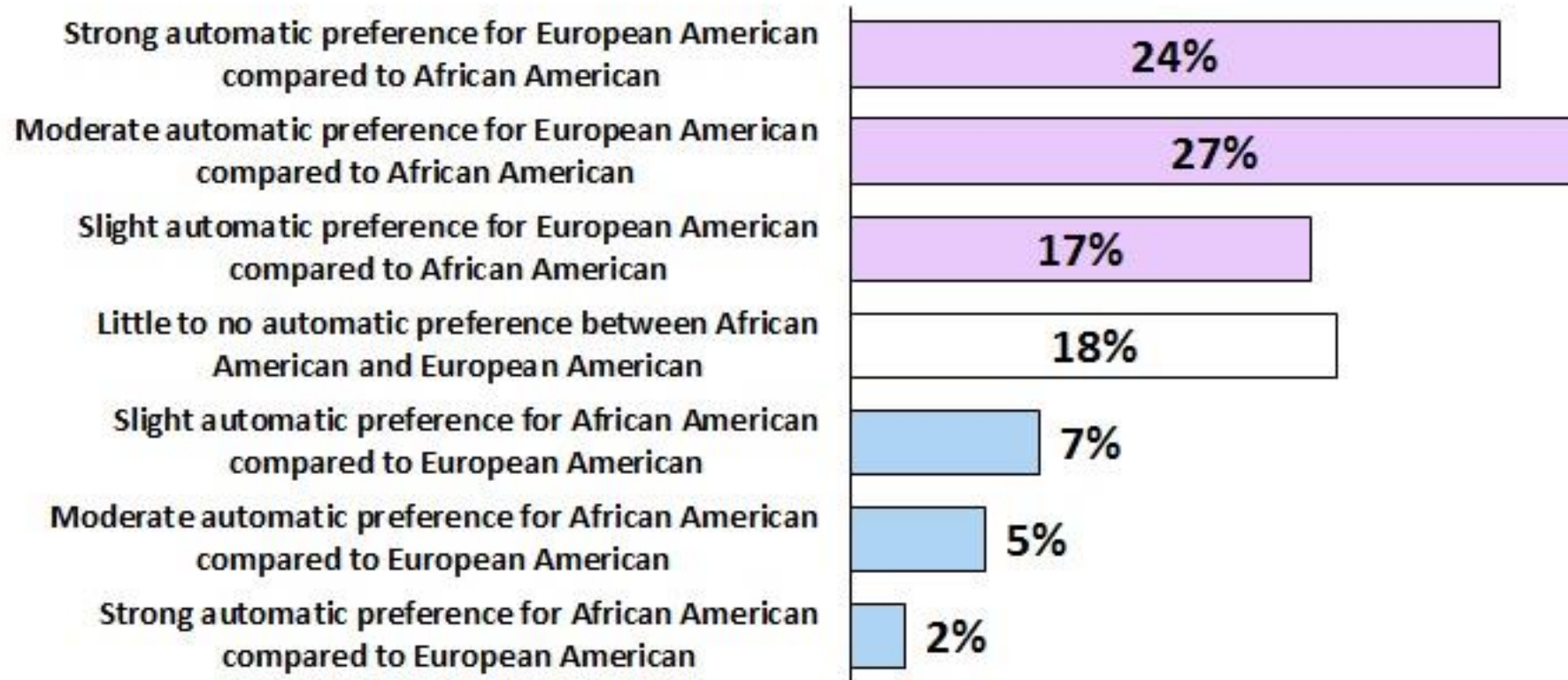Satcher D et al. Health Affairs 24 #2. (2005);24:2459-464.

Institute of Medicine, 2003:

- "It is likely that the vast majority [of clinicians] endorse egalitarian and non-racist attitudes."

- "A large body of published research reveals that racial and ethnic minorities experience a **lower quality of health services**, and are less likely to receive even routine medical procedures than are white Americans."

UNEQUAL TREATMENT

CONFRONTING RACIAL AND ETHNIC DISPARITIES IN HEALTHCARE

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Unconscious/Implicit bias: automatic preference for one group over another

Percent of web respondents with each score

Strong automatic preference for European American compared to African American — **24%**

Moderate automatic preference for European American compared to African American — **27%**

Slight automatic preference for European American compared to African American — **17%**

Little to no automatic preference between African American and European American — **18%**

Slight automatic preference for African American compared to European American — **7%**

Moderate automatic preference for African American compared to European American — **5%**

Strong automatic preference for African American compared to European American — **2%**

This distribution summarizes 3,314,277 IAT scores for the Race task completed between December 2002 and December 2015.

68% of test takers preferred European-Americans

Unconscious/implicit bias—refers to the attitudes or stereotypes that affect our understanding, action and decisions in an unconscious manner

https://implicit.harvard.edu/implicit/takeatest.html

Implicit bias and its impact on clinical care

- Non-white patients of providers who have higher implicit bias favoring whites perceive lower quality of care
- The impact of implicit bias on clinical decision-making varies by specialty, and clinical scenario
  - Pediatricians who have implicit-bias favoring whites demonstrated no difference in clinical decision making stratified by race
  - Internists and ED physicians reviewing clinical vignettes: less likely to offer thrombolytics to black patients with coronary artery disease
    - Informing them of their bias lessened its impact in future decisions

Blair IV et al. Ann Fam Med. 2013 Jan-Feb;11(1):43-52.
Green AR, et al. J Gen Intern Med. 2007;22(9):1231–8.
Sabin JA, Greenwald AG. Am J Public Health. 2012;102(5):988–95.

- Racial/ethnic and income-related health disparities identified:
  - Life expectancy and health outcomes
  - Racial/ethnic disparities persist after accounting for differences in income and education
  - Unconscious bias favoring whites a contributing factor
- Higher life expectancy may be seen in communities with increased access to public resources and education
  - Medicaid Expansion under the Affordable Care Act in selected states:
    - Associated with reduced mortality for people of color and those living in high poverty communities

THE TUBERCULOSIS EPIDEMIC IN 2017

TEST ME
TREAT ME

STOP TB
PARTNERSHIP

- 60 year old man without health insurance, receives care through a sliding scale payment system at a public safety net hospital
  - Diagnosed with drug-resistant pulmonary tuberculosis
  - Family—wife and 2 adopted younger children
  - Required to remain isolated for several weeks, loses his job
  - Now unable to pay his mortgage
  - Outreach staff discover there is very little food in the house, one of the children is in need of shoes for school

- TB clinic provides:
  - TB related services at no cost to the patient
  - Resources for food
- TB clinic patient assistance fund is able to cover mortgage
  - Avoids public health threat of an infectious homeless patient
  - Preserves housing resource
- ***Result: able to stay on TB treatment, social situation is stabilized***
  - ***Health disparity avoided: death from TB and infection of family members***

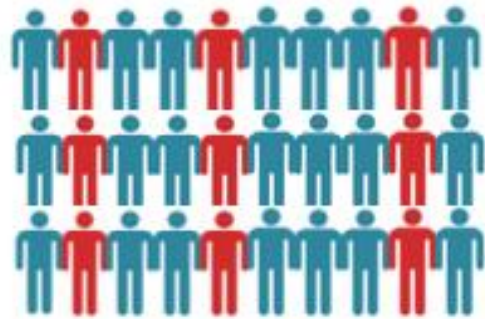# TB is the leading cause of death from an infection globally

10.4 million people FELL ILL FROM TB

That's 28,500 people every day

1.8 million deaths

TB deaths among HIV-negative people

TB deaths among HIV-positive people
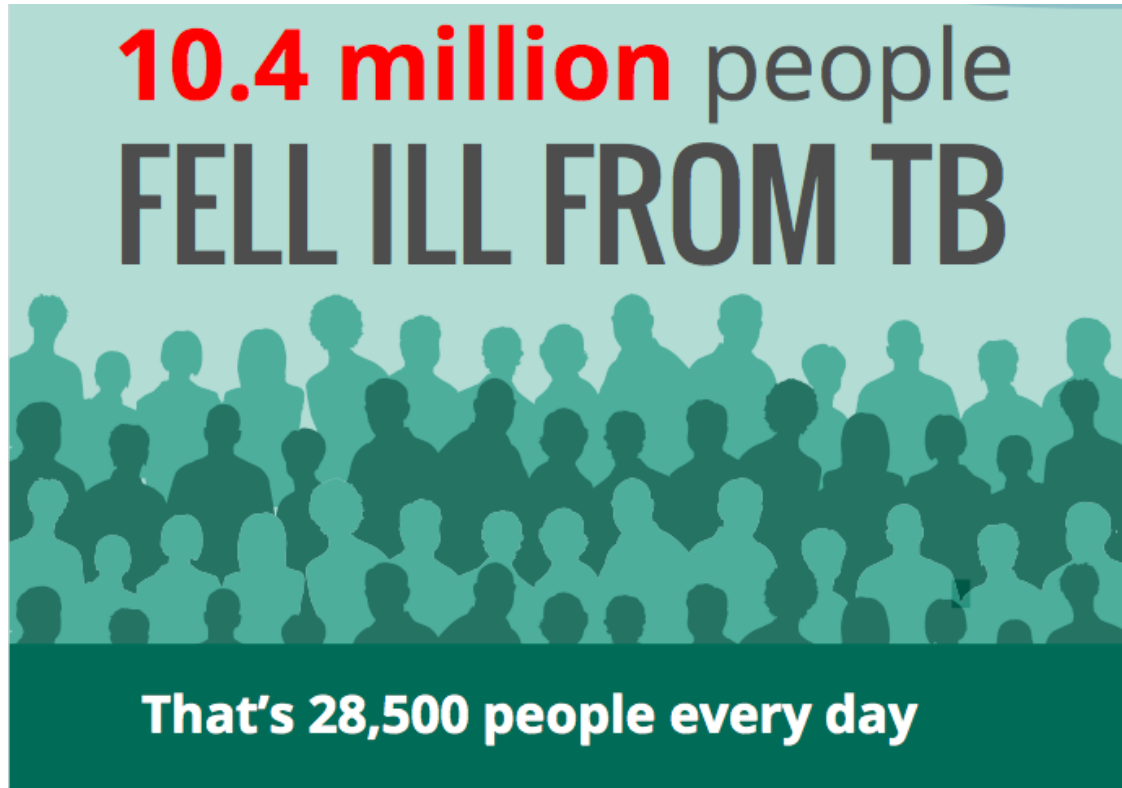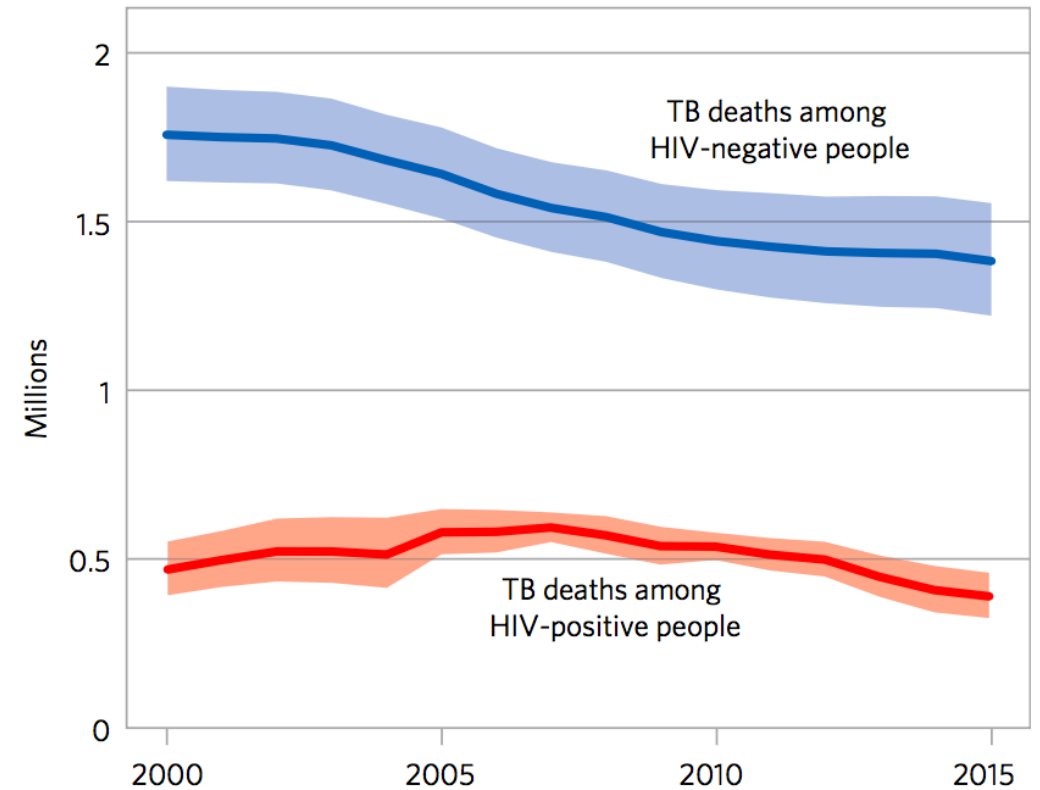
Global Tuberculosis Report 2016
www.results.org
www.who.int

Denver Public Health

2-3 billion persons with LTBI globally

About one in three persons

RISK FACTORS

Exposure → LTBI → Active TB

RISK FACTORS
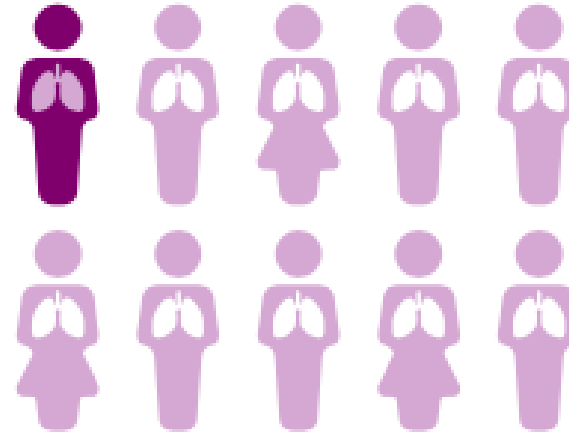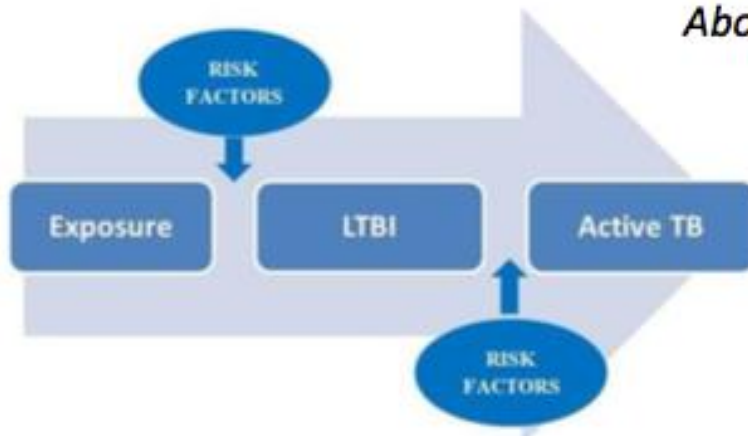
1 in 10

Without treatment, 1 in 10 people with latent TB infection will develop TB disease.

Guidelines on the management of latent tuberculosis infection

THE END TB STRATEGY

World Health Organization
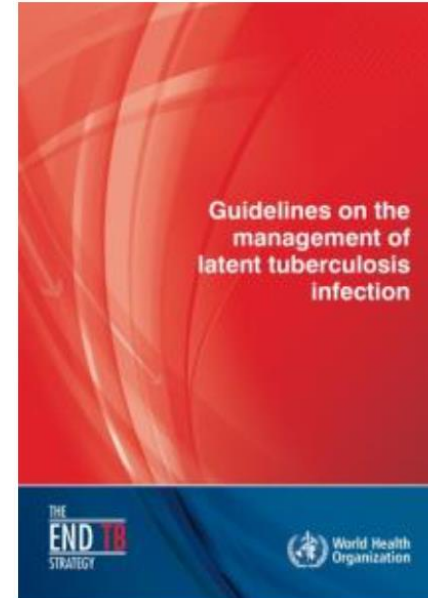
Latent TB: infection with *M. tuberculosis* without any symptoms or abnormalities identified after testing (i.e., your chest radiograph is normal and you feel well)
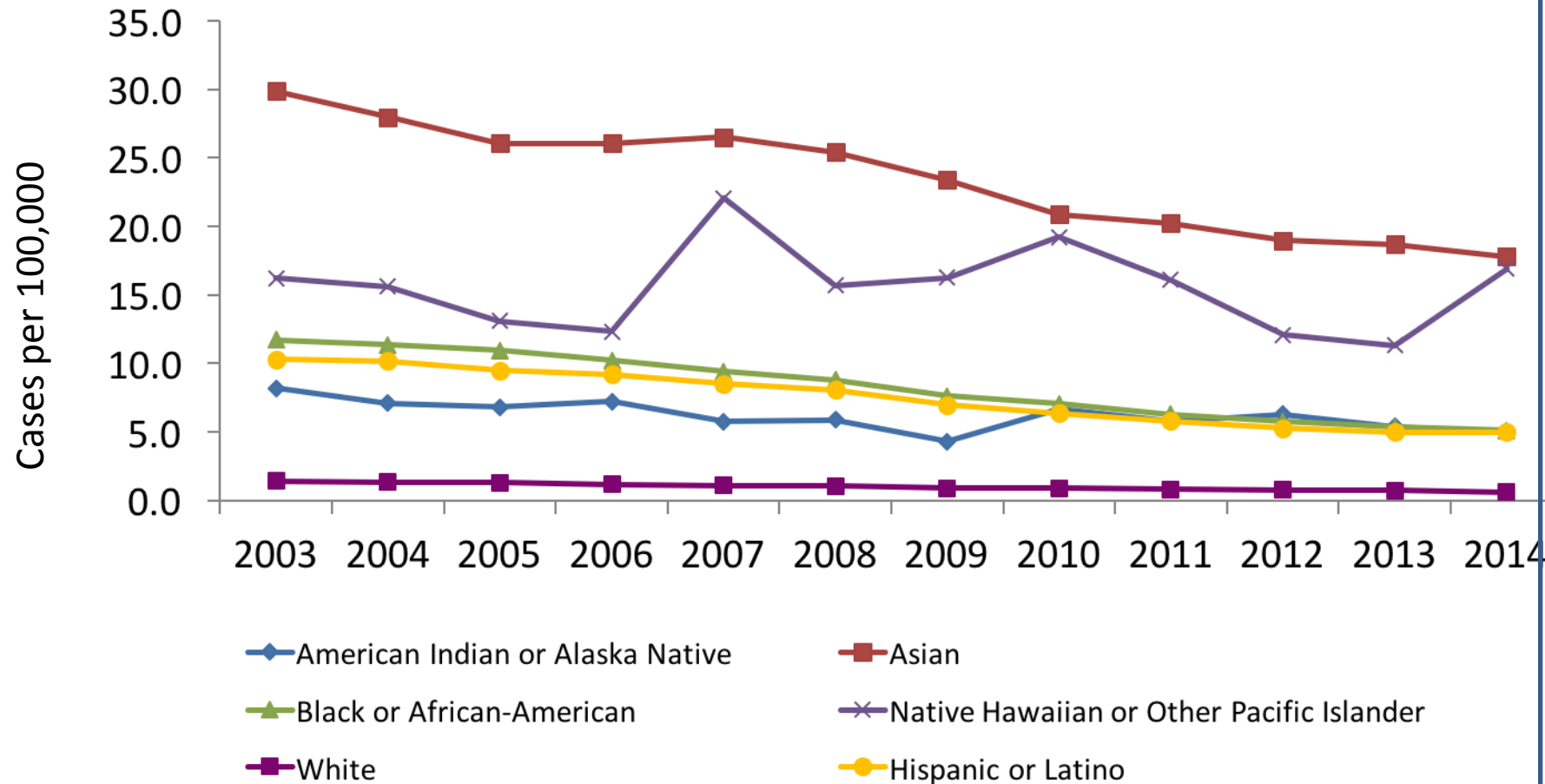
www.who.int

For the first time in 2 decades, overall TB incidence remained flat in the U.S.

9,563 persons with active TB in 2015 compared to 9,421 in 2014

TB incidence in United States
- Overall
- Among US-born persons
- Among foreign-born persons
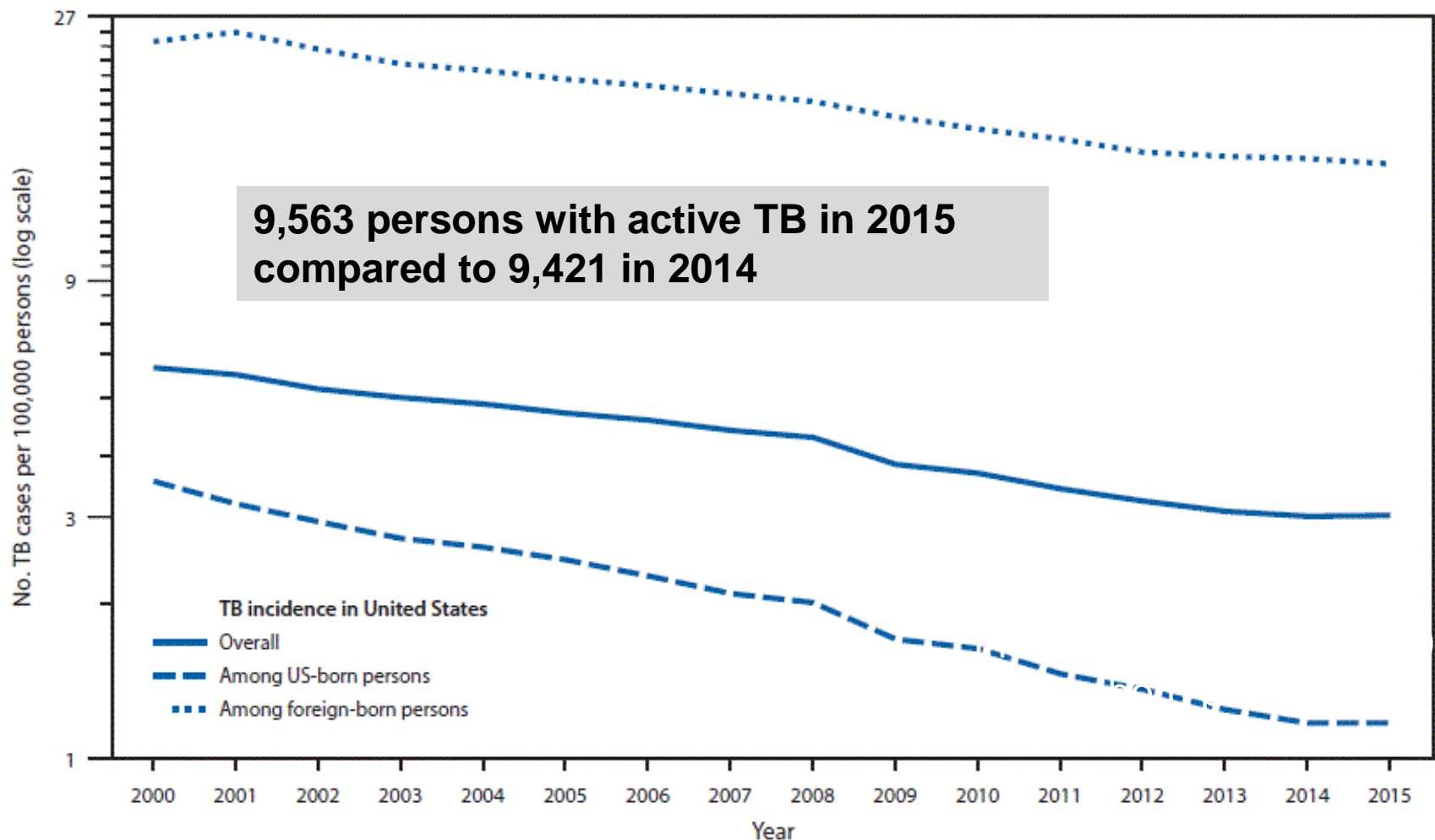
Incidence of TB in the US: 3.0/100,000

Incidence of TB in Colorado: 1.3/100,000

Salinas JL, et al. MMWR Morb Mortal Wkly Rep 2016; 65: 273-278

Salinas JL, et al. MMWR Morb Mortal Wkly Rep 2016

# Racial/ethnic disparities in recent transmission of TB

- Analysis from Jan 2011-Sept 2014
  - n=26,586 genotyped cases
  - Evidence for recent transmission in 14%
- 91% among individuals born in the U.S.
- After multivariable analysis, adjusted prevalence ratio (aPR) was higher for:
  - Children < 4 years of age
 - People of color
  - Individuals reporting homelessness

Characteristic	Value	Limited recent transmission		Extensive recent transmission	
		aPR	Wald 95% CI	aPR	Wald 95% CI
Sex	Female	Reference		Reference	
	Male	1.1	1.0–1.2	1.1	1.0–1.3
Age (years)	≤4	2.8	2.4–3.3	1.9	1.4–2.6
	5–14	1.5	1.1–2.0	1.3	0.8–1.9
	15–24	1.4	1.3–1.6	1.2	1.1–1.5
	25–44	Reference		Reference	
	45–64	0.9	0.8–1.0	1.0	0.9–1.1
	≥65	0.5	0.4–0.6	0.5	0.4–0.6
Origin	Foreign-born	0.4	0.3–0.4	0.2	0.2–0.2
	U.S.-born	Reference		Reference	
Race and ethnicity*	Hispanic	1.5	1.3–1.7	2.0	1.7–2.4
	American Indian /Alaska Native	1.5	1.2–2.0	3.6	2.9–4.4
	Asian	1.1	0.9–1.3	2.4	1.9–3.0
	Black	1.6	1.4–1.8	3.0	2.6–3.5
	Native Hawaiian / Pacific Islander	1.5	1.1–2.2	3.2	2.3–4.5
	White	Reference		Reference	

*Persons of Hispanic ethnicity might be of any race; non-Hispanic persons are categorized as Asian, black, white, American Indian/Alaska Native, Native Hawaiian or other Pacific Islander, or of multiple races. Bold text indicates statistically significant result.

Yuen CM, et al. PLoS ONE 11(4): 2016

TST prevalence: no travel to TB endemic area
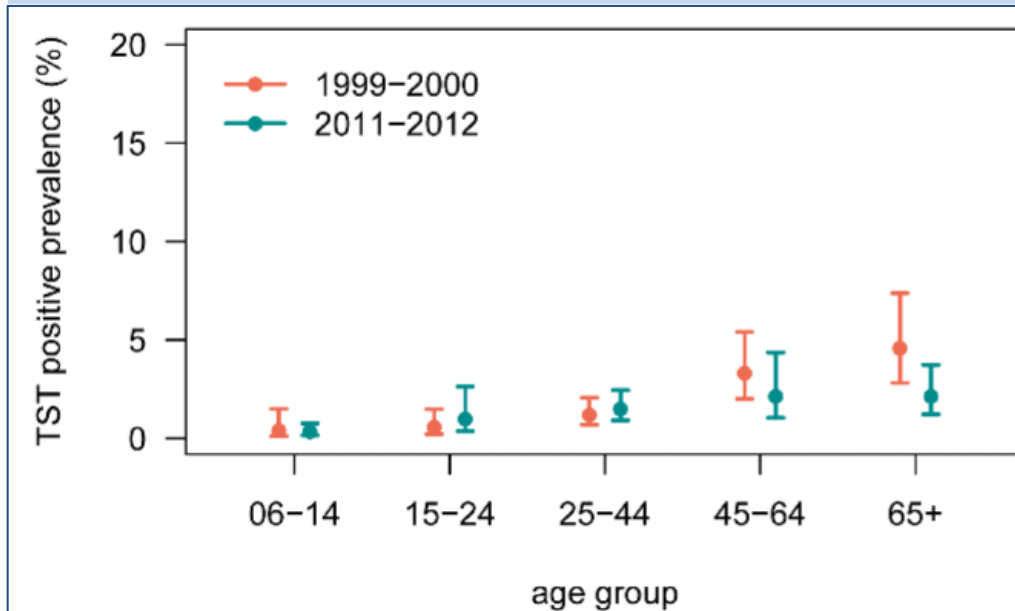
TST prevalence: lived in TB endemic area
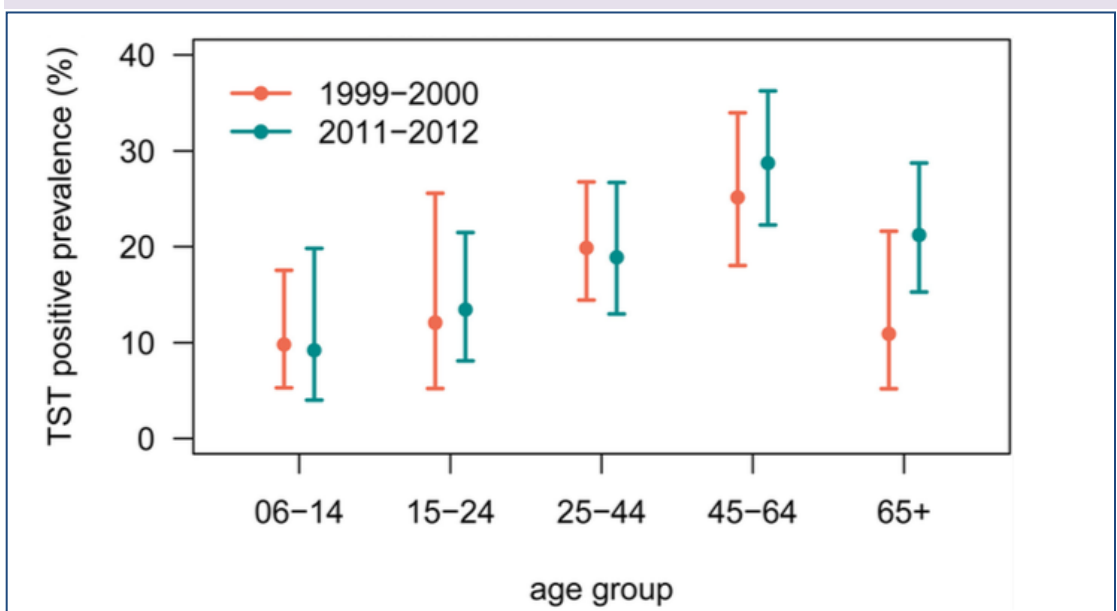
13 million individuals with latent TB in the US

158,000 individuals with latent TB in Colorado

Miramontes, PLoS One, 2015

Higher TB incidence as Socio-economic status (SES) *decreases*

TB RATE RATIOS BY RACIAL/ETHNIC GROUP AND 1st AND 4th CROWDING QUARTILES: FINAL SES MODEL (U.S.-BORN ONLY)

Race/Ethnicity	Crowding Quartile	
	1st (*Highest*) (95% CI)*	4th (*Lowest*) (95% CI)*
White	Baseline	Baseline
Black	2.1 (2.2–2.3)	7.0 (6.8–7.3)
Hispanic	1.6 (1.5–1.7)	4.1 (3.8–4.5)
Asian	3.3 (3.0–3.7)	4.5 (3.8–5.3)
Native American	1.9 (1.7–2.2)	3.6 (3.0–4.2)

* Rate ratios compare risk in the designated racial/ethnic group to that in whites within the 1st (highest) and 4th (lowest) SES quartiles for crowding in the final SES model, i.e., the combined SES model with race/ethnicity-crowding interaction variable. CI denotes confidence interval.

Adjustment for the six indicators reduced risk ratios by half for Black Americans, Hispanics and Native Americans
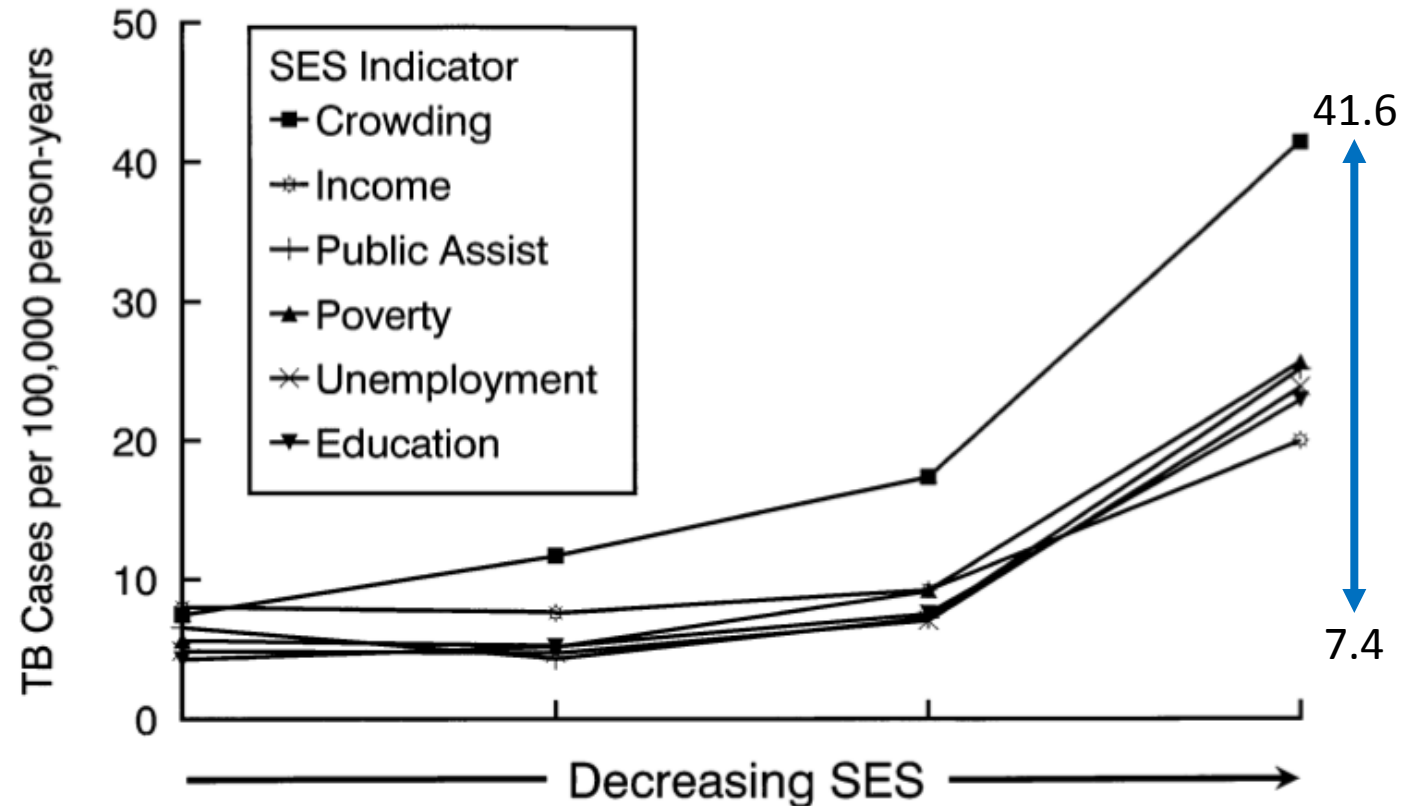
- SES likely influences TB risk in 2 ways:
  - 1) direct effect of living in crowded conditions
  - 2) SES–health gradient: TB risk increases as SES decreases

Cantwell MF, et al. AJRCCM 1998

Health inequities and disparities associated with migration

- N=248 from Los Angeles County
  - Half smear-positive; 1/3 with cavitary disease
- Average delay in seeking care was 74 days
  - Exposed an average of 8 additional people at home or work

Asch S, et al. AJRCCM 1998;157:1244–1248.

Factor	% with Factor (n)	% of those with Factor who delayed(n)	% of those without factor who delayed (n)	p value
Unemployed	49% (115)	25%(29)	14% (17)	0.033
Unsure where to go	24% (57)	33% (19)	16% (28)	0.003
Anticipated high cost	43% (101)	27%(27)	14%(19)	0.018
Anticipated long wait in office	44% (102)	26% (26)	14%(18)	0.023
Anticipated long wait for appt	30%(72)	28%(20)	16%(27)	0.043
Fear of immigration authorities	6%(15)	47%(7)	18%(40)	0.007
Thought could self-treat	32% (77)	31%(24)	14%(23)	0.002

Health inequities resulting from migration: World Health Organization recommendations

- Avoid disparities in health status and access to health services between migrants and the host population

- Ensure migrants' health rights

- Put in place lifesaving interventions so as to reduce excess mortality and morbidity

- Minimize the negative health outcomes of the migration process on migrants' health outcomes

Kontunen, K, et al. Health Promotion International, Vol. 29 No. S1, 2014.

- Population 3600

- 2 hours from Tuskegee

- Poorest county in Alabama

- 20% uninsured (Alabama did not accept Medicaid Expansion)

- Average income $13,000

- Since 2014: 29 with active tuberculosis (TB) **incidence 253/100,000**
 - 150 with latent TB

https://www.hsph.harvard.edu/ecpe/tuberculosis-in-rural-america-what-tuberculosis-in-marion-al-tells-us

- Most TB disease in the U.S is due to reactivation of latent infection
  - The prevalence of latent TB is higher among individuals who were born or who lived outside of the US
  - Lack of clear options for healthcare, and possibly the threat of deportation associated with delays in care for migrants
- Recent TB transmission affects children, people of color and individuals who are homeless
- Increasing TB incidence strongly correlates with lower socioeconomic status
  – Accounts for half of racial/ethnic disparities identified

Can We Eliminate TB?

At least 70% of individuals with active TB in Colorado could have avoided developing TB disease

**INDIVIDUALS WITH ACTIVE TB IN COLORADO BY YEARS IN U.S. TO DIAGNOSIS, 2009-2016**

US-born 22%

> 5 years 48%

< 1 year 10%

1-5 years 20%
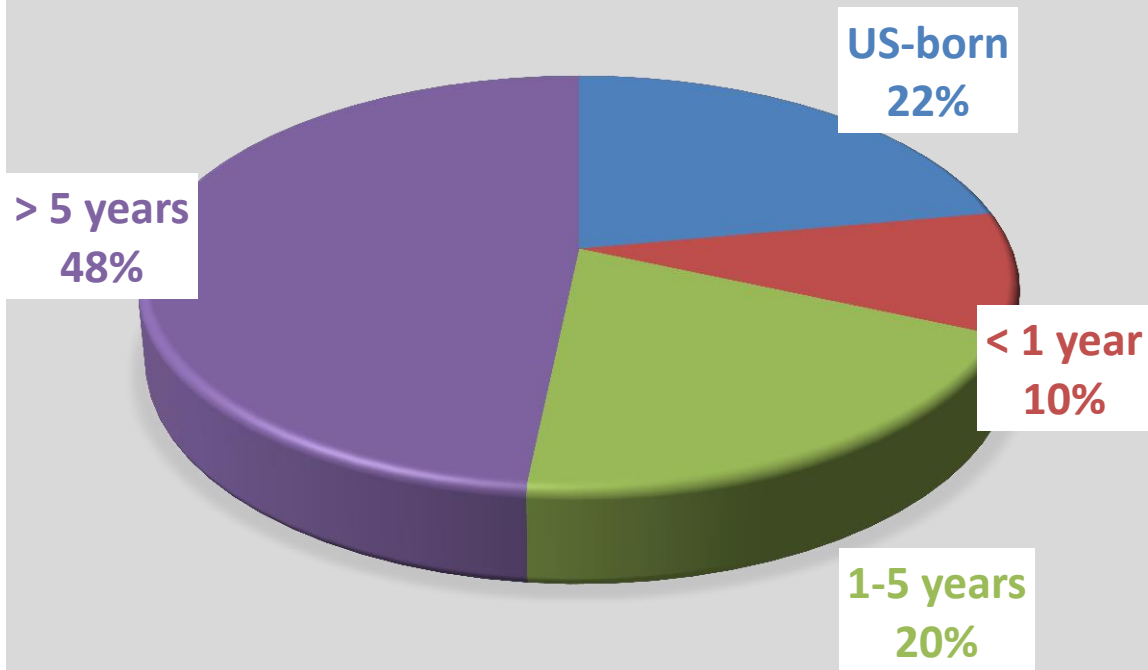
| Race/ethnicity for individuals with active TB who are US-born, 2012-2016 (N= 74)			
	n	%	Colorado Demographics
Hispanic/Latino	25	34%	17%
Black	15	20%	4%
Asian	2	3%	2%
American Indian	2	3%	1%
White	30	41%	82%

Of those tested at diagnosis and with known years in US to diagnosis, 155/222 (70%) of persons had been here for 1 year or more and tested positive for TST or IGRA at diagnosis

Denver Health Primary Care Latent Tuberculosis Infection Cascade of Care*, 2012-2014

5-10% lifetime risk of developing active TB = 340-680 individuals
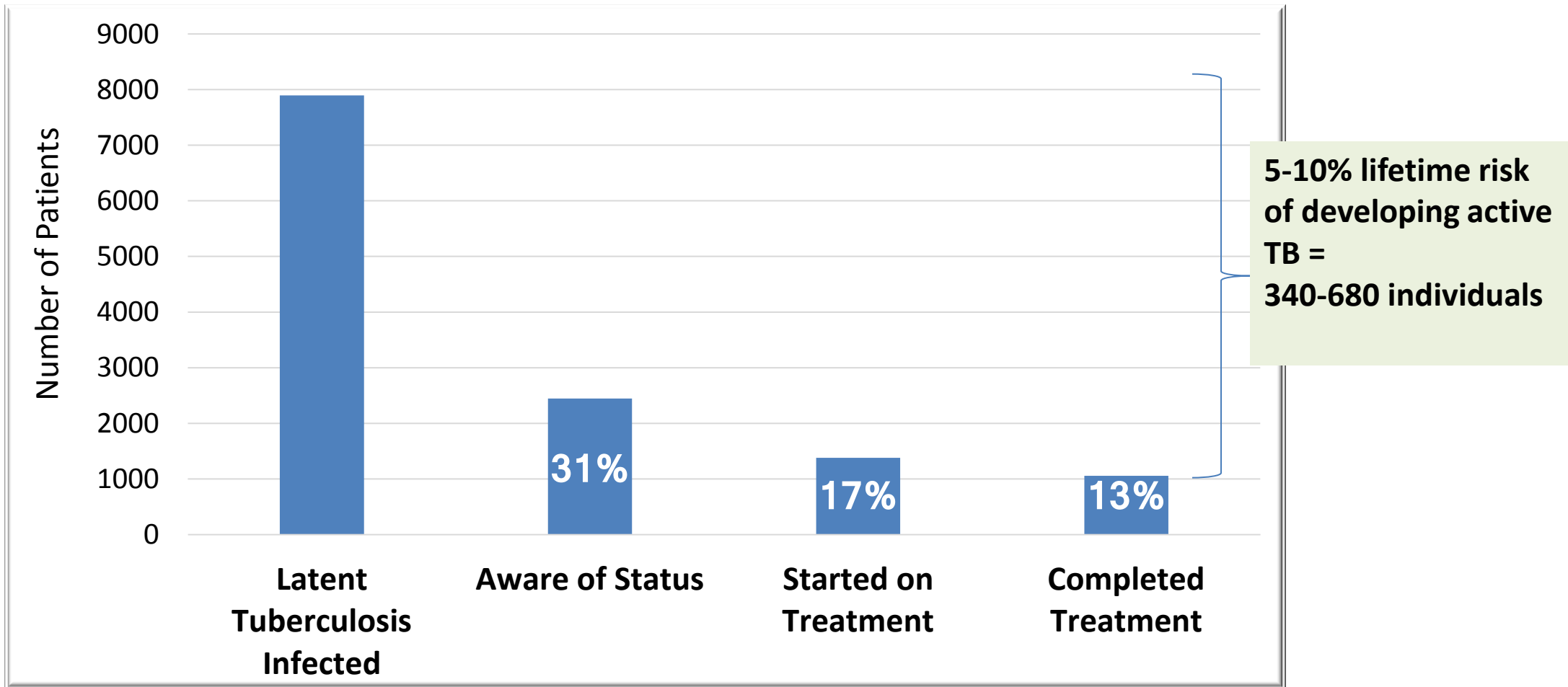
*Single risk factor—prior residence in a TB endemic area

Projected Time to TB Elimination in the U.S.

Dye C, et al. Annual. Rev. Public Health 2013.
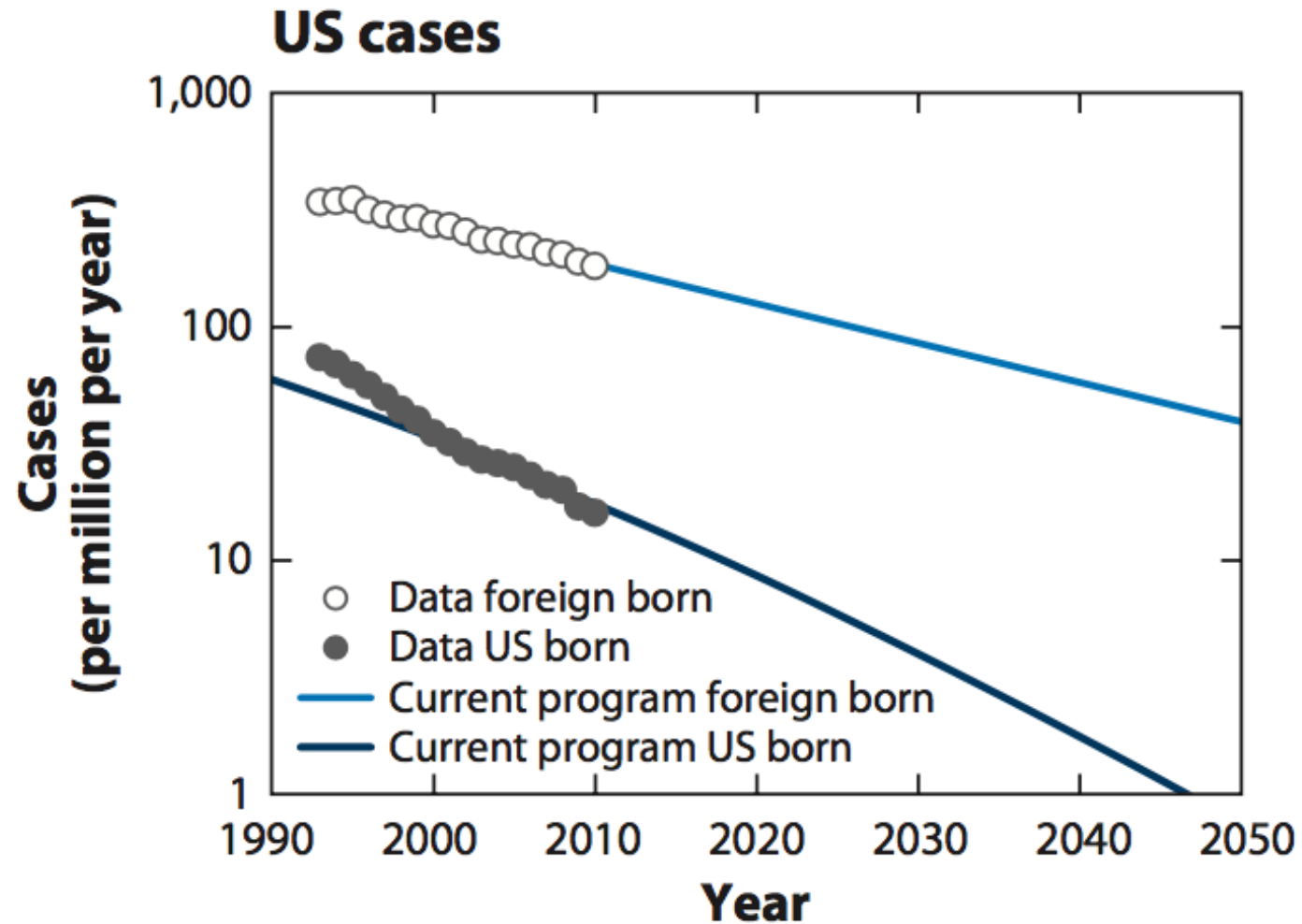
Achieving Elimination By Advancing Health Equity

Improved population health associated with decreased TB incidence

| Health indicator	Adjusted estimate of effect on change in TB incidence between 1990-2005
Increase in life expectancy by one year	-7.8
Increase in measles vaccination coverage	-1.3
1% increase in TB treatment success rate	-0.9

Oxlade, O et al. IJTLD 2009

Increased social protection spending is associated with decreased TB incidence

- Social protection spending:
  - Cash benefits or benefits in kind for disabled, elderly, families, unemployed, homeless, low income earners
  - Housing benefits

- Increase of US $100 per person:
  - 1.5% decrease in # TB case notifications
 - 1.7% decrease in estimated TB incidence
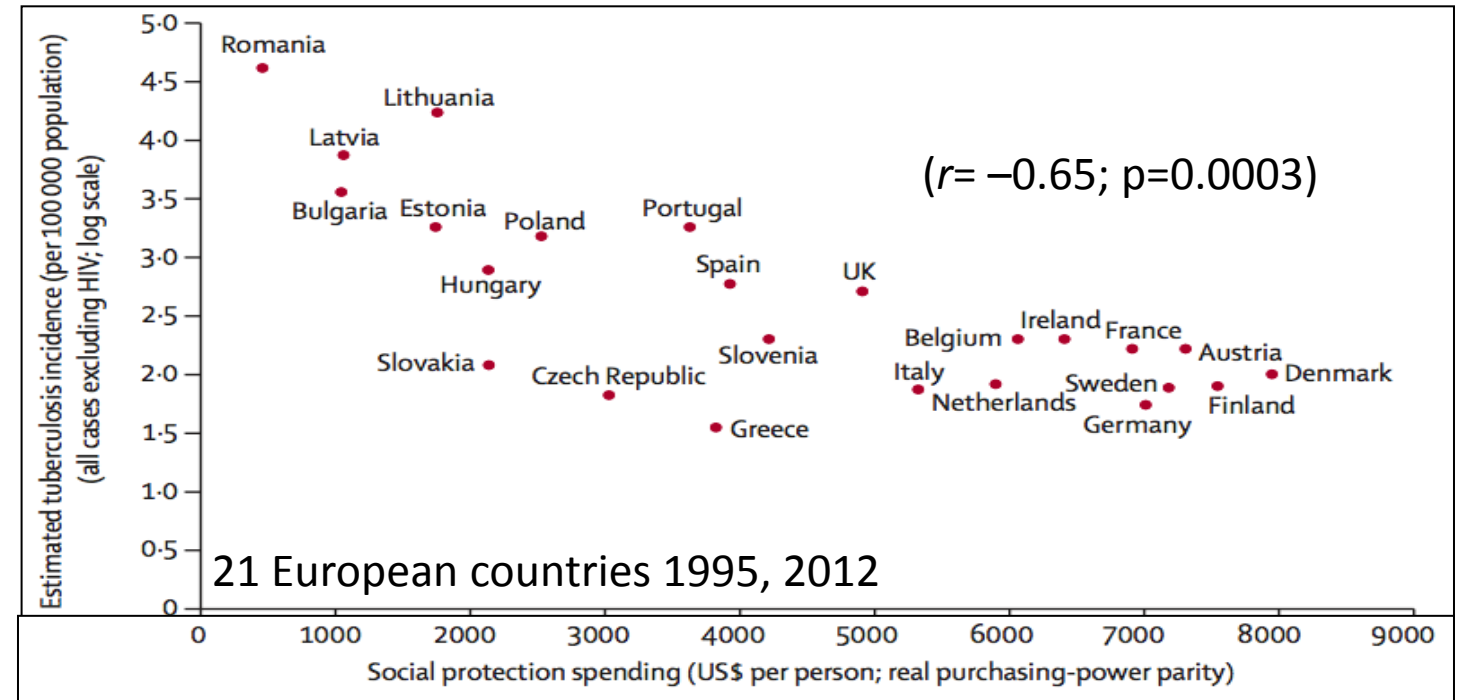
(r= −0.65; p=0.0003)

21 European countries 1995, 2012

Reeves A, et al. Lancet Infect Dis 2011

- Peru: Innovative Socio-economic Interventions Against TB (ISIAT) project
  - Socio-economic interventions to reduce TB burden
    - Aims to increase use of TB care/prevention services
      - Mitigate poverty-related TB risk in households of active TB patients
- Baseline: years 2003-2007
  - Intervention commenced 12/2007

Rocha C, et al. *Int J Tuberc Lung Dis* 2011
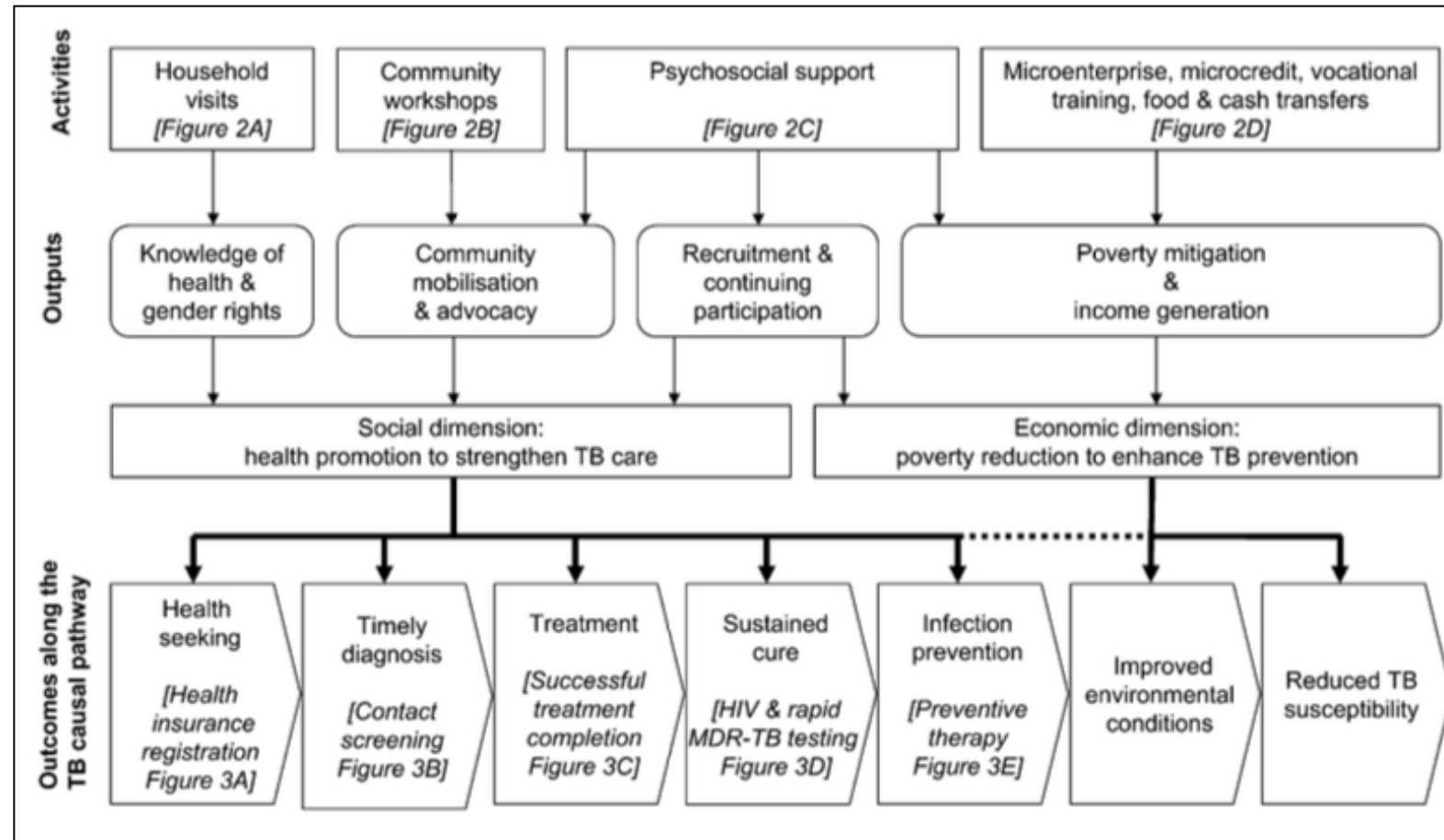
RESULTS

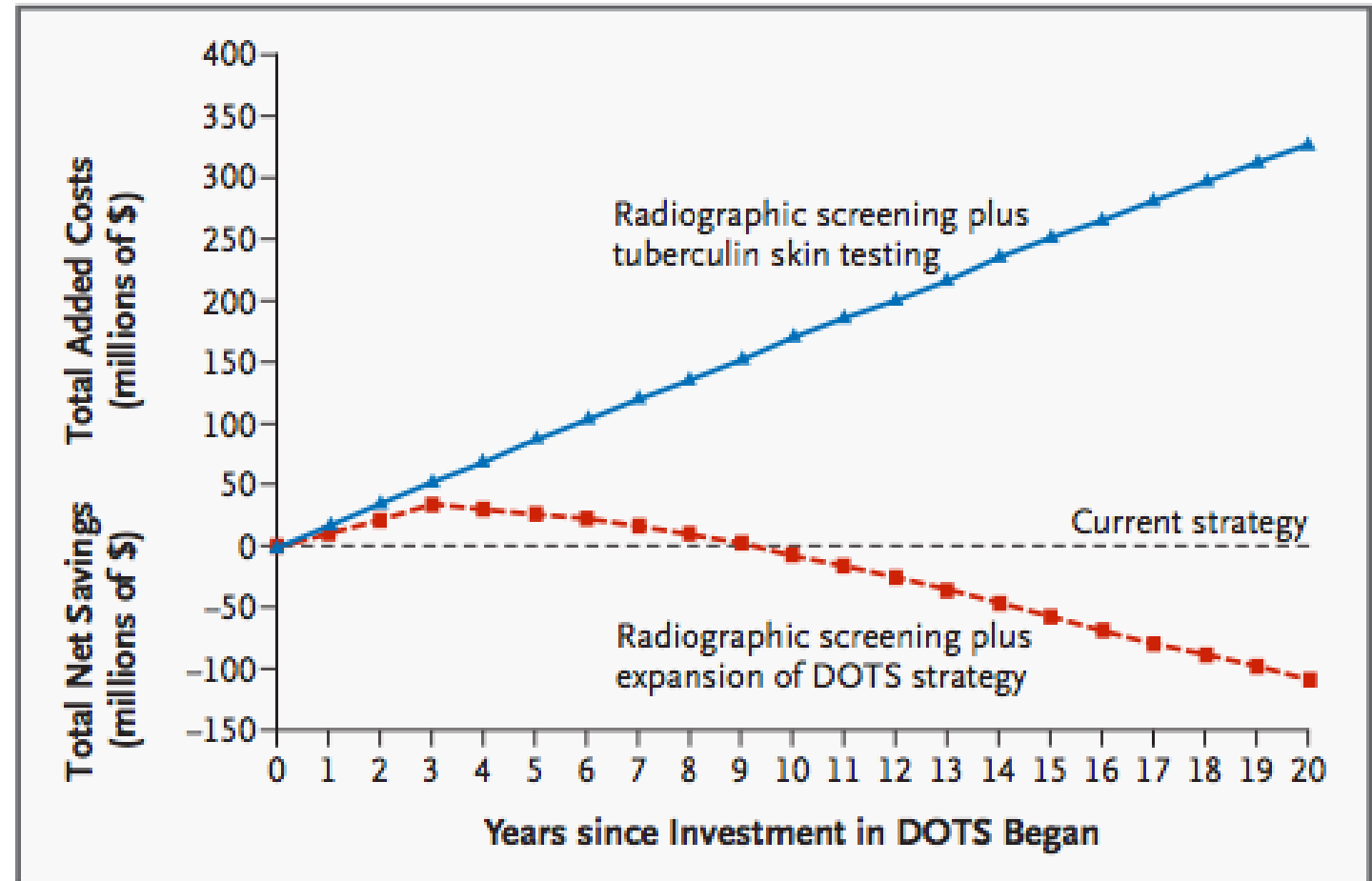Interim analysis of 2078 individuals, 336 with active TB
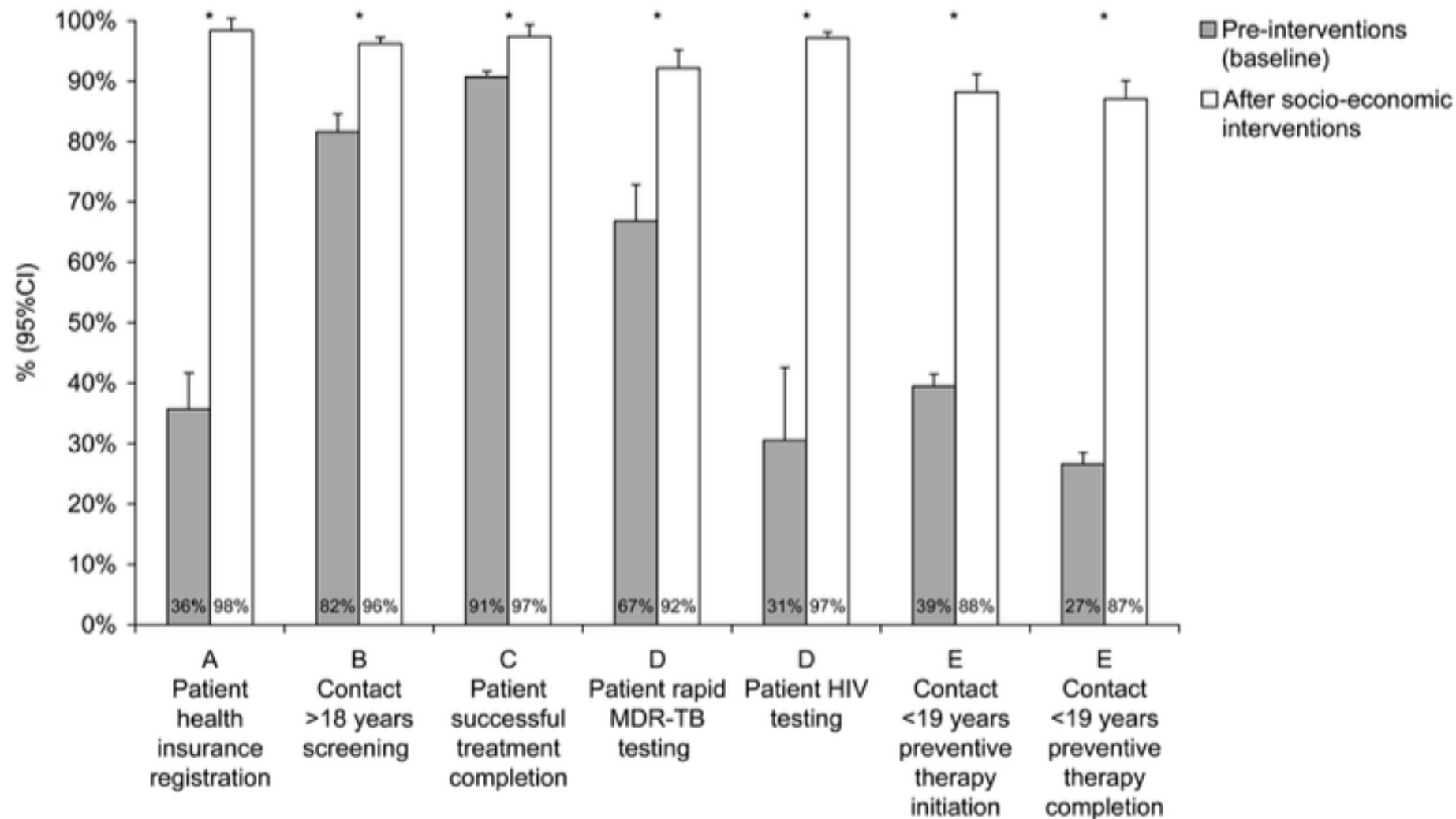
Pre-interventions: A) 216 patients; B) 642 contacts; C) 1554 patients; D) 190 MDR-TB patients testing, 72 for HIV testing E) 2829 contacts initiated LTBI therapy; n=1116 contacts with treatment completion.
Post intervention: : A) 318 patients; B) 748 household contacts; C) 307 patients; D) 307 MDR- TB patients testing, 318 for HIV testing; E) 542 contacts for LTBI therapy; 441 contacts with treatment completion. * Indicates P < 0.00001 for pre-interventions vs. post-interventions

Modeling cost-effectiveness of investing in TB services in other countries

- Expansion of DOTS in Mexico through allocation of $34.9 million:
  - 2591 fewer cases of tuberculosis in the US
  - Net savings of $108 million over 20 years

Schwartzman K N Engl J Med 2005;

JAMA | US Preventive Services Task Force | RECOMMENDATION STATEMENT

Screening for Latent Tuberculosis Infection in Adults
US Preventive Services Task Force Recommendation Statement

Population	Asymptomatic adults at increased risk for infection
Recommendation	Screen for latent tuberculosis infection (LTBI). Grade: B

Risk Assessment	Populations at increased risk for LTBI include persons who were born in, or are former residents of, countries with increased tuberculosis prevalence and persons who live in, or have lived in, high-risk congregate settings (eg, homeless shelters and correctional facilities). Local demographic patterns may vary across the United States; clinicians can consult their local or state health departments for more information about populations at risk in their community.
Screening Tests	Screening tests include the Mantoux tuberculin skin test and interferon-gamma release assays; both are moderately sensitive and highly specific for the detection of LTBI.
Treatment and Interventions	The CDC provides recommendations for the treatment of LTBI at http://www.cdc.gov/tb/topic/treatment/ltbi.htm.
Balance of Benefits and Harms	The USPSTF concludes with moderate certainty that the net benefit of screening for LTBI in persons who are at increased risk for tuberculosis is moderate.

JAMA, 2016

Automatic clinical reminders can improve TB preventative screening

- 4135 patients registering during the post-intervention phase
  - 73% had at least one CDC-defined risk factor
  - 610 met the alert criteria (birth in a high-risk TB country and aged 40 years)
  - 183% increase, in adherence to screening recommendations (p=0.001)

Steele AW et al. Am J Prev Med 2005;28(3):281–284
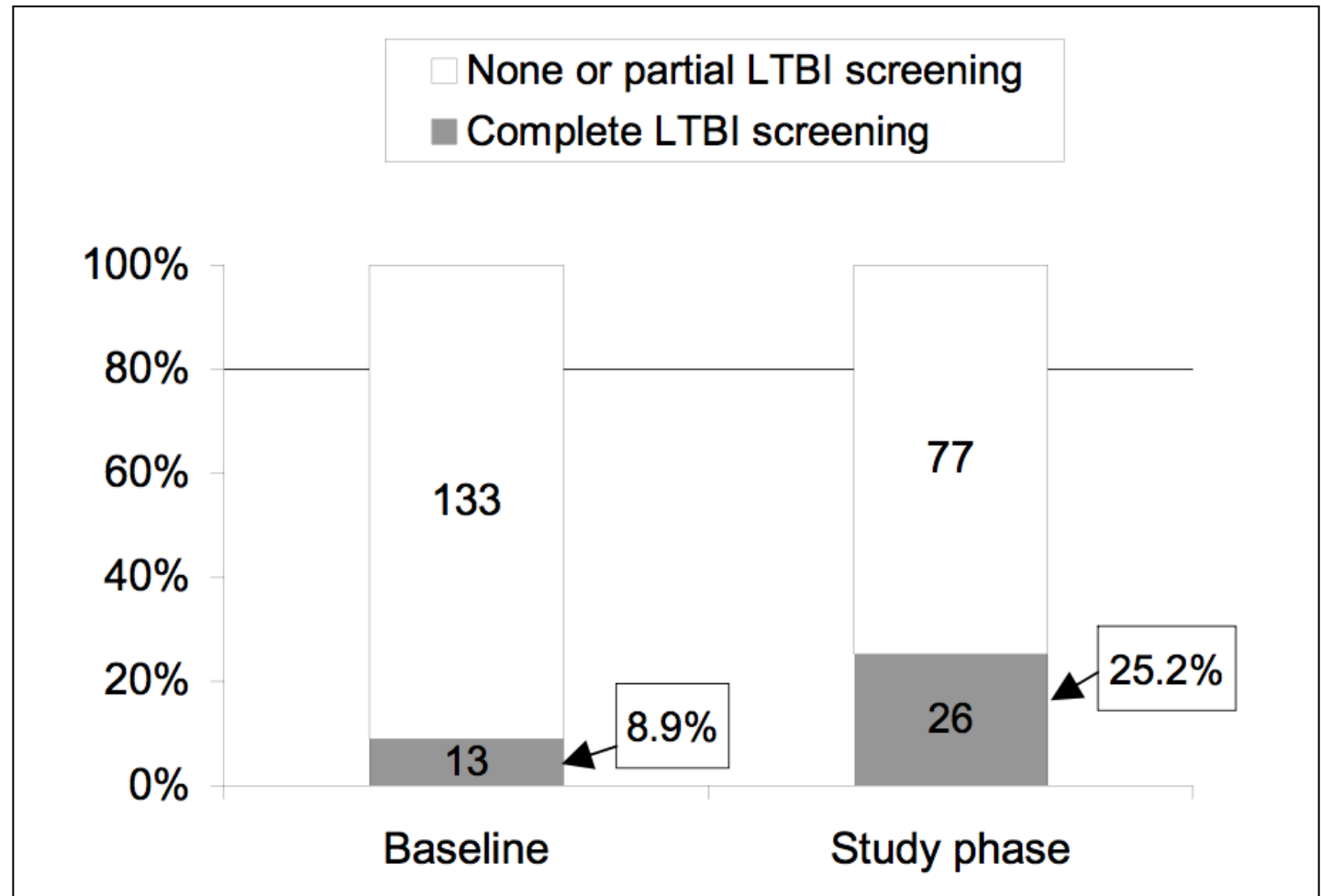
Future interventions

1. Preventing TB disease for individuals who are already infected

- Increasing collaboration for TB services with countries from whom we receive a significant proportion of immigrants

- Evaluating and alleviating implicit bias as it impacts TB prevention services

- Extend health insurance for all individuals

- Mitigate the unmeasured costs of accessing healthcare: transportation, need for childcare, loss of wages

- Community education to address the stigma of TB

2. Minimizing delays in diagnosis of individuals with TB disease

- Extending health insurance for all individuals

- Evaluating and alleviating any threat of deportation that impacts delays in care

- Use of electronic medical record reminders for evaluating TB infection and disease

3. Preventing TB infection

- Decreasing crowded housing and greater pathways to housing for homeless individuals

Summary

- Health inequities can lead to health disparities and are pervasive in healthcare and our community
- The impact of TB is felt most by:
  - people of color
  - those with lower socio-economic status
  - Individuals who were born or have lived in TB endemic areas
- Addressing racial/ethnic and economic health disparities in our community will likely propel us towards TB elimination in the U.S. and in Colorado

Of all the forms of inequality, injustice in health is the most shocking and inhuman

-Martin Luther King, Jr

http://old.seattletimes.com/special/mlk/