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

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Denver Public Health
Goals

• 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
What is health equity?

• 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

### Social Determinants of Health

#### PROPORTIONAL CONTRIBUTION TO PREMATURE DEATH

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health care</td>
<td>10</td>
</tr>
<tr>
<td>Genetics</td>
<td>30</td>
</tr>
<tr>
<td>Social circumstance</td>
<td>15</td>
</tr>
<tr>
<td>Behavior</td>
<td>40</td>
</tr>
<tr>
<td>Environment</td>
<td>5</td>
</tr>
</tbody>
</table>

#### Health Outcomes

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

**References**

- McGinnis JM et al., *Health Affairs* 21, no.2 (2002):78-93
- Schroeder SA et al. *NEJM* 2007;357:1221-8
Patient #1: Woman who is not taking her HIV medications

- 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....”
Patient #1: Woman who is not taking her HIV medications

• 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

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

Men

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

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


https://healthinequality.org/documents/
Race-Adjusted Expected Age at Death: 40 Year Old Men

Bottom Quartile of U.S. Income Distribution

Note: Lighter Colors Represent Areas with Higher Life Expectancy

https://healthinequality.org/documents/
Map of Denver neighborhoods and life expectancy

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)

Correlations of expected age at death: health and social factors

https://healthinequality.org/documents/

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline mortality</th>
<th>Net change in mortality after Expansion</th>
<th>P value for differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># deaths/100,000</td>
<td># deaths/100,000 (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Entire cohort</td>
<td>320</td>
<td>-19.6 (-27.3 to 11.9)</td>
<td>N/A</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>309</td>
<td>-14.0 (-19.8 to -8.2)</td>
<td>0.04</td>
</tr>
<tr>
<td>Non-white</td>
<td>361</td>
<td>-41.0 (-64.7 to -17.3)</td>
<td>reference</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-34 yr</td>
<td>83</td>
<td>1.0 (-12.8 to 14.8)</td>
<td>0.006</td>
</tr>
<tr>
<td>35-64 yr</td>
<td>446</td>
<td>-30.4 (-41.0 to -19.9)</td>
<td>reference</td>
</tr>
<tr>
<td>Level of poverty in county</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>334</td>
<td>-22.2 (-31.0 to -13.5)</td>
<td>0.01</td>
</tr>
<tr>
<td>Low</td>
<td>283</td>
<td>-11.3 (-19.2 to 3.3)</td>
<td>reference</td>
</tr>
</tbody>
</table>

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)

Sommer BD, et al.  NEJM 367;11
• 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

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

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

Summary

- 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
Patient #2

• 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
Patient #2: addressing health inequities

• 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

Global Tuberculosis Report 2016
www.results.org
www.who.int
TB infection (latent TB) is very common globally

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)
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

Incidence of TB in the US: 3.0/100,000

Incidence of TB in Colorado: 1.3/100,000


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

13 million individuals with latent TB in the US

158,000 individuals with latent TB in Colorado

TST prevalence: no travel to TB endemic area

TST prevalence: lived in TB endemic area

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

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
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

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


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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

Marion, Alabama: community with significant TB transmission in the U.S.

- 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

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.

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.

Achieving Elimination By Advancing Health Equity
## Improved population health associated with decreased TB incidence

<table>
<thead>
<tr>
<th>Health indicator</th>
<th>Adjusted estimate of effect on change in TB incidence between 1990-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in life expectancy by one year</td>
<td>-7.8</td>
</tr>
<tr>
<td>Increase in measles vaccination coverage</td>
<td>-1.3</td>
</tr>
<tr>
<td>1% increase in TB treatment success rate</td>
<td>-0.9</td>
</tr>
</tbody>
</table>

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

Integrated health promotion and poverty reduction interventions: impact on TB in a community

- 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

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
Domestic Returns from Investment in the Control of Tuberculosis in Other Countries

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

Screening for Latent Tuberculosis Infection in Adults

US Preventive Services Task Force Recommendation Statement

<table>
<thead>
<tr>
<th>Population</th>
<th>Asymptomatic adults at increased risk for infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation</td>
<td>Screen for latent tuberculosis infection (LTBI).</td>
</tr>
<tr>
<td></td>
<td>Grade: B</td>
</tr>
</tbody>
</table>

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 (e.g., 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


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.
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)

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/