Use of the Latent Tuberculosis Infection (LTBI) Care Cascade in the Tuberculosis Epidemiologic Studies Consortium-III (TBESC-III)

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TB Learning Collaborative

April 6, 2023
Agenda

- What is a care cascade?
- Case study: TBESC-III
  - Introduction to TBESC-III
  - Defining the TBESC-III care cascade
- TBESC-III interventions to improve the LTBI care cascade in primary care settings
What is a care cascade?
What is a care cascade?

- Health framework to monitor the progress of a population through testing and treatment
  - Used for many public health issues
- Usually a set of sequential steps (bars)
  - Patients have to go through the steps in order
  - Can measure number of patients or percentage (of total or of previous step)

Example LTBI care cascade from 15 local health departments (LHD)

Losses and drop-outs at each stage of the care cascade from a meta-analysis
How can you use a care cascade?

- Can be built from available patient records
  - Example: electronic medical records (EMR)
- Identify where patients are lost
  - Interventions can be developed to address large drop-offs

Example LTBI care cascade from 15 local health departments (LHD)

Losses and drop-outs at each stage of the care cascade from a meta-analysis
Challenges

▪ No standard definition for care cascade
  • Which steps to include depend on goals
    • Typically include identifying people at risk for TB infection, testing, diagnosis, and treatment
  • Definitions behind those steps can vary

▪ Data generally not collected for this purpose
  • Can take a lot of work to define steps based on available data
Case Study: TBESC-III
Tuberculosis Epidemiologic Studies Consortium (TBESC)

Mission: To assist TB Elimination efforts in the U.S. by designing and conducting epidemiological research studies to answer the most important questions to guide policy and practice.

TBESC-III
2021–2026

- Launched in October 2021
- 4.5-year contract
TBESC-III Specific Aims

1. Identify primary care settings serving non-U.S.–born persons at risk for LTBI
2. Collect retrospective and prospective EMR data
3. Design and implement clinical care-based interventions to improve performance measures across the LTBI care cascade
4. Monitor and evaluate intervention performance over time to identify efficient and effective strategies
TBESC-III Awarded Sites

Denver Health and Hospital Authority Primary Care
PI: Michelle Haas, MD

North East Medical Services (NEMS)
PI: Priya Shete, MD, MPH

International Community Health Services (ICHS)
PI: Masa Narita, MD

RTI International
PI: Carolina Barbosa, PharmD, PhD

Kaiser Permanente
Northern California
PI: Jacek Skarbinski, MD
Defining the TBESC-III Care Cascade
Introduction to Electronic Medical Record (EMR) Data

- Digital medical information about a patient
  - Also called electronic health record (EHR) data
  - Increasingly being used by medical systems
  - Often consists of tables representing different sets of information on a patient

- Mix of structured data (defined set of values, such as race) and free text fields (written statements about a patient, such as visit notes)
  - Data contained in free text fields is challenging to use systematically
EMR Data Collection Plan

- **Baseline Period** – minimum of 12 months before intervention(s) are implemented
  - Baseline cohort – anyone who seeks care at a participating clinic during the baseline period
  - All sites implemented their first intervention by October 2022
    - Will close out the baseline period in October 2023 to allow time for all baseline patients to complete treatment

- **Intervention Period** – time after intervention(s) are implemented at the clinic
  - Intervention cohort - anyone who seeks care at a participating clinic during the intervention period
Defining the TBESC-III LTBI Care Cascade: Hypothetical Baseline Care Cascade
Population at Clinic

- Total population of interest
  - Based on time and location
- For TBESC-III, this is all patients who had a primary care visit during the baseline period
  - All steps have time restrictions
Met Screening Criteria

- All patients who should be screened for LTBI
- Several groups have screening recommendations:
  - California Adult TB Risk Assessment
  - U.S. Preventative Services Task Force
  - CDC supports these recommendations
- May use International Classification of Disease (ICD) codes and demographics
  - ICD codes are standardized codes used to capture medical diagnoses and procedure information
# TB Screening Recommendations

<table>
<thead>
<tr>
<th>Source</th>
<th>Screening Recommendation</th>
<th>EMR variables</th>
</tr>
</thead>
</table>
| California Adult TB Risk Assessment         | Birth not in US, Canada, Australia, New Zealand or Western or Northern Europe                                                                                                                                              | • Country of birth (U.S.-born vs non-U.S.—born)  
• If country of birth unavailable, non-English language preference |• HIV – ICD codes  
• Organ transplant – ICD codes  
• Aftercare following organ transplant – ICD codes  
• Immunosuppressive drugs prescribed |• ICD codes |
Met Screening Criteria, Continued

- For TBESC-III, this bar contains all patients who:
  - Were born outside the United States
  - If country of birth is missing for a patient then that patient is included if they have a non-English preference
- Both variables are often found in patient demographics
  - Country of birth generally has a high rate of missingness
Cascade Eligible

- Used in TBESC-III to identify patients eligible for interventions
  - Typically would not be used in other cascades
- Removes patients that had:
  - TB diagnosis ever
  - TB treatment ever
  - LTBI diagnosis prior to first visit
  - LTBI treatment prior to first visit
  - Valid TB test prior to first visit
TB Diagnostic Test Ordered

- Testing typically found in a lab/diagnostics table in the EMR
  - Sometimes Tuberculin Skin Test (TST) is in immunizations table
- TBESC-III limited this part to Interferon Gamma Release Assays (IGRAs) but others may want to include TSTs
  - IGRA is recommended over TST for patients > 5 years old, especially for non-U.S.–born patients

<table>
<thead>
<tr>
<th>Number of Patients</th>
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<tbody>
<tr>
<td>Population at Clinic</td>
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</table>

- Bar chart showing the number of patients at different stages of TB care cascade.
Valid Test Results

- Exclude tests that do not have a positive or negative result
- Test results limited to standardized results fields
  - Results in free text ignored
- Used in TBESC-III to assess lab performance and get better estimates of positivity
  - Often not included in cascades
Tested Positive

- Only patients with positive test results
  - Drop off at this step represents patients that test negative so are ineligible to continue in the care cascade
- Need to handle multiple test results
Chest X-Ray Performed

- Chest X-ray needed to rule out pulmonary TB disease
- Results generally in free text field so not easily analyzable
- TBESC-III only looks to see if chest X-ray was ordered
Diagnosed with LTBI

- TBESC-III uses ICD codes
- ICD use varies by clinic, clinician, and time
Prescribed LTBI Treatment

- TBESC-III uses prescriptions as a proxy for patients being offered and accepting treatment
- Identifying LTBI regimens can be challenging
  - Avoid including TB treatments
  - Rifampin (R) is used for many conditions

TBESC-III LTBI treatment regimens:
- 3 months isoniazid (H) and rifapentine (P; 3HP)
- 4 months R (4R)
- 3HR
- 6 months or 9 months H (6H or 9H)
- 6-12 months Moxifloxacin
- 6-12 months Levofloxacin
- TBESC-III uses prescriptions being filled (picked up) as a proxy for starting LTBI treatment
**Completed LTBI Treatment**

- TBESC-III uses filled prescriptions as a proxy for completing LTBI treatment
  - Looks to see if a sufficient number of doses has been filled during a specific timeframe defined by clinicians

- Long regimens may lead to censoring
Defining the Baseline LTBI Care Cascade

Each step must occur after the prior step

- **Number of Patients**
  - Population at Clinic
  - Met Screening Criteria
  - Cascade Eligible
  - TB Diagnostic Test Ordered
  - Valid Test Results
  - Tested Positive
  - Chest X-Ray Performed
  - Diagnosed with LTBI
  - Prescribed LTBI Treatment
  - Started LTBI Treatment
  - Completed LTBI Treatment

- **Non-U.S.-born**
  - if country of birth unknown, **non-English language** preference

- **Excluding patients that had**
  - TB diagnosis ever
  - TB treatment ever
  - LTBI diagnosis prior to first visit
  - LTBI treatment prior to first visit
  - Valid TB test prior to first visit

- **IGRA tests only**

- **Chest X-ray ordered**
  - Results not available

- **ICD code for LTBI**

- **LTBI treatment regimens**:
  - 3HP
  - 4R
  - 3HR
  - INH (6 months or 9 months)
  - Moxifloxacin
  - Levofloxacin

- **Completion based on doses filled in specific time frame**
Defining the Baseline LTBI Care Cascade

Each step must occur after the prior step

- Population at Clinic
- Met Screening Criteria
- Cascade Eligible
- TB Diagnostic Test Ordered
- Valid Test Results
- Tested Positive
- Chest X-Ray Performed
- Diagnosed with LTBI
- Prescribed LTBI Treatment
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- if country of birth unknown, non-English language preference

EXCLUDING patients that had
- TB diagnosis ever
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- LTBI diagnosis prior to first visit
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- Valid TB test EVER prior to first visit

IGRA tests only

Chest X-ray ordered
- Results not available

ICD code for LTBI

LTBI treatment regimens:
- 3HP
- 4R
- 3HR
- INH (6 months or 9 months)
- Moxifloxacin
- Levofloxacin

Completion based on doses filled in specific time frame

Purple bars indicate steps that are defined by the patient population and cannot be changed by interventions.
TBESC-III interventions to improve the LTBI care cascade in primary care settings
TBESC-III Work Plan

- Sites will design and propose interventions that improve adoption of CDC LTBI recommendations:
  - Increase targeted testing of non-U.S.–born population
  - Use of IGRAs for TB testing
  - Use of rifamycin-based short course treatment regimens for LTBI
<table>
<thead>
<tr>
<th>Site</th>
<th>EMR modification</th>
<th>Case management / Care navigation</th>
<th>Education / Trainings</th>
<th>Site specific interventions / Activities</th>
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EMR Analytic Plan

Hypothetical LTBI Care Cascade

<table>
<thead>
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<th>Baseline LTBI Care Cascade</th>
<th>Intervention LTBI Care Cascade</th>
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Intended Project Outcomes

- *Increased* availability of policy-based screening programs
- *Increased* percentage of non-U.S.–born populations screened for LTBI
- *Increased* treatment completion for LTBI
- *Decreased* progression from LTBI to TB disease
- *Decreased* incidence of TB disease in the United States
Key Takeaways

- **LTBI care cascade** can be used to *identify where patients are lost* in the process of TB testing and treatment
  - Interventions can be designed to improve steps with large drops
- **LTBI care cascade** can be built from **EMR data**
  - Steps and definitions are not standardized
- **TBESC-III** is using the LTBI care cascade to determine *which primary care interventions are most effective*
Acknowledgments

Epidemiology Team
TBESC sites
TBESC patients

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
### Why non-USB?

- **In 2021**, 71% of reported TB cases in the United States were non-U.S.–born
  - Consistent with prior years

- An estimated 16% of non-U.S.–born persons living in the United States have LTBI ([NHANES](https://www.cdc.gov/nhanes/index.htm))
  - Compared to 2.8% in the U.S.-born

![TB Incidence Rates and Percentages by Origin of Birth, United States, 2021 (N=7,849)](image)

- U.S.-born, 28% (Rate: 0.8 per 100,000)
- Non-U.S.–born 71% (Rate: 12.5 per 100,000)
- Origin of birth unknown, <1%