



Planning for TB Elimination using Tabby2:

A tool to estimate state-level future TB and latent TB infection (LTBI), and costs associated with targeted LTBI testing and treatment

Created December 2021

Objectives

Users will be able to:

- **Estimate future state-level TB cases and LTBI prevalence**
 - Without additional interventions (base case scenario)
 - With accelerated testing and treatment of populations at high risk for TB;

- **Estimate the associated number of LTBI tests, costs, and benefits; and**

- **Use the estimations to set informed targets for progress towards TB elimination.**

Tabby 2

<https://ppmltools.org/tabby2>

Documentation of the Tabby2 model:

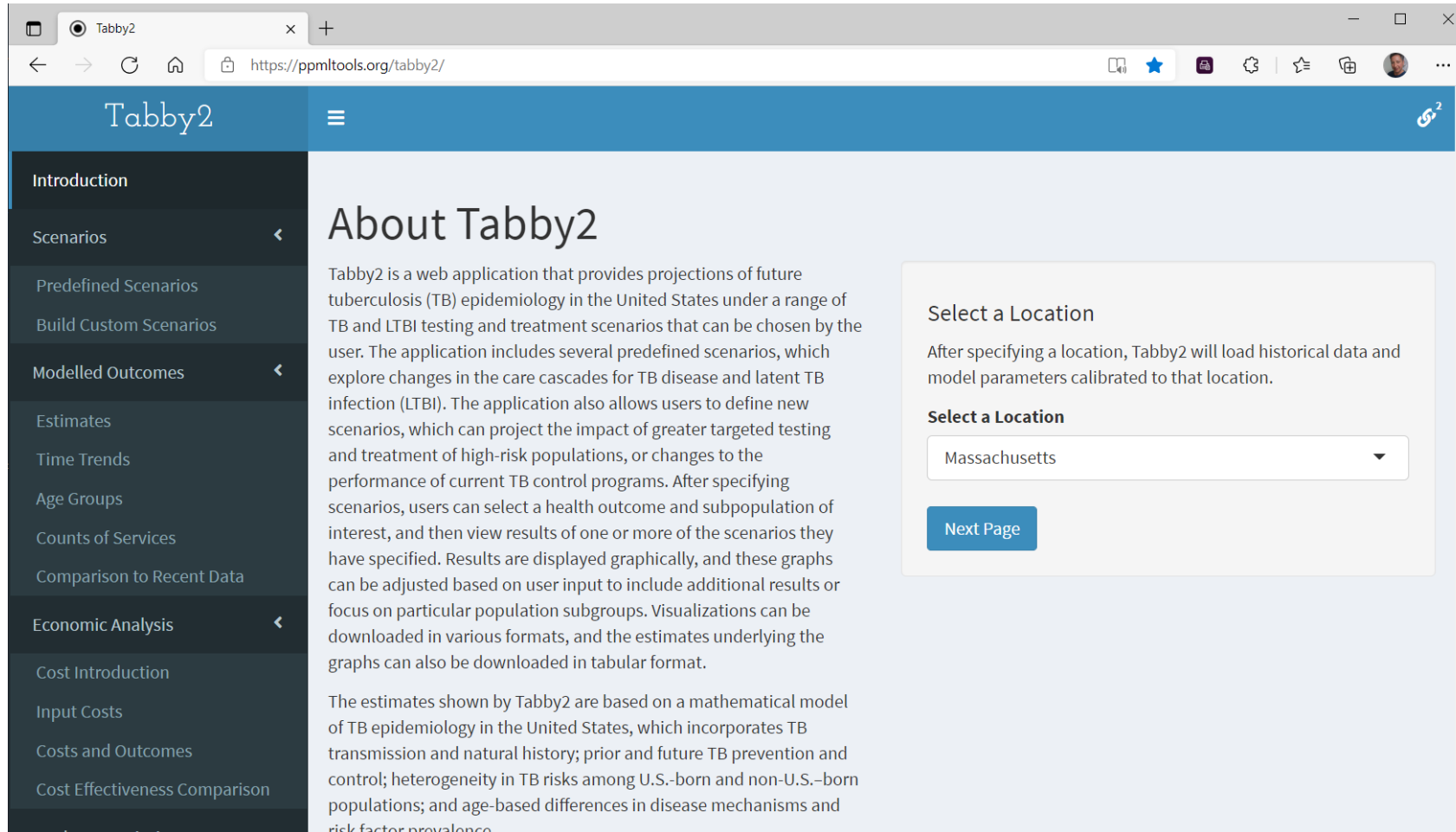
Menzies et al. 2018. "Prospects for tuberculosis elimination in the United States: results of a transmission dynamic model" Am J Epid. 187(9):2011-2020. <https://academic.oup.com/aje/article/187/9/2011/4995883>

Estimation methods are detailed on the first page of the tool, by clicking "Cost Introduction" and "Further Description" from the left-hand panel. Assumptions and parameter estimates are found at: <https://github.com/PPML/tabby2/blob/master/utilities/inst/md/Tabby2EconomicAnalysisMethods.md> . Users should familiarize themselves with the Tabby2 methods before use.

Example: The following slides show screen shots from Tabby2, using Massachusetts (MA) as an example, to show how to use Tabby2 to estimate TB incidence in 2050 under the base case scenario

Select Massachusetts for Estimation

- Under “Select a location”: Choose “Massachusetts”, then select “Next Page”



The screenshot shows a web browser window with the URL <https://ppmltools.org/tabby2/>. The page title is "Tabby2" and the main heading is "About Tabby2". The left sidebar contains a navigation menu with the following items: Introduction, Scenarios, Predefined Scenarios, Build Custom Scenarios, Modelled Outcomes, Estimates, Time Trends, Age Groups, Counts of Services, Comparison to Recent Data, Economic Analysis, Cost Introduction, Input Costs, Costs and Outcomes, and Cost Effectiveness Comparison. The main content area contains the following text:

Tabby2 is a web application that provides projections of future tuberculosis (TB) epidemiology in the United States under a range of TB and LTBI testing and treatment scenarios that can be chosen by the user. The application includes several predefined scenarios, which explore changes in the care cascades for TB disease and latent TB infection (LTBI). The application also allows users to define new scenarios, which can project the impact of greater targeted testing and treatment of high-risk populations, or changes to the performance of current TB control programs. After specifying scenarios, users can select a health outcome and subpopulation of interest, and then view results of one or more of the scenarios they have specified. Results are displayed graphically, and these graphs can be adjusted based on user input to include additional results or focus on particular population subgroups. Visualizations can be downloaded in various formats, and the estimates underlying the graphs can also be downloaded in tabular format.

The estimates shown by Tabby2 are based on a mathematical model of TB epidemiology in the United States, which incorporates TB transmission and natural history; prior and future TB prevention and control; heterogeneity in TB risks among U.S.-born and non-U.S.-born populations; and age-based differences in disease mechanisms and risk factor prevalence.

On the right side of the page, there is a "Select a Location" dialog box. It contains the following text:

Select a Location

After specifying a location, Tabby2 will load historical data and model parameters calibrated to that location.

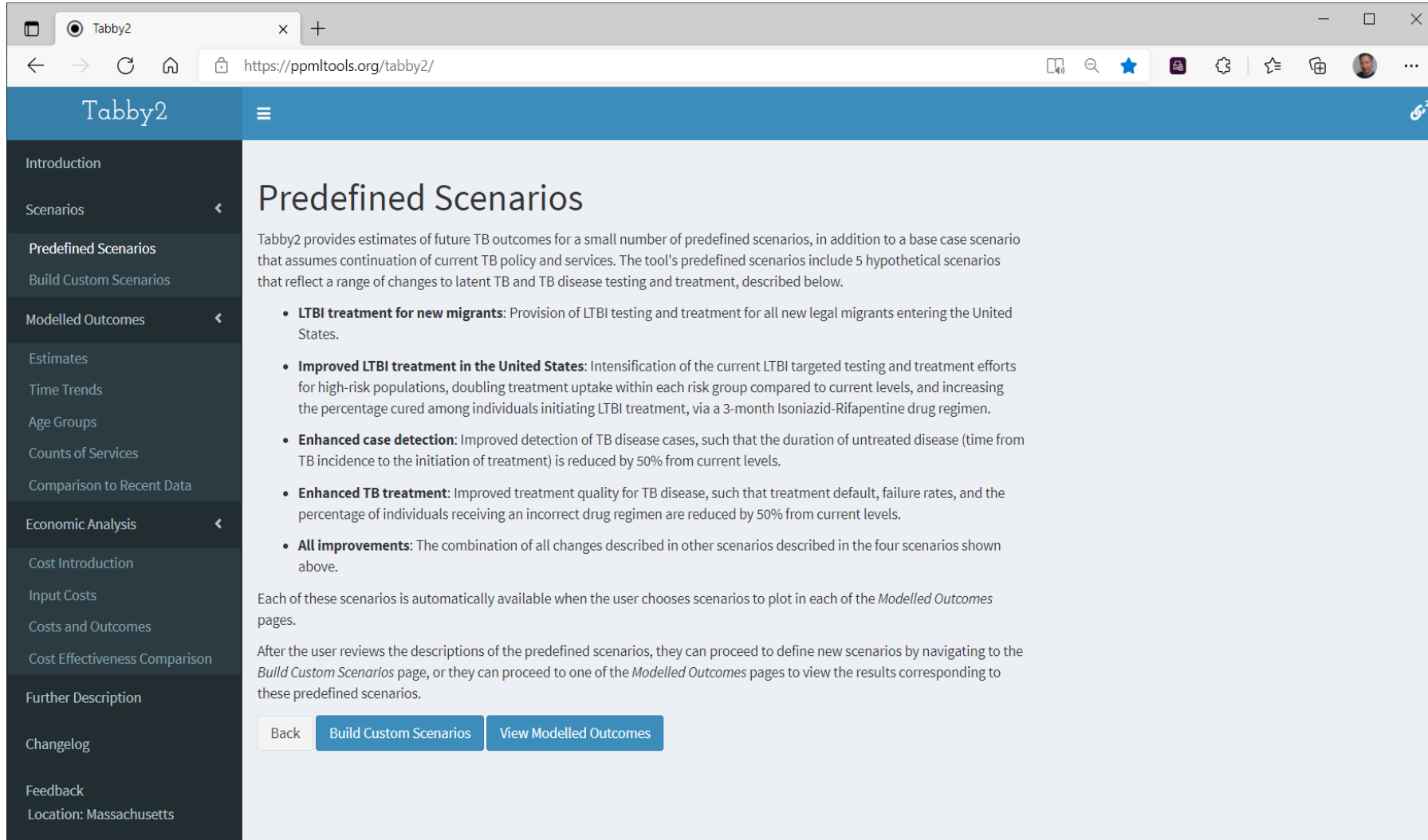
Select a Location

Massachusetts

Next Page

Estimate the Base Case

- Under Predefined Scenarios: Select “View Modeled Outcomes”



The screenshot shows a web browser window with the URL <https://ppmltools.org/tabby2/>. The page title is "Predefined Scenarios". The left sidebar contains a navigation menu with the following items: Introduction, Scenarios, **Predefined Scenarios**, Build Custom Scenarios, Modelled Outcomes, Estimates, Time Trends, Age Groups, Counts of Services, Comparison to Recent Data, Economic Analysis, Cost Introduction, Input Costs, Costs and Outcomes, Cost Effectiveness Comparison, Further Description, Changelog, Feedback, and Location: Massachusetts. The main content area has the heading "Predefined Scenarios" and a paragraph: "Tabby2 provides estimates of future TB outcomes for a small number of predefined scenarios, in addition to a base case scenario that assumes continuation of current TB policy and services. The tool's predefined scenarios include 5 hypothetical scenarios that reflect a range of changes to latent TB and TB disease testing and treatment, described below." Below this paragraph is a bulleted list of five scenarios: "LTBI treatment for new migrants", "Improved LTBI treatment in the United States", "Enhanced case detection", "Enhanced TB treatment", and "All improvements". At the bottom of the page, there are three buttons: "Back", "Build Custom Scenarios", and "View Modelled Outcomes".

Tabby2

Predefined Scenarios

Tabby2 provides estimates of future TB outcomes for a small number of predefined scenarios, in addition to a base case scenario that assumes continuation of current TB policy and services. The tool's predefined scenarios include 5 hypothetical scenarios that reflect a range of changes to latent TB and TB disease testing and treatment, described below.

- **LTBI treatment for new migrants:** Provision of LTBI testing and treatment for all new legal migrants entering the United States.
- **Improved LTBI treatment in the United States:** Intensification of the current LTBI targeted testing and treatment efforts for high-risk populations, doubling treatment uptake within each risk group compared to current levels, and increasing the percentage cured among individuals initiating LTBI treatment, via a 3-month Isoniazid-Rifapentine drug regimen.
- **Enhanced case detection:** Improved detection of TB disease cases, such that the duration of untreated disease (time from TB incidence to the initiation of treatment) is reduced by 50% from current levels.
- **Enhanced TB treatment:** Improved treatment quality for TB disease, such that treatment default, failure rates, and the percentage of individuals receiving an incorrect drug regimen are reduced by 50% from current levels.
- **All improvements:** The combination of all changes described in other scenarios described in the four scenarios shown above.

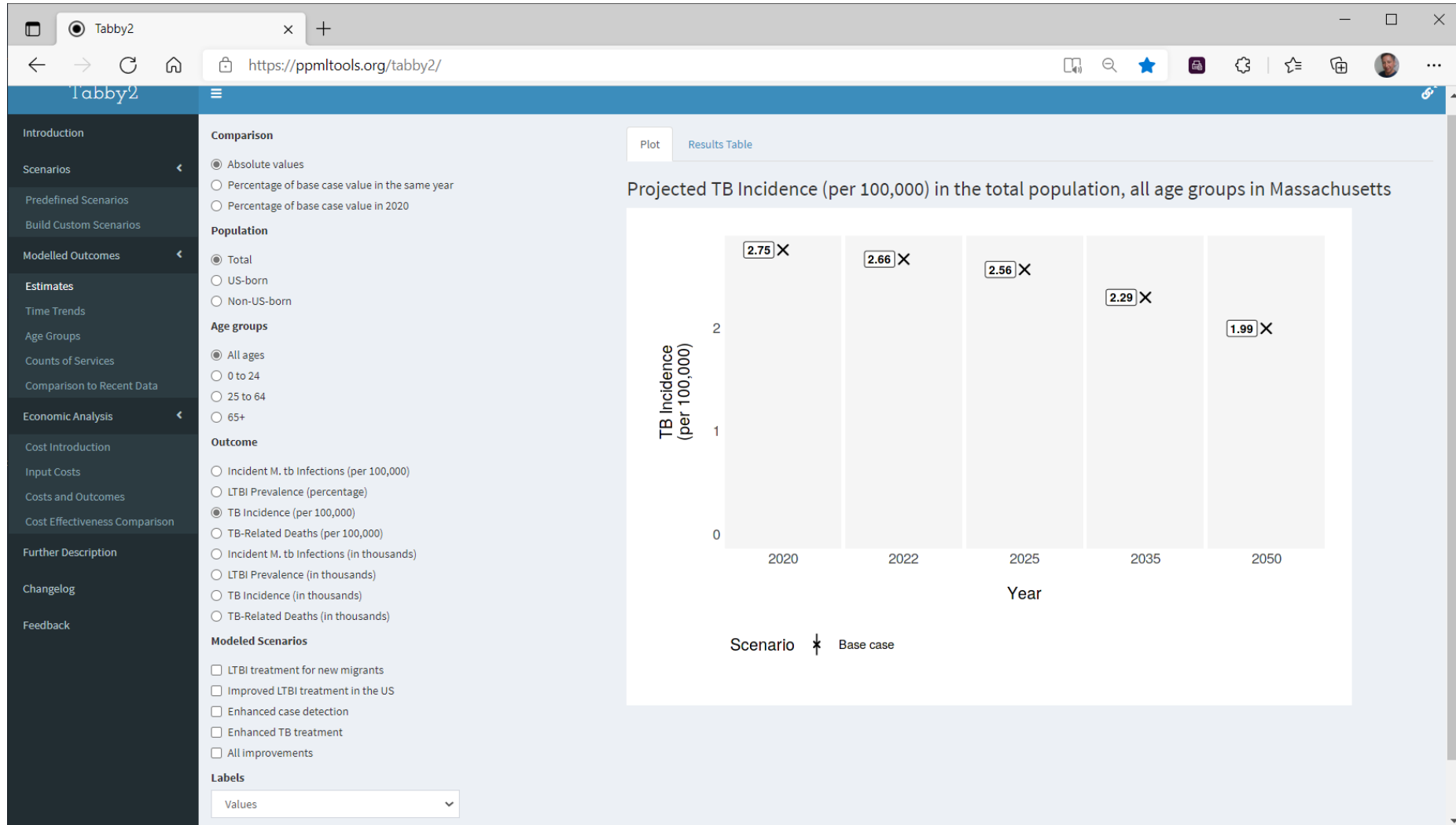
Each of these scenarios is automatically available when the user chooses scenarios to plot in each of the *Modelled Outcomes* pages.

After the user reviews the descriptions of the predefined scenarios, they can proceed to define new scenarios by navigating to the *Build Custom Scenarios* page, or they can proceed to one of the *Modelled Outcomes* pages to view the results corresponding to these predefined scenarios.

[Back](#) [Build Custom Scenarios](#) [View Modelled Outcomes](#)

Estimate TB Incidence in 2050 Under the Base Case Scenario

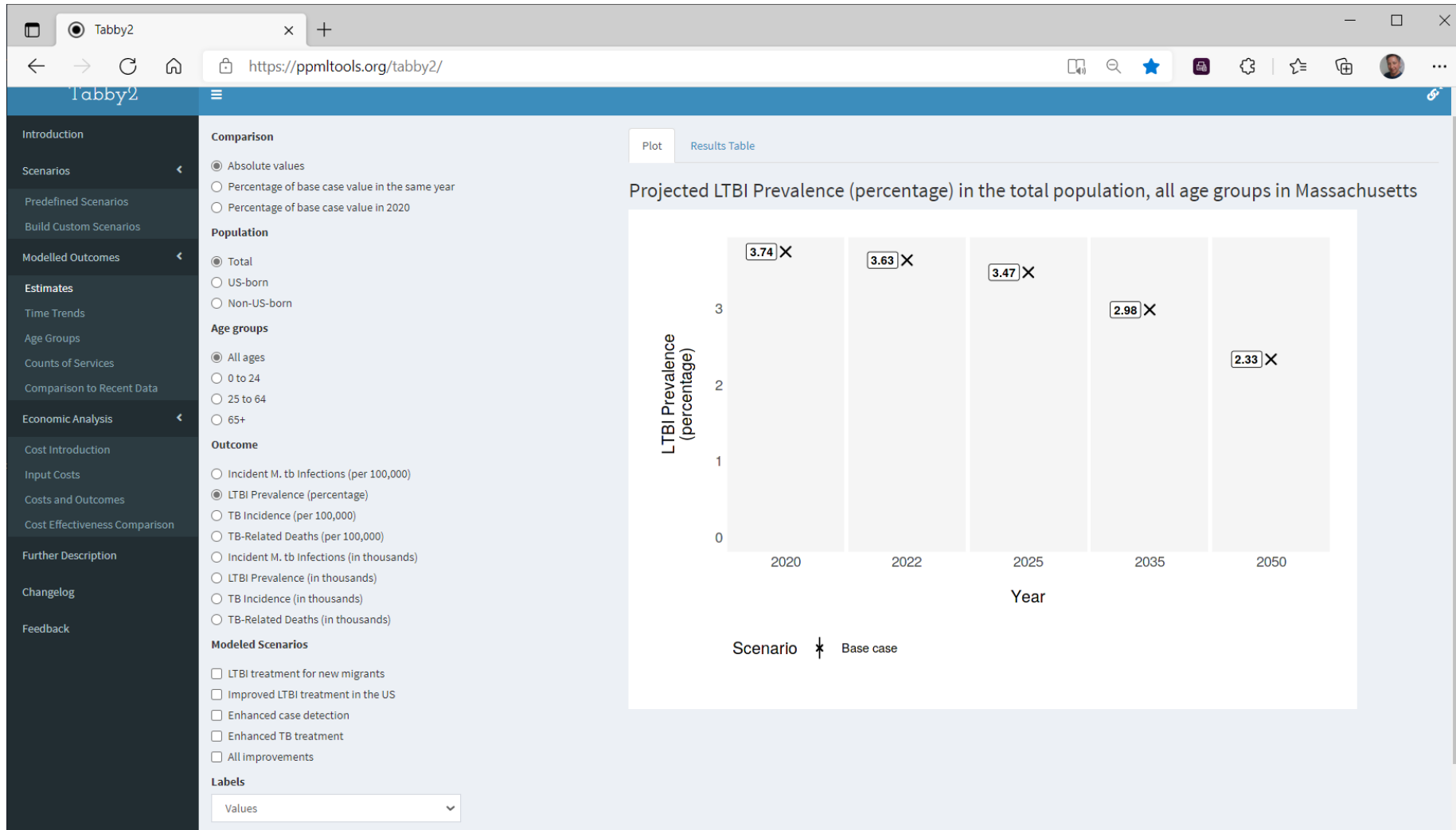
- Under Outcomes, select “TB Incidence per 100,000”
- Under Labels, select “Values”
- Results: 2.75/100,000 in 2020 and 1.99/100,000 in 2050



Estimate the LTBI Prevalence Percentage in 2050

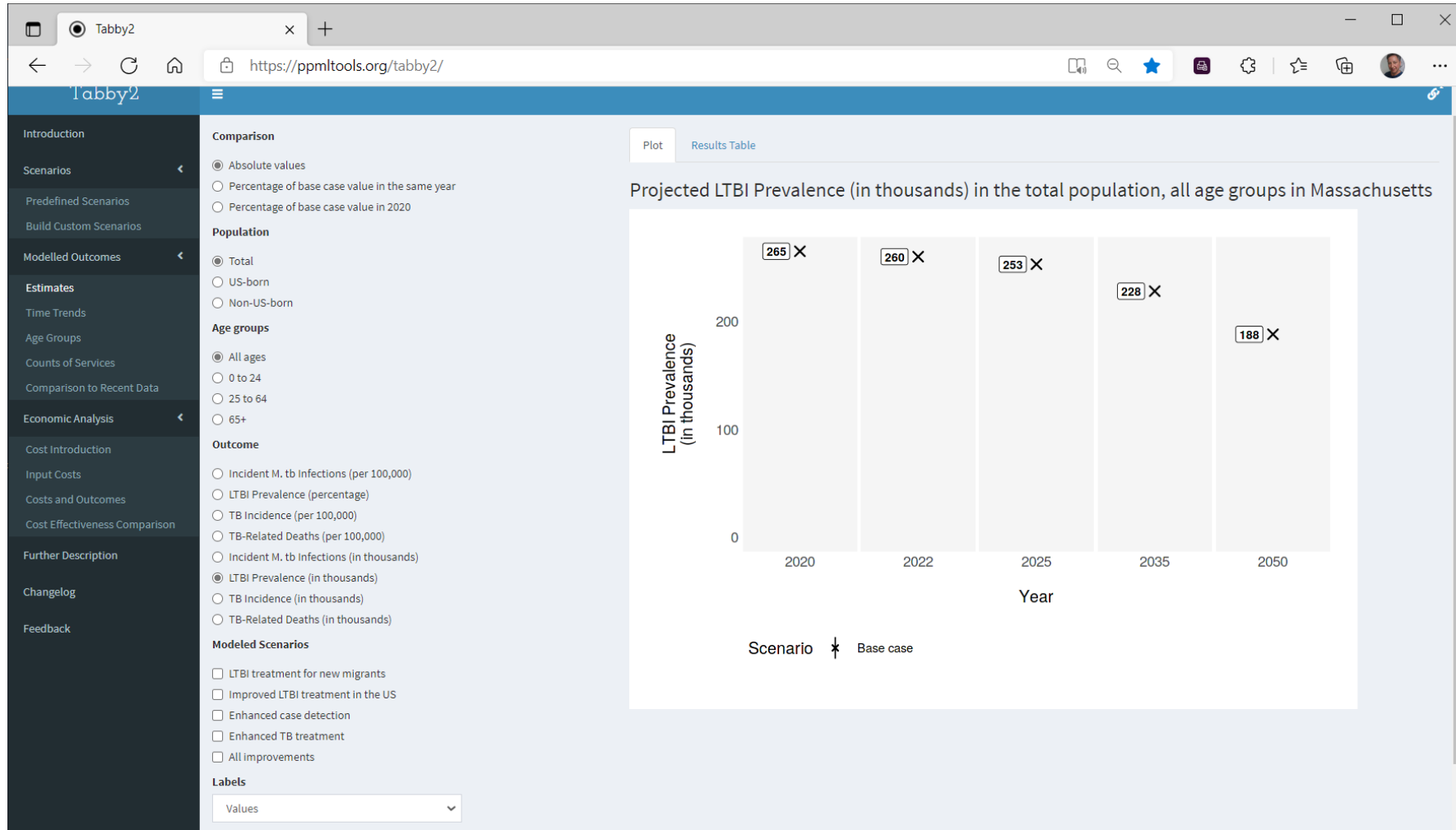
Under the Base Case Scenario

- Select Outcome “LTBI Prevalence (percentage)”
- LTBI prevalence projected at 3.74% in 2020, 2.33% in 2050



Estimate the Number of Persons with LTBI in 2050 Under the Base Case Scenario

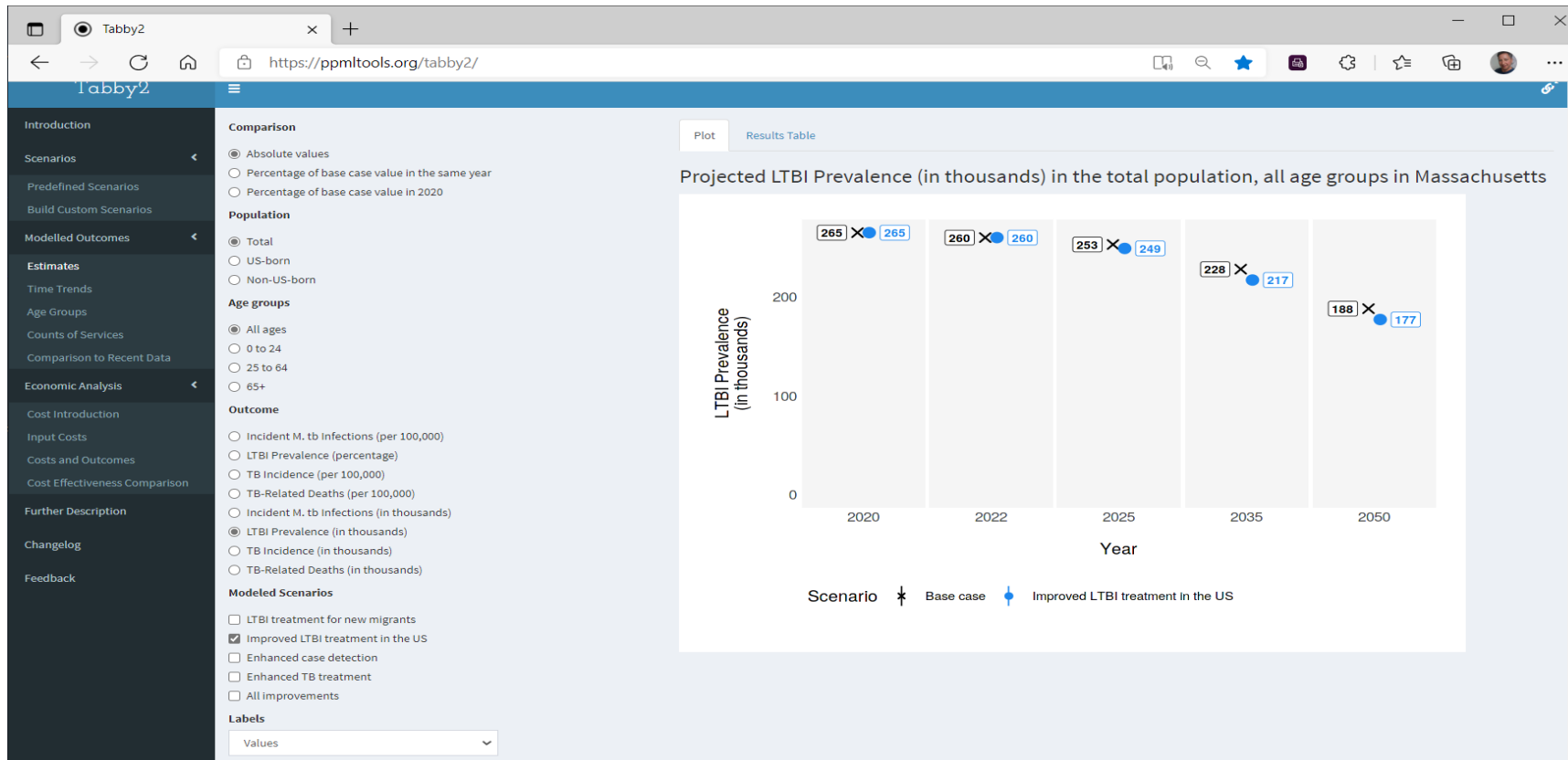
- Select Outcome “LTBI Prevalence (in thousands)”
- LTBI prevalence projected at 265,000 in 2020; 188,000 in 2050



**Estimate MA TB and LTBI in 2050 Under
the “Improved LTBI Treatment (Tx)”
Scenario**

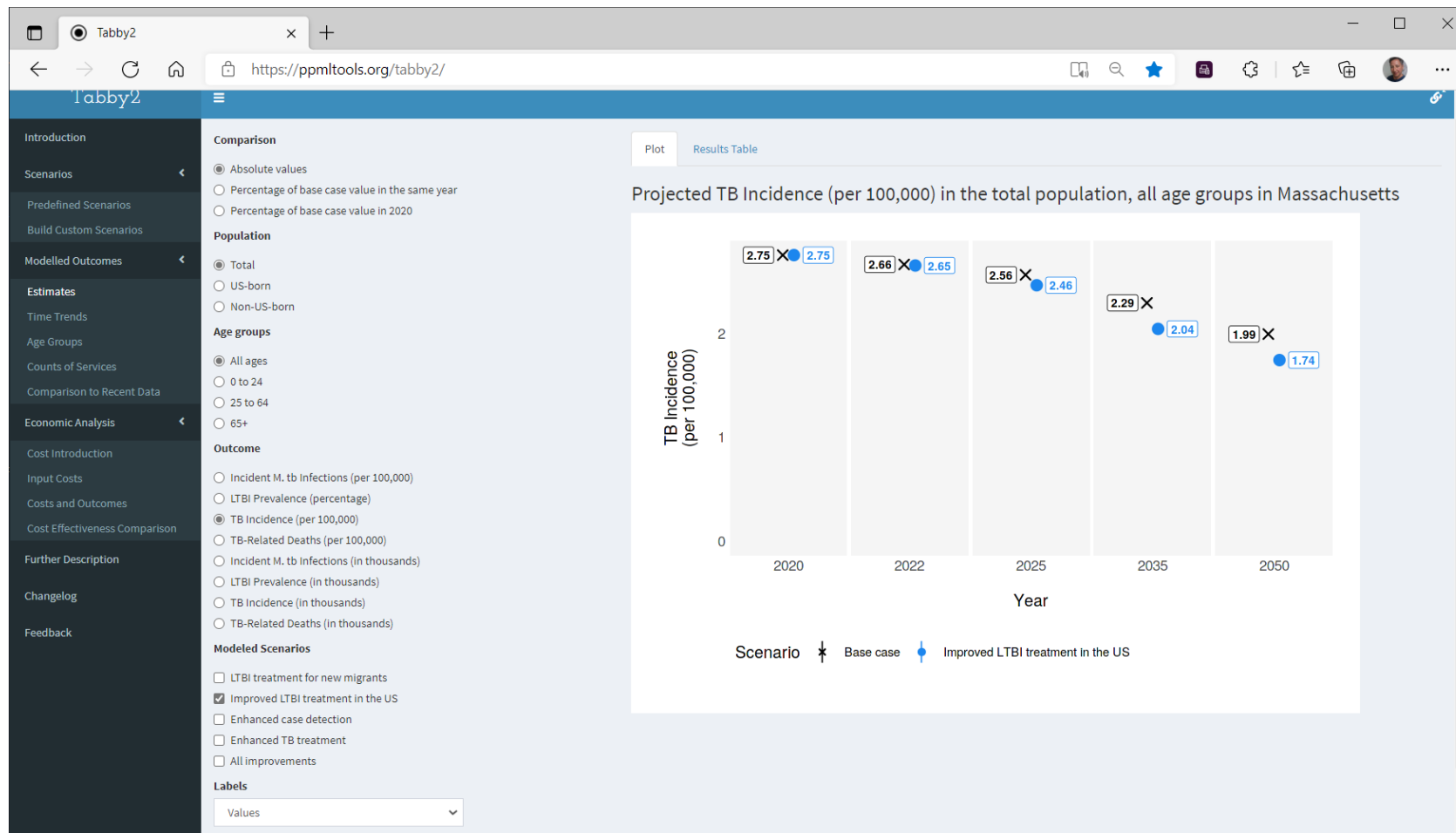
Under the “Improved LTBI Tx” Scenario, Estimate the Number with LTBI in 2050

- Under Modeled Scenarios, select: “Improved LTBI Tx in the United States,” which includes for populations at high risk, a doubling of one-time testing, with 77.3% LTBI Tx initiation and 87.2% completion. This reduces the number with LTBI in MA in 2050 to 177,000 from 188,000.



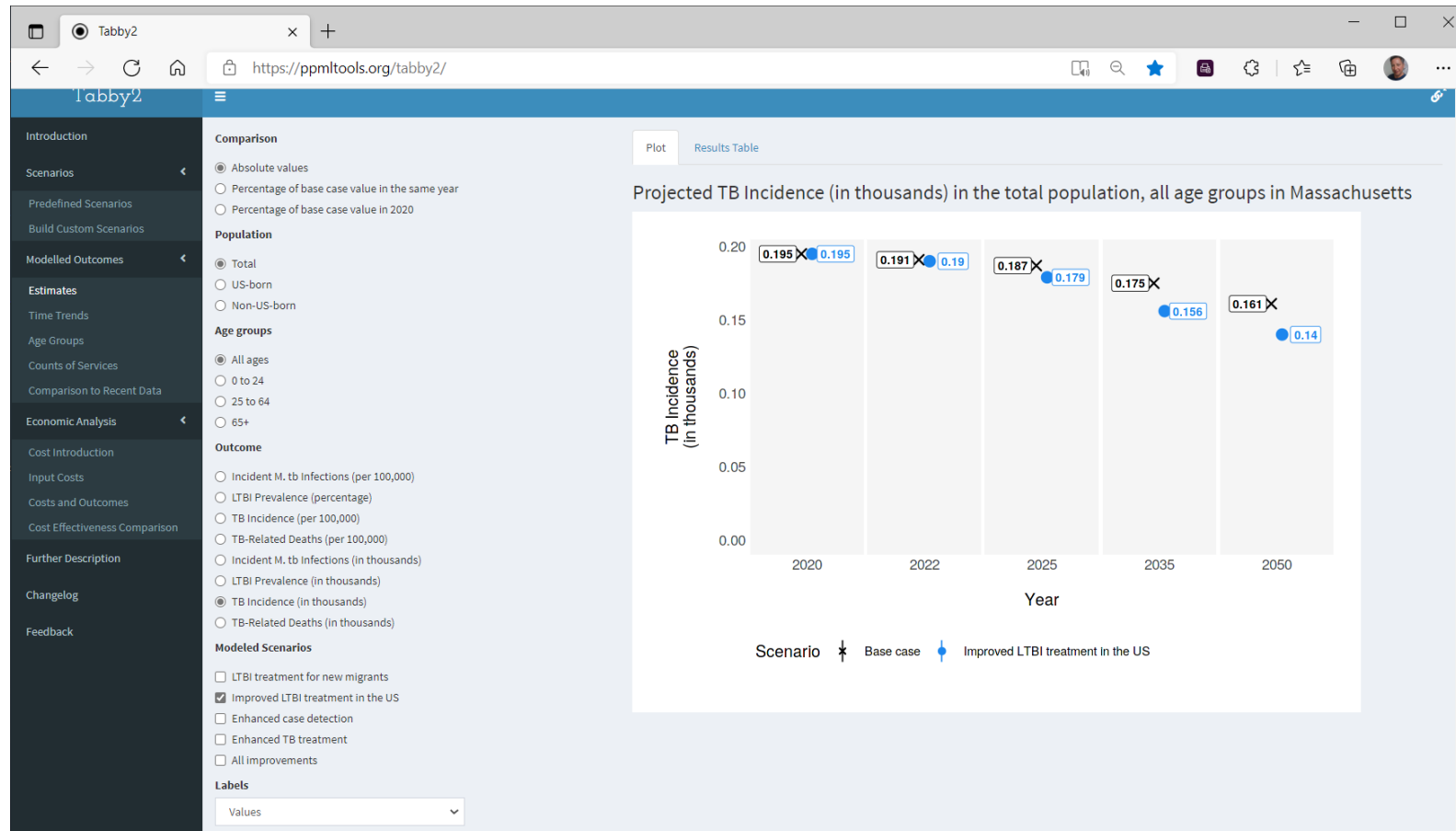
Under the “Improved LTBI Tx” Scenario, Estimate TB Incidence in 2050

- On the left-hand panel, Select Outcome “TB Incidence (per 100,000)”
- With improved LTBI Tx, TB incidence is projected at 1.74 versus 1.99 per 100,000 under the base case scenario in 2050



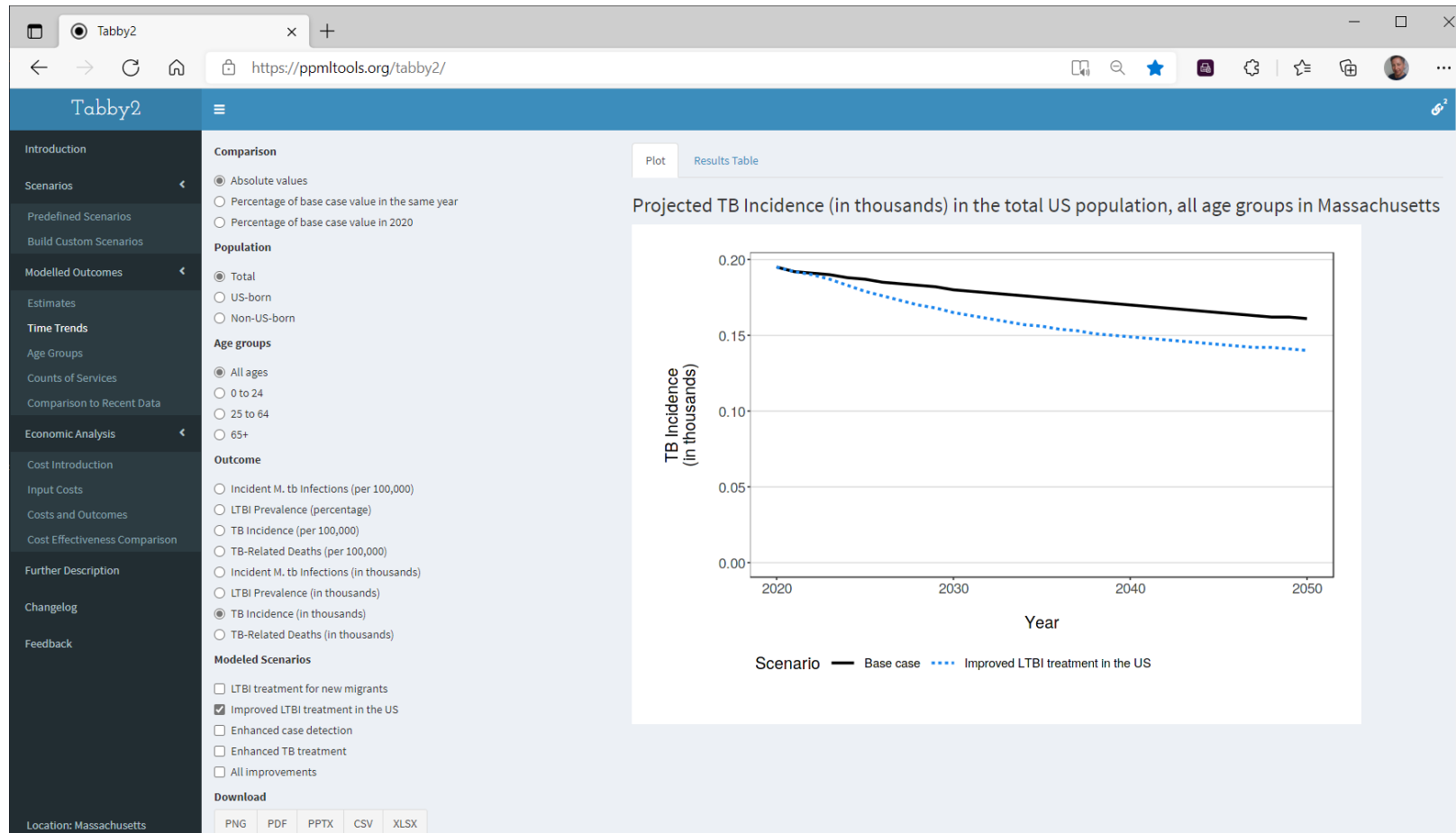
Under the “Improved LTBI Tx” Scenario, Estimate the Number of TB Cases in 2050

- On the left-hand panel, Select Outcome “TB Incidence (in thousands)”
- With improved LTBI Tx, TB cases are projected at 140 versus 161 under the base case scenario in 2050



Under the “Improved LTBI Tx” Scenario, Estimate TB Trends

- Select “Time Trends” from the left-hand dark bar
- Re-select Outcome “TB incidence in thousands” and “Improved LTBI Tx” under Scenarios



Under the “Improved LTBI Tx” Scenario, Estimate the Number of TB Cases by Year

- Select “Results Table” from above the graph: point estimates by year for the base case scenario and for the “Improved LTBI Tx” scenario are displayed and can be downloaded

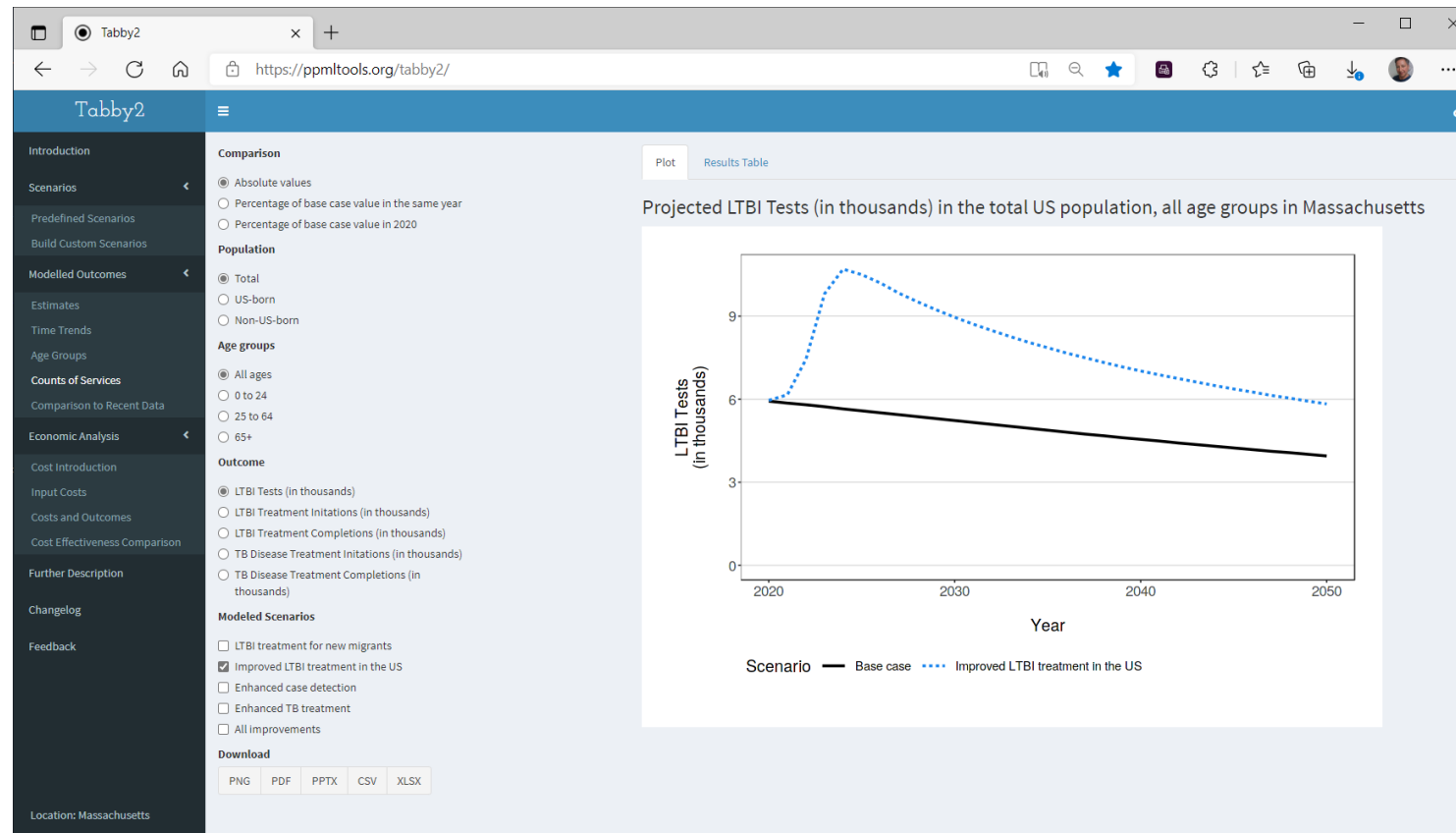
The screenshot shows the Tabby2 web application interface. The browser address bar displays <https://ppmtools.org/tabby2/>. The left sidebar contains navigation menus for Introduction, Scenarios, Modelled Outcomes, Time Trends, Economic Analysis, and Further Description. The main content area is titled "Comparison" and shows settings for "Absolute values" and "Population" (Total, US-born, Non-US-born). Under "Age groups", "All ages" is selected. Under "Outcome", "TB Incidence (in thousands)" is selected. The "Modelled Scenarios" section has "Improved LTBI treatment in the US" checked. Below these settings are download options: PNG, PDF, PPTX, CSV, and XLSX. The "Results Table" tab is active, displaying a table with columns: outcome, scenario, population, age_group, comparator, year, and value. The table shows TB incidence estimates from 2020 to 2044 for the Base Case scenario, all populations, and all ages, with values ranging from 0.166 to 0.195.

outcome	scenario	population	age_group	comparator	year	value
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2020	0.195
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2021	0.192
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2022	0.191
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2023	0.19
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2024	0.188
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2025	0.187
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2026	0.185
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2027	0.184
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2028	0.183
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2029	0.182
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2030	0.18
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2031	0.179
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2032	0.178
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2033	0.177
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2034	0.176
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2035	0.175
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2036	0.174
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2037	0.173
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2038	0.172
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2039	0.171
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2040	0.17
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2041	0.169
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2042	0.168
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2043	0.167
tb_incidence_000s	Base Case	all_populations	all_ages	absolute_value	2044	0.166

**Estimate Resources Needed by MA in the
Base Case and in the “Improved LTBI Tx”
Scenario**

Estimate the Number of LTBI Tests in the Base Case and “Improved LTBI Tx” Scenarios

- On the left-hand bar, select “Counts of Services” and LTBI tests (in thousands) and reselect the scenario “Improved LTBI Treatment”
- The number of LTBI tests in the base case scenario and the “Improved LTBI Tx” scenario are displayed



Estimate the Number of LTBI Tests by Year in the Base Case and “Improved LTBI Tx” Scenarios

- Above the graph, select “Results Table”
- The number of LTBI tests in the base case and the scenario are displayed by year. Download the table and sum. The 30-year total increase in LTBI tests is 87,640 with improved LTBI treatment vs. the base case scenario (239,670-152,030).

The screenshot shows the Tabby2 web application interface. The left sidebar contains navigation options like Introduction, Scenarios, and Economic Analysis. The main content area is titled 'Comparison' and shows settings for 'Absolute values', 'Population' (Total), 'Age groups' (All ages), and 'Outcome' (LTBI Tests). The 'Results Table' is displayed, showing data for the years 2020 to 2038. The table has columns for outcome, scenario, population, age_group, comparator, year, and value. The values represent the number of tests in thousands.

outcome	scenario	population	age_group	comparator	year	value
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2020	5.93
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2021	5.86
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2022	5.8
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2023	5.73
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2024	5.65
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2025	5.58
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2026	5.51
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2027	5.44
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2028	5.37
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2029	5.3
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2030	5.23
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2031	5.16
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2032	5.09
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2033	5.02
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2034	4.95
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2035	4.88
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2036	4.81
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2037	4.74
ltbi_tests_000s	Base Case	all_populations	all_ages	absolute_value	2038	4.68

Estimate the Number of LTBI Treatment Starts under the Base Case and “Improved LTBI Tx” Scenarios

- Under Outcomes, select “LTBI Treatment Initiations (in thousands).” Download the table and sum. The 30-year total increase in LTBI treatments is 46,960 with improved LTBI treatment vs. the base case scenario (128,450-81,490).

The screenshot shows the Tabby2 web application interface. The left sidebar contains navigation options such as Introduction, Scenarios, Predefined Scenarios, Build Custom Scenarios, Modelled Outcomes, Estimates, Time Trends, Age Groups, Counts of Services, Comparison to Recent Data, Economic Analysis, Cost Introduction, Input Costs, Costs and Outcomes, Cost Effectiveness Comparison, Further Description, Changelog, and Feedback.

The main content area is titled 'Comparison' and includes several sections:

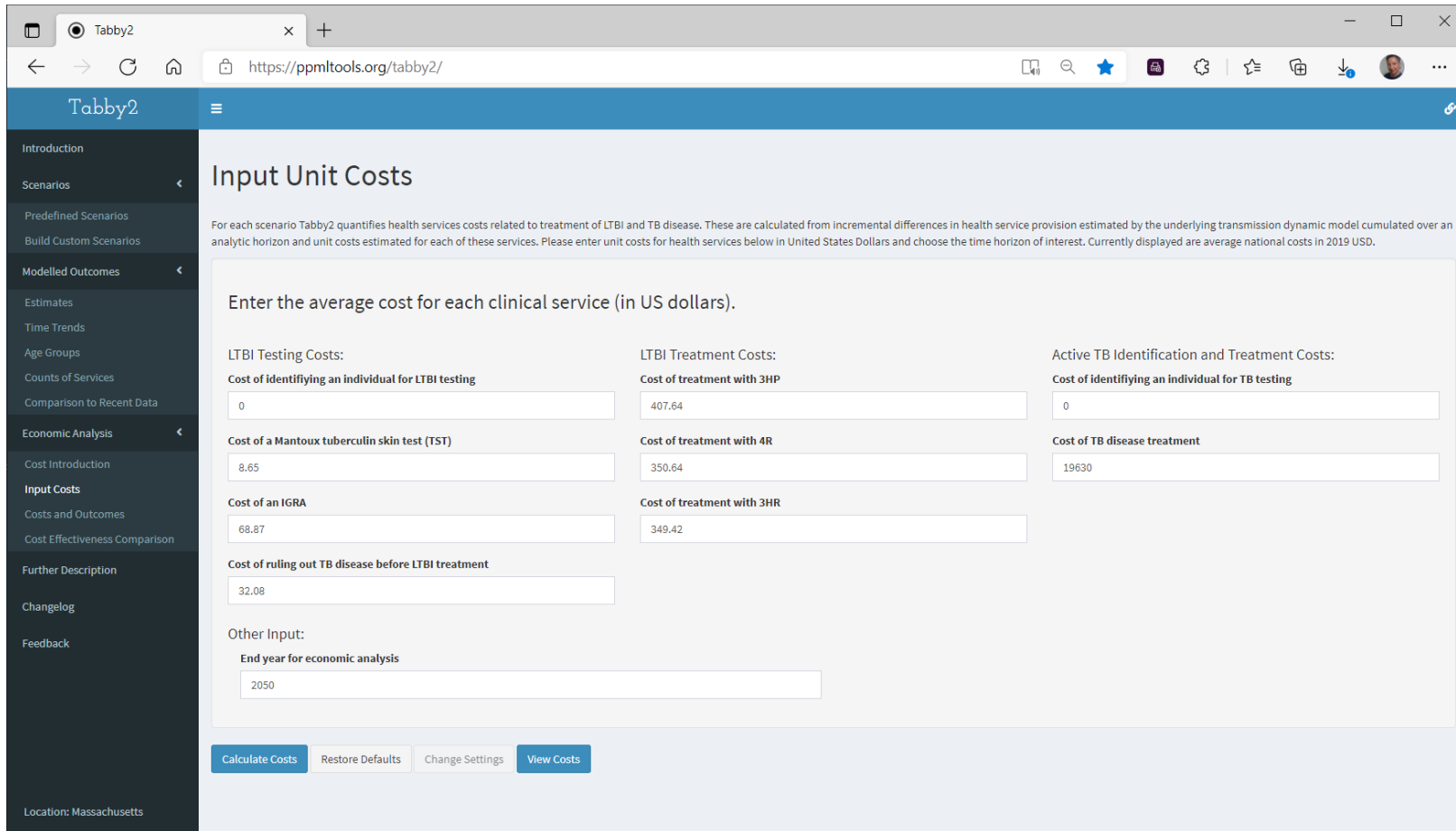
- Comparison:** Radio buttons for 'Absolute values', 'Percentage of base case value in the same year', and 'Percentage of base case value in 2020'. 'Absolute values' is selected.
- Population:** Radio buttons for 'Total', 'US-born', and 'Non-US-born'. 'Total' is selected.
- Age groups:** Radio buttons for 'All ages', '0 to 24', '25 to 64', and '65+'. 'All ages' is selected.
- Outcome:** Radio buttons for 'LTBI Tests (in thousands)', 'LTBI Treatment Initiations (in thousands)', 'LTBI Treatment Completions (in thousands)', 'TB Disease Treatment Initiations (in thousands)', and 'TB Disease Treatment Completions (in thousands)'. 'LTBI Treatment Initiations (in thousands)' is selected.
- Modeled Scenarios:** Checkboxes for 'LTBI treatment for new migrants', 'Improved LTBI treatment in the US', 'Enhanced case detection', 'Enhanced TB treatment', and 'All improvements'. 'Improved LTBI treatment in the US' is checked.
- Download:** Buttons for 'PNG', 'PDF', 'PPTX', 'CSV', and 'XLSX'.

The 'Results Table' is displayed with the following columns: outcome, scenario, population, age_group, comparator, year, and value. The table shows data for the years 2020 to 2038, comparing the Base Case and Improved LTBI Tx scenarios. The 'value' column shows the number of treatment starts in thousands, ranging from 3.64 in 2020 to 2.88 in 2038.

outcome	scenario	population	age_group	comparator	year	value
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2020	3.64
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2021	3.6
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2022	3.56
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2023	3.51
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2024	3.47
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2025	3.43
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2026	3.39
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2027	3.34
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2028	3.3
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2029	3.26
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2030	3.21
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2031	3.17
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2032	3.13
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2033	3.08
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2034	3.04
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2035	3
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2036	2.96
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2037	2.92
ltbi_txinits_000s	Base Case	all_populations	all_ages	absolute_value	2038	2.88

Review or Change Input Costs

- On the left-hand bar, select “Input Costs”
- The default settings for costs are displayed. You can modify or keep these. **IMPORTANT:** then, select “Calculate Costs.” Give the software a few minutes to calculate.



The screenshot shows the 'Input Unit Costs' page in the Tabby2 web application. The page is titled 'Input Unit Costs' and includes a navigation sidebar on the left. The main content area contains a form for entering average costs for various clinical services. The form is organized into three columns: LTBI Testing Costs, LTBI Treatment Costs, and Active TB Identification and Treatment Costs. Each column has several input fields with numerical values. At the bottom of the form, there is an 'Other Input' section with a field for 'End year for economic analysis' set to 2050. Below the form are four buttons: 'Calculate Costs', 'Restore Defaults', 'Change Settings', and 'View Costs'. The browser address bar shows the URL 'https://ppmltools.org/tabby2/'.

Tabby2

Input Unit Costs

For each scenario Tabby2 quantifies health services costs related to treatment of LTBI and TB disease. These are calculated from incremental differences in health service provision estimated by the underlying transmission dynamic model cumulated over an analytic horizon and unit costs estimated for each of these services. Please enter unit costs for health services below in United States Dollars and choose the time horizon of interest. Currently displayed are average national costs in 2019 USD.

Enter the average cost for each clinical service (in US dollars).

LTBI Testing Costs:	LTBI Treatment Costs:	Active TB Identification and Treatment Costs:
Cost of identifying an individual for LTBI testing	Cost of treatment with 3HP	Cost of identifying an individual for TB testing
<input type="text" value="0"/>	<input type="text" value="407.64"/>	<input type="text" value="0"/>
Cost of a Mantoux tuberculin skin test (TST)	Cost of treatment with 4R	Cost of TB disease treatment
<input type="text" value="8.65"/>	<input type="text" value="350.64"/>	<input type="text" value="19630"/>
Cost of an IGRA	Cost of treatment with 3HR	
<input type="text" value="68.87"/>	<input type="text" value="349.42"/>	
Cost of ruling out TB disease before LTBI treatment		
<input type="text" value="32.08"/>		
Other Input:		
End year for economic analysis		
<input type="text" value="2050"/>		

[Calculate Costs](#) [Restore Defaults](#) [Change Settings](#) [View Costs](#)

Location: Massachusetts

Calculate Costs and Outcomes under the Base Case and “Improved LTBI Tx” Scenarios

- On the left-hand bar, select “Costs and Outcomes.” Reselect the “Improved LTBI Treatment” scenario
- Estimated TB cases, deaths, quality-adjusted life years (QALYs), and life years over 2020-2050 are in the top table. Improvements in health may yield longer and better lives—outcomes that can be quantified as life-years gained or QALYs gained.
- Results in the top table, second column show 476 (5,445-4,969) TB cases and in the third column 48 (418-370) deaths prevented. Estimated additional costs of the intervention (\$166,502-\$150,650=\$15,852,000 in 2019 dollars) can be calculated from the “Total Health Services Cost” column in the bottom table.

The screenshot shows the Tabby2 web application interface. The left-hand navigation menu is expanded to 'Costs and Outcomes'. The 'Modeled Scenarios' section has the 'Improved LTBI treatment in the US' checkbox selected. The 'Outcomes Table' and 'Costs Table (in mil)' are displayed, comparing 'Base Case' and 'Improved LTBI treatment in the US' scenarios.

Scenario	TB Cases (in 000s)	TB Deaths (in 000s)	QALYs Lost (in 000s)	Life Years Lost (in 000s)
Base Case	5,445	0.418	10.340	9.324
Improved LTBI treatment in the US	4,969	0.370	9.383	8.432

Scenario	Health services cost due to LTBI treatment	Health services cost due to TB disease	Productivity cost due to LTBI treatment	Productivity cost due to TB disease	Total health services cost	Total cost
Base Case	43.757	106.893	7.112	246.657	150.650	404.419
Improved LTBI treatment in the US	68.965	97.537	11.210	224.333	166.502	402.045

Use Cost Effectiveness Analysis to Compare “Improved LTBI Tx” with the Base Case Scenario

- Cost effectiveness analysis provides information to answer: “Is the intervention the best use of scarce resources?”
- The Incremental Cost Effectiveness Ratio (ICER)

$$= \frac{\text{Net Cost of Improved LTBI Tx} - \text{Net Cost of Base case Services}}{\text{Change in TB cases with Improved LTBI Tx} - \text{Change in TB cases with Base case Services}}$$

- Where net costs equal the costs of the Improved LTBI Tx intervention or Base Case services minus the costs of prevented TB cases occurring under each scenario
- Typically, both future costs and outcomes are discounted, because money available for spending today is worth more than the same amount of money available for spending in the future. Favorable outcomes are similarly valued more today than in the future. Discounting converts all future costs and outcomes to their present value. Use of a social discount rate of 3% is standard. In Tabby2, you can select discounting under the “Cost Effectiveness” tab. Otherwise, the default is no discounting, which provides undiscounted costs that might be helpful for current budgeting purposes.
- QALYs combine morbidity (for example, TB cases) and mortality (for example, deaths with TB) outcomes

Estimate the Cost per Additional TB Case Prevented in the “Improved LTBI Tx” Compared with the Base Case Scenario

- Select “View Cost Comparison” from below; Reselect the “Improved LTBI Tx” scenario. Select under Costing Perspective “Health Services costs only” and “include” discounting
- The ICER is displayed as \$41,583 per additional TB case prevented.

The screenshot shows the Tabby2 web application interface. The left sidebar contains a navigation menu with categories like Introduction, Scenarios, Modelled Outcomes, Estimates, and Economic Analysis. The main content area is titled 'Comparison Table' and displays a 'Cost Effectiveness Table'.

Scenario	Discounted Health Services Cost (in mil)	Discounted Incremental Health Services Cost (in mil)	Discounted Total Effect (TB cases in 000s)	Discounted Incremental Effect (TB cases in 000s)	ICER
Improved LTBI treatment in the US	113.780	11.699	3.391	0.281	41583
Base Case	102.081	0.000	3.672	0.000	

Below the table, there are two buttons: 'View Costs and Outcomes' and 'Change Unit Costs'. The interface also shows various settings for 'Modeled Scenarios', 'Incremental cost effectiveness ratios (ICERs)', 'Effectiveness Measure', 'Costing Perspective', and 'Discount health and economic outcomes at 3% annually?'.

Change the Costing Perspective from “Health Services” to “Health Services and Patient Productivity Losses”

- Select a costing perspective of “health services and patient productivity losses.” (Note losses=costs). The ICER becomes more cost effective, at \$4,864 per additional TB case prevented.

The screenshot shows the Tabby2 web application interface. The browser address bar displays <https://ppmtools.org/tabby2/>. The application has a dark blue sidebar with navigation links: Introduction, Scenarios, Predefined Scenarios, Build Custom Scenarios, Modelled Outcomes, Estimates, Time Trends, Age Groups, Counts of Services, Comparison to Recent Data, Economic Analysis, Cost Introduction, Input Costs, Costs and Outcomes, Cost Effectiveness Comparison, Further Description, Changelog, and Feedback. The main content area is titled "Tabby2" and contains several sections:

- Modeled Scenarios:** Includes checkboxes for "LTBI treatment for new migrants", "Improved LTBI treatment in the US" (checked), "Enhanced case detection", "Enhanced TB treatment", and "All improvements".
- Incremental cost effectiveness ratios (ICERs):** Includes radio buttons for "Compare scenarios in order of increasing effectiveness" and "Compare scenarios to the basecase scenario" (selected).
- Effectiveness Measure:** Includes radio buttons for "TB cases" (selected), "TB deaths", "QALYs", and "Life years".
- Costing Perspective:** Includes radio buttons for "Health services costs only" and "Health services and patient productivity costs" (selected).
- Discount health and economic outcomes at 3% annually?** Includes radio buttons for "Include" (selected) and "Do not include".

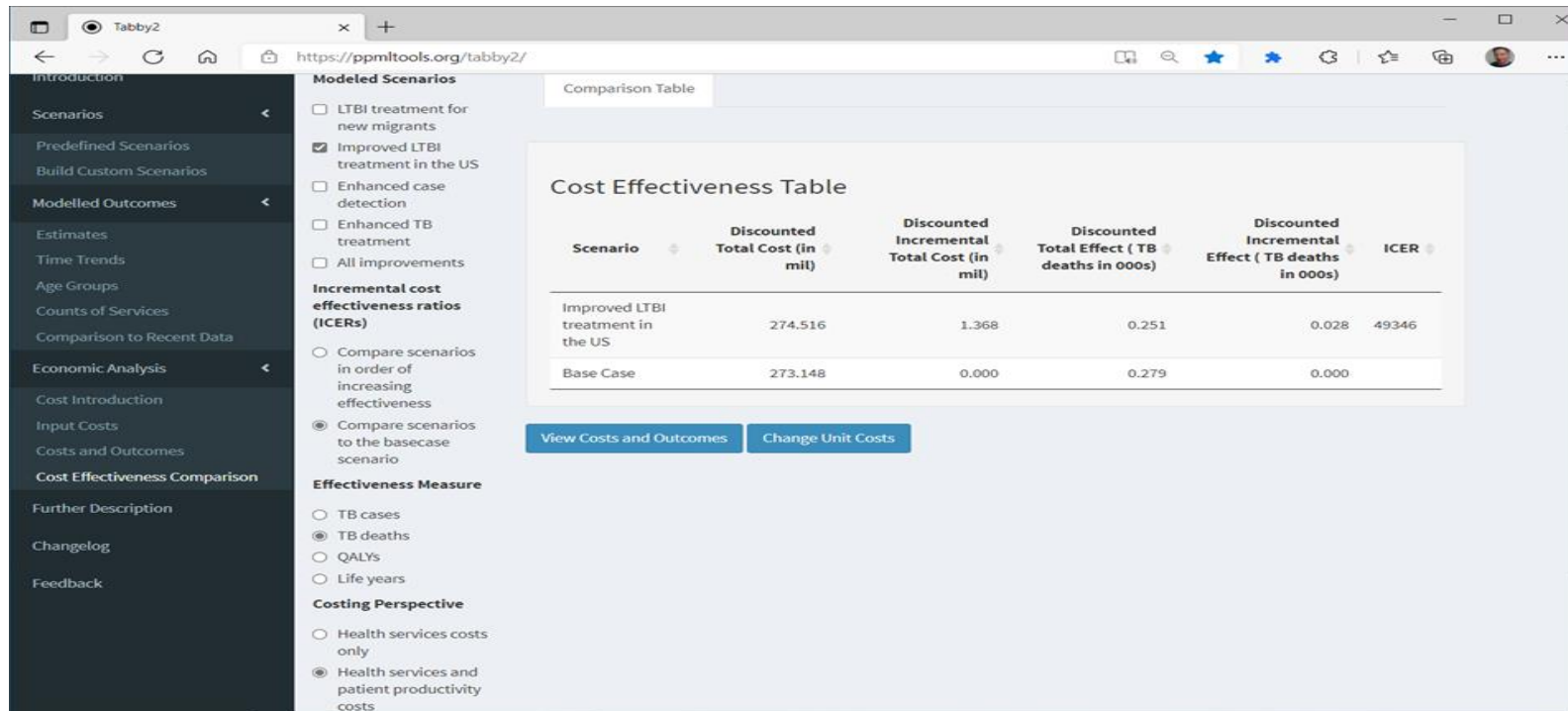
The "Comparison Table" section displays a "Cost Effectiveness Table" with the following data:

Scenario	Discounted Total Cost (in mil)	Discounted Incremental Total Cost (in mil)	Discounted Total Effect (TB cases in 000s)	Discounted Incremental Effect (TB cases in 000s)	ICER
Improved LTBI treatment in the US	274.516	1.368	3.391	0.281	4864
Base Case	273.148	0.000	3.672	0.000	

Below the table are two buttons: "View Costs and Outcomes" and "Change Unit Costs".

Estimate the Cost per Additional TB Death Prevented in the “Improved LTBI Tx” Compared with the Base Case Scenario

- Select “TB Deaths” from the left-hand menu “Effectiveness Measure”
- Displayed is the health services and patient productivity costs perspective, this is \$49,346 per additional TB death prevented by the improved LTBI treatment scenario.



Comparison Table

Cost Effectiveness Table

Scenario	Discounted Total Cost (in mil)	Discounted Incremental Total Cost (in mil)	Discounted Total Effect (TB deaths in 000s)	Discounted Incremental Effect (TB deaths in 000s)	ICER
Improved LTBI treatment in the US	274.516	1.368	0.251	0.028	49346
Base Case	273.148	0.000	0.279	0.000	

[View Costs and Outcomes](#) [Change Unit Costs](#)

Modeled Scenarios

- LTBI treatment for new migrants
- Improved LTBI treatment in the US
- Enhanced case detection
- Enhanced TB treatment
- All improvements

Incremental cost effectiveness ratios (ICERs)

- Compare scenarios in order of increasing effectiveness
- Compare scenarios to the basecase scenario

Effectiveness Measure

- TB cases
- TB deaths
- QALYs
- Life years

Costing Perspective

- Health services costs only
- Health services and patient productivity costs

Estimate the Cost per Additional QALY Gained in the “Improved LTBI Tx” Compared with the Base Case Scenario

- Keeping the costing perspective of “health services and patient productivity losses” and selecting QALYs as the outcome results in an ICER of \$37,349 per additional QALY gained.

The screenshot displays the Tabby2 web application interface. The left sidebar contains navigation options such as 'Introduction', 'Scenarios', 'Modelled Outcomes', 'Estimates', 'Time Trends', 'Age Groups', 'Counts of Services', 'Comparison to Recent Data', 'Economic Analysis', 'Cost Introduction', 'Input Costs', 'Costs and Outcomes', 'Cost Effectiveness Comparison', 'Further Description', 'Changelog', and 'Feedback'. The main content area is titled 'Comparison Table' and features a 'Cost Effectiveness Table' with the following data:

Scenario	Discounted Total Cost (in mil)	Discounted Incremental Total Cost (in mil)	Discounted Total Effect (QALYs in 000s)	Discounted Incremental Effect (QALYs in 000s)	ICER
Improved LTBI treatment in the US	274.516	1.368	0.961	0.037	37349
Base Case	273.148	0.000	0.997	0.000	

Below the table are two buttons: 'View Costs and Outcomes' and 'Change Unit Costs'. The application also shows various settings on the left, including 'Modeled Scenarios' (with 'Improved LTBI treatment in the US' checked), 'Incremental cost effectiveness ratios (ICERs)' (with 'Compare scenarios to the basecase scenario' selected), 'Effectiveness Measure' (with 'QALYs' selected), and 'Costing Perspective' (with 'Health services and patient productivity costs' selected).

Summarize results to educate policy makers for improved LTBI treatment in MA to further TB elimination

- **Over 30 years of doubling current LTBI one-time testing of persons at high risk for TB in Massachusetts:**
 - TB incidence could be reduced from 1.99/100K in the year 2020 to 1.74/100K in the year 2050;
 - Over the 30-year period, the number of TB cases could be reduced by 476; this could result in 48 fewer TB deaths;
 - The estimated number of additional people tested for LTBI is 87,640 and treated for LTBI to reduce future TB is 46,960.

Summarize results to educate policy makers for improved LTBI treatment in MA to further TB elimination (continued)

- Over 30 years of doubling current LTBI one-time testing of persons at high risk for TB in Massachusetts:
 - The (undiscounted) healthcare system cost of this intervention is \$166,502,000 compared to \$150,650,000 under current practices, an increase of \$15,852,000.
 - Discounting of future costs and outcomes is necessary in cost effectiveness analysis to account for the preference for immediate versus delayed outcomes. However, policy makers would want to know the estimated undiscounted healthcare costs of the intervention to facilitate budgeting for the intervention.

Summarize results to educate policy makers for improved LTBI treatment in MA to further TB elimination(continued)

- Over 30 years of doubling current LTBI testing of persons at high risk for TB in Massachusetts, compared with that of the base case scenario of continuation of current level of prevention services, the intervention results in:
 - Without including patient costs, \$41,583 per additional TB case prevented
 - Including patient costs,
 - \$4,864 per additional TB case prevented
 - \$49,346 per additional TB death prevented
 - \$37,349 per additional QALY gained

Conclusions

- **Tabby2 can help states estimate the future number of TB cases and TB deaths over 30 years, based on projections from historical values**
- **Tabby2 can be used with default values, or state-specific input costs**
- **From pre- (or user)-defined scenarios, Tabby2 computes the impact of increasing LTBI testing and treatment on TB cases prevented, TB deaths, and QALYs gained**
- **By comparing the base case with a scenario of increased LTBI testing/treatment, the number and cost of additional LTBI tests/treatments can be estimated, along with the preventable costs of TB cases and associated deaths**
- **This information can be compiled to make a compelling case for furthering TB elimination**

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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.

