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Effectiveness and Cost-Effectiveness of Expanded Targeted Testing and Treatment of Latent Tuberculosis Infection Among the Medicare Population in 2022

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Abstract

Background: In the United States, older adults have elevated prevalence of latent tuberculosis infection (LTBI) and incidence of tuberculosis (TB).

Objective: To estimate the health benefits and cost-effectiveness of LTBI testing and treatment among the Medicare-eligible population.

Design: Model-based cost-effectiveness analysis.

Data Sources: Nationally representative surveys and published evidence.

Target Population: Medicare-eligible persons aged 65 years or older with at least 1 of 15 factors associated with elevated TB risk, as identified by guidelines from the U.S. Preventive Services Task Force (USPSTF) and other organizations.

Time Horizon: Lifetime.

Perspective: Societal.

Intervention: One-time offer of LTBI testing and treatment versus no intervention.

Outcome Measures: Lifetime TB cases and deaths averted, quality-adjusted life-years (QALYs) gained, costs, and incremental cost-effectiveness ratios (ICERs).

Results of Base-Case Analysis: In 2022, there were an estimated 29.9 million Medicare-eligible persons (95% uncertainty interval [UI], 28.4 to 31.6 million persons) aged 65 years or older with elevated TB risks, including 14.7 million (95% UI, 13.4 to 16.0 million) with USPSTF-recommended factors. In the target population, 4.9 million persons (95% UI, 4.0 to 5.8 million persons) (16.4% [95% UI, 13.9% to 19.1%]) were estimated to have LTBI. Testing and treatment of LTBI was estimated to prevent 10 946 TB cases (95% UI, 4684 to 20 579 cases)

and 2579 TB deaths (95% UI, 1106 to 4882 deaths), with 13 234 lifetime QALYs (95% UI, 5343 to 25 519 lifetime QALYs) gained. For the overall target population and for persons with USPSTF-recommended factors, ICERs were \$192 000 (95% UI, \$92 000 to \$503 000) and \$155 000 (95% UI, \$77 000 to \$393 000) per QALY gained, respectively.

Results of Sensitivity Analysis: The ICER was \$109 000 (95% UI, \$49 000 to \$285 000) per QALY gained for 65-year-olds newly eligible for Medicare.

Limitation: Health benefits from averted post-TB sequelae were not estimated.

Conclusion: Medicare-eligible persons represent approximately one third of all U.S. persons with LTBI. Testing and treatment of LTBI in this population could lead to substantial reductions in TB and TB-related mortality, particularly among 65-year-olds newly eligible for Medicare.

Primary Funding Source: Centers for Disease Control and Prevention.

In 2022, 58.5 million persons aged 65 years or older were enrolled in Medicare Part A or B (1). These individuals—representing 18% of the U.S. population—have a higher burden of tuberculosis (TB) than younger cohorts, with a higher prevalence of TB infection measured by blood assay in NHANES (National Health and Nutrition Examination Survey) (8.3% for the population aged ≥ 65 years vs. 5.0% in the overall population) and elevated TB incidence rates (4.3 per 100 000 persons vs. 2.9 per 100 000 persons in the overall population) (2, 3). Health outcomes for TB are also worse for older persons, who have a higher TB case fatality rate than younger populations (4, 5). Moreover, the proportion of U.S. TB cases attributed to long-standing or latent TB infection (LTBI) increases progressively with age; TB disease among older persons is more frequently the result of reactivation of established infection than of recent community transmission (6). Expanding LTBI testing and treatment among the Medicare population could reduce TB incidence by treating infection to prevent progression to disease (7).

In the United States, LTBI testing is recommended for individuals with known exposure to TB, such as close contacts of persons with infectious TB disease, as well as for those with higher lifetime TB exposure, such as persons born in countries with high TB incidence (7). Testing is also recommended for persons with immunosuppressive conditions that increase LTBI reactivation rates, such as HIV infection (7–9). Preventive treatment is recommended for those diagnosed with LTBI who do not have documentation of prior treatment or evidence of current TB disease. Prior studies of LTBI testing and treatment of individuals with these risk factors have reported incremental cost-effectiveness ratios (ICERs) ranging from \$12 000 to \$50 000 per quality-adjusted life-year (QALY) gained (10–12). However, to our knowledge, the magnitude of potential health benefits has not been assessed for the Medicare population. The cost-effectiveness of LTBI screening and treatment in the general U.S. population has been studied (13–15), and analyses of screening in older populations in Canada, Hong Kong, and Japan have found this intervention to be effective, yet an analysis has not been done among the older population in the United States (16–18). In addition, the coverage of LTBI testing remains low, and gaps persist in TB preventive care (19, 20). In this study, we assessed the health effect and cost-effectiveness of LTBI testing and treatment for the Medicare-eligible population aged 65 years or older in 2022.

Methods

Study Population

We defined the Medicare-eligible population as persons aged 65 years or older who were either U.S. citizens or eligible non-U.S.-born residents in 2022, excluding Medicare-eligible persons younger than 65 years (21, 22). Within this population, we defined a TB risk population based on 3 groups of risk factors that confer elevated risk for developing TB (Supplement Table 1, available at [Annals.org](https://www.annals.org)). Group A included persons with 1 of 4 factors (non-U.S. birth, history of homelessness, history of incarceration, or residence in a long-term care facility) recommended by the U.S. Preventive Services Task Force (USPSTF) for LTBI testing and treatment in primary care settings (7). Group B included persons with 1 of 4 factors (recent contact with a person with TB disease, diagnosed HIV infection, use of immunosuppressive medications, or receipt of a solid organ transplant) recommended for LTBI testing and treatment for which services are typically provided outside primary care settings (8). Finally, group C included persons with 1 of 7 factors (diagnosed diabetes, end-stage renal disease, chronic kidney disease, cancer of the head or neck or blood, gastrectomy, body mass index $<20 \text{ kg/m}^2$, or current smoking) that are not specifically part of the USPSTF screening recommendation but that produce elevated risks for TB disease among persons with LTBI (8, 9).

We extracted population data by age, sex, race and ethnicity, and nativity from the 2021 ACS (American Community Survey) (23) and estimated the numbers of Medicare-eligible persons aged 65 years or older in 2022. Data on non-U.S. birth and most risk factors in groups B and C were sourced from the ACS, NHIS (National Health Interview Survey), and NHANES. For risk factors not covered by these sources, we used national surveillance reports or published studies (Supplement Table 1). We applied mixed-effects generalized linear models using these data to predict the prevalence of each risk factor in the Medicare-eligible population. We summed these values to estimate the population with at least 1 risk factor, after adjusting for individuals with multiple risk factors (Supplement, available at [Annals.org](https://www.annals.org)). We extracted data on interferon-gamma release assay (IGRA) test results for TB infection from the 2011-to-2012 NHANES cycle (24, 25) and fitted logistic regression models to estimate IGRA positivity for each analytic stratum. We estimated LTBI prevalence by adjusting IGRA positivity based on reported estimates of IGRA sensitivity and specificity (26) using a published approach (27).

Intervention Scenarios

We examined 2 LTBI testing and treatment scenarios. The first assumed expanded LTBI screening via a one-time offer of screening for all Medicare beneficiaries (aged ≥ 65 years) with at least 1 TB risk factor in 2022. The second scenario assumed a one-time offer of LTBI screening for persons aged 65 years who were newly eligible for Medicare in 2022 and had at least 1 TB risk factor. Under this second scenario, the intervention was assumed to be offered as part of the “Welcome to Medicare” visit for new Medicare enrollees. Under both scenarios, we assumed that LTBI testing would be via IGRA or tuberculin skin test. We assumed that 100% of the non-U.S.-born and 50% of the U.S.-born Medicare population would be tested using IGRA. Those with positive results would receive a chest radiograph

to rule out TB disease before being offered treatment to prevent TB disease (either 3 months of self-administered weekly rifapentine and isoniazid or 4 months of self-administered daily rifampin) (28, 29).

We compared intervention scenarios versus a counterfactual scenario with no LTBI screening. For all scenarios, persons developing TB disease in the future were assumed to receive prompt diagnosis and treatment consistent with national performance indicators (Supplement Table 2, available at [Annals.org](https://www.annals.org)) (30).

Markov Model

We constructed a Markov cohort model representing TB natural history and receipt of related health services (Supplement Figure 1, available at [Annals.org](https://www.annals.org)), parameterized using published evidence (Supplement Table 2). For individuals in the TB risk population, the proportion initiating LTBI treatment was calculated as the product of 1) the fraction without a history of LTBI treatment (88.1% for those with LTBI and 99.4% for those without) (31), 2) the fraction that would accept testing if offered (76.2%) (32), 3) the fraction testing positive and diagnosed with LTBI (varied by risk factor), and 4) the fraction that would accept treatment if offered (76.2%) (30). We assumed that a fraction of treated individuals would discontinue the regimen before completion and a fraction would have treatment hepatotoxicity (0.3%) (28) with potential associated death (33, 34). For those with LTBI completing LTBI treatment, we assumed that most (93.0%) (28, 35) would clear LTBI and have no future risk for reactivation of TB. Individuals not completing the regimen were assumed to receive no benefit. Those incorrectly diagnosed with LTBI (that is, false-positive diagnoses) could receive LTBI treatment (Supplement Figure 1) and potentially have treatment toxicity but no other health effects. Individuals with LTBI not receiving LTBI treatment were assumed to have similar outcomes to those in the “no screening” counterfactual.

The model simulated future TB-related outcomes, including progression to TB disease, TB diagnosis and treatment initiation, and recovery through treatment. Individuals could die of TB disease, or deaths could be related to excess mortality from modeled risk factors or background mortality. Individuals surviving TB disease were assumed to face no further TB-related health consequences. Background mortality rates specific to age, sex, and race were extracted from U.S. life tables (36). Excess mortality rates associated with TB disease and coprevalent conditions were modeled by applying condition-specific mortality rate ratios (Supplement Table 2). We did not model future exposure to infection because the consequence of these infections would be unaffected by the screening intervention. We did not consider the consequences of secondary transmission from future TB cases in the main analysis but considered this in sensitivity analysis.

Cost-Effectiveness Analysis

We estimated costs from a TB service perspective, a health care sector perspective, and a societal perspective, with the societal perspective used in the main analysis (Supplement Table 3, available at [Annals.org](https://www.annals.org)) (37). Costs (Supplement Table 2) were inflated to 2021

values using relevant price indices (38) and reported in 2021 U.S. dollars. To calculate cost-effectiveness results, we applied a 3% annual discount rate to future costs and benefits.

We compared results of intervention versus no intervention scenarios to calculate the numbers of TB cases averted, TB deaths averted, and QALYs gained. We aggregated results across demographic strata and reported outcomes as absolute values as well as per 100 000 persons in the TB risk population. We estimated incremental costs and ICERs from each perspective, for each risk factor, and for each risk factor group, and we present these ICERs rounded to the nearest thousand.

Sensitivity Analysis

We specified probability distributions representing the uncertainty associated with each model parameter (Supplement Table 2) and estimated outcomes using a second-order Monte Carlo simulation (39). To do so, we sampled 1000 parameter sets using a Latin hypercube sample (40) and simulated results for each of these parameter sets. We calculated point estimates for each outcome as the mean of these 1000 values and calculated 95% uncertainty intervals as the 2.5th and 97.5th percentiles. We calculated partial-rank correlation coefficients (PRCCs) to quantify the influence of individual parameters on study outcomes (41) and cost-effectiveness acceptability curves to report uncertainty in results. We did several sensitivity analyses and reestimated results under the following scenarios: 1) assuming lower (1.7%) (42) and 2) higher (7.0%) discount rates, 3) using an alternative source for the base rate of reactivation of TB for persons with LTBI (0.084 [43] vs. 0.051 in the main analysis [27]), 4) assuming 100% acceptance and completion of LTBI testing and treatment, 5) using LTBI test characteristics from a published USPSTF review (7), and 6) considering the consequences of averted secondary TB cases (parameter values shown in Supplement Table 2). Analyses were done using R, version 4.2.1 (R Foundation) (44).

Role of the Funding Source

Employees of the Centers for Disease Control and Prevention participated as study investigators.

Results

In 2022, an estimated 29.9 million Medicare-eligible persons aged 65 years or older had 1 or more of the TB risk factors considered in the analysis. Among these persons, an estimated 4.9 million had LTBI, for a prevalence of 16.4%. Approximately half of the TB risk population (14.7 million persons) had risk factors recommended by the USPSTF for screening in primary care settings (group A: non-U.S. birth, history of homelessness, history of incarceration, or residence in a long-term care facility), with the highest average LTBI prevalence of 27.4%.

We estimated that 2.0 million 65-year-olds were newly eligible for Medicare in 2022 and had 1 or more of the TB risk factors considered in the analysis, of whom 0.3 million had LTBI (prevalence, 17.1%). Group B had the smallest estimated population but a similar LTBI prevalence to group A. The highest LTBI prevalence was estimated among those who

were non–U.S.-born, were homeless, or had close contact with persons with infectious TB disease (Table 1; Supplement Table 4, available at [Annals.org](https://annals.org)).

Health Outcomes

Compared with no testing or treatment, a one-time intervention of LTBI testing and treatment provided to the Medicare-eligible population aged 65 years or older was estimated to result in 2.6 million persons initiating LTBI treatment, preventing 10 946 future TB cases and 2579 TB deaths, with 13 234 lifetime QALYs gained (Figure 1; Supplement Table 5, available at [Annals.org](https://annals.org)). Among persons with USPSTF-recommended risk factors (group A), an estimated 7975 TB cases and 1870 TB deaths would be averted, with 10235 QALYs gained (Figure 1; Supplement Table 5). The health benefits estimated for the intervention varied across risk factor groups, reflecting differences in population size, LTBI prevalence, and LTBI reactivation rates (Figure 1; Supplement Table 4). For 65-year-olds newly eligible for Medicare in 2022, we estimated that the intervention would result in 0.2 million LTBI treatments initiated, 1168 TB cases and 237 TB deaths averted, and 1632 QALYs gained compared with no testing and treatment (Figure 2; Supplement Table 5). Most of these benefits were estimated to accrue among persons with USPSTF-recommended risk factors (group A) (Figure 2).

Incremental Costs

Compared with no intervention, LTBI testing and treatment of the Medicare-eligible population aged 65 years or older was estimated to have incremental costs of \$1474 million from a TB service perspective (\$2040 million of intervention vs. \$566 million of no intervention), \$1715 million from a health care perspective, and \$1802 million from a societal perspective, which includes all future health care and non–health care expenditures as well as productivity losses from early death (Supplement Table 6, available at [Annals.org](https://annals.org)). Most incremental costs were estimated for persons with USPSTF-recommended risk factors (group A), with estimated societal incremental costs of \$1126 million (Figure 1). For 65-year-olds newly eligible for Medicare in 2022, we estimated that the incremental costs of the intervention would be \$91 million (\$153 million of intervention vs. \$62 million of no intervention) from a TB service perspective, \$120 million from a health care perspective, and \$119 million from a societal perspective (Figure 2; Supplement Table 6).

Cost-Effectiveness

Compared with no LTBI testing and treatment, the intervention for the Medicare-eligible population aged 65 years or older was estimated to have an ICER of \$192 000 per QALY gained from a societal perspective. For persons with USPSTF-recommended (group A) risk factors, the ICER was estimated as \$155 000 per QALY gained. For those with group B and group C risk factors, the ICERs were estimated as \$220 000 and \$324 000 per QALY gained, respectively (Table 2). The magnitude of estimated intervention health benefits, costs, and ICERs varied widely across the 15 risk factor populations. The greatest health benefits were estimated for the non–U.S.-born, Medicare-eligible population aged 65 years or older, which had an ICER of \$116 000 per QALY gained (Figure 3 and Table 2).

For 65-year-olds newly eligible for Medicare in 2022, the ICER for the intervention (compared with no LTBI testing and treatment) was estimated as \$109 000 per QALY gained in the overall TB risk population. The ICER was \$89 000 per QALY gained for the subset of this population with USPSTF-recommended risk factors (group A) (Table 3). The greatest health benefits were estimated for non-U.S.-born individuals newly eligible for Medicare (aged 65 years), who had an ICER of \$72 000 per QALY gained (Figure 3).

Sensitivity Analyses

Supplement Table 7 (available at [Annals.org](https://annals.org)) reports PRCCs identifying parameters with the greatest influence on cost-effectiveness results. In this analysis, the base rate of reactivation of TB for individuals with LTBI in the overall population (PRCC, -0.94) and the cost of IGRA testing (PRCC, 0.62) were found to have the strongest relationship with the ICER for the intervention provided to Medicare-eligible persons aged 65 years or older with at least 1 TB risk factor.

Supplement Figure 2 (available at [Annals.org](https://annals.org)) shows cost-effectiveness acceptability curves for the intervention offered to the overall TB risk population aged 65 years or older and for risk factor groups A, B, and C. In these results, there was a 23.6% probability that the ICER would fall below \$150 000 per QALY for the intervention provided to persons with at least 1 TB risk factor. This probability was 42.9% for those with group A risk factors. Supplement Figure 3 (available at [Annals.org](https://annals.org)) shows cost-effectiveness acceptability curves for the intervention offered to 65-year-olds newly eligible for Medicare.

Among Medicare-eligible persons aged 65 years or older with at least 1 TB risk factor, the estimated ICER was \$166 000 per QALY gained at a discount rate of 1.7% and \$291 000 per QALY gained at a discount rate of 7% (Supplement Tables 8 and 9, available at [Annals.org](https://annals.org)). When we reestimated results with a higher base LTBI reactivation rate (0.084 [43] vs. 0.051 [27] per 100 person-years), estimated health benefits were approximately 64% higher and cost-effectiveness ratios more favorable (39% lower) (Supplement Table 10, available at [Annals.org](https://annals.org)). When we assumed 100% acceptance and completion of LTBI testing and treatment, estimated health benefits increased by approximately 87% and ICERs decreased by 24% (Supplement Table 11, available at [Annals.org](https://annals.org)). Similarly, using an alternative source of LTBI test characteristics (a recent USPSTF review [45]) and considering the consequences of averted secondary TB cases both produced greater health benefits (QALYs gained, 5% and 12% higher, respectively) and more favorable cost-effectiveness ratios (incremental cost per QALY gained, 14% and 16% lower, respectively) (Supplement Tables 12 and 13, available at [Annals.org](https://annals.org)).

Discussion

We evaluated the lifetime health outcomes, costs, and cost-effectiveness of a one-time testing and treatment intervention offered to Medicare-eligible persons aged 65 years or older with elevated risks for developing TB. We estimated that the intervention could prevent more than 10 000 TB cases and 2500 TB deaths, with more than 13 000 lifetime QALYs gained. Most of these health gains were estimated to accrue among persons with 1 of 4 risk factors (non-U.S. birth, history of homelessness, history of incarceration, or

residence in a long-term care facility) recommended by the USPSTF for LTBI screening and treatment in primary care settings (7). Overall, restricting testing to 65-year-olds newly eligible for Medicare increased cost-effectiveness, with cost-effectiveness ratios similar to those found in previous studies for the general U.S. population (13–15). Further, among the 15 individual risk factors examined, per person health gains were highest—and cost-effectiveness ratios most favorable—for those factors associated with substantially higher LTBI prevalence than in the general population (most notably, non-U.S. birth) or with high LTBI reactivation rates due to weakened immunity (such as HIV infection). Per person health gains were lower for risk factors associated with more modest increases in LTBI prevalence or reactivation risks, or with high competing mortality risks (such as chronic kidney disease). For each risk factor and risk factor group, restricting the intervention to 65-year-olds newly eligible for Medicare resulted in more favorable cost-effectiveness ratios because younger Medicare beneficiaries would receive the benefit of longer remaining life-years (that is, lower general mortality compared with older populations) after prevention of TB morbidity and mortality.

These results can be compared with prior cost-effectiveness estimates for LTBI testing and treatment among persons with recommended risk factors in the general U.S. population. Among the non-U.S.-born Medicare population, one-time screening was associated with an ICER of \$116 000 per QALY gained, which is higher than most prior cost-effectiveness estimates reported for non-U.S.-born adults, although within range of previous studies (\$80 000 to \$174 000) (13–15). Several factors may have contributed to these differences; one is our focus on an older age group. Although older populations have higher LTBI prevalence and TB case fatality rates than younger populations, our analyses assumed that they also have lower LTBI reactivation rates (27) and higher competing mortality risks, such that there are fewer years over which prevention benefits can accrue. As a consequence, the remaining lifetime risk for TB disease for someone with LTBI is estimated to be lower in the Medicare-eligible TB risk population than in younger populations (46). Similarly, the QALYs lost for each TB death will be lower, given the older average age of the Medicare-eligible TB risk population. Another difference is the base LTBI reactivation rate used in our analysis, which was derived from our regression analysis of 2011-to-2012 NHANES IGRA results showing lower LTBI reactivation rates at ages 65 years or older (27), compared with a 2006-to-2008 genotyping study of TB cases by the Centers for Disease Control and Prevention that found higher reactivation rates in this age group (43). When we undertook a sensitivity analysis using the higher rates (43) (Supplement Table 10), the estimated health gains from the intervention were approximately 64% higher than in our main analysis. Additional contributing factors include the change in price levels between our study and earlier studies and the fact that for older populations the broader accounting of costs and productivity losses under the societal perspective tends to increase ICERs, despite reducing them in younger populations. Nonetheless, our results show that substantial health gains would be possible with this intervention.

This study synthesized multiple empirical data sources and estimated outcomes for many risk factor groups and population strata, providing a comprehensive profile of potential intervention effects in the Medicare-eligible population. However, the study has several limitations. First, for some risk factors (such as prior gastrectomy), inherent data limitations

affected estimates of population size and LTBI prevalence, such that outcomes estimated for these groups involve additional uncertainty. Similarly, estimates of the joint distribution of risk factors (required to estimate how the number of individuals with any risk factor relates to the estimated populations with each individual risk factor) were uncertain, and in some cases we assumed that risk factors were distributed independently where data were not available. Second, some analytic inputs were based on population-average values, yet these values may differ in older populations. Specifically, some prior studies suggest that rates of treatment initiation may be higher (47), and treatment completion lower (48), in older adults than in younger patients. However, other evidence suggests that these rates may not differ substantially between adult age groups (49, 50), and we chose to set them at population-average values. Third, we did not consider the health benefits for persons identified with TB disease through the screening intervention (the number of whom is expected to be small). Fourth, the cost-effectiveness results had substantial uncertainty (represented by wide uncertainty intervals). Future studies to reduce uncertainty around key model parameters (LTBI reactivation rates for risk groups; intervention costs) would allow more precise cost-effectiveness estimates. Finally, our analysis did not consider the prevention of long-term post-TB sequelae among TB survivors, which would be an additional benefit of LTBI testing and treatment. Although the magnitude of this outcome relative to other health benefits is uncertain, it would increase the health benefits estimated for the intervention, if considered.

This study evaluated the health outcomes and cost-effectiveness of testing and treatment of LTBI for the Medicare-eligible population aged 65 years or older with risk factors for developing TB disease. We estimated that 29.9 million Medicare-eligible persons have such risk factors and, of this total, 14.7 million persons have risk factors for TB infection that the USPSTF recommends for screening of all adults in primary care. We found that LTBI testing and treatment among the Medicare population would be impactful, preventing more than 10 000 TB cases and 2500 TB deaths; testing in this population had similar cost-effectiveness ratios to other previously published LTBI testing and treatment interventions for the U.S. population (14). Greater cost-effectiveness was observed among non-U.S.-born 65-year-olds newly eligible for Medicare. These results suggest that testing and treatment is just as impactful and cost-effective in this population as in other populations where LTBI targeted testing and treatment has already been implemented as recommended by the USPSTF (7).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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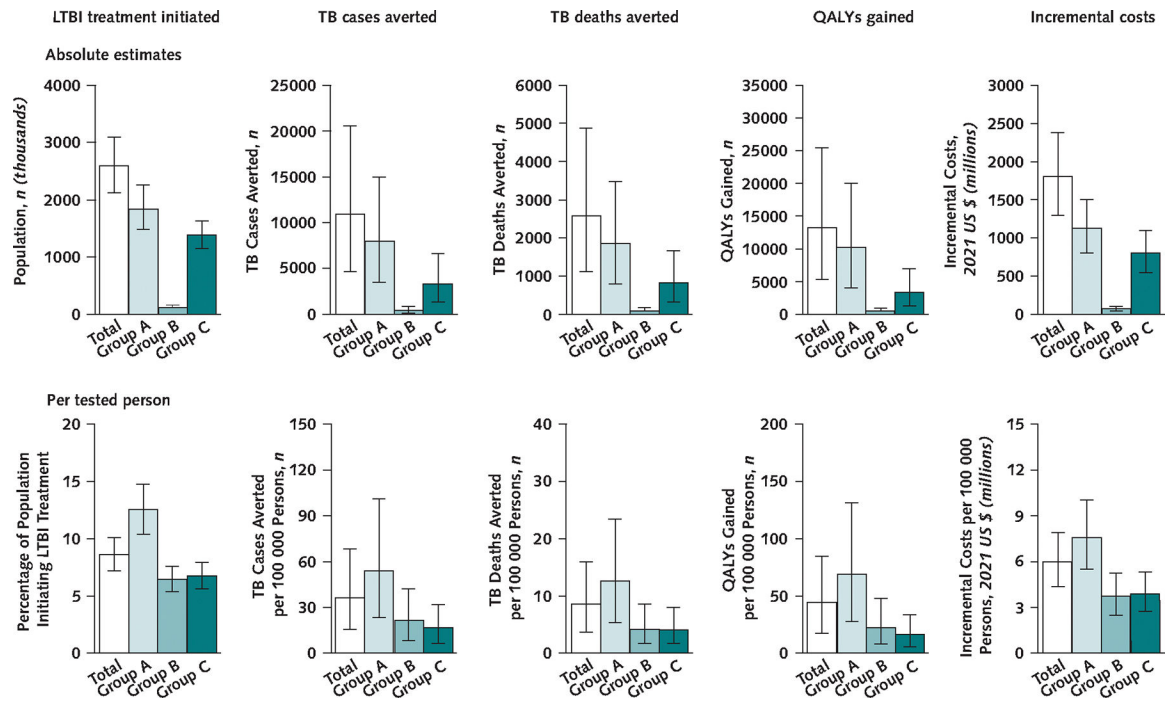


Figure 1.

Estimated numbers receiving LTBI treatment, TB cases averted, TB deaths averted, QALYs gained, and incremental societal costs, for an LTBI testing and treatment intervention for Medicare-eligible persons aged ≥ 65 y with selected risk factors in 2022.

Group A included Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7). Group B included Medicare-eligible persons with 1 of 4 factors that are acknowledged by the USPSTF as conferring risk for either exposure or progression to TB disease but are regularly screened or tested for outside primary care settings. Group C included Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation. LTBI = latent tuberculosis infection; QALY = quality-adjusted life-year; TB = tuberculosis.

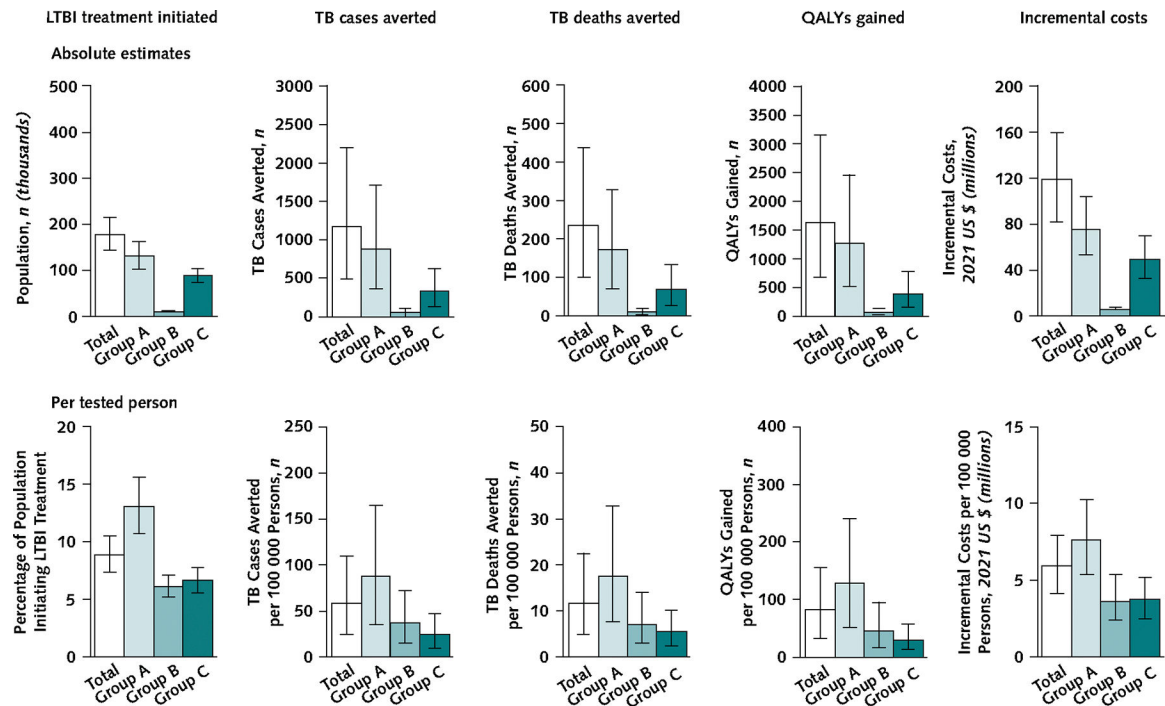


Figure 2.

Estimated numbers receiving LTBI treatment, TB cases averted, TB deaths averted, QALYs gained, and incremental societal costs, for an LTBI testing and treatment intervention for individuals aged 65 y who were newly eligible for Medicare in 2022 and had selected risk factors.

Group A included Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7). Group B included Medicare-eligible persons with 1 of 4 factors that are acknowledged by the USPSTF as conferring risk for either exposure or progression to TB disease but are regularly screened or tested for outside primary care settings. Group C included Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation. LTBI = latent tuberculosis infection; QALY = quality-adjusted life-year; TB = tuberculosis.

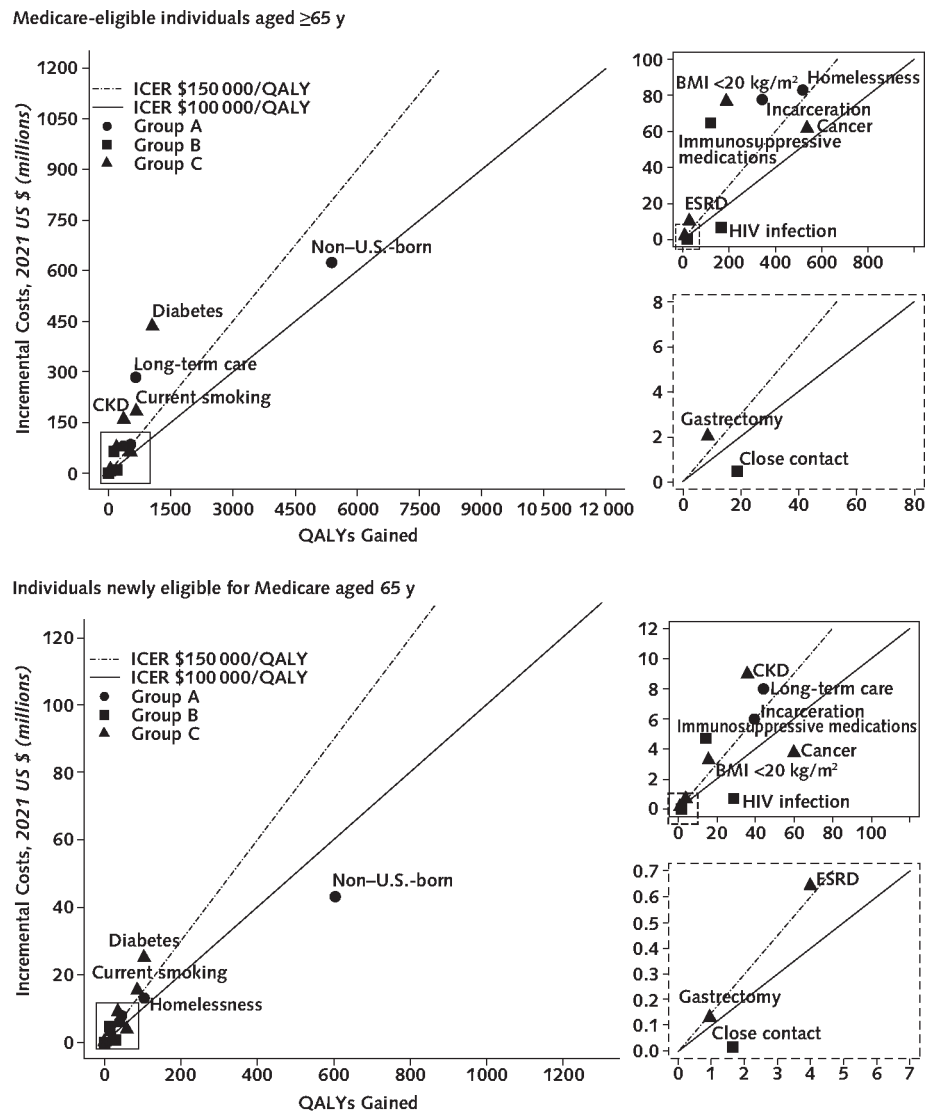


Figure 3.

Estimated incremental cost per QALY gained for an LTBI testing and treatment intervention among Medicare-eligible persons with selected risk factors (aged ≥ 65 y [*top*] and newly eligible for Medicare aged 65 y [*bottom*]) in 2022.

Group A included Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7). Group B included Medicare-eligible persons with 1 of 4 factors that are acknowledged by the USPSTF as conferring risk for either exposure or progression to TB disease but are regularly screened or tested for outside primary care settings. Group C included Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation. Estimates for persons who are organ transplant recipients are excluded because ICERs for this group are dominant. BMI= body mass index; CKD= chronic kidney disease;

ESRD= end-stage renal disease; ICER= incremental cost-effectiveness ratio; LTBI= latent tuberculosis infection; QALY= quality-adjusted life-year; TB= tuberculosis.

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Table 1.

Population, LTBI Prevalence, and Population With LTBI Among the Medicare-Eligible Population, by Risk Factor, in 2022^{*}

Group	Population (95% UI), <i>n</i> (millions)	LTBI Prevalence (95% UI), %	Population With LTBI (95% UI), <i>n</i> (millions)
All groups	29.94 (28.43–31.60)	16.39 (13.87–19.09)	4.91 (4.04–5.81)
Group A[†]	14.69 (13.39–16.04)	27.39 (23.52–31.66)	4.03 (3.28–4.91)
Non-U.S.-born	6.54 (5.26–7.88)	43.87 (36.33–51.77)	2.87 (2.18–3.70)
History of homelessness	1.38 (1.36–1.40)	30.79 (24.32–37.86)	0.42 (0.33–0.52)
History of incarceration	2.34 (2.29–2.40)	17.11 (14.67–19.70)	0.40 (0.34–0.46)
Long-term care	6.21 (5.96–6.50)	19.91 (17.01–22.92)	1.24 (1.06–1.43)
Group B[‡]	1.96 (1.90–2.04)	10.61 (9.17–12.25)	0.21 (0.18–0.24)
Close contact	0.009 (0.007–0.013)	24.07 (19.69–29.51)	0.002 (0.002–0.003)
HIV	0.18 (0.15–0.20)	14.60 (12.35–17.15)	0.03 (0.02–0.03)
Immunosuppressive medication recipient	1.77 (1.71–1.84)	10.12 (8.62–11.90)	0.18 (0.15–0.21)
Organ transplant recipient	0.010 (0.009–0.011)	12.14 (9.95–14.36)	0.0012 (0.0010–0.0015)
Group C[§]	20.44 (19.47–21.55)	11.08 (9.58–12.74)	2.27 (1.97–2.62)
Diabetes	11.61 (11.25–11.99)	12.41 (10.86–14.01)	1.44 (1.26–1.63)
End-stage renal disease	0.28 (0.04–0.93)	11.16 (8.98–13.74)	0.03 (0.005–0.11)
Chronic kidney disease	3.77 (3.06–4.24)	10.44 (8.73–12.43)	0.39 (0.30–0.48)
Cancer of the head, neck, or blood	1.67 (1.22–2.30)	10.04 (7.31–12.78)	0.17 (0.12–0.23)
Gastrectomy	0.05 (0.04–0.07)	10.49 (9.06–12.13)	0.006 (0.004–0.008)
BMI <20 kg/m ²	2.03 (1.51–2.71)	9.91 (7.44–12.47)	0.20 (0.15–0.26)
Current smoking	4.57 (4.33–4.85)	9.41 (7.59–11.24)	0.43 (0.35–0.52)

BMI = body mass index; LTBI = latent tuberculosis infection; UI = uncertainty interval.

^{*} Overall and group population estimates are smaller than the sum of populations for each risk factor because there are persons with >1 risk factor within groups A, B, and C and all groups.

[†] Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7).

[‡] Medicare-eligible persons with 1 of 4 factors that are acknowledged by the USPSTF as conferring risk for either exposure or progression to TB disease but are regularly screened or tested for outside primary care settings.

[§] Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation.

Table 2.

Estimated Discounted QALYs Gained, Discounted Incremental Costs, and ICERs for an LTBI Testing and Treatment Intervention for Medicare-Eligible Persons Aged 65 Years or Older in 2022 *

Group	QALYs Gained (95% UI)	Incremental Costs (95% UI), 2021 US \$ (millions)	ICER (95% UI), \$/QALY Gained
All groups	9056 (3586 to 17 500)	1736(1231 to 2298)	192 000 (92 000 to 503 000)
Group A[†]	6883 (2693 to 13475)	1067 (763 to 1441)	155 000 (77 000 to 393 000)
Non-U.S.-born	5373 (2138 to 10423)	623 (419 to 891)	116000 (59000 to 285000)
History of homelessness	517 (180 to 1096)	83 (55 to 114)	161 000 (68 000 to 479 000)
History of incarceration	342 (134 to 662)	77 (55 to 104)	227 000 (111 000 to 603 000)
Long-term care	651 (243 to 1280)	283 (199 to 383)	435 000 (205 000 to 1 191 000)
Group B[‡]	326(122 to 682)	72 (48 to 101)	220 000 (101 000 to 638 000)
Close contact	19 (6 to 41)	0.5 (0.3 to 0.8)	26 000 (10 000 to 78 000)
HIV	171 (55 to 369)	7 (3 to 12)	39 000 (15 000 to 114000)
Immunosuppressive medication recipient	124 (35 to 297)	65 (45 to 91)	523 000 (212 000 to 1 986 000)
Organ transplant recipient	14 (3 to 39)	-0.02 (-0.7 to 0.4)	Dominant (Dominant to 118 000)
Group C[§]	2435 (910 to 5099)	788 (542 to 1097)	324 000 (141 000 to 922 000)
Diabetes	1045 (336 to 2233)	435 (303 to 601)	417 000 (180 000 to 1 290 000)
End-stage renal disease	30 (2 to 138)	10 (2 to 34)	340 000 (106 000 to 2 086 000)
Chronic kidney disease	357 (96 to 888)	158 (105 to 222)	443 000 (198 000 to 1 606 000)
Cancer of the head, neck, or blood	536 (144 to 1363)	62 (34 to 97)	115000 (40000 to 469 000)
Gastrectomy	8 (3 to 20)	2 (1 to 3)	238 000 (97 000 to 751 000)
BMI <20 kg/m ²	188 (41 to 497)	77 (47 to 119)	410 000 (137 000 to 1 746 000)
Current smoking	666 (252 to 1344)	181 (125 to 252)	271 000 (120 000 to 784000)

BMI = body mass index; ICER = incremental cost-effectiveness ratio; LTBI = latent tuberculosis infection; QALY = quality-adjusted life-year; UI = uncertainty interval.

* Intervention compared with no LTBI testing and treatment counterfactual. Costs assessed from a societal perspective. Costs and health benefits discounted at 3% per year.

[†] Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7).

[‡] Medicare-eligible persons with 1 of 4 factors that are acknowledged by the USPSTF as conferring risk for either exposure or progression to TB disease but are regularly screened or tested for outside primary care settings.

[§] Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation.

Table 3.

Estimated QALYs Gained, Incremental Costs, and ICERs for an LTBI Testing and Treatment Intervention for Persons Aged 65 Years Newly Eligible for Medicare in 2022 *

Group	QALYs Gained (95% UI)	Incremental Costs (95% UI), 2021 US \$ (millions)	ICER (95% UI), \$/QALY Gained
All groups	1032 (422 to 1992)	112 (76 to 154)	109 000 (49 000 to 285 000)
Group A[†]	790 (314 to 1528)	70 (48 to 98)	89 000 (41 000 to 228 000)
Non-U.S.-born	603 (234 to 1189)	43 (28 to 64)	72 000 (33 000 to 183 000)
History of homelessness	103 (37 to 214)	13 (8 to 18)	126000 (50 000 to 396000)
History of incarceration	40 (15 to 75)	6 (4 to 8)	151 000 (70 000 to 396 000)
Long-term care	44 (17 to 85)	8 (6 to 11)	180 000 (82 000 to 484000)
Group B[‡]	47 (18 to 97)	5 (3 to 8)	113 000 (48 000 to 333 000)
Close contact	2 (0.6 to 4)	0.02 (−0.01 to 0.04)	9000 (Dominant to 51 000)
HIV	29 (9.3 to 64)	0.7 (0.02 to 1)	23 000 (1000 to 76 000)
Immunosuppressive medication recipient	15 (4 to 33)	5 (3 to 7)	321 000 (129 000 to 1 086 000)
Organ transplant recipient	2 (0.4 to 6)	−0.02 (−0.1 to 0.04)	Dominant (Dominant to 76000)
Group C[§]	264 (103 to 523)	49 (33 to 69)	185 000 (79 000 to 513 000)
Diabetes	104 (36 to 210)	25 (17 to 35)	242 000 (100 000 to 713 000)
End-stage renal disease	4 (0.3 to 18)	1 (0.1 to 2)	161 000 (37 000 to 916 000)
Chronic kidney disease	36 (11 to 84)	9 (6 to 13)	251 000 (117 000 to 787 000)
Cancer of the head, neck, or blood	60 (16 to 146)	4 (1 to 7)	63 000 (17 000 to 264 000)
Gastrectomy	1 (0.3 to 2)	0.1 (0.08 to 0.2)	138 000 (52 000 to 434000)
BMI <20 kg/m ²	16 (4 to 42)	3 (2 to 5)	206 000 (69 000 to 859 000)
Current smoking	86 (33 to 167)	15 (10 to 22)	179 000 (75 000 to 511 000)

BMI = body mass index; ICER = incremental cost-effectiveness ratio; LTBI = latent tuberculosis infection; QALY = quality-adjusted life-year; UI = uncertainty interval.

* Intervention compared with no LTBI testing and treatment counterfactual. Costs assessed from a societal perspective. Costs and health benefits discounted at 3% per year.

[†] Medicare-eligible persons with 1 of 4 factors recommended by the U.S. Preventive Services Task Force (USPSTF) for screening and testing in the primary care setting for LTBI (7).

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[§] Medicare-eligible persons with 1 of 7 factors associated with increased risk for TB disease who are not specifically part of the USPSTF screening recommendation.