A systematic review of the number needed to screen to detect a case of active tuberculosis in different risk groups

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Abbreviations and definitions

ACF: active case-finding
AFB: acid-fast bacilli
AIDS: acquired immune deficiency syndrome
ARTI: annual risk of tuberculosis infection
ART/ARV: antiretroviral therapy
Cx: culture
CXR: chest X-ray
ECF: enhanced case-finding
HIV: human immunodeficiency virus
HAART: highly active antiretroviral therapy
ICF: intensified case-finding
IGRA: interferon-gamma release assay
IPT: isoniazid prophylaxis therapy
LTBI: latent tuberculosis infection
MDR: multi-drug resistant tuberculosis
ND: not defined
NS: not specified
NNS: number needed to screen
NS: not specified
RCT: randomized controlled trial
Sm: sputum smear microscopy for AFB
Sx: symptoms
TB: tuberculosis
TST: tuberculin skin test

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Introduction

The WHO official global TB control policy advocates the DOTS strategy, which relies on passive self-presentation for case detection.[1] Despite the successes of DOTS in controlling TB in, some evidence suggests that active case-finding may be a necessary component of TB control in high-prevalence areas, particularly in the setting of HIV.[23] Self-presentation to a health center by symptomatic persons alone may be insufficient to detecting enough cases of TB to make an impact on the epidemic[1]. Although such "passive case-finding" is efficient, as patients who self-present to a health facility are more likely to be symptomatic and detectable, the burden of arriving at a health facility remains with the patient. Obstacles to self-presentation such as distance to the nearest health facility, sex, socioeconomic factors, and age have all been associated with delayed time to diagnosis of TB from onset of symptoms.[4,5] Furthermore, TB-HIV coinfection can alter the typical presentation of TB symptoms; thus coinfected individuals may be less likely to suspect TB and be less likely to self-present to health facilities.[6,7]

In contrast to the passive case-finding strategy, active case-finding (ACF) places the onus of case-finding on the health system, not the patient. There are numerous strategies for active case-finding, ranging from population-wide screening to targeted case-finding in high risk groups such as health care workers, HIV positive individuals, and miners. Another group frequently targeted for screening, particularly in the industrialized world, are contacts of known TB cases, who have an increased risk due to their known exposure. In the United States, for example, contact tracing is standard practice when a case of TB is reported. In contrast, in South Africa, there is no routine contact tracing in households or workplaces, although adults patients are requested to bring young children (< 5 years of age) to the clinic or screening.[8]

ACF has been used extensively in a variety of settings for detecting TB, and this strategy has been demonstrably effective in reducing TB prevalence, incidence, and mortality.[9] Methodologies ranging from total population screening using mobile chest X-ray (CXR) units to symptom screens of HIV patients followed by sputum smear microscopy and sometimes culture have been employed to detect TB. The primary criticism of ACF is that it is resource-intensive, high cost, and there is not a consensus on the most appropriate screening algorithms or the population categories (e.g. risk groups) to prioritize for screening, as well as the frequency of screening. Population-based screens are thought to be extremely expensive and low-yield, while symptom screens may fail to detect TB patients with non-traditional case presentations, as commonly seen in HIV patients. Health systems in low-income countries do not have the budget or the human resources to conduct constant population-wide screens, but the evidence for more targeted ACF methods is inconclusive as to the optimal method, particularly in dual TB/HIV epidemic settings.

A recent review and meta-analysis of contact tracing studies conducted in low-income countries found an overall prevalence of active TB disease in 5% of contacts of known cases using a clinical case-definition for TB, and half as much when bacteriologic confirmation was required.[10] Even this more restrictive case definition is a prevalence

more than twice as much as the background prevalence in South Africa, one of the highest-burden countries in the world. This further suggests that household-based ACF may be a higher-yield intervention than population-based.

Little is known about the programmatic efficacy of ACF in the context of widespread background HIV prevalence. In the review of household contact studies, only 4 papers had any data on the HIV status of the index TB case, and none had data on the HIV status of the contacts. There is an ongoing debate about the efficacy and, importantly, the cost-effectiveness of ACF in high HIV prevalence settings. Current large-scale studies (eg ZAMSTAR[11]) are seeking to determine this, but results may be context-dependent. To date, little formal cost-effectiveness analysis has been done to assess ACF and although models have been proposed, data from actual interventions remains limited.

There is increasing realization that addressing the current TB case-finding deficit will require introduction of ACF and enhanced case-finding (ECF) strategies. The WHO has made intensified (active) case-finding among HIV-infected individuals one of the pillars of the 3I's policy for TB/HIV, which recommends that all HIV-infected individuals be screened for TB (*intensified case-finding (ICF)*), provided with *isoniazid prophylaxis therapy* (IPT) if they do not have active TB, and the introduction of *infection control* measures in settings where there is a risk for exposure to TB.[12] Besides HIV-infected people, other populations are likely to require more aggressive case-finding to reduce TB incidence. For example, HIV positive individuals who do not know their status will not benefit from 3I's-driven ACF, though they remain at high risk.

This systematic review was undertaken to evaluate and synthesize the existing body of evidence that has been collected about ACF to assess the number of people needed to screen in order to detect one case of active TB. Specifically, it sought to answer the following questions:

1) What is the average number of people needed to screen (NNS) in order to detect one case of active TB?
2) How do population characteristics affect the NNS?
3) How does the underlying prevalence of TB and/or HIV affect the NNS
4) How do different screening tools and strategies affect the NNS

This review updates and extends the 2005 systematic review of active case-finding by Golub et al.[9], with particular attention to an understanding how population, location, and screening strategy interact.

New advances in TB diagnostic tools also require a comprehensive understanding of how, where, and in what populations ACF can be beneficial to a TB program. The WHO recently approved the GeneXpert MDR/RIF rapid platform-based diagnostic tool for TB detection, and it is already clear that it performs well under trial conditions in high-risk populations such as HIV-infected people and prisoners.[12] Understanding the landscape of ACF strategies will be critical when considering how best to utilize this and other new tools as they become available.

We conducted a comprehensive, systematic review of the literature addressing ACF for TB in the global context. We discuss the evidence for the use of ACF in specific populations, the resources that are required for ACF, and conclude with recommendations about what populations may benefit most from which ACF approaches, as well as identify priorities for future research.

Methods

Selection of papers and abstracts to include

We searched online databases PubMed, EMBASE, and SCOPUS from 1980-2010 to identify titles and abstracts of peer-reviewed papers that met criteria for initial review. Due to the lack of standardization of terminology historically used to describe active case-finding, search terms were broad and intended to maximize sensitivity of the search to relevant papers. Search terms included combinations of "tuberculosis," "TB," "consumption," "phthisis," with "active case-finding," "intensified case-finding," "mass chest X-ray," "chest radiography," "contact screening," "contact examination," "prevalence survey," and "screening," among other terms. A complete list of search terms for each database can be found in Appendix A.

Titles and abstracts identified by the search terms were entered into a database, duplicates were eliminated, and remaining entries were independently screened by two readers for inclusion in the next stage of review. Discrepancies were resolved by consensus and/or consultation with a third reader. Initial review criteria were very broad and required only that the publication be original research (ie not a review, commentary, or author reply letter); titles, abstracts, or key words suggest that active case-finding took place. Titles and abstracts were included for further review if a determination could not be made at this stage. We excluded studies that screened only for TB infection, not active TB, such as annual risk of TB infection (ARTI) studies and TB screening prior to TNF-α inhibitor prescription. Papers and abstracts in English, Spanish, French, Russian, and Japanese were accepted; other languages were excluded due to lack of language capacity to evaluate these publications.

In addition to online databases, abstracts from 2008-2010 of the conferences of the International AIDS Society (AIDS/IAS), the International Union Against Tuberculosis and Lung Diseases, and the American Thoracic Society were searched to identify the most recent research conducted on active case-finding strategies. Search terms differed slightly among the three conferences and included "tuberculosis;" "TB;" "case-finding;" "contact tracing;" and "active." A complete list of search terms for conference abstracts can be found in Appendix B. Inclusion criteria for abstracts identified by these search terms were: 1. One or more active case-finding strategies was undertaken in the study; 2. The number of people screened was reported; 3. The number of cases of active TB detected using active case-finding was reported.

Review process & data abstraction

The review process at each stage is outlined in Figure 1. PDFs were obtained of all available papers eligible for full review. A single reader determined eligibility for final inclusion using the inclusion criteria: 1. The paper was an original research contribution and not a review, commentary, or other non-original piece; 2. Active case-finding was conducted on all or some of the study population; and 3. The prevalence or incidence of active TB cases detected through active case-finding was reported. Papers not meeting these criteria were rejected at this stage and the reason for rejection recorded in the study database. Papers for which it was not clear from the abstract whether active case-finding or passive case-finding only was conducted were reviewed in full to determine this. Duplicate publications or publications reporting data that had already been described in a previous study were discarded. Peer-reviewed publications were given priority over conference abstracts if the publication included the data presented in the abstract.

Study characteristics and results were abstracted from each included paper and entered into a database according to a standardized protocol. Abstracted data included study design, demographic information about the study population, active case-finding strategy, case definition for TB, and outcome. If multiple populations or risk groups were screened separately but reported in a single publication, each population was abstracted separately.

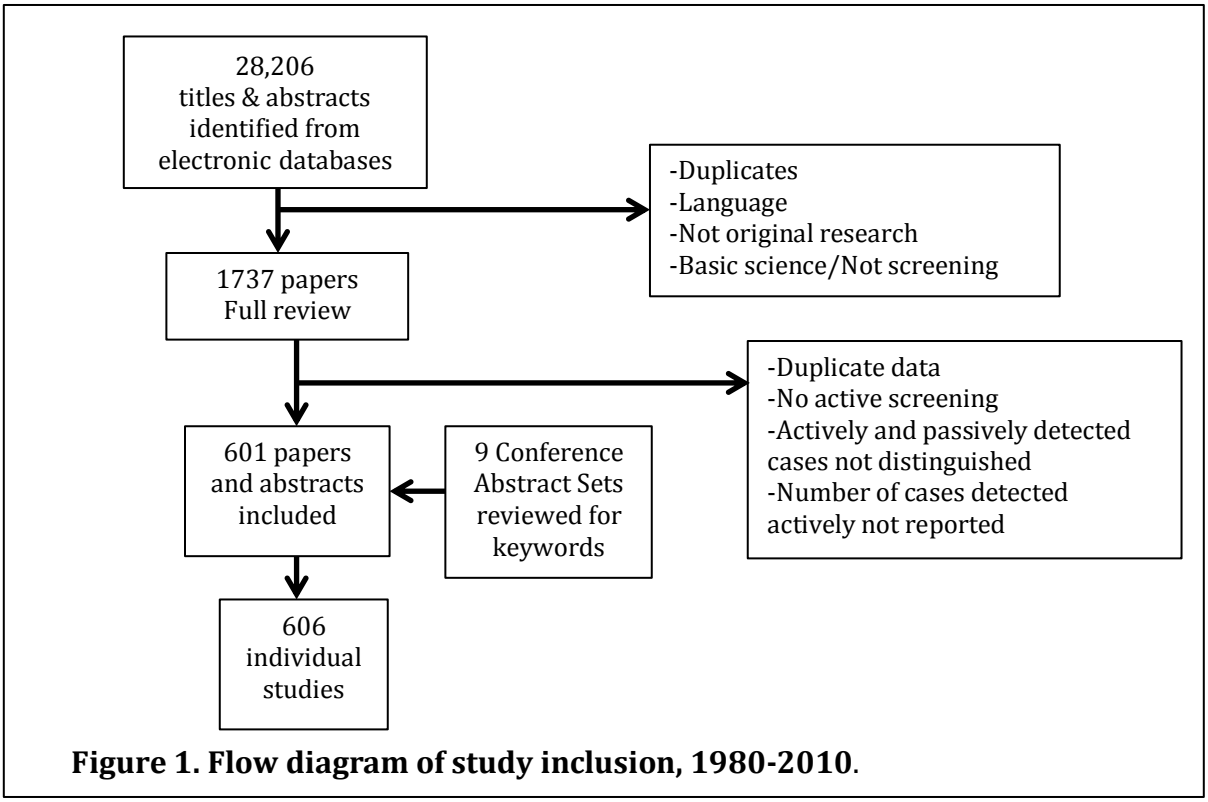

Figure 1. Flow diagram of study inclusion, 1980-2010.

Definitions

The *study population* was defined as the number of people screened for TB, according to individual study criteria, regardless of the availability of results. If the number of people screened for whom results were available was the only number reported, that number was taken as the study population.

Active TB was defined as any diagnosis of tuberculosis disease. Diagnostic criteria varied across included studies. Any case of active TB defined as such within a given study was included as a case.

In this review, a strategy was considered to be "*primary screening*" if it applied to all of the study population, and "*secondary screening*" if only a subset of the studied population received it. The diagnostic criteria used to make a final determination of what constituted a case of TB in a given study was also described separately. Data on both primary and secondary screening strategies were abstracted if available. For example, a study that screened a population with TST and then followed up positive TSTs with a chest X-ray would be classified as using TST as a primary screen and a chest X-ray as a secondary screen. If diagnosis was made on the basis of chest X-ray, chest X-ray would also be the diagnostic approach. A study that reported screening all participants for a symptom history and diagnosing TB using a combination of TB culture, radiological, and clinical criteria would have "symptom screen" as a primary screen, no secondary screen, and diagnostic criteria including culture, X-ray, and clinical criteria. For studies that did not describe specific diagnostic criteria, all screening criteria were included as diagnostic criteria.

Papers that reported TB cases identified through both active and passive case-finding were included if the active and passive case-finding results could be disaggregated; for these papers the subset of the study population that was actively screened was treated as the study population for purposes of data abstraction. Only actively-detected TB was counted as a case found; if a case of TB was detected by the study which had previously been detected through passive case-finding (e.g. the person was already on treatment), this case was *not* counted as a case of TB detected by active case-finding.

Papers were not included if the study population was pre-screened (e.g. for TB symptoms) unless the source population size was also reported. For example, a study that conducted active case-finding in 100 HIV patients reporting cough > 2 weeks would not be included unless the total population size of HIV patients screened in order to find the 100 coughers was also reported. The minimum dataset required for inclusion in the database were the number of people screened and the number of active TB cases detected actively, or the incidence of active TB detected by ACF.

Data analysis

The primary outcome of interest in this review was the number of persons required to be screened in order to detect a single case of active TB (number needed to screen, or NNS). For each individual study, this was computed indirectly as the inverse of the prevalence of TB detected through direct screening. Due to substantial known heterogeneity between studies in terms of population composition, screening and diagnostic approaches, background prevalence of TB, HIV, and other risk factors, it was not possible to calculate meaningful aggregate estimates of NNS across all studies. Studies were stratified according to a number of these features in an effort to create more homogenous subgroups for analysis.

NNS Calculations

We report individual study NNSes as well as crude medians and weighted mean NNS values, along with ranges and interquartile ranges (IQR). Crude median NNS values were calculated by taking the inverse of the median of the prevalences detected in the individual studies. Weighted mean NNS values were calculated by first taking a weighted average of the prevalence detected in each individual study, weighted by study population size, and then calculating the inverse. A study which detected no TB cases had an undefined NNS (i.e. resulting in an infinite calculated NNS due to dividing by zero). However, studies that detected no TB cases did contribute to the summary estimates since summary estimates were calculated from prevalences before inverting the value to generate the NNS. Ranges report the highest defined NNS value and indicate where the upper range is undefined due to a study detecting zero cases. IQRs were calculated by taking the inverse of the quartiles of the yield. Where there were multiple studies in a category that detected zero cases of TB, these zero values may result in undefined quartile values. All NNS calculations were rounded up to the nearest integer value in order to better represent the concept of number of individuals needed to screen.

Sensitivity analysis

Sensitivity analyses were conducted for each risk group or each incidence stratum within a risk group in order to identify single studies whose yield of active TB detected heavily influenced the weighted mean NNS. The Stata meta-analysis command "metainf" was used to sequentially remove each study in a set and calculate the weighted average yield (prevalence) without that study using random-effects meta-analysis. Yields were log-transformed prior to these calculations in order to achieve normally distributed data. The standard error for the prevalence in each study were calculated by the formula $\sqrt{(p * (1-p) / N)}$. Where study prevalence was zero, the Agresti-Coull estimator was used for the standard error.[13] Logarithms of yields of zero were calculated by adding 0.5 to the numerator and denominator, by convention. Studies whose absence moved the weighted mean yield outside of the confidence interval of the average yield calculated by including all studies were defined as being significant outliers. Individual studies whose absence resulted in a marked shift of the mean (identified by visual inspection of the graphical output) while remaining within the confidence bounds were defined as outliers which

influenced the mean. Weighted NNSes calculated from the inverse of the mean yield excluding these outliers are reported as well. Statistical calculations were conducted in Stata 9.0 (College Station, TX).

Further sensitivity analyses were conducted by restricting NNS calculations to the subset of studies that reported bacteriologic criteria (sputum smear or culture) as components of the diagnostic algorithm. Studies that did not include bacteriologic criteria or did not state the criteria used were not included in this subset analysis.

A small number of studies could be included in multiple risk groups (e.g. both HIV-infected and drug users). These studies thus contributed to multiple NNS calculations.

HIV infection was the most commonly identified co-risk in the risk groups evaluated for this study. For the purposes of this review, a study population was considered as part of the HIV-infected risk group if the study population was explicitly identified as an HIV-infected population (100% HIV-infected), or if the study evaluated the HIV status of participants and found >75% of participants to be HIV-infected.

Because the underlying incidence of TB affects the yield of each screening approach in different settings, results have been divided into four categories based on the 2010 country-level incidence of TB (WHO, 2010):

1. **Low incidence: less than 30 per 100,000.**
2. **Moderate incidence: 30-100 per 100,000.**
3. **Medium incidence: 100-300 per 100,000.**
4. **High incidence: >300 per 100,000.**

Results

We included 601 papers and abstracts in the final analysis, which are summerised in Table 1. From these papers, we identified 26 risk categories and settings. For each category, we stratified the analyses by background TB incidence in the country of the study. Details for each category are provided in Tables 2-26 in Annex C.

Eighty-four countries were represented in this set of studies. Major sources of variability in the studies included for each category include the size of the population screened, screening and diagnostic tools available, screening algorithms used, Xray technology available, the diagnostic criteria used, and the age groups screened in each group. Other sources of variability within the studies in each category are described in the individual sections.

Table 1. Mean number needed to screen (NNS) to find one case of TB in select risk categories; all screening approaches are aggregated within risk group. ND=not defined. *Upper range of NNS not defined due to presence of a study that found zero cases of TB. Highest defined NNS reported as upper limit of range.

Pop'n Screened/ Study Type (# studies)	**Median NNS (IQR) Weighted Mean NNS (Range) (# studies)**			
	Low Incidence	Moderate Incidence	Medium Incidence	High Incidence
General Inpatient (N=4)	-	-	9 (7-23) 795 (6-3364) (N=4)	
General Outpatient (N=14)	441 (130-628) 758 (42 – 30000) (N=6)		224 (54-281) 269 (19-806) (N=8)	
VCT (N=5)	-		21 (18-23) 37 (8-120) (N=5)	
Vaccine Trial (N=3)	-	-	22 (7-343) 140 (7-343) (N=3)	-
Community/ Pop'n wide (N=98)	2314 (676-ND) 3922 (137-30865*) (N=20)	273 (55-713) 669 (15-5594) (N=9)	305 (138-773) 603 (25-4286) (N=51)	89 (32-152) 100 (16-6355) (N=18)
HIV clinic/cohort (N=74)	25 (11-144) 30 (8-391*) (N=8)	31 (23-45) 61 (5-316) (N=6)	15 (7-32) 13 (2-120*) (N=40)	10 (5-22) 10 (3-64) (N=20)
Pregnancy (N=9)	1457 (208-3848) 536 (88-3843*) (N=5)	-	37 (27-70) 36 (25-143) (N=4)	
Diabetes (N=6)	-	2223 (-) (N=1)	37 (25-38) 35 (17-54) (N=5)	
Drug users (N=8)	252 (149-ND) 158 (108-252*) (N=5)	5 (-) (N=1)	11 (8-20) 20 (8-20) (N=2)	-
Prisons (N=44)	520 (69-1676) 1180 (4-2945*) (N=18)	45 (34-82) 155 (19-191) (N=10)	43 (21-123) 110 (7-2762) (N=16)	
Homeless (N=18)	83 (38-196) 133 (22-1778) (N=18)	-	-	-
Immigration/ Refugee/Border (N=38)	136 (58-427) 108 (6-1630*) (N=32)		156 (78-165) 120 (57-291) (N=6)	

Continued

Table 1. Continued.

Pop'n Screened/ Study Type	Crude Median NNS (IQR) Weighted Mean NNS (Range) (# studies)			
	Low Incidence	Moderate Incidence	Medium Incidence	High Incidence
Occupational—Miners (N=8)	48 (-) (N=1)	154 (-) (N=1)	-	41 (26-49) 36 (21-93) (N=6)
Occupational—Military (N=6)	261 (153-984) 1159 (134-492*) (N=4)	-	138 (73-1440) 1280 (73-1440) (N=2)	-
Occupational—Health Care (N=16)	ND (4222-ND) 1613 (30-5550*) (N=12)		393 (46-1684) 506 (25-842*) (N=4)	-
Occupational –Other (N=14)	764 (96-3406) 1565 (47-5235*) (N=9)	-	104 (52-160) 109 (4-778) (N=5)	-
Contact tracing—Household (N=89)	63 (33-300) 54 (5-430*) (N=28)	40 (21-69) 40 (7-355*) (N=16)	33 (8-79) 25 (3-568*) (N=32)	14 (9-22) 17 (2-129) (N=13)
Contact tracing—Community (N=78)	107 (39-447) 104 (3-4200*) (N=73)	56 (50-107) 85 (6-137) (N=5)	-	
Contact tracing—Health Care (N=17)	ND (445-ND) 276 (7-223*) (N=16)	25 (-) (N=1)	-	-
Contact tracing—Other (N=4)	ND (*) (N=3)	-	198 (-) (N=1)	-
Elder/Nursing homes (N=7)	273 (84-ND) 120 (68-137*) (N=6)		-	7 (-) (N=1)
Psychiatric Facilities (N=3)	62 (32-1275) 1049 (32-1275) (N=2)		111 (-) (N=1)	-
Immigrants (N=26)	203 (60-2524) 235 (3-1262*) (N=24)	-	384 (198-6250) 1206 (198-6250) (N=2)	-
Other disease risks (N=6)	2846 (268-ND) 290 (10-2846*) (N=5)	-	4 (-) (N=1)	-
Gynecology clinics (N=5)	18 (-) (N=1)	-	10 (6-30) 13 (5-38) (N=4)	
Other/multiple risk groups (N=4)	97 (66-140) 107 (54-177) (N=4)	-	-	-
Other institutional settings (N=6)	673 (80-1475) 810 (13-1475*) (N=5)		45 (-) (N=1)	-

Findings from Select Risk Groups

Values presented are weighted means (ranges) unless otherwise stated.

HIV/AIDS (Table 2, annex C)

The risk of TB is high in HIV-infected persons, and screening for TB in HIV is recommended at the time of diagnosis and periodically thereafter. A total of 63 papers were included reporting active case-finding in populations consisting entirely of persons infected with HIV. The median NNS across this set of studies was 12 (IQR 7-34) Weighted mean NNS across all studies of persons with HIV was 13 (2-391). Eleven additional studies that included study populations with a primary risk group other than HIV, but with a reported HIV prevalence >75% in the study population, had a median NNS of 22 (IQR 8-47) and weighted mean of 23 (5-88). In total, 74 studies reported the number of active TB cases found among high-HIV prevalence populations screened. For this group of studies, the mean weighted NNS=13 (2-391) across all background incidence levels. The median NNS was 15 (IQR 7-34). In low and moderate countries, studies that used a **primary screen** consisting of **only a symptom screen** had a weighted **mean NNS=39**, compared to a weighted **mean NNS=60** in studies that screened using anything other than symptom screen alone. In medium and high incidence countries, studies with a primary screen consisting of **only a symptom screen** had a weighted mean **NNS of 41**, compared to any **other primary screen** with **NNS=10**. In medium and high incidence countries, studies that used a **primary or secondary screen including chest X-ray** had a **mean NNS=8,** compared to **NNS=23** in studies that did not use chest X-ray as part of the screening. In medium and high incidence countries, studies that used **TB culture in the diagnosis** had a mean **NNS=3**, compared to **NNS=26** in studies that did not use TB culture in the diagnosis.

Sensitivity Analyses
In no incidence setting did a single study significantly affect the weighted mean NNS. In low-incidence settings, removing the two studies with the largest effect on the weighted mean NNS had the effect of shifting the weighted mean NNS from 30 to 19. In moderate-incidence settings, the weighted mean NNS calculated without the study with the largest effect resulted in a shift from 61 to 35. In medium-incidence settings, the weighted mean NNS shifted from 13 to 26 after omitting the study with the largest effect. In high-incidence settings, the mean shifted from 10 to 7 when the two most influential studies were omitted. Restricting studies to those with bacteriologic confirmation of TB disease resulted in slight variation in the mean NNS, but not consistently higher or lower. The overall weighted mean NNS was 8 when limited to studies with bacteriologic confirmation. In low-incidence settings, NNS was 54; moderate incidence, NNS was 35, medium incidence, NNS was 7, and high incidence, NNS was 9 with bacteriologic confirmation.

Voluntary Counseling and Testing (Table 3)
The population of persons attending VCT centers for HIV testing is enriched for HIV-infected persons, and VCT attendees may also be at higher risk for TB than the general

population. Not all persons attending VCT are HIV-infected, so this is a separate category from the "HIV clinic/cohort" category. ACF conducted in VCT settings was only reported in medium and high TB incidence countries (total N=5), screening a total of 19, 513 persons. The overall weighted mean NNS in VCT settings was 37 (range 8-120). The median NNS was 21 (IQR 18-23). In studies that used **only a symptom screen** to screen VCT clients for TB, the mean **NNS was 42 (23-120),** compared to **18 (8-21)** in studies that used other screening approaches (including smear). Studies that used **TB culture in the diagnosis** of VCT clients screened for TB had a mean NNS of 20 (18-21) compared to those that did not use culture, NNS=40 (8-120). Restricting studies to those with bacteriologic confirmation only marginally affected the weighted mean yield, increasing NNS to 38 from 37. Omitting the most influential study resulted in a mean NNS of 38.

Community-wide/Population-Wide Surveys (Table 4)

This category includes all ACF activities that have screened an unselected (or randomly sampled) population. Study types include national and regional prevalence surveys (including door-to-door surveys) and mass chest X-ray campaigns. School-wide/university-wide surveys were also included in this category. Additional sources of variability in these studies include: a) Completeness of coverage in the communities screened; b) age groups screened in the communities. A total of 98 studies were included, for which the median NNS was 305 (IQR 115-1250). The overall weighted mean NNS for community-wide screens is: **566 (15-30,865*).** Six of 98 studies detected zero cases of TB. The mean NNSes by incidence category can be found in Table 1. In medium and high incidence countries, studies that used a **primary screen** consisting of **only a symptom screen** had a **mean NNS=447 (16-6355)**, compared to an **NNS=525 (24-3189)** in studies that screened using anything other than symptom screen alone. In medium and high incidence countries, studies that used a **primary or secondary screen including chest X-ray** had a **mean NNS=577 (16-3189)**, compared to **NNS=374 (25-6355)** in studies that did not use chest X-ray as part of the screening. In medium and high incidence countries, studies that used **TB culture in the diagnosis** had a mean **NNS=267 (16-6355)**, compared to **NNS=953 (25-4286)** in studies that did not use TB culture in the diagnosis.

Sensitivity Analyses:
Restricting studies to those with bacteriologic criteria for diagnosis resulted in a similar median NNS (271 (IQR 113-936)) and a reduced weighted mean NNS (376 (25-4286)) in medium incidence countries. All studies in moderate and high incidence categories had studies using bacteriologic diagnoses. In low and moderate incidence countries, no single study significantly affected the NNS. Omitting the most influential study resulted in a weighted mean NNS of 3530 for low incidence settings. In moderate-incidence countries, omitting the most influential study resulted in a mean NNS of 184. One study dominated the NNS in medium-incidence countries; omitting this study from the estimate resulted in a weighted mean NNS of 418. In high-incidence countries, omitting the most influential study gave a mean NNS of 84.

Household Contact-Tracing (Table 5)
Household contact-tracing is defined as active case-finding that takes place among household contacts of a known case of active TB (index case). Sources of variability in these studies include: a) how households were defined; b) whether both adult and child contacts were included c) how soon after identification of the index case the household contacts were screened. A total of 89 household contact-tracing studies were included. The median **NNS: 36 (IQR 14-109)** and the weighted mean NNS was 40 (2-568*). (See Table 1 for NNS stratified by background TB incidence). In medium and high incidence countries, studies that used a **primary screen** consisting of **only a symptom screen** had a **mean NNS=64 (20-568)**, compared to an **NNS=18 (2-165)** in studies that screened using anything other than symptom screen alone. In medium and high incidence countries, studies that used a **primary or secondary screen including chest X-ray** had a **mean NNS=17 (2-155)**, compared to **NNS=54** (5-568) in studies that did not use chest X-ray as part of the screening. Across **all incidence categories**, studies with chest X-ray in the primary screen had a mean NNS of 39 (2-355), compared to NNS= 48 (5-568) in studies with no screening chest X-ray. In medium and high incidence countries, studies that used **TB culture in the diagnosis** had a mean **NNS=35 (7-305)**, compared to **NNS= 25 (2-568)** in studies that did not use TB culture in the diagnosis. Including **all incidence categories**, studies with TB culture used for diagnosis had a mean NNS= 40 (5-327) with NNS also 40 (2-568) in studies not using TB culture in the diagnosis.

Community Contact-Tracing (Table 6)
Studies that include greater community contact-tracing, for example workplace or school contacts. These studies may also include household contacts, but describe TB evaluation of contacts outside the immediate household setting. Most studies included used a "widening ring" approach, in which close contacts were screened first, and then increasingly distant contacts (e.g. casual contact, low proximity contact, low time-exposure contacts) screened as contacts in more proximal rings tested positive. Major sources of variability in these studies include the degree of coverage of contacts screened and the relative closeness of contacts included in screening. 78 out of 79 studies of community contact-tracing were conducted in high (N=73) and moderate (N=5) incidence countries. Five studies did not detect any TB among contacts. The **overall weighted mean NNS** in community contact screening is **104 (3-4200*).** The median NNS is 106 (IQR 39-346). In low and moderate incidence countries, nearly all studies (74/78) used TST in the screening approach. Studies that used **TST alone as the primary screen** had a mean **NNS of 87 (6-4200**), whereas studies that used **both TST and CXR** in the primary screen had a mean **NNS of 64 (3-583).**

Sensitivity Analyses
In low incidence settings, studies using bacteriologic confirmation had a similar mean NNS of 107 compared to all studies (NNS 104). No single study significantly affected the weighted mean. Omitting the two studies with the largest influence on the weighted mean resulted in a weighted mean NNS of 99. In moderate-incidence settings, all studies used bacteriologic confirmation and no single study had a notable influence on the weighted mean.

Health Care Contact-Tracing (Table 7)
Studies that conduct contact-tracing in health-care settings, typically after health care workers or patients have been exposed to a patient discovered to have active TB. These studies may also include family or household contacts, but the primary population screened are health care workers and patient contacts. All but one study was conducted in a low-incidence country. All studies in low-incidence countries included TST in the primary screen. The **overall median NNS** for this setting was **undefined (222-ND) due to the large number of studies detecting zero cases. The weighted mean NNS was 96 (7-223*).** Twelve studies (all in low-incidence countries) detected zero cases of active TB among health-care contacts screened. Among studies in low-incidence countries **using CXR in the primary screen**, NNS was **208 (7-223),** compared to the one study **not using CXR** in the primary screen, with **NNS=1806 (88-ND*). Culture as a component of the diagnosis** was associated with an **NNS of 380** (88-223*), compared to **NNS=254 (7-22*)** for studies **not employing culture** in the diagnosis.

Sensitivity analysis
Restricting to studies which specified bacteriologic confirmation resulted in a weighted mean NNS of 47. No single study significantly affected the overall mean NNS. Omitting the two studies with the greatest influence resulted in mean NNSes of 214 and 207, respectively, and omitting both resulted in a mean NNS of 145.

Other contact-tracing settings
Four additional studies reported contact-tracing among contacts of active TB cases in settings other than household, community, and health care. Three of the studies were outbreak investigations in military settings, including one on an aircraft carrier, and one was a contact-tracing study after exposures on commercial airplanes. Three did not detect any additional cases of active TB through screening. The NNS in the one study that found additional cases was 198, which was in a Taiwanese military setting.

Pregnancy (Table 8a) & Gynecologic clinic settings (Table 8b)
Studies include screening pregnant women attending antenatal clinics, pregnant women receiving prevention-of-mother-to-child-transmission (PMTCT) care for HIV prevention, and women presenting for delivery. Nine studies were found which screened pregnant women. Among pregnant women screened, the overall **median NNS was 144 (IQR 47-1457)** and the **weighted mean was 169 (25-3847)** (see Table 1 for NNS stratified by background TB incidence). One study did not detect any cases of active TB through active screening. All but one study in medium and high incidence countries used TB culture as a component of the diagnosis. Studies conducted in low-incidence countries tended to screen otherwise high-risk populations, including high proportions of women who were immigrants from high-incidence countries[14,15],[16] and poor urban women[16,17]. Of note, in four of the 9 studies, (one in the United States, one in India and two in South Africa) screening was conducted in HIV-infected women only. The weighted mean NNS among studies (N=4) focusing on **pregnant women with HIV** in medium & high incidence countries was **36 (25-88).** In medium and high-incidence countries, studies **using CXR in either screening step** found **NNS=34 (25-143)**, compared to studies **not using CXR in**

the screening steps, with **NNS=47 (-)**. Studies using culture in the diagnosis had an NNS of **32 (25-47)** vs. **143** in the study not using culture in the diagnosis.

Sensitivity analyses
No single study significantly affected the overall weighted mean. Omitting the study with the greatest influence resulted in an overall weighted mean NNS of 111. Restricting to studies with bacteriological confirmation of disease resulted in a weighted mean NNS of 75.

A total of 4 studies screened 1689 women attending gynecology and infertility clinics for TB. The median NNS was 18 (IQR 6-24) and the overall weighted mean NNS was 14 (5-38).

Sensitivity analyses
No single study significantly affected the overall NNS. Omitting the study with the largest influence resulted in a weighted mean NNS of 11. Restricting to studies with bacteriologic confirmation resulted in a mean NNS of 13.

Drug Users (Table 9)
Studies that screen drug users, some of which include and heavy alcohol users and alcoholics. The majority (N=7 out of 8) studies in this group describe those who primarily use illegal drugs, although there is overlap between this population and heavy drinkers of alcohol. One study[18] reported TB screening among a population of both drug and alcohol users. Major sources of variability include the kinds of drugs used, whether study participants were identified from treatment programs or not, and other major comorbidities (including HIV) that may affect the TB risk of study participants. The **overall median crude NNS was 126 (IQR 11-503).** The **weighted mean NNS was 34 (5-252*).** Two studies found zero cases of TB among persons actively screened. Studies that used **TST as the initial screen** found a mean **NNS of 150 (108-150*)**, compared to studies that did not use TST as the initial screen, with NNS 21 (5-252). Studies that obtained a **chest Xray on all participants** had a mean **NNS of 54 (5-108)**. Studies that used **culture in the diagnosis** of TB had a mean **NNS of 103, range (5-150*))**, vs. studies that **did not use culture (NNS=22, range (8-252*))**.

Sensitivity analysis
No single study significantly affected the overall mean NNS. Omitting the most influential study resulted in a weighted mean NNS of 27. Restricting calculations to studies with bacteriologic confirmation resulted in a weighted mean NNS of 85 (5-252*)

Homeless populations (Table 10)
All studies in homeless populations took place in low-TB-incidence countries. The **crude median NNS was 83 (IQR 38-196)**, and the **overall mean NNS: 133 (22-1778),** screening a total of 76,607 people. In studies that used a **primary screen** of **chest Xray alone**, the mean **NNS=67 (33-1778)**, those that used chest Xray among other screening tools in the primary screen had a mean NNS of 70 (33-1778), and those that did not use chest Xray at all in the primary screen had a mean NNS of 455 (22-590). Studies that used a **primary screen of TST alone** had **NNS=504 (310-510)**, those included TST in the

primary screen had a mean NNS of 369 (22-590), and those that did not include TST in the primary screen had a mean NNS of 67 (33-1778).

Sensitivity analysis
No single study had a significant effect on the overall weighted mean. Omitting the most influential study resulted in a mean weighted NNS of 86. Restricting studies to those with bacteriologic confirmation shifted the mean weighted NNS to 113.

General Outpatient/Emergency (Table 11)
This section includes 14 studies that report screening patients presenting to outpatient facilities or emergency rooms with undifferentiated complaints. The **median NNS for this category is 246 (IQR 58-573)**, representing the screening of 401,034 individuals. The **mean weighted NNS is 325 (19-30,000).** In studies taking place in **high and medium-incidence** countries, studies using **symptom screen only** had a mean **NNS of 321 (208-806)** compared to those using an **initial screen other than symptoms** alone: **NNS= 51 (19-58).** In **low and moderate-incidence countries**, using **symptom screen alone** had an **NNS of 3274 (130-30,000)**, compared to studies using any other initial screening approach, **NNS= 364 (42-628)**. Including **chest X-ray in the primary or secondary screen** (high and medium-incidence countries) resulted in an **NNS= 634 (19-806),** compared to **studies not including chest X-ray in the screening**, with **NNS= 217 (51-322). Across all incidence groups**, using chest X-ray alone for the primary screen had an **NNS of 42 (-),** compared to **any other primary screen: NNS 329 (19-30,000).**

Sensitivity Analysis
A single study dominated the NNS for low and moderate incidence countries. Omitting this study resulted in a weighted mean NNS of 334. No single study significantly affected the mean yield and NNS in medium and high incidence countries.

General Inpatient (Table 12)
Studies included in this category report on screens of hospital inpatients without specific risk factors for TB. The crude median NNS for general inpatients is 9 (IQR 7-23). The **overall mean NNS** for screening hospital inpatients was **794 (6-3364).** All included studies used either chest Xray or symptoms alone as the primary screen.

Sensitivity analysis
One study significantly affected the overall mean NNS. Omitting this study (a study that screened nearly a thousand times as many patients as any of the others) resulted in a weighted mean NNS of 7. Restricting studies to those using bacteriologic confirmation resulted in a weighted mean NNS of 795.

Prisons (Table 13)

This category includes both outbreak investigations in prisons after identification of a known TB patient as well as routine intake screening for TB at entry to jail or prison. **The overall mean NNS for prisons** was **75 (IQR 27-520**), representing 1,111,628 individuals screened. The **weighted mean NNS** for prisons was **316 (4-2945*)**. Two

studies conducted in USA prisons found no cases of TB in 14,891 inmates screened. In **low and moderate-incidence** countries, **screening with TST alone** yielded an **NNS=1091 (4-2571)** and screening with **chest X-ray alone had an NNS=1709 1364-2945)**. Combining **symptom screen and chest X-ray in the primary screen had an NNS of 162 (19-562)**, and combining **symptoms and TST in the primary screen had an NNS of 557 (4-2945)**. In **medium and high-incidence countries**, a **primary screen of symptoms alone** had an **NNS of 169 (25-2762)** compared to any **other primary screening approach NNS 63 (7-586).** In **medium and high-incidence countries**, using **culture in the diagnosis** had an **NNS of 75 (17-586)** compared to **not using culture** in the diagnosis: **NNS = 175 (7-2762).** Across **all incidence categories**: **TST included in primary** screen had an **NNS of 859 (4-2751)** vs **TST not in primary screen (NNS 231 (7-2945)).** In **all incidence categories**, when **sputum smear was included in the primary or secondary screen**, the **NNS was 108 (7-2762)**, compared to when **sputum smear was not included in the screening, NNS 316 (4-2945).**

Sensitivity analysis
Restricting analysis to studies that used bacteriological confirmation of TB resulted in a crude mean of 55 (IQR 26-206) and weighted mean NNS of 260 (4-2945). No single study significantly affected the overall weighted mean. Omitting the study with the largest influence on the weighted mean resulted in a weighted mean NNS of 230. Among low-incidence countries, no single study affected the weighted mean. Omitting the most influential study in low-income studies results in a weighted mean NNS of 1161. Omitting the most influential study in moderate-incidence settings yields a mean NNS of 35. In medium and high incidence countries, the mean NNS calculated without the most influential study was 60.

Immigration/Refugees/Border (Table 14)
This category contains studies of active case-finding occurring at the time of immigration (such as visa application) or border-crossing into the destination country. The majority of these studies report screening of immigrants or refugees coming from a high-incidence country to a low-incidence country. Several papers report screening of refugees housed in refugee camps. The **overall median NNS** of immigration screening is **156 (66-320).** The **weighted mean NNS was 108 (6-1630),** representing 3,429,573 individuals screened in 38 studies. Two studies found zero cases of TB. Studies that reported screening using TST but not CXR in the primary screen had an NNS of 206 (79-1112). Studies using chest Xray but not TST in the primary screen had an NNS of 108 (31-875). Studies using both CXR and TST in the primary screen had an NNS of 100 (6-1630). Studies including sputum smear as a component of either the primary or secondary screen had an NNS of 103 (6-242), compared to studies that did not include smear in either screening step (NNS=244 (15-1630)).

Sensitivity analysis
Restricting studies to those using bacteriologic confirmation resulted in an overall crude median NNS of 124 (31-427) and a weighted mean NNS of 107. No single study significantly affected the weighted mean NNS in low and moderate incidence countries.

Omitting the study with the most influence on the weighted mean NNS resulted in an NNS of 186.

Immigrant communities (Table 15)
This risk category represents studies that screen expatriate immigrant communities. The majority of these studies screen immigrants from high-incidence TB countries living in low-incidence TB countries. The overall **crude median** was **211 (IQR 61-6250).** The **overall weighted mean NNS=160 (3-6250)** resulted from a combined total of 60,447 screened in 26 studies. Six studies detected zero cases of TB. Studies using **TST in the primary screen** and not chest Xray had an **NNS of 459 (37-1262).** The NNS of studies using **chest Xray** but not TST in the primary screen was **744 (253-1137)**. The NNS in studies using **both TST and chest Xray** in the primary screen was **57 (3-308).** Among studies that included a **symptom screen** in the primary screen, the **NNS was 246 (25-6250)**, compared to **NNS=265 (3-1137)** among studies **not including a symptom screen in the primary screen**.

Sensitivity analysis
Restricting analysis to studies using bacteriologic confirmation results in a crude overall median NNS of 253 (IQR 136-6250) and a weighted overall mean NNS of 447 (25-6250). In low-incidence settings, no single study significantly affected the overall mean NNS. Without the most influential study included, the weighted mean NNS is 265.

Occupational Settings – Health Care Workers (Table 16)
Studies in this category report results of screening health care workers. These studies are typically annual employment screens and do not include studies of health care workers being screened after exposure to a known TB case; those are described in the "Contact Tracing—Health Care Workers" section. The overall median NNS is undefined (IQR 93-ND), representing 30,145 health care workers screened. The overall mean weighted NNS was 1040 (25-5550*). There were 9 studies that found zero cases of active TB. In studies using **TST alone** in the primary screen, the NNS was **4021 (30-5550**). Studies not using TST alone in the primary screen had a weighted mean NNS of 819 (25-3910). A primary screen including both **chest Xray and TST combined** had an **NNS=121 (25-256).**

Sensitivity analyses
Restricting studies to those using bacteriologic confirmation only resulted in a weighted mean NNS of 999. No single study significantly influenced the weighted mean NNS in low and moderate incidence settings. Calculating the NNS without the most influential study in this category resulted in a weighted mean NNS of 1310.

Occupational Settings – Miners (Table 17)
The majority of studies from high-incidence were evaluations of annual screening of miners according to company policy. The **crude median NNS was 44 (IQR 31-64).** The **mean weighted NNS** was **41 (21-154).** All high-incidence countries represented in these studies have a known high prevalence of HIV among miners, though the HIV status of screened persons was not always available. All high-incidence country studies utilized chest x-ray in the primary screen. In high and medium-incidence countries, studies with

sputum smear in the primary screen had an NNS of 41 (39-43), compared to studies without smear in the primary screen, with NNS 36 (21-93). In high-incidence country studies with culture in the diagnostic algorithm, NNS= 37 (26-93). One study did not use culture, which had an NNS of 21.

Sensitivity analyses
Restricting studies to those with bacteriologic confirmation resulted in a weighted mean NNS of 42. Among high-incidence countries, no single study significantly affected the weighted mean. Omitting the most influential study resulted in a mean NNS of 36.

Occupational Settings – Military (Table 18)
The overall **median NNS** in this category is **262 (134-1440),** screening 313,938 individuals. The **weighted mean NNS was 1159 (73-1440*).** One study found zero TB cases. Studies using chest X-ray alone as the primary screen found an NNS of 1239 (73-1440). All other primary screen approach resulted in an NNS of 254 (179-492).

Occupational Settings – Other (Table 19)
Studies in this category included screening for TB among workers of diverse professions including railroad workers, cotton mill employees, weavers, factory workers, bank employees, and rickshaw cart pullers. The **median overall NNS =226 (IQR 74-2030)** and the **weighted mean NNS was 850 (4-5235)**. One study found zero cases of TB.

Sensitivity analyses
No single study significantly affected the weighted mean NNS for low-income settings. Omitting the most influential study resulted in a weighted mean NNS of 619. Similarly, in medium-incidence settings, no single study significantly affected the weighted mean NNS. Omitting the most influential study in medium-incidence settings resulted in a mean NNS of 1565. Restricting the studies to those with bacteriologic confirmation of TB resulted in an NNS of 147 in low-incidence settings; all studies in medium-incidence settings used bacteriologic confirmation.

Elder/Nursing Facilities (Table 20)
Seven studies screened residents of nursing homes and elder care facilities. Three studies did not detect any cases of active TB through screening. The crude mean NNS in elder care settings is 137 (68-ND). The overall weighted mean NNS was 73 (7-137*), derived from screening 5686 individuals.

Sensitivity analyses
Restricting studies to those with bacteriologic confirmation resulted in a median NNS of 75 and a weighted mean NNS of 68. No single study significantly affected the weighted mean NNS. Omitting the most influential study from the calculation resulted in a weighted mean NNS of 40.

Psychiatric Facilities (Table 21)
The **overall NNS** in screens conducted in psychiatric or mental health inpatient or residential facilities was **107 (32-1275),** representing 15,736 individuals screened. All studies included chest X-ray in the primary screen.

Other institutional settings (Table 22)
Other institutional settings included a long-term care facility, a group home for intellectually disabled persons, a university dormitory, a pediatric cancer center, and an orphanage. One study[19] screened persons in drug treatment facilities and correctional facilities, but it was not specified which cases were identified from which settings. Composite NNSes were not calculated due to the diversity of the populations; the individual study NNSes are reported in Table 22.

Diabetes (Table 23)
Six studies reported screening people with diabetes (both Type I and Type II) for TB. The overall **crude median NNS** for people with diabetes is **37 (25-54).** The **weighted mean NNS** for diabetes is **265 (17-2223).** Studies in medium and high incidence countries that used chest Xray as a component of screening had a mean NNS of 40, compared to 25 in studies not using chest Xray for screening. In medium and high incidence countries, studies using culture in the diagnosis had a mean NNS of 46, compared to NNS 25 in studies not using culture.

Sensitivity analysis
No single study significantly affected the overall weighted mean. Omitting the study with the largest influence on the overall mean resulted in a weighted **mean NNS of 35**. All studies used bacteriologic confirmation of TB.

Other disease risks (Table 24)
Six studies screened persons with underlying disease risks. These included patients receiving hemodialysis[20,21], chronic renal failure patients[22], persons with a history of TB, MDR-TB or lung abnormalities on X-ray[23,24], and persons with asbestosis[25]. These results are summarized in Table 24.

Vaccine Trial (Table 25)
Three studies screened candidates as part of baseline eligibility screening for a vaccine trial. These populations were pre-selected on multiple other criteria prior to TB screening. Results are summarized in Table 25.

Other (26)
Four additional studies screened diverse populations consisting of persons who may have fit into one or more other risk categories described here, but the number of persons in each risk category and the risk category of the persons found to have TB were not always specified. However, these NNSes represent a valuable contribution to the understanding of screening yields since in fact persons at risk for TB often have multiple risk factors. These results are reported in Table 26.

Algorithm-Specific NNS

In order to determine if specific screening and diagnostic components were associated with lower NNSes, we calculated overall and incidence-specific NNSes for select screening strategies commonly used in active case-finding. Crude median and weighted mean NNSes are shown in Table 24.

Table 24. Numbers given in table are crude median NNS (IQR) (top row) and weighted mean NNS and (range of NNS) (bottom row) from the studies included in each category. ND=not defined

Screening Algorithm	**Overall**	**Low & Moderate Incidence**	**Moderate & High Incidence**
CXR in primary screen	70 (22-282) 148 (2-11019)	112 (39-573) 127 (3-11019)	27 (9-106) 204 (2-3189)
No CXR in primary screen	143 (34-1112) 212 (3-30865)	302 (54-61729) 343 (3—30865)	73 (24-285) 188 (3-6355)
CXR in primary or secondary	94 (27-415) 149 (2-11019)	145 (45-1202) 203 (2-2189)	37 (12-144) 180 (2-30865)
Symptom screen only as primary screen	156 (42-773) 319 (3-30865)	713 (57-30030) 713 (15-30865)	142 (40-601) 308 (3-6355)
Sputum smear in primary screen	30 (9-111) 25 (2-2298)	80 (22-268) 63 (5-936)	22 (7-57) 21 (2-2298)
Sputum smear in primary or secondary screen	50 (19-214) 112 (2-30865)	55 (23-247) 110 (5-30865)	47 (17-200) 118 (2-6355)
No sputum in primary or secondary screen	122 (34-742) 180 (2-30865)	180 (51-2031) 139 (3-30865)	58 (20-256) 280 (2-6355)
Culture in diagnosis	82 (25-285) 199 (2-11019)	115 (37-508) 382 (3-11019)	45 (15-155) 128 (2-6355)
No culture in diagnosis	153 (33-1495) 199 (2-30865)	328 (58-ND) 96 (3-30865)	44 (14-249) 305 (2-6250)

Discussion & Conclusion

This systematic review summarizes the existing literature documenting active case-finding for TB from 1980-2010. The NNS to detect 1 case of active TB varies widely both within incidence settings, depending on the risk group screened, and across incidence settings, demonstrating the high variability inherent in the heterogenous screening approaches and populations evaluated.

Meaningful comparisons are difficult to make given the variability of the study populations and screening algorithms included, and indeed due to the heterogeneity of the screened

populations even within given risk groups identified in the study. While the variability precludes identifying a single "best" screening method or population to target for screening, the NNSes presented may provide guidance in setting priorities in a local context. For example, in resource –limited settings (often equivalent to high-TB-incidence settings), prioritizing the screening of risk groups with low NNSes may be useful.

For example, setting an arbitrary threshold of NNS=100 for high and medium incidence countries would result in the following risk groups included as priorities for screening: HIV-infected persons (including VCT attendees) (NNS 10-37), elder/nursing homes and other institutions (NNS 7-45), household contacts (NNS 17-25), drug users (NNS=20), persons with diabetes (NNS=35), miners (NNS=36), pregnant women and GYN clinic attendees(NNS=36-39), certain community-wide screening (high-incidence only) (NNS=100). Prisons just barely falls outside this threshold with an NNS of 110, but depending on how the TB epidemic were structured in a given setting, this may also need to be a high-priority group with a high yield expected from screening.

In lower TB incidence settings and higher resource settings, allowing the threshold to be set higher at an NNS of 200 would expand the populations to target to occupational settings including homeless persons, immigration/refugee/border settings, military settings, community contact-tracing; with even more resources available or in very low TB incidence settings, it would be reasonable to use an even higher threshold for NNS.

Based on the NNSes seen in this review, risk groups such as general outpatients, psychiatric facilities in low-incidence settings, health care occupational screens, military occupational screens, and community-wide screens consistently have among the highest NNSes, suggesting that screening these populations is likely to be lower-yield and more resource-intensive than TB programs may desire to undertake.

Similarly, while there was a high degree of variability in the NNS associated with different screening algorithms depending on the setting and risk group, several broad trends emerged. Of the many combinations of components of a screening algorithm, the presence of chest Xray in the algorithm consistently resulted in lower NNSes; it may be advisable to include CXR if resources to do so are available. While symptom screen alone was associated with overall higher NNSes, inclusion of sputum smear in either a primary or secondary screen was associated with lower mean NNSes than algorithms that did not include any sputum smear as a component of the screen. Overall, use of culture in the diagnosis was associated with lower NNSes than algorithms that did not include culture.

Review Limitations

In an effort to be as comprehensive as possible in evaluating the evidence for active case-finding for TB, we included as many papers as met our minimum inclusion criteria as we found. There was substantial heterogeneity among the case-finding approaches and reporting, and a single approach to evaluating the evidence may unintentionally obscure the many differences between the studies. In particular, we included both cross-sectional

screens (detecting prevalent cases) as well as papers that described longitudinal follow-up with repeated screening on the same population (detecting incident cases). A single summary statistic obscures the distinction between these two approaches, and the need for multiple rounds of screening when evaluating incident cases. Other categories may have such limited evidence that their applicability outside of the specific studies and study settings may be limited. For example, among the studies evaluating pregnant women for TB, most studies screened only pregnant HIV-infected women, so the findings from this category are likely not representative of the expected NNS for all pregnant women.

Despite these limitations, the strengths of this review lie in its demonstration of the substantial heterogeneity of expected TB cases that can be found by active case finding in different incidence settings. This review, combined with ongoing surveillance of the literature, can serve as a tool for governmental National Tuberculosis Programs, non-governmental organizations active in TB control, and other relevant programs in assessing the expected yield of programs given an incidence setting and available screening and diagnostic capacities. Because this review differentiated between cases detected actively and those detected passively (and calculated NNS based only on the actively detected cases), the NNSes presented represent what a TB program could expect to achieve beyond an existing program relying on active case-finding (e.g. DOTS) if a given population were targeted for additional screening. The NNSes provided in this review, both individual and composite, provide insight into which settings and populations will result in higher-yield screening, with implications for cost-effectivness in a given setting. This data may also prove useful in establishing point estimates and ranges for costing and cost-effectiveness studies as future interventions are conceived. We anticipate that this review, combined with knowledge of local epidemiology and priorities, can be used as a tool to inform the prioritization of target groups and screening approaches in order to maximize the use of available resources to detect, treat, and cure TB.

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Appendix A. Database search terms

Database	Terms
PubMed/ Medline	((("Mass Screening"[MeSH Terms] OR "Mass Chest X-Ray"[MeSH Terms] OR "contact tracing"[MeSH Terms] OR "health surveys"[MeSH Terms] OR "Cross-Sectional Studies"[MeSH Terms] OR "Epidemiologic Studies"[MeSH Terms]) OR ("Mass Chest X Ray" OR "Mass Chest X-Rays" OR "Mass Screenings" OR "Mass screening" OR "Screenings" OR "screening" OR "health survey" OR "Cross-Sectional Studies" OR "Case-detection" OR "case finding" OR "active case finding" OR "contact tracing" OR "intensified case-finding" OR "intensified case finding" OR "contact screening" OR "survey" OR "cross-sectional studies" OR "tuberculosis case-finding" OR "population screening" OR "prevalence studies")) **AND** (("tuberculosis"[MeSH Terms] OR "tuberculosis" OR "Pulmonary Consumption" OR "Consumption, Pulmonary" OR "Pulmonary Phthisis" OR "Tuberculoses") OR ("Mycobacterium tuberculosis"[MeSH terms]))) **NOT** ("animals"[MeSH Terms] NOT ("humans"[MeSH Terms] AND "animals"[MeSH Terms]))
EMBASE	'tuberculosis'/exp OR 'lung tuberculosis'/exp OR 'lung tuberculosis' OR 'tuberculosis' OR 'pulmonary consumption' OR 'consumption, pulmonary' OR 'pulmonary phthisis' OR 'tuberculoses' **AND** ('tuberculosis control'/exp OR 'case finding'/exp OR 'mass radiography'/exp OR 'mass screening'/exp OR 'contact examination'/exp OR 'screening'/exp OR 'mass radiography' OR 'mass screening' OR 'contact examination' OR 'population screening' OR 'mass roentgenologic screening' OR 'mass chest x ray' OR 'mass chest x-rays' OR 'mass screenings' OR 'screenings' OR 'screening' OR 'health survey' OR 'cross-sectional studies' OR 'case-detection' OR 'case finding' OR 'active case finding' OR 'contact tracing' OR 'intensified case-finding' OR 'intensified case finding' OR 'contact screening' OR 'cross-sectional' OR 'tuberculosis case-finding' OR 'prevalence studies') **NOT** ('animal'/exp NOT ('animal'/exp AND 'human'/exp))
SCOPUS	((KEY(**tuberculosis** OR **phthisis** OR (**pulmonary consumption**))) OR (TITLE(**tuberculosis** OR **phthisis** OR (**pulmonary consumption**)))) **AND** (TITLE-ABS-KEY(((**"Mass Chest X Ray"**) OR (**"Mass Chest X-Rays"**) OR (**"Mass Screenings"**) OR (**"Mass screening"**) OR (**screenings**) OR (**screening**) OR (**"health survey"**) OR (**"Cross-Sectional Studies"**) OR (**"Case-detection"**) OR (**"case finding"**) OR (**"active case finding"**) OR (**"contact tracing"**) OR (**"intensified case-finding"**) OR (**"intensified case finding"**) OR (**"contact screening"**) OR (**"prevalence survey"**) OR (**"cross-sectional studies"**) OR (**"population screening"**) OR (**"prevalence study"**))))

Appendix B. Search terms for conference abstracts

Conference	Year	Search terms	No. hits
IAS/AIDS	2008	Tuberculosis; TB Note: this search retrieved nearly 3500 fewer hits than a search that also included words attempting to limit to active case-finding.	507
IAS	2009	“ ”	169
IAS/AIDS	2010	“ ”	483
IUATLD	2008	Case-finding; contact tracing; active	488
IUATLD	2009	Case-finding; contact tracing; active	520
IUATLD	2010	Case-finding; contact tracing; active	573
ATS	2008	tuberculosis	184
ATS	2009	“ ”	184
ATS	2010	“ ”	244

IAS/AIDS: International AIDS Society; International AIDS Conference.
IUATLD: International Union Against TB and Lung Diseases; Union World Conference.
ATS: American Thoracic Society International Conference.

Appendix C. Tables 2-26

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2008	Ruutel[1]	Estonia	NS	112	TST IGRA		NS	.
Low	1994	Kvale[2]	USA	Adults	1171	Sm Cx		Sm Cx	391
Low	2002	Schulte[3]	USA	Adults	176	TST		Sm Cx	88
Low	1993	Guelar[4]	Spain	Adults & children	839	CXR TST		CXR Sm Cx NS	37
Low	2003	McLaughlin[5]	USA	Adults	294	Sx CXR TST	Sm Cx	CXR Sm Cx	19
Low	2010	Jam[6]	Iran	Adults & children	262	TST		NS	11
Low	1996	Hoffman[7]	USA	Adults & children	31	TST		CXR Cx	11
Low	2000	Cabarcos[8]	Spain	NS	233	Sx TST		NS	8
Mod	2008	Saraceni[9]	Brazil	NS	5357	TST		NS	316
Mod	2008	Wang[10]	China	Adults & children	2550	Sx	CXR Sm	CXR Sm NS	45
Mod	2010	Dembele[11]	Burkina Faso	Adults	2383	Sx	Sm	CXR Sm Other	35
Mod	2009	Qian[12]	China	Adults	195	Sx CXR TST	Sm	CXR Sm	28
Mod	2010	Sun[13]	China	Adults	340	Sx CXR Sm Cx		CXR Sm Cx	23
Mod	1997	Yoong[14]	Malaysia	Adults	49	Sx CXR		CXR Sm Cx NS	5
Med	2005	Seyler[15]	Cote d'Ivoire	Adults	129	Sx	CXR Sm Cx	CXR Sm Cx Other	.
Med	2008	Mazitov[16]	Russia	NS	360	Sx TST	CXR Sm	CXR Sm	120
Med	1997	Hecker[17]	Uganda	Adults	90	TST		NS	90
Med	2006	Joseph[18]	Haiti	Adults	28261	Sx	CXR Sm	Clinical CXR Sm	86
Med	2010	Turinawe[19]	Rwanda	NS	62835	Other		NS	73
Med	1996	Saenghirun-vattana[20]	Thailand	NS	46	Sx CXR	Sm Cx	Clinical CXR Sm Cx Other	46

Med	1998	Halsey[21]	Haiti	Adults	10521	Sx CXR TST		CXR NS	44
Med	2001	Meleshen-kov[22]	Burundi	NS	80	CXR		CXR Other NS	40
Med	2008	Vandebriel[23]	Rwanda	NS	10362	Sx		NS	39
Med	2008	Shah[24]	Vietnam	Adults & children	597	CXR		Clinical CXR Sm	34
Med	2007	Gupta[25]	India	Adults	715	Sx TST	CXR Sm Cx	CXR Sm Cx	30
Med	2009	Braitstein[26]	Kenya	Children	6535	Sx CXR TST Sm Other		Clinical CXR Sm Other	28
Med	2009	Musa[27]	Nigeria	NS	18043	Other		NS	26
Med	2006	Mugisha[28]	Uganda	Adults & children	7696	Sx	Sm	Clinical CXR Sm Other	23
Med	2008	Matee[29]	Tanzania	Adults	2216	Sx CXR Sm Cx		Clinical CXR Sm Cx Other	22
Med	2005	Elenga[30]	Cote d'Ivoire	Children	282	Sx CXR TST	Sm Cx Other	Clinical CXR Sm Cx Other	21
Med	2009	Rajasek-aran[31]	India	Adults only	5099	Sx	CXR Sm	Clinical CXR Sm Other	20
Med	1995	Aisu[32]	Uganda	Adults	1524	Sx	CXR Sm	Clinical CXR Sm	19
Med	2010	Reddy[33]	Peru	Adults	435	Sx CXR TST Sm Cx Other		CXR Sm Cx	17
Med	1997	Hawken[34]	Kenya	Adults & children	684	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx Other	15
Med	2009	Shah[35]	Ethiopia	Adults	453	Sx CXR Sm Cx		CXR Sm Cx	15
Med	2010	Yienya[36]	Kenya	Children	249	TST		Other	14
Med	1997	Gilks[37]	Kenya	Adults	587	TST Sm Cx		CXR Sm Cx	12
Med	2008	Ngowi[38]	Tanzania	Adults & children	233	Sx CXR Sm Cx		Clinical CXR Sm Cx Other	12
Med	2010	Sanguli[39]	Kenya	Children	485	Sx CXR TST Other		CXR Other	12
Med	2000	Swami-	India						

		nathan[40]							
Med	2008	Jittimanee[41]	Thailand	NS	23593	Other		NS	9
Med	2009	Monkong-dee[42]	Thailand, Vietnam	Adults	1060	Sx CXR Sm Cx Other		Clinical CXR Sm Cx Other	8
Med	2010	Poudyal[43]	Nepal	Adults	86	Sx Sm		Sm	8
Med	2009	Gebi[44]	Nigeria	NS	1385	CXR		CXR Sm	7
Med	2005	Mtei[45]	Tanzania	Adults	93	Sx CXR TST IGRA Sm Cx Other		CXR Sm Cx Other	7
Med	2008	Khaw-chaoenpor[46]	Thailand	Adults	350	CXR TST		Clinical CXR Sm Cx	7
Med	2008	Mahajan[47]	India	NS	230	Sx CXR	Sm Cx	Clinical Sm Cx Other	7
Med	2008	Melaku[48]	Ethiopia	NS	1015	Other		NS	6
Med	2001	Merchant[49]	India	Children	285	Sx CXR TST		Clinical CXR Other NS	4
Med	2002	Awoyemi[50]	Nigeria	Adults	58	Sx CXR Sm Cx		CXR Sm Cx	4
Med	2010	Subraman-ian[51]	India	Adults	188	Sm		Sm	3
Med	2004	Louie[52]	Vietnam	Adults	100	Sx		CXR Sm Cx NS	3
Med	2006	Maniar[53]	India	Adults only	8640	CXR TST Sm Cx Other		Clinical CXR Sm Cx Other	2
High	2010	Agizew[54]	Botswana	Adults	2732	CXR		Clinical CXR Sm cx Other	64
High	2006	Kali[55]	South Africa	Adults	370	Sx	Sm Cx	Sm Cx	47
High	2009	Gideon[56]	South Africa	Adults	429	Sx TST IGRA Cx		Cx	27
High	2003	Nachega[57]	South Africa	Adults	318	TST	CXR	Clinical CXR Sm Cx Other	25
High	2006	Day[58]	South Africa	Adults	920	Sx CXR Sm Cx		Clinical CXR Sm Cx Other	25

High	1995	Godfrey-Faussett[59]	Zambia	Adults	95	Sx CXR	Sm Cx	Clinical CXR Sm Cx	19
High	2001	Waddell[60]	Zambia	Adults & children	862	Other		Other	19
High	2003	Churchyard⁶¹	South Africa	Adults	338	Sx CXR	Sm Cx	CXR Sm Cx Other	13
High	2004	Mohammed[62]	South Africa	Adults	129	Sx CXR TST Sm Cx		CXR Sm Cx NS	12
High	2002	Kimerling[63]	Cambodia	Adults	441	Sx Sm Cx		Sm Cx	12
High	2006	Lawn[64]	South Africa	Adults & children	804	Other		Clinical CXR Sm Cx Other	9
High	2010	Cain[65]	Cambodia, Vietnam, Thailand	Adults & children	1768	Sx CXR Sm Cx Other		CXR Sm Cx	7
High	2009	Chea[66]	Cambodia	NS	212	Sx CXR Sm Cx Other		Clinical CXR Sm Cx Other	6
High	2010	Bassett[67]	South Africa	Adults	825	Sx CXR Sm Cx		CXR Sm Cx	6
High	2008	Tiam[68]	Lesotho	Adults	336	Sx CXR		CXR Sm	5
High	2007	Cain[69]	Cambodia	Adults	455	Other		CXR sm Other	5
High	2010	Houlihan[70]	South Africa	Adults	810	Sx CXR Sm		CXR Sm	5
High	2010	Dawson[71]	South Africa	Adults	235	Sx CXR Sm Cx		CXR Sm Cx	5
High	2009	Lawn[72]	South Africa	Adults	235	Sx CXR Sm Cx Other		CXR Sm Cx	5
High	2010	Lawn[73]	South Africa	NS	241	Sx CXR Sm Cx Other		CXR Sm Cx Other	3

Table 2. HIV-infected populations. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Med	2008	Shetty[74]	India	NS	9921	Sx		Clinical CXR Sm Other NS	12
Med	2006	Mugisha[28]	Uganda	Adults & children	7696	Sx	Sm	Clinical CXR Sm Other	23
Med	2010	Munseri[75]	Tanzania	Adults & children	1280	Sx CXR Sm Cx Other		Clinical CXR sm Cx Other	21
High	2008	Chheng[76]	Cambodia	Adults	496	Sx Sm		Clinical Sm Cx	18
High	2008	Mwangelwa[77]	Zambia	Adults & children	120	Other		NS	8

Table 3. Voluntary Counseling and HIV Testing Settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2001	Levitin[78]	Israel	Children	10133	TST	CXR	CXR NS	.
Low	2005	Magkanas[79]	Greece	Adults	2466	CXR	TST Cx	CXR Cx NS	.
Low	1984	Rowlands[80]	Saudi Arabia	Children	973	Sx TST		CXR NS	.
Low	2001	Sebro[81]	Trinidad and Tobago	Adults	12662	CXR		CXR NS	.
Low	2006	Garcia-Sancho[82]	Mexico	Children	858	Sx		Clinical CXR Sm Cx Other NS	.
Low	1984	Grantland[83]	USA	Children	435	TST	CXR	CXR NS	.
Low	2008	Rumman[84]	Jordan	Adults	61730	Sx	Sm	Sm	30865

Low	1987	Hayashi[85]	Japan	NS	363608	CXR		CXR Sm Cx	11019
Low	1993	Al-Kassimi[86]	Saudi Arabi	Adults & children	7721	TST		Cx	7721
Low	2002	Bibi[87]	Israel	Children	27232	TST	CXR	Clinical CXR Sm NS	3891
Low	1998	Pong[88]	USA	Adults	1645	CXR TST Other		Clinical CXR Other	1646
Low	2006	Alavi[89]	Iran	Children	3906	Sx TST	CXR Sm Other	Clinical CXR Sm Other	1302
Low	1994	Alperstein[90]	Australia	Children	2290	TST		Clinical CXR Sm NS	1145
Low	1986	Perez-Stable[91]	USA	Adults & children	1871	CXR TST Sm		CXR Sm	936
Low	1999	Villalbi[92]	Spain	Children	11200	TST		NS	862
Low	1989	Beller[93]	USA	Adults	3343	CXR		CXR Sm Cx NS	558
Low	1994	Caldwell[94]	USA	Adults & children	1005	TST		CXR Sm Cx NS	503
Low	2001	Sanchez-Perez[95]	Mexico	Adults	6140	Sx	Sm Cx	Sm Cx	362
Low	1994	Lodi TB Work Group[96]	Italy	Adults & children	7087	CXR TST		CXR Other NS	296
Low	2008	Romaszko[97]	Poland	Adults	3004	Sx CXR		Clinical CXR Sm Cx Other	137
Mod	2001	Kim[98]	South Korea	Children	1398295	CXR	Sm Cx	CXR Sm Cx	5594
Mod	2010	Miller[99]	Brazil	Adults & children	23865	Sx		CXR Sm	1989
Mod	2007	Odermatt[100]	Laos	Unknown	13541	Sx	Sm	Clinical Sm	713
Mod	1992	Zuluaga[101]	Colombia	Adults	3731	Sx Sm Cx		Sm Cx	374
Mod	2004	China TB Control Collaboration[102]	China	Adults & children	365079	Sx CXR TST	CXR Sm Cx	Clinical CXR Sm Cx	273
Mod	2002	Fernandez de Larrea[103]	Venezuela	Children	502	Sx TST	CXR Sm Cx	Clinical CXR Sm Cx	168
Mod	1993	Hong[104]	South Korea	Adults & children	54870	CXR TST Other		CXR Sm Cx NS	55

Mod	1981	Ng[105]	Singapore	Adults	5413	CXR	Sm	Clinical CXR Sm	53
Mod	2007	Sandoval[106]	Ecuador	Adults & children	653	Sx	Sm	Sm	15
Med	1981	Patel[107]	India	NS	30000	Sx	Sm	Sm	4286
Med	1993	Shteintsaig[108]	Russia	NS	1903400	CXR Other		CXR Other NS	3189
Med	1996	Elink Schuurman[109]	Thailand	Adults & children	20730	Sx		Sm Cx	2304
Med	2006	Kasse[110]	Gambia	Adults & children	29871	Sx CXR Sm		Clinical CXR Sm	2298
Med	2010	Shahed Hossain[111]	Bangladesh	Adults	63715	Sx Sm		Sm	2124
Med	2010	Amare[112]	Ethiopia	Adults	29257	Sx	Sm Cx	Sm Cx	1626
Med	2010	Bjerregaard-Andersen[113]	Guinea-Bissau	Adults	2989	Sx	CXR Sm	CXR Sm Other	1495
Med	2004	Thorson[114]	Vietnam	Adults	35832	Sx	CXR Sm	CXR Sm	1434
Med	2006	Shargie[115]	Ethiopia	Adults	16697	Sx	Sm	Sm	1285
Med	2009	Yimer[116]	Ethiopia	Adults & children	47478	Sx	Sm	Sm	1250
Med	2006	Zaman[117]	Bangladesh	Adults	59395	Sx	CXR Sm	Clinical CXR Sm	1143
Med	2006	Fochsen[118]	India	Adults	45719	Sx	CXR Sm Cx	CXR Sm Cx NS	915
Med	2010	Vandebriel[119]	Rwanda	NS	52844	Sx		NS	826
Med	1999	Narang[120]	India	Adults & children	114266	Sx	Sm Cx	Sm Cx	773
Med	1982	Cassels[121]	Nepal	Adults	67068	Sx	Sm	Sm	605
Med	2002	Holtedahl[122]	Cameroon	Adults & children	1777	Sx		CXR Sm NS	593
Med	2002	Demissie[123]	Ethiopia	Adults	12149	Sx	Sm	Sm	529
Med	1987	Kibrik[124]	Russia	Adults & children	4512	Sx Other		Clinical CXR	502
Med	1995	Balasub-ramanian[125]	India	Adults	5755	Sx	Sm	Sm	480
Med	2010	Hoa[126]	Vietnam	Adults	94179	Sx CXR	Sm Cx	CXR Sm Cx	351

Med	2008	Gopi[127]	India	Adults	236010	Sx CXR	Sm Cx	Clinical CXR Sm Cx	354
Med	2004	Balasub-ramanian[128]	India	Adults	76011	Sx CXR TST	Sm Cx	CXR Sm Cx	330
Med	1995	Chakraborty[129]	India	Adults & children	29499	TST Sm Cx		Sm Cx	307
Med	2007	Akhtar[130]	Pakistan	Adults	5479	Sx	Sm Cx	Sm Cx	305
Med	1992	Xavier[131]	India	Adults	11808	Sx		Sm Cx NS	288
Med	2007	Soemantri[132]	Indonesia	Adults	50154	Sx	Sm	Clinical Sm Cx	285
Med	2009	Bhat[133]	India	Adults	22270	Sx Other	Sm Cx	Sm Cx	269
Med	1993	Mitinskaia[134]	Russia	Children	701	Sx CXR TST Sm Cx Other		CXR Sm Cx Other	234
Med	2010	Rao[135]	India	Adults	1390	Sx	Sm Cx	Sm Cx	232
Med	2006	Gopi[136]	India	Adults	78268	Sx CXR	Sm Cx	Clinical CXR Sm Cx NS	214
Med	2001	Datta[137]	India	Adults & children	26320	Sx CXR TST		CXR Sm Cx NS	209
Med	2002	Gupta[138]	India	Adults	5000	Sx	CXR Sm	CXR Sm NS	200
Med	1991	Hafez[139]	Banglades h	Adults & children	3406	Sx		Sm NS	163
Med	1990	Abramson[140]	Russia	NS	1131	Sx CXR		Clinical CXR Sm Other	162
Med	1994	Berezko[141]	Russia	Adults & children	2227	Sm Cx		Sm Cx	160
Med	2009	Tupasi[142]	Philippine s	Adults & children	22867	Sx CXR	Sm Cx	CXR Sm Cx	152
Med	2004	Murhekar[143]	India	Adults	10570	Sx	Sm	Sm	138
Med	2010	Sekandi Nabbuye[144]	Uganda	Adults	5103	Sx	Sm	Sm	131
Med	2001	TB Research Center[145]	India	Adults & children	100000	CXR	Sm Cx	Clinical CXR Sm Cx	115
Med	2003	Guwatudde[146]	Uganda	Adults & children	1142	Sx	CXR Sm Cx	Clinical CXR Sm Cx	115
Med	1999	Tupasi[147]	Philippine	Adults &	12850	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx	102

			s	children					
Med	1982	Aluoch[148]	Kenya	Adults & children	577	Sm Cx		Sm Cx	83
Med	1984	Mayurnath[149]	India	Adults & children	18311	Sx CXR TST		CXR Cx	82
Med	2010	Rao[150]	India	Adults	11116	Sx	Sm Cx	Sm Cx	67
Med	1982	Aluoch[148]	Kenya	Adults & children	1006	Sx	Sm Cx	Sm Cx	46
Med	1998	Alvi[151]	Pakistan	Adults & children	1077	Sx	CXR Sm	Clinical CXR Sm	40
Med	1981	Nsanzu-muhire[152]	Kenya	Adults & children	1074	Sx	Sm Cx	Sm Cx	40
Med	2009	Sekandi[153]	Uganda	Adults & children	930	Sx	Sm	Sm	29
Med	2008	Mapue[154]	Philippines	Children	15000	Sx TST Other		NS	25
High	2001	Pronyk[155]	South Africa	Adults & children	38127	Sx	Sm Cx	Sm Cx	6355
High	2010	Phuanu-koonnon[156]	Papua New Guinea	NS	7211	Sx	Sm	Sm	601
High	2007	Corbett[157]	Zimbabwe	Adults	4668	Sx Sm Cx		Clinical CXR Sm Cx	173
High	2010	Middelkoop[158]	South Africa	Adults	1250	Sx Sm Cx		Sm Cx	157
High	2007	Den Boon[159]	South Africa	Adults	3483	CXR	Sm Cx	CXR Sm Cx	152
High	2010	Corbett[160]	Zimbabwe	Adults	110432	Sx	Sm	Clinical CXR Sm Cx NS	131
High	2010	Corbett[161]	Zimbabwe	Adults	8979	Sx Sm Cx		Clinical CXR Sm Cx Other	114
High	2009	Corbett[162]	Zimbabwe	Adults	10236	Sx Sm Cx	CXR Sm Cx Other	Clinical CXR Sm Cx Other	113
High	2009	Ayles[163]	Zambia	Adults	8044	Sx Sm Cx		CXR Sm Cx	102

High	2005	Marais[164]	South Africa	Children	1415	Sx CXR TST	Sm Cx Other	CXR Sm Cx	79
High	2006	Den Boon[165]	South Africa	Adults	2068	Sx CXR Sm Cx		CXR Sm Cx	72
High	2008	Williams[166]	Cambodia	Adults	22160	Sx CXR TST Sm		CXR Sm Cx	39
High	2007	Wood[167]	South Africa	Adults	762	Sx Sm Cx		Sm Cx	34
High	1980	Gatner[168]	South Africa	Adults	5477	CXR Sm Cx		CXR Sm Cx	32
High	2002	Kelly[169]	Zambia	Adults	261	Sx		Clinical CXR Sm Other	29
High	1981	Fourie[170]	South Africa	Adults	1386	Sx CXR Sm Cx		CXR Sm Cx	29
High	1980	Fourie[171]	South Africa	Adults	2230	CXR Sm Cx		CXR Sm Cx	24
High	2008	Geldenhuys[172]	South Africa	Children	2393	Sx	CXR Sm Cx Other	CXR Sm Cx	16

Table 4. Community or population-wide screens. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1999	Soren[173]	USA	Adults & children	659	Sx TST		NS	.
Low	2001	Vall Mayans[174]	Spain	Children	415	TST		NS	.
Low	2010	Goodburn[175]	United Kingdom	Adults	16	Sx TST IGRA		Clinical CXR Sm Cx Other	.
Low	1983	Kameda[176]	Japan	Adults & children	189	CXR TST		CXR	.

Low	1980	Kameda[177]	Japan	Adults & children	430	NS		NS	430
Low	2010	Zunic[178]	France	Adults & children	3027	Other		NS	337
Low	2002	Driver[179]	USA	Adults & children	980	Sx TST	CXR	Clinical CXR Sm Cx	327
Low	1986	Sullam[180]	USA	Adults & children	831	TST	CXR	Clinical CXR Sm Cx Other	277
Low	1981	Kameda[181]	Japan	Adults & children	180	NS		NS	180
Low	1993	Ormerod[182]	United Kingdom	Adults & children	7017	CXR TST Other		CXR Sm Cx Other	141
Low	2008	Bakir[183]	Turkey	Children	908	Sx CXR TST IGRA		Clinical CXR Sm Cx Other	114
Low	2007	Salinas[184]	Spain	Adults & children	4356	CXR TST		CXR Sm Cx NS	109
Low	1982	Uhari[185]	Finland	Children	83	Sx CXR TST		Clinical CXR Cx	83
Low	1989	Sherif[186]	Egypt	Adults & children	281	TST		CXR NS	71
Low	1984	Capewell[187]	United Kingdom	Adults & children	4445	CXR TST		CXR Sm NS	57
Low	1994	Fernandez Revuelta[188]	Spain	Adults & children	640	TST		CXR Sm Cx	54
Low	2010	Garcia-Garcia[189]	Spain	NS	159	Sx CXR TST IGRA		CXR NS	53
Low	1990	Ahiko[190]	Japan	NS	405	Sx CXR TST		CXR Sm Cx	45
Low	2004	Remacha Esteras[191]	Spain	Adults & children	2350	CXR TST		CXR NS	38
Low	2009	Kilicaslan[192]	Turkey	Adults	2210	Sx CXR	Sm	Clinical CXR Sm Cx Other	36
Low	2000	Dasgupta[193]	Canada	Adults & children	220	TST	CXR	Clinical CXR Sm Cx	34
Low	2000	Solsona[194]	Spain	Adults &	1176	Sx CXR TST		CXR Sm Cx	31

				children					
Low	2010	Kouw[195]	Netherlands	NS	193	TST Sm Cx Other		Sm Cx NS	22
Low	1991	Matutano[196]	Spain	Adults & children	714	TST		CXR Sm Cx	19
Low	1997	Vidal[197]	Spain	Adults & children	3071	Sx CXR TST	Sm CX	CXR Sm Cx Other	18
Low	2006	Khalilzadeh[198]	Iran	Adults & children	224	CXR TST Sm		CXR Sm	14
Low	2002	Madhi[199]	France	Children	91	CXR TST		Clinical CXR Sm Cx Other	12
Low	2006	Gendrel[200]	France	Children	69	CXR TST Sm Cx		CXR Sm Cx Other	5

Table 5. Household contact-tracing (low-incidence countries). (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Mod	2002	Mohammad[201]	Malaysia	Adults & children	129	TST		NS	.
Mod	2008	Lin[202]	China	Adults & children	1773	CXR TST		CXR Sm NS	355
Mod	2008	Lee[203]	Hong Kong	Adults & children	4661	Sx CXR TST		Clinical CXR Sm Cx	151
Mod	2009	Nguyen[204]	Laos	Adults & children	317	Sx TST Sm	CXR	Clinical CXR Sm Other NS	80
Mod	2001	Carvalho[205]	Brazil	Adults & children	360	Sx CXR TST		Clinical CXR Sm Cx	60
Mod	2002	Noertjojo[206]	Hong Kong	Adults & children	2381	Sx CXR		Clinical CXR Sm Cx	59
Mod	1981	Chen[207]	Singapore	Adults &	6450	Sx CXR TST	Sm	Clinical CXR Sm	45

				children					
Mod	2009	Ottomani[208]	Morocco	Adults & children	787683	Sx CXR TST	Sm	Clinical CXR Sm	40
Mod	2004	Lemos[209]	Brazil	Adults & children	269	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx Other	39
Mod	2009	Maciel[210]	Brazil	Children	155	Sx CXR TST		Clinical CXR Sm Cx Other	31
Mod	2010	Cavalcante[211]	Brazil	Adults & children	699	Sx CXR TST	Sm	Clinical CXR Sm Cx	27
Mod	2001	Teixeira[212]	Brazil	Adults & children	408	Sx TST	CXR Sm Cx	CXR Sm Cx	24
Mod	2000	Espinal[213]	Dominican Republic	Adults & children	803	Sx TST	CXR Sm	Clinical CXR Sm Cx NS	18
Mod	2009	Leimane[214]	Latvia	Children	60	Other		NS	15
Mod	2004	Caldeira[215]	Brazil	Children	184	Sx CXR TST Sm		Clinical CXR Sm Cx	8
Mod	2003	Al Kubaisy[216]	Iraq	Adults & children	1039	Sx TST	CXR Sm	Clinical CXR Sm	7

Table 5 cont'd. Household contact-tracing (moderate-incidence countries). (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Med	2009	Chen[217]	Taiwan	Adults & children	78	CXR TST IGRA		CXR NS	.
Med	2010	Madhavi[218]	India	Children	172	Other		NS	.
Med	2010	Delawer[219]	Afghanistan	Adults	2837	Sx	Sm	Sm	568
Med	2005	Becerra[220]	Peru	Adults &	3347	Sx	Sm Cx	Sm Cx NS	305

				children					
Med	2000	Wares[221]	Nepal	Adults & children	2298	Sm		Sm	165
Med	2010	Sanchez-Lofranco[222]	Philippines	Adults & children	771	Sx CXR	Sm Cx	CXR Sm Cx	155
Med	2010	Schumacher[223]	Peru	NS	12581	Sx		Sm Cx Other	112
Med	1981	Aluoch[224]	Kenya	Adults & children	598	Sm Cx		Sm Cx	86
Med	2007	Jackson-Sillah[225]	Gambia	Adults & children	2381	Sx TST	CXR	Clinical CXR Sm Cx Other	73
Med	2003	Zachariah[226]	Malawi	Adults & children	461	Sx	Sm	Sm	58
Med	1981	Nsanzumuhire[224]	Kenya	Adults & children	345	Sm Cx		Sm Cx	50
Med	2010	Mangi[227]	Pakistan	Adults & children	17247	Sm Cx		Sm Cx	50
Med	2008	Jong[228]	Gambia	Adults & children	1808	Sx		NS	48
Med	1984	Akenzua[229]	Nigeria	Children	332	TST	CXR	CXR Sm Other	42
Med	2008	Achakzai[230]	Pakistan	Adults & children	1118	Sx CXR TST Sm		CXR Sm NS	30
Med	2010	Fojo[231]	Kenya	NS	72	Sx		Sm	36
Med	2010	Amanullah[232]	Pakistan	Children	117	CXR TST Other		CXR NS	30
Med	2003	Guwatudde[146]	Uganda	Adults & children	1206	Sx CXR TST	Sm CX	Clinical CXR Sm Cx	29
Med	2003	Suggaravetsiri[233]	Thailand	Adults & children	1200	Sx	CXR TST Sm	CXR Sm Cx	27
Med	2003	Bayona[234]	Peru	Adults & children	945	Sx	Sm	Sm Cx Other	20
Med	2000	Wang[235]	Taiwan	Adults & children	4595	CXR		CXR Sm Cx	17
Med	2008	Taran[236]	Russia	Adults &	23	Other		NS	12

				children					
Med	2010	Chemutai[237]	Kenya	NS	102	Other		NS	11
Med	1996	Kuaban[238]	Cameroon	Adults & children	416	Sx CXR TST		CXR Sm	9
Med	2000	Eckhoff[239]	Haiti	Adults	61	Sx CXR Sm		Clinical CXR Sm	7
Med	2010	Sia[240]	Philippines	Adults & children	897	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx	7
Med	2009	Duenas[241]	Philippines	Adults & children	112	Sm		Sm	7
Med	1987	Bokhari[242]	Pakistan	Adults & children	1000	CXR TST		Clinical CXR	7
Med	2002	Claessens[243]	Malawi	Children	33	Sx CXR TST		Clinical CXR	6
Med	2006	Sinfield[244]	Malawi	Children	195	Sx TST	CXR Sm	Clinical CXR Sm Other	5
Med	2004	Tkhabisi-mova[245]	Russia	Children	113	Other		Other NS	5
Med	1996	Topley[246]	Malawi	Children	282	Sx CXR TST		Clinical CXR Other	3

Table 5 cont'd. Household contact-tracing (medium-incidence countries). (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
High	2008	Den Boon[247]	South Africa	Adults	3484	Sx CXR Sm		CXR Sm Cx	129
High	1987	Gilpin[248]	South Africa	Adults	132	Sm		Sm	33
High	1993	Klausner[249]	DR Congo	Adults & children	1258	Sx CXR TST		CXR Cx NS	24
High	2010	Bisuta Fueza[250]	DR Congo	Adults & children	296	CXR Sm Cx		CXR Sm Cx	22

High	1984	Saunders[251]	South Africa	Adults & children	3047	CXR TST		CXR NS	19
High	2010	Shapiro[252]	South Africa	Adults & children	2771	Sx Sm Cx		Sm Cx NS	16
High	2009	Song[253]	Cambodia	Adults & children	2639	Sx CXR TST	Sm	Clinical CXR Sm NS	14
High	1997	Beyers[254]	South Africa	Adults & children	664	Sx CXR TST Cx Other		Clinical CXR Sm Cx	13
High	1999	Schaaf[255]	South Africa	Children	128	Sx CXR TST Sm Cx Other		Clinical CXR Sm Cx Other	9
High	2002	Schaaf[256]	South Africa	Children	119	Sx CXR TST Sm Cx Other		Clinical CXR Sm Cx Other	9
High	2009	Marais[257]	South Africa	Children	261	Sx CXR TST		Clinical CXR Cx Other	8
High	2008	Kruk[258]	South Africa	Children	261	Sx CXR TST		Clinical CXR	8
High	2002	Mtombeni[259]	Zimbabwe	Children	174	Sx CXR TST		Clinical CXR Other	2

Table 5 cont'd. Household contact-tracing (high-incidence countries). (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1999	Cardona[260]	Australia	Adults & children	270	TST		NS	.
Low	2001	Kanra[261]	Turkey	Children	341	TST	CXR	CXR Sm Cx NS	.
Low	1996	Rodriguez[262]	USA	Adults & children	1804	TST		CXR Sm Cx NS	.
Low	2000	Smith[263]	USA	Adults & children	173	CXR TST		Clinical CXR	.
Low	1997	Askew[264]	USA	Adults & children	1263	CXR TST		CXR	.
Low	2003	Kobayashi[265]	Japan	Children	106	Sx CXR TST		CXR	.
Low	2001	Trnka[266]	Czech Republic	Adults	775	Sx CXR TST Sm Cx		CXR Sm Cx NS	.
Low	2001	Fitzpatrick[267]	USA	NS	445	TST	CXR	CXR Sm Cx NS	.
Low	2009	Higuchi[268]	Japan	Children	307	Sx CXR TST IGRA		CXR NS	.
Low	2001	Golub[269]	USA	Adults	51	TST		CXR Sm Cx NS	.
Low	2010	Marienau[270]	USA	NS	4550	TST IGRA		NS	.
Low	2008	CDC[271]	USA	NS	210	CXR TST		Clinical CXR Sm Cx Other NS	.
Low	2005	Koster[272]	Netherlands	Adults & Children	21000	TST	CXR	CXR Sm NS	4200
Low	1983	Jones[273]	United Kingdom	Adults & children	726	CXR	CXR	CXR NS	726
Low	1980	Rao[274]	United Kingdom	Adults & children	4081	CXR TST		Clinical CXR NS	583
Low	1999	Curtis[275]	USA	Adults & children	552	Sx CXR TST		Clinical CXR Sm Cx Other	552
Low	1982	Jones[276]	United Kingdom	Adults & children	500	TST	CXR	Clinical CXR NS	500
Low	2008	Ferrer[277]	Spain	Children	470	TST		Sm Cx NS	470

Low	2008	Langen-skiold [278]	Switzerland	Adults & children	3582	CXR TST		CXR NS	448
Low	2009	Castilla[279]	Spain	Adults	692	CXR TST Sm Cx		CXR Sm Cx	346
Low	1998	Washko[280]	USA	Adults & children	1021	TST	Cx	Cx NS	341
Low	2010	Person[281]	USA	Adults	312	Sx TST IGRA		NS	312
Low	1998	Pang[282]	Australia	Adults & children	456	CXR TST		CXR Cx NS	228
Low	2005	Hadjichristodoulou[283]	Greece	Adults & children	642	Sx TST	CXR	CXR Other NS	214
Low	2003	Roberts[284]	United Kingdom	Children	804	TST	CXR	Clinical CXR Sm	201
Low	1986	Bosley[285]	United Kingdom	Adults & children	2317	Sx CXR TST		CXR Sm	166
Low	2010	Nduaguba[286]	USA	NS	33334	Sx CXR TST	CXR	Clinical CXR Sm Cx	158
Low	1993	Liippo[287]	Finland	Adults & children	609	CXR TST		CXR	153
Low	2004	Phillips[288]	USA	Adults & children	591	TST		CXR Sm Cx NS	148
Low	2006	Kirkpatrick[289]	United Kingdom	NS	137	CXR TST IGRA		CXR Other	137
Low	1997	Kiers[290]	Netherlands	Adults & children	6519	CXR TST Sm Cx		CXR Sm Cx Other	134
Low	2008	Aissa[291]	France	Adults & children	1955	Sx CXR TST		Clinical CXR NS	131
Low	1989	Selby[292]	United Kingdom	Adults & children	860	CXR TST		CXR NS	123
Low	2008	Calder[293]	New Zealand	Adults & children	1828	CXR TST		Clinical CXR Sm Cx Other	122
Low	2002	CDC[294]	USA	NS	121	TST	CXR	CXR Sm Cx NS	121
Low	2000	Calder[295]	New Zealand	Adults & children	566	TST	CXR	Clinical CXR Sm NS	114
Low	2008	Ozkara[296]	Turkey	Adults &	300129	Sx CXR TST	Sm	CXR Sm NS	107

				children					
Low	1998	Behr[297]	USA	NS	11211	Sx TST		CXR Sm Cx NS	104
Low	2008	Paranjothy[298]	United Kingdom	Children	206	Sx CXR TST IGRA	Sm Cx Other	Clinical CXR Sm Cx Other	103
Low	1998	Ansari[299]	United Kingdom	Adults & children	707	CXR TST		CXR NS	101
Low	2003	Jereb[300]	USA	Adults & children	56100	Sx TST Other	Other	Sm Cx NS	100
Low	2002	Reichler[301]	USA	Adults & children	2095	TST	CXR	Clinical CXR Sm Cx	88
Low	2008	Duthie[302]	United Kingdom	Adults & children	394	CXR TST		CXR NS	79
Low	2008	Muller[303]	Sweden	Children	216	TST IGRA		Clinical CXR Other	72
Low	2007	Alvarez-Castillo[304]	Spain	Children	398	CXR TST		CXR	67
Low	2005	Toivgoogiin[305]	Japan	Children	566	CXR TST	CXR	CXR Sm Cx NS	63
Low	2007	Alseda[306]	Spain	Adults & children	2083	TST		Clinical CXR Sm Cx Other	62
Low	2001	Zangger[307]	Switzerland	Adults & children	53	TST	CXR	CXR Sm Cx	53
Low	2008	Goris-Pereiras[308]	Spain	Adults & children	712	TST		Sm	51
Low	2000	Marks[309]	USA	Adults & children	6225	TST	CXR	CXR Sm Cx NS	47
Low	2007	Andre[310]	USA	NS	860	TST	CXR	CXR	46
Low	1996	Hortoneda[311]	Spain	Adults & children	1570	TST		CXR Sm	45
Low	1991	Teale[312]	United Kingdom	Adults & children	400	Sx CXR TST		CXR Sm	40
Low	2000	Leung[313]	United Kingdom	Adults & children	199	CXR TST		CXR Sm	40
Low	2003	Seki[314]	Japan	Adults	39	Sx CXR TST		CXR	39
Low	1999	Del Castillo	Spain	Adults &	1228	CXR TST		Clinical CXR Sm Cx	30

		Ortero[315]		children				Other	
Low	2002	Andoh[316]	Japan	Adults & children	227	TST	CXR	CXR Sm Cx	29
Low	1995	Dutt[317]	USA	Adults & children	184	Sx TST	CXR	CXR Sm Cx NS	27
Low	2003	Funk[318]	USA	Adults & children	682	TST		Sm Cx	27
Low	2003	Sanchez[319] Marenco	Spain	Children	387	TST		CXR NS	25
Low	2009	Reichler[320]	USA	Adults & children	3124	TST		NS	23
Low	2001	De Zoysa[321]	New Zealand	Adults	762	TST		CXR Sm Cx NS	22
Low	2004	McElnay[322]	New Zealand	Adults & children	397	TST		Clinical CXR Sm Cx Other NS	21
Low	2001	Mukerjee[323]	United Kingdom	NS	84	TST Other		Clinical CXR Sm Cx NS	12
Low	1994	Hoge[324]	USA	Children	343	CXR TST		CXR	11
Low	2008	Gillman[325]	Sweden	Adults & children	246	Sx TST	CXR	CXR NS	11
Low	1994	Jimenez Luque[326]	Spain	Adults & children	231	NS		NS	8
Low	2006	Dewan[327]	USA	Adults & children	71	Sx TST	CXR Sm Cx	CXR Sm Cx	7
Low	2000	Hill[328]	New Zealand	Adults & children	160	TST		Clinical CXR Sm Cx Other	6
Low	2005	Pina[329]	Spain	Adults & children	150	CXR TST	Other	CXR Sm Cx Other NS	6
Low	2007	Fukazawa[330]	Japan	Adults & children	198	Sx CXR TST IGRA		CXR	5
Low	2008	Yoshiyama[331]	Japan	Adults	22	Other		Clinical Sm Cx Other	3
Low	2006	Voss[332]	New	Children	50	CXR TST		Clinical CXR Cx	3

			Zealand					Other NS	
Mod	2005	Chee[333]	Singapore	NS	2729	TST	CXR	Clinical CXR Sm Cx	137
Mod	2004	Chee[334]	Singapore	Adults & children	5699	Sx TST	CXR	CXR Sm Cx NS	108
Mod	2006	Gazetta[335]	Brazil	Adults & children	166	CXR		CXR Sm Cx	56
Mod	2009	Lew[336]	South Korea	Adults & children	1044	CXR TST IGRA Other		Clinical CXR Sm Cx Other	50
Mod	2010	Lee[337]	South Korea	Adults	92	Sx CXR TST IGRA Sm Cx		CXR Sm Cx Other	6

Table 6. Community contact-tracing. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2007	Nania[338]	USA	Adults & children	413	Sx TST		Clinical CXR	.
Low	1998	Moore[339]	USA	Children	606	Sx TST	CXR	CXR NS	.
Low	2006	Piana[340]	Italy	Adults	138	TST IGRA		Clinical CXR NS	.
Low	2005	Carbonne[341]	France	Adults & children	1478	CXR TST		CXR NS	.
Low	2005	Lee[342]	USA	Adults & children	228	Sx TST	CXR	CXR NS	.
Low	2004	Mouchet[343]	Belgium	Adults & children	416	CXR TST		CXR Cx	.
Low	2008	Ohno[344]	Japan	Adults & children	332	TST IGRA		Clinical CXR Sm Cx Other	.
Low	1991	[345]	United Kingdom	Adults & children	250	CXR TST Other		CXR Other NS	.
Low	2008	Berlioz[346]	France	NS	1656	Sx CXR TST IGRA		Clinical CXR Other	.
Low	2002	Laartz[347]	USA	Children	36	CXR TST		Clinical CXR	.
Low	2002	Linquist[348]	USA	Adults	94	CXR TST		CXR NS	.
Low	1996	Cockerill[349]	USA	Adults	15	CXR TST Sm Cx Other		CXR Sm Cx Other NS	.
Low	1986	George [350]	United Kingdom	Adults & children	668	CXR TST		CXR Sm Cx Other	223
Low	2004	Richeldi[351]	Italy	Adults & children	88	TST IGRA		Clinical CXR Sm Cx Other	88
Low	1997	Gentry[352]	France	Adults	86	Sx CXR TST		CXR Other	22
Low	2002	Munoz[353]	USA	Adults	105	Sx CXR		CXR	7
Med	2004	MMWR[354]	Taiwan	Adults	1463	CXR		CXR Sm Cx	25

Table 7. Health care setting contact-tracing. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1983	Plauche[355]	USA	Adults	935	TST	CXR	Clinical CXR NS	.
Low	2009	Schwartz[356]	USA	Adults	3847	Sx TST	CXR	Clinical CXR Sm Cx	3847
Low	1993	Metersky[357]	USA	Adults	1456	Sx		CXR NS	1456
Low	1986	Ciraru-Vigneron[358]	France	Adults	2697	Sx CXR TST Other		Clinical CXR Sm Cx Other	208
Low	2002	Schulte[359]	USA	Adults	176	TST		Sm Cx	88
Mod	2009	Sheriff[361]	Tanzania	Adults	286	Sx TST	CXR Sm	CXR Sm Other	143
Mod	2007	Gupta[25]	India	Adults	715	Sx TST	CXR Sm Cx	CXR Sm Cx	30
High	2006	Kali[365]	South Africa	Adults	370	Sx	Sm Cx	Sm Cx	47
High	2003	Nachega[57]	South Africa	Adults	318	TST	CXR	Clinical CXR Sm Cx Other	25

Table 8a. Pregnant women. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2009	Nezar[360]	Egypt	Adults	420	Other		Other	18
Mod	1997	Parikh[362]	India	Adults	300	TST IGRA Other		Cx	38
Mod	1980	Padubidri[363]	India	NS	200	Sx Other		Sm Cx	24
Mod	1993	Emembolu[364]	Nigeria	Adults	114	Cx		Cx NS	6
High	1990	Oosthuizen[366]	South Africa	Adults	109	Sm Cx		Sm Cx NS	5

Table 8b. Gynecology clinic setttings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2008	Ruutel[1]	Estonia	NS	112	TST IGRA		NS	.
Low	2004	Brassard[367]	Canada	Adults	262	TST	CXR	CXR Sm Cx NS	.
Low	2010	Garfein[368]	Mexico	Adults	503	Sx IGRA	CXR Sm	CXR Sm	252
Low	1998	Sadeghi-Hassanabadi[369]	Iran	Adults	2093	TST	CXR	Clinical CXR Sm Cx	150
Low	1987	Friedman[370]	USA	Adults	970	Sx CXR TST		CXR Sm Cx NS	108
Mod	1997	Yoong[14]	Malaysia	Adults	49	Sx CXR		CXR Sm Cx NS	5
Med	2010	Kiria[371]	Georgia	Adults	3459	Sx		NS	20
Med	2010	Poudyal[43]	Nepal	Adults	86	Sx Sm		Sm	8

Table 9. Drug users. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1997	Lau[372]	Australia	Adults	3555	CXR		CXR Sm Cx	1778
Low	2002	Kong[373]	USA	Adults	10027	Sx TST	CXR	CXR Sm Cx	590
Low	2009	McAdam[374]	USA	NS	32108	TST		NS	510
Low	2003	McElroy[375]	USA	Adults	620	TST	CXR	Clinical CXR Sm CX NS	310
Low	1986	Barry[376]	USA	Adults	586	Sx CXR TST		CXR Sm Cx	196
Low	1999	Southern[377]	USA	Adults & children	1943	Sx CXR TST		Clinical CXR Sm Cx	195
Low	2009	Badiaga[378]	France	Adults & children	221	Sx CXR Sm Cx		CXR Sm Cx	111
Low	1986	Capewell[379]	United Kingdom	Adults	8956	CXR		CXR Sm Cx	94
Low	2001	Solsona[380]	Spain	Adults	447	CXR TST	Sm Cx	Clinical CXR Sm Cx	90
Low	2006	De Vries[381]	Netherlands	NS	380	CXR		CXR Sm Cx	76
Low	1985	Patel[382]	United Kingdom	Adults	9132	CXR		CXR Sm Cx	69
Low	2006	Yagi[383]	Japan	Adults	1057	CXR		CXR Sm Cx	63
Low	2008	Kaguraoka[384]	Japan	Adults	1065	CXR		CXR	39
Low	2005	Valin[385]	France	Adults	1360	CXR		Clinical CXR Sm Cx NS	38
Low	2006	Lofy[386]	USA	NS	425	Sx CXR TST Sm Cx		CXR Sm Cx	33
Low	2007	Takatorige[387]	Japan	Adults	4400	CXR		CXR	33
Low	1999	Kimerling[388]	USA	Adults	127	Sx TST Sm Cx		Sm Cx	32
Low	1984	Glicksman[389]	USA	Adults	198	Sx TST		NS	22

Table 10. Homeless (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2000	Sokolove[390]	USA	Adults	10,674	Sx Other	CXR	CXR Sm Cx	628
Low	1997	Serwint[391]	USA	Children	573	TST		CXR	573
Low	2000	Sanchez-Perez[392]	Mexico	Adults	2203	Sx		Sm Cx	130
Low	2007	Nakata[393]	Japan	Adults	538	CXR		CXR	42
Mod	2005	Siqueira-Batista[394]	Brazil	Adults & children	60000	Sx		Sm	30000
Mod	1980	Arantes[395]	Brazil	Adults	32225	Sx CXR		Clinical CXR Sm	359
Med	1985	Aluoch[396]	Kenya	Adults & children	87845	Sx	CXR Sm Cx	CXR Sm Cx	806
Med	2008	Thomas[397]	India	Adults	69209	Sx	Sm	Sm NS	322
Med	1990	Seetha[398]	India	Adults & children	6221	Sx		Sm	249
Med	2009	Ngadaya[399]	Tanzania	Adults & children	65530	Sx	Sm	Sm	242
Med	2005	Santha[400]	India	Adults	55561	Sx	Sm	Sm	209
Med	2010	Escombe[401]	Peru	NS	8773	Other	Sm Cx	Sm Cx	58
Med	1980	Tsymbalar[402]	Moldova	NS	1055	Sx Other		Clinical CXR Sm Other	51
High	1998	Houwert[403]	South Africa	Children	627	Sx Other	CXR TST Sm Cx Other	Clinical CXR Sm Cx	19

Table 11. General outpatient & emergency department medical settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Med	2010	Lin[404]	Taiwan	Adults & children	181,613	Sx		Clinical CXR Sm Cx	3364
Med	2001	Willingham[405]	Peru	Adults	250	Sx TST Sm Cx		Sm Cx	7
Med	2002	Beare[406]	Malawi	Adults	634	Sx	CXR Sm Cx Other	Clinical CXR Sm Cx Other NS	6
High	2010	Ferrand[407]	Zimbabwe	Adults & children	301	Sx	Sm Cx	CXR Sm Cx Other	12

Table 12. General inpatient medical settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1989	Spencer[408]	USA	Adults	2240	Sx TST		Sm Cx	.
Low	2005	Risser[409]	USA	Children	12651	CXR TST		CXR NS	.
Low	1996	Puisis[410]	USA	Adults	126608	CXR		CXR Sm Cx NS	2945
Low	2004	Baillargeon[411]	USA	Adults	336668	TST		Clinical CXR Sm Cx NS	2571
Low	1998	Tulsky[5]	USA	Adults	3352	Sx TST		CXR NS	1676
Low	2001	White[412]	USA	Adults	14680	Sx TST	CXR	CXR NS	1468
Low	2008	Erkens[413]	Netherlands	Adults	209967	CXR		CXR NS	1364
Low	1997	Layton[414]	USA	Adults	3933	Sx CXR TST	Sm Cx	CXR Sm Cx	562
Low	2001	Saunders[415]	USA	Adults	25707	Sx TST	CXR	Clinical CXR Sm Cx Other	525
Low	2001	Martin[416]	Spain	NS	3081	TST	CXR	CXR Sm Cx	514

Low	2003	Kiter[417]	Turkey	Adults	3067	Sx CXR		Clinical CXR sm cx	384
Low	2005	Carbonara[418]	Italy	Adults	448	TST	CXR	CXR Sm Cx NS	224
Low	2008	Mor[419]	Israel	Adults	368	Sx TST	CXR	Clinical CXR Sm Cx Other	184
Low	1996	Bergmire-Sweat[420]	USA	Adults	686	Sx TST	CXR	CXR Sm Cx	69
Low	1994	Martin[421]	Spain	Adults	702	TST	CXR	CXR Sm Cx	37
Low	2003	McLaughlin[422]	USA	Adults	294	Sx CXR TST	Sm Cx	CXR Sm Cx	19
Low	1991	Carbajal[423]	Spain	Adults	136	CXR Sm Cx Other		CXR Sm Cx	8
Low	1999	Arranz-Alcalde[424]	Spain	Adults	530	TST		CXR Sm Cx	4
Mod	2008	Wong[425]	Hong Kong	Adults	159017	Sx CXR		Clinical CXR Sm Cx	191
Mod	2005	Chee[333]	Singapore	Adults	704	Sx TST	CXR	CXR Sm Cx	88
Mod	2005	Leung[426]	Hong Kong	Adults	814	Sx CXR	Sm Cx	Clinical CXR Sm Cx Other	82
Mod	2010	Vieira[427]	Brazil	Adults	397	Sx	Sm Cx	Sm Cx	57
Mod	2006	Abrahao[428]	Brazil	Adults	1052	Sx TST Sm Cx		Sm Cx	51
Mod	2009	Lemos[429]	Brazil	Adults	237	Sx TST		Clinical CXR Sm Cx Other	40
Mod	2009	Sanchez[430]	Brazil	Adults	1696	Sx CXR	Sm Cx	Clinical CXR Sm Cx Other	37
Mod	2005	Sanchez[431]	Brazil	Adults	1078	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx Other	34
Mod	2006	Fournet[432]	Brazil	Adults	1633	Sx CXR	Sm Cx	CXR Sm Cx Other	22
Mod	2010	Sanchez[433]	Brazil	Adults	622	Sx CXR		CXR Sm Cx	19
Med	2004	Harries[434]	Malawi	Adults	93877	Sx	Sm	Sm	2762
Med	2002	Chiang[435]	Taiwan	Adults	51494	CXR	CXR Sm Cx	Clinical CXR Sm Cx	586
Med	2004	Rao[436]	Pakistan	Adults	4870	Sx	CXR Sm	Clinical CXR Sm	153
Med	2009	Banda[437]	Malawi	Adults	7661	Sx	Sm	Sm	142
Med	2009	Okaru[438]	Kenya	Adults	3650	Sx	CXR Sm	Clinical CXR Sm cx	108
Med	2002	Sretrirut-	Thailand	Adults	4751	Sx	CXR	CXR Sm Cx	97

		chai[439]							
Med	2010	Kazi[440]	Pakistan	Adults	364	Sx		Sm Cx	52
Med	2010	Banu[441]	Bangladesh	Adults	11000	Sx	Sm Cx	Clinical Sm Cx	45
Med	2006	Noeske[442]	Cameroon	Adults	2474	Sx	Sm	Clinical Sm Cx Other	42
Med	1997	Nyangulu[443]	Malawi	Adults & children	914	Sx	Sm	CXR Sm	28
Med	2003	Shah[444]	Pakistan	Adults & children	386	Sx	Sm	Clinical Sm Other	26
Med	2000	Aerts[445]	Georgia	Adults	7473	Sx Other	Sm Cx	Sm Cx	17
Med	1997	Koffi[446]	Cote d'Ivoire	Adults	1861	Sx CXR Sm		CXR Sm	14
Med	2008	Kosmak[447]	Russia	Adults & children	750	Sx CXR Other		Clinical CXR Sm	8
Med	2010	Mbondi Mfondih[448]	Cameroon	Adults	1617	Sm Other		Sm	7
High	2007	Habeenzu[449]	Zambia	Adults & children	6118	Sx	Sm Cx	Sm Cx	25

Table 13. Prisons. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2008	Trehan[450]	USA	Children	549	Sx TST	CXR	CXR NS	.
Low	2002	Pedemonte[451]	Italy	Children	45	Sx Other	CXR	CXR NS	.
Low	1993	Blum[452]	USA	Adults & children	6520	CXR TST		CXR Cx 1630	
Low	2002	Fernandez Sanfrancisco[453]	Spain	Adults	2223	TST	CXR	CXR Sm Cx	1112
Low	2001	King[454]	Australia	Adults & children	7000	CXR		CXR Sm Cx	875
Low	2000	Dasgupta[193]	Canada	Adults & children	12898	CXR		Clinical CXR Sm Cx NS	759

Low	2007	Schoch[455]	Switzerland	Adults	25000	CXR		Clinical CXR Sm Cx	758
Low	1992	Bonvin[456]	Switzerland	Adults	48741	CXR		CXR Sm Cx	440
Low	2000	Callister[457]	United Kingdom	Adults	41470	CXR		Clinical CXR Sm Cx Other NS	415
Low	2005	Bakker[458]	Netherlands	Children	1598	CXR TST		Clinical CXR Other NS	320
Low	2008	Kaguraoka[384]	Japan	Adults	27918	CXR		CXR	297
Low	1988	Godue[459]	Canada	NS	879	TST		CXR	293
Low	2002	Hobbs[460]	New Zealand	Adults & children	869	CXR TST		CXR NS	218
Low	2008	Winje[461]	Norway	Adults	1000	TST IGRA		Clinical CXR Sm Cx	200
Low	2003	Rysstad[462]	Norway	Adults & children	800	CXR TST	Sm Cx Other	CXR Sm Cx Other	200
Low	2009	Liu[463]	USA	Adults & children	2092729	Sx CXR	Xm	Clinical CXR Sm	104
Low	1997	Lavender[464]	United Kingdom	NS	99	CXR TST		CXR NS	99
Low	2009	Saracino[465]	Italy	Adults	283	CXR TST IGRA Sm		CXR Sm NS	95
Low	2008	Harstad[466]	Norway	NS	2258	CXR TST IGRA		CXR NS	91
Low	1983	Sutherland[467]	USA	Adults & children	426	CXR TST		CXR Other NS	86
Low	1996	Duran[468]	Spain	Adults & children	1489	TST		NS	83
Low	2002	Bothamley[469]	United Kingdom	Adults & children	235	Sx TST		CXR Sm Cx	79
Low	2008	Bodenmann[470]	Switzerland	NS	131	IGRA Other		NS	66
Low	2009	Chaves[471]	Australia	Adults	156	NS		NS	52
Low	1997	Truong[472]	USA	Adults	191	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx	32
Low	2002	Kelly[473]	Australia	Adults & children	1863	Sx CXR		CXR Sm Cx	31
Low	1997	Wells[474]	USA	NS	1086	Sx CXR TST	Sm Cx	CXR Sm Cx	23

Low	2008	Villanueva[475]	USA	Adults & children	353	Sx CXR TST	Sm Cx	CXR Sm Cx	18
Low	2004	LoBue[476]	USA	Adults & children	571	CXR TST		CXR Sm Cx	15
Low	1998	DeRiemer[477]	USA	Adults & children	745	Sx CXR TST		Clinical CXR Sm Cx NS	15
Low	2003	Marras[478]	Canada	Adults & children	181	CXR TST	CXR Sm Cx Other	Clinical CXR Sm Cx Other	6
Mod	2006	Al Marri[479]	Qatar	Adults	32134	Sx CXR	Sm Cx	Clinical CXR Sm Cx	242
Med	2010	Mor[480]	Ethiopia	Adults & children	13379	CXR		CXR NS	291
Med	2004	Wu[481]	Taiwan	Adults	493	CXR		CXR	165
Med	1995	Keane[482]	Vietnam	Adults & children	50249	CXR		CXR Sm	157
Med	2010	Gorbacheva[483]	Nepal, Bhutan	NS	23459	Sx CXR TST		CXR Sm Cx	156
Med	2006	Maloney[484]	Vietnam	Adults	14098	Sx CXR	Sm Cx	CXR Sm Cx	78
Med	2008	Oeltmann[485]	Laos, Thailand	Adults & children	15455	Sx CXR	Sm	Clinical CXR Sm Cx Other	57

Table 14. Immigrant, Refugee, and Border Screening. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2001	Casas Garcia[486]	Spain	Adults & children	222	CXR TST		CXR NS	.
Low	1989	Lange[487]	USA	Children	873	TST		NS	.
Low	2001	Saraiya[488]	USA	Adults & children	5739	TST	CXR	Clinical CXR Sm Cx	.
Low	2005	Magkanas[79]	Greece	Adults	1872	CXR	TST Cx	CXR Cx	.
Low	2002	Huerga[489]	Spain	Children	125	Sx CXR TST		CXR NS	.
Low	1987	Jacobson[490]	USA	Adults & children	813	TST		Clinical Cx	.
Low	2006	Brassard[491]	Canada	Children	2524	Sx TST		Clinical CXr Sm Cx	1262
Low	1990	Orr[492]	Canada	Adults & children	21586	CXR Other		CXR Cx	1137
Low	2002	Chang[493]	USA	Children	706	TST	CXR	CXR Sm Cx	706
Low	2008	Manzardo[494]	Spain	Adults & children	2464	Sx CXR TST		CXR NS	308
Low	1997	Van den Brande[495]	Belgium	Adults & children	4794	CXR		CXR Sm	253
Low	1998	Ormerod[496]	United Kingdom	Adults & children	2242	Sm Cx		Clinical Sm Cx	225
Low	1990	Ormerod[497]	United Kingdom	Adults & children	2033	TST		CXR	185
Low	2003	Garcia de Olalla[498]	Spain	Adults & children	546	Sx TST	CXR	Clinical CXR Other	182
Low	2004	Alcaide Megias[499]	Spain	Adults	3151	NS		CXR Sm Cx	176
Low	2001	El-Hamad[500]	Italy	NS	483	Sx CXR TST		CXR NS	161
Low	2002	Salinas Solano[501]	Spain	Adults & children	406	Sx CXR TST	Sm Cx	Clinical CXR Sm Cx	136
Low	1991	Hostetter[502]	USA	Children	241	TST		Cx NS	61
Low	2009	Sheikh[503]	Australia	Children	239	CXR TST		CXR Other	60

Low	2009	Kik[504]	Netherlands	Adults	812	CXR TST		CXR NS	58
Low	1999	Rivas Clemente[505]	Spain	NS	218	Sx TST		CXR Sm Cx	37
Low	1999	Scolari[506]	Italy	Adults & children	721	Sx CXR TST		Clinical CXR Sm Cx	25
Low	2008	Moradi[507]	Iran	Adults	300	Other		Other	9
Low	1997	Nelson[508]	USA	Adults	99	CXR TST		CXR	3
Med	1988	Toscani[509]	Sudan	Adults & children	6250	Sx	Sm	Sm	6250
Med	2001	Weinstock[510]	Georgia	Adults & children	988	Sx TST	CXR Sm Cx	Clinical CXR Sm Cx	198

Table 15. Immigrants and refugees in community settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1998	Zahnow[511]	USA	Adults	1014	TST		NS	.
Low	1996	Manusov[512]	USA	Adults	501	TST		NS	.
Low	2008	Thijsen[513]	Netherlands	NS	246	TST		NS	.
Low	2009	Tripodi[514]	France	Adults	148	TST IGRA		CXR NS	.
Low	2009	Ringshausen[515]	Germany	Adults	143	Sx TST IGRA	CXR	CXR NS	.
Low	2001	Garcia-Garcia[516]	Mexico	NS	823	Sx	CXR Sm Cx	CXR Sm Cx NS	.
Low	1998	LoBue[517]	USA	Adults	5550	TST	CXR	CXR NS	5550
Low	2010	Migueres[518]	France	NS	11730	NS		Clinical CXR Sm Cx Other	3910
Low	2010	Torres Costa[519]	Portugal	Adults	1682	Sx TST IGRA		Sm Cx Other	187
Mod	2002	Silva[520]	Brazil	Adults	414	TST	CXR	CXR NS	.
Mod	2002	Tan[521]	Malaysia	Adults	287	TST	CXR	CXR Sm Cx NS	.
Mod	2009	Rodrigues[522]	Brazil	Adults	30	TST		NS	30
Med	2002	Ali[523]	Pakistan	Adults	207	Sx CXR TST Other		Clinical CXR Sm Cx	.
Med	2006	Wang[524]	Taiwan	Adults	6734	CXR		Clinical CXR Sm Cx Other	842
Med	2000	Kassim[525]	Cote d'Ivoire	Adults	512	CXR TST		CXR Sm Other	256
Med	2008	Bhatta-charya[526]	India	Adults	124	Sx CXR TST		CXR NS	25

Table 16. Health Care Workers. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1994	Mosquera[527]	Spain	Adults	53753	CXR Sm Cx Other		CXR Sm Cx	48
Mod	2010	Leung[528]	China	Adults	308	CXR TST IGRA Sm Cx		CXR Sm Cx Other	154
High	2008	Churchyard[529]	South Africa	Adults	11077	Sx CXR		CXR sm cx NS	93
High	2008	Fielding[530]	South Africa	Adults	13482	Sx CXR	Sm Cx	CXR Sm Cx	49
High	2004	Corbett[531]	South Africa	Adults	1978	Sx CXR Sm Cx		Clinical CXR Sm Cx NS	43
High	2009	Lewis[532]	South Africa	Adults	1955	Sx CXR Sm Cx		CXR Sm Cx	39
High	2010	Calver[533]	South Africa	Adults	25541	Sx CXR		Clinical CXR Sm Cx	26
High	2008	Park[534]	Lesotho	Adults	624	Sx CXR Other		CXR NS	21

Table 17. Miners. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2008	Nevin[535]	USA	Adults	92	TST		Clinical Sm Cx	.
Low	1984	Ferraris[536]	USA	Adults	2458	Sx TST		CXR Sm Cx	492
Low	2003	LaMar[537]	USA	Adults	3028	Sx TST	Other	CXR Sm Cx	179
Low	1991	Lescreve[538]	Belgium	NS	1199	CXR		CXR	134
Med	2002	Chiang[539]	Taiwan	Adults	305140	CXR	CXR Sm Cx	Clinical CXR Sm NS	1440
Med	1981	Johnston[540]	Nepal	Adults	2021	CXR		CXR NS	73

Table 18. Military. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1999	Parmet[541]	USA	Adults	47	TST	CXR	Clinical CXR NS	.
Low	1985	Shigenobu[542]	Japan	Adults	214611	CXR		CXR	5235
Low	1981	Kitazawa[543]	Japan	Adults	44276	NS		NS	3406
Low	1983	Judson[544]	USA	Adults	6090	TST	CXR	CXR NS	2030
Low	2002	Cappabianca[545]	Italy	Adults	2292	CXR	CXR TST Sm Cx Other	Clinical CXR Sm Cx	764
Low	1987	Nakamura[546]	Japan	NS	43656	CXR		CXR	383
Low	2002	Kimura[547]	Japan	Adults	382	Sx CXR	CXR	CXR Sm Cx Other	96
Low	2008	Gray[548]	Australia	Adults & children	1471	Sx CXR	Sm Cx	Clinical CXR Sm Cx	74
Low	1994	Ciesielski[549]	USA	Adults	94	CXR TST Cx		CXR Cx	47
Med	2007	Su[550]	Taiwan	Adults	17105	Sx CXR	CXR Sm Cx	Clinical CXR Sm Cx Other	778
Med	1999	Tiwari[551]	India	NS	319	Sx	CXR Sm	CXR Sm NS	160
Med	2005	Hassan[552]	Bangladesh	Adults	2281	Sx	CXR TST Sm	CXR Sm	104
Med	1995	Aungkasuva-pala[553]	Thailand	Adults	676	CXR Sm		CXR Sm	52
Med	1983	Marga[554]	Russia	Adults & children	527	CXR		Clinical CXR Sm Cx Other	4

Table 19. Other occupational settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1996	Vega[555]	USA	Adults	91	TST		CXR NS	.
Low	2006	Forssman[556]	Australia	Adults	100	Sx CXR TST	CXR Other	Clinical CXR NS	.
Low	2006	Ohmori[557]	Japan	Adults	212	Sx CXR		CXR	.
Low	1988	Morris[558]	United Kingdom	Adults	809	CXR TST Other		CXR Sm Cx Other NS	68
Mod	2006	Chan-Yeung[559]	Hong Kong	Adults	3682	TST		Clinical CXR Sm Cx Other	137
Mod	1996	Woo[560]	China	Adults	587	TST		CXR Sm Cx	84
High	1991	Morris[561]	South Africa	Adults	205	Sx	Sm	CXR Sm Cx Other	7

Table 20. Nursing and elderly facility/institutional settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1998	Fortuin[562]	Belgium	NS	11473	CXR		CXR NS	1275
Low	2008	Harada[563]	Japan	Adults	63	CXR		CXR NS	1275
Med	2007	Huang[564]	Taiwan	Adults	4200	CXR	Sm Cx	CXR Sm Cx	111

Table 21. Psychiatric facility/institutional settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1998	Chanmugam [565]	USA	Adults	42	TST	CXR	Clinical CXR NS	.
Low	1993	CDC[566]	USA	Adults	38350	TST		NS	1475
Low	1993	Beser[567]	Turkey	Adults	7405	Sx CXR TST		Clinical CXR Sm Cx Other	674
Low	2007	Gauchon[568]	France	Adults & children	80	Sx CXR TST		Clinical CXR Sm Cx	80
Mod	2010	Lee[337]	South Korea	Adults & children	246	CXR		CXR Sm Cx NS	13
Med	2002	Francis[569]	Haiti	Children	445	TST		Clinical CXR	45

Table 22. Other institutional settings. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Mod	1995	Kim[570]	South Korea	Adults	8015	CXR		CXR Sm Cx	2223
Med	1984	Lester[571]	Ethiopia	Adults	427	CXR		CXR Sm Cx	54
Med	2002	Ezung[572]	India	Adults	100	Sx CXR Sm		CXR Sm	38
Med	1984	Tripathy[573]	India	Adults	219	Sm		Sm	25
High	2009	Webb[574]	South Africa	Children	258	Sx CXR TST	Sm Cx Other	CXR Sm Cx	37
High	1984	Gill[575]	South Africa	Adults	66	CXR		CXR Sm	17

Table 23. Diabetes. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1999	Al Shohaib[576]	Saudi Arabia	Adults only	80	CXR TST		CXR Sm Cx	.
Low	2005	Dogan[577]	Turkey	Adults & children	124	TST	CXR	CXR	.
Low	1983	Segarra-Obiol[578]	Spain	Adults	2846	Sx CXR		Clinical CXR Sm Other	2846
Low	1984	Styblo[579]	Netherlands	Adults	13667	CXR Sm Cx		CXR Sm Cx	268
Low	2002	Hassine[580]	Tunisia	Adults	60	Sx CXR TST Sm Cx		Clinical CXR Sm Cx Other	10
Med	2002	Migliori[581]	Russia	Adults	18	Sx	CXR Sm Cx	Clinical CXR Sm Cx	4

Table 24. Persons with underlying diseases or illnesses. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	2008	Katoch[582]	India	Adults & children	23648	Sx	CXR Sm Cx Other	Clinical CXR Sm Cx Other	343
Low	2008	Matee[29]	Tanzania	Adults	2216	Sx CXR Sm Cx		Clinical CXR Sm Cx Other	22
Low	2005	Mtei[45]	Tanzania	Adults	93	Sx CXR TST IGRA Sm Cx Other		CXR Sm Cx Other	7

Table 25. Vaccine trial settings (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified)

TB Inc.	Year	Author	Country	Age group	No. screened	Primary Screen	Secondary Screen	Diagnostic Criteria	NNS
Low	1999	Schluger[583]	USA	Adults & children	3526	Sx TST		Clinical CXR Sm Cx NS	177
Low	2007	De Vries[584]	Netherlands	Adults	3248	CXR		CXR Sm Cx	116
Low	2006	Moonan[585]	USA	Adults & children	3645	Sx CXR TST		Clinical CXR Sm Cx NS	83
Low	1997	Schluger[586]	USA	Adults	591	TST		Clinical CXR	54

Table 26. Other risk groups. (CXR=Chest X-ray. Sm=sputum smear. Cx=TB culture. NS=Not specified

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