World Health Organization

Early detection of Tuberculosis

AN OVERVIEW OF APPROACHES, GUIDELINES AND TOOLS

Early detection of tuberculosis

An overview of approaches, guidelines and tools

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Contents

1. Introduction **1**

1.1 Purpose of this document 1

1.2 Rationale for intensified and early TB case detection 2

2. Systematic actions to improve early TB case detection **4**

2.1 Optimizing actions along the patient-initiated pathway 5

2.1.1 Improving knowledge and awareness 5

2.1.2 Minimizing barriers to health-care access 6

2.1.3 Strengthening identification of patients with suspected TB 7

2.1.4 Ensuring quality-assured diagnosis 8

2.1.5 Improving referral and notification practices 10

2.2 Screening for active TB 11

2.2.1 Conditions for pursuing screening 11

2.2.2 Choosing appropriate screening tools and algorithms 11

2.2.3 Prioritizing risk groups for screening 11

3. Situation analysis for priority-setting **14**

Annex: Policies and guidelines related to TB case detection **17**

References **21**

1. Introduction

1.1 Purpose of this document

Too many people have undetected tuberculosis (TB) for too long; late detection of TB increases their risk of transmitting the disease to others, having poor health outcomes, or that they and their family will suffer distress and economic hardship. The burden of TB is declining slowly worldwide, but progress in controlling TB and mitigating its consequences could be expedited if programmes focused on providing early diagnosis and treatment.

There are many entry points for interventions to improve early detection of TB. The Stop TB Strategy, as well as published guidelines and tools, provide guidance on approaches of proven effectiveness (Annex 1). Additional material is being developed, but is not available for several intervention areas with potential for positive impact.

This document provides an overview of approaches, guidelines and tools to improve early detection of TB. It presents a framework to assess pathways and barriers for early detection of TB from which prioritization of interventions can be based. The document also highlights areas for which additional research and guideline development are required.

A key next step for those planning national efforts in TB care and control is prioritizing interventions for early detection of TB. Prioritization will depend on the national TB epidemiology, existing treatment and control efforts, and available resources and capacity. This document does not attempt to guide prioritization but rather to provide an overview of the approaches that should be considered.

The main target audience for this document is managers and other staff of national TB control programmes (NTPs) and their partners in TB care and control, including nongovernmental organizations, all public and private health-care providers and civil society.

1.2 Rationale for intensified and early TB case detection

Despite the scale up of quality-assured TB services in line with the *Stop TB Strategy* (*1*) and the *International Standards for Tuberculosis Care* (*2*), TB case detection is incomplete, the global TB burden remains high and TB incidence is declining slowly worldwide (*3*). Ensuring ***universal access*** to quality-assured diagnosis and treatment and early detection of TB will diminish transmission, avert deaths and prevent suffering caused by TB, and help countries to move towards elimination of the disease (*3*, *4*).

From both an equity perspective, as well as a TB care and control perspective, it is essential that the ***poorest and most vulnerable groups*** have access to quality-assured diagnosis, treatment, care and support. Poor and vulnerable populations are those most likely to contract infection, develop disease, have poor treatment outcomes, and experience severe social and economic hardship from the disease. If TB is not effectively diagnosed and treated among these groups, it can perpetuate the epidemic and put the whole population at continuous risk of TB (*5*). Specific action is therefore required to ensure equity (*6*), linked to broader efforts to ***strengthen health systems*** (*7*), ***especially at the community level***. This should be coupled with efforts to ***increase awareness of TB and health among communities*** (*8*).

All people with TB have a right to good-quality care. To ensure this right, and to achieve rapid progress in control and elimination of the disease, early detection should be accelerated for ***all types of TB*** by implementing existing approaches for early diagnosis and effective treatment (*1*, *2*, *3*, *9*, *10*) for ***all TB patients*** in ***all age groups*** (*11*) in ***all settings***. Although sputum smear-positive TB is the most infectious form of TB, the risk of transmission in other forms of TB should be acknowledged (*12*). ***Multidrug-resistant TB (MDR-TB) and HIV-associated TB*** require special efforts to ensure early diagnosis (*13*, *14*).

Basic diagnostic and treatment services require strengthening in many settings in line with existing guidelines. Strengthening of laboratory services (for sputum-smear microscopy, culture, drug-susceptibility testing and new diagnostics) (*15*) and X-ray services (*16*, *17*) is essential. Sputum smear microscopy is inexpensive and feasible in most field conditions and effectively identifies the most infectious TB cases; however, this technique has lower sensitivity to detect smear-negative, culture-positive TB, especially among people living with HIV. ***New and better diagnostic tools with proven usefulness and affordability should be scaled up rapidly***, including tools for diagnosis of MDR-TB (*14*,*18*, *19*). Further investment is needed for discovery and testing of new diagnostic tools.

Health-care workers commonly fail to initiate TB investigations when people with TB symptoms seek care. All health-care workers in all relevant public and private health-care facilities should therefore be sensitized about how to ***identify people with suspected TB*** (*9*), especially in those seeking care with respiratory symptoms (*20*).Vulnerable groups such as ***people living with HIV*** (*14*) ***and children*** require special attention (*11*).

A large proportion of TB patients are still managed outside NTP-supported services by providers that are not using diagnostic approaches and treatment interventions in line with best evidence and international standards (*3*, *21*). ***Full engagement of all relevant public and private providers***, and full notification of diagnosed TB cases, is essential to ensure complete detection of TB and effective surveillance (*22*, *23*).

Cough is the most important symptom of pulmonary TB, and the presence of chronic cough should trigger investigation for TB. However, chronic cough is not always present, even among people with sputum smear-positive TB. For complete and early TB detection, the ***definition of suspected TB needs to be as inclusive as possible***. The need is supported by data from several TB prevalence surveys (*24*, *25*, *26*, *27*, *28*) which show that a large proportion of people with active and infectious TB do not have the classical symptoms that conventionally have been used to define suspected TB.

A potential major obstacle for early and complete TB case detection is that 10–25% of bacteriologically-confirmed cases do not report any symptoms early in the disease course, as demonstrated in prevalence surveys (*24–28*). Such cases can be identified only through screening of all people, regardless of symptoms, using chest X-ray or other highly sensitive screening tools. These data suggest that ***TB screening, using investigations other than asking about symptoms, in selected risk groups*** is indicated in order to reach early those people who do not experience symptoms and therefore are unlikely to seek care.

2. Systematic actions to improve early case detection

There are two principal pathways to TB case detection: the patient-initiated pathway and the screening pathway (Figure 1).

The first pathway, previously labelled “passive case-finding”, is the main approach to case-finding currently applied by most NTPs in countries with high TB burdens. The term "passive" reflects the fact that NTPs do not actively seek TB cases outside health facilities, but focus on providing high-quality diagnostic services to people with TB symptoms who approach health facilities. The term “passive” is, however, misleading since the approach requires both active health-seeking and responsive health systems with capacity to identify people who should undergo diagnostic investigations for TB. A better term is therefore the ***“patient-initiated pathway”***. This pathway includes the following steps, each of which represents a potential barrier to early case detection: (i) recognizing symptoms by the sick individual or caretaker; (ii) accessing an appropriate health-care provider; (iii) identifying patients with suspected TB by health-care workers; (iv) successfully applying all required steps in an appropriate diagnostic algorithm, using quality-assured diagnostic tools; (v) referring to the appropriate place of treatment and/or notification (Figure 1).

The second pathway, depicted in the lower part of Figure 1, is the ***“screening pathway”***. Screening refers to the identification of presumptive TB disease among people who do not actively seek and receive care for symptoms or signs compatible with TB. This includes both people with active TB who do not experience symptoms that they perceive as severe enough to warrant medical attention, as well as people who start but do not follow through the patient- initiated pathway. Screening may target the general population, but normally targets specific risk groups. Screening has the potential to detected TB in many people who have not started or not completed the “patient-initiated pathway”. However, screening is normally very resource intense, unless targeted to specific high risk groups that are easy to reach, and should be pursued as a complementary approach after appropriate efforts have been made to address barriers along the “patient-initiated pathway”.

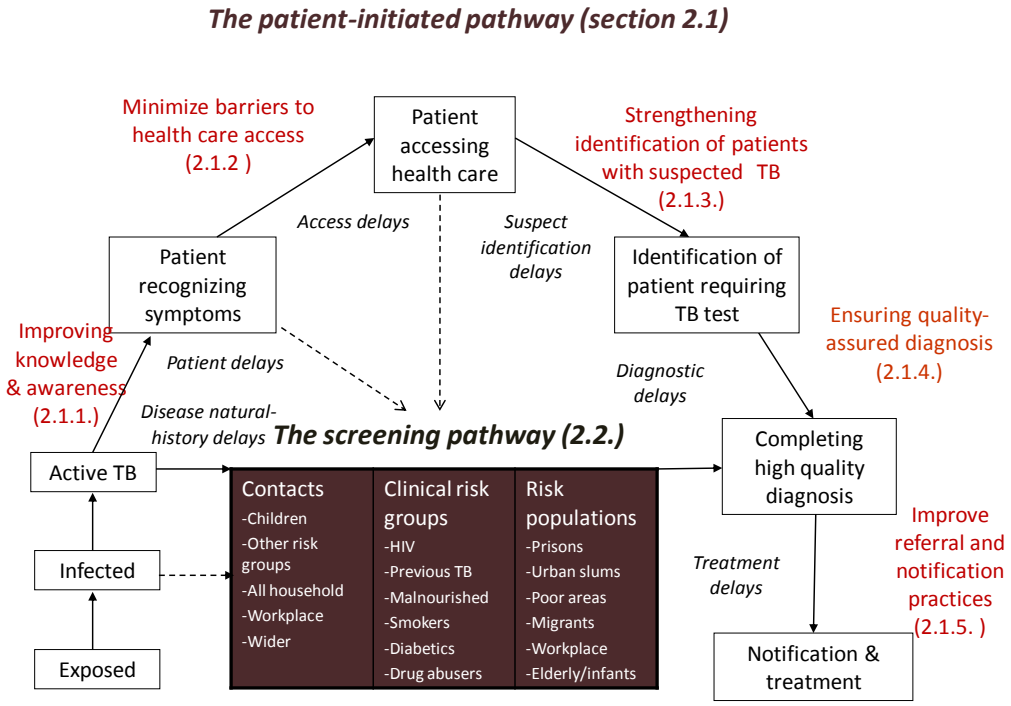


Figure 1. Pathways to TB diagnosis and treatment, and barriers or entry points for interventions to improve case detection and reduce delays in TB detection (numbers in parentheses represent the corresponding sections for each intervention area)

2.1 Optimizing actions along the patient-initiated pathway

The following main actions should be optimized along the patient-initiated pathway:

- improving knowledge and awareness;
- minimizing barriers to health-care access;
- strengthening identification of patients with suspected TB;
- ensuring quality-assured diagnosis of TB;
- improving referral and notification practices.

These actions follow a logical sequence but are not listed in any order of priority. Prioritization of actions will depend on identified gaps and barriers in any given setting. Suggested elements of a situation analysis are discussed further in section 3.

2.1.1 Improving knowledge and awareness

Ensuring high awareness in communities about health in general and of TB and TB services in particular can help to ensure that people recognize TB symptoms and take appropriate action early to seek care from appropriate health facilities (*5*). More importantly, people need to believe that the available general health services offer something valuable at an affordable cost, and be assured that such services do not come at a social cost caused by stigma associated with the disease and/or the services being offered. Any strategy to influence the demand side should be based

on a good understanding of local knowledge and attitudes towards health and health care in the community. Therefore, actively engaging community members and civil society is essential to plan and execute an effective strategy. There are many country experiences of the value of such strategies, and some well-documented successes (*29*, *30*). A powerful way to increase utilization is to ensure that high-quality, accessible and affordable services are in place.

Peoples' health-seeking behaviours are largely influenced by the experiences and attitudes of family, the local community and peers. Ensuring client satisfaction is key to increasing utilization of available TB services. Cured TB patients are effective advocates and can be actively involved in increasing awareness in the community, and also be formally engaged in identifying and referring people with TB symptoms (*31*).

2.1.2 Minimizing barriers to health-care access

Provide TB care free of charge with minimum direct and indirect costs

A basic principle for NTPs is to provide all essential diagnostic tests, as well as the full treatment course, free of charge to patients and without consultation fees (*1*, *7*, *15*). NTPs should also aim to decentralize delivery of services and simplify diagnosis and treatment procedures to ensure access, and minimize direct and indirect costs for patients and their families (*32*). Enablers for accessing health care, such as conditional or unconditional financial or food transfer, should be considered. Some of these actions can be pursued by NTPs alone. However, many of these activities require collaboration with actors engaged in general health-system strengthening as well as with nongovernmental organizations, the private sector, civil society and communities engaged in improving health services for poor and vulnerable populations (*5*, *31*, *33*).

Target vulnerable groups

It is well recognized that the poorest of the poor and those living in remote rural areas, conflict zones and urban slums without basic health-care infrastructure often have poor access to quality-assured diagnostic and treatment services (*6*, *7*). Disempowered, poorly educated, marginalized, informal or illegal residents may have greater difficulties in both accessing care and fully availing themselves of such services, even if they can reach the appropriate facility. Women face special access barriers in many settings, related to, among other things, disempowerment, stigma and lack of financial resources (*34*, *35*). Published guidelines are available for NTPs on how to improve access for these groups (*7*, *9*, *36*, *37*). Possible interventions include enablers targeting specific vulnerable groups and targeted outreach activities combining health information with mobile diagnostic services for vulnerable populations.

Engage health-care providers utilized by poor populations

Many poor people turn to formal or informal private health-care providers or depend on self-treatment, and delay utilization of formal health-care services. It is essential to engage with and improve TB diagnosis and referral mechanisms across all public and private health-care providers, including nongovernmental and civil society

organizations, with special attention to the providers of the poor, and those providers that people often turn to first. All TB services offered by public and private providers should be free of charge to patients (*8*).

Strengthen health systems

In a majority of countries, TB diagnosis and treatment is integrated with delivery of primary health care. Therefore, the performance of the NTP is dependent on the performance of the general health system. Guidelines have been developed for how NTPs can actively contribute to health-system strengthening (*8*). There is no single key intervention that all NTPs need to pursue. The important point is that NTPs, in order to improve case detection and general performance of the programme, need to assess weaknesses in the general health system and contribute to addressing them together with other public health programmes and other relevant stakeholders in the general health system (*38*).

2.1.3 Strengthening identification of patients with suspected TB

Train front-line health staff

All health staff in all parts of the health system should be alert to and know how to ask patients about TB symptoms and refer them for TB diagnostic testing as per guidelines (*15*). This entails training (pre-service and in-service) of all health-care providers, public and private. Restricting the efforts to NTP-affiliated facilities only, or to the specific staff designated for TB care only, is a grave error and misses early identification of all those cases who seek care elsewhere in the health system (*22*). Actively asking all out-patients in primary health-care facilities and hospitals about cough (including those who do not mention cough spontaneously) can yield identification of a substantial additional number of cases (*39*, *40*, *41*). Expanding implementation of such screening practices may also mean involving non-health-care staff as symptom surveyors; such staff may include clerks managing registrations in the out-patient department, who may ask a simple question about cough to all attendees and send eligible patients directly for a diagnostic test.

Intensify case-finding among people living with HIV

The Stop TB Strategy emphasizes the need to screen all people living with HIV for TB (*1*, *10*, *42*). Recent experiences show that intensified case-finding among people with HIV has contributed substantially to overall TB case detection in some countries (*43*). The recommendation is that all adults and adolescents living with HIV who have any of the following symptoms (current cough, fever, night sweats, or weight loss) should be carefully evaluated for TB and other diseases. Children living with HIV who have any one of the following symptoms (poor weight gain, fever, current cough or contact history with a TB case) should also be evaluated for TB (*44*).

Scale up the Practical Approach to Lung Health

Respiratory conditions are usually the first or the second leading cause of care-seeking in primary health-care settings (*45*). Evidence from countries suggests that patients with persistent respiratory symptoms, including those with TB symptoms, are often mismanaged in primary health-care facilities, and that TB screening among eligible patients is often neglected (*46*). The Practical Approach to Lung Health (PAL)

aims to improve the quality of management of respiratory patients, and to ensure coordination among different levels of health care and between TB control programmes and general health services (*20*). Country experience has shown that implementation of this approach can improve the technical capacities of primary health-care workers to manage respiratory patients, including people with suspected TB (*47*). Data from country evaluations suggest that screening for TB among respiratory patients with suspected TB increases with implementation of the approach (*48*), and that case notification rates improve as a consequence (*49*, *50*).

Test for TB on broader indications

The recommended indication for diagnostic testing for pulmonary TB is cough of 2–3 weeks' duration (*6*). A shorter recommended duration of cough leads to higher sensitivity of screening but lower specificity. Appropriate cut-off depends on both the prevalence of TB in the community (which determines the positive and negative predictive value of the symptom screening step) and the available diagnostic resources. Using 2 weeks as a cut-off point increases sensitivity (*51*). Further research is required to determine whether shorter duration of cough, for example in combination with other signs, symptoms and TB risk markers, has sufficient sensitivity and specificity for use as initial TB screening. In addition, any chest X-ray abnormality, regardless of the initial indication for the X-ray, should trigger investigation for TB (*15*, *52*).

Intensify identification of TB in clinical risk groups beyond HIV

The risk of TB is increased among people with tobacco smoking-related conditions (*53*) diabetes (*54*), malnutrition (*55*) alcohol use (*56*) and a wide range of other conditions that impair peoples' defence against TB infection and disease, such as silicosis, malignancies, various systemic immunosuppressant conditions and treatment with immunosuppressant medicines (*57*). In addition, people with previous episodes of TB are at higher risk than the general population of developing a subsequent episode of active TB. It is a relevant part of individual clinical management of these conditions to systematically ask for TB symptoms, at least in high TB burden settings. Potentially, it may be worth testing people with these risk markers on broader indications, along the lines of recommendations for people living with HIV. However, more research and documentation are needed on the feasibility, effectiveness and cost-effectiveness of such approaches before developing general recommendations for NTP policies. Testing all people in a particular clinical risk group for TB is an approach that is part of the screening pathway, which is further discussed in section 2.2. below.

2.1.4 Ensuring quality-assured diagnosis

Improve the use of sputum smear microscopy

WHO recommends the use of sputum smear microscopy as an initial diagnostic tool for pulmonary TB, except among people living with HIV. The test identifies those individuals who are most infectious, at a low cost to health services. Optimal quality of sputum smear microscopy should be ensured through external quality assurance (EQA) systems (*58*). The overall sensitivity of conventional sputum smear microscopy is low, while specificity is high when used correctly, at least in clinical

settings when used to diagnose TB through patient-initiated TB detection (*59*). The definition of smear-positive TB has recently been changed so that one positive sputum smear is now sufficient (*60*). Only two sputum specimens are required and they may be performed on the same day, providing that AFB (acid-fast bacilli) microscopy is quality-assured through EQA systems. This can help to reduce the risk of defaulting during the diagnostic process, as well as the indirect costs of diagnosis to patients.

Enhance diagnosis of sputum smear-negative TB

The recommended algorithm (except for people lining with HIV) when sputum smear is negative conventionally involves a course of broad spectrum antibiotics and a follow up with renewed sputum smear microscopy followed by chest X-ray if required (*6*). This approach minimizes the risk of treating false-positive TB cases diagnosed by an initial chest X-ray alone. However, the approach is associated with the risk of diagnostic delays, high indirect costs to patients, and risk of drop-out during the diagnostic phase. Good access to quality-assured chest X-ray diagnosis combined with effective communication strategies that minimize drop out during the diagnostic phase can potentially improve early case detection of sputum smear-negative cases. TB diagnosis should be expedited in people living with HIV by using all available investigations, including Xpert® MTB/RIF as a first diagnostic test, if available, culture and chest X-ray (*14*, *1*9). Culture or Xpert® MTB/RIF as a follow-on test for HIV-negative individuals with either a negative sputum smear and/or a positive chest X-ray can dramatically improve detection of sputum smear-negative pulmonary TB (*19*).

Improve diagnosis of extrapulmonary TB and TB in children

Existing diagnostic tests for TB in children have shortcomings, and the full range of tests (including bacteriological culture and tuberculin skin testing) is often not available in settings where the vast majority of paediatric TB cases occur. The development of affordable non-sputum based diagnostic tests for paediatric TB in low-resource settings should be a priority for researchers and policy-makers. Challenges for diagnosis of extrapulmonary TB include shortcomings in several diagnostic tests and clinical assessments across many medical specialities. Improved diagnostic algorithms, as well as improved diagnostic capacity, infrastructure and training, is required to ensure effective and early diagnosis (*61*, *62*).

Optimize use of culture

Culture is the gold standard for TB diagnosis, and the method is by definition more sensitive and specific than sputum-smear microscopy and chest X-ray. Wide implementation of quality-assured culture services can help increase bacteriologically-confirmed case detection. It can also be used to feed back diagnostic accuracy to the diagnosing physician. However, the method is expensive and requires an advances laboratory network. Conventional culture also takes a long time (up to 8 weeks). Liquid culture increases the case yield by 10% over solid media, and automated systems reduce the diagnostic delay to days rather than weeks. Liquid systems are, however, more prone to contamination, and the manipulation of large volumes of infectious material mandates appropriate, adequate biosafety measures (*15*).

Set up and scale up new diagnostic tools

TB diagnosis would be considerably simplified with the availability of new sensitive, specific, and cost-effective diagnostic tools that are also applicable at point-of-care in field conditions in resource poor settings. Xpert® MTB/RIF and other new tests in the pipeline have the potential to become point-of care tools suitable for widespread use, provided that challenges with implementation can be overcome and that costs are sufficiently low. However, currently the test is recommended by WHO for use at the intermediate laboratory level (district or sub-district) (*19*). Xpert® MTB/RIF has the advantage of detecting TB with equivalent sensitivity to culture on solid media and of simultaneously detecting rifampicin resistance with high sensitivity (95%) and specificity (98%) in a very short time (less than 2 hours). Another advantage is that it performs equally well among HIV-negative and HIV-positive individuals. It is therefore a useful tool to improve early case detection of MDR-TB and HIV-associated TB (*19*). AFB microscopy and culture remain essential tools for monitoring patients' response to therapy. Conventional drug susceptibility testing of second-line anti-TB medicines remains an important tool to determine additional drug resistance among rifampicin-resistant strains.

2.1.5 Improving referral and notification practices

People with TB symptoms utilize a wide range of public and private providers. In many high TB burden countries, the first point of contact for the majority of people with TB, including poor people, is a private provider (private doctors and hospitals, private pharmacies or informal private providers). These providers are often disengaged from formal national TB control efforts. They may not follow international standards for diagnosis and treatment, and often do not notify TB cases to the NTP. A similar problem exists in parts of the public health-care sector, especially in the hospital sector. TB diagnosis and management under the NTP is normally integrated with primary health care, although some countries provide TB services mainly through specialized, independent TB facilities. Public hospitals, medical colleges, special health insurance-affiliated health facilities, and health facilities belonging to special health services of the armed forces, prison system, police service, etc., are often not fully linked to the NTP (*21*). All public and private providers that are consulted by people with TB symptoms, and who diagnose and/or treat TB, need to be engaged in national TB control efforts in order to ensure early diagnosis, appropriate treatment and full notification of all TB cases. Guidelines have been developed to engage all health-care providers through public–private mix approaches (*22*, *23*). These approaches have proven cost-effective for providers, patients and societies (*63*, *64*).

2.2 Screening for active TB

Global guidelines on screening for active TB are under development.[1] The guidance contained in this section is therefore provisional.

2.2.1 Conditions for pursuing screening

Before pursuing TB screening for active TB, the following set of conditions should be met:

1. Epidemiological relevance of screening[2] has been demonstrated through analysis of national or subnational data.
2. Opportunities and barriers to further improve the patient-initiated pathway have been analysed, and screening has been judged to be an important complement to further actions to improve passive case-finding.
3. Quality-assured TB treatment and management is in place, and capacity is available to scale up treatment further and ensure that barriers to accessing treatment are minimized for those who will be identified through screening.
4. Reasonable public health gains can be expected in relation to investment (financial, human resources, etc), as compared with alternative health interventions (not only to TB control but to all public health interventions).
5. Sufficient resources are available or can be made available without adverse impact on other key functions of the health system.
6. Quality-assured diagnostic tools and strong diagnostic algorithms are in place, or can be put in place, in order to minimize the number of false-positive TB cases.
7. The risk of harm to the screened population or the health system is low.

2.2.2 Choosing appropriate screening tools and algorithms

Screening for active TB should be done with a tool that effectively identifies people who probably have active TB. The tool needs to have high sensitivity.[3] It also needs to be inexpensive and feasible to use in a given setting, and acceptable to a given risk group. Very high specificity is not necessary for a screening tool. However, among those identified with probable disease through screening, the diagnosis needs to be verified through application of a diagnostic test (or a combination of tests) with very high specificity. Different risk groups may require different tools and algorithms for screening and diagnosis, due to variations in sensitivity and specificity in relation to, for example, patient's age and HIV status.

2.2.3 Prioritizing risk groups for screening

Few settings have both the relevant epidemiological situation and the resources to perform complete national mass screening for TB. However, many countries would

[1] WHO plans to complete guidelines on screening for active TB in 2012.
[2] At the time this report was written, a systematic review of benefits of screening was being conducted, aiming to establish the epidemiological and health systems situations in which TB screening is relevant.
[3] At the time this report was written, systematic reviews were being conducted to establish sensitivity, specificity, cost, and feasibility of different screening tools and algorithms. This report therefore does not include details about screening tool options.

be able to identify risk groups within which screening is feasible, relatively cost-effective and affordable. Screening for TB among people living with HIV as well as among TB contacts is established WHO policy. Further work is ongoing to establish the criteria for prioritizing screening in other risk groups. Tentatively, three considerations should be made:

The first consideration for prioritization is the feasibility of screening, including whether it is possible to successfully identify members of a specific risk group; the likelihood that they would take up screening and subsequent confirmatory diagnosis and treatment; and the capacity of the health system to implement screening. Six broad categories of TB risk groups are listed here in an assumed order of feasibility, in terms of where and how to identify people belonging to the risk group.

i. *Contacts of TB cases.* TB contacts are identified through a known TB case, the index case. Contacts can be household members (particularly children aged under 5 years should be prioritized), individuals residing in the same institution, workmates, or people belong to a wider social network of the TB case. The more remote from the index case and/or facility, the more difficult it is to identify and reach them. The main disadvantage of contact screening is high transportation costs, either to family if services are facility-based, or to health system if services are home-based.

ii. *Clinical risk groups.* Clinical risk groups consist of groups with an identified medical condition that is associated with an increased risk of TB, for example, HIV, silicosis, previous TB, diabetes, undernutrition, chronic obstructive lung disease, alcohol dependency, and a wide range of systematic diseases and conditions requiring immunosuppressant treatments. Such risk groups may already be receiving care in a medical facility, in which case they are relatively easy to reach for TB screening, or they may be identified through general health screening, which is more demanding of resources.

iii. *Institutional risk groups.* Institutionalized risk groups are those residing, for example, in a prison, a homeless shelter or a long-term care institution, such as a mental asylum, where TB transmission may be high and other TB risk factors may be prevalent. They may be relatively easily reached, provided that legal and human rights frameworks are conducive while protecting individuals from potential harm. However, uptake and adherence to treatment may be a challenge for some of these groups.

iv. *Occupational risk groups.* Health-care workers, especially those caring for people with TB, may be targeted for TB screening. People working in mining industries and in crowded workplaces in settings where the background TB prevalence is high are also often at elevated risk of TB. All these groups may be relatively easy to reach for TB screening, and cost of screening may be shared with employers.

v. *Residential risk groups.* This may include people living in high-density residential areas including slums, refugee camps, or any other identified high TB prevalence setting. The more well-defined and concentrated the group is, and the better

demographic and social information that is available on these groups, the easier it would be to reach them. Infrastructure, and social and political barriers may exist, and nongovernmental and civil-society organizations can be useful partners to engage in addressing such barriers. Protection of individual rights needs to be ensured.

vi. *Demographic and socioeconomic risk groups.* This includes people with a demographic or socioeconomic characteristic associated with higher TB risk, for example immigrants from a high TB prevalence setting, the elderly, and people in low socioeconomic groups. The possibility of effectively reaching them depends, among other things, on the availability of registers or other data sources from which they may be identified, and the capacity of the health system, social services, immigration services, etc.

The second consideration is the number of people needed to screen in a given risk group in order to identify one individual with previously undiagnosed TB. In principle, the number needed to screen is lowest in the risk groups with the highest TB prevalence, such as people living with HIV, TB contacts and prisoners, who often have a TB prevalence that is in the order of 20 times higher than the general population.[1]

The third consideration for prioritization is the potential public health impact of screening in a given risk group. This depends on: the prevalance of TB in the risk group; the size of the risk group; the consequences of TB for people in the risk group; the risk of transmission within and beyond the risk group; and the cost and feasibility to conduct successful screening in the risk group. Screening restricted to a small and easily accessible risk groups with high TB prevalence will have limited public-health impact. Screening in large risk groups with moderately increased TB prevalence may have higher total yield and a larger impact on TB transmission, while being much less cost-effective in terms of cost per newly identified TB case. In prioritizing risk groups for screening there is therefore often a difficult trade-off to be made between potential effectiveness and affordability. However, cost-effectiveness and affordability should also be considered from a societal viewpoint as well as from the viewpoint of potential reduction in future health care cost for TB.

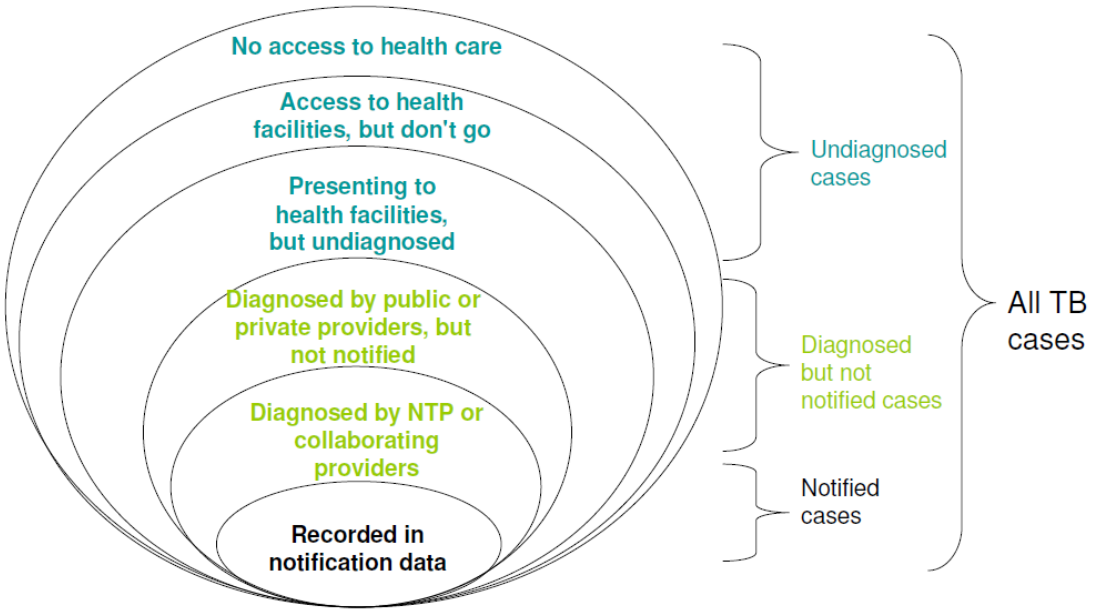
It should be noted that feasibility, number needed to screen and overall public health impact of screening in a given risk group will depend on local context, including TB epidemiology; capacity of health systems and social services; the availability of health, social and demographic data; and regulatory framework. Prioritization will therefore vary considerably among settings.

[1] At the time this report was written, a systematic review was being conducted to establish the number needed to screen to detect a case of previously undiagnosed TB in different risk groups.

3. Situation analysis for priority-setting

Prioritization should start with a gap analysis to identify the most important barriers to early and complete TB case detection. This should be done through dialogue and in collaboration with all concerned stakeholders, including nongovernmental organizations, academia, the private sector, civil society, the community, and patients.

The pathways in Figure 1 can serve as a starting point to identify and prioritize bottlenecks. A complementary approach is to assess the fraction of cases being missed by routine TB notification data, based on the "Onion" model (Figure 2) (*65*). The two approaches are complementary but somewhat overlapping. A difference is that the model in Figure 1 more explicitly considers the health-seeking pathway, delay and role of screening, whereas the onion model more explicitly aims to quantify the fraction of TB cases not accounted for in TB notification data.



NTP, national TB control programme

Figure 2. The "Onion" model: a framework for assessing the fraction of TB cases accounted for in TB notification data

Table 1 suggests assessment approaches in relation to potential barriers, and identifies the required interventions as well as tools, guidelines and policies to assist implementation. The situation assessment should involve analysis of TB programme surveillance data and other routine health system and epidemiological data, as well as, where appropriate, TB prevalence surveys and operational research.

The Annex lists existing guidelines and policy documents. For several interventions that could potentially help address important barriers, the evidence base remains weak or has not yet been fully reviewed and analysed systematically. Guidelines are under development for some of these interventions, as highlighted in Table 1. Interventions with proven effectiveness should be prioritized. However, for some interventions with proven effectiveness, there remain substantial operational challenges that must be documented and assessed for whether they can be overcome. Non-proven interventions should be tested in combination with careful evaluation as operational research, in order to help build the evidence base locally and internationally for innovative approaches.

Table 1. Barriers, assessment approaches and required interventions for early detection of tuberculosis cases

Possible barriers *(corresponding section)*	**Assessment approaches and tools**			**Required interventions**	**Policies and tools for implementation**
	Data from surveillance (66) or prevalence (52) surveys	***Assessment tools***	***Operational research***		
People do not seek care promptly when they recognize TB symptoms (2.1.1)	Health-seeking among people with TB Knowledge and attitude in the community	-Patient cost and health-seeking tool (*67*)	Health-seeking and delay surveys Community KAP surveys	***Improve knowledge and awareness for rapid health-seeking*** • Encourage health-seeking among TB contacts • Provide health education • Engage patients, families and communities in outreach activities	• Community involvement in TB care and prevention • Enablers guidelines* • Contact investigation guidelines*
Poor and vulnerable groups do not have full access to quality-assured diagnostic and treatment services (2.1.2)	Health-seeking among people with TB or people with TB symptoms Cases who have sought health care but are not treated	-Patient cost and health-seeking tool (*67*) -HSS principles (*8*) - tool to identify and reach populations at risk of TB*	Risk factor and SES profile among TB cases in prevalence survey vs profile of NTP cases	***Minimize barriers to health-care access*** • Reinforce TB programme diagnostic and treatment services with attention to health facilities showing weak performance access for subpopulations with higher TB prevalence • Minimize user fees and indirect costs for patients and their families • Provide enablers package	• Addressing poverty in TB control • Patient-centred package • Enablers guidelines* • TB care and control in refugee and displaced populations • Tool to identify and reach populations at risk of TB*
Health workers do not identify all patients who fulfil the definition of suspected TB (2.1.3)	-OPD attendance -No of respiratory cases -No investigated for TB -Positivity ratio	–	-Provider surveys and prospective studies of people seeking care with TB symptoms	***Ensure comprehensive application of existing definition of suspected TB*** • Comprehensive identification of people with chronic cough in all health facilities • PAL	• Implementing the Stop TB Strategy • Practical Approach to Lung Health
A large proportion of TB cases do not fulfil the current standard criteria for suspected TB (2.1.3)	-Proportion of diagnosed cases that fulfil the national definition of suspected TB	–	-Evaluation of symptom screening and diagnostic algorithms	***Make the definition of suspected TB more inclusive*** • Reduce duration of cough from 3 to 2 weeks • Use new symptom screening algorithm for people with HIV • TB testing on broader indications (symptoms, signs, and risk markers)	• ICF among HIV guidelines • Framework on TB and diabetes • TB screening guidelines*
Diagnostic tools and procedures with proven sensitivity, specificity, affordability and feasibility are not available or not adequately employed (2.1.4)	-Use of different diagnostic tools -Distribution of types of TB cases diagnosed -Smear positivity ratio among people tested for TB	-Laboratory EQA (*58*) -X-ray QA (*16, 17*)	-Provider surveys on quality of care	***Improve TB diagnosis*** • Strengthen diagnostic services (laboratory, imaging, etc.) • Enhance sputum smear microscopy through quality assurance • Enhance diagnosis of sputum smear-negative TB • Strengthen culture and DST, at least at central level, and implement new diagnostic tools, especially Xpert® MTB/Rif, at intermediate level • Improve diagnosis of extrapulmonary TB and TB in children	• Roadmap for ensuring quality-assured TB diagnostic services • Framework for implementing new TB Diagnostics • X-ray quality guidelines • Guidelines on TB/HIV diagnosis • Guidelines on TB in children
Many public and private health-care providers do not register or notify TB cases they diagnose and do not treat them in line with national or international guidelines (2.1.5)	-Notification -Treatment outcomes -Identified TB cases who are on treatment but not notified	-PPM national assessment tool (*68*) - HSS principles (*8*)	-Inventory studies -Health-seeking surveys -Policy analysis	***Improve referral and notification*** • Scale up free-of-charge, high-quality TB treatment, management and support, including treatment of DR-TB • Introduce and scale up PPM approaches • Regulate and enforce TB drug prescription and TB case notification • Simplify notification procedure (e.g. through easily accessible electronic reporting of new cases)	• PPM toolkit • ISTC • Implementing Stop TB Strategy • TB treatment guidelines • M&E guidelines • Addressing poverty in TB control • Guidelines on inventory studies*
People with TB are not diagnosed early enough despite efforts to address barriers 1–6 (2.2)	All of above	All of above	Evaluation of interventions for barriers 1–6	***Screen for TB in risk groups*** • Screen people in health services who seek care for issues other than TB symptoms • Screen TB contacts (particularly among children aged <5 years) • Screen high TB prevalence subpopulations	• TB screening guidelines* • Tool to reach risk groups* • ICF among HIV guidelines • Contact investigation guidelines* • TB control in prisons • Framework on TB and diabetes • TB control in refugee camps
Many people with active TB do not have clearly recognizable symptoms early in the disease course (2.2)	Symptom profile among TB cases		Symptoms among people screened for TB, e.g. risk group screening		

*Guidelines under development

DR-TB, drug-resistant tuberculosis; DST, drug susceptibility testing, EQA, external quality assurance; QA, quality assurance; HSS, health-system strengthening; HIV, human immunodeficiency virus; ICF, intensified case-finding; KAP, knowledge, attitude, practices; PAL, Practical Approach to Lung Health; PPM, public–private mix approaches; SES, socio-economic status; OPD, outpatient department; M&E; monitoring and evaluation

Annex 1
Policies and guidelines related to TB case detection

General

The Stop TB Strategy: building on and enhancing DOTS to meet the TB-related Millennium Development Goals. Geneva, World Health Organization, 2006 (WHO/HTM/TB/2006.368).

Implementing the WHO Stop TB Strategy: a handbook for national tuberculosis programmes. Geneva, World Health Organization, 2008 (WHO/HTM/TB/2008.401).

International standards for tuberculosis care and control. The Hague, Tuberculosis Coalition for Technical Assistance, 2006

Treatment of tuberculosis: guidelines, 4th ed. Geneva, World Health Organization, 2009 (WHO/HTM/TB/2009.420).

Guidelines for the programmatic management of drug-resistant tuberculosis. Geneva, World Health Organization, 2008 (WHO/HTM/TB/2008.402).

Guidance for national tuberculosis programmes on the management of tuberculosis in children. Geneva, World Health Organization, 2006 (WHO/HTM/TB/2006.371).

Desk-guide for diagnosis and management of TB in children. Paris, International Union Against Tuberculosis and Lung Disease, 2010 (also available at: http://www.theunion.org/index.php/en/resources/scientific-publications/item/193-desk-guide-for-diagnosis-and-management-of-tb-in-children-).

Addressing poverty in TB control: options for national TB control programmes. WHO/HTM/TB/2005.352. Geneva: World Health Organization, 2005

Patient centered approach package. The Hague, Tuberculosis Coalition for Technical Assistance, 2010 (also available at: http://www.tbcta.org/Library/#216).

Diagnosis

A roadmap for ensuring quality tuberculosis diagnostics services within national laboratory strategic plans. Geneva, World Health Organization, 2010 (also available at: http://www.who.int/tb/laboratory/gli_roadmap.pdf).

Framework for implementing new tuberculosis diagnostics. Geneva, World Health Organization, 2010 (also available at: http://www.who.int/tb/laboratory/whopolicyframework_july10_revnov10.pdf).

Rapid implementation of the Xpert® MTB/RIF diagnostic test: technical, operational 'how-to' and practical considerations. Geneva, World Health Organization, 2011.

Revision of the case definition for sputum smear-positive tuberculosis: background document. Geneva, World Health Organization, 2008 (also available at: http://www.who.int/tb/dots/laboratory/policy/en/index.html).

Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents: recommendations for HIV-prevalent and resource-constrained settings. Geneva, World Health Organization, 2007 (WHO /HTM /TB /2007.379).

Desk-guide for diagnosis and management of TB in children. The Hague, Tuberculosis Coalition for Technical Assistance, 2010 (also available at: http://www.tbcta.org/Library/#231).

External quality assessment for AFB smear microscopy. APHL, CDC, IUATLD, KNCV, RIT and WHO, 2003.

Handbook for district hospitals in resource constrained settings on quality assurance of chest radiography. The Hague, Tuberculosis Coalition for Technical Assistance, 2008 (also available at: http://www.tbcta.org/Library/#149).

Handbook for district hospitals in resource constrained settings for the quality improvement of chest X-ray reading in tuberculosis suspects. The Hague, Tuberculosis Coalition for Technical Assistance, 2010 (also available at: http://www.tbcta.org/Library/#217).

Health systems, public–private mix approaches, Practical Approach to Lung Health, community engagement

Contributing to health system strengthening: guiding principles for national tuberculosis programmes. Geneva, World Health Organization, 2008 (WHO/HTM/TB/2008.400).

Engaging all health care providers in TB control: guidance on implementing public-private mix approaches. Geneva, World Health Organization, 2006 (WHO/HTM/TB/2006.360).

Public–private mix for TB care and control: a toolkit. Geneva, World Health Organization, 2010 (WHO/HTM/TB/2010.12).

Practical Approach to Lung health (PAL): a primary health care strategy for integrated management of respiratory conditions in people of five years of age and over. Geneva, World Health Organization, 2005 (WHO/HTM/TB/2005.351; WHO/NMH/CHP/CPM/CRA/05.3).

Community contribution to TB care: practice and policy. Geneva, World Health Organization, 2003 (WHO/CDS/TB/2003.312).

Community involvement in TB care and prevention: towards partnerships for health. Geneva, World Health Organization, 2008 (WHO/HTM/TB/2008.397).

Empowerment and involvement of tuberculosis patients in tuberculosis control. Geneva, World Health Organization, 2007 (WHO/HTM/STB/2007.39).

Risk groups

Policy guidelines for collaborative TB and HIV services for injecting and other drug users: an integrated approach. Geneva, World Health Organization, 2008 (WHO/HTM/TB/2008.404).

Guidelines for intensified tuberculosis case-finding and isoniazid preventive therapy for people living with HIV in resource-constrained settings. Geneva, World Health Organization, 2010.

Tuberculosis care and control in refugee and displaced populations. Geneva, World Health Organization, 2007 (WHO/HTM/TB/2007.377).

Guidelines for the control of tuberculosis in prisons. Geneva, World Health Organization, 1998 (WHO/TB/98.250).

Collaborative framework for care and control of tuberculosis and diabetes. Geneva, World Health Organization and Paris, International Union Against Tuberculosis and Lung Disease, 2011.

Situation assessment

Tuberculosis prevalence surveys: a handbook. Geneva, World Health Organization, 2010 (WHO/HTM/TB/2010.17).

Revised TB recording and reporting forms and registers, 2006 version. Geneva, World Health Organization, 2006 (WHO/HTM/TB/2006.373).

Assessment of the fraction of cases being missed by routine TB notification data, based on the "Onion" model (also available at: http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/resources_documents/onionmodel.pdf).

PPM for TB care and control: a tool for national situation assessment. Geneva, World Health Organization, (WHO/HTM/TB/2007.391).

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