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Essential Components of a Tuberculosis Prevention and Control Program

Screening for Tuberculosis and Tuberculosis Infection in High-Risk Populations

Recommendations of the Advisory Council for the Elimination of Tuberculosis

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Essential Components of a Tuberculosis Prevention and Control Program

Recommendations of the Advisory Council for the Elimination of Tuberculosis

Summary

Tuberculosis (TB) rates declined steadily for decades in the United States, but several complex social and medical factors caused TB morbidity to increase 14% from 1985 through 1993. The recent increases in TB morbidity have placed additional demands on state and local TB control programs, which already had been substantially weakened by inadequate staffing and funding support. TB programs throughout the nation must be revitalized if they are to provide core TB control activities that enable effective responses to this public health challenge. This report describes a model for TB control programs and the essential components of a successful TB control program, including three priority strategies for TB prevention and control: a) identifying and treating persons who have active TB, b) finding and screening persons who have had contact with TB patients to determine whether they are infected with Mycobacterium tuberculosis *or have active TB and providing appropriate treatment, and c) screening populations at high risk for TB infection and the development of TB disease to detect infected persons and providing therapy to prevent progression to active TB.*

State and local health departments have primary responsibility for preventing and controlling TB. To meet this challenge successfully, TB control programs should be able to administer activities that include the following core components:

- *conducting overall planning and development of policy,*
- *identifying persons who have clinically active TB,*
- *managing persons who have or who are suspected of having disease,*
- *identifying and managing persons infected with* M. tuberculosis*,*
- *providing laboratory and diagnostic services,*
- *collecting and analyzing data, and*
- *providing training and education.*

The Advisory Council for the Elimination of Tuberculosis has prepared this report to provide a national standard by which policymakers, TB control program managers, and others evaluating TB programs can assess individual TB control programs. The report may also help local programs to obtain and maintain adequate resources for TB control activities.

In addition to defining the essential components of a TB control program, this report emphasizes the importance of a) prioritizing TB control activities; b) coordinating care with other health-care providers, facilities, and community organizations; c) using alternative approaches to TB control (e.g., the expanded

use of directly observed therapy); d) targeting screening and prevention programs to high-risk populations; and e) following current recommendations for the treatment of TB. TB control program managers should make every effort to incorporate each of these components into their program activities. TB programs may perform these activities directly, or programs may coordinate with other providers to ensure the implementation of these activities. Failure to meet these core standards can decrease a TB program's effectiveness in controlling this reemergent public health risk.

INTRODUCTION

The incidence of tuberculosis (TB) was declining in the United States until recently, and in 1989, goals were set to eliminate the disease by the year 2010 (*1*). However, instead of continuing to decline, TB morbidity increased 14% from 1985 through 1993 (*2*). This recent trend has been attributed to several factors, including the human immunodeficiency virus (HIV) epidemic, the occurrence of TB in foreign-born persons from countries that have a high prevalence of TB, and the transmission of *Mycobacterium tuberculosis* in congregate settings (e.g., health-care facilities, correctional facilities, drug-treatment centers, and homeless shelters). The increase in TB and the complexity of factors associated with this increase have placed additional demands on public health TB control programs, yet many of these programs lack adequate support for services necessary for TB control. In particular, funding for TB control programs has been reduced markedly because of the increased competition for public health funds; the decrease in government services at federal, state, and local levels; and the decline in TB cases reported before 1985 (*3*). The public health-care infrastructure must be rebuilt to meet the challenge of the recent resurgence of TB cases (*4*).

In the United States, state and local health departments have legal responsibility for the prevention and control of TB in communities. Three strategies are fundamental to the prevention and control of TB. The first priority is identifying and treating persons who have active TB; this priority entails identifying persons who have TB, ensuring that they complete appropriate therapy, and, in exceptional circumstances, using confinement measures. The second priority is finding and screening persons who have been in contact with TB patients to determine whether they have TB infection or disease and providing them with appropriate treatment. The third priority is screening high-risk populations to detect persons who are infected with *M. tuberculosis* and who could benefit from therapy to prevent the infection from progressing to TB disease.

To implement these three strategies, public health TB control programs should coordinate with health-care providers from several community organizations to ensure the provision of direct services for TB patients. Health departments are responsible for providing centralized, coordinated systems for many activities extending beyond individual patient care (e.g., identifying TB cases; ensuring that patients complete therapy; performing contact investigations; screening high-risk groups; and collecting, analyzing, and publishing epidemiologic and surveillance data).

PURPOSE

The Advisory Council for the Elimination of Tuberculosis (ACET) has prepared this report to provide a national standard* for the assessment of individual TB control programs by TB control program managers, policymakers, and other persons evaluating TB programs. This report also may be used to assist local programs in obtaining and maintaining adequate resources for TB control activities. In addition to defining the essential components of a TB control program, these recommendations emphasize the importance of prioritizing TB control activities; coordinating care with other health-care providers, facilities, and community organizations; and using alternative approaches to TB control (e.g., the expanded use of directly observed therapy, targeted screening and prevention programs to high-risk populations, and adoption of current recommendations for the treatment of TB) (*5–7*). Although the size and structure of TB control programs vary according to each community's specific needs, TB control program managers should attempt to incorporate each of these core components into program activities.

OVERALL PLANNING AND POLICY

To achieve effective TB control and progress toward TB elimination, TB control programs should develop an overall TB control strategy, including written policies and procedures, and should be able to provide guidance and oversight to local facilities and practitioners involved in TB control activities. TB control programs should ensure that appropriate laws and adequate staff and funding are available to support TB control activities. These programs also should form networks and coalitions with community groups to assist with implementing TB control activities.

An Overall TB Control Strategy and Written Policies and Procedures

TB control programs should develop an overall TB control strategy in collaboration with local health-care providers, professional societies, and voluntary organizations. To determine specific needs, the program should use local TB morbidity data and standard indicators of program performance (e.g., the rate of completion of therapy). The plan should be developed by the state or local ACET in conjunction with community TB coalition representatives. The TB control strategy should outline program priorities and objectives reflecting the specific needs of the community and the roles of the various agencies, organizations, and providers. TB control programs should also have written policies and procedures that clearly define the standard of practice for TB treatment and prevention in the community (*1,5–18*). These priorities, objectives, and plans should be reviewed periodically and revised as needed.

Advising Local Institutions and Practitioners

TB control programs should provide consultation and oversight for the TB control activities of local facilities and practitioners (and local health departments where appropriate) to ensure that these efforts reflect current standards of care and public health practice. The consultation may be provided by either health department staff or local or regional medical experts who have agreed to act as consultants for the health

*The word "standard" is being used to indicate a prototype established by authority, custom, or general consent.

department. Consultants should be available to advise local practitioners about patient management problems (e.g., monitoring treatment adherence); at least one consultant should be experienced in treating patients having drug-resistant TB. Information on the latest laboratory techniques and technology, guidance about appropriate laboratory methods for local facilities and laboratories, and assistance in conducting contact or outbreak investigations should be available from TB control programs or their consultants. TB programs should seek opportunities to inform persons or facilities about activities and technologies that can improve TB services.

Appropriate Laws and Regulations to Support TB Control Activities

TB control programs periodically should review applicable laws, regulations, and policies to ensure their consistency with currently recommended medical and public health practices (*8*). States and municipalities should create laws, regulations, and policies that provide support and a legal basis for the following TB control activities:

- ensuring the prompt, mandatory reporting of each confirmed and suspected case of TB;
- observing state and local laws and regulations protecting patient confidentiality;
- examining persons at high risk for TB infection and disease and prescribing and monitoring appropriate treatment for these persons;
- ensuring that a treatment plan is devised for all hospitalized patients before their discharge;
- ensuring rapid laboratory examination of specimens and reporting of results (including susceptibility-test results) to the appropriate health department and the requesting clinician;
- ensuring that patients who have TB receive appropriate treatment until they are cured;
- protecting the health of the public by isolating and treating persons who have infectious TB;
- detaining persons who, though not infectious, are unwilling or unable to complete treatment and who are at risk for becoming infectious again and acquiring drug-resistant TB; and
- treating patients without consideration of their ability to pay.

States also should require health-care facilities and congregate-living settings (e.g., correctional facilities) to apply recommended measures for infection control.

Adequate and Appropriate Staff to Conduct TB Control Activities

TB control programs should have adequate and appropriate staff to ensure the fulfillment of TB control activities outlined in this report. The number and type of staff for these programs may vary, depending on the local TB morbidity and the specific needs of the community. Staff are necessary for program planning, program funding, record-keeping, education, and coordination of health department activities with other TB control activities in the community. All TB control programs should have a designated program manager. These programs should have access to, or have on staff, epidemiologists qualified to conduct data-based evaluation and surveillance activities.

Community outreach workers are needed to deliver directly observed TB therapy, thereby ensuring continuity and completion of treatment. Outreach workers may also be involved in other activities (e.g., educating patients, observing preventive therapy, conducting contact investigations, arranging or providing transportation, assisting patients with social services, serving as interpreters, and assisting clinicians with clinical services). These outreach workers may be nurses or lay persons specifically trained for these activities. The TB program should ensure that outreach workers have adequate clinical and administrative supervision.

Depending on clinic needs, clinic staff may be composed of various combinations of nurses, physicians, physician assistants, and other workers. In many areas, clinics have nurse managers responsible for providing most of the education, treatment, clinical monitoring, prevention services, and supervisory needs of the clinic. A physician who is qualified and trained in the diagnosis, management, and clinical monitoring of TB should be available on staff or employed on a contract basis. Clinic staff should have characteristics appropriate to the community's cultural and language needs.

Adequate Funding to Conduct TB Control Activities

TB control programs should seek funding for TB control activities from federal, state, local, and private sources. They should work with local organizations (e.g., state and local medical societies, lung associations, and TB coalition members) to educate policymakers about the local TB problem and local program priorities, needs, and objectives.

Networks with Community Groups

Optimal TB prevention and control activities require a multidisciplinary approach. Thus, TB control programs in communities having a high prevalence of TB should form networks and coalitions with local groups (e.g., cultural and ethnic organizations, community clinics, places of worship, professional societies, lung associations, and medical and nursing schools). In collaborating with these community groups, the TB control program should a) ensure that community leaders, health-care providers, and policymakers are knowledgeable about TB; b) help educate the public about TB; and c) provide guidance and assistance for local screening and prevention services. Coalitions with community groups help TB control programs reach high-risk groups more effectively and provide culturally appropriate services. TB control programs should educate and advise community groups to ensure the quality and appropriateness of TB control activities in accordance with the community's needs. The National Coalition to Eliminate Tuberculosis exemplifies a national coalition involved in educating health-care providers and the public about TB.

MANAGING PERSONS WHO HAVE DISEASE OR WHO ARE SUSPECTED OF HAVING DISEASE

TB control programs should ensure that the services needed to evaluate, treat, and monitor TB patients are readily available in each community. In many areas, these services may be provided directly by the state TB control program. In other areas,

local TB control programs or health-care professionals, with supervision and consultation from the state TB control program, provide treatment services to patients. Although some patients may undergo most of their evaluation and treatment in settings other than the health department, the major responsibility for monitoring and ensuring the quality of all TB-related activities in the community should be undertaken by the health department as part of its duties to protect the public health.

The public health goals of TB patient management are to initiate treatment promptly and ensure the completion of effective therapy to cure illness, reduce transmission, and prevent the development of drug-resistant TB.

Clinical Services

Developing a Treatment Plan

A specific health department employee (case manager) should be assigned primary responsibility and held accountable for ensuring that each patient is educated about TB and its treatment, that therapy is continuous, and that contacts are examined. Some specific responsibilities also may be assigned to other persons (e.g., clinical supervisors [nurses, physicians, or physician assistants], outreach workers, health educators, and social workers).

As soon as TB is diagnosed or suspected, treatment should be started, and the TB case should be reported to the health department. Within 3 working days after the case is reported, a health department worker should visit the patient in the hospital or home to initiate patient education, identify contacts, make appropriate referrals for medical evaluation, and detect possible problems related to adherence to therapy. In cooperation with the other medical, nursing, and outreach staff providing care to the patient, the case manager should develop an initial treatment and monitoring plan based on the initial visit, the medical and nursing assessment, and other available information (Table 1). The initial treatment plan should be developed within 1 week of diagnosis (i.e., within 1 week of initiation of therapy for a person suspected to have TB or within 1 week of identification of a person having a positive culture). This treatment plan should be reviewed regularly and modified as needed when additional relevant information becomes available (e.g., susceptibility-test results) or when the care of the patient is transferred from one provider to another.

The treatment plan should include the specifics of the medical regimen, a monitoring plan for toxicity and for clinical and bacteriologic response, and an assessment of the patient's social, behavioral, and additional medical needs that may affect continuity or completion of therapy (*19*). The health department employee responsible for monitoring treatment adherence should identify and implement methods that promote adherence and that are appropriate to the patient's needs and desires. A treatment plan should be designed for efficiency and economy of services and convenience to the patient.

When developing and implementing a treatment plan, TB control programs should work closely with health-care providers from local hospitals, drug-treatment centers, HIV clinics, correctional facilities, health maintenance organizations, private physicians' offices, and other facilities where TB patients receive medical care. TB control programs should fulfill their mandated responsibilities and also respect the relationship between patient and primary health-care provider.

TABLE 1. Elements of a treatment plan for TB patients

I. Assignment of responsibility
- A. Case manager (i.e., person assigned primary responsibility)
- B. Clinical supervisor (e.g., nurse, physician, physician assistant)
- C. Other caregivers (e.g., outreach worker, nurse, physician, physician assistant)
- D. Person responsible for completing the contact investigation

II. Medical evaluation
- A. Tests for initial evaluation (e.g., tuberculin skin test, chest radiograph, smear, culture, susceptibility tests, HIV test), including results of each test and date completed
- B. Important medical history (e.g., previous treatment, other risk factors for drug resistance, known drug intolerances, and other medical problems)
- C. Potential adverse reactions
  1. Appropriate baseline laboratory tests to monitor toxicity (e.g., liver enzymes, visual acuity, color vision, complete blood count, audiogram, BUN, and creatinine), including results of each test and date completed
  2. Potential drug interactions
- D. Obstacles to adherence

III. TB treatment
- A. Medications, including dosage, frequency, route, date started, and date to be completed for each medication
- B. Administration
  1. Method (directly observed or self-administered)
  2. Site(s) for directly observed therapy

IV. Monitoring
- A. Tests for response to therapy (e.g., chest radiograph, smear, and culture), including planned frequency of tests and results
- B. Tests for toxicity, including planned frequency of tests and results

V. Adherence plan
- A. Proposed interventions for obstacles to adherence
- B. Plan for monitoring adherence
- C. Incentives and enablers

VII. TB education
- A. Person assigned for culturally appropriate education
- B. Steps of education process and date to be completed

VIII. Social services
- A. Needs identified
- B. Referrals, including date initiated and results

IX. Follow-up plan
- A. Parts of treatment plan to be carried out at TB clinic
- B. Parts of treatment plan to be carried out at other sites and person(s) conducting activities

Clinic Services

Clinic services provided by TB control programs should be accessible and acceptable to the members of the community served by the clinic. Clinic hours should be convenient and preferably should include some evening hours for persons who work or attend school during the day. The clinic should be easily accessible by public transportation, or transportation should be provided. Intervals between the time of referral and the time of appointment and waiting times in the clinic should be kept to a minimum. In busy TB clinics or multipurpose clinics, priority should be given to persons having TB or suspected of having TB and to persons receiving TB medications. Clinic services, including diagnostic evaluation, medications, and transportation, should be provided without consideration of the patient's ability to pay. The clinic should have staff members who speak the same language and have similar cultural and socioeconomic backgrounds as the community served by the clinic, or the clinic should employ persons trained to work in cross-cultural settings.

Promoting Adherence

Methods for promoting adherence to therapy should be tailored to the patient's needs, life-style, social support system, and beliefs about health. An assessment of these factors should be included in the development of a treatment plan (*19,20*). Patients should be educated about the causes and effects of TB, the dosing and possible adverse reactions of their medication, and the importance of taking their medication according to the treatment plan. To facilitate adherence, the plan should use short-course treatment regimens and, for patients whose therapy is not directly observed, fixed-dose combination tablets. Providing transportation to the clinic also is important for promoting adherence. A welcoming and respectful atmosphere within the clinic setting is fundamental to maintaining adherence.

Consideration should be given to treating all patients with directly observed therapy (DOT) (*6,7*). With DOT, a health-care provider or other responsible person observes the patient swallowing each dose of anti-TB medication. DOT may be administered with daily or intermittent regimens and may be given to patients in an office or clinic setting or by an outreach worker in the patient's home, place of employment, school, or other mutually agreed-upon place. In some instances, DOT may be administered by the staff of correctional facilities or drug-treatment programs, home health-care workers, staff of maternal and child health facilities, or a responsible community or family member.

Incentives and enablers should be available to enhance adherence to therapy. These incentives range from simple approaches (e.g., offering a cup of coffee or food discount coupons and talking with a patient while he or she is waiting in the clinic) to complex approaches (e.g., obtaining food and housing for a homeless patient).

Health-care professionals, including private practitioners, who become aware of a TB patient who has demonstrated an inability or unwillingness to adhere to a prescribed treatment regimen should consult the health department. The TB control program should assist in evaluating the patient for the causes of nonadherence to therapy and provide assistance (e.g., outreach-worker services) to enable the patient to complete the recommended therapy. If the patient still fails to adhere to treatment, the health department should take appropriate action based on local laws and regulations. This action could entail seeking court-ordered DOT or detention for those

patients who are unwilling or unable to complete their treatment and who are infectious or who are at risk for becoming infectious or developing drug-resistant TB.

Additional services may be necessary to facilitate continuity and completion of therapy. Social workers, translators, and referral sources for drug-treatment services should be available in the clinic or easily accessible to the patients.

Referral System for Other Medical Problems

A system should be in place to facilitate referral of TB patients for evaluation and treatment of other medical problems, including those conditions (e.g., HIV infection, underlying malignancy, diabetes mellitus, and substance abuse) that may affect the course or outcome of TB treatment. Consultants should see referred patients in a timely fashion, and the assessment and recommendations of the consultant should be made available promptly to the referring health-care provider. If patients receive care in more than one setting, treatment should be coordinated with the other health-care providers to ensure continuity and completion of therapy, minimize drug interactions, and avoid duplication of efforts. The TB program should take primary responsibility for ensuring TB treatment and monitoring for adherence.

Clinical Consultative Services

Expert medical consultation should be available for management of all TB patients, including those who have drug-resistant TB. These consultative services should be available to the TB control program and health-care providers in the community. The consultation may be provided by a staff member of the TB control program or by a local or regional consultant collaborating with the health department.

Inpatient Care

Regardless of the patient's ability to pay, appropriate accommodations should be available for any TB patient requiring inpatient hospital care for TB or other conditions. The facility should have effective infection control measures in place to prevent transmission of TB infection in the hospital (*12*). Medical staff knowledgeable about the management of TB patients should be available to assist in the care of the patient while hospitalized. In addition, appropriate medications should be available in the facility so that the patient can continue therapy in the hospital. Appropriate diagnostic services (e.g., radiology and mycobacteriology) should be available to monitor the patient for adverse reactions, the progress of treatment, and other medical conditions. The local TB program and the facility should develop and implement protocols to ensure rapid reporting of known or suspected TB cases to the local health department.

Confinement Capability

To ensure that patients receive treatment until they are cured, TB control programs should have adequate legal authority and appropriate facilities available to isolate and treat patients who have infectious TB. When all less restrictive measures have failed, TB control programs also should have the authority to detain patients unwilling or unable to complete their treatment. This authority also should apply to nonadherent patients who are no longer infectious, but who are at risk for again becoming infectious or for the development of drug-resistant TB.

Infection Control

TB control programs should serve the medical community as sources of information and consultation regarding appropriate infection control practices (*12*). During interactions with the medical community, TB control programs should emphasize the need to maintain a high level of suspicion for TB in evaluating patients who have TB symptoms and also the importance of early diagnosis and isolation and prompt initiation of therapy. The programs should give expert advice or provide referrals to experts for information about appropriate infection control measures for different settings (e.g., hospitals, clinics, nursing homes, correctional facilities, homeless shelters, and drug-treatment centers).

TB control programs should provide guidance to local facilities and the community to ensure the availability of an appropriate number of TB isolation rooms to meet community needs. Because local needs may change, the adequacy of the number of isolation rooms should be reassessed each year as part of the evaluation of the TB control program.

TB control programs should educate the staff of facilities providing care for TB patients about the need for routine periodic evaluation of infection control practices and may also assist in the evaluation process. Assistance may include providing current recommendations and regulations to the facility, providing names of experts in infection control, or providing access to personnel involved in programmatic evaluations.

Coordinating Care with Other Health-Care Providers and Facilities

TB patients often receive care in multiple settings, including HIV clinics, drug-treatment centers, correctional facilities, hospitals, nursing homes, or primary care clinics. When patients move among these various settings, continuity and completion of therapy may be compromised unless a system for the coordination of care exists. Discharge planning for hospitalized patients should begin as soon as TB is diagnosed (i.e., at the time of initiation of therapy in a suspected case or identification of a positive culture in a confirmed case). A representative from the TB control program should visit the patient in the hospital to identify contacts, collect information for the initial treatment plan, and ensure that no obstacles to the patient's follow-up care exist (see Managing Persons Who Have Disease or Who Are Suspected of Having Disease). To provide and coordinate continuous TB treatment and to facilitate transfers of care, TB control programs should communicate regularly with providers and facilities involved in TB patient care, including hospitals, infection-control practitioners, private practitioners, community clinics, correctional facilities, homeless shelters, and drug-treatment centers. TB control programs should consider using a computerized system for coordinating the care of TB patients.

IDENTIFYING PERSONS WHO HAVE CLINICALLY ACTIVE TB

Diagnostic Methods

Clinics providing services for TB patients should have access to the basic methods necessary for the diagnosis of TB, including tuberculin skin testing, chest radiography, sputum induction, and mycobacteriology services for smears, cultures, and drug-susceptibility testing (see Laboratory and Diagnostic Services). TB control programs

should provide guidance to facilities about appropriate diagnostic methods for different circumstances. Sputum smear examinations and cultures for mycobacteria should be performed on persons suspected of having active pulmonary or laryngeal TB. Tuberculin testing is the standard method for screening asymptomatic populations for infection with *M. tuberculosis*. However, screening initially for disease rather than infection may be more appropriate in some circumstances (e.g., when tuberculin skin-test results may be unreliable, when application and reading of the test may be impractical, or when the consequences of an undiagnosed case may be severe). For example, because elderly persons living in long-term care facilities are at high risk for the development of TB and may be anergic, all patients admitted to these facilities should have an initial screening chest radiograph. Chest radiography also may be the preferable screening method for persons incarcerated in jails or residing in other settings where TB is common and where diagnostic delays may result in large numbers of persons being exposed to TB.

Case Finding

Most persons who have TB are diagnosed when they seek medical care for symptoms caused by TB or other medical conditions. Therefore, for early identification of TB cases, health-care providers in the community must have an awareness of TB. Conducting contact investigations is another important way to find TB cases and may yield approximately 700 cases per 100,000 persons evaluated (CDC Program Management Reports 1990–1992, unpublished data). Health departments should seek cases of TB through active surveillance of mycobacteriology laboratories.

Routine screening with chest radiographs to identify persons who have disease is justifiable in certain situations, particularly when the prevalence of TB is extremely high (e.g., among homeless populations or certain immigrant or refugee populations from areas that have a high prevalence of TB) or when the consequences of an undiagnosed case of TB are severe (e.g., in residential facilities for HIV-infected persons, correctional facilities, homeless shelters [*21,22*], or nursing homes). Using local epidemiologic data, TB programs should identify these high-risk groups and settings and determine whether screening is indicated.

Contact Investigation

Staff of TB control programs should begin a contact investigation as soon as they are notified of a suspected or confirmed case of TB. TB control programs should educate health-care providers in the community about the need for prompt reporting of suspected cases. Contact investigations are important for identifying persons who have TB infection and who are at high risk for the development of active disease. Contact investigations are also important for detecting cases of active TB (*5*).

The priority, speed, and extent of a contact investigation should be influenced by the likelihood of transmission (based on the characteristics of the source patient, environment, and contacts) and the possible consequences of infection (especially for HIV-infected contacts or contacts who are young children).

IDENTIFYING AND MANAGING PERSONS INFECTED WITH *M. TUBERCULOSIS*

TB Skin Testing of High-Risk Groups

TB control programs should assess the prevalence and incidence of TB and the sociodemographic characteristics of TB patients and infected persons in each community. On the basis of these data, TB control programs should design tuberculin screening programs to reach the community's high-risk groups (*13,16*). Regular evaluation of the usefulness of these screening programs is extremely important because, in general, screening should not be given preference over higher priority activities (e.g., treatment of TB patients and contact investigation). The practice of screening low-risk groups should be discontinued.

TB control programs should identify and establish working relationships with persons, facilities, and agencies providing health-care services to high-risk populations and should assist them in developing and implementing screening programs appropriate for various situations. Decisions to initiate programs to skin test high-risk groups should be based on the ability of the TB control program and these community groups to provide adequate preventive therapy services. For appropriate implementation of screening programs, the TB control program and local facilities should be able to perform tuberculin skin tests, read and interpret the tests, evaluate those persons who have positive results, initiate preventive therapy when appropriate, monitor patients for adverse reactions, and ensure that patients complete preventive therapy. The plan for evaluation and treatment of patients should be developed before testing begins.

Health-care providers serving high-risk groups should receive assistance from TB control programs in planning and providing these services, including training staff and evaluating screening programs to determine their effectiveness. Members of high-risk groups should be educated about the problem of TB in their community and should be involved in the implementation of screening and prevention programs.

LABORATORY AND DIAGNOSTIC SERVICES

Chest Radiograph and Interpretation

Outpatient and inpatient facilities offering TB treatment should have ready access to a sufficient quantity of radiology equipment and enough trained radiology technicians so that chest radiographs can be obtained each day during clinic hours for all patients needing them. Furthermore, the chest radiograph should be interpreted by a qualified person, and the report of the chest radiograph findings should be available within 24 hours.

Mycobacteriology Laboratory

To ensure that results of acid-fast examinations of specimens are available promptly (ideally, within 24 hours of specimen collection), TB control programs should have access to adequate mycobacteriology laboratory services. Reports of isolation and identification of *M. tuberculosis* should be available within 10–14 days, and

reports of drug-susceptibility tests should be available within 15–30 days of specimen collection. The TB control program should work closely with the laboratory to ensure rapid delivery of specimens to the laboratory and prompt laboratory reporting of acid-fast bacilli smears, culture results, and results of drug-susceptibility tests to the clinician and health department. The laboratory should use rapid laboratory methods, including fluorescent acid-fast staining procedures, inoculation of a liquid medium as primary culture, nucleic acid probes to identify *M. tuberculosis*, and, using radiometric (e.g., BACTEC®) or similar systems, testing of *M. tuberculosis* isolates for susceptibility to the first-line drugs (*23*). These mycobacteriology laboratory services also should be available to TB control programs for monitoring bacteriologic response to therapy.

Diagnostic Services to Assess Drug Toxicity

The outpatient and inpatient facilities where TB treatment is offered should provide, or have access to, diagnostic services for monitoring patients for potential adverse reactions to anti-TB medications. At least monthly during therapy, patients receiving anti-TB medications should be evaluated by a health-care professional (e.g., nurse, physician, or physician assistant) and questioned about possible adverse reactions. The facilities offering TB treatment should be able to perform visual acuity and color vision evaluations on site. Blood tests for liver enzymes, blood urea nitrogen, creatinine, uric acid, complete blood count, and platelets may be performed at an outside laboratory; however, phlebotomy services should be available on site. Audiometry should be available on site or at another accessible location. In geographic areas that have a high prevalence of drug-resistant TB, testing of serum levels for anti-TB medications, especially cycloserine, should be available through a reference laboratory.

HIV Testing and Counseling

All persons who have confirmed or suspected TB should be offered HIV counseling and antibody testing. If TB clinics are unable to perform on-site counseling and testing, they should coordinate with HIV-testing programs to make these services available. In geographic areas that have a high prevalence of HIV-infected persons, TB prevention and control staff should be trained and qualified to provide routine HIV counseling and antibody testing.

DATA COLLECTION AND ANALYSIS

Case Reporting

TB control programs should ensure and facilitate TB case reporting from various community sources (e.g., physicians, laboratories, hospitals, and pharmacies) and routinely monitor the completeness of reporting and the duration of time between diagnosis and reporting. TB control programs also should communicate regularly with infection-control practitioners in hospitals and other facilities that frequently diagnose TB. Case reporting is essential to the compilation of national, state, and local morbidity reports and to program planning and evaluation, and prompt reporting is necessary for effective contact tracing.

TB Registry

To carry out mandatory community public health responsibilities, health department TB control programs should maintain a computerized record system (case registry) with up-to-date information on all current clinically active and suspected TB cases in the community. To ensure follow-up of all TB patients and those persons suspected of having TB, registry information (e.g., smear, culture, and susceptibility results; clinical status; chest radiograph results; and doses of medications being administered) should be obtained and updated on a continuing basis. A specific health department staff member should review detailed registry information for TB cases at least monthly to identify patients who have potential problems with adherence or response to therapy (e.g., patients who have persistently positive sputum or who are taking medications to which their TB organisms are resistant) and to ensure follow-up (e.g., initiating field follow-up visits or arranging medical consultation with providers). TB control programs also should maintain records on the examination and treatment status of the contacts of infectious TB patients and other groups of high-risk infected persons (e.g., persons coinfected with *M. tuberculosis* and HIV).

Protection of Confidentiality

TB control programs should devise policies to ensure the data security and confidentiality of TB records. Strategies should be in place to protect all TB reports, records, and files containing patient names or other identifying information. Local policies regarding the security and confidentiality of such information, including HIV test results, must adhere to all laws applicable in state and local jurisdictions (*8,24*). TB control programs should collaborate with HIV programs to develop and implement such policies.

Drug Resistance Surveillance

TB control programs should ensure that drug-susceptibility tests are performed on all initial isolates of *M. tuberculosis* and that the results are reported promptly to the primary care provider and the local health department. TB control programs should monitor local drug resistance rates to assess the effectiveness of local TB control efforts and to determine the appropriateness of the currently recommended initial TB treatment regimen for the area.

Data Analysis and Program Evaluation

To determine morbidity rates, trends, and demographic characteristics of the TB patient population in the area, TB control programs should analyze the data collected each year. Local health departments should rapidly report cases, including the necessary demographic information, to state health departments, and states should regularly forward the reports to CDC. Timely and complete reporting is essential for local, state, and national public health planning and assessment.

TB control programs should assess program performance by determining the rates for completion of therapy, contact identification, and initiation and completion of preventive therapy. At least annually, TB control program staff should assess progress toward achievement of program objectives. To facilitate the monitoring of TB morbidity and program performance, programs should implement computerized systems for

data collection and analysis. Program evaluation reports should be shared with the appropriate public, private, and community groups.

TB control programs should periodically review screening activities to assess their effectiveness in identifying infected persons and in ensuring that these persons are completing courses of preventive therapy when appropriate. If reviews demonstrate that few or no new cases are being identified by particular screening activities, these activities should be discontinued.

Programs also should conduct periodic reviews of selected records systems (e.g., laboratory reports, pharmacy reports, AIDS registries, and death certificates) to validate the surveillance system and to detect any failure to report cases.

TB control programs should analyze each new TB case and each death caused by TB to determine whether the case or death could have been prevented. Based on such a review, new policies should be developed and implemented to reduce the number of preventable cases and deaths.

In collaboration with community-based organizations and professional societies, health departments should prepare annual reports based on these assessments. These reports should document the extent and nature of the TB problem in the area, assess the adequacy of prevention and control measures, and provide recommendations for program improvements. Some TB programs may determine that an outside review by experts from the state health department, CDC, local lung associations, or other TB experts may be helpful to determine methods for improving program performance and community TB control and for providing support for major changes (e.g., significant restructuring or acquisition of new resources).

TRAINING AND EDUCATION

Staff Training

TB control programs should provide appropriate training and evaluation for all program staff at time of employment and at regular intervals so that staff can maintain an accurate, up-to-date level of knowledge about TB, public health practice, management and evaluation skills, and other related topics.

Education for Health-Care Providers and Members of the Community

TB control programs should provide leadership in TB education in the community. To determine needs for training and education, TB control programs should monitor the level of knowledge about TB among health-care providers, policymakers, and other community members who provide services to TB patients (e.g., the staff of social services departments, correctional services departments, mental health offices, and legal service offices). TB control programs should work closely with medical and nursing schools, schools of public health, community-based organizations, professional societies, minority advocacy groups, and others to meet the training and education needs of the community.

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Screening for Tuberculosis and Tuberculosis Infection in High-Risk Populations

Recommendations of the Advisory Council for the Elimination of Tuberculosis

Summary

*This report from the Advisory Council for the Elimination of Tuberculosis updates and replaces previous recommendations for screening for tuberculosis (TB) and TB infection among high-risk populations. [*MMWR *1990;39(No. RR-8): 1–7]. In particular, these recommendations a) emphasize that screening for TB infection should not be given preference over higher priority TB prevention and control activities, especially identifying and completely treating all persons who have active TB as well as conducting prompt, effective contact investigation; b) provide more detailed recommendations for screening specific high-risk groups; c) provide a detailed description of the tuberculin skin test; and d) revise CDC's previous recommendations regarding anergy testing. This report is for public health policymakers, administrators, program directors and managers as well as health-care providers and others who provide care or services to persons at increased risk for TB infection and disease.*

INTRODUCTION

Tuberculosis (TB) is caused by bacteria (*Mycobacterium tuberculosis* complex, which includes *M. tuberculosis, M. bovis*, and *M. africanum*) transmitted from an infectious source to susceptible persons primarily through the air (e.g., through coughing) (*1*). Most infected persons do not experience clinical illness, but are usually asymptomatic and noninfectious. The only evidence of infection may be a reaction to a tuberculin skin test. However, infection can persist for years, and infected persons can remain at risk for developing clinical TB, especially if the immune system becomes impaired. The estimated number of persons having latent TB infection in the United States ranges from 10 million to 15 million (CDC, unpublished data).

Because of a higher prevalence of infection or a higher risk for disease for any given prevalence of infection among certain groups, the incidence of TB may be higher among these groups than among the total population. Screening and preventive therapy programs are important for persons in these high-risk groups.

PRIORITY OF SCREENING AMONG TB PREVENTION AND CONTROL ACTIVITIES

Three basic strategies are critical to the prevention and control of TB. The first priority is identifying and completely treating all persons who have active TB (*2,3*). The second priority is contact investigation (i.e., finding and evaluating persons who have had contact with TB patients, determining if they have TB infection or disease, and

treating them appropriately) (*4*). Contact investigations are important for identifying persons who have active TB and infected persons at high risk for developing TB. The third priority is screening populations at high risk for TB to locate persons infected with TB and giving complete therapy to prevent the infection from progressing to active, contagious disease (*3,5*). This screening also may identify cases of active disease.

Although screening high-risk populations for TB infection and providing preventive therapy are crucial to achieving the nation's goal of eliminating TB (*6*), completion of TB therapy and contact investigation should have priority over screening. Decisions to screen particular groups should be based on local epidemiologic data and made in consultation with local health jurisdictions to ensure appropriate follow-up, evaluation, and management of persons having TB infection or disease. Health-care agencies or other facilities should consult with the local health department before starting a skin-testing program to ensure that adequate provisions are made for the evaluation and treatment of persons whose tuberculin skin tests are positive. Tuberculin skin-testing programs that identify infected persons without current disease should be undertaken only if the diagnostic evaluation and a course of prescribed therapy can be initiated and completed.

Because most state and local TB control programs that report high TB morbidity have inadequate resources to screen all persons in high-risk groups and treat those persons who are infected, involvement of other health-care providers in screening and preventive treatment activities is important. These health-care providers can augment the limited resources of health departments by conducting appropriate screening efforts. This collaboration will necessitate additional efforts to train health-care workers in the administration, reading, and interpretation of the tuberculin skin test and in the appropriate use of preventive therapy. Priorities for screening activities should be determined by assessment of available resources and the probability of infection and disease among groups in the community.

Groups that have the highest priority in all areas of the country include contacts of persons who have suspected or confirmed TB and patients who have human immunodeficiency virus (HIV) infection or risk for HIV infection. In particular areas of the country, other groups at high risk may include persons who inject illicit drugs, persons who have certain medical risk factors, foreign-born persons recently arrived from countries with a high incidence or prevalence of TB, and residents of congregate settings where risk for transmitting *M. tuberculosis* is increased (e.g., correctional facilities, long-term care facilities, and homeless shelters). Screening persons in low-risk groups is not likely to be cost-effective and should be discontinued.

HIGH-RISK GROUPS

Based on published reports in the medical literature and CDC surveillance data, the Advisory Council for the Elimination of Tuberculosis (ACET) recommends that the following groups be screened for TB and TB infection:

- close contacts (i.e., those sharing the same household or other enclosed environments) of persons known or suspected to have TB;
- persons infected with HIV;

- persons who inject illicit drugs or other locally identified high-risk substance users (e.g., crack cocaine users);
- persons who have medical risk factors known to increase the risk for disease if infection occurs (see Persons Having Other Medical Risk Factors);
- residents and employees of high-risk congregate settings (e.g., correctional institutions, nursing homes, mental institutions, other long-term residential facilities, and shelters for the homeless);
- health-care workers who serve high-risk clients;
- foreign-born persons, including children, recently arrived (within 5 years) from countries that have a high TB incidence or prevalence;
- some medically underserved, low-income populations;
- high-risk racial or ethnic minority populations, as defined locally; and
- infants, children, and adolescents exposed to adults in high-risk categories.

Flexibility is needed in defining high-priority groups for screening. The changing epidemiology of TB indicates that the risk for TB among groups currently considered high priority may decrease over time, and groups currently not identified as at risk subsequently may be considered as high priority. Local public health officials should identify community groups among whom TB and transmission of infection occur. Identification of these groups requires collecting and analyzing a) data on newly reported cases available as part of TB surveillance (e.g., residence, occupation, race/ethnicity, country of origin, and status of HIV infection, injecting drug use, homelessness, and congregate settings), b) data not routinely collected and/or analyzed (e.g., indicators of socioeconomic status), and c) data from tuberculin screening programs (e.g., at correctional institutions and health-care facilities). These data will enable health departments and other local facilities to target screening and treatment programs to locally defined high-risk populations and areas.

Using surveillance information, local or state TB programs should take the lead in determining groups to be screened. Responsibility for conducting screening will vary, depending on local circumstances. For some groups, the local health department should conduct the screening. For others, the health department should discuss the need for screening with other appropriate persons (e.g., correctional facility staff, hospital infection control officers, and shelter operators) and offer assistance in training, evaluation, and, if necessary and possible, provision of supplies. In some areas, gaining the commitment of private health-care providers and community health centers to screen and provide follow-up for the high-risk patients they serve will be vital.

GENERAL COMMENTS ON SCREENING

Screening persons other than members of high-risk groups is not recommended because screening low-risk persons diverts resources from other priority activities and because many positive tests in low-risk persons do not represent TB infection. The goal of screening programs must be clearly defined: screening is usually conducted to identify infected persons who are at high risk for disease and who would benefit from preventive therapy or to find persons who have clinical disease and need treatment. Screening programs also can provide a) epidemiologic data for assessing

TB and its trends in a community, b) data for assessing the value of continued screening, and c) baseline data to help with assessment if subsequent exposure occurs (e.g., for nursing home residents and employees in some occupations). Screening programs should not be undertaken unless necessary facilities for patient evaluation and treatment are identified and made available and unless patients found to be positive are likely to complete preventive therapy.

To the extent possible, members of high-risk groups and their health-care providers should be involved in the design, implementation, and promotion of screening programs (*6–8*). Implementation may be enhanced by using health department or other staff (including trained volunteers) who have linguistic and cultural familiarity with the population at risk.

SCREENING METHODS

Tuberculin skin testing is the standard method for identifying persons infected with *M. tuberculosis* (*1*). The Mantoux test (i.e., the intracutaneous administration of five units of purified protein derivative [PPD] tuberculin) best detects infection. Because they are less specific than the Mantoux test, multiple puncture devices should not be used to screen high-risk populations (*9*).

Screening for disease rather than infection may be more appropriate in some circumstances (e.g., when the tuberculin skin-test results may be unreliable, when administering and reading the test or following up infected persons for preventive therapy may be impractical, when the risk for disease is high, or when the consequences of an undiagnosed case may be severe). Chest radiography is the preferred screening method when the objective is to identify persons who have current pulmonary TB and when preventive therapy for infected persons is not the primary goal (e.g., in high turnover jails or in some homeless shelters). In these screening programs, patients who have signs and/or symptoms suggesting pulmonary or pleural TB (e.g., cough of >2 weeks' duration) should have a standard posterior-anterior chest radiograph, regardless of the tuberculin skin-test result. Although TB produces certain radiographic abnormalities more frequently than others, almost any form of pulmonary radiographic abnormality may result from TB, especially in immunosuppressed persons (*1*).

THE TUBERCULIN SKIN TEST

A detailed review of the tuberculin skin test has been published recently and is summarized here (*10*). Tuberculin skin-test results should be evaluated within the context of each patient's epidemiologic and environmental potential for infection (*11*).

Sensitivity, Specificity, and Positive Predictive Value of the Tuberculin Skin Test

Although the tuberculin skin test is now the only method for detecting *M. tuberculosis* infection, the test is neither 100% sensitive nor 100% specific. Sensitivity is a test's ability to identify correctly those persons who have a condition (e.g., those infected with *M. tuberculosis*). Specificity is a test's ability to identify correctly those persons who do not have a condition. In populations having a high prevalence of

infection with nontuberculous mycobacteria or vaccination with Bacille Calmette-Guérin (BCG), the specificity of the tuberculin test will be low.

The positive predictive value of the tuberculin test is also variable. Positive predictive value reflects the ability of a positive test to identify those persons who have a condition (i.e., the probability that a condition is present when the test is positive). As the prevalence of TB infection in the population decreases, the positive predictive value of the tuberculin test also decreases. The prevalence of infection among the total adult population in the United States is an estimated 5%–10% (CDC, unpublished data). Among populations residing in areas where cross-reactions caused by nontuberculous mycobacteria are common, the positive predictive value of the tuberculin test is low if a cutoff of ≥10 mm is used to define a positive test.

Interpreting Tuberculin Skin-Test Results

The criteria endorsed by the American Thoracic Society and CDC for a positive tuberculin skin-test result are intended to increase the likelihood that persons at high risk for TB will be candidates for preventive therapy and that persons having tuberculin reactions not caused by *M. tuberculosis* will not receive unnecessary diagnostic evaluation or treatment (*1,3,4*).

For those persons who have had recent close contact with a person who has active TB and for those whose chest radiographic findings suggest TB, skin-test reactions are likely to represent infection with *M. tuberculosis*. Persons infected with HIV may have a limited ability to respond to tuberculin, even if they are infected with tubercle bacilli. These groups are at high risk for TB. Thus, to ensure that persons infected with TB are evaluated and appropriately treated, the sensitivity provided by a ≥5-mm cutoff for a positive test is appropriate for these groups (Table 1). Although persons having HIV infection have a decreased ability to respond to tuberculin, some severely immunosuppressed persons infected with tubercle bacilli may still manifest a positive reaction and benefit from tuberculin skin testing.

Other factors (e.g., certain medical conditions or injecting-drug use without simultaneous HIV infection) moderately increase the risk for active TB. A reaction of ≥10 mm should be considered positive for these groups (Table 1). This cutoff is also appropriate for other groups: persons born in countries with a high prevalence or incidence of TB; medically underserved, low-income populations; residents and employees of most correctional institutions and nursing homes; health-care workers in high-risk settings (as defined in CDC guidelines); and, because of the increased risk for severe disease, children <4 years of age.

Routine screening is not recommended for populations at low risk for infection with *M. tuberculosis*. However, if these persons are tested, a higher cutoff of ≥15 mm is recommended (Table 1).

False-Positive Reactions

A small percentage of tuberculin reactions may be caused by errors in administering the test or in reading results. However, false-positive results are more commonly attributable to the presence in tuberculin of antigens shared with other mycobacteria. The potential sources of cross-reactions caused by these antigens are infection with nontuberculous mycobacteria and vaccination with BCG. Distinguishing clearly between reactions caused by infection with *M. tuberculosis* and those caused by other

TABLE 1. Summary of interpretation of tuberculin skin-test results

1. An induration of ≥5 mm is classified as positive in the following:
   - Persons who have had recent close contact with persons who have active TB;
   - Persons who have human immunodeficiency virus (HIV) infection or risk factors for HIV infection but unknown HIV status;
   - Persons who have fibrotic chest radiographs consistent with healed TB.

2. An induration of ≥10 mm is classified as positive in all persons who do not meet any of the above criteria, but who belong to one or more of the following groups having high risk for TB:
   - Injecting-drug users known to be HIV seronegative;
   - Persons who have other medical conditions that have been reported to increase the risk for progressing from latent TB infection to active TB. These medical conditions include diabetes mellitus, conditions requiring prolonged high-dose corticosteroid therapy and other immunosuppressive therapy (including bone marrow and organ transplantation), chronic renal failure, some hematologic disorders (e.g., leukemias and lymphomas), other specific malignancies (e.g., carcinoma of the head or neck), weight loss of ≥10% below ideal body weight, silicosis, gastrectomy, jejunoileal bypass;
   - Residents and employees of high-risk congregate settings: prisons and jails, nursing homes and other long-term facilities for the elderly, health-care facilities (including some residential mental health facilities), and homeless shelters;
   - Foreign-born persons recently arrived (i.e., within the last 5 years) from countries having a high prevalence or incidence of TB;
   - Some medically underserved, low-income populations, including migrant farm workers and homeless persons;
   - High-risk racial or ethnic minority populations, as defined locally;
   - Children <4 years of age or infants, children, and adolescents exposed to adults in high-risk categories.

3. An induration of ≥15 mm is classified as positive in persons who do not meet any of the above criteria.

mycobacteria is difficult. However, the larger the induration, the greater is the likelihood that the reaction represents infection with *M. tuberculosis*. Similarly, clearly distinguishing between a tuberculin skin-test reaction caused by infection with *M. tuberculosis* and a reaction caused by BCG vaccination is difficult. The probability that a skin-test reaction results from infection with *M. tuberculosis* rather than from BCG vaccination increases a) as the size of the reaction increases, b) when the patient is a contact of a person who has TB (especially if that person has infected others), c) when a family history of TB exists or when the patient's country of origin has a high incidence or prevalence of TB, and d) as the interval between vaccination and tuberculin testing increases (because vaccination-induced reactivity wanes over time and is unlikely to persist for >10 years) (*12,13*). A history of BCG vaccination is not a contraindication to skin testing.

False-Negative Reactions

False-negative tuberculin skin-test reactions have many potential causes (*1*). Nonresponsiveness to delayed-type hypersensitivity-inducing antigens like tuberculin is common among persons having impaired immunity (e.g., HIV-infected persons). Delayed-type hypersensitivity can be assessed with skin-test antigens such as tetanus toxoid, mumps, and *Candida*. Most healthy persons in the population are sensitized to these antigens. However, the scientific basis for anergy testing is tenuous (*14*). Most skin-test antigens used for anergy testing have no standardization. Thus, anergy testing is usually not part of screening for TB infection.

All HIV-infected persons should be tuberculin tested (*15,16*). Those who are tuberculin-positive (≥5 mm) should be evaluated for TB disease and placed on appropriate curative or preventive therapy. Preventive therapy should be administered to tuberculin-positive, HIV-infected persons, regardless of age. If they are at high risk for TB, persons failing to react to tuberculin may be evaluated for anergy (*17*), although the lack of standardization of anergy testing practices should be considered.

Booster Phenomenon and Two-Step Tuberculin Skin Testing

Periodic use of the tuberculin skin test is valuable for the surveillance of tuberculin-negative persons at risk for exposure to *M. tuberculosis*. Repeated testing of uninfected persons does not sensitize them to tuberculin. However, delayed-type hypersensitivity resulting from mycobacterial infection or BCG vaccination may gradually wane with years. Although subsequent initial skin testing may be negative, the stimulus of a first test may boost or increase the size of the reaction to a second test administered 1 week to 1 year later and thus may suggest an apparent—but false—tuberculin conversion.

Although the booster phenomenon may occur at any age, its frequency increases with age and is highest among persons >55 years of age and/or among those persons who have had prior BCG vaccination (*18*). When tuberculin skin testing of adults is repeated periodically, as in employee-health or institutional screening programs, an initial two-step approach can reduce the likelihood that a boosted reaction will be misinterpreted as a recent infection. If the first tuberculin test result is negative, a second 5-TU test should be administered 1 week to 3 weeks later. A positive second result probably indicates boosting from a past infection or prior BCG vaccination. Persons having a boosted reaction should be classified as reactors, not converters. If the

second result is negative, the person is probably uninfected, and a positive reaction to subsequent tests indicates a true tuberculin skin-test conversion (see Definition of a Tuberculin Skin-Test Conversion).

Because of problems with continued cross-reactions with other mycobacteria, the specificity of the tuberculin test is less when serial skin testing is performed than when a single test is administered. Thus, serial skin-testing programs tend to overestimate the incidence of new TB infection in the tested population. Because of this potential for overestimation of incidence, serial skin-testing programs should be targeted to populations at high risk for continued exposure to infectious TB.

Definition of a Tuberculin Skin-Test Conversion

Recent tuberculin skin-test converters are considered at high risk. An increase in induration of ≥10 mm within a 2-year period is classified as a conversion to a positive test among persons <35 years of age. An increase in induration of ≥15 mm within a 2-year period is classified as a conversion for persons ≥35 years of age. Regardless of age, for employees in facilities where a person who has TB poses a hazard to many susceptible persons (e.g., health-care facilities, schools, and child-care facilities), an increase of ≥10 mm induration should be considered positive.

Tuberculin Testing During Pregnancy

Studies in which the same patients were tested during and after pregnancy have demonstrated that pregnancy has no effect on cutaneous tuberculin hypersensitivity. Tuberculin skin testing is considered valid and safe throughout pregnancy. No teratogenic effects of testing during pregnancy have been documented (*19*).

RECOMMENDATIONS FOR SPECIFIC HIGH-RISK GROUPS

Contacts of Persons Who Have Infectious TB

Because the risk for infection and disease is particularly high among close contacts of persons having TB, these persons should be identified promptly (usually within 3 days) and examined soon (usually within 7 days) after identification of the potentially infectious patient (*4,6*). State and local health departments should work with local health-care providers to ensure completion of these monitoring activities. Prompt notification of state and local agencies about suspected or newly diagnosed and potentially infectious cases is critical for contact investigation.

Persons Who Have HIV Infection

HIV infection is the strongest risk factor yet identified for the development of TB disease in persons having TB infection (*20–23*). All HIV-infected persons should receive a PPD-tuberculin skin test (5-TU, PPD by the Mantoux method) (*15,16*).

Tuberculin testing for persons infected with HIV should be conducted in settings where HIV-infected persons or those at risk for HIV infection receive care. Administrators should ensure that the recommended screening is implemented and that prompt follow-up, evaluation, and treatment occurs. Because tuberculin skin-test results are less reliable as CD4 counts decline, screening should be completed as early as possible after HIV infection occurs. Those HIV-infected patients at high risk for continuing

exposure to patients who have TB should be screened periodically for TB infection. If they have TB symptoms or if they are exposed to a patient who has pulmonary TB, HIV-infected persons should be evaluated promptly for TB. Because active disease can develop rapidly in HIV-infected persons, the highest priority for contact investigation should be given to persons potentially coinfected with HIV and TB.

Persons Who Inject Drugs

Because they are at high risk for TB and HIV infection, the priority for screening is high for persons who inject illicit drugs (*16,20–22,24,25*). Drug treatment programs and other settings that provide care for persons who inject drugs should skin test injecting-drug users. If further evaluation and case management is necessary, adequate referral mechanisms should be in place. Coordination of these activities with local alcohol and other drug abuse treatment programs should be encouraged. Priority should be given to screening in facilities that are able to provide on-site, directly observed preventive therapy for 6–12 months to persons who have TB infection (e.g., clients of methadone maintenance treatment programs or residential treatment programs).

Persons Who Have Other Medical Risk Factors

Health-care providers should administer tuberculin tests to all patients who have medical risk factors that substantially increase the risk for TB (*3,22*). These patients should be screened in settings where they receive primary or subspecialty care (e.g., infectious disease, immunology, endocrinology, hematology/oncology, nephrology, rheumatology, pulmonology, and gastroenterology) or on admission to a hospital. These medical risk factors include the following:

- HIV infection,
- diabetes mellitus,
- conditions requiring prolonged high-dose corticosteroid therapy and other immunosuppressive therapy (including bone marrow and organ transplantation),
- chronic renal failure,
- some hematologic disorders (e.g., leukemias and lymphomas),
- other specific malignancies (e.g., carcinoma of the head or neck),
- weight of ≥10% below ideal body weight,
- silicosis,
- gastrectomy, and
- jejunoileal bypass.

In addition, persons who have an abnormal chest radiograph showing fibrotic lesions consistent with old, healed TB should be skin tested. Regardless of age, persons who have a positive skin test and parenchymal lung scarring are at high risk for TB if they have not previously received TB treatment or preventive therapy.

Residents and Employees of High-Risk Congregate Settings

High-risk environments are settings where a) persons who have infectious TB are more likely to live, b) environmental characteristics (e.g., type of ventilation and size)

are conducive to transmission, and c) many susceptible persons at risk for prolonged exposure to potentially infectious patients may be located. These environments include prisons and jails (*26,27*), nursing homes and other long-term facilities for the elderly (*28*), health-care facilities (*29*), homeless shelters (*30*), and residential settings for HIV-infected persons (*31*). Persons working in these settings should be educated about the risk for transmission, the signs and symptoms of TB, and proper procedures for minimizing the risk for transmitting TB infection. Clients and employees should be tuberculin tested on admission or initial employment.

Residents and Employees of Prisons and Jails

Recommendations for screening, treatment, and prevention in correctional facilities advise that on entry, all inmates should be screened for TB symptoms by a standardized interview process (*26,27*). Persons who have symptoms suggesting pulmonary TB should be immediately isolated and evaluated for active TB. Initial screening of inmates may vary, depending on each inmate's length of stay and on an assessment of the risk for transmission of TB infection in the facility.

In long-term facilities, tuberculin skin-test screening of all inmates without a documented positive skin-test result should be mandatory. If boosting is common among the population served by the facility, two-step skin testing should be considered. Inmates who have HIV infection and those at risk for HIV infection but whose HIV status is unknown should have a chest radiograph as part of the initial screening, regardless of skin-test results.

In short-term facilities serving high-risk populations, tuberculin skin-test screening is generally not feasible, but is recommended for inmates who will remain in custody for ≥14 days. Inmates who have HIV infection and those at risk for HIV infection but whose HIV status is unknown should have a chest radiograph as part of initial screening, regardless of skin-test status. In some large jails, officials should consider using on-site chest radiography to screen all inmates (short-term and long-term) for TB. In short-term facilities serving low-risk populations, screening inmates may be limited to screening for symptoms, provided that arrangements are made with a collaborating facility to receive inmates exhibiting symptoms.

Tuberculin skin-test screening also should be mandatory for all correctional staff in short-term or long-term facilities. Staff should be informed that if they are immunosuppressed, they should consult a health-care provider for appropriate follow-up and screening for TB.

Medical units within correctional facilities should conduct a thorough risk assessment and follow recommendations for prevention of transmission of TB infection in health-care facilities (*29*). Correctional authorities have primary responsibility for implementing these programs, but health departments should assist in program planning and training as well as regulating, advising, monitoring, and evaluating TB-control activities in correctional facilities.

Residents and Employees of Nursing Homes/Facilities for the Elderly

Because TB case rates increase with age among all racial and ethnic groups and both sexes, screening for TB in facilities providing long-term care to the elderly is recommended (*28*). The incidence of disease is two to seven times higher among nursing home residents in some areas than among demographically similar persons

in other settings. Studies indicate that unsuspected transmission of *M. tuberculosis* in nursing homes/facilities presents a risk to residents and workers (*32,33*). Residents should be screened for TB infection on admission by use of the two-step skin-testing method. Screening with chest radiographs alone is insufficient. Although few residents will be candidates for preventive therapy, baseline test results are essential to interpretation of subsequent tests if an acute exposure occurs. The two-step method also should be used for baseline screening of employees. Testing should be repeated in the event of exposure.

Residents and Workers at Homeless Shelters

Screening to find cases of active TB among the homeless consists of a chest radiograph (and possibly a sputum smear and culture) to determine current disease (*30*). Tuberculin skin-testing programs identifying infected persons who do not have current disease should be undertaken only if the diagnostic evaluation and course of preventive therapy can be initiated and completed. A special effort should be made to identify homeless persons coinfected with TB and HIV infection and to provide directly observed preventive therapy. Unless a shelter has its own health-care staff, the local government or a government-funded agency should assume responsibility for conducting screening programs for the homeless.

Health-Care Workers

Transmission of *M. tuberculosis* is a recognized risk in health-care facilities (*29*). Transmission is most likely to occur from patients who have unrecognized pulmonary or laryngeal TB, who are not on effective anti-TB therapy, and who have not been placed in TB isolation. Recent TB outbreaks in health-care facilities, including outbreaks of multidrug-resistant TB, have created heightened concern about nosocomial transmission. Increases of TB in some geographic areas are related to the high risk for TB among immunosuppressed persons infected with HIV. Transmission of *M. tuberculosis* to HIV-infected persons is of particular concern because, if infected with TB, these persons are at high risk for the rapid development of active TB. Thus, health-care facilities should be particularly alert to the need for preventing transmission of *M. tuberculosis* in settings where persons who have HIV infection receive care or work.

Health administrators and infection control departments in hospitals are responsible for ensuring the implementation of these recommendations. Implementing an effective TB control program requires risk assessment; early identification, isolation, and complete treatment of infectious TB patients; effective engineering controls; an appropriate respiratory protection program; and education, counseling, screening, and evaluation for health-care workers.

The Foreign-Born

TB is a problem among persons who arrive in the United States from countries having a high prevalence or incidence of TB (e.g., most countries in Africa, Asia, and Latin America) (*34–37*). Foreign-born persons at risk include immigrants (documented and undocumented), refugees, and some migrant workers and students. Because disease rates among the foreign-born are highest in the first few years after arrival in the United States, efforts should be made to screen new immigrants.

Culturally and linguistically sensitive evaluation and treatment programs should be provided to help ensure a successful treatment outcome. Services should not be denied because of a real or perceived undocumented immigration status.

Other High-Incidence Population Groups

The incidence of TB is closely related to socioeconomic status; higher rates occur among persons in low-income groups (*38*). Special control strategies targeted toward these low-income groups are needed. In addition, community leaders from high-risk populations and service providers (e.g., health, welfare, and housing) for these groups should be involved in planning and implementing programs (*8*).

Implementation of TB prevention and control efforts among lower socioeconomic groups presents special problems because these groups usually have less access to care, are more likely to have coexisting diseases, lack adequate shelter and transportation, and encounter more obstacles to treatment and health-care delivery. However, screening programs have demonstrated success in reaching these groups (*39,40*).

Screening for TB infection among certain occupational groups may occur at the worksite or other community sites. Screening migrant farm workers for TB infection is best conducted near home sites rather than at temporary work locations so that preventive therapy can be completed more easily for those who are infected (*41*). High-risk groups also may be screened whenever they have access to health care.

Persons Who Use Alcohol and Other Noninjecting Drugs

Because many persons who use alcohol and other noninjecting drugs are members of high-risk groups (e.g., HIV-infected persons, the homeless, residents of correctional facilities, and medically underserved, low-income persons), they should be included in screening activities if they also belong to a high-risk group. Because persons who use alcohol and other noninjecting drugs may be at risk for repeated exposure to others who have TB, a risk assessment and, if necessary, screening for TB infection should be administered on admission to a treatment program and on an annual basis, unless these persons are known to be tuberculin positive. Screening is not recommended for those persons who use alcohol and other noninjecting drugs but who are not members of high-risk groups because this screening diverts resources from higher priority activities.

RECOMMENDATIONS FOR SCREENING CHILDREN AND ADOLESCENTS

Although children in high-risk groups or those exposed to adults in high-risk groups may benefit from screening, most children are not members of high-risk groups. Mass or individual screening of children at low risk is not recommended because screening persons at low risk for TB infection diverts resources from higher priority activities and identifies few infected children (*42,43*). In addition, the reactions in low-risk children are often false-positive.

School-based screening for TB infection among children was started in the 1950s when infection and disease rates were higher than at present. The major purpose of school testing is to identify infected children who can be treated before the infection

progresses to infectious TB during adolescence or adulthood. Because broad-based school testing involves screening large numbers of low-risk children and because the majority of children who have pediatric TB are preschool age, generalized school screening as a public health measure is an ineffective method of detecting or preventing cases of childhood TB and should be discontinued *(43*).

Well-conducted contact tracing of infectious cases and refugee or immigration testing are more efficient methods than nonselective school-based testing for detecting children who have TB infection. However, targeted testing of high-risk children should be encouraged and may be conducted in the school setting (*44*). Before any testing program for children is implemented, arrangements for evaluation and treatment of children who test positive should be in place.

REPEAT SCREENING OF PERSONS AT CONTINUING RISK FOR EXPOSURE

The need for repeat skin testing should be determined by the likelihood of continued exposure to infectious TB. All tuberculin-negative persons should be retested if they are exposed to an infectious person. In some institutional and group-living environments (e.g., hospitals, prisons, nursing homes, and shelters for the homeless), the risk for exposure is enough to justify repeat testing at regular intervals. The frequency of repeat testing depends on the degree of risk for exposure, as determined by locally generated data. To assist in making these decisions, local facilities should compile and analyze their epidemiologic and programmatic data.

ROLE OF HEALTH DEPARTMENTS

In conjunction with local providers serving high-risk populations, health departments should assist in the development, implementation, and evaluation of TB screening programs appropriate for their communities by participating in specific activities:

- **Establishing priorities for prevention and control activities—**Screening for TB infection should not be given preference over higher priority activities, especially complete treatment of patients having TB or TB/HIV infection as well as prompt, effective contact investigation.
- **Determining priorities for screening activities—**This determination should be made by evaluating available resources, the probability of infection and disease among groups in the community, and the ability to ensure that those persons infected with TB will complete preventive therapy. Groups with the highest screening priorities include contacts of persons suspected or confirmed to have TB and patients having HIV infection.
- **Reviewing epidemiologic and programmatic data to identify additional groups for whom screening programs should be developed—**This review includes a) assessing the incidence, prevalence, and sociodemographic characteristics of persons having TB or TB infection; b) identifying high-risk groups and settings to determine whether a need for screening is indicated; c) designing tuberculin screening

programs to reach the high-risk groups in communities; and d) ensuring completion of preventive therapy.

- **Identifying and establishing working relationships with persons, facilities, and agencies providing health-care services to high-risk populations—**These service providers should be assisted in the development, implementation, and evaluation of screening programs appropriate to the needs of the community. The decision to initiate a skin testing program for a high-risk group should be based primarily on the ability of the TB control program and health-care providers to provide adequate preventive therapy services (i.e., tuberculin skin testing, reading and interpreting the tests, evaluating persons who have positive results, initiating preventive therapy when appropriate, monitoring patients for adverse reactions, and ensuring that patients complete preventive therapy). To be effective, the plan for evaluation and treatment should be developed before testing begins.
- **Assisting health-care providers who serve high-risk groups—**These providers should be assisted in providing screening services, evaluating data from screening programs to determine program effectiveness, and recommending appropriate future screening activities.
- **Providing support for staff training—**Staff should be trained to perform, read, and record results of tuberculin skin tests; evaluate positive-tuberculin reactors for clinical TB and preventive therapy; provide preventive therapy and monitor for adherence and adverse drug reactions; and educate clients regarding the need for preventive therapy. The health department or facility may certify staff completing this training.
- **Identifying medical consultants having expertise in TB patient management—**These consultants should be able to assist with managing persons who have TB or are suspected to have TB, their contacts, and persons receiving preventive therapy.
- **Arranging referrals and monitoring—**Upon request, assistance should be provided in making arrangements for referring and monitoring persons who have clinical TB or adverse drug reactions while on preventive therapy.
- **Reviewing screening activities—**Periodic assessments of screening activities are needed to examine the effectiveness of identifying infected persons and of ensuring that these persons complete preventive therapy.
- **Evaluating screening programs—**Regular assessments of screening programs are needed to determine their effectiveness. Recommendations for continuing or discontinuing screening programs should be made on the basis of their effectiveness.

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