

TITLE

Comparison of tuberculosis surveillance systems in low-incidence industrialized countries

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ABSTRACT

Introduction: Comparative analysis of national tuberculosis control programmes (NTP) in industrialized, low-tuberculosis-incidence countries is limited. Analysis of applied methods, function, and accumulated experience contributes to improving global tuberculosis control.

Methods: A questionnaire addressing NTP surveillance infrastructure and characteristics was completed by 19 industrialized countries, with populations greater than 3 million and annual tuberculosis notified incidence rates less than 16 cases per 100,000 populations (2003).

Results: All European countries surveyed adopted Euro-TB definitions. Surveillance information, which usually includes names, is transferred electronically to the national level in 17 of the 19 countries. Surveillance systems capture process and social determinants. Case notification to the central level occurred within a median period of seven days, independent of mandatory notification requirements. Average completeness of tuberculosis case-reporting was estimated as 93.5% (range 65%–100%). Integration between HIV and tuberculosis registries was performed in two countries, and in seven others, both databases were cross-matched periodically.

Conclusion: NTP function in industrialized, low-incidence countries utilizes well-established infrastructure and relies on centralized operations. Approaches are consistent with current WHO surveillance recommendations. This study lays collaborative groundwork for additional multinational analyses to enhance global tuberculosis surveillance, which may assist policy makers in countries moving from middle- to low-incidence rates.

INTRODUCTION

Tuberculosis (TB) control in industrialized countries varies substantially in its organization, function, and history. Consequently, it may be challenging to point to a set of discreet institutional components and label them the “National Tuberculosis Control Programmes” (NTP). Each country has established NTP function, composed of an amalgamated network of organized public and private efforts, which have evolved in association with societal and economic trends in industrialized countries with what is now a low incidence of TB.

Surveillance performance, which provides notice of epidemiologically significant changes, is one of the fundamental public health activities necessary for control and elimination of TB [1]. Over the last fifty years, many countries introduced organized surveillance activities at a national level. More recently, the World Health Organization (WHO) began comprehensive world-wide, annual reporting of traditional TB surveillance data, as well as elements of programme management, which also include treatment outcomes and drug supply [2,3].

Although surveillance performance in industrialized countries developed independent of supranational guidance, most are consistent with the current WHO recommendations [3]. The definitions used for surveillance were also endorsed by the International Union Against Tuberculosis and Lung Disease (IUATLD) [4]. In the last decade, substantial efforts were invested at the international level in developing recommendations and guidance for specialized areas in countries with high TB rates and technical matters related to policy development, including transition issues, in countries shifting from low- to middle income or from high to middle incidence rates [5-12].

TB incidence in most industrialized countries is low (defined by the WHO as less than 20 per 100,000 [13,14]). In addition to their developed economies and lower population sizes, industrialized countries tend to have high functioning NTP in the setting of lower endemicity of TB. This is in part due to a combination of robust societal support of the NTP-associated agencies, consistent application of technologies and long lasting control efforts. The essential elements of TB control in developed and low incidence countries were addressed in Wolfheze workshops [13] and published in the frameworks for TB control in Europe [14,15].

The WHO annual global reports are a useful source to compare countries' burden of disease and the accomplishments of the various NTP [3]. However, this information does not fully address the existing variance between the different programmes, nor does it readily allow for robust comparison between important components of NTP. Thus, a more detailed description and analysis of surveillance systems from industrialized countries will provide a better understanding of operational standards and methods, based on decades of experience gained. Lessons learned could be used to contribute to the development of guidelines for both developing countries and countries undergoing transitions in TB incidence and economic status.

This first descriptive study compares surveillance systems function across industrialized countries with low TB-incidence and lays the collaborative groundwork for advanced and additional analyses.

METHODS

Countries with a) high-income, b) low-TB incidence, and c) populations greater than 3 million (to exclude city-states and micro-nations) were chosen for this study. A high-income country was defined as having a gross national income greater than US\$10,726 per capita, as defined by the World Bank [16]. Low incidence was defined, for the purpose of this study, as averaging less than 16 new cases per 100,000 population annually between the years 2000–2003 [17]. This is a slightly lower threshold than the WHO standard of 20 new cases per 100,000, and includes those countries with a similar pattern of epidemiology, e.g., high incidence among foreign-born population. United Nations 2005 data was used for the total population size in each country [18].

Twenty-one NTP managers of the 19 eligible countries were contacted by electronic mail and were asked to participate by completing a survey containing 48 questions in March 2006. The questionnaire focused on the notification process and on the capacity of the surveillance system, such as reporting regulations, features of the data collection systems, time required for notification, periodic data analysis, process determinants (e.g., follow-up sputum culture results and records of adverse events due to treatment) and whether the system captures social determinants (e.g., country of origin, immigration date and status, homelessness, incarceration, marital status, and occupation). Participants were asked if incentives are provided to the reporting professionals (e.g., monetary value or access to the data) or if penalties were instituted (e.g., civil litigation or reprimands by the medical regulatory authority). Parametric values were compared using the two-tailed Pearson correlation test and continuous values were compared using a two-tailed Student t-test. The questionnaire is available at http://www.health.gov.il/mor/tb_questionnaire.dot (accessed 2 June 2008).

RESULTS

Completed questionnaires were received from all 19 countries between June and August 2006. All countries, except for Australia, Canada, New Zealand and the United States (USA), are part of the European region of the WHO.

All 15 of the 15 European countries surveyed have adopted the Euro-TB case reporting definitions and outcome categorizations [19] (Table 1), which include a minimum set of variables required for notification, links between physician and laboratory notification systems, and unified outcome measures, promulgated in 2002 [14]. Data are submitted electronically in most of the 19 countries (N=17, 89%) and sent to the national level in 16 countries (84%). Patients' data (name, address, identification number, when available) are reported in ten countries (53%). France and Norway are the only two countries who mandate national reporting for latent tuberculosis infection (LTBI); although Norway mandates reporting only if preventive treatment is started. TB suspects are also reported in 14 countries (74%): five countries report suspects only as high as the local level, and nine countries reported to the national level. At the national level, 10 countries (50%) capture process determinants and 12 (63%) include social determinants.

In nearly all countries, physicians and laboratories are required by law to report TB cases to a central authority, typically to the national level. However, in practice, nurses also participate in notifying cases (Table 2). Ten countries (53%) have penalties against professionals who fail to report cases, which are rarely, if ever, enforced. Ireland and United Kingdom provide direct monetary incentives to professionals who notify public health officials of TB cases.

While seven countries (37%) do not specify a time requirement for reporting, the others require compulsory reporting to 1 to 7 days following the date of TB diagnosis.

Notification was reported to occur within a range of 1 to 21 days (median time of seven days), most occurring later than required by law. No significant difference was found in actual reporting time among countries who require notification within a specified time period and those who have no time requirement ($r=0.28$, $p=0.23$). Eleven countries (58%) indicated that each case is reported to the national level at time of diagnosis. In the other eight countries, notification is conducted in a batched mode, mostly on a monthly basis. In Belgium, France and United Kingdom reports are sent to the national level once a year.

Verification of records is performed in all countries mostly by comparing the national reporting form with the laboratory notifications. Ten (53%) countries operate with greater autonomy at the local level in data handling (i.e., decisions about recurrent cases and recording therapy compliance).

The electronic system which stores the data is independent in ten (53%) of the countries and integrated with other electronic reporting systems in the others (Table 3). Laboratory results are integral for national control systems in all countries and are required to be reported for TB cases in most countries ($N=16$, 84%). Treatment outcomes are included in all but four countries (Finland, France, Italy and Switzerland). TB surveillance systems include both surveillance and case management related data fields in most countries ($N=17$, 89%), which include process indicators, such as treatment outcomes. Only Ireland, Italy, and Switzerland restrict their system to traditional surveillance only, limited to case counts and associated data. Data in most countries (17 of 19) are analyzed and reports are disseminated annually. Eight countries (the Czech Republic, Finland, France, Israel, New Zealand, Norway, the Netherlands, and USA) have validated TB case reporting in formal studies and published their findings [20-22]. The average completeness of TB case reports was estimated by

NTP managers to range from 65% to 100% (average of 93.5%); only moderate correlation was found between estimated TB reporting completeness and the existence of penalties or incentives ($r=0.46$, $p=0.048$).

All countries register drug susceptibility testing (DST) results (Table 4).

Although molecular laboratory methods are used in all countries results are required in three countries (Austria, Denmark and Norway). Although HIV data are collected in each country, the integration is performed automatically only in two countries (Denmark and in Finland), while in seven countries, both TB and HIV databases are cross-matched periodically.

DISCUSSION

NTP surveillance function in low-incidence industrialized countries surveyed is well established both at the national and sub-national levels, and is similar in aspects of reporting indicators. The flow of data moves in a prompt manner, even in those countries in which no time requirements are specified, no penalties are imposed and no incentives are provided. Data and information structure of the national registries in each country are consistent with WHO recommendations.

Data are transmitted electronically in most industrialized countries examined, and in the others, systems are being upgraded to include electronic transmittal, away from letters and facsimiles. As industrialized low-incidence countries continually increase and refine the use of information technology, data and information transfer among countries could be enhanced. This, for example, might help improve international coordination on immigrant health screening. Moreover, this surveillance enhancement could serve as a model for global surveillance systems integration, monitoring additional communicable and emerging infections.

As the trend of global migration of people from high- to low-TB incidence countries rises [23], the interest in international comparison of social characteristics may increase and benefit from a more standardized approach [24]. These particular data are used in case management and programme planning, including identifying high risk groups, which underscore the continued association between morbidity and the social determinants of TB in the industrialized countries [25]. A significant proportion of TB cases in industrialized countries are foreign-born individuals [24,26].

NTP programmes structure differs. For example, some countries use codes assigned for TB cases rather than personal identifiers for reporting, as required by law to protect confidentiality. Personal identifiers may facilitate internal reliability, whereas

coding may promote notification as patients are ensured of their privacy protection. The ability to protect patients' rights and ensure data integrity is a delicate balance that countries are careful to maintain.

Minor differences exist in outcome definitions of TB and in reporting time among countries outside of the European region of the WHO, which may limit the ability to compare those determinants among different NTP [27]. To perform more accurate global comparisons, industrialized countries should consider further refinements and harmonization in these definitions [28].

Nurses facilitate the reporting of TB cases in many of the countries, although only physicians and laboratories are obliged by law to notify the national level. As nurses are increasingly becoming the backbone of human resources in public health systems, along with the increasing accreditation in their profession, further evaluation should be done to assess if formal transfer of some surveillance tasks from physicians to nurses can enhance reporting efficiency, completeness, and quality.

Most TB control measures are performed at the provincial or the regional level. Based on unsolicited comments from some countries, such as Australia, Belgium, Canada, Switzerland, and United Kingdom, significant intra-national differences were found among internal regions (e.g., States, cantons, and provinces). These differences reflect greater autonomy or political constraints below the national level, which may limit standardization of TB control. To increase the quality of data collection, collaborative efforts made by local professionals in internally diverse countries could increase internal reporting.

HIV infection status is an integral component of TB surveillance systems in only a few countries, an unexpected finding given the inextricable link between the two

infections and, in many European countries, the association with immigration [24,29]. Instead, HIV is captured in a separate registry, to which TB data are cross-matched in some countries. The reasons for separate registries may be to better protect confidentiality, minimize technical obstacles in integration, and ameliorate political and financial challenges. Additional studies should be performed to assess whether HIV testing for each TB patient, strengthening the TB/HIV monitoring [5], and merging the two databases for routine analysis improve effectiveness of surveillance and patient care in industrialized countries. Surveys and special studies might be used in countries in which merging TB and HIV databases cannot be done for confidentiality reasons or culture and DST are not collected on all individuals to monitor incidence and trends of multi- or extensively-drug resistant strains.

Finally, although incorporating LTBI cases in the central registry and preventive treatment outcome indicators may further support the national TB registry, especially in countries which are close to TB elimination in their native-born population [14], no consensus was evident among the countries surveyed, regarding the applicability and sustainability of its inclusion; further studies are needed in this area.

The specific NTP infrastructure in each country has a direct impact on TB detection rates, treatment outcome, and control [15]. Several factors may be operative. First, each currently industrialized country established its own programme according to its distinctive epidemiology, health infrastructure, political commitment, social norms, geographic structure, and resources available. In most industrialized countries examined, NTP function was established independently and when TB rates and economic status were different. Second, as TB epidemiology in industrialized countries is sensitive to immigration, different adjunctive components (including surveillance) were added to control programmes in some countries to address evolving local immigration patterns

and to meet domestic naturalization regulations. Finally, the unique organization and funding of health systems in each country reflect individual development. Collectively, these factors for different NTP infrastructure make the development of cohesive international guidelines that are applicable to emerging industrialized countries challenging [30].

Effective linkage between laboratories and public health authorities, especially electronic, is helpful to ensure completeness of reporting and to increase validity of the National registry [22]. Laboratories that confirm TB cases have been considered the most complete source for data [20]. We therefore expected to find higher completeness of reporting among countries where reporting by the laboratory was required; but this could not be demonstrated because it applied to only two countries in our study. Moreover, there may be under-reporting among non-laboratory confirmed cases where the diagnosis is based only on clinical findings.

Global TB figures are reported annually by WHO and compare incidence across countries. It would be worthy to evaluate whether harmonized approaches to programme evaluation may further encourage inter-country periodic evaluation of the completeness and the validity of TB surveillance. Validation of surveillance data is often costly and labour exhaustive [22], yet is the basis for estimating case detection rates [25,32]. Although intuitively true, there is no evidence that decentralization of TB surveillance system operations and function strengthens overall information quality.

These survey results may further assist countries with higher TB incidence in improving their surveillance systems. For example, we believe that the use of a nationwide reliable electronically connected system that includes the national level should also be established between TB laboratories and the national HIV/AIDS registry. Moreover, reporting should include clinical, diagnostic and social determinants of the

patients and registered at the national level. Greater autonomy to mid-level health departments may improve the verification of cases and the completion of missing information prior to transmission to the national level. Importantly, nurses should participate in data reporting, as they have the clinical experience and administrative skill to perform these tasks. Finally, evaluation of the completeness of the TB database and time required for cases to be reported should be performed periodically. In this study, we did not find a significant association with incentive or penalties to the reporter and estimated completeness, and we believe that it is the NTP manager's responsibility to persuade local professionals of the importance of notification, in part, to decrease reporting bias.

Our study is subject to several limitations. First, it is cross sectional and does not dissect the development of the various systems over time. Second, it excludes industrialized countries not meeting our case definition, potentially missing extensive experience gained in TB control among other less-populated industrialized countries. Third, this survey was not designed to incorporate any measure of effectiveness, and thus we cannot prioritize or suggest how a difference in one system might affect another if applied. Finally, this study in its focus on surveillance systems may miss other effects of NTP function and organization that affect surveillance, such as changes in the quality of human resources and adherence to treatment over time. To obtain a deeper perspective of the effects of the structure of different NTP, additional detailed comparisons should be performed, evaluating financial incentives, treatment funding, relationships between public and private providers, and additional structure indicators, such as qualification and training of personnel, number and location of treatment sites.

CONCLUSION

NTP surveillance function in low-incidence, high-income countries is well established, centrally operated and is consistent with the WHO (including Euro-TB) and IUATLD recommendations for reporting and data dissemination. Improved global harmonization in outcome determinants and Internet-based electronic contact among various industrialized countries may enhance global TB control. Analysis of surveillance data and function may assist medium incidence countries moving from medium- to low incidence rates and from vertically to horizontally organized health care systems. Nevertheless, detailed studies should be performed to compare structure, process, and effectiveness of different NTP systems to identify fundamental attributes of an optimal system.

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Table 1: Basic structure of TB^s surveillance systems of 19 low-incidence developed countries

Country	Case definition	Level of reporting	Data are transfer from the local to the National level	Case identifiers	LTBI[‡] notification	Are TB suspects reported	Does the National system capture process indicators[*]	Does the National system capture social determinants[@]
Austria	Euro-TB definition	National	Electronically and post	Name, address	Not required	Yes, to local level	No	Yes
Australia	Lab findings and/or clinical determinants	Provincial	Electronically	Code	Not required	Yes, to local level	No	Yes
Belgium	Euro-TB definition	National	Electronically and post	Initials, code, zip	Not required	Yes	No	Yes
Canada	Lab findings and/or clinical determinants	Provincial	Electronically and post	Code	Not required	Yes, to local level	No	Yes
Czech Republic	Euro-TB definition	National	Electronically	Name, ID number, address	Not required	No	Yes	Yes
Denmark	Euro-TB definition	National	Post	Name, ID number, address	Not required	Yes	Yes	Yes
Finland	Euro-TB definition	National	Electronically and post	Name, ID number, address	Not required	No	No	Only country of birth and immigration status
France	Euro-TB definition	National	Electronically	Code	Mandatory [¶]	Yes	Yes	Yes
Germany	Euro-TB definition	National	Electronically	Code	Not required	Yes, to local level	Yes	Only country of birth and citizenship

Country	Case definition	Level of reporting	Data are transfer from the local to the National level	Case identifiers	LTBI[‡] notification	Are TB suspects reported	Does the National system capture process indicators[*]	Does the National system capture social determinants[@]
Ireland	Euro-TB definition	National	Electronically	Code	Not required	No	Yes	Yes
Israel	Euro-TB definition	National	Electronically and post	Name, ID number, address	Not required	Yes	Yes	Only country of birth and immigration status
Italy	Euro-TB definition	National	Electronically and post	Name, ID number, address	Not required	Yes	Yes	Yes
Netherlands	Euro-TB definition	National	Electronically	code	Not required	Yes, to local level	Yes	Yes
New Zealand	Lab findings and/or clinical determinants	National	Electronically and post	Code	Not required	Yes	No	Yes
Norway	Euro-TB definition	National	Post	Name, ID number, address	Mandatory [‡]	No	No	Only country of birth and year of arrival.
Sweden	Euro-TB definition	National	Electronically and post	Name, date of birth, address	Not required	Yes	No	Only country of birth and year of arrival
Switzerland	Euro-TB definition	National	Electronically and post	Name, date of birth, address	Not required	No	No	Only country of birth and immigration status
United Kingdom	Euro-TB definition	National	Electronically, post and fax [‡]	Name, address [‡]	Not required	Yes	Yes	Only ethnicity and country of birth
USA	Lab findings and/or	County	Electronically	Code	Not required	Yes	Yes	Yes

Country	Case definition	Level of reporting	Data are transfer from the local to the National level	Case identifiers	LTBI [‡] notification	Are TB suspects reported	Does the National system capture process indicators [*]	Does the National system capture social determinants [@]
	clinical determinants	and/or state						

\$ Tuberculosis

‡ Latent tuberculosis infection

* Examples of process indicators are follow-up on sputum samples, culture results and adverse events.

@ Examples of social determinants are country of origin, marital status, occupation, homelessness, incarceration, nationality/country of origin of TB cases.

¶ Only for children under 15 years old

€ Only if preventive treatment is started

% Notification in Scotland and Northern Ireland are delivered by post only.

¥ Scotland requires also ID number of each case.

Table 2: Basic mechanics of TB^s surveillance systems of 19 low-incidence developed countries

	Who is responsible to report	Who actually reports	Is there a penalty for not reporting	Is there direct incentive for the reporting level	Time required to notify	Actual time for reporting ^a	Fashion of data reporting to the national level	Location where TB reports are verified	Which level decides on recurrent case
Austria	Physician, lab	Physician, lab, public health authorities	No	No	1 day	1-2 days	Case-by-case	National	National
Australia	Physician, lab	Physician, lab, public health authorities	Yes	No	1 day, Σ varies	30 days	Batched	Provincial	National
Belgium	Physician, lab	Physician, nurse, lab, insurer	No	No	2 days ^c	7 days	Batched (annually)	National	Local
Canada	Physician, lab	Physician, lab	Yes	No	No time limits	3 days	Batched (weekly)	Province	Province
Czech Republic	Physician, lab	Physician, lab	Yes	No	1 day	2 days	Case-by-case	Regional	Local
Denmark	Physician, lab	Physician,	Yes	No	No time limits	14 days	Case-by-case	National	National
Finland	Physician, lab	Physician, lab	No	No	3 days	21 days	Case-by-case	Local	Local
France	Physician, lab	Physician, lab	No	No	No time limits	10 days	Batched (annually)	National	National
Germany	Physician, lab	Physician, lab	Yes	No	1 day	3 days	Case-by-case	National	National

	Who is responsible to report	Who actually reports	Is there a penalty for not reporting	Is there direct incentive for the reporting level	Time required to notify	Actual time for reporting ^a	Fashion of data reporting to the national level	Location where TB reports are verified	Which level decides on recurrent case
Ireland	Physician, lab	Physician, lab	Yes	Yes	3 days	20 days	Case-by-case	National	Local
Israel	Physician, lab	Physician, nurse, lab	Yes	No	1 day	2 days	Case-by-case	National	Local
Italy	Physician, nurse, lab	Physician, lab	No	No	No time limits	1 day	Batched (monthly)	Regional	Local
Netherlands	Physician	Physician, lab	Yes	No	1 day	7 days	Case-by-case	Local	National
New Zealand	Physician	Physician, nurse, lab	No	No	No time limits	3 days	Batched (monthly)	Regional	Local
Norway	Physician, lab	Physician, lab	No	No	No time limits	20 days	Case-by-case	National	National
Sweden	Physician, lab	Physician, lab	No	No	1 day	No estimate	Case-by-case	National	National
Switzerland	Physician, lab	Physician, lab	Yes	No	7 days	14 days	Case-by-case	National	National
United Kingdom	Physician [§]	Physician, nurse, lab	Yes	Yes	No time limits	No estimate ☐	Batched (annually) ☐	Local	Local
USA	Physician, lab	Physician, nurse, lab	No	No	2 days	No estimate	Batched (monthly)	National	Local

§ Tuberculosis

^a Estimation of the NTP manager for the average time required for notification

- Σ Time required for notification varies between jurisdictions
 - « Only in the Flemish part of the country
 - § Scotland requires reporting also from pathologists, nurses and labs.
 - α Northern Ireland estimates the time of notification in 7 days.
 - © Scotland and northern Ireland reports case-by-case.

Table 3: Functional characteristics of TB^s surveillance systems of 19 low-incidence developed countries

	Is TB reporting system independent	Does the National system capture lab results [^]	Type of TB system	Does the system capture treatment outcomes	Is there an indicator for DOT ^Δ	Frequency of analyzing the data in the National level	Frequency of publishing the data from the National level	NTP ^e estimates for completeness of reporting (%)
Austria	Independent	Yes	Surveillance and case management	Yes	No	Annually	Annually	100
Australia	Integrated with other systems	Yes	Surveillance and case management	Yes	No	Annually	Annually	98
Belgium	Independent	Yes	Surveillance and case management	Yes	No	Annually	Annually	90
Canada	Independent	Yes	Surveillance and case management	Yes	Yes	Annually	Annually	100
Czech Republic	Independent	Yes	Surveillance and case management	Yes	Yes	6 monthly	6 monthly	99
Denmark	Integrated with other reporting system	Yes	Surveillance and case management	Yes	No	6 monthly	Annually	100
Finland	Integrated with other reporting	Yes	Surveillance and case management	No	No	Quarterly	Annually	95

	Is TB reporting system independent	Does the National system capture lab results [^]	Type of TB system	Does the system capture treatment outcomes	Is there an indicator for DOT ^Δ	Frequency of analyzing the data in the National level	Frequency of publishing the data from the National level	NTP ^ε estimates for completeness of reporting (%)
	system							
France	Independent	Yes	Surveillance and case management	No	No	Annually	Annually	65
Germany	Integrated with other reporting system	Yes	Surveillance and case management	Yes	No	Annually	Annually	95
Ireland	Independent	Yes	Surveillance only	Yes	No	Quarterly	Annually	95
Israel	Independent	Yes	Surveillance and case management	Yes	No	Annually	Annually	99
Italy	Independent	Partly	Surveillance only	No	No	6 monthly	Annually	80
Netherlands	Integrated with other reporting system	Yes	Surveillance and case management	Yes	Yes	Quarterly	Annually	90
New Zealand	Integrated with other reporting system	Yes	Surveillance and case management	Yes	Yes	Monthly	Monthly	96
Norway	Integrated with other	Yes	Surveillance and case management	Yes	No	Quarterly	Annually	95

	Is TB reporting system independent	Does the National system capture lab results [^]	Type of TB system	Does the system capture treatment outcomes	Is there an indicator for DOT ^Δ	Frequency of analyzing the data in the National level	Frequency of publishing the data from the National level	NTP [€] estimates for completeness of reporting (%)
	reporting system							
Sweden	Integrated with other reporting system	Yes	Surveillance and case management	Yes	Yes	Annually	Annually	95
Switzerland	Integrated with other reporting system	Yes	Surveillance only	No	No	Annually	Annually	95
United Kingdom	Independent	Yes	Surveillance and case management	Yes	No ^Æ	Annually [±]	Annually	95
USA	Independent	Yes	Surveillance and case management	Yes	Yes	Annually	Annually	95

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[^] Examples of lab determinants are drug susceptibility testing, restriction fragment length polymorphism (RFLP) results.

^Δ Directly observed therapy

[€] National TB program

^Æ Scotland does have indicator for directly observed therapy

[±] Northern Ireland analyzes the data quarterly

Table 4: Characteristics of TB^s and HIV laboratory data in TB surveillance systems of 19 low-incidence developed countries

	Is DST ^{III} required for each case	Is RFLP [®] required for each case	Is HIV data collected Nationally in the country	Are HIV data automatically integrated with the national TB system	Does the TB system indicate HIV infection	Source of HIV data
Austria	Yes	Yes	Yes	No	No	
Australia	Yes	No	Yes	No	Yes	TB cases are tested for HIV
Belgium	Yes	No	Yes	No	Yes	TB cases are tested for HIV
Canada	Yes ^{&}	No	Yes	No	Yes	TB cases are tested for HIV
Czech Republic	Yes	No	Yes	No	No	
Denmark	Yes	Yes	Yes	Yes (AIDS only)	Yes	Both data bases are cross matched
Finland	Yes	No	Yes	Yes	Yes	Both data bases are cross matched
France	Yes	No	Yes	No	No	
Germany	Yes	No	Yes	No	No	
Ireland	Yes	No	Yes	No	Yes	TB cases are tested for HIV
Israel	Yes	No	Yes	No	Yes	Both data bases are cross matched
Italy	No	No	Yes	No	Yes	Both data bases are cross matched
Netherlands	Yes	No	Yes	No	Yes	Select TB cases are tested for HIV
New Zealand	Yes	No	Yes	No	Yes	Both data bases are cross matched
Norway	Yes	Yes	Yes	No	No	Limited data
Sweden	Yes	No	Yes	No	No	
Switzerland	Yes	No	Yes	No	No	
UK	Yes	No ^{>}	Yes	No	Yes	Both data bases are cross matched
USA	Yes	No	Yes	No	Yes	Both data bases are cross matched

© Restriction fragment length polymorphism

\$ Tuberculosis

III Drug susceptibility testing

& Although not legally required, drug susceptibility testing is performed in practice for all new isolates upon physicians' requests.

> With the exception of Scotland