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Early View

Original article

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Tuberculosis in the European Union and European Economic Area: a survey of national tuberculosis programmes

Simon M. Collin[1], Gerard de Vries[2], Knut Lönnroth[3], Giovanni Battista Migliori[4], Ibrahim Abubakar[5], Sarah R Anderson[1], Dominik Zenner[1,5]

1. Respiratory Diseases Department, Centre for Infectious Disease Surveillance and Control, National Infection Service, Public Health England, London, NW9 5EQ, UK

2. KNCV Tuberculosis Foundation, Den Haag, Netherlands

3. Karolinska Institutet, Stockholm, Sweden

4. Istituti Clinici Scientifici Maugeri IRCCS, Via Salvatore Maugeri, 4 - 27100 Pavia, Italy

5. UCL Institute for Global Health, London, UK

Correspondence: Dr Dominik Zenner, Respiratory Diseases Department, Centre for Infectious Disease Surveillance and Control, National Infection Service, Public Health England, London, NW9 5EQ, UK. dominik.zenner@phe.gov.uk +44 (0)20 8327 7456

120-character summary: Need for national TB control plans and investment in human resources to work towards TB elimination across the EU/EEA.

Abstract

Question: How many European Union (EU) and European Economic Area (EEA) countries have national TB control plans/strategies, and what are the priority actions/populations and barriers to implementation?

Methods: Survey of EU/EEA national TB programme leads.

Results: The response rate was 100% (31 countries). 55% of countries reported having a national TB strategy, all of which were in implementation; five were preparing a strategy. 74% have a defined organisational TB control structure with central coordination, and 19% have a costed programme budget; few organisational structures included patient/civil society representation. The most frequently mentioned priority TB control actions were: reaching vulnerable population groups (80%); screening for active TB in high-risk groups (63%); implementing electronic registries (60%); contact tracing and outbreak investigation (60%); and tackling MDR-TB (60%). Undocumented migrants were the most commonly (46%) identified priority population. Perceived obstacles to implementation included barriers related to care recipients (lack of TB knowledge, treatment seeking/adherence), care providers (including need for specialist training of nurses and doctors) and health system constraints (funding, communication between health and social care systems).

Answer: This survey has provided an insight into TB control programmes across the EU/EEA which will inform the development of a TB strategy toolkit for member states.

Introduction

Tuberculosis (TB) incidence continues to decline across the European Union (EU) and European Economic Area (EEA), but projected trends show that a strengthening of efforts is needed if the WHO (World Health Organization) End TB vision to is to be realised by EU/EEA member states [1, 2]. Because of the specific TB epidemiology in low-incidence countries, programmes to work towards TB elimination in this context typically include interventions directed at vulnerable and high-risk groups alongside wider health system efforts to improve treatments, prevent resistance, and implement new technologies [2-5]. The WHO End TB Strategy [6] recommends that each country develops a national TB control plan or strategy [7]. Across the EU/EEA, support for national TB programmes is provided at supranational level through the ECDC (European Centre for Disease Prevention and Control) Framework Action Plan, which takes into account social, economic and epidemiological heterogeneity between and within member states [8]. One of the core indicators of the Framework Action Plan is the availability of a national TB control plan or strategy which has been formally adopted by the respective national government [9]. A 2013 survey of European countries [10] found that only 15 EU/EEA countries had a national TB control plan [10], although this survey predated publication of the WHO End TB Strategy.

Here we report the findings of a survey which gathered information from national TB programme leaders across the EU/EEA regarding the availability, implementation and content of national TB control plans. The aim of the study was to obtain an up-to-date picture of national TB control plans and strategies, including prioritisation of action areas and barriers to the implementation of interventions for TB control and prevention.

Methods

This survey was conducted as part of the European Commission funded E-DETECT TB (Early Detection and Integrated Management of Tuberculosis in Europe) project, which aims to improve TB control efforts across Europe through translational research designed to reach high-risk groups in EU/EEA countries as well as the development of a practical toolkit to support national TB strategy development and implementation [11, 12].

The survey used an online questionnaire to collect data from national TB programme leaders or representatives across all 31 countries of the EU/EEA. The questionnaire was designed and tested at Public Health England (PHE) in collaboration with E-DETECT TB partners. The survey comprised 11 sections (see Box) including fixed and open questions (see Supplementary File 1) and was implemented using SelectSurvey (SelectSurvey.NETv4, ClassApps LLC, Kansas City, MO, USA). The methodology was consistent with that of a previous European survey [10], thereby allowing progress on some indicators to be evaluated.

The barriers section was aligned with the SURE (Supporting the Use of Research Evidence) checklist of barriers to implementing health policy options [13], thereby generating a list of 44 factors which could impede TB control and prevention. These were grouped under four subheadings: recipients of care (6 factors); providers of care (5 factors); health system constraints (27 factors); and social and political constraints (6 factors). Invitations to complete the survey were distributed via email to national TB programme managers listed by WHO and ECDC on 17th May 2017. Survey questions were worded in accordance with terminology used in ECDC documents [8, 9] which are familiar to EU/EEA TB programme teams. In addition, the survey administrator (SC) was available by email, telephone and at the 2017 Wolfheze meeting in case clarification was needed.

E-DETECT TB Survey of EU/EEA national TB programme leaders
National strategies, coordination and resources
1   Availability and implementation of a national TB control plan or strategy
2   TB programme coordination and stakeholder representation
3   Resources (including budget, workforce development, and new tools for TB control and prevention)
4   Monitoring and surveillance
Finding and treating TB in the population
5   TB in high-risk and vulnerable population groups
6   Clinical and technical (guidelines, laboratory quality assurance, contact tracing, vaccination)
7   Multidrug-resistant (MDR) TB
8   HIV/TB
Priorities and barriers
9   Priority actions - which existing or new actions are most important or have the greatest urgency?
10   Priority populations - which groups have the highest unmet need for TB detection and treatment?
11   Barriers to TB control and prevention

Data were exported from SelectSurvey to Stata (Stata Statistical Software: Release 13. StataCorp LP, College Station, TX, USA). Data were analysed descriptively, tabulating frequency (%) of responses for each questionnaire item for all countries combined and separately for low (<10/100,000) and medium-high (≥10/100,000) TB incidence [1] countries. Questionnaire items which asked respondents to rate priorities or unmet need as high/medium/low were given an overall percentage score, which was calculated by dividing a weighted sum of individual responses (coded as low=0, medium=1, high=2) by the theoretical maximum score.

Results

Survey completion

The survey was completed by programme managers or their delegated representatives in all of the 31 countries (100% response rate). Responses were received between 17th May and 19th September 2017. Responses for Liechtenstein were provided jointly by representatives from Liechtenstein and Switzerland (a non-EU/EEA country), reflecting a unified approach to TB control and prevention in the two countries. We retained N=31 as the denominator for our analyses (although not all questions were mandatory, hence some responses show a denominator <31). Survey responses not quantified in Table 1 or in the text are summarized in supplementary tables.

National strategies, coordination and resources

Availability and implementation of a national TB control plan or strategy

Just over half (17/31) of EU/EEA countries have a national TB control plan or strategy (**Figure 1, Table 1**). All of those with a plan had begun implementation, including six in 2015/2016, and five in 2011-2013. Thirteen plans covered periods of 3-9 (median 5) years' duration, typically beginning in 2011-2016 and ending in 2017-2020, and the remainder were open-ended (4 plans). Of the 14 countries without a national TB control plan or strategy, five were either preparing a plan or intended to prepare a plan, two of which were expected to be finalised in 2017 and one in 2019.

TB programme coordination

Three quarters (23/31) of countries reported having a clearly defined organisational structure, and about half of these were defined in the national TB control plan or strategy (**Table 1**). TB control and prevention was coordinated centrally by a national TB control board, committee or other formal body in 55% (17/31) of countries, and by other national bodies or regional control structures in 35.5% (11/31) of countries.

Stakeholder representation

The majority (>80%) of the 17 national TB control boards (or committees or other formal bodies) had Ministry/Department of Health and national public health department representation. More than half had clinical, laboratory, epidemiology, and local public health representatives, but professional bodies (41%), local TB control boards (35%), and nursing (29%) were less frequently represented. Non-governmental organisations, patients and civil society were represented on few (<5) control boards, as were pharmacies (2) and private health providers (1). Two of the 17 coordinating bodies met monthly, five met annually, five irregularly, and the remainder every 3-6 months. Specific funding had been allocated to 5/17 coordinating bodies, and 5/17 received regular reports from local (regional, district, state, provincial, etc.) TB control boards, committees or other formal bodies.

Budget

One fifth of countries (6/31) had a costed budget for a national TB programme, with 17 of the remaining 25 countries having budgets for parts of a TB programme and/or providing for TB-related activities within their national, federal or municipal healthcare systems. Half of countries (16/31) had conducted an impact assessment or other financial or health economic assessment of the likely impact of TB control.

Workforce training and development

One fifth of countries had a strategy for training and developing a specialist TB workforce (coordinated at a national level in 14/16 countries). The parts of the TB workforce with the greatest perceived need for training and development were: community/primary health workers, 59.3% (16/27); specialist nurses, 51.9% (14/27); specialist doctors, 37.0% (10/27); microbiologists 33.3%, (9/27); epidemiologists, 33.3%, (9/27); surveillance scientists, 18.5% (5/27). Five countries mentioned other needs for workforce training and development, including: general practitioners (3 countries); radiologists, pulmonologists and specialist radiologists (1 country); and immigration and prison services (1 country). Five respondents commented that low TB incidence in their country led to low knowledge and experience of TB because healthcare professionals encountered few cases - a further two stated that there is a need for knowledge updates among healthcare workers and general practitioners (GPs).

New tools for TB control and prevention
One fifth of countries had a strategy for introducing and implementing new tools for TB control and prevention, including: rapid diagnostic tests, 85.7% (12/14); treatment observation, 71.4% (10/14); infection control, 57.1% (8/14); drug susceptibility testing, 57.1% (8/14); surveillance, 50.0% (7/14); microbiology, 50.0% (7/14); contact tracing, 35.7%, (5/14); outbreak investigation, 28.6% (4/14).

Monitoring and surveillance
All countries had a national TB case registry, and three quarters (23/31) had a strategy for monitoring and evaluation of TB control and prevention, half of which (11/23) were documented in the national TB control plan/strategy. The median number of full-time equivalent (FTE) staff assigned to TB surveillance in national offices was 2, with a range from 0.5 to 8.5 FTE.

Finding and treating TB in the population

Raising awareness of TB
Twenty-one (67.7%) countries had programmes for raising awareness of TB at community or primary care level, of which four were documented in the national TB control plan/strategy. The community or primary care groups reached by these programmes included: primary care doctors/GPs, 95.2% (20/21); primary care health workers, 76.2% (16/21); social workers, 66.7% (14/21); and general public, 57.1% (12/21). Other groups for awareness-raising included: services for people living with HIV; prisons; schools; and non-governmental organisations working with vulnerable groups.

Active and latent TB in high-risk and vulnerable groups
A number of vulnerable population groups were identified as being at higher risk of having latent or active TB: asylum seekers (88.5%), prisoners (84.6%), refugees (76.9%), documented migrants (69.2%), undocumented migrants (57.7%), and people with drug problems (57.7%). Screening for active TB was conducted among asylum seekers in 77.4% of countries, refugees in 71.0% and current prisoners in 74.2%. Point-of-entry and post-entry screening for active TB among documented migrants was conducted by 32.3% and 41.9% countries, respectively. Two countries conducted screening for active TB in social care institutions and for people entering shared community accommodation. A strategy for TB control in prisons was in place in 77.4% of countries, of which nine were documented in the national TB control plan/strategy. The groups most commonly identified for latent TB infection (LTBI) screening were asylum seekers (33.3%), refugees (26.7%) and current prisoners (26.7%). Point-of-entry and post-entry screening for LTBI in documented migrants was conducted by 20.0% and 16.7% of countries, respectively.

Contact tracing
Contacts of cases were tested for LTBI in 86.7% (26/30) of countries, and the majority (83.9% (26/31)) had a strategy to implement and ensure comprehensive contact tracing, of which half (13/26) were documented in a national TB control plan/strategy. Recommended approaches to tracing included: household contacts, 96.2% (25/26); workplace contacts, 92.3% (24/26); healthcare facility contacts, 92.3% (24/26); and community contacts, 80.8% (21/26).

Vaccination
Two thirds of countries (20/30) had a strategy to provide and promote BCG vaccination, of which half (9/20) were documented in the national TB control plan/strategy. The proportions of BCG vaccination strategies that included universal infant, high-risk infant and high-risk adult BCG vaccination were 42.1% (8/19), 57.9% (11/19) and 21.1% (4/19), respectively. Of the 10 countries that did not have a BCG vaccination strategy, two vaccinated infants born to immigrant parents from high TB incidence countries and three would vaccinate selectively in high-risk situations.

MDR and XDR-TB
The majority of countries (80% (24/30)) had a strategy to tackle drug-resistant TB, of which 58% (14/24) were documented in the national TB control plan/strategy. Measures to tackle drug-resistant TB included: using directly observed treatment, 87.5% (21/24) - including video-observed in 4/21; patient-centred MDR-TB case management, 79.2% (19/24); concentrating expertise in MDR-TB treatment centres, 79.2% (19/24); infection control in health facilities, 75.0% (18/24); multidisciplinary MDR-TB case management, 66.7% (16/24). All of the countries with a drug-resistant TB strategy routinely conducted first-line drug susceptibility testing.

HIV/TB

An integrated approach to TB and HIV control was reported by 61.3% (19/31) of countries, of which 58% (7/19) were documented in the national TB control plan/strategy. TB patients were routinely tested for HIV in 77.4% (24/31) of countries, and people living with HIV were screened for TB in 74.2% (23/31) of countries; 61.2% (19/31) of countries did both. The majority of countries (80.7% (25/31)) monitored TB/HIV coinfection at national level.

Guidelines and professional networks

National TB control and prevention guidelines were available in 80.7% (25/31) of countries, and laboratory diagnostic services were subject to external quality assurance in all countries. Forms of professional and clinical support available to clinicians included: clinical guidelines, 90.3% (28/31); specialist training, 74.2% (23/31); infection control guidelines, 74.2% (23/31); clinical networks, 54.8% (17/31); research meetings, 45.2% (14/31); and local multidisciplinary teams, 41.9% (13/31). Expert group meetings for clinicians managing difficult and MDR/XDR-TB cases were mentioned by 4/31 respondents.

Priorities and barriers

Priority actions: "In relation to TB control in your country, which existing or new actions do you think are most important or have the greatest urgency?"

Of the 18 pre-specified action areas, the five most frequently rated as high priority were: reaching vulnerable population groups (80.0%); screening for active TB in high-risk population groups (63.3%); implementing electronic TB case registries (60.0%); contact tracing and outbreak investigation (60.0%); and MDR-TB (60.0%). The two most frequently rated as low priority were BCG vaccination (56.7%) and establishing or managing local TB control boards (43.3%). Several countries indicated other high priority action areas, including mobile outreach, increasing TB expertise and experience in health care professionals, and broader social support for vulnerable groups. Weighted scores based on high, medium and low priority ratings are show in **Figure 2**.

Priority populations: "In relation to TB control in your country, which population groups do you think have the highest unmet need for TB detection and treatment?"

Respondents most frequently identified a high level of unmet need for TB detection among undocumented migrants (46.7%); unmet need for TB detection was rated as low or medium among other vulnerable/high-risk groups. Unmet need for TB treatment was ranked as medium/high for homeless people by 61.3% of countries, and for undocumented migrants by 66.7%. Weighted scores based on high, medium and low ratings of unmet need are show in **Figure 3**.

Barriers: "Which of the following factors impede TB control in your country?"

Three barriers among service users were identified by a majority of countries: people in vulnerable/high-risk groups lacking knowledge about TB (74.2%); low motivation to adhere to treatment among vulnerable/high-risk groups (70.0%) and low motivation to seek treatment among vulnerable/high-risk groups (58.1%) (**Figure 4**). Only one 'provider of care' factor was identified by a majority of countries: the need for specialist training for nurses in TB patient care (56.7%). 'Social and political' constraints were perceived by only 19-36% of countries impeding TB control. Four health system constraints were selected by more than 40% of respondents: numbers of specialist TB nurses (45.2%); funding of national TB control and prevention programme (43.3%); funding in the wider healthcare system (43.3%) and communication between the health care and social care systems (41.9%) (**Figure 5**).

Responses to key items in relation to national TB incidence
Ten EU/EEA countries had TB incidence ≥10/100,000 according to ECDC estimates for 2006-2015: United Kingdom (10/100,000), Spain (12), Croatia (13), Estonia (18), Poland (19), Portugal (23), Bulgaria (24), Latvia (41), Lithuania (56), Romania (84). Of these 10 countries, 80% had a national TB control plan/strategy compared with 43% of countries with low TB incidence (**Table 2**). In terms of total annual numbers of incident TB cases (based on 2015 data), two countries with no national plan/strategy had <50 cases, three had 300-500 cases, four had 500-800 cases, and four had >1,000 cases. All countries with medium-high TB incidence had a clearly defined organisational structure and central coordination of TB control compared with 62% and 86%

respectively in low-incidence countries. There were no differences in the proportions with central coordination or specific funding for TB control.

A higher proportion of countries with low TB incidence identified screening for active TB in migrants from high-incidence countries as a high priority action (67% compared with 30% of countries with high-medium TB incidence), whereas high-medium TB incidence countries were more likely to identify MDR-TB, HIV/TB as high priority (**Table 2**). Differences in responses to the question about unmet need for TB detection and treatment were apparent only for TB detection in undocumented migrants - 62% of low TB incidence countries reported high unmet need compared to 11% of medium-high incidence countries, and TB treatment in people with alcohol problems - 40% of medium-high incidence countries reported high unmet need compared to 10% of low incidence countries. The median number of factors identified as barriers to TB control and prevention were similar in low and medium-high incidence countries (**Table 2).**

Discussion

This survey has provided an up-to-date picture of the availability, implementation and content of national TB control plans in EU/EEA countries, and insights into priority action areas, population groups, and barriers to programme implementation. It shows that just over half of EU/EEA countries have a national TB strategy, of which all have been or are being implemented. Although the majority of countries have a defined organisational structure, and half have central coordination, a minority have a costed programme budget, suggesting sub-optimal capacity to coordinate activities at the national level [14, 15]. Of note is that few national TB control boards included patient or civil society representatives.

A majority of respondents mentioned vulnerable population groups, screening for active TB in high-risk groups, implementing electronic case registries, and MDR-TB as priority actions. These were selected by respondents from a list of 18 action areas, which we specified under the tacit assumption that they are not 'more important' than ensuring the fundamentals of TB diagnosis and treatment within a universal healthcare system, or guaranteeing social protections and minimum socioeconomic conditions to prevent TB on a societal level [16]. Rather, they represent specific areas for new or scaled-up interventions as part of an overall strengthening of efforts to control and prevent TB. As might be expected, a higher proportion (62%) of low TB incidence countries identified undocumented migrants as having high unmet need for TB detection and treatment than did low-medium TB incidence countries (21%), reflecting the disproportionately high number of TB cases occurring in migrant groups in low TB incidence countries [2].

One third of respondents indicated a lack of government recognition of TB control as a public health priority, but the most commonly cited barriers related to recipients of care, care providers (mainly specialist training) and health system constraints. The perception that TB control can be impeded by factors related to recipients of care, namely lack of TB knowledge, seeking care and adherence, must be interpreted as a challenge to providers to address issues of awareness and stigma [17] and to develop and deploy evidence-based interventions [18]. The importance of good communication and coordination within the health care system and between health and social care systems has been demonstrated in reports of cases and outbreaks in EU/EEA countries [19, 20].

Survey findings in the context of other studies

A 2013 survey of 38 European national TB programme representatives found that, of 26 countries also included in our survey, 15/26 had a national TB control plan [10]. In our study this proportion was unchanged, but three additional countries now indicated that they had a plan (for 2007-2016, 2013-2018 and 2015-2020) and three countries that previously had a plan responded as follows: one had a formalised TB programme during 2007-2009 which was finished to limit the number of vertical plans and committees in public health, although the framework was still in place and a new programme was planned for 2017-2020; one has a federal structure with legally-established local, regional and national responsibilities and a coherent approach to TB control and prevention which was considered to replace the need for a national programme; and one has a plan scheduled for 2019-2021. The availability of a (costed) national TB control plan which has been formally adopted by the national government is one of the core indicators for the Framework Action Plan to Fight TB in the EU [9]. Our survey results indicate that two thirds (20/31) of EU/EEA countries will have implemented a national TB control plan before 2020.

The single most important priority for stakeholders was TB control amongst vulnerable, particularly migrant populations. This perception of need may in part be attributed to recent experience of large refugee movements across continental Europe. Barriers to accessing services [21] and the large numbers of people affected [22] would make it likely that there is a significant unmet need in these population groups, but robust evidence for the effectiveness of targeted TB interventions is surprisingly scarce and urgently needed. Other under-served populations have been frequently mentioned as priority groups, and TB control among these groups remains a challenge [17]. A key part of our survey was to identify perceived barriers to strategy implementation. Here, an

important observation was that clinical, particularly tertiary services were felt to be prioritised compared to public health and prevention opportunities in some settings. Whilst it is uncertain to what extent this represents respondents' personal views, a perceived under-prioritisation of public health services is cause for concern.

Strengths and limitations

The main strength of this study is that it achieved a 100% response rate from TB programme leads or their delegates in the 31 EU/EEA countries. It can therefore be seen as a representative view of key TB control stakeholders in the EU/EEA, thereby allowing comparison of previous survey results [10]. Questions were kept similar to validated frameworks and piloted among a small but key group of professionals, including two national TB programme leaders and the head of the ECDC TB Programme. The main limitation is that some responses may reflect personal opinions of respondents, particularly responses to questions asking about priorities and barriers. We did not ask whether respondents had sought the views of colleagues, but we know that a number of respondents did consult within their programmes to provide correct and consensus responses to the survey. Although survey questions were worded in accordance with ECDC terminology [8, 9], the survey was available only in English and linguistic differences might cause ambiguities in the interpretation of questions. Also, some terms may overlap or mean different things in different countries (or to the same groups of people at different points in their journeys), for example, asylum seekers, refugees, and 'documented/'undocumented' migrants. To pre-empt these issues, telephone and email support was provided for the duration of the survey, and face-to-face at the 2017 Wolfheze meeting. For the current paper, we did not attempt an evidence synthesis based on free text comments which accompanied some of the survey responses, but we did inspect any such comments to ensure the validity of our descriptive analyses and to provide additional detail where relevant.

Implications and recommendations for TB policy and practice in EU/EEA countries
Progress in the availability of national TB strategic plans has been slow, with half of EU/EEA countries not having a plan in place at the time of this survey despite publication of the WHO End TB Strategy in 2015 [6]. Whether recent international meetings such as the Global Ministerial Conference on Ending TB in the Sustainable Development Era (Moscow, November 2017) and the UN High-Level Meeting on TB (New York, September 2018) will increase government commitment to, and prioritisation of, TB control and elimination across the EU/EEA remains to be seen. Clearly, having a plan is only the first step - implementation requires centralised coordination, sufficient funding and evidence-based interventions.
The EU/EEA has favourable indices for determinants of trends in TB incidence such as economic growth, human development and public resources [23], and annual rates of decline for the region (4.3% during the period 2007-2016) are faster than all other regions [1]. However, this downward trend is still unlikely to meet the WHO target of TB elimination by 2050 in European low-incidence countries [24]. A key issue with regard to recommendations for policy and practice in the EU/EEA is the considerable social, economic and epidemiological heterogeneity between and within countries. As our survey has shown, EU/EEA countries which carry a high burden of TB in their native population, e.g. Romania accounted for almost one quarter of reported cases in 2016, are understandably much less concerned about cases in foreign-born population groups than countries where these represent the vast majority of reported cases, e.g. 90% in Sweden and 96% in Malta [1]. However, commonalities (and common borders) exist which provide potential for EU/EEA-wide and local interventions. Several such areas were highlighted in the most recent ECDC/WHO TB monitoring and surveillance report for Europe [1], and it is instructive to match these with responses to our survey and with evidence for effective interventions.
Identifying and treating TB cases of foreign origin, and ensuring good access to healthcare for migrants and other vulnerable population groups, is clearly a priority in countries where these are foci for the majority of cases. Limited evidence for the effectiveness of interventions in vulnerable populations [18] and for active and latent TB screening in migrants [25, 26] should give impetus to rigorously-conducted large-scale evaluations of different approaches to addressing this issue, given that any successful approach is likely to be generalizable across low TB incidence EU/EEA countries, and many migrants cross internal EU/EEA borders in journeys from their ports of arrival.
Prisons are a focus of higher TB and MDR-TB incidence in most countries [27] and, although three quarters of countries in our survey have a strategy for TB control in prisons, only half rated this as a priority area. Data on TB in prisons in EU/EEA countries is scarce, with only 18 countries providing monitoring data in the years to 2016 [1]. We echo the ECDC/WHO recommendation that all EU/EEA countries collect information to support accurate monitoring of TB in prisons at EU/EEA level, and again, we would advocate for evaluations to provide an evidence base for interventions that are likely to be effective regardless of country.

Our survey highlighted a perceived need for investment in human resources/expertise. This indicates a need in higher TB incidence EU/EEA countries to expand specialist training for clinical staff, whilst low TB incidence countries can contribute collaboratively through guideline development, providing technical assistance, exchanging technology, and strengthening research capacity. Indeed, cross-border collaboration between high and low TB incidence countries is one of 8 priority action areas within the WHO/European Respiratory Society framework towards TB elimination [28]. This will also address the issue in low TB incidence EU/EEA countries of clinicians having insufficient first-hand experience to manage TB cases, with TB being so rare in some countries that there is a danger of losing local knowledge and expertise [29].

 'Inadequate systems for TB control programme monitoring and evaluation' was identified as a factor impeding TB control by only one quarter of survey respondents, and three quarters of countries had a strategy for monitoring and evaluation, yet the ECDC/WHO report indicated that only 14 of 26 WHO targets could be effectively monitored based on data from EU/EEA countries, with reporting of LTBI, HIV status and treatment outcomes as areas requiring most improvement [1]. Monitoring EU/EEA-wide treatment outcomes is important given an apparent decline in success rates (from an average of 77% during 2011–2013 to 74% in 2014-2015), substantial between-country variation and success rates for both MDR and XDR TB that are far below WHO targets [1]. Benchmarking and identifying differences is essential if countries are to disseminate and share best clinical practice. At an epidemiological level, a common strategy enables monitoring of emerging threats, such as the increasing proportion of XDR TB among MDR TB cases (from 14% in 2012 to 21% in 2016) [1].

We note that routine collection of complete data from all countries for the wide range of indicators included in ECDC/WHO report, which could be gradually expanded to collect data on, for example, palliative care for XDR-TB and comorbidities such as diabetes and mental health, largely obviates the need for future one-off surveys. In the meantime, we trust that our survey findings will serve to inform the development of an evidence-based toolkit which EU/EEA and other countries can use to design national TB strategies [12], thereby supporting these countries to work collaboratively towards TB elimination.

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Footnotes

References

1.	ECDC/WHO Regional Office for Europe. Tuberculosis surveillance and monitoring in Europe 2018. Stockholm: ECDC; 2018.

2.	Lonnroth K, Migliori GB, Abubakar I, et al. Towards tuberculosis elimination: an action framework for low-incidence countries. *Eur Respir J* 2015: 45(4): 928-952.

3.	Rendon A, Fuentes Z, Torres-Duque CA, et al. Roadmap for tuberculosis elimination in Latin American and Caribbean countries: a strategic alliance. *Eur Respir J* 2016: 48(5): 1282-1287.

4.	Voniatis C, Migliori GB, Voniatis M, et al. Tuberculosis elimination: dream or reality? The case of Cyprus. *Eur Respir J* 2014: 44(2): 543-546.

5.	Al Yaquobi F, Al-Abri S, Al-Abri B, et al. Tuberculosis elimination: a dream or a reality? The case of Oman. *Eur Respir J* 2018: 51(1).

6.	Uplekar M, Weil D, Lonnroth K, et al. WHO's new end TB strategy. *Lancet* 2015: 385(9979): 1799-1801.

7.	WHO. Toolkit to develop a National Strategic Plan for TB prevention, care and control. WHO, Geneva, 2015.

8.	ECDC. Framework Action Plan to Fight Tuberculosis in the European Union. Stockholm: ECDC; 2008.

9.	ECDC. Progessing towards TB elimination: A follow-up to the Framework Action Plan to Fight Tuberculosis in the European Union. Stockholm: ECDC; 2010.

10.	D'Ambrosio L, Dara M, Tadolini M, et al. Tuberculosis elimination: theory and practice in Europe. *Eur Respir J* 2014: 43(5): 1410-1420.

11.	Early Detection and Integrated Management of Tuberculosis in Europe (E-DETECT TB). 2017 [cited 28/09/2017]; Available from: www.e-detecettb.eu

12.	Abubakar I, Matteelli A, de Vries G, et al. Towards tackling tuberculosis in vulnerable groups in the European Union: the E-DETECT TB consortium. *Eur Respir J* 2018: 51(5).

13.	The SURE Collaboration. SURE Guides for Preparing and Using Evidence-Based Policy Briefs: 5. Identifying and addressing barriers to implementing policy options. Version 2.1 [updated November 2011]. Available from http://www.who.int/evidence/sure/ [Accessed 29/09/2017].

14.	Broekmans JF, Migliori GB, Rieder HL, et al. European framework for tuberculosis control and elimination in countries with a low incidence. Recommendations of the World Health Organization (WHO), International Union Against Tuberculosis and Lung Disease (IUATLD) and Royal Netherlands Tuberculosis Association (KNCV) Working Group. *Eur Respir J* 2002: 19(4): 765-775.

15.	Veen J, Migliori GB, Raviglione M, et al. Harmonisation of TB control in the WHO European region: the history of the Wolfheze Workshops. *Eur Respir J* 2011: 37(4): 950-959.

16.	Migliori GB, Sotgiu G, Rosales-Klintz S, et al. ERS/ECDC Statement: European Union standards for tuberculosis care, 2017 update. *Eur Respir J* 2018: 51(5).

17.	de Vries SG, Cremers AL, Heuvelings CC, et al. Barriers and facilitators to the uptake of tuberculosis diagnostic and treatment services by hard-to-reach populations in countries of low and medium tuberculosis incidence: a systematic review of qualitative literature. *Lancet Infect Dis* 2017: 17(5): e128-e143.

18.	Heuvelings CC, de Vries SG, Greve PF, et al. Effectiveness of interventions for diagnosis and treatment of tuberculosis in hard-to-reach populations in countries of low and medium tuberculosis incidence: a systematic review. *Lancet Infect Dis* 2017: 17(5): e144-e158.

19.	Abid M, McCarthy N, Saldana L, et al. Extensively drug-resistant tuberculosis case in the Thames Valley, UK and public health interventions. *J Infect Public Health* 2011: 4(4): 207-210.

20.	Gillini L, Centis R, D'Ambrosio L, et al. Is Europe ready to reach tuberculosis elimination? An outbreak report from Southern Italy. *Eur Respir J* 2015: 46(1): 274-277.

21.	de Jong L, Pavlova M, Winters M, et al. A systematic literature review on the use and outcomes of maternal and child healthcare services by undocumented migrants in Europe. *Eur J Public Health* 2017: 27(6): 990-997.

22.	International Organization for Migration (IOM). World Migration Report 2018. Geneva: IOM; 2017.

23.	Suk JE, Manissero D, Buscher G, et al. Wealth inequality and tuberculosis elimination in Europe. *Emerg Infect Dis* 2009: 15(11): 1812-1814.

24.	WHO. Definitions and reporting framework for tuberculosis. WHO, Geneva, 2013.

25.	Greenaway C, Pareek M, Abou Chakra CN, et al. The effectiveness and cost-effectiveness of screening for active tuberculosis among migrants in the EU/EEA: a systematic review. *Euro Surveill* 2018: 23(14).

26.	Greenaway C, Pareek M, Abou Chakra CN, et al. The effectiveness and cost-effectiveness of screening for latent tuberculosis among migrants in the EU/EEA: a systematic review. *Euro Surveill* 2018: 23(14).

27.	Biadglegne F, Rodloff AC, Sack U. Review of the prevalence and drug resistance of tuberculosis in prisons: a hidden epidemic. *Epidemiol Infect* 2015: 143(5): 887-900.

28.	WHO. Framework towards tuberculosis elimination in low-incidence countries. WHO, Geneva, 2014.

29.	Luzzati R, Migliori GB, Zignol M, et al. Children under 5 years are at risk for tuberculosis after occasional contact with highly contagious patients: outbreak from a smear-positive healthcare worker. *Eur Respir J* 2017: 50(5).

Table 1: Availability and implementation of national TB control plan/strategy, and TB programme coordination in EU/EEA[†] countries

Question	Response	%
Do you have a national TB control plan or strategy?	Yes	54.8% (17/31)
(If yes) Has implementation of the plan or strategy started?	Yes	100.0% (17/17)
(If no) Is a national TB control plan or strategy being prepared?	Yes	14.2% (2/14)
If no) Do you intend to prepare a national TB control plan or strategy?	Yes	25.0% (3/9)
Does your national TB control and prevention programme have a clearly defined organisational structure?	Yes, as defined in national TB control plan/strategy	38.7% (12/31)
	Yes, but not defined in national TB control plan/strategy	35.5% (11/31)
	No	25.8% (8/31)
Is TB control and prevention coordinated centrally by a national TB control board or committee or other formal body?	Yes, as described in national TB control plan/strategy	32.3% (10/31)
	Yes, but not described in national TB control plan/strategy	22.6% (7/31)
	No, but other national bodies coordinate specific TB control and prevention tasks	35.5% (11/31)
	No	9.7% (3/31)
Has specific funding been allocated to the national TB control board?	Yes	29.4% (5/17)
Is TB control and prevention coordinated locally by local TB control boards or committees or other formal bodies?	Yes	47.1% (8/17)

[†] European Union (EU) and European Economic Area (EEA)

Table 2: Responses to selected questionnaire items in relation to national TB incidence

Questionnaire item	Low TB incidence (<10/100,000)	Medium-high TB incidence (≥10/100,000)
	(21 countries)	(10 countries)
National TB control plan or strategy	9 (42.9%)	8 (80.0%)
Clearly defined organisational structure	13 (61.9%)	10 (100.0%)
Central coordination	18 (85.7%)	10 (100.0%)
Specific funding allocated to TB control	2 (28.6%)	3 (30.0%)
High priority actions		
Training and developing a specialist TB workforce	10 (47.6%)	5 (50.0%)
Introducing and implementing new tools for TB control	8 (38.1%)	6 (60.0%)
External quality assurance for laboratory services	7 (33.3%)	5 (50.0%)
Implementing electronic TB case registries	12 (57.1%)	6 (60.0%)
Staffing and expertise for national TB surveillance	9 (42.9%)	3 (30.0%)
Establishing or managing local TB control boards	4 (19.1%)	1 (10.0%)
Publishing and disseminating clinical guidelines	6 (30.0%)	5 (50.0%)
Raising awareness of TB at community/primary care level	8 (38.1%)	5 (50.0%)
Reaching vulnerable population groups	17 (81.0%)	7 (70.0%)
TB control in prisons	8 (38.1%)	6 (60.0%)
Latent TB infection screening in high-risk population groups	11 (52.4%)	4 (40.0%)
Screening for active TB in high-risk population groups	13 (61.9%)	6 (60.0%)
Ensuring continuity of TB drug supply	8 (38.1%)	6 (60.0%)
Screening for active TB in migrants from high-incidence countries	14 (66.7%)	3 (30.0%)
Contact tracing and outbreak investigation	13 (61.9%)	5 (50.0%)
BCG vaccination[†]	2 (9.5%)	2 (20.0%)
MDR-TB[†]	10 (47.6%)	8 (80.0%)
HIV/TB	7 (35.0%)	7 (70.0%)
Barriers to TB control and prevention	median (IQR)	median (IQR)
Recipients of care barriers (range 0 - 6)	3 (1 - 4)	3 (2 - 4)
Providers of care barriers (range 0 - 5)	2 (1 - 3)	1.5 (1 - 3)
Social and political constraints (range 0 - 6)	2 (0 - 3)	1 (0 - 2)
Health system constraints (range 0 - 27)	5 (2 - 7)	6.5 (2 - 10)

[†] BCG = Bacillus Calmette-Guérin; MDR = multi-drug resistant

Figure 1: National TB control plans or strategies in EU/EEA countries

European countries that have:

- Have implemented TB plan/strategy
- Making preparations for TB plan/strategy
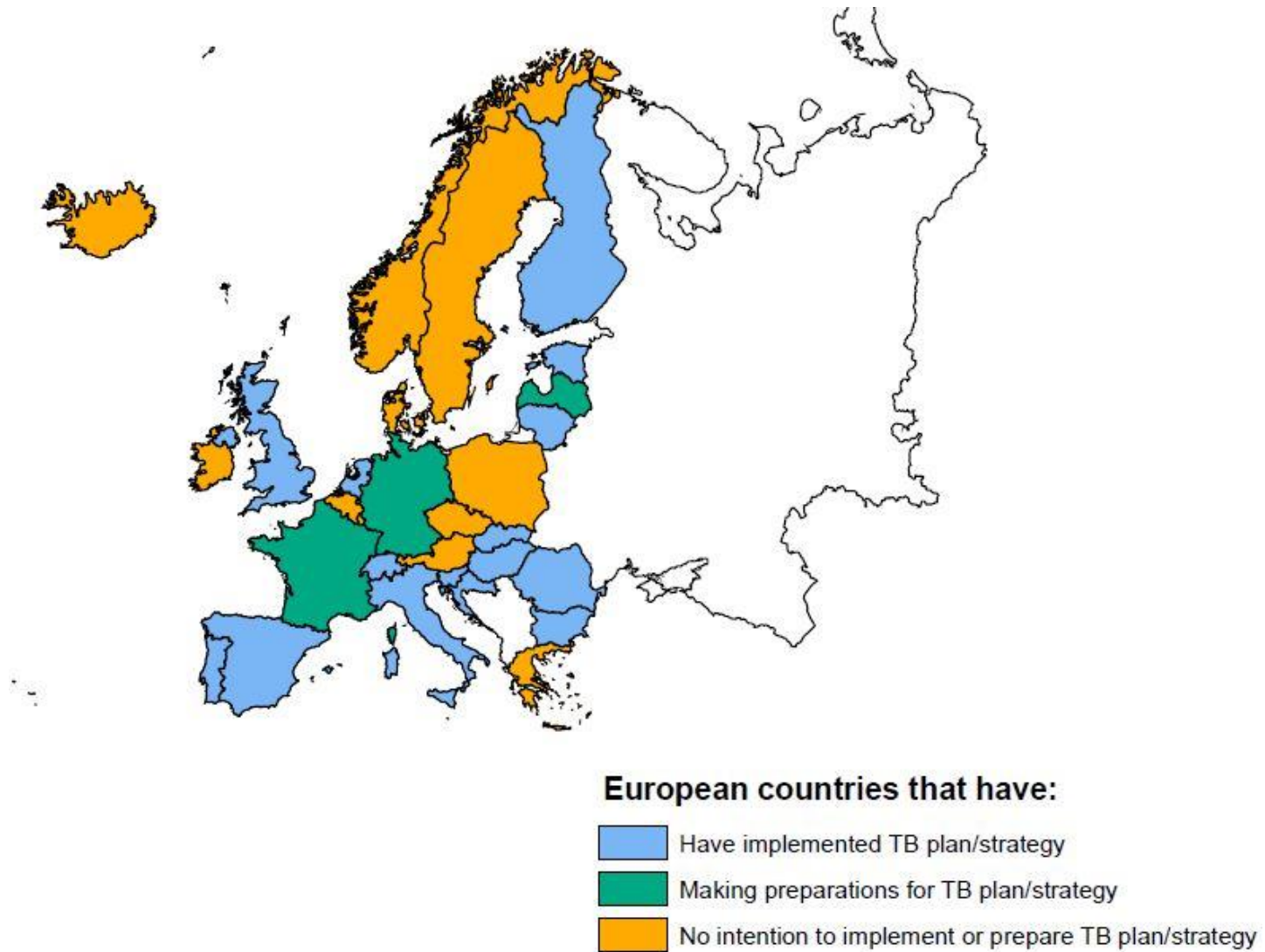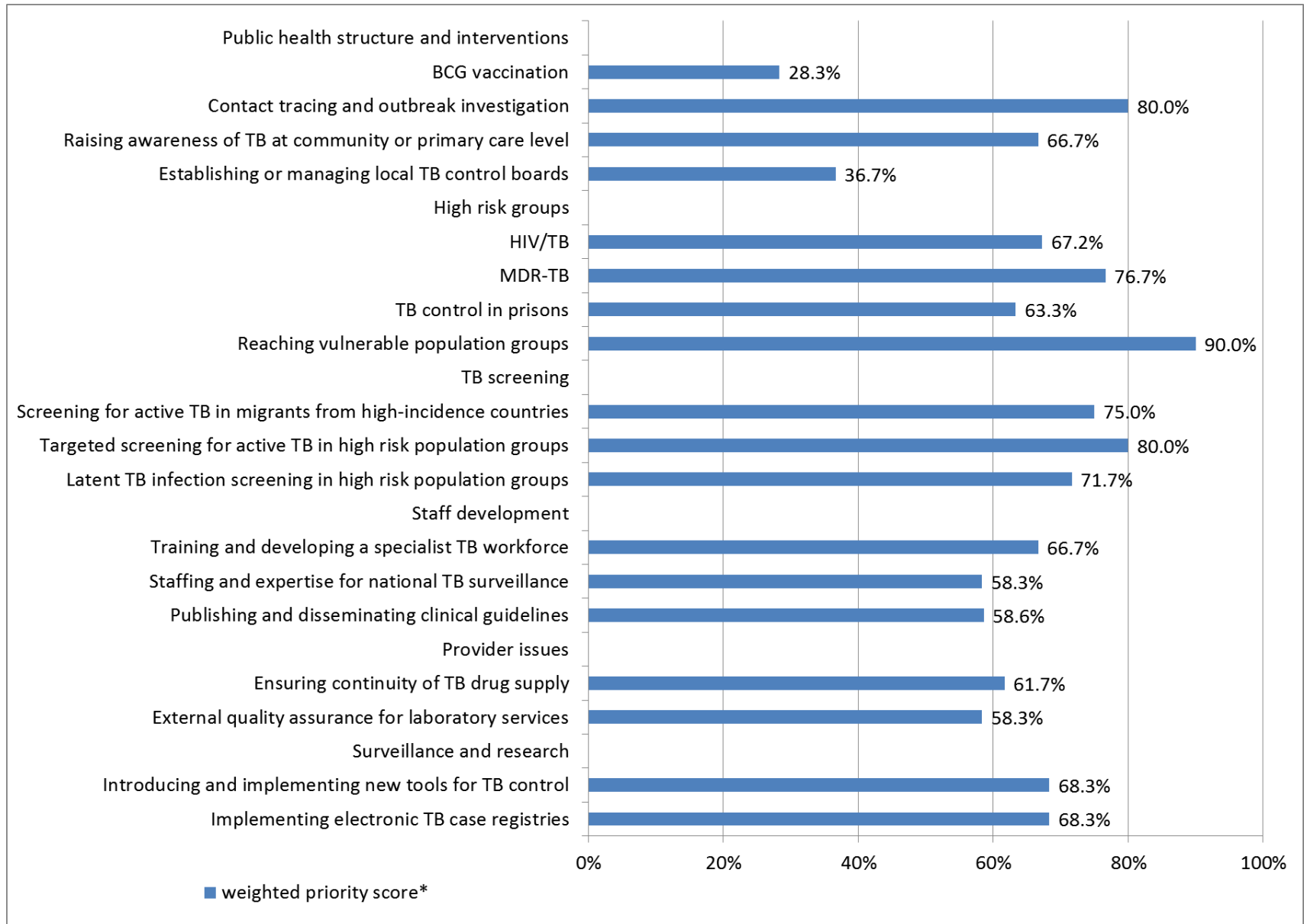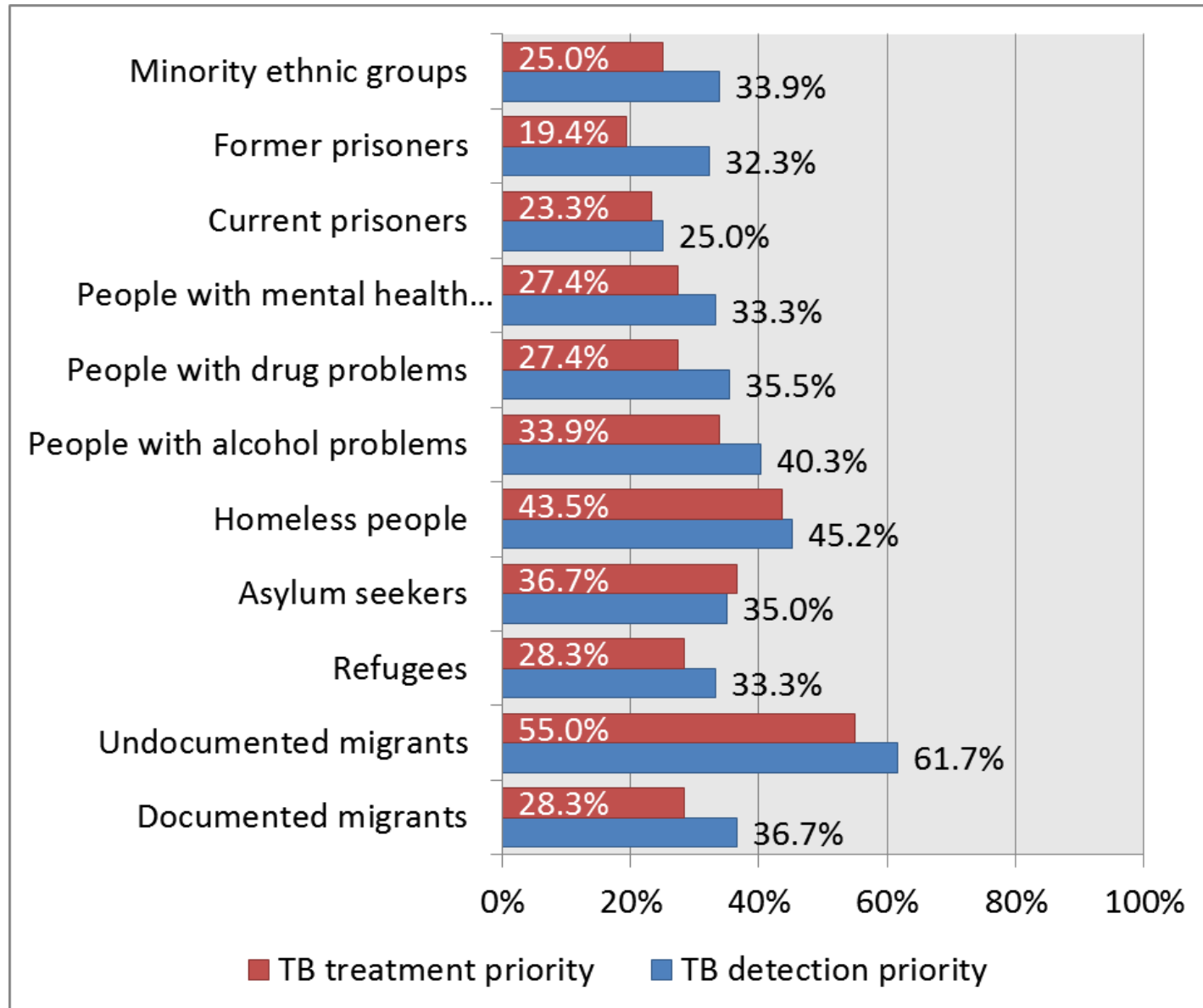- No intention to implement or prepare TB plan/strategy

Figure 2: Priority actions – *"In relation to TB control in your country, which existing or new actions do you think are most important or have the greatest urgency?"*

Category	weighted priority score*
Public health structure and interventions	
BCG vaccination	28.3%
Contact tracing and outbreak investigation	80.0%
Raising awareness of TB at community or primary care level	66.7%
Establishing or managing local TB control boards	36.7%
High risk groups	
HIV/TB	67.2%
MDR-TB	76.7%
TB control in prisons	63.3%
Reaching vulnerable population groups	90.0%
TB screening	
Screening for active TB in migrants from high-incidence countries	75.0%
Targeted screening for active TB in high risk population groups	80.0%
Latent TB infection screening in high risk population groups	71.7%
Staff development	
Training and developing a specialist TB workforce	66.7%
Staffing and expertise for national TB surveillance	58.3%
Publishing and disseminating clinical guidelines	58.6%
Provider issues	
Ensuring continuity of TB drug supply	61.7%
External quality assurance for laboratory services	58.3%
Surveillance and research	
Introducing and implementing new tools for TB control	68.3%
Implementing electronic TB case registries	68.3%

* Priority actions were ranked 'low', 'medium' and 'high' priority by respondents. We scored these responses low=0, medium=1 and high=2, and converted the total score for each priority action into a percentage by dividing the total by the maximum possible score (=62 if all 31 countries indicated 'high' priority)

Figure 3: Priority populations – *"In relation to TB control in your country, which population groups do you think have the highest unmet need for TB detection and treatment?"*

Population group	TB treatment priority	TB detection priority
Minority ethnic groups	25.0%	33.9%
Former prisoners	19.4%	32.3%
Current prisoners	23.3%	25.0%
People with mental health…	27.4%	33.3%
People with drug problems	27.4%	35.5%
People with alcohol problems	33.9%	40.3%
Homeless people	43.5%	45.2%
Asylum seekers	36.7%	35.0%
Refugees	28.3%	33.3%
Undocumented migrants	55.0%	61.7%
Documented migrants	28.3%	36.7%

■ TB treatment priority   ■ TB detection priority

* Unmet need was ranked 'low', 'medium' and 'high' by respondents. We scored these responses low=0, medium=1 and high=2, and converted the total score for each priority population into a percentage by dividing the total by the maximum possible score (=62 if all 31 countries indicated 'high' unmet need)

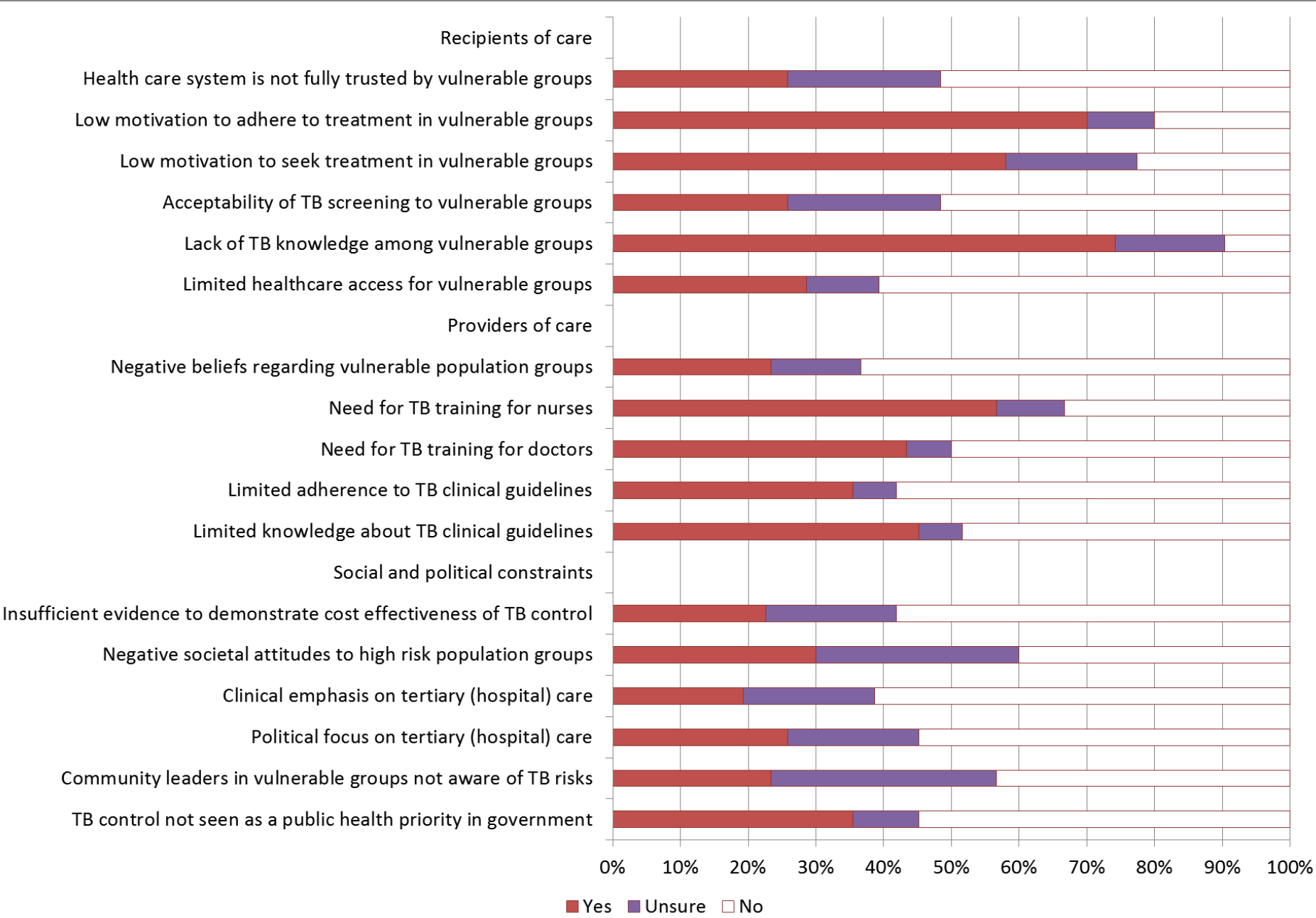# Figure 4: Barriers – *"Which of the following factors impede TB control in your country?"*

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Recipients of care
- Health care system is not fully trusted by vulnerable groups
- Low motivation to adhere to treatment in vulnerable groups
- Low motivation to seek treatment in vulnerable groups
- Acceptability of TB screening to vulnerable groups
- Lack of TB knowledge among vulnerable groups
- Limited healthcare access for vulnerable groups

Providers of care
- Negative beliefs regarding vulnerable population groups
- Need for TB training for nurses
- Need for TB training for doctors
- Limited adherence to TB clinical guidelines
- Limited knowledge about TB clinical guidelines

Social and political constraints
- Insufficient evidence to demonstrate cost effectiveness of TB control
- Negative societal attitudes to high risk population groups
- Clinical emphasis on tertiary (hospital) care
- Political focus on tertiary (hospital) care
- Community leaders in vulnerable groups not aware of TB risks
- TB control not seen as a public health priority in government

Legend: ■ Yes ■ Unsure □ No

Figure 5: Barriers (health system constraints) – *"Which of the following factors impede TB control in your country?"*
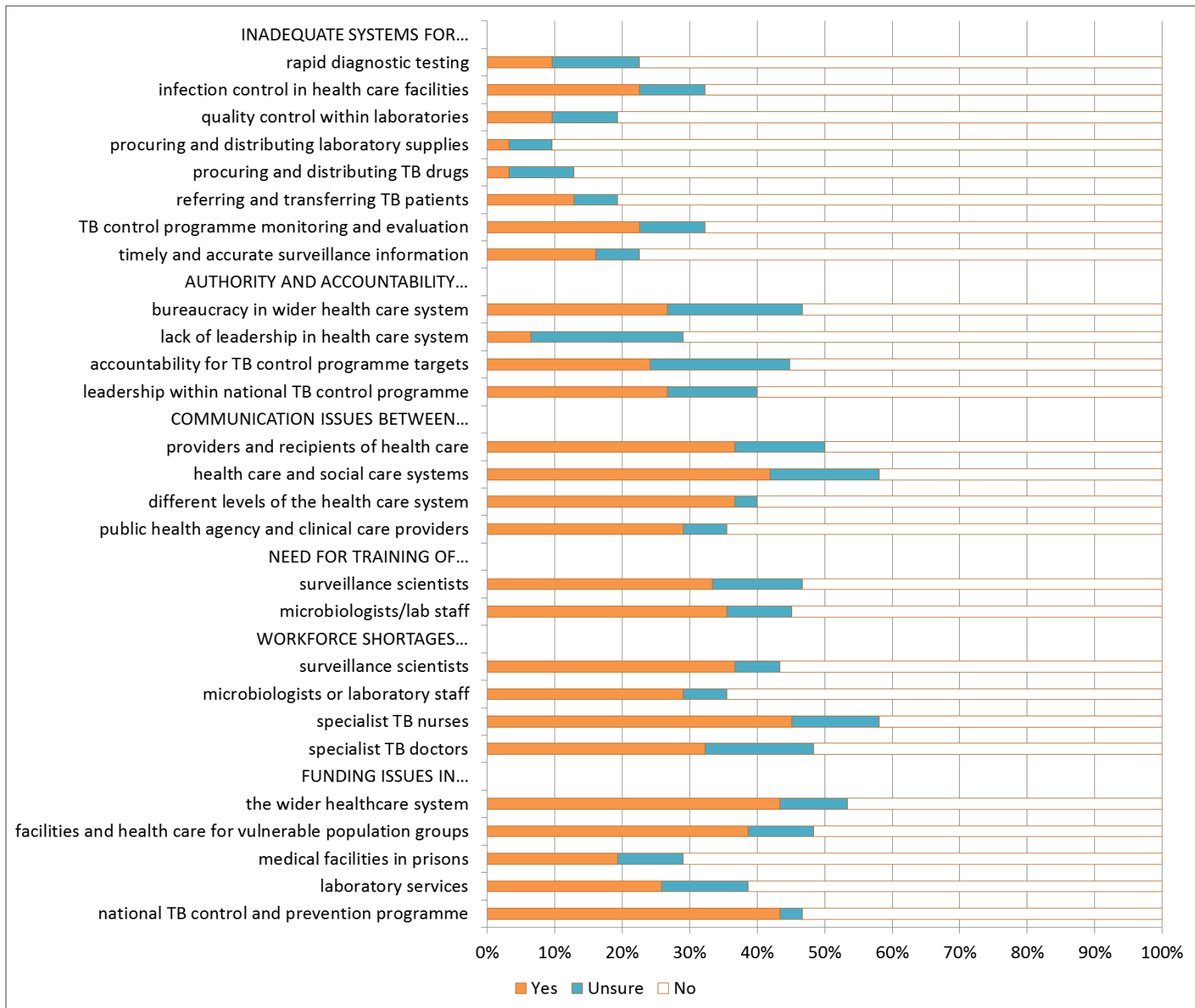
Supplementary Material

Supplementary File 1: Survey questionnaire
Supplementary File 2: Survey responses (Tables S1 - S5)

Part 1

E-DETECT TB Survey

EDETECT**TB**

1a) Do you have a national TB control plan or strategy?

Yes →

1b) What period does the strategy or plan cover?
Start year, End year

→ **1c) Has implementation of the plan or strategy started?**

Yes → **1d) When did implementation start?**
Month/year, year or comment → Part 2

No → **1d) When do you expect it to start?**
Month/year, year or comment → Part 2

No ↓

1b) Is a national TB control plan or strategy being prepared?

Yes → **1c) What period will the strategy or plan cover?**
Start year, End year

→ **1d) When do you expect to have a final version?**
Month/year, year or comment → Part 2

No ↓

1c) Do you intend to prepare a national TB control plan?

Yes → **1d) What period will the strategy or plan cover?**
Start year, End year

→ **1e) When do you expect to have a final version?**
Month/year, year or comment → Part 2

No ↓

Part 2

2: COORDINATION

2a) Does your national TB control and prevention programme have a clearly defined organisational structure?

○ Yes, as defined in national TB control plan/strategy

○ Yes, but not defined in national TB control plan/strategy

○ No

Select file to upload: (click "Browse" button below to locate file) File size restricted to: 4000 KB File type restricted to: No file type restrictions. [Upload]

File Name: (limit 255 characters) [   ] File Description: (limit 255 characters) [   ]

Files Uploaded:

2b) Is TB control and prevention coordinated centrally by a national TB control board or committee or other formal body?

○ Yes, as described in national TB control plan/strategy

○ Yes, but not described in national TB control plan/strategy

○ No, but other national bodies coordinate specific TB control and prevention tasks

○ No

Please describe briefly how TB control and prevention is coordinated in your

country

2c) Which stakeholders are represented on the national TB control board? This question refers to the control board or committee or other formal body indicated in question 2a).

☐ Ministry or Department of Health

☐ National public health department

☐ Local public health departments

☐ Local TB control boards

☐ Specialist clinicians

☐ Laboratory services

☐ Epidemiologists

☐ Specialist TB nurses

☐ Private health providers

☐ Pharmacies

☐ Professional bodies

☐ TB patient representatives

☐ Non-governmental organisations

☐ Civil society

☐ Other (please list all other participants) [   ]

17. **2d) How often does the national TB control board meet?** 0=irregularly, 1=monthly, 3=every 3 months, 6=every 6 months, 12=annually, 24=every two years, etc.

Every [   ] months

2e) Has specific funding been allocated to the national TB control board? This question refers to funding allocated specifically to cover the costs of central coordination of TB control by the control board or committee or other formal body indicated in question 2a).

○ Yes ○ No

2f) Is TB control and prevention coordinated locally by local TB control boards or committees or other formal bodies? 'Local' includes control at the level of region, district, state, province, etc.

○ Yes ○ No

20. **2g) How often do local TB control boards report to the national TB control board?** 0=irregularly, 1=monthly, 3=every 3 months, 6=every 6 months, 12=annually, 24=every two years, etc.

Every [   ] months

3: RESOURCES

3a) Does the national TB control and prevention programme have its own costed budget? i.e. a
budget allocated specifically to TB control and prevention measures, not including routine clinical treatment of TB cases

○ Yes

○ No, but some parts of the programme have their own budgets

○ No

Please describe briefly how TB control and prevention is funded in your country

3b) Has an impact assessment for national TB control and prevention been done? e.g. a cost benefit
analysis or other assessment of the likely impact of TB control based on epidemiological and financial information

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No, but impact assessment for some parts of the programme have been done

○ No

Please describe briefly what impact assessments have been done

3c) Do you have a strategy for training and developing a specialist TB workforce?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

At what level is training and development of the specialist TB control workforce coordinated?

☐ National

☐ Regional (state, province, region)

☐ Local (county, district, city)

☐ No coordination

Which parts of the TB workforce have the greatest need for training and development?

☐ Specialist doctors

☐ Specialist nurses

☐ Microbiologists

☐ Surveillance scientists

☐ Epidemiologists

☐ Community health workers

☐ Other (please list)

[Optional] Please comment briefly on any aspects of TB workforce development which you think might be relevant to this survey, including approaches and obstacles to training, recruitment and retention:

3d) Do you have a strategy for introducing and implementing new tools for TB control and prevention?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

In which areas are you developing new tools?

☐ Surveillance

☐ Rapid diagnostic tests

☐ Microbiology

☐ Drug susceptibility testing

☐ Treatment observation

☐ Contact tracing

☐ Outbreak investigation

☐ Infection control

☐ Other (please list)

[Optional] Please comment briefly on any aspects of introducing and implementing new tools for TB control and prevention which you think might be relevant to this survey:

3e) Do you have a strategy for ensuring continuity of TB drug supply?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

[Optional] Please comment briefly on any aspects of TB drug supply which you think might be relevant to this survey:

4: MONITORING

4a) Do you have electronic TB case registries? (select all that apply)

☐ No electronic registries

☐ National registry

☐ Regional registries

☐ Local registries

☐ Other (please specify)

4b) Do you have a strategy for monitoring and evaluation of TB control and prevention?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

[Optional] Please comment on any aspects of TB programme monitoring and evaluation which you think might be relevant to this survey:

4c) How many staff in your national office are assigned to TB surveillance?

	Full-time staff	Part-time staff	
Data analysts			
Epidemiologists			
Surveillance scientists			
Public health officers			
Medical staff			
Administrative staff			
TB nurses			
Other			

5: POPULATION

5a) Do you have any programmes for raising awareness of TB at community or primary care level? i.e. within local communities or among primary care providers

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

In which community or primary care groups are you trying to raise awareness?

☐ General public

☐ Primary care doctors (GPs)

☐ Primary care health workers

☐ Social workers

☐ Other (please specify)

5b) Do you have any programmes for reaching vulnerable population groups? We define 'vulnerable population group' as a subpopulation within a country of low or medium TB incidence, who are at higher risk of having latent or active TB.

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

Which vulnerable population groups have been identified? (select all that apply)

☐ Documented migrants

☐ Undocumented migrants

☐ Refugees

☐ Asylum seekers

☐ Homeless people

☐ People with alcohol problems

☐ People with drug problems

☐ People with mental health problems

☐ Current prisoners

☐ Former prisoners

☐ Minority ethnic groups

☐ Other (please specify)

5c) Do you have a strategy for TB control in prisons?

○ Yes, as documented in national TB control plan/strategy

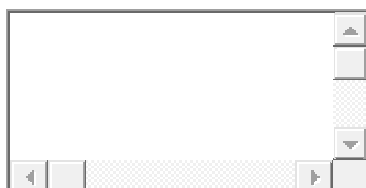○ Yes, but not documented in national TB control plan/strategy

○ No

5: POPULATION (continued)

5d) Do you conduct targeted screening for active TB in high risk groups?(select all that apply)

☐ No targeted screening

☐ Documented migrants (at point of entry, i.e. on arrival)

☐ Documented migrants (post-entry)

☐ Undocumented migrants

☐ Refugees

☐ Asylum seekers

☐ Homeless people

☐ People with alcohol problems

☐ People with drug problems

☐ People with mental health problems

☐ Current prisoners

☐ Former prisoners

☐ Minority ethnic groups

☐ Other (please specify)

5e) Do you conduct screening for active TB in migrants from high-incidence countries?(from countries in any of the following regions)

☐ No pre-entry screening

☐ Central Asia

☐ South Asia (including Afghanistan, Pakistan, Bangladesh and India)

☐ Southeast Asia

☐ South or Central America

☐ Middle East

☐ North Africa

☐ Sub-Saharan Africa

☐ Europe

☐ Other (please specify)

5f) Do you conduct latent TB infection (LTBI) screening in high risk groups? (select all that apply)

☐ Contacts of cases

☐ Documented migrants (at point of entry, i.e. on arrival)

☐ Documented migrants (post-entry)

☐ Undocumented migrants

☐ Refugees

☐ Asylum seekers

☐ Homeless people

☐ People with alcohol problems

☐ People with drug problems

☐ People with mental health problems

☐ Current prisoners

☐ Former prisoners

☐ Minority ethnic groups

☐ Other (please specify)

6: CLINICAL

6a) Are national TB control and prevention guidelines available?

○ Yes ○ No

6b) Are laboratory diagnostic services subject to external quality assurance (EQA)?

☐ No EQA

☐ ERLN-TB

☐ WHO Collaborating Centre

☐ WHO SRLN

☐ INSTAND e.V.

☐ ISO 15189

☐ Other (please specify)

Percentage of reference laboratories with ERLN-TB EQA score >80% [   ]

6c) Is culture confirmation of new pulmonary TB cases recommended?

○ Yes ○ No

6d) What professional and clinical support is available to clinicians?

☐ Clinical guidelines

☐ Clinical networks

☐ Specialist training

☐ Local multidisciplinary teams

☐ Infection control guidelines

☐ Research meetings

☐ Other (please specify)

6: CLINICAL (continued)

6e) Do you have a strategy to implement and ensure comprehensive contact tracing?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

Please comment:

Which approaches to contact investigation are recommended?

☐ Household contact tracing

☐ Community contact tracing

☐ Workplace contact tracing

☐ Health care facility contact tracing

☐ Other (please specify)

6f) Do you have a strategy to provide and promote BCG vaccination?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

Please comment:

Which groups have been identified for BCG vaccination? (select all that apply)

☐ Universal infant

☐ High-risk infant

☐ High-risk adult

☐ Other (please specify)

7: MDR-TB and XDR-TB

7a) Do you have a strategy to tackle drug-resistant TB?

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

Please comment:

Which measures are included?

☐ Routine first-line drug susceptibility testing

☐ Directly observed treatment

☐ Video observed treatment

☐ Multidisciplinary MDR-TB case management

☐ Patient-centred MDR-TB case management

☐ Centres of expertise in MDR-TB treatment

☐ Infection control in health facilities

☐ Other (please specify)

8: HIV/TB

8a) Do you have an integrated approach to TB and HIV control? i.e. TB and HIV services are integrated or work closely together

○ Yes, as documented in national TB control plan/strategy

○ Yes, but not documented in national TB control plan/strategy

○ No

Please comment:

8b) Are TB patients routinely tested for HIV and/or HIV patients screened for TB? (select all that apply)

☐ No coordinated HIV/TB testing

☐ TB patients tested for HIV

☐ HIV patients screened for TB

☐ Other (please specify)

8c) Is TB/HIV coinfection monitored at national level?

○ Yes ○ No

9: PRIORITY ACTIONS - In relation to TB control in your country, which existing or new actions do you think are most important or have the greatest urgency?

a) Please rate the priority of each of the 9 action areas listed below:

	Low	Medium	High
Training and developing a specialist TB workforce	○	○	○
Introducing and implementing new tools for TB control	○	○	○
External quality assurance for laboratory services	○	○	○
Implementing electronic TB case registries	○	○	○
Staffing and expertise for national TB surveillance	○	○	○
Establishing or managing local TB control boards	○	○	○
Publishing and disseminating clinical guidelines	○	○	○
Raising awareness of TB at community or primary care level	○	○	○
Reaching vulnerable population groups	○	○	○

b) Please rate the priority of each of the 9 action areas listed below:

	Low	Medium	High
TB control in prisons	○	○	○
Latent TB infection (LTBI) screening in high risk population groups	○	○	○
Targeted screening for active TB in high risk population groups	○	○	○
Ensuring continuity of TB drug supply	○	○	○
Screening for active TB in migrants from high-incidence countries	○	○	○
Contact tracing and outbreak investigation	○	○	○
BCG vaccination	○	○	○
MDR-TB	○	○	○
HIV/TB	○	○	○

c) Please list here any other action areas which are a high priority for TB control in your country:

10: PRIORITY POPULATIONS - In relation to TB control in your country, which population groups do you think have the highest unmet need for TB case detection and treatment?

a) Please rate the level of unmet need for TB <u>detection</u> in the following vulnerable/high risk population groups:

	Low	Medium	High
Documented migrants	○	○	○
Undocumented migrants	○	○	○
Refugees	○	○	○
Asylum seekers	○	○	○
Homeless people	○	○	○
People with alcohol problems	○	○	○
People with drug problems	○	○	○
People with mental health problems	○	○	○
Current prisoners	○	○	○
Former prisoners	○	○	○
Minority ethnic groups	○	○	○

b) Please list here any other population groups which have high unmet need for TB <u>detection</u>:

c) Please rate the level of unmet need for TB <u>treatment</u> in the following vulnerable/high risk population groups:

	Low	Medium	High
Documented migrants	○	○	○
Undocumented migrants	○	○	○
Refugees	○	○	○
Asylum seekers	○	○	○
Homeless people	○	○	○
People with alcohol problems	○	○	○
People with drug problems	○	○	○
People with mental health problems	○	○	○
Current prisoners	○	○	○
Former prisoners	○	○	○
Minority ethnic groups	○	○	○

d) Please list here any other population groups which have high unmet need for TB <u>treatment</u>:

11: BARRIERS - Please indicate whether any of the following factors impede TB control in your country?

RECIPIENTS OF CARE

	Yes	No	Unsure
Vulnerable population groups have limited access to health facilities	○	○	○
People in vulnerable/high risk groups lack knowledge about TB	○	○	○
Acceptability of TB screening to vulnerable/high risk groups	○	○	○
Low motivation to seek treatment in vulnerable/high risk groups	○	○	○
Low motivation to adhere to treatment in vulnerable/high risk groups	○	○	○
Health care system is not fully trusted by vulnerable/high risk groups	○	○	○

PROVIDERS OF CARE

	Yes	No	Unsure
Varying degree of knowledge about TB clinical guidelines	○	○	○
Varying degree of adherence to TB clinical guidelines	○	○	○
Need for specialist training of doctors in TB diagnosis and management	○	○	○
Need for specialist training of nurses in TB patient care	○	○	○
Negative beliefs regarding vulnerable/high risk population groups	○	○	○

HEALTH SYSTEM CONSTRAINTS

	Yes	No	Unsure
Funding of national TB control and prevention programme	○	○	○
Funding of laboratory services	○	○	○
Funding of medical facilities in prisons	○	○	○
Funding of facilities and health care for vulnerable population groups	○	○	○
Funding constraints in the wider healthcare system	○	○	○
Insufficient numbers of specialist TB doctors	○	○	○

Insufficient numbers of specialist TB nurses	○	○	○
Insufficient numbers of microbiologists or laboratory staff	○	○	○
Insufficient numbers of surveillance scientists	○	○	○
Need for further training of existing microbiologists/lab staff	○	○	○
Need for further training of existing surveillance scientists	○	○	○
Communication between public health agency and clinical care providers	○	○	○
Communication between levels of the health care system	○	○	○
Communication between the health care and social care systems	○	○	○
Communication between providers and recipients of health care	○	○	○
Allocation of authority within national TB control programme	○	○	○
Clear accountability for meeting TB control programme targets	○	○	○
Inadequate management or leadership within health care system	○	○	○
Inadequate systems to obtain timely and accurate surveillance information	○	○	○
Inadequate systems for TB control programme monitoring and evaluation	○	○	○
Inadequate processes for referring and transferring TB patients	○	○	○
Inadequate systems for procuring and distributing TB drugs	○	○	○
Inadequate systems for procuring and distributing laboratory supplies	○	○	○
Bureaucracy in wider health care system	○	○	○
Slow turnaround of diagnostic testing	○	○	○
Inadequate quality control within laboratories	○	○	○
Inadequate infection control within health care facilities	○	○	○

SOCIAL & POLITICAL CONSTRAINTS

	Yes	No	Unsure
Lack of recognition of TB control as a public health priority at top level of government/health ministry	○	○	○
High TB risk lacks credibility among community/opinion leaders in vulnerable groups	○	○	○
Political focus on tertiary (hospital) care, i.e. treatment rather than control & prevention	○	○	○
Clinical emphasis on tertiary (hospital) care, i.e. treatment rather than control & prevention	○	○	○
Negative societal attitudes to high risk population groups	○	○	○
Insufficient evidence to demonstrate cost effectiveness of TB control programme	○	○	○

OTHER FACTORS Please list here any other barriers to TB control in your country:

Table S1: Resources for TB control and prevention in EU/EEA countries

Question	Response	%
Does the national TB control and prevention programme have its own costed budget?	Yes	19.4% (6/31)
	No, but some parts of the programme have their own budgets	22.6% (7/31)
	No	58.1% (18/31)
Has an impact assessment for national TB control and prevention been done?	Yes, as documented in national TB control plan/strategy	16.1% (5/31)
	Yes, but not documented in national TB control plan/strategy	12.9% (4/31)
	No, but impact assessment for some parts of the programme have been done	22.6% (7/31)
	No	48.4% (15/31)
Do you have a strategy for training and developing a specialist TB workforce?	Yes, as documented in national TB control plan/strategy	16.1% (5/31)
	Yes, but not documented in national TB control plan/strategy	35.5% (11/31)
	No	48.4% (15/31)
Do you have a strategy for introducing and implementing new tools for TB control and prevention?	Yes, as documented in national TB control plan/strategy	12.9% (4/31)
	Yes, but not documented in national TB control plan/strategy	38.7% (12/31)
	No	48.4% (15/31)
Do you have a strategy for ensuring continuity of TB drug supply?	Yes, as documented in national TB control plan/strategy	25.8% (8/31)
	Yes, but not documented in national TB control plan/strategy	38.7% (12/31)
	No	35.5% (11/31)

Table S2: Specific populations for TB control and prevention and TB screening in EU/EEA countries

	Programmes for vulnerable groups	Screening for active TB[†]	Testing for latent TB infection (LTBI)[‡]
Population group	n=26	n=31	n=30
Documented migrants (at point of entry, i.e. on arrival)	18 (69.2%)	10 (32.3%)	6 (20.0%)
Documented migrants (post-entry)		13 (41.9%)	5 (16.7%)
Undocumented migrants	15 (57.7%)	8 (25.8%)	4 (13.3%)
Refugees	20 (76.9%)	22 (71.0%)	8 (26.7%)
Asylum seekers	23 (88.5%)	24 (77.4%)	10 (33.3%)
Homeless people	20 (76.9%)	15 (48.4%)	4 (13.3%)
People with alcohol problems	12 (46.2%)	4 (12.9%)	2 (6.7%)
People with drug problems	15 (57.7%)	9 (29.0%)	6 (20.0%)
People with mental health problems	5 (19.2%)	2 (6.5%)	1 (3.3%)
Current prisoners	22 (84.6%)	23 (74.2%)	8 (26.7%)
Former prisoners	5 (19.2%)	1 (3.2%)	1 (3.3%)
Minority ethnic groups	7 (26.9%)	3 (9.7%)	3 (10.0%)

[†] Two countries (6.5%) had no targeted screening for active TB

[‡] The majority of countries (86.7% (26/30)) tested for LTBI in contacts of cases; 36.7% (11/30) of respondents mentioned screening for LTBI prior to commencing immunosuppressive therapies. One country did not provide a response, and this was treated as 'missing' rather than 'no screening/testing'

Table S3: Priority actions for TB control and prevention in EU/EEA countries

	Priority rating		
Action area[†]	**Low**	**Medium**	**High**
Training and developing a specialist TB workforce	5 (16.7%)	10 (33.3%)	15 (50.0%)
Introducing and implementing new tools for TB control	3 (10.0%)	13 (43.3%)	14 (46.7%)
External quality assurance for laboratory services	7 (23.3%)	11 (36.7%)	12 (40.0%)
Implementing electronic TB case registries	7 (23.3%)	5 (16.7%)	18 (60.0%)
Staffing and expertise for national TB surveillance	7 (23.3%)	11 (36.7%)	12 (40.0%)
Establishing or managing local TB control boards	13 (43.3%)	12 (40.0%)	5 (16.7%)
Publishing and disseminating clinical guidelines[‡]	6 (20.7%)	12 (41.4%)	11 (37.9%)
Raising awareness of TB at community or primary care level	3 (10.0%)	14 (46.7%)	13 (43.3%)
Reaching vulnerable population groups	0 (0.0%)	6 (20.0%)	24 (80.0%)
TB control in prisons	6 (20.0%)	10 (33.3%)	14 (46.7%)
Latent TB infection screening in high risk population groups	2 (6.7%)	13 (43.3%)	15 (50.0%)
Targeted screening for active TB in high risk population groups	1 (3.3%)	10 (33.3%)	19 (63.3%)
Ensuring continuity of TB drug supply	7 (23.3%)	9 (30.0%)	14 (46.7%)
Screening for active TB in migrants from high-incidence countries	2 (6.7%)	11 (36.7%)	17 (56.7%)
Contact tracing and outbreak investigation	0 (0.0%)	12 (40.0%)	18 (60.0%)
BCG vaccination	17 (56.7%)	9 (30.0%)	4 (13.3%)
MDR-TB	2 (6.7%)	10 (33.3%)	18 (60.0%)
HIV/TB[‡]	4 (13.8%)	11 (37.9%)	14 (48.3%)

[†] These were presented in two groups of nine, under the question "Please rate the priority of each of the 9 action areas listed below"

[‡] This item had missing data for one country, hence denominator is 29 countries

Table S4: Priority populations for TB control and prevention in EU/EEA countries

Population group	Unmet need for TB detection			Unmet need for TB treatment		
	Low	Medium	High	Low	Medium	High
Documented migrants	14 (46.7%)	10 (33.3%)	6 (20.0%)	17 (56.7%)	9 (30.0%)	4 (13.3%)
Undocumented migrants	7 (23.3%)	9 (30.0%)	14 (46.7%)	10 (33.3%)	7 (23.3%)	13 (43.3%)
Refugees	15 (50.0%)	10 (33.3%)	5 (16.7%)	17 (56.7%)	9 (30.0%)	4 (13.3%)
Asylum seekers	15 (50.0%)	9 (30.0%)	6 (20.0%)	14 (46.7%)	10 (33.3%)	6 (20.0%)
Homeless people	9 (29.0%)	16 (51.6%)	6 (19.4%)	12 (38.7%)	11 (35.5%)	8 (25.8%)
People with alcohol problems	10 (32.3%)	17 (54.8%)	4 (12.9%)	16 (51.6%)	9 (29.0%)	6 (19.4%)
People with drug problems	12 (38.7%)	16 (51.6%)	3 (9.7%)	19 (61.3%)	7 (22.6%)	5 (16.1%)
People with mental health problems	13 (43.3%)	14 (46.7%)	3 (10.0%)	18 (58.1%)	9 (29.0%)	4 (12.9%)
Current prisoners	18 (60.0%)	9 (30.0%)	3 (10.0%)	20 (66.7%)	6 (20.0%)	4 (13.3%)
Former prisoners	15 (48.4%)	12 (38.7%)	4 (12.9%)	22 (71.0%)	6 (19.4%)	3 (9.7%)
Minority ethnic groups	14 (50.0%)	9 (32.1%)	5 (17.9%)	17 (60.7%)	8 (28.6%)	3 (10.7%)

Table S5: Barriers to TB control and prevention in EU/EEA countries

	Factors which impede TB control		
	No	**Yes**	**Unsure**
Recipients of care			
Vulnerable population groups have limited access to health facilities	17 (63.3%)	8 (26.7%)	3 (10.0%)
People in vulnerable/high risk groups lack knowledge about TB	3 (9.7%)	23 (74.2%)	5 (16.1%)
Acceptability of TB screening to vulnerable/high risk groups	16 (51.6%)	8 (25.8%)	7 (22.6%)
Low motivation to seek treatment in vulnerable/high risk groups	7 (22.6%)	18 (58.1%)	6 (19.4%)
Low motivation to adhere to treatment in vulnerable/high risk groups	6 (20.0%)	21 (70.0%)	3 (10.0%)
Health care system is not fully trusted by vulnerable/high risk groups	16 (51.6%)	8 (25.8%)	7 (22.6%)
Providers of care			
Varying degree of knowledge about TB clinical guidelines	15 (48.4%)	14 (45.2%)	2 (6.5%)
Varying degree of adherence to TB clinical guidelines	18 (58.1%)	11 (35.5%)	2 (6.5%)
Need for specialist training of doctors in TB diagnosis and management	15 (50.0%)	13 (43.3%)	2 (6.7%)
Need for specialist training of nurses in TB patient care	10 (33.3%)	17 (56.7%)	3 (10.0%)
Negative beliefs regarding vulnerable/high risk population groups	19 (63.3%)	7 (23.3%)	4 (13.3%)
Social and political constraints			
Lack of recognition of TB control as a public health priority at top level of government/health ministry	17 (54.8%)	11 (35.5%)	3 (9.7%)
High TB risk lacks credibility among community/opinion leaders in vulnerable groups	13 (43.3%)	7 (23.3%)	10 (33.3%)
Political focus on tertiary (hospital) care, i.e. treatment rather than control & prevention	17 (54.8%)	8 (25.8%)	6 (19.4%)
Clinical emphasis on tertiary (hospital) care, i.e. treatment rather than control & prevention	19 (61.3%)	6 (19.4%)	6 (19.4%)
Negative societal attitudes to high risk population groups	12 (40.0%)	9 (30.0%)	9 (30.0%)
Insufficient evidence to demonstrate cost effectiveness of TB control programme	18 (58.1%)	7 (22.6%)	6 (19.4%)

Table S5: Barriers to TB control and prevention in EU/EEA countries (continued)

Health system constraints	Factors which impede TB control		
	No	Yes	Unsure
Funding of national TB control and prevention programme	16 (53.3%)	13 (43.3%)	1 (3.3%)
Funding of laboratory services	19 (61.3%)	8 (25.8%)	4 (12.9%)
Funding of medical facilities in prisons	22 (71.0%)	6 (19.4%)	3 (9.7%)
Funding of facilities and health care for vulnerable population groups	16 (51.6%)	12 (38.7%)	3 (9.7%)
Funding constraints in the wider healthcare system	14 (46.7%)	13 (43.3%)	3 (10.0%)
Insufficient numbers of specialist TB doctors	16 (51.6%)	10 (32.3%)	5 (16.1%)
Insufficient numbers of specialist TB nurses	13 (41.9%)	14 (45.2%)	4 (12.9%)
Insufficient numbers of microbiologists or laboratory staff	20 (64.5%)	9 (29.0%)	2 (6.5%)
Insufficient numbers of surveillance scientists	17 (56.7%)	11 (36.7%)	2 (6.7%)
Need for further training of existing microbiologists/lab staff	17 (54.8%)	11 (35.5%)	3 (9.7%)
Need for further training of existing surveillance scientists	16 (53.3%)	10 (33.3%)	4 (13.3%)
Communication between public health agency and clinical care providers	20 (64.5%)	9 (29.0%)	2 (6.5%)
Communication between levels of the health care system	18 (60.0%)	11 (36.7%)	1 (3.3%)
Communication between the health care and social care systems	13 (41.9%)	13 (41.9%)	5 (16.1%)
Communication between providers and recipients of health care	15 (50.0%)	11 (36.7%)	4 (13.3%)
Allocation of authority within national TB control programme	18 (60.0%)	8 (26.7%)	4 (13.3%)
Clear accountability for meeting TB control programme targets	16 (55.2%)	7 (24.1%)	6 (20.7%)
Inadequate management or leadership within health care system	22 (71.0%)	2 (6.5%)	7 (22.6%)
Inadequate systems to obtain timely and accurate surveillance information	24 (77.4%)	5 (16.1%)	2 (6.5%)
Inadequate systems for TB control programme monitoring and evaluation	21 (67.7%)	7 (22.6%)	3 (9.7%)
Inadequate processes for referring and transferring TB patients	25 (80.7%)	4 (12.9%)	2 (6.5%)
Inadequate systems for procuring and distributing TB drugs	27 (87.1%)	1 (3.2%)	3 (9.7%)
Inadequate systems for procuring and distributing laboratory supplies	28 (90.3%)	1 (3.2%)	2 (6.5%)
Bureaucracy in wider health care system	16 (53.3%)	8 (25.8%)	6 (20.0%)
Slow turnaround of diagnostic testing	24 (77.4%)	3 (9.7%)	4 (12.9%)
Inadequate quality control within laboratories	25 (80.7%)	3 (9.7%)	3 (9.7%)
Inadequate infection control within health care facilities	21 (67.7%)	7 (22.6%)	3 (9.7%)