A multinational Delphi consensus on tuberculosis screening of migrants in Europe

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The findings of this study offer actionable policies to address gaps and weaknesses in Europe's response to tuberculosis among migrants, advancing efforts to eliminate TB as a public health threat https://bit.ly/4m8DR02

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Abstract

The disproportionate burden of tuberculosis among migrants in the World Health Organization (WHO) European Region underscores the urgent need to address the public health challenges associated with global migration. Recommendations for screening of pulmonary tuberculosis (TB) and TB infection (TBI) are highly variable across European countries, highlighting the need for standardised practices and coordinated efforts to reduce TB risk more effectively. This study aims to produce a harmonised set of recommendations to contribute to elaboration for policy action using the Delphi method. It brings together a multidisciplinary panel of 33 TB experts from academia, healthcare, non-governmental organisations and government agencies across 22 countries to formulate consensus-based recommendations. The panel created 19 consensus statements and 36 recommendations for governments, health systems and other stakeholders. The recommendations span four key domains: 1) policy, 2) health systems and health professionals, 3) screening procedures and priority populations and 4) continued treatment and care. This study recommends a unified, evidence-based approach to TB screening in migrants, with free access to diagnosis and treatment, culturally sensitive care, use of digital tools and coordinated efforts across health systems to ensure effective and equitable TB control in Europe. Thus, the experts emphasised key recommendations that strike a balance between immediate health system interventions, screening procedures and cultural inclusivity to more effectively address TB among migrants. The findings of this study offer actionable policies to address gaps and weaknesses in Europe's response to tuberculosis among migrants, advancing efforts to eliminate TB as a public health threat.

Introduction

In Europe, the number of migrants from high tuberculosis (TB) burden countries is rising, significantly impacting European countries' healthcare systems [1]. Approximately 5.1% of Europe's population comprises migrants, with 23 million non-EU citizens residing there [2]. Migrants in the World Health Organization (WHO) European Region face a disproportionate burden of infectious diseases, particularly tuberculosis (TB). Globally, TB remains a leading cause of morbidity and mortality, causing 1.3 million deaths in 2022 and contributing to 1.85% of global disability-adjusted life years in 2019 [3, 4]. Migration significantly influences TB epidemiology in Europe, particularly in western Europe, where migrants constitute a substantial portion of people affected by TB [5]. For instance, migrants account for 70% of the total cases of people affected by TB in countries such as Sweden, the UK and the Netherlands [6]. To address this, low-incidence TB European countries usually adhere to WHO and European Centre for Disease Prevention and Control (ECDC)-issued guidelines to screen migrants from high-incidence regions for active TB and TB infection (TBI) using chest radiography, tuberculin skin tests or interferon gamma release assay (IGRA) [6–8]. These measures aim to prevent onward transmission, benefiting both resident populations and migrants. Despite these efforts, challenges persist in implementing TB screening [9–11]. These include a lack of clarity on target demographics, procedures, cost-effectiveness, optimal timing, healthcare access, healthcare training, treatment management and cultural barriers [12]. Consequently, screening practices for active TB and TBI among migrants vary significantly across European countries [13, 14]. Recognising the importance of harmonising international practice, we sought to establish a consensus on best practice for migrant screening in Europe. To develop a European consensus regarding these ongoing problems, we carried out a Delphi study with a multidisciplinary, geographically diverse panel of n=33 academic, health, non-governmental organisation (NGO), government and other experts in TB from 22 countries and territories, representative of all the WHO European regions.

Methodology

Migrant definition

The definition of migrant [15] can be found in supplementary material S1.

Delphi data collection

This study uses surveys with a four-point Likert scale with agreement–disagreement response options: "agree", "somewhat agree", "somewhat disagree" and "disagree", along with a fifth option of "not

qualified to respond". Surveys were developed and distributed using Microsoft Forms, with each round lasting 2–3 weeks. Panellists had the opportunity to provide comments and propose edits for individual statements and recommendations *via* text boxes accompanying each item. Data analysis reflected the multiple-methods nature of Delphi studies and was managed by the study's core group members [16]. Across the rounds, we analysed the frequencies of all statements and recommendations. Quantitative analysis of the results involved assigning each statement and recommendation a grade to indicate the level of combined agreement (agree + somewhat agree), using a classification that has been used in other Delphi studies in which "U" denotes unanimous (100%) agreement; "A" denotes 90–99% agreement; "B" denotes 78–89% agreement; and "C" denotes 67–77% agreement. Based on prior studies (15), the core group determined to adopt a supermajority threshold (⩾67% combined agreement) as the minimum cut-off for consensus. Responses marked "not qualified to respond" were recorded in the data tables but excluded from the denominator when calculating agreement/disagreement levels. Additionally, qualitative data from open-ended text-box comments were reviewed extensively by the core group that individually assessed the comments before discussing them in online review meetings attended by four project co-chairs (first authors MP, AA, DNM and RD). Based on these reviews and discussions, revisions to statements and recommendations were made for subsequent survey rounds.

Delphi panel

The co-chairs identified and invited a panel of TB experts: a group of n=100 (representative from 72 countries) academic, health, NGO, government and policy experts in TB; the core group identified individuals with expertise in TB; under-represented countries were identified and targeted through PubMed/Medline searches for authors of TB research studies in these countries. The process included several key steps: an interactive digital data collection phase, an online consensus meeting with the core group (MP, AA, DNM and RD) to draft the initial survey based on the literature, and a specially developed survey responded to by multiple TB experts (first survey) (n=38 experts). This was followed by two rounds of consensus surveys (R1 and R2) to refine the statements and recommendations, culminating in a final round (R2) focused on drafting the top five recommendations (n=33 experts). In the final set of recommendations in R2, expert panellists ranked the top five recommendations. The Delphi study methodology, including sample and data collection, is depicted in figure 1.

This study was approved by the Ethics Committee of the Institute of Public Health of the University of Porto (CE24260).

Characterisation of the experts' panel

The final panel of experts is diverse in terms of demographic, geographical and disciplinary characteristics is depicted in supplementary material S2.

Results

The expert group involved 60.6% male and 39.4% female participants; mean±SD age of 55.5±9.5 years.

Table 1 summarises key characteristics of the panel of experts.

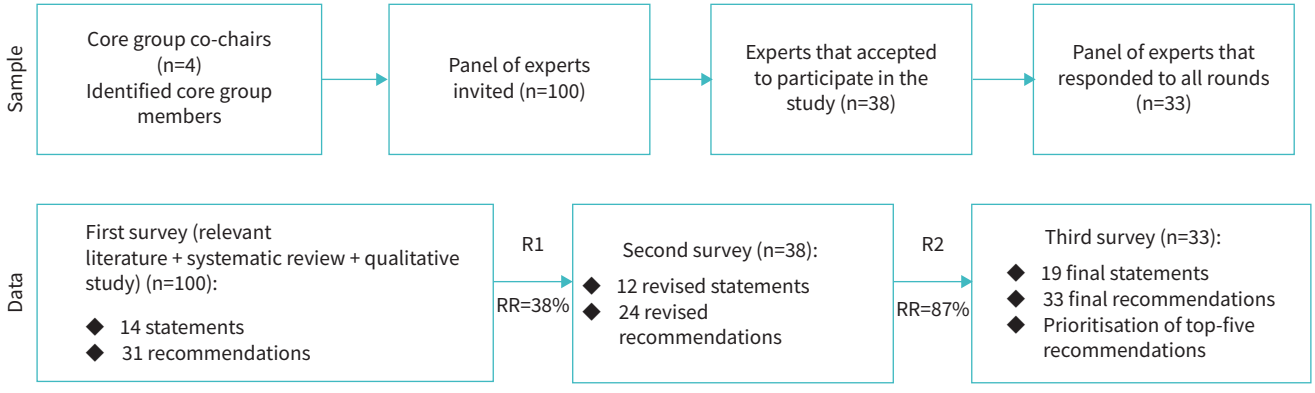

FIGURE 1 Delphi panel generation and data collection. R1: Round 1; R2: Round 2; RR: response rate.

Key statements and recommendations

The multidisciplinary and multinational Delphi consensus study produced 19 statements (figure 2 and supplementary material S3) and 36 recommendations (table 2) on screening for TBI and active pulmonary disease in migrants, categorised into four domains. The following four domains summarise the main areas of discussion, focusing on the statements and recommendations shown in figure 2 (supplementary material S3) and table 2, respectively. Furthermore, the recommendations were also prioritised, with the top five ranked by the expert panel. The quantitative results for agreement and disagreement on the statements and recommendations are given in the tables and are further reviewed in the Discussion.

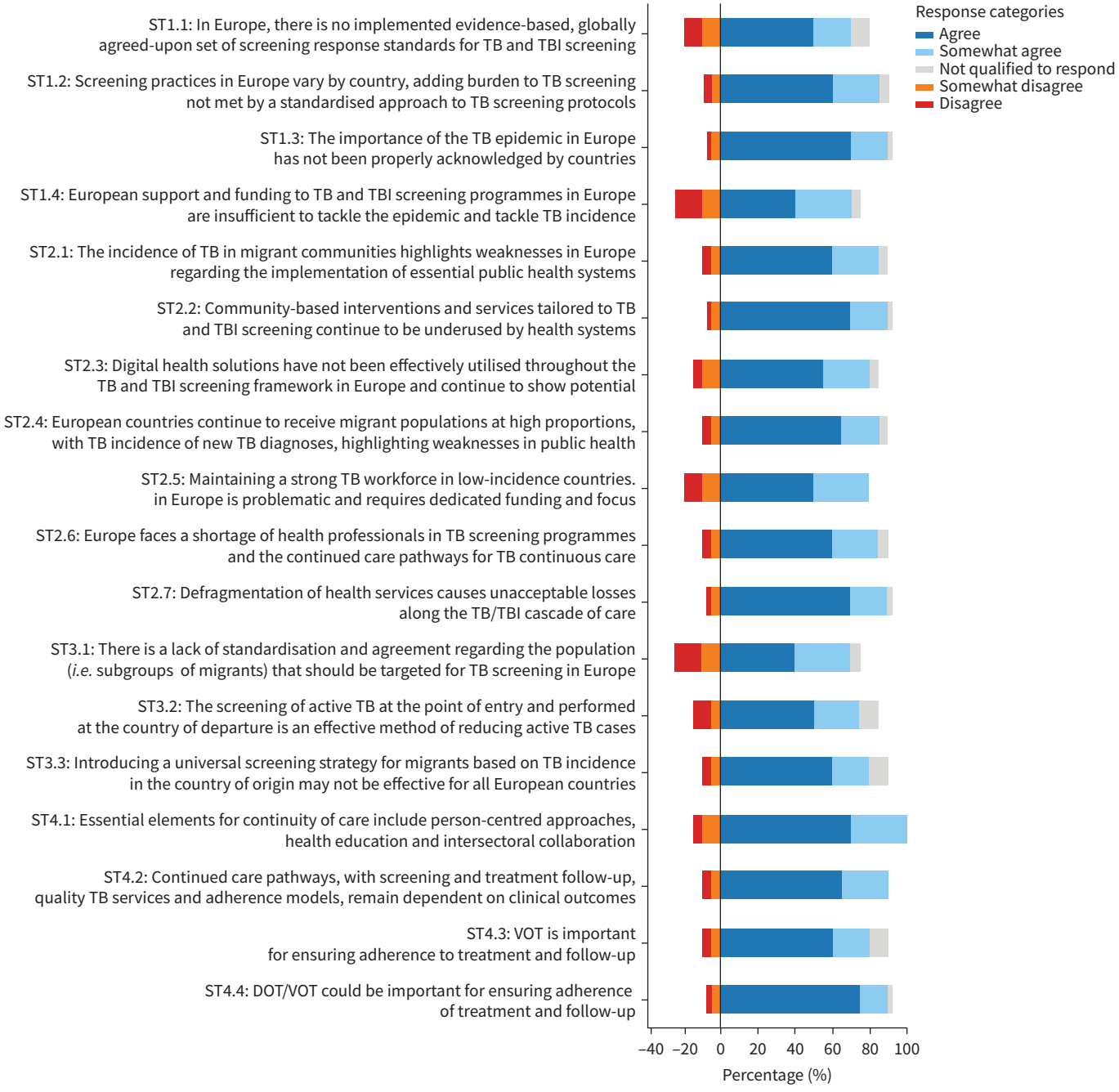

FIGURE 2 Consensus statements with data collected as checkboxes on a four-point Likert scale. The y axis represents the statements presented to panellists who agree and somewhat agree with the statements (positive scale) or who disagree or somewhat disagree (negative scale). The panellists who considered themselves not qualified to respond did not provide a response of agreement. TBI: TB infection; DOT: directly observed therapy; VOT: video-observed therapy.

TABLE 1 Expert panel characteristics (n=33).

Characteristic	
Sex	
Man	20 (60.6)
Woman	13 (39.4)
Age, years	55.4±9.5
Academic degree	
Doctorate	31 (81.6)
Master	4 (10.5)
Other	3 (7.9)
Primary sector of employment	
Civil society	1 (3.0)
Private	1 (3.0)
Academic	15 (45.5)
Public	14 (42.4)
Other	1 (3.0)
Primary field	
Public health	8 (24.2)
Clinical research	14 (42.4)
Clinical care	8 (24.2)
Health policy/advocacy	1 (3.0)
Other	2 (6.1)
Global region of origin	
Europe	25 (75.8)
Western Pacific	1 (3.0)
Eastern Mediterranean	1 (3.0)
Africa	2 (6.1)
America	3 (9.1)
Southeast Asia	1 (3.0)

Data are presented as n (%) or mean±SD.

Policies

Substantial combined agreement among the expert panellists (range 88–100%) indicates that maximising public support for health policies in Europe remains a key area for screening of TB. There was unanimous agreement that European countries lack an evidence-based approach (figure 2 and supplementary material S3; ST1.1.1) and that TB and TBI screening practices in Europe for migrant populations vary by country (ST1.1.2). Furthermore, there was considerable agreement that the significance of the TB epidemic is insufficiently recognised as a public health priority by European countries (figure 2 and supplementary material S3; ST1.1.3) and that the support and funding for screening programs are insufficient to effectively address the issue (ST1.1.4).

The panel recommendations in policy mainly focused on European governments prioritising TB screening for migrants (table 2; REC1.2.1) and developing standardised guidelines for the screening of TB and TBI in migrants (REC1.2.2). The panel of experts unanimously agreed on the importance of policies ensuring free healthcare access, tests and treatment for migrants with TB or TBI in Europe (REC1.2.3. and REC 1.2.4). Continuous updates to screening practices based on new evidence, early health access and health exam to identify migrants' needs and improved collaboration among healthcare sectors are also unanimously recommended (REC 1.2.5, REC 1.2.6 and REC 1.2.7). Additionally, the panel agrees that TB screening programmes should integrate the assessment of risk factors such as diabetes or social vulnerability and co-infections, such as HIV and hepatitis B/C (REC1.2.8).

Health systems and health professionals

A very high combined agreement was achieved among the expert panellists regarding the "health systems and health professionals" domain (range 97–100%).

The panel of experts agrees that the persistence of TB incidence among migrants exposes significant weaknesses in Europe's essential public health implementation despite recent important advances in this area (figure 2 and supplementary material S3; ST2.1.1). Community-based TB and TBI screening

TABLE 2 Consensus recommendations (RECs) resulting from the Delphi study

Recommendations	Grade	Agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Disagree (%)	Not qualified to respond (%)
1. Policy						
REC1.2.1. European governments should address the TB screening of migrants as a public health priority.	A	87.8	6.1	6.1	0	0
REC1.2.2. European governments and global health organisations should support the development of uniform guidelines for the screening of pulmonary TB and TBI in migrants.	U	90.1	9.9	0	0	0
REC1.2.3. Policies for free TB healthcare access, tests, and treatment for all migrants with active TB should be implemented in Europe.	U	100	0	0	0	0
REC1.2.4. Policies for free TB healthcare access, tests, and treatment for all migrants with TBI should be implemented in Europe.	A	75.8	21.2	3.0	0	0
REC1.2.5. There is a need for a continuous update and uptake of new evidence regarding TB and TBI screening in migrants.	U	90.9	9.1	0	0	0
REC1.2.6. Policies for health checks aimed at the early identification of migrants' potential health needs should be implemented across Europe.	U	81.8	18.2	0	0	0
REC1.2.7. Collaboration between primary healthcare, private care, and public health programs should be improved in Europe.	U	91.0	6.0	0	0	3.0
REC.1.2.8. The assessment of risk factors for TB (such as diabetes or social vulnerability) and other high-prevalent IDs (HIV/Hep B/C) should be integrated in the European TB screening programs for migrants.	A	91.0	6.0	3.0	0	0
2. Health systems and health professionals						
REC2.2.1. Preparedness and response planning to TB and TBI burden in Europe should adopt a whole-of-society approach that includes multiple disciplines, sectors, and actors (for example, business, civil society, media, and psychology).	U	75.8	24.2	0	0	0
REC2.2.2. Community-based health programs in Europe should be used to engage migrants, leveraging local resources like pharmacies, clinics, and community centres.	U	84.9	15.2	0	0	0
REC2.2.3. The screening of TB in Europe should involve trained health professionals, cultural mediators, and community organisations to address stigma, discrimination, and fear.	U	94.0	6.0	0	0	0
REC2.2.4. Social support services, such as housing and food assistance, should be integrated into TB care programs in Europe for all vulnerable groups, including migrants during the screening.	U	94.0	6.0	0	0	0
REC2.2.5. Translators and cultural mediators should be included in the screening team.	U	100	0	0	0	0
REC2.2.6. Health professionals from the screening team should receive specific training on the migrant population care.	U	87.9	12.1	0	0	0
REC2.2.7. Digital health technologies, including artificial intelligence should be adapted to expand access, including all the migrants' subgroups.	U	75.8	24.2	0	0	0
REC2.2.8. Digital health free-of-charge, including push notifications can be helpful to reach people who have not been identified and also to raise awareness in migrant population and provide relevant information on the TB and TBI screening program.	U	69.7	27.3	0	0	3.0
REC2.2.9. Digital health solutions may also be used for the treatment, continued care and support of migrants.	U	70.0	30.0	0	0	0
REC2.2.10. Public health system of each European country should be responsible for TB and TB screening in migrants.	U	78.8	18.2	0	0	3.0
REC2.2.11. New government regulation is needed in Europe for TB screening and free preventive treatment.	U	78.8	15.2	0	0	6.0

Continued

TABLE 2 Continued

Recommendations	Grade	Agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Disagree (%)	Not qualified to respond (%)
3. Screening procedures and population targeted						
REC3.2.1. Screening for TB based on TB incidence on the country of origin should not be the only indicator when deciding on active TB and TBI screening.	B	69.7	18.2	6.1	6.1	0
REC3.2.2. Specific criteria, such as an incidence cut-off range based on the country of origin, may be established to select the migrant population for TB and TBI screening at the country of arrival.	B	33.3	51.5	9.1	6.1	0
REC3.2.3. When recommended a universal screening coverage, migrants should be screened, independently of their subgroup (*i.e.* refugees and people seeking asylum; labour migrants; undocumented migrants; pregnant migrants; and foreign students).	B	57.6	24.2	18.2	0	0
REC3.2.4. All migrants should be screened for TBI, independently of their age (minors, adults, and elderly).	C	42.4	30.3	18.2	9.0	0
REC3.2.5. Screening for pulmonary TB should be performed using a questionnaire of symptoms and X-ray.	A	69.7	24.3	3.0	3.0	0
REC3.2.6. Screening for TBI should be performed using IGRA, TST or other skin test.	A	78.8	15.2	3.0	3.0	0
REC3.2.7. Screening for TB should be based on taking into account TB incidence in the country of origin but also the TB incidence of the subgroups in the country of arrival.	A	75.8	18.2	3.0	3.0	0
REC3.2.8. Screening for TB should take into account the permanence period of migrants in the country of arrival but also the time since leaving the country of origin.	A	66.7	24.2	3.0	6.1	0
REC3.2.9. Screening for TB and TBI in Europe should be based on an incidence cut-off based on the country of origin but also in conjunction with other TB risk factors, and should also include the resources of the country of origin.	B	63.6	21.2	9.1	3.0	3.0
4. Treatment and continued care						
REC4.2.1. Person-centred care models should be used, including comprehensive health education and literacy programs tailored to migrants' needs.	U	97.0	3.0	0	0	0
REC4.2.2. Follow-up protocols based on clinical conditions should be adopted, including extended follow-up periods for drug-resistant TB and cases of preventive treatment refusal.	U	87.9	9.1	0	0	3.0
REC4.2.3. VOT is a powerful tool to be used to monitor and support treatment adherence among migrants with TB, ensuring continuous and effective care.	A	54.5	33.3	9.1	0	3.0
REC4.2.4. DOT/VOT could be used to monitor and support treatment adherence among migrants with TB, ensuring continuous and effective care.	A	69.7	27.3	3.0	0	0
REC4.2.5. Treatment should be offered to all migrants with active TB.	U	100	0	0	0	0
REC4.2.6. Treatment should be offered to all migrants with TBI.	B	54.5	30.3	15.2	0	0
REC4.2.7. DOT or VOT should be tailored according to the patient/circumstances.	A	90.9	6.1	0	3.0	0
REC4.2.8. The full course of treatment must be carried out in the country in which active TB was diagnosed.	C	42.4	30.3	15.2	12.1	0

TB: tuberculosis; TBI: TB infection; DOT: directly observed therapy; VOT: video-observed therapy; IGRA: interferon gamma release assay; TST: tuberculin skin test. Grades are based on the percentage of combined agreement (agree + somewhat agree). U: unanimous (100%) agreement; A: 90–99% agreement; B: 78–89% agreement; C: 67–77% agreement. Responses to each REC are presented as percentages of the total responses.

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interventions remain underused (ST2.1.2) and digital health solutions are not effectively employed in screening programs or during the continuum of care (ST2.1.3). Additionally, an overall agreement points out that in many European countries, migrants represent a large share of new TB diagnoses, further emphasising gaps in public health systems (ST2.1.4) and that maintaining a robust TB workforce in low-incidence countries is challenging due to inadequate funding (ST2.1.5). The panel of experts support that Europe also faces a shortage of health professionals in TB screening and care programs (ST2.1.6), while fragmented health services lead to substantial losses along the TB/TBI care cascade (ST2.1.7).

The panel recommendations in health systems and health workers unanimously agree that preparedness and response to TB and TBI in Europe should take a holistic, society-wide approach involving multiple sectors and disciplines (*e.g.* civil society and media) (table 2; REC2.2.1). A unanimous agreement also supports that community-based programs leveraging local resources, such as TB clinics, general clinics and public health clinics and pharmacies are key to engaging migrants (REC2.2.2) and that screening efforts should include trained health professionals, cultural mediators and organisations to address stigma and fear (REC2.2.3) while integrating social support services like housing and food assistance (REC2.2.4). In addition, the experts unanimously support the idea that translators and cultural mediators are vital team members (REC2.2.5) and that professionals should receive specific training on migrant care (REC2.2.6).

Moreover, the panel of experts unanimously agrees that digital health technologies, including artificial intelligence, should expand access to all migrant subgroups, offering free tools (*e.g.* push notifications) to improve awareness and reach underserved populations (REC2.2.7 and REC2.2.8), and can also support treatment and ongoing care (REC2.2.9). The experts unanimously agree that public health systems in European countries must take responsibility for TB screening (REC2.2.10), and that new regulations are required to ensure free preventive treatment and standardised approaches (REC2.2.11).

Screening procedures and priority populations

There is relatively reasonably high, though somewhat lower, combined agreement among the expert panellists in the "screening procedures and priority populations" domain (where it ranged from 73% to 97%). An overall agreement exists that there is no standardised view on which migrant subgroups should be targeted for TB screening (figure 2 and supplementary material S3; ST.3.1.1)). The panel also agrees that pre-entry screening in the country of departure is effective in reducing TB cases in destination countries (ST.3.1.2). However, universal screening thresholds based on TB incidence in migrants' countries of origin (*e.g.* >40–100 cases per 100 000 population) may not be suitable for all European countries (ST.3.1.3 and ST3.1.4).

The panel of experts recommended that TB and TBI screening should not rely solely on country-of-origin incidence of TB (table 2; REC.3.1.1), and should also incorporate other specific criteria, such as TB risk factors (REC.3.1.2). The risk factors include chronic diseases, such as diabetes or social vulnerability and other high-prevalence infectious diseases, such as HIV and hepatitis B and C. The panel of experts also agree that when universal screening is recommended, all migrants should be screened, regardless of their subgroup (REC.3.1.3) and that all migrants should be screened for TBI irrespective of their age (REC.3.1.4). Overall agreement exists that symptom questionnaires and X-rays should be used for pulmonary TB screening (REC.3.1.5), while IGRA, tuberculin and other skin tests should be used for TBI screening (REC.3.1.6). In addition, screening approaches should consider TB incidence in both the country of origin and subgroups in the host country (REC.3.1.7), as well as the migrants' time in the host country and duration since departure (REC.3.1.8). Finally, screening should also align with available resources in the country of origin (REC.3.1.9).

Treatment and follow-up

A strong consensus among expert panellists in the "treatment and follow-up" domain (ranging from 85–100%) was achieved.

There was unanimous agreement for the continuity of care relying on person-centred approaches, health education and literacy (figure 2 and supplementary table S3; ST4.1.1). Continued care, including screening and follow-up, varies based on clinical conditions (ST4.1.2). VO) and DOT are considered critical methods by the panel of experts to ensure adherence to treatment and follow-up (ST4.1.3 and ST4.1.4).

The panel recommendations focus on person-centred care models, including health education and literacy programs, addressing migrants' needs (table 2; REC4.2.1). According to the panel of experts' follow-up protocols should consider clinical conditions, especially for drug-resistant TB and preventive treatment

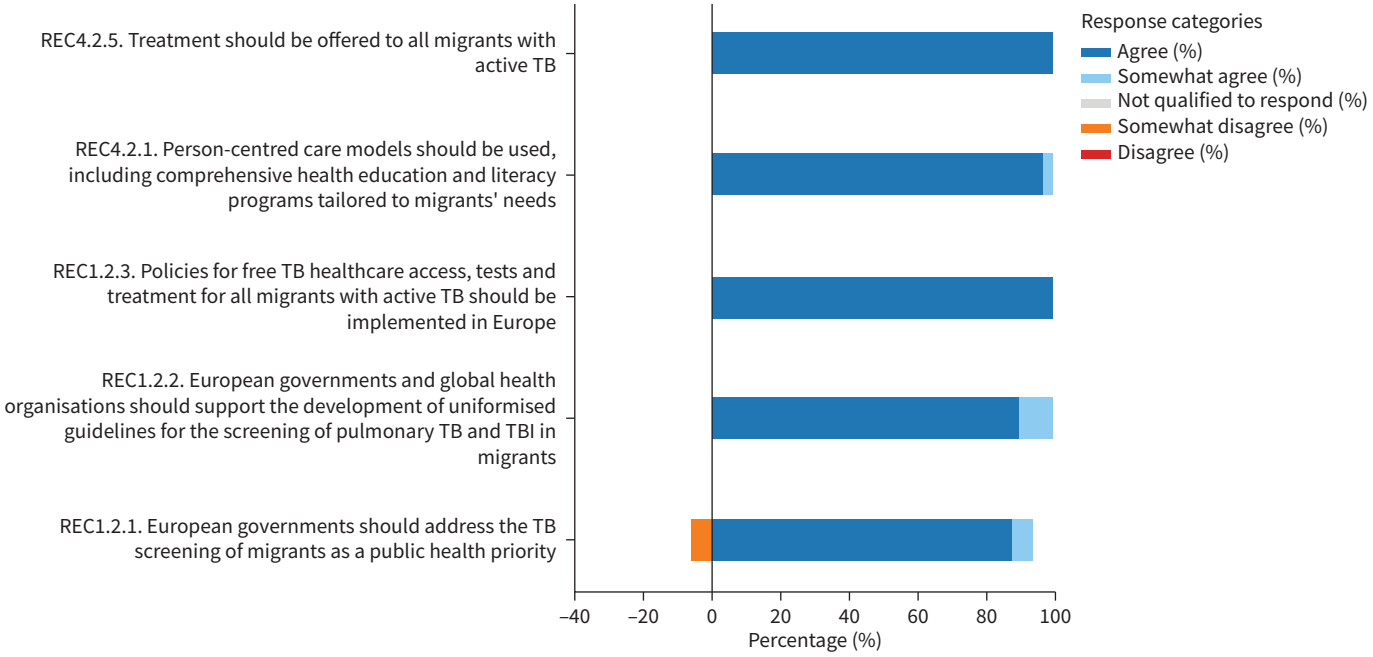

FIGURE 3 Top-ranked recommendations with data collected as checkboxes on a four-point Likert scale. The y axis represents the statements presented to panellists who agree and somewhat agree with the statements (positive scale) or who disagree or somewhat disagree (negative scale). The panellists who considered themselves not qualified to respond are also represented. TBI: TB infection.

refusals (REC4.2.2). An overall agreement exists that VOT and DOT are essential tools to monitor and support treatment adherence tailored to individual circumstances (REC4.2.3, REC4.2.4 and REC4.2.7). The experts recommend that treatment should be provided to all migrants with active TB or TBI, with the entire course completed in the diagnosing country (REC4.2.5, REC4.2.6 and REC4.2.8).

Top-ranked and prioritised consensus recommendations

The top five recommendations (table 2) emphasise policy, treatment and continuity of care (from high to low priority: REC4.2.5, REC4.2.1, REC1.2.3, REC1.2.2 and REC1.2.1). These were (figure 3): 1) the experts underscored the critical need for free treatment for all migrants diagnosed with active TB (REC4.2.5.); 2) the experts prioritised implementing person-centred care models for screening, incorporating tailored health education and literacy programs to address the specific needs of migrants (REC4.2.1.); 3) the panel identified the establishment of policies ensuring free access to TB healthcare, diagnostic tests and treatment for all migrants with active TB as a key priority for European countries (REC1.2.3.); 4) the experts advocated for European governments and global health organisations to support the development of standardised guidelines for TB and TBI screening in migrants (REC1.2.2.); and 5) in alignment with the preceding recommendations, the panel emphasised that TB screening in migrants should be a public health priority (REC1.2.1.).

Areas of lower agreement

From table 2, it is clear that the domains with a higher disagreement were “screening procedures and priority populations” and also in “treatment and continued care.” Of all the 36 recommendations, eight showed at least 10% disagreement (table 2). Among these, five recommendations had over 15% disagreement (figure 4): 15.2% of experts opposed the use of specific criteria, such as an incidence cut-off range based on the country of origin to select the migrant population for TB and TBI screening in the country of arrival (REC3.2.2); 18.2% of panellists were opposed to the recommendation of a universal screening coverage, where migrants should be screened, independently of their subgroup (*i.e.* refugees and people seeking asylum; labour migrants; undocumented migrants; pregnant migrants; and foreign students; REC 3.2.3); 24.3% opposed screening all migrants for TBI, independent of their age (minors, adults and the elderly) (REC3.2.9); 15.2% opposed offering treatment to all migrants with TBI (REC4.2.6); and 27.3% were opposed to the suggestion that full treatment to completion should be carried out in the country in which active TB was diagnosed (REC4.2.8).

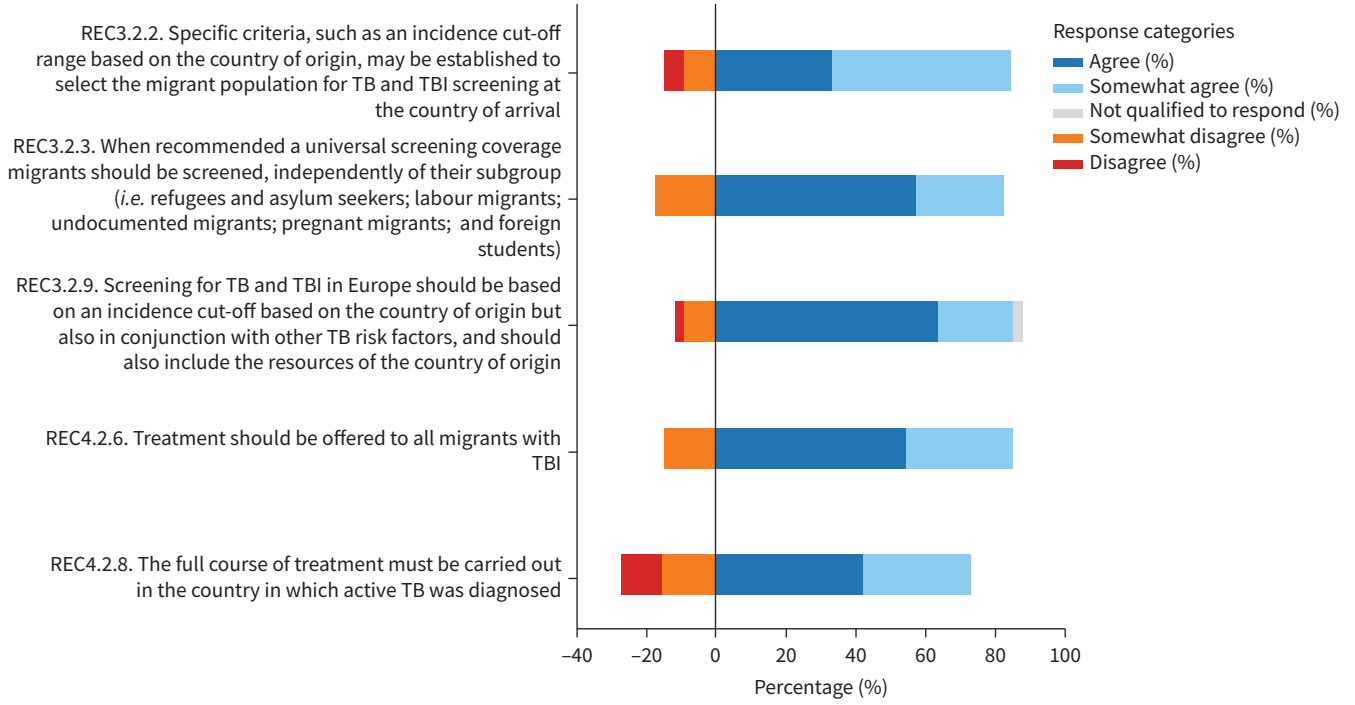

FIGURE 4 Lower agreement recommendations with data collected as checkboxes on a four-point Likert scale. The y axis represents the statements presented to panellists who agree and somewhat agree with the statements (positive scale) or who disagree or somewhat disagree (negative scale). TBI: TB infection.

Discussion

TB remains a significant public health threat in Europe, affecting vulnerable groups, including migrants [9]. This study is a harmonised consensus on statements and recommendations for screening of migrants in Europe, using panellist with diverse geographical origin and areas of expertise. This study elaborates a set of recommendations that can be implemented in real practice in Europe. The set of statements and recommendations resulting from this consensus address gaps identified from national, WHO and ECDC strategic plans.

The Delphi process in this study follows a methodology designed to progressively increase agreement on statements and recommendations through successive survey rounds [17]. The top priorities emphasise free treatment for migrants with TB, person-centred screening approaches tailored to migrants' needs and policies ensuring free access to TB healthcare, diagnostics and treatment in European countries. These priorities underscore the importance of equitable access and continuity of care for this vulnerable population. The panel of experts defends higher funding and investment in the public area, in the national health systems and their health workers. In this context, it is essential to notice that Europe faces a shortage of health professionals in the health systems [18] and this is extended to the TB screening programs and the continuum of care.

Notably, the panel of experts advocated for standardised pulmonary TB and TBI screening guidelines and called for European governments and global organisations to make migrant TB screening a public health priority. The Delphi methodology allowed for interactive consensus-building while identifying key areas of disagreement to inform decision-making and identify high priority areas of research. Although the study revealed relatively few areas of disagreement, highlighting these disagreements can guide decision-makers in prioritising actions and researchers in driving the generation of high-quality evidence. The lowest level of agreement in the policy domain was found in the statement about the importance of the TB epidemic in Europe, which has not been properly acknowledged by European countries.

The very high combined agreement among the expert panellists in the "health systems and health professionals" domain (range 97–100%) highlighted their recognition that strengthening and building resilient health systems in Europe is an essential area for European TB screening.

Disagreement was most pronounced in recommendations related to “screening procedures and priority populations” and “treatment and continued care”, which highlights the complexity of this domain and the greater challenges in reaching a consensus. For example, notable disagreements included opposition to using country-of-origin criteria for screening, universal screening across all migrant subgroups, and screening all migrants for TBI regardless of age. The disagreement in this recommendation arises from the fact that, although TBI treatment is generally considered safe for elderly populations, they remain at a higher risk of developing drug-induced liver injury and experiencing other adverse events. TB remains a prompt global discussion in Europe [9, 13, 14], particularly about fracturing opinions among screening migrants’ subgroups for TB using a universal incidence cut-off range as advocated by ECDC and WHO. This consensus defended the selection of the screening population and the fact that procedures should be data-driven and informed by evidence. Thus, the cut-off may not be uniform for all of Europe and even for each country since the incidence of TB could vary widely in different regions. Furthermore, other variables should be considered to decide whether to screen or not, including TB incidence in the country of arrival and the differential compared with the country of origin, risk factors for acquiring the infections and risk factors for progressing from TBI to active TB, and the route conditions and time from leaving the country of origin and time to stay at the country of arrival.

Treatment-focused disagreements included whether all migrants with TBI should receive treatment and whether the entire treatment course should occur in the diagnosing country. These areas of divergence highlight critical points for further investigation and policymaking, particularly balancing public health priorities with human rights and a struggle between government’s duty of care to populations as a whole and individuals’ rights and freedoms.

This study has several strengths, one of which is the use of Delphi methodology. By showing increased agreement with each successive round, this methodology allowed a panel of experts to assess and propose refined statements and recommendations, thereby enabling a consensus and, in some cases, inclusively reaching unanimity. Also, as it was conducted online, experts from all WHO regions were able to take part easily, making it an extremely efficient process. The consistency of agreement levels across the two survey rounds further reinforces the confidence and reliability of the Delphi methodology and the comprehensive work performed in the preliminary phase of the project. Remarkably, incorporating expert panel feedback resulted in more complex and robust statements and recommendations, including integrated multi-item statements. The high response rates across both rounds highlight the rigorous application of the method, reflecting the commitment of the expert panel. Furthermore, the endorsement of the final consensus statements and recommendations representative of 22 countries underscores the relevance of this study. To reduce potential bias from a limited sample, a multidisciplinary panel with geographical diversity was assembled, though regions outside WHO Europe were minimally represented. The multidisciplinary panel minimised the possible selection and was identified from core groups, being corresponding authors of key TB publications from the six WHO regions, ensuring a truly representative perspective. This study also has limitations that should be mentioned. It does not include screening for extrapulmonary tuberculosis, which is an important aspect when addressing TB in migrant populations. Although 100 experts from 72 countries were invited, only 33 completed all Delphi rounds and were included in the final Consensus Panel. The limited number of participants may reduce the generalisability of the results and increase the likelihood of bias. In addition, although the panel was geographically diverse, three-quarters of participants were based in Europe. This disproportionate representation reflects the European focus of the study. However, it is important to recognise that this regional concentration may have limited the inclusion of perspectives from settings with differing TB epidemiology, healthcare structures and migration patterns. These variations might have contributed to the lack of consensus on certain recommendations. Future consensus efforts could benefit from increased representation of experts from high TB burden regions outside Europe to enhance the global applicability and robustness of recommendations. Despite being a well-known robust methodology, the Delphi methodology has some limitations that need to be described and discussed in detail. The multi-method sampling approach (outlined in the Methods section) proved effective, as only a small percentage of panellists reported feeling unqualified to respond to specific statements or recommendations. While the study was conducted in English, which restricted participation to English speakers, the inclusion of experts from 22 countries enhances confidence in the recommendations’ validity across Europe. A potential limitation is that the entire process was conducted anonymously and virtually. Although this ensured broad participation and unbiased responses and reduced the impact of dominant opinions, an in-person meeting could have provided additional opportunities to address points of disagreement more effectively.

Future research should focus on evaluating the implementation of these recommendations in different health system contexts, including feasibility, acceptability and cost-effectiveness. In addition, the

development of clear monitoring frameworks and accountability mechanisms at national levels will be essential to track adoption, ensure policy compliance and measure the real-world impact of TB screening strategies among migrant populations.

Conclusion

A multidisciplinary panel of experts developed consensus statements and recommendations with the potential to address the real-world TB control challenges faced by the European continent. The involvement of a diverse group of stakeholders, including clinicians, academics and public health authorities enhances the consistency, validity, relevance and applicability of the study's findings. The key priorities identified by the experts include recommendations in: 1) policy (governments should treat TB screening in migrants as a public health priority, ensure free access to diagnosis and treatment and adopt standardised, evidence-based guidelines across Europe); 2) health systems (strengthen public health systems with higher levels of funding, workforce training, cultural mediators and community-based approaches. Leverage digital health tools and ensure that social support is integrated into TB care); 3) screening procedures (implement data-driven screening strategies that go beyond country-of-origin incidence and consider individual risk factors, host country context, and time since migration); and 4) treatment and care (promote person-centred, continuous care. Offer treatment to all diagnosed migrants, support adherence through DOT/VOT and tailor care to clinical and personal circumstances).

This consensus process should help to advance a European vision for informed decision-making on TB screening and migrant health. Specifically, it provides a robust framework with clear recommendations for improving TB management and prevention among migrants in the European context, but it may also be relevant to other low-TB incidence settings. Thus, although these recommendations are tailored to the European context, they may also be relevant globally and be used in other countries facing similar challenges in migrant TB screening and care. The recommendations emphasise the need for a harmonised, evidence-based approach that considers the public health priorities and the healthcare needs of migrant populations.

The findings provide a robust guide to developing more consistent, efficient and equitable screening programs across Europe, which aim to ensure better health outcomes for migrants and host communities. The consensus reinforces the importance of multidisciplinary cooperation to bridge the gap between policy and practice and provides a template for similar international initiatives. Finally, the authors of this study advocate for the adoption of these recommendations in Europe through strong collaboration among health workers, professional associations, patient groups and policymakers. Future studies should explore the implementation and scalability of these recommendations, with particular attention to sustainable financing models, the role of government in policy enforcement and the active engagement of all relevant stakeholders.

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