**How effective are current approaches to migrant screening for infectious diseases in Europe? A systematic review**

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**ABSTRACT**

Migration to Europe has increased in recent years, with considerable implications for health systems. Migrants to Europe face a disproportionate burden of tuberculosis (TB), HIV, and hepatitis B and C, yet experience a plethora of barriers to accessing statutory health care on arrival, and a better understanding of how to deliver effective and cost-effective screening, vaccination, and health services to this group is now critical. We did a systematic review to document and assess the effectiveness and cost-effectiveness of current approaches for infectious diseases screening, and to explore facilitators and barriers experienced by marginalised migrants to accessing screening programmes. Following PRISMA guidelines, we searched Embase, Pubmed, PsychINFO, the Cochrane Library, and Web of Science (1989 to 1 July 2015, updated in January 2018), with no language restrictions, and systematically approached experts across the EU for grey literature. Inclusion criteria were primary research studies assessing screening interventions for any infectious disease in the migrant (foreign-born) population residing in EU or EEA countries. Primary outcomes were the following effectiveness indicators: uptake of screening, coverage, infections detected, and treatment outcomes. Of 4112 unique records, 46 studies met our inclusion criteria, from 10 European countries (Belgium, Denmark, France, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the UK) encompassing 248,402 migrants. We found that most European countries screening migrants focus on single diseases only - predominantly active and/or latent TB - and specifically target asylum seekers and refugees, with 22 studies reporting on other infections (including HIV and hepatitis B and C). An infection was detected in 3.74% [range: 0.00 – 95.16] of migrants. Latent TB had the highest prevalence across all infections (median: 15.02% [0.35 – 31.81]). Uptake of screening by migrants was high (median 79.50% [18.62-100.00] ­– particularly in primary health-care settings (uptake 96.77% [76.00 – 100.00]). However, in 24.62% (0.12 – 78.99) of migrants screening was not completed and a final diagnosis was not made. Pooled data highlight high rates of treatment completion in migrants (83.79%, range 0.00 – 100.00) yet data were highly heterogeneous for this outcome, masking important disparities between studies and infections, with only 54.45% (35.71 – 72.27) of migrants with latent TB ultimately completing treatment after screening. Coverage of the migrant population in Europe is low (39.29% [14.53-92.50]). Data on cost-effectiveness were lacking, but suggest moderate to high-cost effectiveness of migrant screening programmes depending on migrant group and disease targeted. European countries have adopted a variety of approaches to screening migrants for infections, however these are limited in scope to single diseases and a narrow sub-set of migrants, with low coverage. More emphasis must be placed on developing innovative and sustainable strategies to facilitate screening and treatment completion and improve health outcomes, encompassing multiple key infections with consideration given to a wider group of high-risk international migrants. Policy makers and researchers involved with global migration need to ensure a longer-term view on improving health outcomes in migrant populations as they integrate into health systems in host countries.

**INTRODUCTION**

Rates of migration are rising globally, and have increased dramatically in Europe in recent years,[1](#_ENREF_1),[2](#_ENREF_2) with significant implications for health services.[2-4](#_ENREF_2) Overall, approximately 30% of TB cases in the European Union (EU) are foreign, born but there is considerable variation between countries[5](#_ENREF_5) - for example, over 80% of active TB cases in Norway and Sweden are in migrants, and rates of TB in migrant populations remain high for several years after arrival to the EU.[6](#_ENREF_6) MDR-TB is an emerging concern in migrant populations in the EU, who are disproportionately affected.[7](#_ENREF_7) Hepatitis B and C prevalence in migrants in Europe is estimated to be 6 and 2 times higher, respectively, than the general population.[8](#_ENREF_8),[9](#_ENREF_9) Although migrants (foreign born) face the largest burden of infectious diseases in the EU and European Economic Area (EEA), there is evidence that these disparities are attributed not only to higher rates in migrants’ countries of origin, but also poor living conditions and barriers to healthcare in transit and host countries, with some groups of migrants (including undocumented migrants, refugees, and asylum seekers) being refused or charged for statutory health care.[10](#_ENREF_10),[11](#_ENREF_11)

Understanding the unique health-care pathways for these hard to reach groups is important both from an individual and public health perspective.[12-15](#_ENREF_12) However, major shortfalls in data collection and surveillance across the EU for key infections in migrants make inter-country comparisons difficult, which has hampered policy in this area. Furthermore, there appears to be considerable variation across Europe in terms of screening approaches and best practice for early detection and treatment of infectious diseases.[16](#_ENREF_16) Most immigrant screening programmes in Europe have historically focused on tuberculosis in a variety of settings, including on arrival at ports or holding centres and/or post-arrival community-based screening, yet it is unclear exactly what approach is most effective and/or cost-effective, acceptable to migrants, and has highest uptake and best treatment outcomes.[5](#_ENREF_5),[17](#_ENREF_17) The benefits to low-incidence TB countries of pre-departure screening - targeting migrants applying for long-term visas before they migrate from high-burden countries - has been recently reported.[18](#_ENREF_18) In addition, there has been renewed focus on incorporating latent TB screening more successfully into immigrant screening programmes,[19](#_ENREF_19),[20](#_ENREF_20) and exploring whether we need to go beyond tuberculosis screening, to encompass diseases such as hepatitis and HIV.[21](#_ENREF_21)

Importantly, several studies report worse treatment outcomes in migrant patients testing positive for latent TB, TB, MDR-TB, hepatitis B, and HIV, with drop-out at every stage of the screening and treatment pathway,[22-25](#_ENREF_22) suggesting innovative strategies are needed to target migrants in order to minimise loss to follow up and ensure treatment completion. In addition, there are concerns that where policies exist to screen migrants for diseases in certain settings, this is not done in practice.[26](#_ENREF_26) At present, it remains unclear as to what approaches work best in order to improve health outcomes in migrant populations across Europe, what constitutes an effective and cost-effective approach to screening migrants, what should be screened for, who we should be targeting, where screening should be delivered, and what the facilitators and barriers to are to initiating and completing the screening process. We therefore carried out a systematic review to document and explore the range of approaches to migrant screening for infectious diseases currently adopted across the EU/EEA and to assess the effectiveness of the various approaches, in order to inform optimal strategies for screening migrants in the European context.

**METHODS**

The aims of this systematic review are to: (i) assess the effectiveness and cost-effectiveness of screening for infectious diseases in migrant populations from high-prevalence countries entering or residing in countries within the EU/EEA; and (ii) explore factors that act as facilitators or barriers to migrants accessing screening.

Search strategy and selection criteria

The systematic review was conducted in line with PRISMA guidelines.[27](#_ENREF_27) We searched Embase, Pubmed, PsychINFO, the Cochrane Library, and the Web of Science (social science citations only) between 1989 and 1 July 2015 with no language restrictions, using a Boolean search strategy combining keyword and MeSH terms for “migrant”, “infectious diseases”, and “screening” (see supplementary Figure 1 for the full search strategy). We also screened the reference lists of included studies, and approached experts in the field of migrant health and infectious diseases across Europe for grey literature. We updated our search in January 2018 and include a description of all relevant references in the Discussion section.

Inclusion criteria were primary research assessing screening interventions for any infectious diseases in the migrant (foreign-born) population originating from countries outside of Western Europe, North America, Australia or New Zealand, and residing in EU or EEA countries (Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom). Studies had to report one of the following effectiveness indicators: uptake, coverage, infections detected, infections treated, failure to complete treatment, patients not diagnosed, acceptability, or facilitators or barriers to screening (Table 1).

We excluded studies not assessing a screening intervention for infectious diseases, only targeting migrants from Western Europe, North America, Australia or New Zealand, conducted outside of the EU/EEA, lacking specific data for migrants, or not disaggregating contact tracing from screening.

Three authors (FS, JO, LN) contributed to the title and abstract screening. SH, FS, JO, and LN contributed to the full-text screening, and agreed final study inclusion. FS, JO, and LN also conducted the reference checking. For references only available as abstracts, an attempt was made to contact the author for the availability of the full text. Studies in foreign languages were translated and included in the review.

Quality assessment

We examined the quality of included studies by adapting criteria from the Health Technology Assessment,[28](#_ENREF_28) Cochrane Effective Practice and Organisation of Care Group,[29](#_ENREF_29) and a systematic review conducted by Edward et al (2012).[30](#_ENREF_30) Scores were summed and converted into percentages. We also established minimum quality criteria for inclusion. For observational studies, papers had to include: an adequately described research question or objective, appropriate sampling and participant selection, adequately detailed results, sufficient internal and external validity, and minimal biases. Qualitative papers had to include a sufficiently described research question/objective, an evident and appropriate study design, appropriate data collection methods, clearly described and systematic data analysis, and minimal bias.

FS, JO, and LN performed the quality assessments. Differences in assigned scores were discussed until a consensus was reached, and the agreed decisions were applied to the remaining assessments. Where agreement could not be reached, SH arbitrated.

Data extraction and synthesis

FS and JO extracted data from the included studies. Data were recorded on *a priori* forms summarising the primary outcomes and general characteristics of studies, description of the interventions, effectiveness indicators, any other outcomes reported, and facilitators and barriers to screening.

We used ESRC guidance on the conduct of narrative synthesis to aid data synthesis.[31](#_ENREF_31) Extracted data for each effectiveness indicator in the included studies were converted into percentages. In cases where raw numbers were not reported, percentages for the indicators as reported in the study were used. Where complete data for neither the raw numbers nor percentages were available, the effectiveness indicator was not reported. Due to variation between studies, percentages were combined to represent the median percentage and range for each indicator. As a result of the large variability between the studies and limited data on standard error reporting, a meta-analysis of effectiveness was not considered appropriate.

To compare the effectiveness of screening interventions by target population, setting, and disease, the median percentage and range for each effectiveness indicator was reported for each subgroup. In studies that reported more than one setting or target group, indicators were separated for each group or setting where possible. Indicators that were not reported separately were excluded from this part of the analysis.

Target population was divided into eight subgroups for whom discrete data were available: 1) all immigrants (foreign-born); 2) refugees and asylum seekers (‘refugees’ defined as persons who meet the definition in the 1951 Convention related to the Status of Refugees and its 1967 Protocol, or of other relevant regional instruments, and ‘asylum seekers’, defined as a person wishing to be granted refugee status, and awaiting decision on his or her application for refugee status under relevant international instruments), 3) migrants with HIV (targeted for screening because of their HIV status); 4) migrants from specific regions/countries of origin; 5) undocumented migrants (whose entry into or presence in a country contravenes immigration laws - this may include people who have: overstayed their visas, entered the country without declaring themselves, or been trafficked); 6) pregnant migrants; 7) labour migrants (defined as persons who are to be engaged, are engaged, or have been engaged in a remunerative activity in a state of which they are not a national); and 8) foreign students.

Screening setting was divided into six subgroups: 1) migrant specialist centre or place of residence, including reception centres, migrant health centres, homes; 2) specialist healthcare, such as hospital-based disease units; 3) non-clinical community settings, including social events, places of worship, community centres; 4) primary healthcare, including General Practice; 5) the border; or 6) mixed settings.

The synthesis of the facilitators and barriers involved first tabulating the findings and the factors, and then performing a thematic analysis to combine these factors into themes.[31](#_ENREF_31)

**RESULTS**

4112 unique records were included in the title and abstract screening, 3,680 of which were excluded. The full-text of 432 articles were assessed for eligibility, and 376 records were excluded. Three additional records were identified from consulting experts, grey literature, and the bibliography screening. Of the 60 retained papers, 13 did not meet the minimum quality criteria and were excluded (Figure 1). A total of 46 papers were included in the systematic review,[32-78](#_ENREF_32) reporting screening for infectious diseases across 248,402 migrants (supplementary Table 1).

Across the papers, migrants screened included ‘all immigrants,’[35](#_ENREF_35),[38](#_ENREF_38),[40](#_ENREF_40),[43](#_ENREF_43),[49](#_ENREF_49),[53](#_ENREF_53),[55](#_ENREF_55),[58-60](#_ENREF_58),[64](#_ENREF_64),[67](#_ENREF_67),[69](#_ENREF_69),[72](#_ENREF_72),[73](#_ENREF_73),[78](#_ENREF_78) refugees or asylum seekers,[33](#_ENREF_33),[34](#_ENREF_34),[36](#_ENREF_36),[41](#_ENREF_41),[42](#_ENREF_42),[45-48](#_ENREF_45),[54](#_ENREF_54),[56](#_ENREF_56),[61](#_ENREF_61),[63](#_ENREF_63),[70](#_ENREF_70) migrants with HIV,[66](#_ENREF_66),[75](#_ENREF_75),[77](#_ENREF_77) place-specific migrants,[44](#_ENREF_44),[51](#_ENREF_51),[52](#_ENREF_52),[57](#_ENREF_57),[62](#_ENREF_62),[65](#_ENREF_65),[71](#_ENREF_71),[74](#_ENREF_74) undocumented migrants,[32](#_ENREF_32),[37](#_ENREF_37),[39](#_ENREF_39),[50](#_ENREF_50) pregnant migrants,[68](#_ENREF_68) and labour migrants and foreign students.[33](#_ENREF_33) Screenings were carried out in migrant homes, [38](#_ENREF_38),[58](#_ENREF_58) migrant reception centres,[41](#_ENREF_41),[42](#_ENREF_42),[45](#_ENREF_45),[47](#_ENREF_47),[53](#_ENREF_53),[56](#_ENREF_56),[63](#_ENREF_63),[70](#_ENREF_70) migrant designated health centres,[32](#_ENREF_32),[36](#_ENREF_36),[37](#_ENREF_37),[39](#_ENREF_39),[48](#_ENREF_48),[50](#_ENREF_50),[60](#_ENREF_60),[61](#_ENREF_61),[67](#_ENREF_67), specialist healthcare services,[32](#_ENREF_32),[33](#_ENREF_33),[35](#_ENREF_35),[39](#_ENREF_39),[51](#_ENREF_51),[55](#_ENREF_55),[59](#_ENREF_59),[64](#_ENREF_64),[66](#_ENREF_66),[68](#_ENREF_68), non-clinical community settings,[35](#_ENREF_35),[44](#_ENREF_44),[51](#_ENREF_51),[57](#_ENREF_57),[62](#_ENREF_62),[66](#_ENREF_66),[71](#_ENREF_71),[74](#_ENREF_74), primary care[35](#_ENREF_35),[38](#_ENREF_38),[40](#_ENREF_40),[43](#_ENREF_43),[46](#_ENREF_46),[54](#_ENREF_54),[63](#_ENREF_63),[72](#_ENREF_72),[73](#_ENREF_73),[78](#_ENREF_78), and borders.[33](#_ENREF_33),[34](#_ENREF_34),[49](#_ENREF_49),[69](#_ENREF_69) Migrants were screened for TB[32-35](#_ENREF_32),[37](#_ENREF_37),[39-42](#_ENREF_39),[45](#_ENREF_45),[47](#_ENREF_47),[49](#_ENREF_49),[50](#_ENREF_50),[53-56](#_ENREF_53),[58](#_ENREF_58),[59](#_ENREF_59),[69](#_ENREF_69),[70](#_ENREF_70),[72](#_ENREF_72),[73](#_ENREF_73),[78](#_ENREF_78) (including latent TB [32](#_ENREF_32),[34-37](#_ENREF_34),[39](#_ENREF_39),[42](#_ENREF_42),[43](#_ENREF_43),[50](#_ENREF_50),[58](#_ENREF_58),[59](#_ENREF_59),[66](#_ENREF_66),[69](#_ENREF_69),[78](#_ENREF_78)), HIV,[51](#_ENREF_51),[52](#_ENREF_52),[62](#_ENREF_62),[65](#_ENREF_65) Chagas disease,[57](#_ENREF_57),[64](#_ENREF_64),[77](#_ENREF_77) toxoplasmosis,[68](#_ENREF_68) or multiple diseases (combined screening for HIV, TB, hepatitis B, hepatitis C, malaria, syphilis, mumps, measles, rubella, schistosomiasis, urinary parasites, shigella, salmonella, varicella zoster, and/or intestinal parasites).[36](#_ENREF_36),[38](#_ENREF_38),[43](#_ENREF_43),[44](#_ENREF_44),[46](#_ENREF_46),[60](#_ENREF_60),[63](#_ENREF_63),[66](#_ENREF_66),[67](#_ENREF_67),[74](#_ENREF_74),[75](#_ENREF_75) Studies were conducted in the UK,[35](#_ENREF_35),[41](#_ENREF_41),[44](#_ENREF_44),[49](#_ENREF_49),[51](#_ENREF_51),[55](#_ENREF_55),[58](#_ENREF_58),[59](#_ENREF_59),[62](#_ENREF_62),[65](#_ENREF_65),[69](#_ENREF_69),[71](#_ENREF_71),[78](#_ENREF_78) Switzerland,[32-34](#_ENREF_32),[36](#_ENREF_36),[53](#_ENREF_53),[54](#_ENREF_54),[56](#_ENREF_56),[63](#_ENREF_63) the Netherlands,[40](#_ENREF_40),[47](#_ENREF_47),[72-74](#_ENREF_72) Italy,[37](#_ENREF_37),[39](#_ENREF_39),[50](#_ENREF_50),[67](#_ENREF_67),[68](#_ENREF_68) Spain,[43](#_ENREF_43),[57](#_ENREF_57),[64](#_ENREF_64),[66](#_ENREF_66),[75](#_ENREF_75),[77](#_ENREF_77) France,[38](#_ENREF_38),[48](#_ENREF_48),[60](#_ENREF_60) Belgium,[52](#_ENREF_52),[70](#_ENREF_70) Norway,[42](#_ENREF_42),[45](#_ENREF_45) Denmark,[46](#_ENREF_46) and Sweden.[61](#_ENREF_61)

Effectiveness of infectious diseases screening in migrants

Screening uptake (table 1) across included studies was high (median: 79.50%; range: 18.62 – 100.00). However, coverage (table 1) was low across the studies with a median of only 39.29% (range: 14.53 - 92.50). Infection was detected in 3.74% (range: 0.00 – 95.16) of migrants across the studies, and among patients offered treatment, a median of 83.79% (range: 0.00 – 100.00) completed treatment. A significant proportion of migrants did not complete screening and were not diagnosed (median: 24.62%; range 0.12 – 78.99). Furthermore, a median of 60.21% (range: 9.09 – 94.44) of detected infections were missed by screening and identified passively (e.g. upon presenting to care) (Table 2).

Five studies found that migrants with infections detected through active screening were more likely to experience shorter symptomatic periods, reduced infectious periods, and lower hospitalisation rates than those identified passively,[45](#_ENREF_45),[47](#_ENREF_47),[56](#_ENREF_56),[72](#_ENREF_72),[73](#_ENREF_73) pointing to the benefit of active screening. There were inconsistent findings regarding whether TB cases identified through active screening had better treatment outcomes than those identified passively.[45](#_ENREF_45) [79](#_ENREF_79)[101](#_ENREF_101)[73](#_ENREF_73) Five studies examining the acceptability of screening (for HIV [3], Hepatitis B and C [1], and TB [1]), identified that both migrants and service providers perceived screening to be acceptable.[35](#_ENREF_35),[51](#_ENREF_51),[52](#_ENREF_52),[62](#_ENREF_62),[71](#_ENREF_71)

Impact of setting, target population, and disease on screening effectiveness

Screening uptake was high across all settings, ranging from 68.06% (range: 18.62 – 99.35) in specialist healthcare, to 96.77% (range: 76.00 – 100.00) in primary care. Infections detected and infections treated were highest in specialist care although the proportion of migrants who did not complete screening and were not diagnosed was also highest in this setting (median: 29.83; range: 0.16 – 78.99). Screenings in primary care also showed a high rate of infections treated (median: 100%; range: 84.58 – 100.00) (Table 3).

Screening uptake was also found to be high across all migrant groups ranging from 70.62% (range: 64.42 – 99.35) among migrants with HIV, to 89.91% (range: 57.81 – 100.00) among asylum seekers and refugees. Infections detected were highest among HIV positive migrants (median: 16.84%; range: 1.61 – 95.16), with lower rates in all other groups. The lowest percentage of migrants who did not complete screening and were not diagnosed was in refugees and asylum seekers (median: 5.28%; range: 0.12 – 64.51) (Table 4).

Screening uptake was high across all infections, though uptake was highest for Hepatitis B (median 87.39%: range: 32.34 – 100.00) and TB (median 86.49%; range: 18.62 – 100.00) (Table 5). When combined, latent and active TB screening showed the lowest incidence of infection detected (median: 0.59%; range: 0.00 – 31.81), however latent TB was found to have the highest detected prevalence across all infections (median: 15.02%; range: 0.35 – 31.81). The percentage of infections treated was suggested to be lower for latent TB than for active TB (median: 54.45%, range: 35.71 – 72.27 for latent TB versus median: 72.27%, range: 56.56 – 100.00 for latent and active TB combined). There was also a high rate of patients who did not complete screening and were not diagnosed (latent and active TB: 24.62%, range 1.54 – 78.99; latent TB: 26.67%, range 0.16 – 67.18) (Table 5).

Barriers and facilitators to screening

Fifteen studies[35](#_ENREF_35),[37](#_ENREF_37),[39](#_ENREF_39),[41](#_ENREF_41),[45](#_ENREF_45),[46](#_ENREF_46),[48](#_ENREF_48),[50-52](#_ENREF_50),[58](#_ENREF_58),[62](#_ENREF_62),[65](#_ENREF_65),[71](#_ENREF_71),[78](#_ENREF_78) reported barriers and facilitators to screening. We summarised barriers to screening into four key themes: ‘migrant insensitive services’, ‘cultural and individual mind-set’, ‘structural and service barriers’, and ‘other individual barriers’ (Table 6). Facilitators to screening programmes for infectious diseases identified were as follows: well-trained and dedicated screening staff, involving migrants in service delivery and collaborations, tailored outreach, and improved service provider management of services (Table 6).

Cost-effectiveness of screening

Few studies explored the cost-effectiveness of infectious diseases screening in migrants, and included studies showed significant methodological variation, making data comparisons difficult.

For TB, the cost-effectiveness of screening was consistently shown to be higher when targeted at migrants from high prevalence countries and close contacts,[59](#_ENREF_59),[69](#_ENREF_69),[79-85](#_ENREF_79) with cost-effectiveness decreasing as the incidence in countries of origin falls.[59](#_ENREF_59) Latent TB screening was consistently found to be cost-effective, with TST or IGRA being the most cost-effective approaches when the risk of TB was high, for example among close contacts or populations from high incidence countries (e.g. with an incidence of 150 or more cases per 100,000,[80](#_ENREF_80) though the definition for this varied).[37](#_ENREF_37),[59](#_ENREF_59),[80-82](#_ENREF_80),[84-86](#_ENREF_84) IGRA in particular was more cost-effective than other screening methods. This may be attributed to its increased sensitivity and specificity compared with other methods,[81](#_ENREF_81),[84](#_ENREF_84),[87](#_ENREF_87),[88](#_ENREF_88) as well as the resource demands and risk of loss to follow up of repeat visits needed for TST. The falling price of IGRA tests may be another contributory factor. Screening for Hepatitis B or C in migrants was found to be moderately cost-effective.[8](#_ENREF_8),[9](#_ENREF_9),[13](#_ENREF_13),[89](#_ENREF_89),[90](#_ENREF_90) As for TB, screening was suggested to be more cost-effective in populations from countries with higher incidence rates. There were limited data on cost-effectiveness of HIV screening in migrants.

In the literature, it was highlighted that the effectiveness of screening was dependent on uptake, patients not diagnosed, infections treated, infections missed, and treatment adherence, reinforcing the importance of improving these factors. Furthermore, the cost-effectiveness of screening is sensitive to the cost of treatment, which, as in the case of Hepatitis C, varies significantly based on the availability of, demand for, and patenting of drugs. As a result, the literature on cost-effectiveness was heterogeneous. It is also important to note that a narrow perspective was utilised in many cases in the cost-effectiveness analysis, and models were limited by assumptions based on weak empirical data.

**DISCUSSION**

We found that numerous approaches to infectious diseases screening in migrants are currently adopted across Europe with significant variation in the effectiveness of screening in relation to setting, target population, and infection. Most screening programmes are focused on refugees and asylum seekers, and single infectious diseases, commonly active and/or latent TB. Across the studies, any infection was detected in 3.74% (range: 0.00 – 95.16) of 248,402 migrants screened. However, this varied by setting with the greatest rate of infection detected in specialist healthcare. Infection with latent TB was high, identified in 15.02% (range: 0.35 – 31.81) of screened migrants. Uptake of screening by migrants was high (median 79.50%, range 18.62-100.00) across all settings, target groups, and infections, particularly in primary health-care settings and among migrants who were asylum seekers and refugees. However, in 24.62% (0.12 – 78.99) of migrants, screening was not completed and a final diagnosis was not made. Pooled data highlight high rates of treatment completion in migrants (83.79%, range 0.00 – 100.00) - particularly in specialist and primary healthcare – yet data were highly heterogeneous for this outcome, masking large disparities between studies and infections, with only 54.45% (35.71 – 72.27) of migrants with latent TB ultimately completing treatment after screening. Coverage of the migrant population in Europe is low (39.29% [14.53-92.50]). Data on cost-effectiveness were lacking, but suggest moderate to high-cost effectiveness of migrant screening programmes depending on migrant group (i.e. migrants from high prevalence TB areas) and disease targeted (TB, hepatitis B and C).

An update of the search in January 2018 yielded seven additional papers reporting primary data on the effectiveness or cost-effectiveness of infectious diseases screening in migrants.[91-97](#_ENREF_91) Consistent with preceding research, most studies were focused on a single infectious disease,[91-93](#_ENREF_91),[96](#_ENREF_96),[97](#_ENREF_97) with the majority on TB screening,[92](#_ENREF_92),[93](#_ENREF_93),[96](#_ENREF_96),[97](#_ENREF_97) though there were examples of combined screening programmes.[94](#_ENREF_94),[95](#_ENREF_95) There was also a significant focus on refugee and asylum seeking populations.[93](#_ENREF_93),[94](#_ENREF_94),[97](#_ENREF_97) Consistent with the preceding literature, the findings were heterogeneous. The effectiveness of screening programmes was supported by evidence that screening was acceptable among migrants. In a screening programme in Italy to identify and offer care to migrants with hepatitis C infection, the majority (1,727 [85%] of 2,032) migrants agreed to the screening. The high uptake highlights the acceptability of HCV screening, which in this case identified 70 cases of hepatitis C infection, all of which were previously unkown.[91](#_ENREF_91) There was also evidence that CXR screening was an effective approach for diagnosing asymptomatic asylum seeking patients with active TB who would otherwise be missed by symptom-based screening. The utility of this approach was in part attributed to the high prevalence of TB in the individuals screened, and the relatively low number needed to screen (187), both of which resulted in a unit cost of screening of <20 euros per individual screened.[93](#_ENREF_93) Research also showed that LTBI screening and treatment costs are small compared to the total cost of LTBI and TB disease screening and treatment, and that increasing the identification and treatment of LTBI decreases the costs per avoided case.[92](#_ENREF_92) In a cost-effectiveness analysis of TB screening in Flanders, Belgium, the incremental cost-effectiveness ratio (cost per active case detected) was lowest when following up asylum seekers with abnormal CXR on initial screening by the Federal Agency for Asylum, and highest for ‘other’ migrants, intending to stay in Flanders for more than 3 months and originating from countries with >50 active TB cases per 100,000.[96](#_ENREF_96) Some evidence questioned the effectiveness and cost-effectiveness of screening, suggesting it often entailed high costs and that costs per identified case were high, for example for TB, which had a low yield and a high number needed to screen, limiting effectiveness and cost-effectiveness.[91](#_ENREF_91),[93](#_ENREF_93),[94](#_ENREF_94),[96](#_ENREF_96),[97](#_ENREF_97) These findings point to the importance of targeting screening based on setting and risk.

Active and latent TB screening dominated the literature, which is consistent with surveys with infectious disease experts,[5](#_ENREF_5),[98](#_ENREF_98) and reflects increasing attention to the identification and treatment of both active and latent TB in migrants in health policy in low-incidence settings.[99](#_ENREF_99) This reflects mounting evidence indicating latent TB screening for migrants from intermediate to high-TB incidence countries is cost-effective,[82](#_ENREF_82),[85](#_ENREF_85),[100](#_ENREF_100),[101](#_ENREF_101) with several European countries exploring latent TB screening in migrants on arrival as a means of reducing the burden of TB.[102](#_ENREF_102),[103](#_ENREF_103) Public Health England, for example, have recently rolled out the Collaborative Tuberculosis Strategy[104](#_ENREF_104) to target high-risk migrant groups in England for latent TB testing as a means of tackling high levels of TB in London and other major cities.[104](#_ENREF_104),[105](#_ENREF_105)

The high rates of latent TB identified in migrant screening programmes across the EU/EEA, and the low levels of screening and treatment completion in EU programmes, point to the need to improve testing and treatment for this infection in migrants. With around a quarter of the global population thought to be infected with latent TB, effectively tackling TB in Europe will require a concerted effort to identify and screening migrants on arrival for latent TB infection.[101](#_ENREF_101),[106](#_ENREF_106) However, there is a lack of consensus around the most effective approach,[19](#_ENREF_19),[101](#_ENREF_101) which is inhibited by significant variation in data around rates of latent TB in migrants.[101](#_ENREF_101) What is now clear is that specific approaches may be needed in more marginalised or underserved migrant groups to improve uptake of screening and treatment outcomes for latent TB, including tackling barriers to free statutory health services on arrival in the host country and to promote full and meaningful access.[107](#_ENREF_107) More emphasis must be placed on developing innovative strategies to ensure screening and treatment completion - we found that only 54.45% of migrants with latent TB ultimately completed treatment after screening, for example, suggesting that in order for immigrant screening programmes to ultimately be successful we may need to better engage newly arrived migrants, designing programmes that address unique cultural and social needs, across multiple settings.

The effectiveness of infectious diseases screening in migrants was evidenced by several indicators. The high uptake of screening by these often high risk and hard to reach migrant groups, almost 80% across EU/EEA programmes, suggests not only that screening is acceptable in these groups, but also that targeted screening programmes for migrants are feasible. Similar high rates of uptake and acceptability have been previously reported in studies exploring migrant screening.[35](#_ENREF_35),[108](#_ENREF_108) Few studies have explored the views of migrants or service providers on infectious diseases screening,[12](#_ENREF_12) although, in five studies here, both migrants and service providers perceived screening to be acceptable.[35](#_ENREF_35),[51](#_ENREF_51),[52](#_ENREF_52),[62](#_ENREF_62),[71](#_ENREF_71) With this in mind, more effort should be focused around ensuring completion of screening and any subsequent treatment, and acquiring a better understanding of what unique barriers migrants face that impact on their ability to complete the screening process once they have engaged.

Active screening in migrants resulted in better patient outcomes than routine detection of infectious diseases. Migrant screening programmes were consistently found to be moderately or highly cost-effective, depending on migrant group and infections targeted. Analyses were predominantly focused on TB screening in migrants, which was suggested to be cost-effective, particularly when targeted at migrants from high prevalence countries and close contacts. This supports findings from a recent study, reporting that screening for active TB and latent TB can be effective and cost-effective but that this is highly setting-specific, with best results achieved if screening is restricted to high-risk groups and/or migrants from high-incidence countries.[109](#_ENREF_109) Researchers have called for further data on the yield of different screening practices and on cost-effectiveness in order to better design “rational and sustainable screening plans”.[109](#_ENREF_109) Further research is needed, given a lack of consensus in this area and concerns around the strength of existing cost-effectiveness evidence; more robust models are needed which incorporate a migrant perspective – not only a health services cost perspective.[96](#_ENREF_96),[110](#_ENREF_110)

We found several factors that limited the effectiveness of screening. There was low coverage across the studies (39.29%, range 14.53 – 92.50), and nearly a quarter of migrants screened dropped out and did not complete screening and were not ultimately given a diagnosis, which aligns with other recent studies.[22-25](#_ENREF_22) Furthermore, over 60% of diagnosed infections were not detected in screening and identified upon presentation to services (passively). There were also important disparities between studies, with some reporting very low treatment completion rates, as well as disparities across infections. For example, pooled data for TB showed that only 72% of infections were ultimately treated, which reflects the EU/EEA TB treatment rate for new culture-confirmed pulmonary TB cases in 2013 (75.9%),[16](#_ENREF_16),[111](#_ENREF_111) but is below the WHO target of 85%.[112](#_ENREF_112) Treatment completion rates were even lower for latent TB, with only 54.45% (range: 35.71 – 72.27) of migrants completing treatment. One factor to consider with respect to low rates of completion of preventive treatment for LTBI is the low positive predictive value of the tests used (TST or IGRA) for detection, making systematic testing and treatment in high-risk groups difficult to do.[113](#_ENREF_113) A Swiss study has shown that in a specialist migrant centre treatment completion rates for LTBI can be high (60 [80%] of 70 asylum seekers), yet reported that several IGRA-positive migrants (11 of 98) failed to attend the medical assessment post-screening.[114](#_ENREF_114)

These data raise questions around the effectiveness of current screening approaches, and may be partly attributed to the highly mobile nature of this group and significant barriers to engaging with services relating to entitlement to services, fear of accessing services, stigma or discrimination, competing priorities (e.g. work or housing), language, or health literacy.[12](#_ENREF_12),[107](#_ENREF_107),[115](#_ENREF_115),[116](#_ENREF_116) In addition, the effectiveness of screening approaches will be dependent on the political and financial situation in the host country, which may be dependent on whether a host nation is one in which migrants are transiting through (such as many of the southern European countries) or a final destination country (for example, many western European countries).

A key factor associated with non-adherence to TB treatment may be migrants’ legal status and whether or not they are undocumented migrants – individuals who may be marginalised and may fear approaching statutory health services because of concerns around being identified or charged for health care received.[117](#_ENREF_117) It is likely that the effectiveness of public health initiatives targeted at migrants groups, including infectious diseases screening and vaccination, will be inhibited by campaigns to increase charging for migrants accessing health services. There is also concern that data sharing, enabling the use of patient records for immigration enforcement, will exacerbate barriers to care.[116](#_ENREF_116),[118](#_ENREF_118) Increasingly restrictive health services across Europe are likely to lead to poorer and more costly health outcomes, both in migrants and the wider population.[10](#_ENREF_10)

The barriers identified in this review are consistent with previous research around factors inhibiting health services engagement,[116](#_ENREF_116) and strengthen the limited evidence on barriers to infectious diseases screening uptake and treatment completion. In order to improve the effectiveness of screening, it will be essential not only to address these barriers, [12](#_ENREF_12),[119-122](#_ENREF_119) but also to integrate strategies to facilitate access to services for these populations, like those identified in this review. These should include staff training to improve the sensitivity and acceptability of services, outreach work and awareness raising, anonymous testing, and promotion of screening and preventative health. Ultimately, efforts to improve the detection and treatment of infectious diseases in migrant populations should go beyond screening on arrival, prioritising responsive and accessible health systems so that at-risk migrants can approach health systems early. In order to reduce poorer and more costly health outcomes, as well as transmission, it is essential that TB control and care reflects a commitment to early diagnosis, timely and effective treatment, continuity of care (including across borders), and integration of enablers and advocacy to facilitate access to care. [123](#_ENREF_123)

The review provides a systematic examination of data on screening effectiveness across a diverse group of 248,402 migrants, contributing to the limited and inconsistent evidence base around whether infectious diseases screening in migrants is effective or cost-effective. Furthermore, this evidence synthesis provides insight into the under-examined mechanisms which present barriers to or facilitate screening and treatment in the growing migrant population in Europe. However, the review also highlighted several key limitations in the evidence-base, including the low quality of data (with numerous papers not meeting minimum standards for reporting quality), and the lack of studies (and participants) for many of the migrant groups, infections, and settings examined, which resulted in wide ranges in some of the results. The data were also heterogeneous in relation to methods, settings, target populations, and definitions for migrant patients, and were further limited by inconsistency in the criteria for diagnosis of infections, as well as referral pathways of screening programmes. Such variation across the studies make comparisons across the data or the identification of best practice difficult.

As migrants face the largest burden of infectious diseases across Europe, and with major increases in migration to Europe in recent years, screening in this population is undoubtedly an important consideration. While migration may not be a threat to the host community as a whole, transmission within migrant communities ­make the detection and treatment of infectious diseases a priority. [124](#_ENREF_124),[125](#_ENREF_125)

The high uptake and acceptability of infectious diseases screening, and moderate to high cost-effectiveness suggest that infectious diseases screening in migrants in Europe is an effective and cost-effective strategy. Our research shows that migrants are likely to be proactive about their health on arrival, with high uptake into screening programmes, yet the current EU/EEA approach to screening is too limited in scope – focussing on single diseases and a narrow sub-set of forced migrants.

European countries have adopted a variety of approaches to screening migrants for infectious diseases to date. Renewed focus must be placed on developing innovative strategies to delivering screening and the completion of necessary treatment for multiple key infections to a wider group of high-risk international migrants, with policy makers and researchers involved with global migration taking a longer-term view on improving health outcomes in this group as they integrate into health systems in host countries. The particularly high uptake in primary care may suggest that this may be a particularly effective setting in which to screen. This also suggests that offering screening in multiple settings may improve coverage, uptake, and treatment completion in migrant communities, echoing previous recommendations.[35](#_ENREF_35) Though only eight studies reported on screenings in non-clinical community-based settings, they may also be effective sites for screening.[126](#_ENREF_126) Collaborating with community organisations has proved fruitful in past screening studies[44](#_ENREF_44),[65](#_ENREF_65),[86](#_ENREF_86),[127](#_ENREF_127) and qualitative research on screening in migrant communities has pointed to the perceived benefit of collaborations with community organisations and more community-based services due to the increased ownership and the opportunity to build migrant sensitive services.[12](#_ENREF_12) Such settings may thus also enable efforts to address the barriers and facilitators to the detection and treatment of infectious diseases in migrants identified in the research.

Evidence-based guidance on infectious diseases screening to encompass multiple key infections and the broader range of migrants currently residing in the EU are now needed, with a focus placed on effective implementation that will need to be appropriately resourced, as well as a long-term view to ensure health systems are responsive and accessible. More emphasis must be placed on developing innovative and sustainable strategies to increase coverage rates and ensure screening and treatment completion, in order for migrant screening programmes to ultimately be successful, and to better engage newly arrived migrants in latent TB screening. Such priorities will be essential to achieve TB targets across Europe. Policy makers and researchers involved with global migration need to ensure a longer-term view on improving health outcomes in migrant populations as they integrate into health systems in host countries.

**Contributions**

SH and JSF conceived the project. FS coordinated the data collection and analysis, and FS, SH, JO, and LN did the abstract screening and identified included papers. FS, JO, and LN did the data extraction and all authors supported the analysis and interpretation of data. FS, SH, and LN wrote a first draft of the paper and JSF, MB, and JO inputed into subsequent drafts.

**Conflict of interest**

SH is a Senior Editor at TLID. All other authors declare no conflicts of interest.

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**Table 1** Definitions of effectiveness indicators for screening interventions

|  |  |
| --- | --- |
| Uptake | Percentage of persons who agreed to be screened after being offered screening for a disease. |
| Coverage | Percentage of eligible persons within the target population who had been screened for a disease through the intervention during the study period. |
| Infections detected | Percentage of disease detected for each disease tested in the screening intervention. |
| Patients not diagnosed | Percentage of population who began screening but who dropped out before diagnosis could be made. |
| Infections treated | Percentage of population who completed treatment when offered. |
| Infections not treated | Percentage of population who were offered treatment, but did not complete it. |
| Active diseases missed by screening | Percentage of active diseases reported in the target population who were passively detected and therefore missed by the screening intervention. |

**Table 2** Effectiveness of infectious disease screening in migrants

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome** | **Observations** | **Mean *N* (SD)** | **Median *N* (range)** |
| All\*\*\* | 87 | 4663.14 (11428.14) | 371.00 (31.00-68122.00) |
| Uptake | 33 | 1082.52 (2113.74) | 79.50 (18.62 – 100.00) |
| Coverage | 11 | 19632.90 (15305.80)\* | 39.29 (14.53- 92.50) |
| Infections detected | 83 | 3336.30 (9355.02) | 3.74 (0.00 - 95.16) |
| Patients not diagnosed | 16 | 2261.88 (3630.49) | 24.62 (0.12 – 78.99)\*\* |
| Infections treated | 20 | 39.95 (101.28) | 83.79 (0.00 – 100.00) |
| Diagnosed infections missed by screening | 10 | 380.90 (652.83) | 60.21 (9.09 - 94.44) |

*N* = number of migrants in the sample/analysis; Observations = number of times across all 46 included papers the outcome was presented; SD = standard deviation

\*Missing data for one observation

\*\*Remaining studies did not have cases not diagnosed

\*\*\*Includes only numbers in the quantitative analysis. Three studies (mean *N*=54.67 [13.58], median 53.00 [42.00-69.00]) were only on implementation issues and not included in the effectiveness analysis.

**Table 3: Effectiveness indicators according to setting**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Setting of intervention | **Uptake** | | | **Infections detected** | | | **Patients not diagnosed** | | | **Infections treated** | | |
| Obs | Mean *N* (SD) | Median % uptake (range) | Obs | Mean *N* (SD) | Median % infected (range) | Obs | Mean *N* (SD) | Median % not diagnosed (range) | Obs | Mean *N* (SD) | Median % treated (range) |
| Migrant centre or place of residence | 11 | 2316.64 (3339.90) | 78.59 (53.61-100.00) | 16 | 4245.56 (5702.73) | 1.25 (0.00-60.00) | 7 | 2394.00 (3076.09) | 28.57 (1.54-67.18) | 3 | 61.67 (54.60) | 83.00 (57.66-100.00) |
| Specialist healthcare | 8 | 610.75 (531.00) | 68.06  (18.62-99.35) | 24 | 434.29 (673.32) | 10.98 (0.16-95.16) | 5 | 977.00 (934.55) | 29.83 (0.16 -78.99) | 5 | 5.40 (3.58) | 100.00 (33.33-100.00) |
| Non-clinical community setting | 5 | 713.20 (666.99) | 78.41  (32.34-100.00) | 6 | 291.33 (141.50) | 2.65 (0.63-15.94) | 0 | . | . | 2 | 7.50 (3.54) | 5.00 (0.00-10.00) |
| Primary healthcare | 7 | 44.14 (17.70) | 96.77 (76.00-100.00) | 16 | 4596.31 (16947.41) | 3.31 (0.00-40.00) | 1 | 39.00 | 23.08 | 5 | 97.60 (199.39) | 100 (84.58-100.00) |
| Border | 0 | . | . | 3 | 14741.33 (25168.39) | 0.36 (0.00-1.01) | 0 | . | . | 1 | 44.00 | 72.27 |
| Mixed | 2 | 739.50 (818.12) | 86.49 (79.50-93.47) | 14 | 5251.86 (5069.12) | 3.97 (0.22-31.81) | 3 | 4836.00 (7219.54) | 5.47 (0.12-19.40) | 2 | 5.50 (4.95) | 83.34 (66.67-100.00) |

*N* = number of migrants in the sample/analysis; Obs = number of times across all 46 included papers the data were presented; SD= standard deviation

**Table 4 Effectiveness indicators according to target migrant population**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Target population | **Uptake** | | | **Infections detected** | | | **Patients not diagnosed** | | | **Infections treated** | | |
| Obs | Mean *N* (SD) | Median % uptake (range) | Obs | Mean *N* (SD) | Median % infected (range) | Obs | Mean *N* (SD) | Median % not diagnosed (range) | Obs | Mean *N* (SD) | Median % treated (range) |
| All immigrants | 13 | 362.31 (504.59) | 78.59 (18.62-100.00) | 29 | 3378.72 (12573.30) | 3.20 (0.00-23.33) | 5 | 375.60 (483.47) | 26.16 (0.16-78.99) | 7 | 69.57 (169.54) | 100.00 (55.56-100.00) |
| Asylum seekers and refugees | 6 | 3869.83 (3986.62) | 89.81 (57.81-100.00) | 19 | 6261.05 (5990.31) | 3,11 (0.11-60.00 | 5 | 6181.20 (4585.60) | 5.28 (0.12-64.51) | 5 | 51.40 (40.78) | 72.27 (57.66-100.00) |
| HIV migrants | 5 | 327.80 (96.60) | 70.62 (64.42-99.35) | 16 | 179.69 (64.25) | 16.84 (1.61-95.16) | 0 | . | . | 3 | 3.00 (2.00) | 100.00 (33.33-100.00) |
| Place-specific migrants | 5 | 713.20 (666.99) | 78.41 (32.34-100.00) | 7 | 268.71 (142.36) | 3.01 (0.63-15.94) | 0 | . | . | 2 | 7.50 (3.54) | 5.00 (0.00-10.00) |
| Undocumented migrants | 4 | 647.25 (574.20) | 86.36 (66.13-93.47) | 5 | 648.20 (402.77) | 1.56 (0.62-31.81) | 6 | 567.67 (410.72) | 23.99 (5.47-67.18) | 1 | 2.00 | 100.00 |
| Pregnant migrants | 0 | . | . | 1 | 179.00 | 42.20 | 0 | . | . | 0 | . | . |
| Foreign workers | 0 | . | . | 1 | 43803.00 | 0.36 | 0 | . | . | 0 | . | . |
| Foreign students | 0 | . | . | 1 | 2469.00 | 0.16 | 0 | . | . | 0 | . | . |

*N* = number of migrants in the sample/analysis; Obs = number of times across all 46 papers the data were presented; SD = standard deviation

***Table 5 Effectiveness outcomes by infection***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **infection** | **Uptake** | | | **Infections detected** | | | **Patients not diagnosed** | | | | **Infections treated** | | |
| Obs | Mean *N* (SD) | Median % uptake (range) | Obs | Mean *N* (SD) | Median % infected (range) | Obs | Mean *N* (SD) | Median % not diagnosed (range) | Obs | | Mean *N* (SD) | Median % treated (range) |
| Tuberculosis (combined) | 8 | 2551.50 (3734.53) | 86.49 (18.62-100.00) | 26 | 7261.62 (15573.07) | 0.59 (0.00-31.81) | 12 | 1749.92 (2486.13) | 24.62 (1.54-78.99) | 7 | | 100.00 (161.03) | 72.27 (56.56-100.00) |
| Latent TB | -- | -- | -- | 8 | 1101.38 (1556.38) | 15.02 (0.35 – 31.81) | 4 | 818.75 (514.87) | 26.67 (0.16 – 6718) | 4 | | 20.50 (15.89) | 54.45 (35.71 – 72.27) |
| Hepatitis B | 4 | 508.50 (632.71) | 87.39 (32.34-100.00) | 10 | 2001.00 (4179.85) | 7.29 (0.63-29.02) | 0 | . | . | 1 | | 5.00 | 0.00 |
| Hepatitis C | 3 | 598.67 (741.80) | 78.59 (32.34-96.77) | 7 | 852.71 (945.55) | 3.14 (0.00-5.85) | 0 | . | . | 1 | | 10.00 | 10.00 |
| HIV | 3 | 157.33 (152.68) | 82.46 (77.06-96.77) | 5 | 1033.00 (1068.23) | 3.20 (1.20-4.81) | 0 | . | . | 0 | | . | . |
| Parasites | 7 | 964.43 (1671.94) | 81.54 (53.61-100.00) | 20 | 861.80 (2185.16) | 14.66 (1.61-60.00) | 0 | . | . | 8 | | 6.75 (6.61) | 100.00 (33.33-100.00) |
| Other | 5 | 303.00 (152.05) | 70.62 (64.42-96.77) | 9 | 3592.33 (5021.50) | 3.33 (0.22-95.16) | 1 | 13148.00 | 0.12 | 1 | | 1.00 | 100.00 |

*N* = number of migrants in the sample/analysis; Obs = number of times across all 46 papers the data were presented; SD = standard deviation.

**Table 6 Summary of barriers and facilitators of screening programmes identified in included papers**

|  |  |
| --- | --- |
| **Barriers** | **Facilitators** |
| Migrant insensitivity   * Fear of screening providers judgment * Discrimination and fear of racism and health tourism stigma * Anxiety about breaches in confidentiality * Lack of professionalism * Lack of staff training and support | Well-trained and dedicated screening staff   * Ensuring confidentiality * Communication * Culturally sensitive and appropriate services * Free from discrimination * Trust and respect of staff’s judgment * Language support   Migrant involvement   * Patient involvement in delivery * Increasing migrant community ownership and collaborations |
| Culture and individual mind-set   * Low perception of risk * Missing tradition of preventative health-seeking behaviour * Fear of disease-related stigma and social rejection * Fear of disease-related consequences * Misconceptions of diseases | Outreach   * Tailored awareness-raising in migrant communities prior to screening provision of (a) health access (b) disease * Testing in user-friendly outreach settings   General health check approach and promotion  Anonymous testing approach |
| Other individual barriers   * Limited financial resources * Insufficient information and explanation of screening |
| Structural and service barriers   * Poor management (referrals) * Incoherency of screening (screening in different settings) * Multiple steps for screening test * Lack of appropriate confidential space * Funding * Difficulty to communicate between laboratory for result queries * Lack of time | Service provider management   * Quick turnover of results * Efficient referrals * High quality support * Clear algorithms for screening service * Quality assurance * Good coordination |