BMJ Open

Interventions to improve latent and active tuberculosis treatment completion rates in underserved groups in low incidence countries: a scoping review

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ABSTRACT

Background People in underserved groups have higher rates of tuberculosis (TB) and poorer treatment outcomes compared with people with no social risk factors.

Objectives This scoping review aimed to identify interventions that improve TB treatment adherence or completion rates.

Eligibility criteria Studies of any design focusing on interventions to improve adherence or completion of TB treatment in underserved populations in low incidence countries.

Sources of evidence MEDLINE, Embase and Cochrane CENTRAL were searched (January 2015 to December 2023).

Charting methods Piloted data extraction forms were used. Findings were tabulated and reported narratively. Formal risk of bias assessment or synthesis was not undertaken.

Results 47 studies were identified. There was substantial heterogeneity in study design, population, intervention components, usual care and definition of completion rates. Most studies were in migrants or refugees, with fewer in populations with other risk factors (eg, homelessness, imprisonment or substance abuse). Based on controlled studies, there was limited evidence to suggest that shorter treatment regimens, video-observed therapy (compared with directly observed therapy), directly observed therapy (compared with self-administered treatment) and approaches that include tailored health or social support beyond TB treatment may lead to improved outcomes. This evidence is mostly observational and subject to confounding. There were no studies in Gypsy, Roma and Traveller populations, or individuals with mental health disorders and only one in sex workers. Barriers to treatment adherence included a lack of knowledge around TB, lack of general health or social support and side effects. Facilitators included health education, trusted relationships between patients and healthcare staff, social support and reduced treatment duration.

Conclusions The evidence base is limited, and few controlled studies exist. Further high-quality research in well-defined underserved populations is needed to confirm the limited findings and inform policy and practice in TB management. Further qualitative research should include more people from underserved groups.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Strengths of this scoping review were the comprehensive searches using sensitive search strategies, full-text screening by several reviewers and detailed data extraction.

⇒ A further strength was the inclusion of any study design to capture all relevant evidence.

⇒ Limitations included the lack of formal risk of bias assessment and lack of formal quantitative synthesis.

INTRODUCTION

Tuberculosis (TB) is the 13th leading cause of death worldwide, with over 80% of cases and deaths in low-income and middle-income countries.[1] In low incidence countries, TB tends to be most prevalent in vulnerable populations such as migrants, people experiencing homelessness or people with substance abuse disorders.[2] In England, there has been a decline in TB notification rates over the last 10 years, but the rate of decline has slowed, with rates remaining highest in large urban areas with high levels of deprivation and in underserved groups.[3] Underserved groups have been defined by the Collaborative Tuberculosis Strategy for England as 'individuals whose social circumstances, language, culture or lifestyle (or those of their parents or carers) make it difficult to recognise the clinical onset of TB, access diagnostic and treatment services, self-administer treatment (or, in the case of children and young people, have treatment administered by a parent or carer); or attend regular appointments for clinical follow-up'.[4] Some migrant groups (eg, asylum seekers and refugees), people who experience homelessness, people in contact with the criminal justice system, or with mental health needs, and/or drug and alcohol misuse are all included in this

definition.[3 5] It can include other groups who share a common feature of being underserved by healthcare services due to a lack of access or other issues.[5]

People in underserved groups not only have higher rates of TB but also poorer treatment outcomes, for example, higher rates of death and/or loss to follow-up in people with at least one social risk factor compared with those without a social risk factor.[5]

This scoping review was undertaken to inform the 2023 update of Tackling TB in Inclusion Health Groups: A toolkit for a multi-agency approach resource,[6] which aims to provide best practice, shared learning and recommendations to support the design, delivery and improvement of services to tackle TB in underserved groups in England and support the TB Action Plan for England, 2021–2026.[5] Undeserved groups, termed 'health inclusion groups' in the recent toolkit update, include those with one or more social risk factors such as current or history of drug misuse, homelessness or imprisonment. The aim of this scoping review was to provide an overview of the recent evidence base for interventions or approaches that could help improve treatment adherence and/or completion rates for both active and latent TB in underserved groups in low incidence countries. This is particularly relevant in a post-COVID-19 context, due to the fragmentation of some services that arose during the pandemic.[7]

An existing systematic review, published in 2018, updated and extended work commissioned by the National Institute for Health and Care Excellence and assessed the effectiveness of service delivery and organisational models to manage TB within these populations.[8 9] A further systematic review focused on the qualitative literature on barriers and facilitators to TB management in such populations.[10] For this scoping review, it was, therefore, decided to focus on more recent evidence since the publication of these two systematic reviews.

METHODS

Methods for this scoping review were guided by the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis.[11] A scoping review approach was chosen to map the availability of evidence in terms of volume, study design/s and type of underserved population; to summarise the evidence for different approaches to improving TB treatment adherence or completion rates in underserved populations; to provide a resource of extracted data from primary studies and to identify gaps in the evidence. We believe our question was suitable for this scoping approach due to the broad nature of the question (any study designs or intervention, active and latent TB, any underserved population), the fact that we anticipated gaps in the literature and were not aiming to use results to answer a defined question on the effectiveness of a specific intervention or to inform guidance or practice.[12] The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews

(PRISMA-ScR) checklist was adhered to (online supplemental material 1).[13]

Searches

Sensitive search strategies using text and index terms relating to TB, underserved populations and treatment completion or adherence were used (online supplemental material 2). The term 'inclusion health group', more recently preferred to 'underserved' or 'vulnerable' group, was not included in the search strategy as preliminary searches did not find this term represented in relevant articles. MEDLINE ALL (Ovid), Embase (Ovid) and Cochrane CENTRAL were searched from January 2015 to December 2023 to identify studies since the previous relevant systematic reviews were published. There were no restrictions by study design, language or intervention. Reference lists of existing systematic reviews were checked for additional studies.

Study selection

Titles and abstracts were screened by one reviewer (JD) and full texts were checked by two or more reviewers (JD, CH, AR and LA). Any disagreements were resolved through discussion with the whole team. The study selection process was documented in a PRISMA flow diagram (figure 1), and reasons for exclusion of full-text studies were recorded. Primary studies of any design were included where they assessed the effect of an intervention on treatment completion and/or adherence rates in underserved groups in low incidence countries (online supplemental material 3 for full inclusion and exclusion criteria). Mixed populations including underserved groups were included providing subgroup analyses were reported for the underserved groups only. Single-arm studies were included to gain an overview of any additional interventions and risk groups they were evaluated in, and to record factors associated with non-completion. Underserved groups included populations described as disadvantaged, underserved, hard-to-reach or vulnerable; prison populations; underserved or undocumented migrants, refugees, asylum seekers, victims of human trafficking/modern slavery or unaccompanied minors; homeless people; sex workers; Gypsy, Roma, Traveller (GRT) groups; people with alcohol and/or drug misuse; people with mental health disorders. Both active and latent TB were included. Any intervention was eligible, including changes to existing services, introduction of new services or comparisons between different treatment approaches providing the focus was on underserved groups. Studies exploring different approaches to screening or testing were included as studies show that there can be significant losses to care at that point.[14] The nature of this initial contact may, therefore, have an effect of retaining people in the cascade of care. Such studies had to report the effect on treatment adherence or completion, studies only reporting screening uptake were excluded. Qualitative evidence was included where this was in the context of treatment approaches to TB in underserved populations.
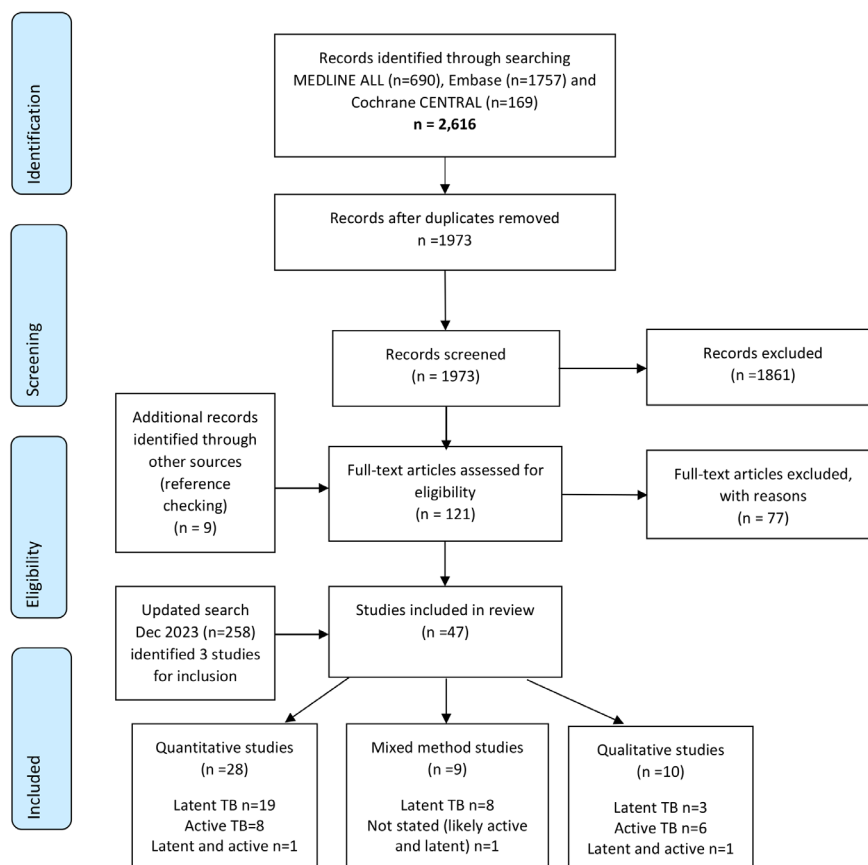
Figure 1 PRISMA flow diagram. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Low incidence countries were defined by the WHO estimates of TB incidence by country and territory, 2020 (updated June 2022).[15]

Data extraction

A piloted data extraction form was used. For quantitative studies, data items extracted included study design, population characteristics (risk factors, type of TB (latent/active), sample size), details on intervention and comparator (where applicable), completion rates and factors associated with non-completion. For qualitative studies, data items extracted included population characteristics, sample size, data collection and analysis method, method of recruitment and representativeness of sample, intervention and comparator (where applicable), and main facilitators and barriers to adherence and/or treatment completion. Formal risk of bias assessment was not undertaken, but any study limitations as described by the study authors were recorded.

Synthesis

Findings were tabulated and reported narratively. Studies were grouped by type of intervention and further subgrouped where applicable by population and type of TB (active or latent). Meta-analysis, for example, of completion rate was precluded by substantial heterogeneity in study design, populations, settings, interventions, drug treatment regimen and definition of completion rate. No formal thematic or other synthesis of qualitative findings was undertaken, but the main barriers and facilitators to treatment adherence and/or completion were extracted and narratively summarised.

Patient and public involvement

Patients or the public were not involved in this scoping review.

RESULTS

47 studies were included: 28 quantitative, 9 mixed-methods and 10 qualitative studies (figure 1). Figure 2 shows the volume of evidence by study design, type of underserved population and latent or active TB. Most studies (n=27) were in migrants/refugees (57.4%), six studies (12.8%) were in (predominantly) people experiencing
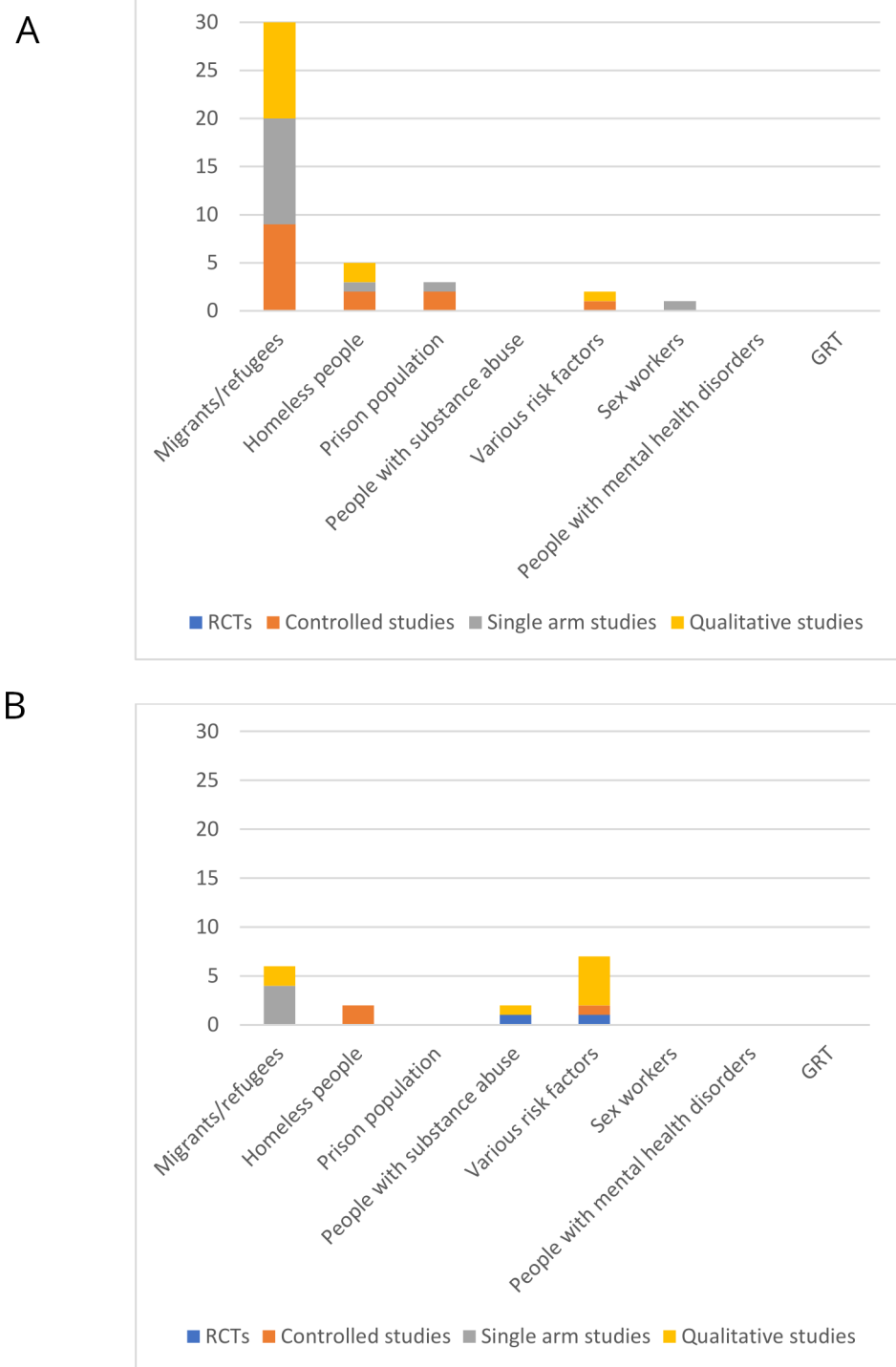
Figure 2 (A) Number and type of studies in different underserved groups—latent TB. (B) Number and type of studies in different underserved groups—active TB. Mixed-methods studies contributed to both qualitative and quantitative study numbers; qualitative studies undertaken either in underserved population or in health care workers; various risk factors include the other categories but are not focused specifically on a single type of underserved population; studies with mixed populations (latent/active) included in both Figure A and B; GRT, Gypsy, Roma, Traveller; RCTs, randomised controlled trials.

homelessness, three (6.4%) in prison populations, two (4.3%) in people with substance abuse, one (2.1%) in sex workers and eight (17.0%) in populations with a variety of risk factors. There were no studies in the GRT population, and no studies focused specifically on those with mental health disorders, although this was an additional risk factor in some populations. No studies specifically mentioned victims of human trafficking/modern slavery or unaccompanied minors. Thirty (63.8%) were in latent TB, 14 (29.8%) were in active TB and three (6.38%) focused on both active and latent TB. Of the latent TB studies, most (70%) were in migrants/refugees, and of
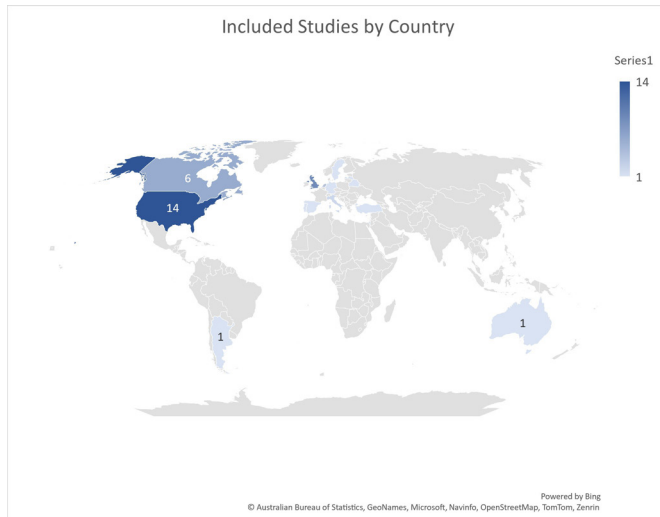
Figure 3 Included studies by country.

the active TB studies, most (71.4%) were in populations with social risk factors (homelessness, prison, substance abuse or a variety of risk factors).

Of the quantitative studies (n=36 including the quantitative component from mixed-methods studies), only 2 (5.5%) were randomised controlled trials (RCTs), 17 (47.2%) were studies including a control group (concurrent, historical or before-and-after study) and 17 (47.2%) were single-arm studies. Nineteen studies contributed to qualitative evidence (10 qualitative studies and 9 mixed-methods studies). Most studies were based in the USA, the UK or Canada (figure 3). The focus of the results reported here is on findings from the RCTs and controlled studies, as single-arm studies are inherently inappropriate for demonstrating a benefit of a certain type of treatment, and comparisons across single-arm studies were not possible due to substantial clinical and methodological heterogeneity. Additional details on single-arm and qualitative studies are in online supplemental materials 4,5.

Different drug regimens and treatment lengths
We identified four studies, all in latent TB. Four observational studies compared 3HP (3 months of once-weekly isoniazid plus rifapentine), or either 3HP or 4R (4 months of daily rifampin) with 6H (isoniazid for 6 months) or 9H (isoniazid for 9 months) (online supplemental material 6 for Table of study characteristics and main findings from RCTs and controlled studies).[16–19] Study populations were prisoners in two US studies[17 19]; the general population with subgroup analyses for people experiencing homelessness, 'irregular' migrants sent by non-governmental organisations (NB 'irregular' not further defined by study authors) and asylum seekers/refugees in an Italian study[18] and government-assisted refugees in a Canadian study.[16] Studies consistently found higher completion rates with the shorter 3HP or 4R regimens compared with the longer 6H or 9H regimens, with statistically significant differences based on unadjusted analyses in two of the four studies (p<0.001[17] and p<0.0001[18]). For the study

that looked at completion rates by subgroup, the shorter treatment regimen was found to have higher completion rates (p<0.0001) in favour in people experiencing homelessness.[18] There was no statistically significant difference for migrants or refugees/asylum seekers (unadjusted analyses).[18] Main reasons for treatment non-completion included parole, discharge or transfer out of prison for the prison populations.[17 19] One study found that shorter treatment duration and female sex tended to positively affect treatment completion in government-assisted refugees.[16]

Different types of treatment administration (directly observed therapy/video-observed therapy/self-administered treatment)
We identified one study in active TB and two studies in latent TB.

An RCT set in the UK compared directly observed therapy (DOT) with video-observed therapy (VOT) in a population with active TB and social risk factors.[20] This study found significantly higher completion rates with VOT compared with DOT (adjusted OR (95% CI): 2.52 (1.17 to 5.47), p=0.019[20]). Levels of initial engagement with DOT were substantially lower compared with VOT, with particularly low engagement (with DOT) among younger adults, foreign-born patients and those without social risk factors or mental health problems.[20] An Argentinian prospective cohort study in active TB did not directly compare modes of administration but found that self-administered treatment (SAT) was associated with a higher risk of incomplete treatment compared with DOT or mixed DOT/SAT (based on multivariable model, in socioeconomically disadvantaged patients).[21]

A US-based retrospective cohort study compared DOT with SAT in a homeless population with latent TB and found significantly higher completion rates with DOT (adjusted OR (95% CI): 1.40 (1.07 to 1.82), p=0.014).[22] A retrospective cohort set in Israel also found slightly lower treatment completion rates with SAT compared with semi-DOT in Ethiopian immigrants with latent TB living in reception centres, though the difference was not statistically significant (adjusted OR (95% CI): 0.54 (0.28 to 1.04), p=0.08).[23] Semi-DOT was defined as once weekly DOT administered by a nurse with the second weekly dose self-administered.

Factors significantly associated with treatment completion in the US cohort were male sex, being black/African American, older age and positive HIV status, while alcohol use was associated with decreased odds of completing treatment.[22] The Israeli cohort found that treatment completion was significantly lower in those with side effects.[23]

Screening or testing approaches
We identified three studies in latent TB. Two studies in latent TB compared the impact on treatment outcomes of different screening strategies. A Canadian retrospective cohort study compared screening with an interferon gamma release assay (IGRA) test only with a sequential

screening strategy (tuberculin skin test (TST) followed by IGRA if positive TST).[24] Treatment completion rates were very similar among those who started treatment, however, screening completion rates were higher with the IGRA only strategy (adjusted OR (95% CI): 3.74 (2.30 to 6.09) p<0.001). A US-based before-and-after study compared a strategy of mainly IGRA (post-2011) with a strategy of mainly TST (pre-2011).[25] Treatment completion rates were also similar, but diagnosis of latent TB was higher pre-2011 and treatment initiation was higher post-2011. In both studies, patients were treated in the same way once identified as eligible for treatment though either screening strategy. A study set in the Netherlands looked at six different community strategies, including education sessions, for engaging Eritrean migrants with screening for latent TB and subsequent treatment.[26] The treatment completion rate was 97% overall, but there was no analysis by type of community strategy. Uptake of latent TB education differed between strategies from 13% to 75%, and uptake of screening after education sessions was 64%.

Strategies tailored to people experiencing homelessness, social risk factors or substance abuse

We identified three studies in active TB and one study in latent TB.

Among the active TB studies, one was undertaken in a homeless population,[27] and one in a population with social risk factors where many were homeless.[28] In both, a standard approach to TB treatment was compared with an enhanced approach with provision of additional services (a UK residential respite service[27] or integration of a social care team into a UK TB service[28]). Both included social and mental health support and support for drug/alcohol use, and in one study, accommodation was also provided.[27]

An RCT set in the USA was undertaken in substance users (drug and/or alcohol) that compared provision of DOT by community outreach staff who were former substance users with standard DOT.[29] All three studies found that completion rates were significantly higher in the enhanced arms (RR (95% CI: 2.5 (1.2 to 5.1), p value not reported),[29] adjusted OR (95% CI): 2.97 (1.44 to 6.96), p value not reported[27] and adjusted OR 2.35 (95% CI 1.41 to 3.91), p=0.001[28]).

A US study in homeless people with latent TB compared a standard approach with a nurse-led, community health worker programme.[30] This also included social and mental health support and support for drug/alcohol use and the community health workers were formerly homeless people. Completion rates were higher in the enhanced programme (91.8% in prospective arm compared with 66% in historical control, no summary estimate provided).

Factors for non-completion were variable, for example, non-completion more likely in people aged <50 (in the intervention group in the latent TB study[30]); or a more unstable housing situation (regardless of treatment type) in the US-based RCT in active TB.[29]

Strategies tailored to migrants, refugees and asylum seekers

We identified four studies in latent TB. A US retrospective cohort study compared a refugee health clinic, which included collaborative working between refugee resettlement agencies and refugee health clinics, with a standard clinic.[31] An Australian retrospective cohort study compared a refugee health and well-being service providing intensive transitional care with a universal primary care clinic.[32] Services provided by the clinics included interpreter services, educational material and multidisciplinary healthcare teams. Significantly greater completion rates were reported both in the refugee health clinic compared with the standard clinic (unadjusted OR (95% CI): 9.44 (2.39 to 37.30), p value not reported[31]) and the refugee health and well-being service compared with the universal primary care clinic (OR not reported, p=0.0373 based on unadjusted analysis).[31 32] Factors associated with non-completion were not reported. One retrospective cohort study compared TB physician and nursing outreach integrated into an Israeli migrant reception centre with a regional TB clinic.[33] Both study arms included nurse-managed semi-DOT and transport to regional clinics was provided free of charge.[33] Completion rates were similar. Factors significantly associated with non-completion were age <5 years and side effects. A Swedish study compared standard care (up to 2013) with a strategy of all subjects being given prescheduled appointments for nurse visits, assisted by interpreters.[34] The completion rate was significantly higher in those initiating treatment after 2013 compared with those initiating treatment earlier (OR not reported, p<0.01 based on unadjusted analysis). Additional factors significantly associated with completion were a regimen of isoniazid treatment for 6 months compared with 9 months and receiving latent TB treatment in connection with immunosuppressive treatment (multivariate analysis).

Conditional cash transfer

We identified one study in active TB. An Argentinian prospective cohort study compared conditional cash transfer (contingent on adherence to health checks and treatment) with standard care in a socioeconomically disadvantaged population.[21] Treatment success was significantly higher with the conditional cash transfer (adjusted OR 2.91 (95% CI 1.97 to 4.28), p=0.001). Factors associated with incomplete treatment were SAT, younger age, lack of insurance, lower income and use of alcohol and illicit drugs.

Single-arm studies

There were 17 single-arm studies (5 as part of a mixed-methods study, online supplemental material 4). These looked at completion rates after 3HP/DOT (in prisoners[35] and people experiencing homelessness[36]); mandatory screening in asylum seekers[37]; a migrant focused TB screening programme[38]; medical examination by civil surgeons for people who were adjusting immigration status to permanent residency[39]; screening at a sexual

health clinic for sex workers[40]; integrated clinics for migrants, refugees or asylum seekers[41–46]; other strategies tailored to migrants, refugees or asylum seekers (such as engaging community health workers or TB education)[47–50] or the effect of the CureTB Programme, a continuity of care programme for patients relocating outside of the USA before completing treatment.[51] Completion rates were not directly comparable due to heterogeneity in populations, settings, approaches to screening and treatment, length and methods of follow-up and definition of completion rate, as well as any differences in intervention components. Nonetheless details on factors associated with non-completion (reported in online supplemental material 4) may be useful for those interested in the feasibility of such approaches.

Qualitative evidence

There were 19 studies contributing evidence on barriers and facilitators to initiating and completing treatment for latent or active TB (online supplemental material 5). There was substantial variability in population characteristics, setting and type of interventions experienced or delivered. Eleven studies (57.9%) focused on providing TB care to migrants or refugees, the remainder on people with social risk factors (homelessness, substance abuse or a combination of risk factors). Eight of the studies (42.1%) included only healthcare workers but also provided data on perceived patient level barriers and facilitators. Some barriers were common across several studies, including: a lack of knowledge particularly around latent TB and TB-associated stigma; fear of disclosure and language barriers (especially for migrants); lack of other (non-TB) health or social support; unstable housing and transience of population; lack of staff resources; lack of connectivity between different services and burden of treatment including side effects. Some common facilitators included health education; building trusted relationships between patients and healthcare staff; collaborative working with other services or community organisations; social support and reduced treatment duration. Some barriers were population specific, for example, coping with withdrawal symptoms while in hospital (people with substance use disorder), inability to safely store medications (people experiencing homelessness) or fear of deportation (asylum seekers). Population-specific facilitators included the use of interpreters (asylum seekers/refugees), hostel workers reminding patients to take medication (people experiencing homelessness) or referral to support for substance abuse.

DISCUSSION

This scoping review identified 47 quantitative, mixed-methods or qualitative studies focusing on TB treatment adherence in underserved populations in low incidence countries. Heterogeneity across studies was high in terms of study design, population, country, intervention components, usual care and outcome definitions. Focusing on the 19 quantitative controlled studies, higher completion rates were found with VOT compared with DOT (statistically significant finding from one RCT) and with conditional cash transfer compared with standard care alone (statistically significant finding from one observational study, adjusted result) for active TB. For latent TB, higher completion rates were consistently found with shorter treatment regimens compared with longer treatment regimens (statistically significant findings in two of four studies, unadjusted results); DOT or semi-DOT compared with SAT (statistically significant finding in the DOT study, adjusted result); clinics that integrated TB services within primary care compared with standard TB care (statistically significant findings in two studies, unadjusted results); and other refugee focused services (such as prescheduled appointments assisted by interpreters) compared with standard clinics (statistically significant finding in one of two studies, unadjusted result). Enhanced approaches that included social, mental health and drug/alcohol use support compared with standard TB care led to higher completion rates for both active and latent TB (statistically significant findings in three of four studies, results from RCT or adjusted results). Evidence from two studies exploring whether types of screening for latent TB had an impact found little difference in treatment completion rates when comparing IGRA alone versus TST followed by IGRA, or IGRA alone versus TST alone. However, screening completion rates were higher with a one-step screening approach (statistically significant finding from one study, adjusted result), which could affect the overall number of people treated.

Factors associated with non-completion were inconsistently reported in the quantitative studies, but included treatment side effects, instability of housing, transience of population and use of alcohol or drugs; a factor associated with treatment completion was a shorter treatment regimen. This was reflected in the findings from the qualitative evidence where factors such as side effects and unstable housing were also found to be barriers to treatment completion, and reduced treatment duration was found to be a facilitator. Other facilitators identified across the qualitative evidence included health education and social (and language) support, while common barriers include a lack of disease knowledge, stigma and lack of cohesion and resources across different services.

Strengths of this scoping review were the comprehensive searches using sensitive search strategies, full-text screening by several reviewers and detailed data extraction. A further strength was the inclusion of any study design to capture all relevant evidence. Nonetheless the evidence identified was limited: findings from the controlled studies were based on 1–4 (mostly observational) studies for each comparison and should therefore be interpreted cautiously. Evidence from observational studies is likely to be subject to confounding and not all studies adjusted for this. Formal risk of bias assessment was not undertaken, and heterogeneity precluded any formal synthesis. There is a lack of consistency in

the literature around defining vulnerable populations. Despite a sensitive search strategy, it is possible that studies may have been missed where vulnerable populations and/or treatment completion were described using different terminology.

Given the limitations of the published evidence base, the results of this evidence review were combined with several additional sources to inform the Tackling TB in Inclusion Health Groups: A toolkit for a multi-agency approach document.[6] These included:

► A rapid consultation exercise with TB nurses and regional TB programme managers and leads on how their services work with inclusion health groups, and their experience of the challenges and enablers.

► A UK Health Security Agency (UKHSA) Knowledge and Library Service evidence review looking at the impact of the COVID-19 pandemic on TB services for inclusion health groups.

► Collection of recommendations, exemplars of local and regional good practice from across the country, and tools, links and resources for services to draw on and adapt locally.

► Comments and contributions from a wide range of stakeholders and also via two task and finish groups.

Improved representation of inclusion health/underserved groups within TB research is still needed to support further steps to improve prevention, detection and control of TB in these populations.

A previous systematic review[8] evaluated screening and completion rates in underserved populations in low incidence countries. The authors found that adherence or completion rates were increased in drug users with more intensive or tailored approaches compared with standard care: enhanced case management by peers[52]; mobile screening and treatment service at a convenient community location[53]; and DOT and active follow-up of non-adherent patients.[54] A fourth study included in the systematic review found no difference in completion rates in migrants, drug users, homeless people and prisoners when DOT was at a convenient location in the community versus at a health clinic.[55] This finding of higher completion rates with more enhanced approaches in three out of four studies is consistent with the findings from the more recent studies identified in this scoping review. Some of the barriers (eg, stigma) and facilitators (eg, social support) identified here are also similar to those identified in a 2017 systematic review of qualitative evidence.[10] These findings are also reflected in higher incidence settings. A recent systematic review looking at interventions throughout the TB care cascade for active TB in mainly low-income and middle-income countries found that interventions that included counselling and education were significantly associated with treatment success.[56] A further systematic review assessing community-based TB interventions (such as electronic medication monitors, community health worker or family direct observation therapy) in low-income and middle-income countries found these approaches may improve

treatment success while also offering convenience to patients.[57]

Evidence on sex workers was limited to one single-arm study, and no studies were identified that focused on GRT populations. There were no studies that focused specifically on people with mental health disorder, though this was an additional risk factor in some studies. No studies specifically mentioned victims of human trafficking/modern slavery or unaccompanied minors. Future studies should focus on these underrepresented groups in particular. While a larger proportion of evidence was in migrants, asylum seekers or refugees, this is not a homogeneous group and there is variation around the terminology and categories used for different groups of migrants. There is no uniform understanding in the literature of what constitutes a 'vulnerable' population. While some groups, for example, incarcerated populations, are reasonably well defined and studied, some groups may have risk factors which align them with more than one (overlapping) category thus making their identity more difficult to capture.[58] Future studies should consider this when defining populations for research. Given the strong connection between social determinants of health and TB-related vulnerability, future studies should also consider strategies that are linked to alleviation of poverty and social protection.[58]

Only 17 low incidence countries contributed to the evidence base, with much of the evidence originating from the USA, the UK and Canada, which raises questions about generalisability to other countries. Much of the evidence is observational and future studies would benefit from a randomised design, for example, cluster randomisation, to minimise selection bias. Future qualitative research should include more people from underserved groups in addition to healthcare workers, as the former group was often underrepresented in the body of evidence identified here.

CONCLUSION

Evidence in underserved populations is limited, heterogeneous in terms of study design, populations, settings and interventions, and mostly observational in nature. The available evidence from controlled studies suggests that shorter treatment regimens, VOT compared with DOT, DOT compared with SAT, and approaches tailored to specific populations and that include health or social support beyond TB treatment may lead to improved adherence and completion rates. Further research is needed to confirm these findings, ideally in large studies designed to minimise selection bias such as RCTs, and in well-defined populations that include GRT populations, sex workers and individuals with mental health disorders. Further qualitative research should aim to include more people from underserved groups as well as healthcare workers. The purpose of the Tackling TB in Inclusion Health Groups: A toolkit for a multiagency approach resource is to provide local systems with support to lead

the development, improvement and delivery of services to tackle TB in inclusion health groups using an integrated approach across inclusion health groups and the TB pathway. The scoping review findings have been integrated into this toolkit to draw together the best available evidence together with best practice and learning from across the country.

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