

1 **Real time evaluation of a multi-agency TB screening event for persons**
2 **experiencing homelessness in a town with low incidence of TB in England**

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11 **Summary**

12 Real time evaluation (RTE) supports populations to engage in evaluation of health
13 interventions who could otherwise be overlooked, such as people experiencing
14 homelessness (PEH), who are additionally at higher risk of acquiring TB and
15 developing severe complications of TB. The aim of this RTE was to explore the
16 understanding of TB amongst PEH, identify any barriers and facilitators to attending
17 screening for PEH as well as suggestions for improvement for any future TB
18 screening events targeting PEH. The RTE was carried out by free-text structured
19 one to one interviews. We conducted a real time evaluation (RTE) of a tuberculosis
20 (TB) screening event, targeted at persons experiencing homelessness (PEH) in a
21 town in England, that was performed immediately after screening for TB at our
22 screening venue. Handwritten forms were later transcribed into Microsoft Excel to
23 support thematic analysis, with codes ascribed to answers that were then developed
24 into core themes. All RTE participants (n=15), found out about the screening event
25 on the day of the event. Stigma around drug use, not understanding the purpose of
26 TB screening, lack of trusted individuals/services at the screening event, too many
27 partner organisations at the screening event and language barriers were key
28 concerns identified amongst screening attendees. Facilitators to screening included
29 a positive welcome to the event, satisfactory explanation of screening tests and
30 sharing of results. A better need for promotion of the event and information on the
31 purpose of TB screening amongst PEH, was identified from our RTE. Due to lack of
32 trust identified amongst some RTE participants, consideration of the number and
33 function of wider services present, should be considered for future screening events.

34

35 **Introduction**

36 Tuberculosis (TB), a bacterial infection caused by *Mycobacterium tuberculosis* still
37 contributes to global mortality and morbidity. In 2021, 10.6 million people were ill with
38 TB and 1.6 million people died from TB worldwide [1]. In low TB incidence countries
39 (incidence of ≤ 10 per 100,000 population) [2] such as England (7.8 per 100,000
40 population in 2021) [2], TB transmission disproportionately affects deprived
41 populations such as persons experiencing homelessness (PEH), migrant and ethnic
42 minority groups [2].

43

44 Homelessness in England is defined within The Housing Act 1996 [3]. This legal
45 definition includes persons who have no accommodation available for them to
46 occupy (e.g., sleeping rough) and individuals with a place to sleep that is temporary
47 accommodation (e.g., in institutions or a shelter) [3] [4]. Those that live in insecure or
48 unfit housing also fall under the definition [3] [4].

49

50 PEH face substantial health inequalities and have high and complex health needs
51 [5]. PEH are expected to die over 30 years earlier than the general population [6].
52 PEH can be at higher risk of exposure to and transmission of TB especially if they
53 seek shelter and congregate in overcrowded, poorly ventilated areas and are
54 amongst other high-risk individuals [7]. PEH may also have increased risk of
55 activation of latent TB, and thereafter be more likely to develop more severe forms of
56 active TB, than the general UK-born population. This is a result of differential
57 vulnerabilities such as higher rates of co-morbidities within these groups and
58 differential treatment seeking behaviour or access to treatment [8] [9].

59

60 From a public health perspective, preventing further person to person transmission
61 of TB can be done by effective contact tracing, screening and prompt diagnosis and
62 treatment commencement. In the UK, this is led by UK Health Security Agency
63 (UKHSA) health protection teams (HPTs) in collaboration with other stakeholders
64 including local National Health Service (NHS) TB teams, Integrated Care Boards
65 (ICBs) and local authorities [10].

66

67 In this paper, we describe the implementation and findings of an RTE of a multi-
68 agency TB screening event targeted at the homeless population in a town with a low
69 incidence of TB in England (Town X) following a TB cluster investigation by UKHSA.

70

71 **Background to the targeted TB screening event**

72 *Background to TB in Town X and cluster notification*

73 Town X is a low but increasing TB incidence town in England. Regular screening of
74 workers in several local factories in Town X had been conducted prior to the COVID-
75 19 pandemic by the local TB team, due to historic TB cluster investigations, with a
76 plan to recommence these in 2023. In November 2022, the East Midlands Health
77 Protection Team (HPT) and Field Service (FS) Midlands Team at UKHSA, were
78 notified to a fifth case of active TB linked to a factory setting in Town X. At the time of
79 investigation, UKHSA was aware of five whole genome sequencing (WGS) clusters
80 of TB circulating in this town. The FS Midlands team conducted initial descriptive
81 epidemiology of cases notified to UKHSA from January 2010.

82

83 *Descriptive epidemiology and network diagrams*

84 Cases were defined as confirmed or probable. A confirmed case had culture
85 confirmed TB with a WGS result within an existing TB WGS cluster in Town X and
86 with an epidemiological link to any other WGS cluster case, notified since January
87 2010. A probable case had laboratory confirmed TB with clinical compatible illness or
88 clinically diagnosed TB, with an epidemiological link to a confirmed case but no WGS
89 result, notified since January 2010. Case data was extracted from the National
90 Tuberculosis Surveillance System and the HPT case management system
91 (HPZone), supplemented with local TB service intelligence and WGS results
92 provided by UKHSA's Field Services.

93

94 Twenty-nine individuals met the case definition (24 confirmed, 5 probable). Of
95 recently notified cases (2020 to 2022; 3 confirmed, 4 probable), 100% were born
96 outside of the United Kingdom and had experienced homelessness. The three
97 recently confirmed cases belonged to three of the five WGS clusters in Town X,
98 indicating continued transmission within these clusters.

99

100 A population at risk for TB transmission - PEH - was identified through
101 epidemiological investigations. Therefore, it was agreed by the incident management
102 team (IMT) to conduct a targeted one-day TB screening event for this group.

103

104 *Details of TB screening event for PEH in Town X*

105 Following the identification of the homeless outreach centre in the descriptive
106 epidemiology, this voluntary and community sector organisation (VCSO) was
107 included in planning the multi-agency TB screening event. The event was held at a
108 local church less than 50 meters from the location of the VCSO to accommodate
109 wider health and social services and a mobile TB screening van on site. The VCSO
110 led promotion of the event amongst its service users. Attendees underwent an initial
111 TB assessment by the local TB service and were offered an interferon gamma
112 release assay (IGRA) and chest x-ray. A paper TB screening questionnaire was
113 used to record information for attendees, including demographics (age, sex,
114 ethnicity, country of birth), history of Bacille Calmette-Guerin (BCG) vaccination, TB
115 symptoms, TB risk factors (e.g., travel outside of the UK, contact with someone with
116 TB) and on-the-day investigations (IGRA, chest x-ray). Remote translation services
117 were available to support the screening event and its evaluation for PEH whose first
118 language was not English, where clinical staff were not conversant in PEH
119 attendees' language of choice. The local authority provided a packed lunch and self-
120 care package (toiletries) for PEH attendees who underwent screening.

121
122 Wider health and social services were also invited to the screening event to provide
123 support and advice to attendees as agreed within our IMTs to promote wider health
124 promotion activities. The services included: community NHS Trust vaccination team,
125 substance misuse support services, smoking cessation advisors, housing
126 association, integrated sexual health service, specialist neighbourhood practitioners
127 and a sexual health charity.

128

129 *Real-Time Evaluation and its use in interventions designed for PEH*

130 A real-time evaluation (RTE) is designed to provide immediate (real time) feedback
131 to those planning or implementing a project or programme, so that they can make
132 improvements during the event and for future events. RTEs are normally associated
133 with emergency response or humanitarian interventions [11] but this evaluation
134 approach can be applied to other scenarios.

135

136 A systematic review of screening programmes for active TB amongst PEH in
137 Organization for Economic Co-operation and Development (OECD) countries,
138 identified loss to follow up before diagnosis in multiple studies [12] demonstrating the
139 value of concurrent testing with immediate results as performed within this screening
140 event. None of the included studies explicitly include reference to participant
141 evaluation in their respective papers either during or after screening [12]. The
142 Medical Research Council's (MRC) latest guidance on designing and evaluating
143 complex health interventions states the importance of meaningful engagement with
144 stakeholders including service users, at every stage of design and delivery of
145 interventions to maximise their impact and effectiveness [13]. The Local Government
146 Association's (LGA) briefing paper reflecting in lessons learned from the COVID-19
147 pandemic and the needs of local public health from UKHSA, states the importance of
148 locally driven processes and responses than 'top-down' prescribed systems to build
149 health protection capabilities of the future [14].

150

151 There are numerous studies utilizing mixed methods evaluation for interventions
152 designed for PEH. Whilst many include service users in evaluation [15] [16], several

153 do not [17] [18] [19]. Post-intervention process evaluation has the benefit of directed
154 enquiry, based on initial quantitative findings in sequential mixed-method studies.
155 However, loss to follow up amongst PEH within health settings could challenge this
156 specific mixed-methods approach for this population [14]. RTE provides an additional
157 opportunity to gather immediate participatory insights into health interventions for this
158 group that may otherwise be overlooked, which is amenable to concurrent mixed-
159 method study design [20]. A recent study demonstrates a framework for using RTE
160 within a targeted chlamydia screening programme, resulting in a number of impactful
161 changes to the programme that they believe improved its effectiveness [21].

162

163 *Study rationale*

164

165 Following epidemiological investigations, PEH in Town X were identified as our
166 population at risk for TB transmission. Engagement of PEH with our targeted one-
167 day TB screening event and subsequently with healthcare services for diagnosis and
168 treatment would help prevent further person to person transmission of TB. However,
169 the uptake or use of healthcare services by PEH could be impacted by numerous
170 factors. These include difficulties in navigating and accessing healthcare services,
171 engagement issues related to distrust in institutions or healthcare providers,
172 disenfranchisement or stigmatisation, and 'chaotic' lifestyles where health and care
173 are not immediate priorities [22]. Additionally, attitudinal issues from service
174 providers resulting from a combination of stigmatisation and a lack of confidence or
175 understanding of working with PEH may impact uptake or use of healthcare services
176 by PEH [22].

177

178 Understanding the experiences and opinions of PEH in the context of targeted public
179 health interventions such as TB screening, is vital in shaping future public health
180 interventions and in turn, improving health outcomes for this group. However, there
181 is no published literature that utilises real-time evaluation within the context of
182 targeted screening for tuberculosis amongst PEH.

183 Therefore, our aim was to explore the suitability of RTE as a method of evaluation of
184 a TB screening event for PEH.

185

186 Our objectives were to:

- 187 1. Organise a TB screening event for PEH in Town X
- 188 2. Conduct an RTE of our targeted TB screening event through free-text
189 structured interviews with consenting PEH attendees of our targeted TB
190 screening event
- 191 3. To assess the level of understanding of TB, the screening process and result
192 notification in consenting PEH attendees of our targeted TB screening event
- 193 4. Identify barriers and facilitators to engagement with TB screening amongst
194 consenting PEH attendees of our targeted TB screening event
- 195 5. Identify additional support services or health promotion partners that would be
196 beneficial for future TB screening events targeted at PEH

197

198 **Methods**

199 Our RTE involved one to one free-text structured interviews with our target users
200 (PEH) and was performed during the multi-agency screening event. PEH are largely
201 unexplored within medical research, so we adopted a free-text structured interview

202 approach to ensure we could capture a range of perspectives. All participants were
203 invited to complete the RTE after completing their TB screening assessment and
204 after interacting with any wider health and social services present. Demographic
205 characteristics were captured for all screening attendees but not for those
206 additionally involved in RTE. Local public health intelligence was sought to clarify the
207 numbers and natures of PEH in Town X. Participants were consented to participate
208 in the RTE immediately after screening. Our real time evaluation interviews were
209 held in a shared clinical area immediately after screening to maximise engagement
210 with participants. A copy of our data collection tool for these interviews can be found
211 in Supplementary File 1. Questions covered: understanding of TB; how individuals
212 found out about the screening event; concerns about the screening event; thoughts
213 on explanation of the IGRA and chest x-ray; comfortability with next steps; any
214 suggestions for changes to the day that could have encouraged participation;
215 helpfulness of wider services available on the day; thoughts on whether wider
216 services could have been provided in a better way and suggestions for any other
217 services that attendees felt should have been present at the screening event.
218 Interviews were performed by members across a multi-professional team and
219 handwritten forms were manually transcribed into Microsoft Excel to perform
220 thematic analysis. Codes were assigned to free text responses that were then
221 developed into summary themes for each of the key questions within the interview.

222

223 *Ethics approval*

224 Ethics approval was not required as the data were used by the organisations
225 involved to conduct communicable disease outbreak investigations and RTE formed

226 part of our service evaluation of this intervention. All data were collected within
227 statutory approvals granted to UKHSA for public health disease surveillance and
228 control. Information was held securely and in accordance with the Data Protection
229 Act 2018, GDPR and Caldicott guidelines.

230

231 **Results**

232

233 Twenty-eight individuals attended the screening event in March 2023 and 54%
234 (n=15) participated in our RTE.

235

236 *Demographics of screening attendees*

237 Sixty-four percent of attendees were male (18/28). The age of attendees ranged
238 from 23 to 57 years, with a median age of 42 years. Ninety-three percent of
239 attendees (26/28) stated they were registered with a GP. Forty-six percent of
240 attendees stated they were born in the UK (13/28), whilst the remainder were either
241 born in Poland, Lithuania, or Latvia. Whilst the primary language cited by most
242 attendees was English (15/28, 54%), nearly half of attendees had a primary
243 language that was not English. Polish, Latvian, Lithuanian and Russian were the
244 other primary languages reported by attendees. The majority of attendees were
245 unemployed (18/28, 64%). Eighteen (64%) provided some address details. Of these,
246 9 (50%) cited either a local hotel, our VCSO or a temporary accommodation provider
247 as their residential address. Ten attendees did not provide an address (36%).

248

249 *Real-time Evaluation (RTE)*

250 *a) Understanding of TB*

251 5/15 (33%) participants could not describe a key symptom or consequence of
252 tuberculosis. 4/15 (27%) other participants demonstrated understanding of the long-
253 term implications of TB. 5/15 (33%) participants described typical symptoms or
254 clinical presentations that result from tuberculosis. 1/15's (7%) summarised response
255 could not be assigned into the above three themes.

256

257 *b) Effectiveness of Promotion/Awareness of Screening event*

258 All participants stated they were made aware of the screening event on the same
259 day they attended the event. For 5 participants, it was unclear how they found out
260 about the event. Of the remaining 10 participants, most had learned about the event
261 whilst attending the VCSO, however, the housing association that was included as
262 one of our wider health and social services and a mental health event running on the
263 same day were both also mentioned as sources of information on the screening
264 event.

265

266 *c) Communication about TB screening tests and results*

267 Most participants (14/15) were satisfied with the explanation for screening tests and
268 how results would be shared with them. One participant was dissatisfied with how
269 the TB screening tests were explained to them and another was unclear on how
270 results would be communicated to them. For these participants, we consulted the TB
271 nurses to address these identified concerns at the time of the event.

272

273 *d) Suggestions to improve TB screening services provided*

274 Most participants were satisfied with how the event was delivered, however there
275 were reports of people being scared about stigma surrounding drug use, and not
276 understanding the purpose of screening. Participants mentioned the importance of a
277 positive welcome and involving PEH in organising/delivering future events. One
278 suggested co-ordination with another large homeless charity who provide evening
279 meals.

280

281 *e) Suggestions to improve wider services provided*

282 Most participants were satisfied with the services provided, but some mentioned
283 service providers communicating in English as a key barrier, with lack of trust in
284 using telephone translation services available and a preference for trusted
285 individuals as translators. Two participants mentioned other drug users they knew,
286 were afraid of attending the event. One mentioned their partner being a Person Who
287 Injects Drugs (PWID) who was concerned about the ability to provide a blood sample
288 due to challenging veins.

289

290 *f) Suggestions for further support services*

291 Most participants did not have suggestions for further wider health and social
292 services that could be worthwhile to include in future screening events. A stall
293 focused on dentistry care and check-ups was suggested as an additional service.
294 Key themes emerging from this part of the RTE included it being overwhelming to
295 have so many staff and services present, the importance of trusted individuals to
296 help on the day and the presence of voluntary sector services to discuss
297 volunteering opportunities.

298

299 *g) Concerns prior to attending multi-agency TB screening event*

300 The majority of participants (13/15) had no concerns prior to attending screening.
301 Concerns identified included unease ahead of attending the screening event prior to
302 arriving due to allergies and discomfort at the provision of wider health promotion
303 services.

304

305 *Screening results*

306 Twenty-four screening attendees had an IGRA test (86%) and 26 had a chest x-ray
307 (93%). Two attendees had symptoms suggestive of TB, so a sputum sample was
308 taken for each attendee. All results were negative for latent or active TB.

309

310 **Discussion**

311 Real-time evaluations were first used in the 1990s in response to increasing
312 humanitarian crises, where the United Nations High Commissioner for Refugees
313 (UNHCR) required a means to rapidly evaluate the effectiveness and impact of
314 humanitarian responses to inform immediate action [23], and have scarcely been
315 used outside of this context. This study is the first of its kind to utilise real-time
316 evaluation within the context of targeted screening for tuberculosis amongst PEH.

317

318 Twenty-eight persons attended our targeted TB screening event in Town X. Nineteen
319 attendees provided either no address, or a temporary accommodation provider
320 address. Assuming those not declaring an address had no address to provide, we
321 hypothesise that these 19 attendees would be legally defined as PEH. We

322 hypothesise that most of the remaining participants would also meet the legal
323 definition of homelessness based on their interaction with our VCSO - a local
324 homeless outreach centre.

325

326 Local public health intelligence suggests in March 2023 there were a total of 23
327 rough sleepers in Town X. However, we were unable to formulate screening uptake
328 rates for rough sleepers as this data does not encapsulate broader forms of
329 homelessness.

330

331 While rates of GP registration within attendees was high (93%), probing
332 consideration of the representativeness of our sample, these high levels of
333 registration are consistent with national rates of registration (97%) [24].

334

335 Efforts to understand the most effective health communication methods for PEH
336 have demonstrated the importance of trusted messengers, alongside verbal, face-to-
337 face engagement [25] [26] [27]. Participatory development of PEH within a digital
338 health communication campaign for COVID-19 suggested easily accessible, multi-
339 lingual, discrimination sensitive, clear and simple communication methods also help
340 to reach PEH [28]. A US qualitative study with PEH additionally suggested that PEH
341 seek information from multiple sources to determine trustworthiness of messages
342 [29].

343

344 Promotion of our targeted TB screening event for PEH in Town X was led by a local
345 homeless outreach centre (our VCSO). through verbal, face-to-face communication.

346 A broader communication strategy (through a targeted media campaign amongst
347 numerous health and social services including leaflets, posters), was dissuaded in
348 our IMT discussions as there was a concern that these efforts could inadvertently
349 detract engagement amongst PEH.

350

351 However, RTE suggested that our nuanced promotion strategy through the local
352 VCSO did not attract PEH who were informed of the event in advance of the
353 screening day as all participants stated they were made aware of the screening event
354 on the same day they attended the event. It is unclear whether this is because our
355 RTE findings were a mismatch with the local VCSO's engagement with PEH or if
356 potential attendees were informed but chose not to attend. Considering the
357 importance demonstrated of multiple communication methods for PEH being used to
358 verify information and improve trust [29], a broader communication strategy may
359 have been worthwhile.

360

361 RTE provided a voice for PEH in Town X to share their perceptions on how to best
362 align healthcare services for their specific needs. A positive welcome and
363 explanation of tests and results information were facilitators to engagement with our
364 screening event. However, with 46% of attendees not participating in the RTE,
365 attrition bias is worth considering. Whilst we involved our VCSO in promoting our
366 event, their presence was limited during our screening event itself. Trusted partners
367 within health delivery are known to be especially important when designing services
368 for PEH [30]. Our local VCSO partner were consulted separately in planning the
369 event but were not involved directly within our IMT meetings. Involving this partner

370 within these meetings could have encouraged this partner to play a broader role in
371 delivery of our intervention, including on-the-day presence. This may have improved
372 uptake, especially in groups that may mistrust existing healthcare services as
373 identified by our RTE.

374

375 Pre-engagement with PEH in Town X, could have permitted us to highlight and
376 address any pre-identified barriers or execute facilitating factors to improve TB
377 screening uptake. These include improving understanding of TB and the purpose of
378 screening (which ranged from no to some understanding) improving trust in
379 translation services provided or the possibility to maximise engagement if screening
380 was held in conjunction with popular weekly offers of food by a local charity.
381 However, using RTE, we were able to clarify testing and results information for
382 attendees where the need was identified through RTE, enabling us to make real-time
383 modifications to our TB screening event and subsequently, engagement with
384 screening attendees who may have been lost to follow up.

385 Whilst the wider services provided were received well by RTE participants, achieving
386 a balance between overwhelming attendees and providing the most useful services
387 to PEH should be considered when organising future TB screening events targeted
388 for PEH.

389

390 **Conclusion**

391 We found that RTE was a suitable method of evaluation of a TB screening event for
392 PEH in Town X. RTE provided us insights into understanding of TB, screening, and
393 results notification processes amongst PEH in Town X, and enabled us to identify

394 barriers and facilitators to attending TB screening by PEH in Town X and identify
395 additional support services or health promotion partners that would be beneficial for
396 future TB screening events targeted at PEH.

397

398 Whilst prior engagement with PEH in Town X would have been beneficial in
399 improving TB screening uptake, RTE enabled us to obtain immediate feedback from
400 PEH who may have been otherwise lost to follow up. This enabled modification of
401 the screening event in real time, which a conventional longer-term evaluation would
402 not have enabled us to do. We hope through considering factors presented within
403 this paper in the planning and delivery of TB screening events for PEH in the future,
404 including incorporation of RTE, public health teams will achieve high levels of
405 engagement with TB screening and treatment to subsequently improve health
406 outcomes for PEH – a group more vulnerable to TB transmission and poorer TB
407 outcomes.

408

409 **Supplementary Material**

410 The supplementary material for this article can be found on the Cambridge Core
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412

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422

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426

427 **Conflicts of interest**

428 None.

429

430 **Data availability statement**

431 Data are incorporated into the article and material contained within. Individual level
432 data are confidential and cannot be shared.

433

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436

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