

Letter to the Editor

## Preliminary Feasibility Study of Questionnaire-based Active Pulmonary Tuberculosis Screening in Marseille Sheltered Homeless People, Winter 2018

Systematic screening for latent tuberculosis (TB) in migrants is rendered impotent, notably because the tests are poorly predictive and because only a negligible proportion of those screened achieve completion of therapy [1]. Restricting the screening to individuals with symptoms of active TB is more effective in lowering TB importation and less expensive [2]. As a gold standard for the diagnosis of active pulmonary TB [3], sputum culture for TB has been recommended as a screening tool in a systematic and community-based screening program for TB in high-risk groups in low-incidence countries [4,5], but it is expensive and time-consuming. In France, active screening for TB by chest radiography [Chest X-rays (CXR)] is recommended in migrants who have arrived <2 years ago from countries with high TB endemicity [6]. Tuberculin skin test or interferon gamma release assay is recommended for diagnosis only among children <15 years and HIV-infected patients [6]. A study conducted in Paris, France, among recent migrants consulting in a primary care medical centre dedicated to people living in precarious conditions has revealed that only 31% of eligible migrants underwent TB screening by chest radiography [7]. An alternative screening method based on a questionnaire has been proposed in Geneva, Switzerland, in the setting of homeless shelters [8]. We conducted a cross-sectional 1-day survey at a Marseille homeless shelter aiming to assess the feasibility of conducting such questionnaire-based screening program. Individuals further underwent sputum microbiological analysis. Reports of chest radiography were obtained from individuals who participated in a subsequent campaign of screening conducted at the same shelter. Case definition for pulmonary TB was a polymerase chain reaction (PCR) and/or positive culture for *Mycobacterium tuberculosis* complex (MTC).

With ethical approval (Protocol: 2010-A01406-33), we enrolled 98 adult homeless people dwelling in one of the main shelters in Marseille in the winter of 2018, all of whom were male (100%) and of the mean age  $\pm$  SD (range) = 39.3 years  $\pm$  17.6 (19–83) Table 1. All participants signed an informed consent. About 87% of participants were migrants settled in France, approximately 8 years prior to the survey. About 40% had been chronically homeless defined as an episode of homelessness lasting continuously for more than 1 year. The prevalence of smokers was recorded to be 59%. A proportion of 5.1% participants reported previous pulmonary treatment and 4.1% had a relative who had pulmonary TB. All participants were questioned about their alleged symptoms; the main current complaints were feeling sick (53.1%), persistent cough for more than 3 weeks (14.3%), cough with phlegm (16.3%),

sweating at night (16.3%), and weight loss over the last 3 months (17.3%). No case of fever was recorded.

A questionnaire specially designed to identify patients at high-risk for active TB, based on the country of origin, clinical data, and contact with patients with TB was administered (available at [www.tb-screen.ch](http://www.tb-screen.ch)) Table 2. The scores ranged from 0 to 14 with an average of 5.4 Table 2. Nine participants (9.2%, score  $\geq$  10) were screened positive (Supplementary Table 1) and 89 participants (90.8%, score < 10) were screened negative. For migrants, positive screening was associated with a shorter period of residence in France. Three (3.1%) participants came from countries with a national TB incidence of over 500/100,000 habitants or a national multidrug-resistant TB (MDR-TB) incidence higher than 20/100,000 habitants.

Sputum samples were collected from all participants for culturing MTC organisms and specific MTC–quantitative PCR (qPCR) [9]. No DNA was detected and all the cultures were observed to be negative 6 weeks after recruitment. Hence, no case of active TB was diagnosed based on microbiological criteria. In addition, the results of a CXR campaign conducted in the same shelter by the TB control centre of Marseille 1 month post-survey were retrieved from individuals who participated in the two subsequent screening campaigns. Only 29 (29.6%) individuals who answered the questionnaire, comprising four (4.1%) positive score and 25 (25.5%) negative scores, participated in the CXR-based screening campaign. Among the four positive-questionnaire-participants, only one had radiological sequels of past pulmonary TB and three were found to have normal CXR. No abnormal CXR feature consistent with pulmonary TB was found among 25 negative-questionnaire participants. A total of 165 additional homeless people who did not participate in the first campaign were enrolled in the CTX-based screening campaign conducted in the shelter, and none were found with radiological signs corresponding to active TB.

According to WHO, systematic screening is recommended for the homeless population to ensure that active TB is detected early to help reduce TB transmission within shelters, as well as to reduce the risk of poor treatment outcomes, health sequelae, and adverse social and economic consequences of TB for the individual [10]. Most low-incidence countries, including France, have policies to screen migrants systematically from countries where TB is endemic for active TB [10]. The prevalence of active TB among homeless people through various measures has been reported to be between 0% and 2% in Western Europe [7]. In Marseille, over the past two decades, we have seen a change in the homeless

**Table 1** | Characteristics of homeless population (N = 98 individuals)

Characteristics	Total	Positive screening according to questionnaire	Negative screening according to questionnaire	p-value <sup>a</sup>
Total	98	9	89	
Gender				
Male	98 (100)	9 (100)	89 (100)	1.00
Female	0	0	0	
Mean age (SD)	39.3 ± 17.6	47.2 ± 15.3	38.5 ± 17.6	0.15
Age range (years)	(19–83)	(25–73)	(18–83)	
18–65 years of age	90 (91.8)	8 (88.9)	82 (92.1)	0.55
>65 years of age	8 (8.2)	1 (11.1)	7 (7.9)	0.55
Nationality				
France	12 (12.2)	1 (11.1)	11 (12.4)	N/A
Migrant	86 (87.8)	8 (88.9)	78 (86.7)	
Mean duration of residence in France for migrants (SD)	8.23 (0–24.4)	2.7 (0–6.2)	8.8 (0–25.6)	0.01
Range of duration of residence in France for migrants	1 week–63 years	1 month–9 years	1 week–63 years	
≥1 year	39 (45.3)	4 (50)	35 (44.9)	0.71
<1 year	47 (54.7)	4 (50)	43 (55.1)	0.71
Mean duration of homelessness (SD)	2.68 (0–7.2)	2.51 (0–3.8)	2.7 (0–7.4)	0.94
Range of duration of homelessness	1 week–63 years	1 week–9 years	1 week–63 years	
≥1 year	39 (40.2)	4 (44.4)	35 (39.8)	0.99
<1 year	58 (58.8)	5 (55.6)	53 (60.2)	0.99
Unknown	1 (-)			
Alcohol				
Frequent	13 (13.3)	1 (11.1)	12 (13.5)	0.99
Rare or never	85 (86.7)	8 (88.9)	77 (86.5)	0.99
Tobacco consumption	58 (59.2)	7 (77.8)	51 (57.3)	0.37
Cannabis	26 (26.5)	5 (55.6)	21 (23.6)	0.08
Injected substances	0	0	0	N/A
Snorted substances	7 (7.2)	1 (11.1)	6 (6.8)	0.85
Drug substitutes	8 (8.2)	3 (33.3)	5 (5.7)	0.025
Diabetes mellitus	5 (5.1)	0 (0)	5 (5.6)	0.99
Fever (temperature measured)	0	0	0	N/A

<sup>a</sup>Comparison between positive and negative questionnaire group. SD, standard deviation; N/A, not applicable.

**Table 2** | Tuberculosis screening questionnaire

Items	Total	Positive screening	Negative screening
Total	98	9	89
Mean score (SD, range)	5.4 ± 3.2 (0–14)	11.8 ± 1.3 (10–14)	4.8 ± 2.5 (0–9)
Part 1. (Q0) Country of origin (0–8 points)			
0 if national TB incidence <20/100,000	18 (18.4)	1 (11.1)	17 (19.1)
1 if 20–49/100,000	5 (5.1)	0 (0)	5 (5.6)
2 if 50–99/100,000	40 (40.8)	4 (44.4)	36 (40.4)
3 if 100–149/100,000	8 (8.2)	1 (11.1)	7 (7.9)
4 if 150–199/100,000	20 (20.4)	1 (11.1)	19 (21.3)
5 if 200–299/100,000	0	0	0
6 if 300–399/100,000	4 (4.1)	0	4 (4.5)
7 if 400–499/100,000	0	0	0
8 if ≥500/100,000 or if national MDR-TB incidence ≥20/100,000	3 (3.1)	2 (22.2)	1 (1.1)
Part 2. Interview questions (0–16 points)			
Q1. Cough (four points if positive answer: Have you been coughing for more than 3 weeks?)	14 (14.3)	5 (55.6)	9 (10.1)
Q2. Cough with phlegm (two if positive answer)	16 (16.3)	4 (44.4)	12 (13.5)
Q3. Weight loss over the last 3 months (one if positive answer)	17 (17.3)	6 (66.7)	11 (12.4)
Q4. Sweating at night (one if positive answer)	16 (16.3)	6 (66.7)	10 (11.2)
Q5. Previous TB treatment (one if positive answer)	5 (5.1)	1 (11.1)	4 (4.5)
Q6. TB in a member of immediate family (one if positive answer)	4 (4.1)	2 (22.2)	2 (2.2)
Q7. Currently feeling sick (three if positive answer)	52 (53.1)	9 (100)	43 (48.3)
Q8. Impression of poor health by the examiner (three if positive answer)	1 (1.0)	1 (11.1)	0

SD, standard deviation; TB, tuberculosis; Q0–Q8, Question from 0 to 8; MDR, multidrug-resistant.

population with a growing proportion of migrants [11]. Active TB was diagnosed in two of 221 individuals (0.9%) by CXR in Marseille homeless people in 2005 [5]. During the period from 2013 to 2017, we conducted 1-day cross-sectional survey and found no cases of

active TB, diagnosed by qPCR in both sputum and stool (in 180 individuals in winter 2013), by qPCR of sputum (in 144 individuals in winter 2014), and by sputum culture (in 195 individuals in winter 2017) (unpublished data). According to the centre for TB

control, in Marseille there were 107 pulmonary TB cases diagnosed in 2016, including seven (6.5%) among homeless people.

We have demonstrated that it is indeed feasible to conduct and implement a TB screening campaign using a questionnaire among the sheltered homeless population in Marseille, France. The success factors mentioned by staff were that the questionnaire contained a few, simple, closed-ended questions available in 32 different languages; it took a little time (10–15 min) to complete; and it was generally well accepted by all participants and screeners. We found a higher prevalence of participants with a positive screening result as compared with a study by Janssens et al. (9.2% vs. 4.1%).

A major finding in our survey is that 100% participants who screened negative by way of questionnaires were confirmed negative through sputum analysis, including screening by using highly sensitive PCR detection and culture-based gold standard method. In addition, CTX-based screening for individuals with available results was also found to be negative.

We propose that the screening questionnaire for symptoms of active TB be considered as a first rapid and reasonable assessment tool that would be more cost-effective if only participants with a positive score were to undergo CXR screening. A limitation of this preliminary study is that only 30% of participants underwent CTX-based TB screening because of a rapid turnover of homeless people in the shelter and because the two screening campaigns were not conducted in coordination. Further studies are therefore needed to better assess the reliability of the questionnaire in the context of homeless shelters in Marseille.

## CONFLICTS OF INTEREST

No potential conflicts of interest relevant to this letter was reported.

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TD and PG contributed to the experimental design, data analysis, statistics, interpretation, and scripting. TD, VT, and TL administered questionnaires, examined patients, and collected samples. FH analysed chest radiography results. MD contributed to critically reviewing the manuscript. PG coordinated the work.

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