



Early View

Research letter

Towards selective tuberculosis screening of people in prison in a low-incidence country

Gerard de Vries, Sylvia Commandeur, Connie Erkens, Walid Haddad, Niesje Jansen, Peter Kouw, Margreet Kamphorst-Roemer

Please cite this article as: de Vries G, Commandeur S, Erkens C, *et al.* Towards selective tuberculosis screening of people in prison in a low-incidence country. *Eur Respir J* 2019; in press (<https://doi.org/10.1183/13993003.02209-2019>).

This manuscript has recently been accepted for publication in the *European Respiratory Journal*. It is published here in its accepted form prior to copyediting and typesetting by our production team. After these production processes are complete and the authors have approved the resulting proofs, the article will move to the latest issue of the ERJ online.

Copyright ©ERS 2019

Towards selective tuberculosis screening of people in prison in a low-incidence country

Gerard de Vries, Sylvia Commandeur, Connie Erkens, Walid Haddad, Niesje Jansen, Peter Kouw, Margreet Kamphorst-Roemer

In 2018, 806 tuberculosis (TB) patients were notified in the Netherlands, which was the second lowest number recorded since notification became mandatory in 1980; only 2017 had less notified cases (n=783) [1]. In this century, TB notification rates in the Netherlands declined by 50%, from 9.3 patients per 100,000 population in 2001 (1492 patients) to 4.7 per 100,000 in 2018. In 2018, 77% of the TB patients were born outside the Netherlands.

Prisoners in many countries in the world have a higher risk for TB due to pre-existing risk factors, poor access to health services and overcrowding conditions [2–8]. In the Netherlands, a radiographic TB screening programme for prisoners was started in 1994 after several outbreaks occurred in prisons. Noteworthy is the contact investigation in 1990 of a prison officer with non-infectious pulmonary TB [9]. The investigation revealed the source patient, a prisoner with smear-positive cavitating TB, 41 infections (4 had primary TB) among 160 prison officers and other staff investigated, and 49 infections among 260 prisoners and ex-prisoners (also 4 had primary TB). It led to a nationwide programme with contractual arrangements between the Custodial Services of the Ministry of Justice, responsible for the health of the prisoners, and the Municipal Health Services (MHS), responsible for infectious disease control in their areas. Mobile x-ray units (MXU) have been deployed to screen new inmates; for the last 15 years these have all been equipped with digital devices. All prisons, including the detention centres for undocumented migrants, are visited weekly, except those for minor aged prisoners. The chest x-rays are read within 24 hours by public health TB physicians of the MHSs. Findings are recorded in the electronic client registration system of the MHSs. The public health TB physician is responsible for further action, which may require the prisoner to visit the MHS for consultation and/or referring the prisoner to a pulmonologist in a hospital, e.g. for bronchoscopy. If TB is diagnosed and respiratory isolation or specialized clinical care is required, the prisoner is transferred to the prison with medical facilities including a respiratory isolation unit (one in the country) or to a specialized TB centre (two in the country). Prisoners with non-infectious TB are treated ambulatory in the prison for the duration of their detention. The TB nurse of the MHS offers the patient support and enables continuity of care after release from the prison. In 2018, the Netherlands had 24 prisons and three detention centres for undocumented migrants. Four MXUs are used for the prison TB screening programme.

The table shows that 493,092 new entrants in prisons were screened in the years 2001-2018 in the Netherlands. The yield dropped in 2007 and 2008. Therefore, the Ministry of Justice requested the Committee for Practical TB Control (CPT), which is a multidisciplinary platform for TB policy and guideline development in the Netherlands, to evaluate the effectiveness of the screening and advise on a more selective approach [10]. In the Netherlands, a cut-off of a screening yield of 50/100,000 (number needed to screen 2000) has been chosen to decide on continuation or discontinuation of screening [11]. This cut-off was arbitrarily set to limit exposure of healthy individuals to radiation and to increase the effectiveness of screening. The evaluation showed that the yield was particularly low among prisoners born in the Netherlands (33-35 per 100,000 screenings) and below the recommended threshold for TB screening. Based on these findings, the CPT advised to limit radiographic screening of Dutch-born prisoners to those with risk factors (homelessness, illicit drug use, history of previous TB, recent contact with a TB patient, known disorders of the immune system or previous imprisonment in a foreign country) or with TB symptoms; and to continue screening of all foreign-born prisoners. This selective

approach was implemented in 1/1/2011. A second evaluation resulted in adjustment of the screening criteria. Since 1/7/2016 the following criteria are used: i) prisoners born in a country with a World Health Organization (WHO) estimated TB incidence $\geq 10/100,000$ and ii) prisoners from all other countries if they have a history of previous TB, previous imprisonment in a foreign country during the last five years or those with symptoms suggestive for TB.

During 2001-2018, a total of 445 prisoners with TB were notified in the Netherlands; 355 (80%) were identified by the radiographic screening programme, 75 (17%) due to presentation of symptoms, 6 (1%) through contact investigation and 9 (2%) by other ways of active case finding or with unknown mode of detection (data from the National TB Register). The patients had the following characteristics: 93% were man; median age was 32 years; 82% were born outside the Netherlands; 90% had pulmonary TB (128 with positive microscopy of sputum smears or bronchoalveolar lavage, i.e. 29% of all patients); 84% had positive *Mycobacterium tuberculosis* complex culture results (six had a combined rifampicin and isoniazid resistant (i.e. multidrug-resistance [MDR]) TB, one rifampicin resistant TB and 20 isoniazid resistant TB), 11% had a previous history of TB and 4% had an HIV co-infection. Prisoners with TB identified by the radiographic screening programme had more often pulmonary TB than prisoners diagnosed outside the screening programme with TB (96% versus 64%; $p < 0.01$) and were more often foreign-born (85% versus 71%; $p < 0.01$). Culture confirmation rates were similar for patients diagnosed by screening or otherwise (86% versus 80%; $p = 0.06$).

We divided the study into two periods: '2001-2010' when all prisoners were eligible for screening and '2011-2018' when screening was selective. The TB rate among all new inmates was 68 per 100.000 in 2001-2010 and 42 per 100.000 in 2011-2018, indicating a lower TB risk for prisoners in the latter period (Table). The yield of the radiographic screening increased from 67 per 100.000 in 2001-2010 to 86 per 100.000 persons screened in 2011-2018, due to the more targeted screening approach. As a result, the proportion of new inmates screened reduced from 82% in 2001-2010 to 38% in 2011-2018. In both periods similar proportion of notified prisoners with TB were found by screening (81% and 78% respectively). These data indicate that the triage criteria adequately identified prisoners with a higher risk of TB among the prisoner population. The total costs of the screening programme however hardly reduced since most of the costs are made to operate the weekly MXU screening service. Currently, less costly options are considered such as screening prisoners for latent TB infection, as has been suggested by others [12, 13].

Continuation of treatment and treatment completion of prisoners with TB is challenging [14]. In the Netherlands, the duration of detention is usually short: 26% of prisoners are incarcerated less than two weeks and 73% less than three months [15]. Consequently, prisoners are often released from detention while still on treatment. Undocumented migrants with TB are legally allowed to complete TB treatment in the Netherlands. Of the prisoners with TB in our study (cohort 2001-2017; results of 2018 are not yet available), 66.2% completed treatment, 14.8% discontinued treatment 18.4% had unknown treatment results, often because the person left the country, and 0.5% ($n=2$) died. So, despite several arrangements and interventions, the results of TB treatment of prisoners are less favourable than for other TB patients in the Netherlands, which is close to 90%.

Our practice demonstrates that through periodic evaluation it is possible to identify the risk populations among prisoners in a low burden country and adapt the screening methods accordingly. The rate among the prisoner population eligible for screening is comparable with the higher rates found in prisons in

Western European countries [14, 16], i.e. about ten times higher than in the general population. Our study also shows that prisoners with TB are at risk for less favourable treatment outcomes. Achieving continuity of care after release from prison remains a major concern in the management of TB in prisoners.

Literature

1. Tuberculosis in the Netherlands 2018. Surveillance and monitoring of interventions report. Bilthoven: RIVM; 2019.
2. Dara M, Acosta CD. Tuberculosis prevention and control in prisons: do we know enough? *Int. J. Tuberc. Lung Dis.* 2014; 18: 758–759.
3. Dara M, Acosta CD, Melchers NVSV, Al-Darraji HAA, Chorgoliani D, Reyes H, Centis R, Sotgiu G, D'Ambrosio L, Chadha SS, Migliori GB. Tuberculosis control in prisons: current situation and research gaps. *Int. J. Infect. Dis.* 2015; 32: 111–117.
4. Baussano I, Williams BG, Nunn P, Beggiato M, Fedeli U, Scano F. Tuberculosis incidence in prisons: a systematic review. *PLoS Med.* 2010; 7: e1000381.
5. Melchers NVSV, Elsland SL van, Lange JMA, Borgdorff MW, Homborgh J van den. State of Affairs of Tuberculosis in Prison Facilities: A Systematic Review of Screening Practices and Recommendations for Best TB Control. *PLOS ONE* 2013; 8: e53644.
6. Dolan K, Wirtz AL, Moazen B, Ndeffo-Mbah M, Galvani A, Kinner SA, Courtney R, McKee M, Amon JJ, Maher L, Hellard M, Beyrer C, Altice FL. Global burden of HIV, viral hepatitis, and tuberculosis in prisoners and detainees. *Lancet* 2016; 388: 1089–1102.
7. Kamarulzaman A, Reid SE, Schwitters A, Wiessing L, El-Bassel N, Dolan K, Moazen B, Wirtz AL, Verster A, Altice FL. Prevention of transmission of HIV, hepatitis B virus, hepatitis C virus, and tuberculosis in prisoners. *Lancet* 2016; 388: 1115–1126.
8. O'Grady J, Maeurer M, Atun R, Abubakar I, Mwaba P, Bates M, Kapata N, Ferrara G, Hoelscher M, Zumla A. Tuberculosis in prisons: anatomy of global neglect. *Eur. Respir. J.* 2011; 38: 752–754.
9. Keizer ST, Postema-Postma GC. Een groepsinfectie in De Koepel [An outbreak in the Koepel prison]. *Tegen de Tuberculose* 1993; 89: 58–61.
10. Jansen-Aaldring NL, Erkens CGM, de With A. Netherlands. TB care for prisoners: a patient-centred and multisectoral approach. *Good practices in the prevention and care of tuberculosis and drug-resistant tuberculosis in correctional facilities* WHO Regional Office for Europe; 2018. p. 18–20.
11. de Vries G, van Rest J, Meijer W, Wolters B, van Hest R. Low yield of screening asylum seekers from countries with a tuberculosis incidence of <50 per 100 000 population. *Eur. Respir. J.* 2016; 47: 1870–1872.
12. Public health guidance on active case finding of communicable diseases in prison settings. Prevention and control of communicable diseases in prison settings. Stockholm: ECDC; 2018.
13. Rosales-Klitz S, Bruchfeld J, Haas W, Heldal E, Houben RMGJ, van Kessel F, Mandelbaum M, Matteelli A, Migliori GB, Oordt-Speets A, Solovic I, Vašáková M, Verver S, de Vlas SJ, Vonk Noordegraaf-Schouten MJM, de Vries G, Zenner D, van der Werf MJ. Guidance for programmatic management of latent tuberculosis infection in the European Union/European Economic Area. *Eur. Respir. J.* 2019; 53.

14. Anderson C, Story A, Brown T, Drobniewski F, Abubakar I. Tuberculosis in UK prisoners: a challenge for control. *J Epidemiol Community Health* 2010; 64: 373–376.
15. Infographic Gevangeniswezen 2019. <https://www.dji.nl/themas-cijfers-en-publicaties/cijfers-en-publicaties/kerncijfers-dji.aspx>. Den Haag: Dienst Justitiële Inrichtingen; 2019.
16. Aerts A, Hauer B, Wanlin M, Veen J. Tuberculosis and tuberculosis control in European prisons. *Int. J. Tuberc. Lung Dis.* 2006; 10: 1215–1223.

Table: Number of new entrants in prisons, prisoners screened, tuberculosis among prisoners (identified by screening or otherwise), screening yield and prevalence of tuberculosis among prisoners in the Netherlands, 2001-2018.

Legends Table

MXU: mobile X-ray unit; TB: tuberculosis.

Year	Number of new entrants in prison (n)	Number prisoners screened (n)	Coverage of screening (%)	TB among prisoners (n)	TB diagnosed by MXU screening (n)	Yield of screening (per 100,000)	TB not diagnosed by MXU screening (n)	Prevalence (per 100,000)
2001	35,000*	26,158	75%	28	17	65	11	80
2002	33,100	25,730	78%	36	25	97	11	109
2003	37,750	29,079	77%	36	26	89	10	95
2004	45,379	37,752	83%	42	32	85	10	93
2005	54,790	46,702	85%	25	25	54	0	46
2006	54,851	44,546	81%	46	46	103	0	84
2007	51,366	42,467	83%	13	13	31	0	25
2008	48,078	40,248	84%	21	15	37	6	44
2009	46,285	39,072	84%	33	27	69	6	71
2010	46,052	37,464	81%	29	23	61	6	63
Total 2001-2010	4,52,651	3,69,218	82%	309	249	67	60	68
2011	46,231	22,779	49%	30	22	97	8	65
2012	44,352	20,412	46%	22	17	83	5	50
2013	43,307	18,494	43%	20	17	92	3	46
2014	44,218	15,309	35%	16	13	85	3	36
2015	40,587	14,200	35%	6	4	28	2	15
2016	35,957	12,222	34%	15	13	106	2	42
2017	35,664	10,466	29%	20	13	124	7	56
2018	35,241	9,929	28%	7	7	71	0	20
Total 2011-2018	3,25,557	1,23,811	38%	136	106	86	30	42
Total	7,78,208	4,93,029	63%	445	355	72	90	57

* estimated number