HHS Public Access

Author manuscript

Int J Tuberc Lung Dis. Author manuscript; available in PMC 2022 January 05.

Published in final edited form as:

Int J Tuberc Lung Dis. 2021 June 01; 25(6): 513–515. doi:10.5588/ijtld.21.0065.

Spatial distribution of tuberculosis among individuals with a history of incarceration in an urban Ugandan community

Katherine O Robsky[1,2], **James Mukiibi**[2], **Annet Nalutaaya**[2], **Peter J Kitonsa**[2], **David Isooba**[2], **Olga Nakasolya**[2], **Yeonsoo Baik**[1,2], **Caleb Erisa Kamoga**[2], **Emily A Kendall**[2,3], **Achilles Katamba**[2,4], **David W Dowdy**[1,2,3]

[1]Johns Hopkins Bloomberg School of Public Health, Department of Epidemiology

[2]Uganda Tuberculosis Implementation Research Consortium, Makerere University, Uganda

[3]Johns Hopkins School of Medicine

[4]Clinical Epidemiology and Biostatistics Unit, Department of Medicine, Makerere University, College of Health Sciences

To the Editor:

In low- and middle-income countries, people living in prisons have up to 30 times the risk of tuberculosis (TB) compared to the general population.[1] Upon release, previously incarcerated individuals may experience progression of undiagnosed or incompletely treated TB acquired while incarcerated;[2,3] they may also have higher prevalence of TB risk factors such as poverty and residence in areas with high TB burden.[4] Individuals with a history of incarceration may also experience unemployment, unstable housing, substance abuse, and/or stigma,[5] which may increase their risk for TB and limit their ability to access health services.[6] In Uganda, TB incidence among prisoners is high (955 per 100,000 person-years),[2] but the risk of TB after release is not well described. We compared the prevalence and geographic distribution of TB among previously incarcerated individuals to the general population within a single Ugandan community.

This analysis was part of a case-control study in a well-defined area of Kampala, Uganda (total area 2.2 km^2; estimated population 50,000, estimated pulmonary TB prevalence 940 per 100,000 people[7]). We divided the area into five regions for analysis based on geographic and sociodemographic proximity. There are no prisons located within the study area; however, there is a police station where individuals may be held upon arrest pending payment of fines or transfer to a central prison. From May 2018 through August 2020, we enrolled adults (≥15 years) diagnosed with TB at the four clinics providing TB services within the study area; each TB patient was matched with two control patients with negative diagnostic evaluations for TB at the same facility. We also conducted an active case finding campaign in the study area from February to December 2019, in which we tested more than 12,000 adult residents of the study area for pulmonary TB (regardless of symptoms) using sputum Xpert MTB/RIF Ultra (Cepheid, Inc., Sunnyvale, CA). Participants with positive

Corresponding author: Katherine O Robsky, krobsky1@jhu.edu.

Xpert results during this campaign were enrolled as cases and matched with one control resident from the same zone with a negative sputum result.

Our exposure of interest was self-reported history of incarceration, defined as spending at least one night in prison or police cell. For each region, we calculated the population prevalence of incarceration-associated TB and the proportion of TB cases and controls who reported previous incarceration (with corresponding binomial confidence intervals [CI]). We used log-binomial regression to estimate prevalence ratios for previous incarceration according to socioeconomic characteristics, stratified by TB case status. We estimated the association of previous incarceration with TB using conditional logistic regression, adjusting for age, sex, and region of residence. We used the resulting matched odds ratios to estimate the population attributable fraction (PAF) of incarceration-associated TB.[8] We used logistic regression adjusted by enrollment location and stratified by region to estimate region-specific associations between previous incarceration and TB and corresponding PAFs.

Of 569 enrolled participants, 163 (29%, 95% CI 25-33%) reported previous incarceration. The duration of incarceration was short (median 4 days, interquartile range 1-32) and most individuals were released more than a year before study enrollment (n=122, 75%). Participants enrolled at health facilities were more likely to report previous incarceration (33%) compared to those enrolled during community case finding (21%, p=0.003).

The following groups of individuals had a higher prevalence of previous incarceration: people age 35-44 (prevalence ratio [PR] 2.0 [95% CI: 1.1, 3.7] for cases and 2.8 [1.5, 5.2] for controls, relative to age 18-34) or ≥45 years old (cases: PR 2.3 [1.2, 4.2]; controls: 1.9 [0.93, 3.8]), men (cases: PR 4.9 [2.6, 9.2]; controls: PR 4.7 [2.8, 7.8]), and those consuming alcohol at least monthly over the last year (cases: PR 2.4 [1.6, 3.6]; controls: PR 2.7 [1.8, 4.0]). HIV-positive cases were less likely to be previously incarcerated than HIV-negative cases (PR 0.69 [0.43, 1.1]); this association was not observed among controls (PR 1.1 [0.71, 1.8]). There was no significant association between household income quartile and previous incarceration.

People with TB were more likely to report previous incarceration (89/225, 40%) than people without TB (74/344, 22%), including after adjustment for age, sex and region (matched adjusted prevalence odds ratio: 1.9, 95%CI: 1.2, 3.1). The prevalence of incarceration-associated TB ranged from 52 to 294 per 100,000 population (Figure 1, Panel A). In four out of five regions, participants with TB were more likely than those without TB to report previous incarceration. (Figure 1, Panel B). The overall population attributable fraction (PAF) of TB associated with previous incarceration was 26% (95%CI 20-32%) and ranged from 10% to 37% by region (Figure 1, Panel A).

This study found that 40% of individuals diagnosed with TB in a well-defined community in Kampala reported previous incarceration, nearly twice as many as TB-negative controls. While risk of TB is even higher among current inmates in Uganda,[2] those who have previously spent time in jail or prison cells — even for a short time — represent an important and under-recognized population at high risk of TB. Previous studies have

investigated the prevalence of TB among current inmates,[9,10] but our analysis demonstrates that individuals continue to bear a disproportionate burden of TB after release. While longer durations of incarceration increase the likelihood of acquiring TB in prisons;[11] our findings suggest that having spent time in jail or prison is associated with TB risk even when those incarcerations were too brief to be the likely location of most TB transmission. Our results confirm previous findings that being male and consuming alcohol are independently associated with both incarceration and TB.[10,12] Our high PAF estimate suggests that, if the societal disadvantages experienced by previously incarcerated people could be removed, a substantial fraction of TB morbidity and mortality might be averted. Furthermore, the concentration of previously incarcerated individuals with TB in certain regions (even without a prison nearby) suggests that regionally targeted active case finding may help identify undiagnosed TB in these communities.

We did not collect data on the type of jails or prisons or the frequency of incarceration for participants who may have had multiple stays, limiting our ability to understand the social consequences of incarceration and the potential risk of TB exposure in this population.[13,14] Additionally, while our small sample size may lead to imprecision in our estimates, our inclusion of data from a community-wide active case finding program enabled us to include not only routinely detected cases but also individuals with undiagnosed prevalent TB.

In conclusion, in this urban Ugandan community, TB among previously incarcerated individuals is common and geographically heterogeneous. In addition to interventions in prisons, geographically targeted improvements in TB case detection and/or the social conditions that promote TB among previously incarcerated individuals may help reduce the burden of TB.

References

1. Baussano I et al. Tuberculosis Incidence in Prisons: A Systematic Review. PLOS Med. 7, e1000381 (2010). [PubMed: 21203587]
2. Schwitters A et al. Tuberculosis incidence and treatment completion among Ugandan prison inmates. Int. J. Tuberc. Lung Dis. Off. J. Int. Union Tuberc. Lung Dis. 18, 781–786 (2014).
3. Telisinghe L et al. HIV and tuberculosis in prisons in sub-Saharan Africa. Lancet Lond. Engl. 388, 1215–1227 (2016).
4. Banu S et al. Pulmonary Tuberculosis and Drug Resistance in Dhaka Central Jail, the Largest Prison in Bangladesh. PLOS ONE 5, e10759 (2010). [PubMed: 20505826]
5. Calcaterra S, Beaty B, Mueller SR, Min S-J & Binswanger IA The Association between Social Stressors and Drug Use/Hazardous Drinking among Former Prison Inmates. J. Subst. Abuse Treat. 47, 41–49 (2014). [PubMed: 24642070]
6. Rubenstein LS et al. HIV, prisoners, and human rights. The Lancet 388, 1202–1214 (2016).
7. Kendall EA et al. The spectrum of tuberculosis disease in an urban Ugandan community and its health facilities. Clin. Infect. Dis. Off. Publ. Infect. Dis. Soc. Am. (2020) doi:10.1093/cid/ciaa1824.
8. Greenland S & Drescher K Maximum likelihood estimation of the attributable fraction from logistic models. Biometrics 49, 865–872 (1993). [PubMed: 8241375]
9. Banu S et al. Effect of Active Case Finding on Prevalence and Transmission of Pulmonary Tuberculosis in Dhaka Central Jail, Bangladesh. PLoS ONE 10, (2015).
10. Ali S et al. Prevalence of Pulmonary Tuberculosis among Prison Inmates in Ethiopia, a Cross-Sectional Study. PLOS ONE 10, e0144040 (2015). [PubMed: 26641654]

11. Biadglegne F, Rodloff AC & Sack U Review of the prevalence and drug resistance of tuberculosis in prisons: a hidden epidemic. Epidemiol. Infect. 143, 887–900 (2015). [PubMed: 25376279]
12. Simou E, Britton J & Leonardi-Bee J Alcohol consumption and risk of tuberculosis: a systematic review and meta-analysis. Int. J. Tuberc. Lung Dis. Off. J. Int. Union Tuberc. Lung Dis. 22, 1277–1285 (2018).
13. Camplain R et al. Epidemiology of Incarceration: Characterizing Jail Incarceration for Public Health Research. Epidemiol. Camb. Mass 30, 561–568 (2019).
14. Owokuhaisa J, Thokerunga E & Bazira J Prevalence of Pulmonary Tuberculosis among Prison Inmates at Mbarara Central Prison, South Western Uganda. Adv. Res. 2, 618–625 (2014). [PubMed: 26949722]

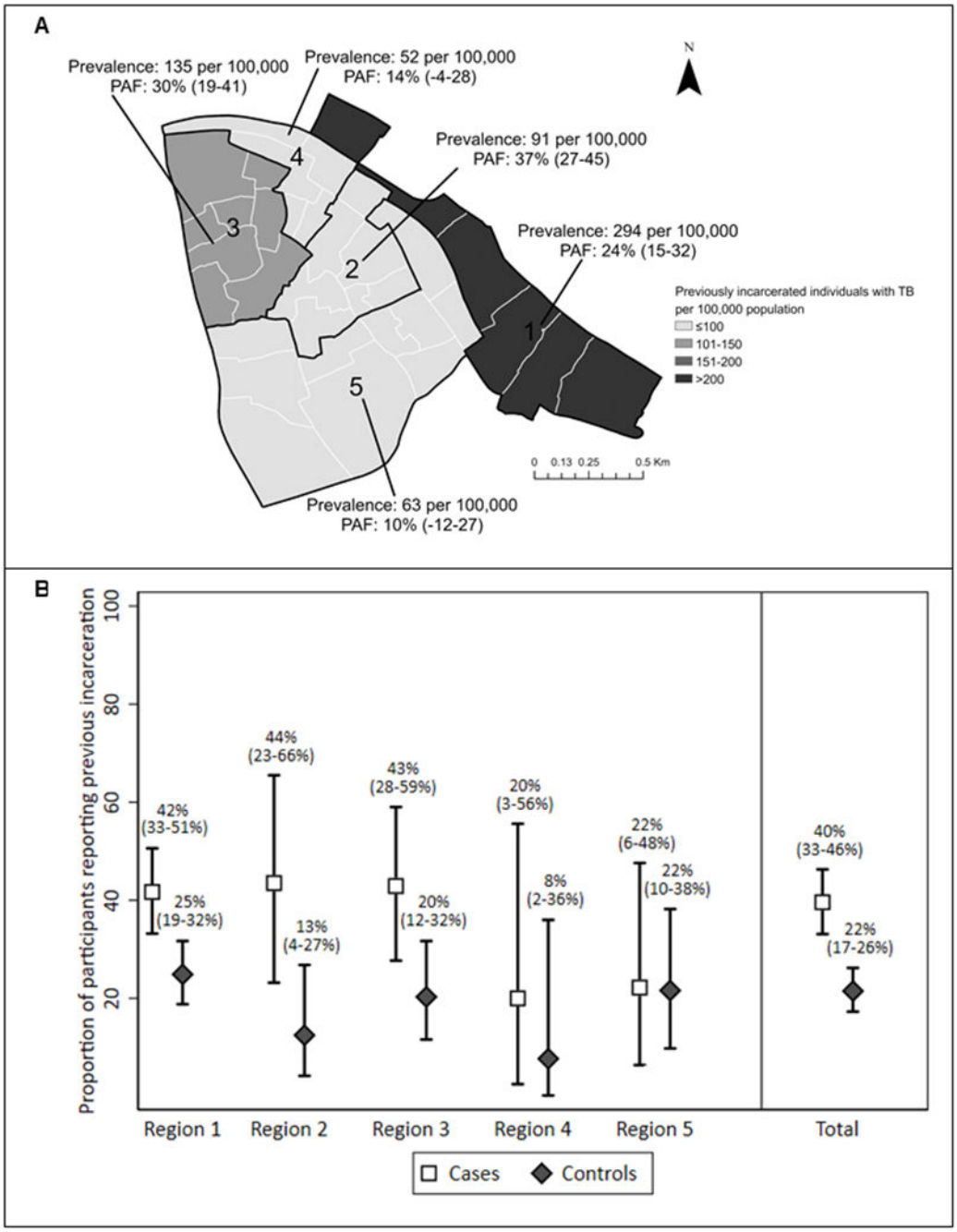

Figure 1. Participants reporting ever spending a night in a prison or jail cell by region of residence.

Panel A shows the population prevalence (per 100,000 residents) of incarceration-associated TB (i.e., TB diagnosed among people who reported previous incarceration) by region. The population attributable fraction (PAF) is also indicated. Panel B shows the proportion of participants diagnosed with TB (white squares) and matched controls without TB (gray diamonds) who reported previous incarceration (with 95% binomial confidence intervals) by region and for the entire study population.