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Tuberculosis report among injection drug users and their partners in Kazakhstan

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Abstract

Objectives: Tuberculosis (TB) is a major threat to global public health. Kazakhstan has the second highest percentage of multidrug-resistant tuberculosis (MDR-TB) cases among incident tuberculosis cases in the world (WHO 2013). A high burden of MDR-TB suggests TB prevention, control, and treatment programs are failing. This study provides an epidemiologic profile of TB among injection drug users (IDUs), a high-risk and chronically under-served population, in Kazakhstan.

Study design: Cross-sectional study.

Methods: The authors studied the characteristics and risk environment of IDUs with self-reported previous active TB and their primary sexual partners in Almaty, Kazakhstan. 728 individuals (364 couples) participated in a couple-based study in 2009.

Results: 16.75% of participants reported at least one positive TB test (x-ray) in their lifetime. In a multivariable logistic regression adjusting for couple-based sampling, persons with positive TB test were significantly more likely to be older (odds ratio (OR) 7.26, 95% confidence interval (CI): 1.73, 30.43), male (OR 5.53, 95% CI: 2.74, 11.16), have a shorter duration of injection drug use (OR 0.17, 95% CI: 0.04, 0.65), have received high social support from their significant other (OR 2.13, 95% CI: 1.03, 4.40) and more likely (non-significantly) to have been incarcerated (OR 7.03, 95% CI: 0.64, 77.30).

Conclusions: Older men with a history of incarceration and recent injection drug use were more likely to have positive TB test in Kazakhstan. Social network support, while potentially positive

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Ethical approval

The study received ethical review by the Columbia University Institutional Review Board and the Kazakhstan School of Public Health.

Completing interests

None declared.

for many aspects of population health, may increase risk of TB among IDUs in this context. Public health policies that target high-risk populations and their at-risk networks may be necessary to stem the rise of MDR-TB in Central Asia.

Keywords

Tuberculosis; Injection drug users; Central Asia; Social support; Kazakhstan; Incarceration

Introduction

The continued spread of tuberculosis (TB) and development of drug resistance is a threat to global public health.[1] The World Health Organization (WHO) reported an estimated 8.7 million incident cases of TB and 1.4 million deaths in 2011.[1] While global TB incidence rates have largely declined or stabilized in recent years,[1] in regions such as the form Soviet Union, multidrug-resistant TB (MDR-TB) incidence – an indicator of a poorly functioning TB control and care program – has been on the rise.[2] In 2011 Kazakhstan had the second highest percentage of MDR-TB cases among incident TB cases (30.3% compared to 3.7% globally).[1] To effectively oversee the care and treatment of TB patients, the Kazakhstan national tuberculosis treatment program (NTP) operates a network of primary and district level TB clinics and microscopy laboratories at no cost to legal residents.[3] TB diagnosis is standard protocol for annual physical exams, covering 62.3% of adults in 2011.[6] Challenging their public health approach to this high burden of MDR-TB is a limited understanding of the specific mechanisms that are driving local TB and MDR-TB transmission in the region.[2]

Injection drug use (IDU) is a critical driver of TB.[3] Kazakhstan has one of the highest rates of IDU in the world,[4] with some areas reporting over 10% of the population injecting drugs.[4] In the nation's largest city, Almaty, there were an estimated 17,000 IDUs in 2011 out of a population of 1,413,526.[5,6] Unsafe injection practices,[7] duration and other drug use,[3,8] and contextual environmental factors[9,10] have been shown to increase IDUs' negative health outcomes, specifically the risk of hepatitis B[11] and C[12] and HIV/AIDS.[13] Duration[3,14,15] and type of drug use,[8,15,16] age at first injection,[15] recent drug treatment,[17] exposure to TB cases,[18] incarceration,[3,19] food insecurity,[20] and co-infections (mental health disorders[16] and HIV/AIDS[17]) among IDUs have been associated with an increase risk of incident TB.

Specific drivers of TB among IDUs in Kazakhstan are still largely unknown, including TB diagnostic coverage. This study explores the associations between reported TB case status (x-ray) and sociodemographic characteristics, risk environment, and health status among a high-risk population of IDUs and their primary sexual partners in Almaty, Kazakhstan.

Methods

Data source

Project Renaissance is a longitudinal couple-based HIV prevention intervention in Almaty, Kazakhstan that took place from 2009 to 2012 and has been described in detail elsewhere.[5] Briefly, 728 individuals (364 couples, 75.36% of those screened) completed the 1.5-h

baseline Audio Computer Assisted Self Interview (ACASI) in Russian and biological testing for HIV, hepatitis C (HCV), and other sexually transmitted infections (STIs). Participants were recruited into the study in Almaty City – by former drug user research assistants – from public injection locations and syringe exchange programs. After screening, potentially eligible participants invited their primary sexual partner to also be screened and join the study, thus forming a study couple. The current study examines cross-sectional data from the baseline interview and biological testing.

Study population

Eligible couples were: both aged 18 or older; cross-identified as the other's primary sexual partner; in relationship for at least six months; intended to stay in relationship for at least next 12 months; were in a couple where one or both individuals reported a recent (30 days) unprotected intercourse event with a partner; and were in a couple where one or both individuals reported injecting drugs recently (30 days). Couples were not included if: either individual demonstrated diminished mental capacity that would impede informed consent process; either individual reported intimate partner violence perpetrated by study partner within the past year; either individual failed to commit to entire study length; either individual reported pregnancy intentions in coming 18 months; either individual did not speak, read, and/or understand fluent Russian; or if both individuals did not meet all previously described eligibility criteria.

Study variables

Sociodemographics—The authors collected information about participants' sociodemographic characteristics, including gender, age, ethnicity (Kazakh, Russian, or other), and marital status (legally married, common-law marriage, divorced, separated, widowed, or never married). Socio-economic variables included years of education, recent homelessness (having no place to sleep in the past 90 days), and recent poverty (experiencing food insecurity or having insufficient money for food in the past 90 days). Measures of criminal history included a history of incarceration and arrests.

Social support—The complete Multidimensional Scale of Perceived Social Support (MSPSS)[21,22] and relevant subscales of family, friends, and significant others measured social support of each participant. The MSPSS has been used with former Soviet Union populations.[23]

Current and past drug and alcohol use—The authors used the Risk Behaviour Assessment (RBA) to assess HIV risk behaviours and past drug use and number of days of use in the past 30 days for the following types of drugs: cocaine, heroin, cannabis, sedatives, stimulants, methamphetamines, opiates, alcohol, methadone, and other drugs not taken as prescribed. RBA validity and reliability with IDU populations have been documented in the former Soviet Union.[24] They assessed recent (past 90 days) unsafe injection behaviours, including: adding blood into an injected drug; frontloading, back-loading, drawing blood into the syringe before injecting (vein testing); purchasing and using a heroin injection prepared by someone else; sharing cookers, cotton, rinse water, and other paraphernalia; dividing drug solutions with others through use of the same cooker or spoon; using a cooker,

cotton, or rinse water previously used by another injector; using a syringe after someone else dispensed drugs into it from their used syringe; using needles or syringes previously used by someone else; or using unclean needles or syringes. Participants who reported recent (prior 90 days) engagement in at least one of these unsafe injection behaviours were coded as positive for 'any unsafe injection act in the past 90 days.'

Current and prior alcohol usage were evaluated through self-report and potential alcohol dependency was measured through the CAGE questionnaire.[25,26] The CAGE questionnaire has been used in former Soviet Union populations.[27,28]

Sexual behaviours—The RBA was used to collect self-reported data on recent (prior 90 days) sexual behaviours on participants with their study partner and with all other partners, described in detail elsewhere.[5]

Biological testing for Chlamydia, Gonorrhoea, Syphilis, HIV, and HCV—To complement self-reported infection status and utilize objective assessment measures, they used biological assays to test for Chlamydia trachomatis, Neisseria gonorrhoea, HIV, HCV, syphilis, and other STI status in accordance with accepted international testing standards,[29] documented elsewhere.[5]

Previous tuberculosis diagnosis—The main study outcome, life-time reported tuberculosis status, was measured with the self-report item, 'Have you ever been diagnosed with tuberculosis?' Active TB diagnosis through X-ray is standard protocol for annual physical exams, with 62.3% of adults X-rayed in 2011.[6]

Statistical analysis

Univariate analyses were conducted to document relevant characteristics of this vulnerable population and explore outliers. Bivariate analyses were conducted to assess the relationship between reported TB status and each sociodemographic variable, social support, current and past drug and alcohol usage, sexual behaviour, and tested STI status through X^2, and Fisher's exact tests. Generalized estimating equations with robust variance, assuming independence across couples and correcting for dependence within couple, were used to estimate the cross-sectional relationship between reported TB status and significant ($P = 0.10$) determinants from bivariate analysis and epidemiologically relevant review. All analyses were conducted in SAS 9.3.

Results

The life-time prevalence of active TB in the total sample of 728 individuals was 167.58 per 1000 (17%) consistent with global IDU estimates.[3,12,30,31] Table 1 shows population characteristics of the entire study and those reporting a positive TB diagnosis. Study participants' mean age was 35.75 years (SD = 7.80); those with a positive TB diagnosis' mean age was 39.89 years (SD = 7.06) and were significantly older than those without a positive TB diagnosis. By design, half of the complete study population was female. However, only 19% of those with a positive TB diagnosis were female, significantly less than those who did not report a positive TB diagnosis. A comparable majority of the entire

study population and the TB positive respondents were married (86% total, 88% TB positive), Russian (66% total, 66% TB positive), and Christian (70% total, 72% TB positive). Key general risk environment variables were similar in the entire study and the TB positive respondents, with an exception of reporting ever being arrested, where 67% of the entire sample reported ever being arrested and 89% of the TB positive respondents reporting ever being arrested. Sexual and drug-related risk behaviours and general health characteristics were also comparable between with TB positive respondents and the overall study sample. A larger proportion of respondents reporting a previous positive TB diagnosis tested positive for HIV (25% total, 34% TB positive) and for HCV (75% total, 89% TB positive).

TB positive respondents consistently reported higher levels of previous and recent drug usage, with 59% of respondents who reported a positive life-time active TB diagnosis reporting the duration of their injection drug use as over 18 years, compared to only 14% in the total study sample.

Table 2 shows the crude bivariate analysis and adjusted generalized estimating equation multivariable analysis adjusting for couple-based sampling. Unadjusted analysis found significant associations between positive active TB test report and age over 23 years (odds ratio (OR) 7.79, 95% confidence interval (CI) 3.60–16.87), male (OR 5.54, 95% CI 3.43–8.96), school attendance for 10 years (OR 2.06, 95% CI 1.19–3.56), ever incarcerated (OR 16.96, 95% CI 2.32–124.16), longer duration of drug use (OR 7.17, 95% CI 3.74–13.74), previous treatment for drug or alcohol abuse (OR 1.58, 95% CI 1.07–2.33), moderate social support from their significant other (OR 1.82, 95% CI 1.13–2.93), recent drug use (OR 4.31, 95% CI 1.33–14.05), ever smoked drugs (OR 4.18, 95% CI 1.90–9.20), seropositive for HIV (OR 1.73, 95% CI 1.14–2.63), and seropositive for HCV (OR 2.96, 95% CI 1.65–5.31).

Significant associations remained in the final generalized estimating equation multivariable analysis in that positive TB test reporters were more likely to be older (OR 7.26, 95% CI 1.73–30.43), male (OR 5.53, 95% CI 2.74–11.16) have a shorter duration of injection drug use (OR 0.17, 95% CI 0.04–0.65), and received high social support from their significant other (OR 2.13, 95% CI 1.03–4.40). Variables that were significant in bivariate analysis which are no longer significant in complete adjusted model include school attendance for 10 years (OR 1.49, 95% CI 0.76–2.93), ever incarcerated (OR 7.03, 95% CI 0.64–77.30), previous treatment for drug or alcohol abuse (OR 1.01, 95% CI 0.61–1.67), recent drug use (OR 3.00, 95% CI 0.60–15.09), ever smoked drugs (OR 1.10, 95% CI 0.28–4.28), seropositive for HIV (OR 1.14, 95% CI 0.68–1.92), and seropositive for HCV (OR 1.43, 95% CI 0.54–3.78).

Discussion

In an analysis of IDUs and their partners in Kazakhstan they found that older men with a history of incarceration and recent injection drug use have higher odds of reporting a positive life-time active TB result compared with other IDUs. In the final adjusted model, social network support, while potentially positive for many aspects of population health, significantly increase the odds of active TB report among IDUs.

Consistent with previous IDU studies, they found a life-time active TB prevalence estimate of 167.58 per 1000 (17%),[3,12,30,31] approximating WHO national estimates for Kazakhstan from 2010 of 118–472 per 1000.[32] IDUs are an extremely vulnerable population and their increased risk for TB can be understood through biological (immune dysregulation)[33] and social factors related to poor living conditions[33] and access to appropriate timely treatment. 34% of their individual reporting a TB positive result were seropositive for HIV. This percentage is significantly higher than the WHO national reported statistics for Kazakhstan (1% of TB positive patients tested positive for HIV in 2010),[32] however consistent with estimates of TB-HIV co-infection elsewhere.[34]

This work confirms many known drivers of TB, such as modifiable socio-behavioural factors including confined living conditions such as imprisonment,[35–41] migrant status,[2,42,43] cigarette smoking,[44–48] alcohol consumption,[35,49–53] and comorbidity with HIV,[33,43,54] diabetes,[55–58] and some mental health illnesses.[59] Perhaps the most surprising result in their study was that social support increased the risk of a TB positive test result; in most other contexts social support is considered salutogenic.[34,60] There are three possible explanations for this finding. First, it is possible that in this environment of high contagion and poor living conditions that exposure to high social support of a significant other could also increase exposure to that significant others infectious agents, thus increasing the odds of a positive TB test result. Second, it is possible that persons with better social supports are more likely to be screened for TB. Third, while every attempt was made to find valid scales for social support, no validation study has been conducted to date testing the MSPSS in Central Asia, thus it is possible that the scale or subscale is not measuring the same underlying construct that is typically captured by this measure.

There are several limitations to their study. First, the main outcome of interest, reported previous active TB positive test result is not a precise measure of active TB prevalence. Those with a positive previous test result also might be more likely to seek care because they are generally sicker than their peers. However if this were the case they would expect to see significant adjusted associations between TB case report and tested HIV and HCV status and none were found. They did not have available additional questions quantifying the number of positive test results per individual, type of positive test (skin, x-ray, culture), time of positive test result, or previous treatment regimens (completed or otherwise), however given the current testing protocol it is assumed to be x-ray diagnosis of active TB. It is plausible, as with all self-reported items, that a small proportion of the study population tested positive for TB in their life-time but failed to disclose so in their study due to fear of stigmatization or disclosure of treatment default status to health authorities. Given the paucity of research on this topic with IDUs, use of an imprecise outcome measure is a reasonable first step in documenting the risk profile of this population. Temporality cannot be adequately assessed or established in this study. Thus, it is not possible to determine if high social support from a significant other increased the risk of exposure to TB or if because of a positive TB test result individuals sought greater social support from their significant others, or if neither mechanism is operative. Similarly, it is not possible to precisely estimate the change frequency of infection over time based on this cross-sectional design. A third limitation is related to the limited sample size. Notable risk factors for TB – incarceration and HIV status – are not significant in the final adjusted model, however the results are suggestive of an

association that has failed to reach significance. A larger study population would perhaps increase the precision of these estimates and perhaps illuminate others.

Older men with a history of incarceration, recent injection drug use, and high social network engagement are at higher odds of reporting a positive TB test among IDUs in Kazakhstan. This extremely high-risk population needs increased attention and may benefit from preventive chemotherapy. Activities such as active case finding should be included into all harm reduction policy and programs serving this population.[61] Successful treatment of this population requires coordination and/or integration among currently distinct care systems, such as criminal justice, drug treatment, and HIV/AIDS and TB systems. Improved integration of public health policies that target high-risk populations and their at-risk networks are necessary to stem the rise of MDR-TB.

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Table 1 –

Study population characteristics, among Project Renaissance participants in Kazakhstan, 2009–2010.

Variable	Total study n (%)	TB+ n (%)
Sample size	728 (100)	122 (100)
Sociodemographics		
Age in years, mean (SD)	35.75 (7.8)	39.89 (7.06) ***
Years of education, mean (SD)	11.41 (3.3)	10.81 (3.06) *
Monthly income, mean (SD)	31,933 (56,407)	42,419 (10,2030)
Gender		
Female	364 (50)	23 (19) ***
Marital status		
Married	629 (86)	107 (88)
Ethnicity		
Kazakh	85 (12)	18 (15)
Russian	478 (66)	81 (66)
Religion		
Muslim	119 (16)	20 (16)
Christian	512 (70)	88 (72)
General risk environment		
Homelessness [a]	98 (13)	18 (15)
Food insecurity [a]	355 (48)	64 (52)
Ever incarcerated	435 (89) [b]	107 (99)
Ever arrested	488 (67)	108 (89) ***
Social support [c]	184 (25)	31 (25) *
Drug use behaviour		
Used drugs, ever	647 (89)	119 (98) **
Used drugs, recently [a]	591 (91)	116 (97) *
Smoked drugs, ever	598 (82)	115 (94) **
Injected drugs, ever	566 (78)	116 (95) ***
Duration of injection drug use		
<3 years	178 (24)	12 (10) **
3 – <12 years	160 (22)	10 (8) **
12 – <18 years	179 (25)	28 (23)
>18 years	211 (29)	72 (59)
Binge drinking	505 (69)	81 (66)
Sexual risk behavior		
Unprotected sexual intercourse, recent [d]	622 (92) [e]	101 (90)
Drug-related risk behaviours		

Variable	Total study n (%)	TB+ n (%)
Used needle/syringe by someone else	169 (30)[f]	41 (37)
Treated for drug or alcohol abuse	325 (45)	66 (54)*
General health		
Quality of life (nutrition)[g]	374 (51)	61 (50)
Quality of life (fitness)[g]	265 (36)	43 (35)
Current STI (tested)	26 (4)	5 (4)
Reported STI[a]	69 (16)[h]	11 (15)
Tested HIV+	183 (25)	42 (34)*
Tested HCV+	546 (75)	108 (89)**

Note.

* = $P < 0.05$,

** = $P < 0.01$,

*** = $P < 0.001$ for bivariate analysis comparing those with positive TB report to those without a positive TB report.

[a] Within the past 90 days.

[b] 240 respondents did not answer this item. 89% corresponds to 435/(728–240) = 89.1%.

[c] Highest tertile of significant other MSPSS subscale.

[d] Within the past 30 days.

[e] 168 respondents did not answer this item. 30% corresponds to 169/(728–168) = 30.2%.

[f] 51 respondents did not answer this item. 92% corresponds to 622/(728–51) = 91.9%.

[g] Good, very good, or excellent rating.

[h] 287 respondents did not answer this item. 16% corresponds to 69/(728–287) = 15.6%.

Table 2 –

Associations with positive active TB test report, among Project Renaissance participants in Kazakhstan, 2009–2010.

	Unadjusted[a]		Adjusted[b]	
	OR	**95% CI**	**OR**	**95% CI**
Age				
<17 years	1.00		1.00	
17–19 years	2.36	(1.00, 5.55)	2.79	(0.78, 10.01)
20–24 years	1.65	(1.16, 2.35)	5.34	(1.40, 20.32)
>24 years	7.79	(3.60, 16.87)	7.26	(1.73, 30.43)
Gender				
Female	1.00		1.00	
Male	5.54	(3.43, 8.96)	5.53	(2.74, 11.16)
Education				
<10 years	1.00		1.00	
10 years	2.06	(1.19, 3.56)	1.49	(0.76, 2.93)
11 years	0.98	(0.54, 1.78)	0.77	(0.36, 1.68)
≥12 years	0.66	(0.38, 1.17)	0.76	(0.38, 1.53)
Incarcerated, ever	16.96	(2.32, 124.16)	7.03	(0.64, 77.30)
Duration of injection drug use				
<3 years	1.00		1.00	
3 – < 12 years	0.92	(0.39, 2.20)	0.17	(0.04, 0.65)
12 – <18 years	2.57	(1.26, 5.22)	0.20	(0.05, 0.76)
>18 years	7.17	(3.74, 13.74)	0.29	(0.07, 1.15)
Treated for drug or alcohol abuse	1.58	(1.07, 2.33)	1.01	(0.61, 1.67)
Social support – significant other				
Lowest tertile	1.00		1.00	
Middle tertile	1.82	(1.13, 2.93)	1.62	(0.90, 2.90)
Highest tertile	1.45	(0.84, 2.51)	2.13	(1.03, 4.40)
Drug use, recent[c]	4.31	(1.33, 14.05)	3.00	(0.60, 15.09)
Smoked drugs, ever	4.18	(1.90, 9.20)	1.10	(0.28, 4.28)
Tested HIV +	1.73	(1.14, 2.63)	1.14	(0.68, 1.92)
Tested HCV +	2.96	(1.65, 5.31)	1.43	(0.54, 3.78)

[a] Unadjusted bivariate odds ratios.

[b] Multivariable odds ratios adjusting for all variables presented.

[c] Within the past 90 days.