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# Tuberculosis screening among Bolivian sex workers and their children



Silvia S. Chiang <sup>a,b,\*</sup>, Jessica K. Paulus <sup>c</sup>, Chi-Cheng Huang <sup>d</sup>,  
P.K. Newby <sup>a</sup>, Dora Castellón Quiroga <sup>e</sup>, Renée Boynton-Jarrett <sup>a,1</sup>,  
Lara Antkowiak <sup>a,b,1</sup>

<sup>a</sup> Boston University School of Medicine, Division of General Pediatrics, 850 Harrison Avenue, 5th Floor, Boston, MA 02118, USA

<sup>b</sup> Boston Children's Hospital, Department of Medicine, 300 Longwood Avenue, Boston, MA 02115, USA

<sup>c</sup> Tufts Clinical and Translational Science Institute, Tufts Medical Center, 35 Kneeland Street, 8th–11th Floors, Boston, MA 02111, USA

<sup>d</sup> Department of Medicine, Lahey Clinic, 41 Burlington Mall Road, Burlington, MA 01805, USA

<sup>e</sup> Independent Consultant, La Paz, Bolivia

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**Abstract** Bolivian sex workers were more likely than other employed women to report tuberculosis screening only if they reported HIV screening. Of all women with household tuberculosis exposure, <40% reported screening for themselves or their children. Coupling tuberculosis screening with sex workers' mandatory HIV screenings may be a cost-efficient disease-control strategy.

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## 1. Introduction

Bolivia has the Western Hemisphere's second highest tuberculosis (TB) incidence and prevalence [1]. The city of El Alto (population 843,934 [2]) has been recognized as a TB epicenter [3] with poor

indices of disease control and detection [4]. Commercial sex workers (CSWs) have multiple TB risk factors-socioeconomic marginalization, crowded workplaces, limited healthcare access, and high HIV infection risk [5–7]-but their TB screening practices have been described in only one study, which demonstrated under-screening among Mexican CSWs [8]. TB screening, household exposure, and disease were assessed among El Alto's CSWs and their children by comparing them with a group of women in other professions (controls) and their children.

\* Corresponding author at: Baylor College of Medicine, Department of Pediatrics, Section of Infectious Diseases, 1102 Bates Street, Suite 1120, Houston, TX 77030, USA. Tel.: +1 (832) 824 4330; fax: +1 (832) 825 4347.

E-mail address: [schiang@alumni.stanford.edu](mailto:schiang@alumni.stanford.edu) (S.S. Chiang).

<sup>1</sup> RBJ and LA are joint senior authors.

## 2. Methods

### 2.1. Sample

From July to September 2010, a cross-sectional study was conducted to evaluate TB and other health issues faced by El Alto's CSWs and their children. One hundred twenty-five CSWs and 125 controls were recruited; eligible participants were 18–45 years old, lived in El Alto, worked outside the home at least two days or nights per week, and had at least one child under the age of ten. Sampling was stratified into five age brackets: 18–25, 26–30, 31–35, 36–40, and 41–45. Enrollment into each group was capped at 80 women (40 CSWs, 40 controls). A similar number of participants in each bracket was achieved except the oldest. Only five 41–45-year-old CSWs with a child under age ten were recruited, so the recruitment of CSWs from the other brackets was expanded to meet enrollment goals.

### 2.2. Participant recruitment and interviews

Four female Bolivian interviewers recruited eligible participants in three locations adjacent to El Alto's red-light district: a government-run clinic; House of Hope, a drop-in center for CSWs operated by a faith-based organization; and a church. Interviewers administered one-on-one surveys in closed rooms at the House of Hope and the church. No surveys were administered in the clinic to avoid biased answers to healthcare-related questions. Participants received an incentive of powdered milk purchased for 35 *bolivianos* (approximately 5 U.S. dollars).

Interviewers obtained informed consent, read survey questions to participants, and recorded answers. To limit bias, interviewers provided standard, minimal clarification to questions. The survey consisted of 39 multiple-choice and 12 open-ended questions. The TB section asked about prior maternal and child TB screening (by skin test, chest radiograph, and/or sputum microscopy), household exposure, and disease. HIV screening history was also assessed. Additionally, participants were asked to provide demographic information and to use three-point Likert scales to rate their perceived quality of and comfort level with healthcare services (detailed in [Table 1](#)).

Because there was no local institutional review board (IRB) in 2010, this study was approved by a group of local professionals from within and outside the medical field and Boston University School of Medicine's IRB.

### 2.3. Statistical analysis

Descriptive characteristics between cases and controls were compared using two-tailed Student's *t* and Pearson  $\chi^2$  tests. Differences in maternal and child TB screening were characterized by odds ratios (ORs) with 95% confidence intervals (CIs). Three multivariable models evaluated the role of potential confounders. Model 1 included maternal age at the time of the interview. Model 2 included maternal age, highest maternal education level, economic variables (daily wage, number of days or nights worked per week, number of children's meals per day), and healthcare variables (perceived quality of and comfort level with healthcare services). Model 3 included all Model 2 variables and prior HIV screening. Analyses were conducted with SAS version 9.2 (SAS Institute, Cary, NC).

## 3. Results

[Table 1](#) compares demographic and socioeconomic characteristics between CSWs and controls. Among all participants, 22% and 17% reported previous TB screening for themselves and their children, respectively. Multivariable analysis using Model 2 demonstrated a greater likelihood of TB screening among CSWs (OR = 2.48, CI: 1.12–5.52). However, after further adjustment for HIV screening, the association disappeared (OR = 0.99, CI: 0.37–2.62) ([Table 2](#)). The difference in the likelihood of child TB screening between the groups did not reach statistical significance ([Table 2](#)).

Of the 11% of all women who reported household TB exposure, 36% and 39% reported previous maternal and child TB screening, respectively. [Table 1](#) demonstrates the lack of statistically significant differences in rates of household exposure, maternal TB disease, and child TB disease between CSWs and controls. However, this study may not have been adequately powered to detect differences.

## 4. Discussion

This study yielded two important findings. First, <40% of all women with household TB exposure—the most important epidemiologic risk factor for infection—reported prior TB screening for themselves and their children. The World Health Organization recommends household contact investigation, as well as isoniazid preventive therapy (IPT) for contacts under age five in whom active disease has been ruled out [9]. However, the Bolivian National Tuberculosis Program does not count contact investigation or IPT among its

**Table 1** Characteristics of CSWs and controls in El Alto, Bolivia.

Variable	All women (n = 250)	CSWs (n = 125)	Controls (n = 125)	p-Value
Maternal age, mean (SD)	30.62 (6.91)	30.02 (6.39)	31.22 (7.36)	0.17
Wage per day, mean (SD) <sup>a</sup>	85.19 (72.00)	123.68 (72.81)	46.70 (46.07)	<0.0001
Days or nights worked per week, n (%)				0.01
2–3	88 (35)	45 (36)	43 (34)	
4–5	88 (35)	53 (42)	35 (28)	
6–7	74 (30)	27 (22)	47 (38)	
Meals per day eaten by children, n (%)				0.01
≤2	44 (18)	17 (13)	27 (22)	
3	118 (47)	53 (42)	65 (52)	
≥4	88 (35)	55 (45)	33 (26)	
Highest education level, n (%)				0.24
Some primary school or less	85 (34)	45 (36)	40 (32)	
Graduated primary school or some high school	93 (37)	50 (40)	43 (34)	
Graduated high school or more	72 (29)	30 (24)	42 (34)	
Number of children, n (%)				0.07
1	52 (21)	24 (19)	28 (22)	
2	80 (32)	48 (38)	32 (26)	
3	51 (20)	27 (22)	24 (19)	
≥4	67 (27)	26 (21)	41 (33)	
Comfort level with healthcare providers, n (%)				0.44
Uncomfortable or very uncomfortable	108 (43)	58 (46)	50 (40)	
Neutral	16 (6)	9 (7)	7 (6)	
Comfortable or very comfortable	126 (51)	48 (47)	68 (54)	
Perceived quality of healthcare, n (%)				0.72
Not very good or poor	136 (54)	70 (56)	66 (53)	
Good	97 (39)	48 (38)	49 (39)	
Excellent or very good	17 (7)	7 (6)	10 (8)	
Concern about HIV infection, n (%)				<0.0001
Yes	169 (68)	104 (83)	65 (52)	
No	81 (32)	21 (17)	60 (48)	
Previous HIV screening, n (%)				<0.0001
Yes	141 (56)	111 (88)	30 (24)	
No	109 (44)	14 (12)	95 (76)	
Household TB exposure, n (%)				0.23
Yes	28 (11)	11 (9)	17 (14)	
No	222 (89)	114 (91)	108 (86)	
Prior maternal TB disease, n (%)				0.62 <sup>b</sup>
Yes	4 (2)	3 (2)	1 (1)	
No	246 (98)	122 (98)	124 (99)	
Prior child TB disease, n (%)				0.50 <sup>b</sup>
Yes	2 (1)	2 (2)	0 (0)	
No	248 (99)	123 (98)	125 (100)	

<sup>a</sup> In January 2010, approximately 7.02 bolivianos equaled 1 USD.

<sup>b</sup> Calculated using two-tailed Fisher's exact probability test because some cell values were < 5.

priorities [10]. The <40% screening rate for household contacts of TB patients and Bolivia's lack of emphasis on prevention are not surprising since low-income countries typically focus resources on symptomatic patients [11]. Nevertheless, recent analyses have demonstrated the cost-effectiveness of IPT in a resource-limited area [12], and household contact investigation in Lima, Peru, has led to a fivefold increase in TB disease detection [13].

The second important finding was an association between HIV screening and TB screening among CSWs. In 2001, Bolivia's Ministry of Health mandated regular HIV screening for CSWs [14]. Further investigation is needed: to clarify whether required HIV screening led to increased TB screening; to document screening locations for CSWs; and to assess the impact of TB screening for CSWs on disease detection and prevention. Nonetheless,

**Table 2** Likelihood of maternal and child TB screening by maternal occupation.

	Screened, <i>n</i> (%)	Not screened, <i>n</i> (%)	Crude OR (95% CI) <i>p</i> -value	Age-adjusted OR <sup>a</sup> (95% CI) <i>p</i> -value	Age, socioeconomic, and health care variable- adjusted OR <sup>b</sup> (95% CI) <i>p</i> -value	Age, socioeconomic, health care variables, and HIV screening- adjusted OR <sup>c</sup> (95% CI) <i>p</i> -value
Controls <sup>d</sup>	21 (17)	103 (83)	1.00 (reference)			
CSWs	33 (26)	92 (74)	1.76 (0.95, 3.25) 0.07	1.87 (0.99, 3.42) 0.05	2.48 (1.12, 5.52) 0.03	0.99 (0.37, 2.62) 0.98
Children of controls	17 (14)	108 (86)	1.00 (reference)			
Children of CSWs	26 (21)	99 (79)	1.67 (0.85, 3.26) 0.13	1.72 (0.88, 3.38) 0.12	1.59 (0.69, 3.66) 0.27	0.79 (0.29, 2.16) 0.64

<sup>a</sup> Model 1: adjusted for maternal age (years).

<sup>b</sup> Model 2: adjusted for maternal age (years), maternal education (some primary school, primary graduation/some high school, graduated high school), wages per day (\$), days or nights worked per week (2–3, 4–5, 6–7), children's meals per day ( $\leq 2$ , 3,  $\geq 4$ ), perceived quality of medical care (not very good/poor, good, excellent/very good), comfort level of medical care (uncomfortable/very uncomfortable, neutral, comfortable/very comfortable).

<sup>c</sup> Model 3: adjusted for maternal age (years), maternal education (some primary school, primary graduation/some high school, graduated high school), wages per day (\$), days or nights worked per week (2–3, 4–5, 6–7), children's meals per day ( $\leq 2$ , 3,  $\geq 4$ ), perceived quality of medical care (not very good/poor, good, excellent/very good), comfort level of medical care (uncomfortable/very uncomfortable, neutral, comfortable/very comfortable), HIV testing (yes/no).

<sup>d</sup> One respondent with unknown maternal TB screening history was excluded.

these findings have two potential public health implications. First, incorporating TB screening into medical encounters for which the government has already committed resources may be a cost-efficient strategy to increase detection of a prevalent disease. Second, mandatory regular HIV screening, which increases exposure to healthcare, may translate into other health benefits for CSWs; this possibility also merits further investigation.

This study had limitations. It could not determine causation between HIV screening and TB screening because both were retrospectively reported without information on relative timing. Since this study did not ask participants about HIV status, it is possible that some TB screening was prompted by HIV infection, though the 0.39% HIV prevalence among Bolivian CSWs renders this possibility less likely [15]. This study relied on self-reported data, which may be inaccurate, especially in an undereducated sample. To address this limitation, standard explanations (using simple lay vocabulary) of HIV, TB, differences between latent and active TB, and common diagnostic tests were provided. Interviewer-administered surveys carry a risk of social desirability bias, but given the participants' low average education level, interviewer-administration was preferred over self-administration. By recruiting participants at a health center, the study may have oversampled women who regularly access medical care, resulting in an overestimation of TB screening. Finally, there was difficulty recruiting eligible 41–45 year-old CSWs, but exclusion of 41–45 year-old CSWs and controls from regression models affected neither the clinical nor the statistical significance.

In conclusion, low rates of TB screening, even among families with household exposure, represent lost opportunities for disease detection and prevention. In addition, further research into the association between HIV screening and TB screening among CSWs could translate into cost-effective TB control strategies in this high-prevalence area.

## Conflict of interest

None.

## Author contributions

SSC, CCH, LA, and RBJ designed the study. DCQ supervised data collection. JKP and PKN performed analyses. SSC and JKP wrote the manuscript. All authors approved the final version of the manuscript.

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