HHS Public Access

Author manuscript

Infect Control Hosp Epidemiol. Author manuscript; available in PMC 2016 May 01.

Published in final edited form as:

Infect Control Hosp Epidemiol. 2015 May ; 36(5): 522–528. doi:10.1017/ice.2015.5.

Determinants of Tuberculosis Infection Control Related Behaviors among Healthcare Workers in the Country of Georgia

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Abstract

Objective—To better understand tuberculosis (TB) infection control (IC) in healthcare facilities (HCFs) in Georgia.

Design—A cross-sectional evaluation of healthcare worker (HCW) knowledge, beliefs and behaviors toward TB IC measures including latent TB infection (LTBI) screening and treatment of HCWs.

Setting—Georgia, a high burden multidrug-resistant TB (MDR-TB) country.

Participants—HCWs from the National TB Program and affiliated HCFs.

Methods—An anonymous self-administered 55-question survey developed based on the Health Belief Model (HBM) conceptual framework.

Results—In total, 240 HCWs (48% physicians; 39% nurses) completed the survey. Overall average TB knowledge score was 61%. Only 60% reported frequent use of respirators when in

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Presented in part: 43rd World Conference on Lung Health of the International Union of Tuberculosis and Lung Diseases (the Union), Kuala Lumpur, Malaysia, 2012 (abstract, poster #PC-280-16).

contact with TB patients. Only 52% were willing to undergo annual LTBI screening; 48% were willing to undergo LTBI treatment. In multivariate analysis, HCWs who worried about acquiring MDR-TB infection (aOR 1.7; 95% CI 1.28-2.25), who thought screening contacts of TB cases is important (aOR 3.4; 95% CI 1.35-8.65), and who were physicians (aOR 1.7; 95% CI 1.08-2.60) were more likely to accept annual LTBI screening. In regards to LTBI treatment, HCWs who worked in an outpatient TB facility (aOR 0.3; 95% CI 0.11-0.58) or perceived a high personal risk of TB re-infection (aOR 0.5; 95% CI 0.37-0.64) were less likely to accept LTBI treatment.

Conclusion—The concern about TB re-infection for HCWs is a major barrier to their acceptance of LTBI treatment. TB IC measures must be strengthened in parallel or prior to the introduction of LTBI screening and treatment of HCWs.

Introduction

Nosocomial transmission of *Mycobacterium tuberculosis* has been documented in a variety of resource-limited country settings[1, 2] largely due to lack of implementation of effective tuberculosis (TB) infection control (IC) measures. Most high-income countries screen healthcare workers (HCWs) for latent TB infection (LTBI) and provide treatment for those with LTBI as part of their TB IC programs. These practices, however, are not yet widely implemented in resource-limited settings.[3, 4] In Georgia, as in other resource-limited, high TB burden countries of Eastern Europe, TB IC measures in healthcare facilities (HCFs) are very limited. Patients with infectious TB have historically been diagnosed and treated in inpatient and outpatient TB facilities organized by the National TB Program (NTP), although persons with undiagnosed TB or suspected cases of TB may be seen at non-TB primary healthcare centers (PHCs), and referred to TB facility later. There are no routine programs in place to screen HCWs for LTBI in Georgia.[5, 6]

In 2012, the estimated TB prevalence in Georgia was 58 per 100,000 population and estimated percent of TB cases with multidrug-resistant TB was 9% and 31% among new and previously treated cases, respectively.[7] A higher prevalence of LTBI among HCWs was reported among those who worked in TB facilities (55%) compared to those who worked in non-TB HCFs (31%) in Georgia. Furthermore, a high rate of recent infection was reported among Georgian HCWs at TB facilities when tested with a commercially available interferon-gamma release assay (22.8/100 person-years).[6] These findings suggest a high rate of ongoing TB transmission in Georgian TB facilities. Implementation of effective TB IC measures, including HCW training and education regarding TB and TB IC, is essential in preventing the nosocomial transmission of TB.[2, 4, 8] We conducted an anonymous survey of Georgian HCWs to provide baseline data on their knowledge, beliefs, and behaviors related to TB IC. The data will be used for the development and implementation of TB IC interventions/programs at Georgian HCFs.

Methods

Study Setting and participants

A cross-sectional evaluation of HCW knowledge, beliefs and behaviors toward TB IC measures was conducted between July-December 2011 among HCWs in Georgia. HCWs

from the Georgian NTP, including the National Center for TB and Lung Diseases (NCTLD) in Tbilisi, its affiliated TB outpatient clinics from whole country, as well as HCWs from PHC were eligible to enroll. Inclusion criteria were age ≥18 years old and being a HCW. HCW was defined as someone who worked in a HCF. Those eligible to participate included 1,400 HCWs employed by the NTP and 3,085 HCWs employed by PHCs. Convenience sampling was used; HCWs undergoing TB education at the NCTLD between July-December 2011were approached with information about the survey before the TB educational sessions. The NTP provides TB education for the NTP and PHC HCWs from entire country on a biennial basis at the NCTLD. HCWs provided oral consent for study participation. The study was approved by the Emory University Institutional Review Board and Georgian NCTLD Ethics Committee.

Data collection

An anonymous self-administered 55-question survey was provided to all participants in the Georgian language (Kartuli). The survey was piloted with 10 HCWs from the NCTLD; these HCWs were not included in the final sample. The survey was developed based on the Health Belief Model (HBM) conceptual framework.[9-12] The survey collected information about respondents' TB knowledge, their health-related behaviors, and willingness to engage in health-related behavioral change with respect to the following: respirator use, UV lights, willingness to be annually screened for LTBI, and willingness to be treated for LTBI if tested positive by LTBI diagnostic tests. In addition, the survey measured the following HBM constructs: perceived susceptibility to and perceived severity of LTBI and TB disease including multi and extensively drug-resistant (M/XDR) TB, perceived benefits of IC measures, perceived barriers to implementing IC measures, and cues to action such as availability of respirators and instructions from managers related to using the respirators. Five-point Likert-type scales were used to assess HCWs' beliefs and behaviors.[13, 14] Perceived susceptibility to TB infection was measured using a five-level variable where 1 indicated no perceived possibility and 5 indicated very good chance of being infected with TB. Perceived severity of TB infection was also assessed using a five-level variable where 1 indicated strong agreement and 5 indicated strong disagreement with the statements of concerns about acquiring LTBI and TB disease. We also asked various socio-demographic questions in order to further characterize the study population.

Statistical analysis

The survey data were entered and managed using a REDCap electronic data capture tool.[15] Statistical analysis was performed in IBM SPSS Statistics version 19. We first calculated frequency distributions; if < 10% of participants responded to a question item, that item was excluded from further analysis. Five-level variables measuring HCWs beliefs about TB IC measures were reduced to three-level variables for multivariate analysis. We used binomial logistic regression to estimate the association between HCW demographic characteristics and knowledge of TB; ordinal (when proportional odds assumption was met) or multinomial logistic regression were used to estimate the association between HCW's beliefs and their IC related behaviors.[16] In multivariable models we adjusted for variables that met statistical and epidemiological criteria[16] and were congruent with the HBM framework. Collinearity was assessed for multivariable models, variables with significant collinearity were removed

from final models. We used the Mann-Whitney U-test to compare the median scores of HCWs' beliefs among two independent groups – HCWs who answered a TB related knowledge question correctly and HCWs who answered the question incorrectly.[17]

Results

Study participants

A total of 298 HCWs were approached to enroll in the study; 240 (81 %) agreed to participate. The characteristics of the study population (n=240) are described in Table 1. The mean age of HCWs who participated was 44.3 years (SD=11.4 years). The majority of the participants were female (90%) reflecting the makeup of HCWs at the NTP and affiliated institutions. Respirators were available for 82% of HCWs from the NTP and for only 45% of HCWs from the PHCs. The mean number of years in healthcare was 19.7 (SD 10.9 years).

HCWs overall average knowledge score was 61%. HCWs who worked with TB patients knew more about TB with 69 % overall average score compared to HCWs who did not with 49.16% overall average score ($p < 0.01$). Nearly all HCWs (98%) knew that TB is transmitted by an airborne route and 70% HCWs knew epidemiological, clinical, and laboratory characteristics of LTBI. However, only 43% of HCWs knew about the level of risk of LTBI progression to TB disease, and only 30% were able to correctly identify high-risk groups for LTBI progression to TB disease. The majority (85%) HCWs knew the preferred regimen for LTBI treatment but fewer (66%) knew the justification for latent TB therapy.

With respect to HCWs perceived threat of TB infection and perceived benefits and barriers of TB IC, 53% of HCWs thought that they were at risk of having LTBI at some point in the future, 36% of the participants were concerned about acquiring LTBI with MDR-TB strains, 48% thought of LTBI as a serious health condition, but 43% of HCWs did not want to receive treatment for LTBI because they believed that they would be exposed to TB again (Table 2).

Seventy-eight percent of HCWs from the NTP and only 36% of HCWs from the PHCs reported frequent use of respirators when around patients who are at risk for or who have active TB. TB IC related behavior and willingness to implement TB IC related behavioral change is described in Table 3.

Predictors of HCWs knowledge about TB

In multivariate analysis, physicians were more likely to know symptoms suggestive of TB disease (aOR 1.7; 95% CI 1.0-2.9), TB diagnostic methods (aOR 1.9; 95% CI 1.1-3.1), high risk groups for TB disease (aOR 2.3; 95% CI 1.3-4.0), and LTBI treatment rationale (aOR 1.5; 95% CI 1.0-2.5) compared to nurses (Table 5). HCWs who work primarily with TB patients were more likely to know about the risk of LTBI progression to TB disease (aOR 3.2; 95% CI 1.6-6.4), high risk groups for TB disease (aOR 2.2; 95% CI 1.0-4.8), LTBI treatment rationale (aOR 2.3; 95% CI 1.2-4.5), and LTBI treatment regimen (aOR 4.2; 95% CI 1.6-11.1) compared to those who did not work with TB patients (Table 5).

Association between HCWs' TB knowledge and Beliefs

HCWs who knew about the risk of progression from LTBI to TB disease ($p < 0.03$) and high risk groups for TB disease ($p < 0.01$) were more likely to worry about acquiring LTBI with drug-resistant strains than those HCWs who do not have these knowledge. HCWs who knew about LTBI treatment rationale ($p < 0.01$) and TB diagnostics ($p < 0.05$) were more likely to think that screening of TB contacts for LTBI is important than those HCWs who did not demonstrate the knowledge. HCWs who knew about LTBI characteristics ($p < 0.04$), LTBI treatment rationale ($p < 0.01$), and TB diagnostics ($p < 0.01$) more likely felt that immunocompromised individuals need to be screened for LTBI than those who did not have this knowledge. Only those HCWs who knew LTBI characteristics ($p < 0.01$) perceived LTBI as a serious infection. As expected, HCWs who work primarily with TB patients consider themselves more susceptible to LTBI than HCWs who do not ($p < 0.01$).

Predictors of TB IC related behaviors

HCWs who indicated that they worry about becoming infected with drug-resistant TB (aOR 1.7; 95% CI 1.29-2.24), HCWs who think that it is important to screen TB contacts (aOR 3.1; 95% CI 1.25-7.77), and HCWs who were physicians (aOR 1.6; 95% CI 1.04-2.42) were more likely to be willing to undergo annual screening for LTBI (Table 5). HCWs were more likely to refuse treatment for LTBI if they worked in TB facilities (inpatients TB facility - aOR 0.3; 95% CI 0.12-0.68; outpatients TB facility - aOR 0.2; 95% CI 0.10-0.35) and perceived a high personal risk of TB re-infection (aOR 0.5; 95% CI 0.36-0.64). Those who thought that LTBI is a potentially serious health condition were more willing to be treated for LTBI (aOR 2.0; 95% CI 1.48-2.60) (Table 5). Availability of respirators in HCFs was the only significant predictor of routine use of respirators (aOR 5.1; 95%CI 3.50-7.30). In multivariable analysis, working in a TB outpatient facility (aOR 3.1; 95%CI 1.37-6.96), perceived susceptibility to LTBI in the future (aOR 1.4; 95%CI 1.02-2.03), and perception that UV germicidal radiation was unlikely to harm HCWs (aOR 0.4; 95%CI 0.24-0.50) were identified as independent predictors of willingness to use UV lights in HCFs (Table 5).

Discussion

In our survey conducted among HCWs from the NTP and PHCs in Georgia, physicians compared to nurses were found to have greater knowledge related to TB and TB IC measures. Also HCWs who worked primarily with TB patients were more educated about TB and related IC activities compared to HCWs who did not see TB patients regularly. HCWs knowledgeable about TB and TB IC measures were more likely to perceive their susceptibility to TB infection, severity of TB disease, and TB IC intervention benefits and barriers. Moreover, HCWs who perceived their susceptibility to TB infection and net benefit of TB IC measures were more likely to comply with IC interventions.

Evidence supports that knowledge is a facilitator of compliance with interventions.[3, 18, 19] Nurses who work mainly with TB patients should be targeted for the training, given their high risk of TB infection[6] and lack of knowledge on this topic. Furthermore, Georgian HCWs who work in non-TB HCFs need training about TB and TB IC, as persons with undiagnosed TB or suspected cases of TB may be seen at these facilities.[6] This is especially

true since TB services are currently being integrated in PHCs as part of the ongoing health system reforms in Georgia.

We analyzed our survey data based on the HBM. The model suggests that individuals conduct an internal assessment of the net benefits of changing their behavior, and decide whether or not to act. The model identifies four aspects of this assessment: perceived susceptibility to ill-health (risk perception), perceived severity of ill-health, perceived benefits of behavior change, and perceived barriers to taking action.[12] Consistent with the HBM, UV light use is well accepted by HCWs who believe that they are at risk of TB infection, but HCWs who think that UV lights can be harmful leads to their reluctance to use UV lights in HCFs. Perceived LTBI threat predicted HCWs' readiness to receive LTBI treatment, while concern for re-infection with TB after LTBI treatment predicted HCWs refusal to be treated for LTBI. Given that a previous study we conducted in the country of Georgia in 2009-2011 reported high rates of occupational acquisition of TB infection (22.8/100 person-years),[6] it is not surprising that Georgian HCWs believe that they remain at risk of TB even after treatment for LTBI. We also found that respirators are not always available for all HCWs, especially in non-TB HCFs. These findings emphasize the need to strengthen IC measures in Georgian HCFs and provide important baseline information for the Georgian Ministry of Health, Labor, and Social Affairs that is currently implementing IC interventions in HCFs.

Our study is subject to limitations. One limitation of our study is that TB IC related behaviors were self-reported rather than observed. For instance, respirator use was measured by HCWs' responses to anonymous questions, rather than by observations of this behavior by the study team. Another limitation of our study is that convenience sampling was used and 19% of those who were approached did not agree to complete the survey. Most of the non-responders (53 out of 58 HCWs) were nurses from the NTP, potentially introducing selection bias. Physician to nurse ratio in TB services and in PHCs is about one to one in Georgia, therefore we expected nearly equal proportion of nurses and physicians in our study population. Physicians comprised 48% of our population, and nurses comprised 40%, so our study slightly overrepresented physicians compared to nurses. A major strength of our study is that it included various types of HCWs from across the whole country.

In summary, our study is the first survey about HCWs' knowledge, beliefs, and behaviors about TB IC and LTBI screening and treatment in Georgia. We were able to identify specific knowledge gaps and beliefs to be addressed during implementation of TB IC measures in Georgian HCFs. Researchers and HCF administrators should pursue the application of behavioral science methods to strengthen TB IC measures implementation process.[20] Based on our survey findings, a targeted campaign is needed to raise HCWs' awareness about TB and about the benefits of TB IC measures to prevent the nosocomial transmission of TB and the particular threats of drug-resistant TB in the country Georgia.

Acknowledgements

Financial support. This study was supported in part by NIH Fogarty International Center [D43TW007124 and D43TW007124-06S1], the Atlanta Clinical and Translational Science Institute [NIH/NCATS UL1TR000454], the Emory Global Health Institute.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. Manuscript preparation.

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Table 1

Demographic Information of Healthcare Workers Surveyed (N=240)

Characteristic	Subcategory	N (%)
Demographic		
Age, years	≤ 35	59 (24.6)
	36 – 44	59 (24.6)
	45 – 51	59 (24.6)
	52 – 60	37 (15.4)
	60 <	20 (8.3)
	Missing	6 (2.5)
Gender	Female	216 (90.0)
Location of HCW Employment	Tbilisi	130 (54.2)
	Other Locations	110 (45.8)
Employment		
Health Facility	TB Facility	136 (56.7)
	Non-TB health facility	104 (43.3)
Respirator Is Available for Most of the Time	Inpatient TB facility	35 (92.1)
	Outpatient TB facility	77 (78.6)
	Non-TB health facility	45 (44.6)
Works Primarily with TB Patients	Yes	136 (56.7)
Occupation	Physician	114 (47.5)
	Nurse	94 (39.2)
	Other	27 (11.3)
	Missing	5 (2.1)
Years Worked in Healthcare	≤ 5	26 (10.8)
	6-20	98 (40.8)
	21-34	80 (33.3)
	35 ≤	22 (9.2)
	Unknown/Missing	14 (5.8)

Note HCW, Healthcare worker; TB, Tuberculosis

Table 2

Healthcare Worker Beliefs about Latent Tuberculosis Infection and Tuberculosis Infection Control (N=240)

Characteristic	No Chance (1) N (%)	Little Chance (2) N (%)	No Opinion (3) N (%)	Some Chance (4) N (%)	Very Good Chance (5) N (%)
Perceived Susceptibility					
Have LTBI now	48 (20.0)	71 (29.6)	11 (4.6)	72 (30.0)	38 (15.8)
Will test positive for LTBI in the future	22 (9.2)	65 (27.1)	25 (10.4)	99 (41.3)	29 (12.1)
Will be diagnosed with TB in the future	35 (14.6)	75 (31.3)	14 (5.8)	104 (43.3)	12 (5.0)
Characteristic	**Strongly Agree (1) N (%)**	**Agree (2) N (%)**	**No Opinion (3) N (%)**	**Disagree (4) N (%)**	**Strongly Disagree (5) N (%)**
Perceived Severity					
Worry about acquiring LTBI	48 (20.0)	84 (35.0)	43 (17.9)	49 (20.4)	16 (6.7)
Worry about acquiring TB disease	30 (12.5)	62 (25.8)	54 (22.5)	68 (28.3)	26 (10.8)
Worry about acquiring LTBI with MDR-TB strains	16 (6.7)	70 (29.7)	64 (26.7)	63 (26.3)	27 (11.3)
Latent TB infection is very serious	30 (12.5)	87 (36.25)	39 (16.3)	70 (29.2)	14 (5.8)
Perceived Benefits					
IC measures prevent nosocomial TB transmission	86 (35.8)	102 (42.5)	29 (12.1)	21 (8.75)	2 (0.8)
UV is an effective IC measure	48 (20)	119 (49.6)	54 (22.5)	12 (5)	7 (2.9)
Respirator protects HCW from TB exposure	116 (48.3)	94 (39.2)	22 (9.2)	5 (2.1)	3 (1.3)
Respirator protects HCW from MDR-TB exposure	89 (37.1)	109 (45.4)	36 (15)	5 (2.1)	1 (0.4)
It is important for Georgian HCWs to be tested for latent TB infection	100 (41.7)	106 (44.2)	23 (9.6)	9 (3.8)	2 (0.8)
It is important to test contacts of patients with TB (family, friends) for latent TB infection.	130 (54.2)	86 (35.8)	15 (6.3)	5 (2.1)	4 (1.7)
It is important to test children who have been exposed to TB for latent TB infection.	147 (61.3)	74 (30.8)	16 (6.7)	0 (0.0)	3 (1.3)
It is important to test individuals with compromised immune systems for latent TB infection.	103 (42.9)	92 (38.3)	38 (15.8)	5 (2.1)	2 (0.8)
Perceived Barriers					
UV lights can harm healthcare workers	31 (12.9)	70 (29.2)	57 (23.8)	73 (30.5)	9 (3.8)

Characteristic	No Chance (1) N (%)	Little Chance (2) N (%)	No Opinion (3) N (%)	Some Chance (4) N (%)	Very Good Chance (5) N (%)
If I tested positive for LTBI, I should not be treated because I will be exposed again in the future	33 (13.8)	70 (29.2)	50 (20.8)	69 (28.8)	18 (7.5)
If I tested positive for LTBI, I should not be treated because probably I have drug-resistant TB strains	23 (9.6)	43 (17.9)	58 (24.2)	93 (38.8)	23 (9.6)
Risks of treating LTBI outweigh benefits to treating LTBI	35 (14.6)	70 (29.2)	84 (35.0)	48 20.0)	3 (1.3)

Note HCW, Healthcare worker; LTBI, Latent Tuberculosis infection; TB, Tuberculosis; MDR-TB, Multidrug-resistant Tuberculosis; IC, Infection Control; UV, Ultraviolet

Table 3

Tuberculosis Infection Control Related Behavior or Willingness to Exhibit Tuberculosis Infection Control Related Behavior

Characteristic	Subcategory	N (240)	% (100)
Respirator Use: How often do you wear a respirator when around patients who are at risk for or who have active TB?	Frequent	144	60.0
	Sometimes	49	20.4
	Never	29	12.1
	Missing	18	7.5
UV light Use: I do not want to work in an area where UV lights are used	Agree	90	37.5
	No Opinion	53	22.1
	Disagree	97	40.4
LTBI Screening: Would you be willing to be tested each year for latent TB infection?	Yes	125	52.1
	No	59	24.6
	Undecided	45	18.8
	Missing	11	4.6
LTBI Treatment: If I tested positive for latent TB infection, I should be treated.	Agree	116	48.3
	No Opinion	40	16.7
	Disagree	84	35.0

Note TB, Tuberculosis; IC, Infection Control; UV, Ultraviolet; LTBI, Latent Tuberculosis Infection.

Table 4

Multivariate analysis for predictors of Healthcare Workers Tuberculosis Knowledge

Outcomes [ab]	**Knowledge of LTBI Character.**	**Knowledge Risk of LTBI progress. to TB**	**Knowledge High risk groups for TB**	**Knowledge TB Sympt.**	**Knowledge TB diag.**	**Knowledge LTBI Treat. Rational**	**Knowledge Of LTBI Treat. Regimen**
Predictors	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Male vs. Female	1.4 (0.4, 5.5)	**9.3 (1.9, 44.9)**	1.7 (0.5, 6.0)	0.6 (0.2, 2.5)	1.6 (0.5, 5.4)	1.3 (0.4, 4.40)	3.0 (0.4, 25,8)
Age‡, years (60 < vs. 52 – 60 vs. 45 – 51 vs. 36 – 44 vs. ≤ 35)	1.3 (0.8, 2.0)	0.9 (0.6, 1.3)	1.2 (0.8, 1.8)	1.5 (0.9, 2.5)	1.2 (0.8, 1.8)	**1.7 (1.1, 2.6)**	1.1 (0.6, 1.9)
Occupation [c] (Physician vs. Nurse vs. Other)	1.6 (1.0, 2.6)	1.4 (0.8, 2.3)	**2.3 (1.3, 4.0)**	**1.7 (1.0, 2.9)**	**1.9 (1.1, 3.1)**	**1.5 (1.0, 2.5)**	0.6 (0.3, 1.1)
Work with TB patients vs. Do not work with TB patients	1.6 (0.8, 3.2)	**3.2 (1.6, 6.4)**	**2.2 (1.0 4.8)**	1.6 (0.8, 3.3)	1.4 (0.7, 2.8)	**2.3 (1.2, 4.5)**	**4.2 (1.6, 11.1)**
Length of Employment [c] (35 ≤ vs. 21 - 34 vs. 6 - 20 vs. ≤5)	0.7 (0.4, 1.2)	0.7 (0.4, 1.3)	0.9 (0.5, 1.9)	0.6 (0.3, 1.3)	0.8 (0.5, 1.5)	0.5 (0.2, 0.9)	0.7 (0.3, 1.7)

Note TB Knowledge variables were coded as correct versus incorrect answers. HCW, Healthcare worker; TB, Tuberculosis; LTBI, Latent Tuberculosis infection.

[a] Definitions of the correct answers are presented in the table 2.

[b] Binary logistic regression was used.

[c] ordinal variables.

Table 5

Multivariate analysis for predictors of Tuberculosis Infection Control Related Behaviors

Outcomes		**Respirator Use** [a]	**UV Light Use in HCF** [b]	**LTBI Screening** [a]	**LTBI Treatment** [a]
Predictors		**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Modifying Factors	TB inpatient vs. non-TB HCF	1.6 (0.48, 5.29)	1.3 (0.43, 3.61)	1.7 (0.72, 4.09)	**0.3 (0.12, 0.68)**
	TB outpatient vs. non-TB HCF	1.0 (0.42, 2.18)	**3.1 (1.37, 6.96)**	0.6 (0.30, 1.17)	**0.2 (0.10, 0.35)**
	Occupation [c]			**1.6 (1.04, 2.42)**	0.7 (0.42, 1.06)
	Respirator availability [c]	**5.1 (3.50, 7.30)**			
Perceived Threat	Will test positive for LTBI in the future		**1.4 (1.02, 2.03)**		
	Worry about acquiring LTBI with MDR-TB strains	1.4 (0.97, 1.97)		**1.7 (1.29, 2.24)**	
	LTBI is very serious				**2.0 (1.48, 2.60)**
Perceived Benefits	UV light is an effective TB IC measure		1.6 (0.69, 3.46)		
	It is important to test TB contacts for LTBI			**3.1 (1.25, 7.77)**	
Perceived Barriers	UV lights can harm HCWs		**0.4 (0.24, 0.50)**		
	If I tested positive for LTBI, I should not be treated because I will be exposed again in the future				**0.5 (0.36, 0.64)**

Note Occupation was coded as Physician versus Nurse versus other; Respirator Availability was coded as Always versus Most of the Time versus Sometimes versus Rare versus Never; Respiratory Use was coded as Frequent versus Sometimes versus Never; UV Light Use in HCF, LTBI Screening, and LTBI Treatment were coded as Yes versus Undecided versus No. UV, Ultraviolet; HCF, Healthcare Facility; TB, Tuberculosis; LTBI, Latent Tuberculosis Infection; MDR-TB, Multidrug-resistant Tuberculosis; IC, Infection Control; HCW, Healthcare Worker.

[a] Ordinal Logistic regression was used.

[b] Polytomous logistic regression was used.

[c] ordinal variable.