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Education and Training Needs of U.S. Tuberculosis Programs

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Abstract

The Centers for Disease Control and Prevention (CDC) funds tuberculosis (TB) Centers of Excellence (COEs) that support TB control and prevention efforts in the United States. In 2018, the TB COEs conducted a multiphased assessment among U.S. staff involved in TB service delivery to identify needs related to TB training, resources, and medical consultation. Representatives from each TB COE and CDC's Division of TB Elimination formed a workgroup to guide the design of the needs assessment. The group used an online survey for data collection. Participants were staff working in some capacity on TB within the United States, Puerto Rico, and the U.S. Virgin Islands. Staff could be in non-public health (e.g., community health center, hospital, laboratory, private practice) or public health (state or local health department staff responsible for TB) settings and did not have to be a clinical health care provider (N = 1,482). We identified four priority areas for future TB training and education efforts. These areas include (1) focus on key topics; (2) tailor training and products to different professions, settings, and skill levels; (3) keep learners updated on the latest resources and best practices; and (4) use a mix of training methods and formats. The findings highlighted future priorities for TB training and education and were shared with health department TB programs throughout the United States.

Keywords

tuberculosis; needs assessment; training; health education; public health workforce; mixed methods

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Disclaimer

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

Tuberculosis (TB), an airborne infectious disease, remains among the leading causes of death worldwide (World Health Organization [WHO], 2024). TB incidence rates in the United States generally declined from 9.7 cases per 100,000 population in 1993 to 2.2 cases per 100,000 population in 2020 (Centers for Disease Control and Prevention [CDC], 2024). The decline in TB incidence rates was due, in part, to increased investments in U.S. TB programs, which prevented as many as 300,000 TB cases from 1995 to 2014 (Castro et al., 2016). However, each year from 2021 to 2023, TB cases and incidence rates have increased (CDC, 2024). The U.S. TB incidence rate remains among the lowest globally (WHO, 2024); even so, the recent increases highlight the importance of refocusing attention on the U.S. TB elimination goal of <1 case per million persons annually (Institute of Medicine [US] Committee on the Elimination of Tuberculosis in the United States & Geiter, 2000). In addition, disparities in TB persist. In 2023, the percentage of U.S. TB cases was 36.8% among Hispanic or Latino persons, 30.0% among Non-Hispanic Asian persons, 17.6% among Non-Hispanic Black or African American persons, and 9.3% among Non-Hispanic White persons (CDC, 2024). Four states have the highest burden of TB in the United States: California, Florida, New York, and Texas (CDC, 2024).

Latent TB infection (LTBI) is a condition in which TB bacteria are present in the body but do not cause sickness and do not spread to others (LoBue & Mermin, 2017). Previous studies estimate that in the United States over 80% of TB cases each year are attributable to LTBI developing into TB disease, which is infectious and can be deadly if not treated properly (CDC, 2024; LoBue & Mermin, 2017). People at risk for LTBI include those who may have been exposed to TB bacteria by living in or frequently visiting countries where TB is more common, living in communal group settings where TB is more common (e.g., homeless shelters or prisons), spending time with someone with TB disease, and working in settings where TB is more common (e.g., hospitals or prisons) (US Preventive Services Task Force et al., 2023).

TB prevention efforts include education and support for health care providers to increase their awareness of TB. Low numbers of TB cases in the United States contribute to low provider awareness and lead to lower suspicion of TB, causing delayed diagnosis for persons with infectious TB and contributing to ongoing TB transmission in communities (Jereb, 2002). Another strategy for TB prevention is offering treatment to individuals with LTBI to prevent progression to TB disease.

The control of infectious diseases, such as TB, requires an educated, informed, and resourced health workforce (Capriles-Quirós et al., 2014). Responsibility for TB prevention in the United States lies primarily with the public health sector (Jeffries et al., 2017). Community and private health care providers serving persons at high risk for TB infection and disease are key partners in TB prevention, diagnosis, and treatment (CDC, 2004). The Centers for Disease Control and Prevention (CDC) funds TB Centers of Excellence (TB COEs) that support TB prevention efforts in the United States. Each TB COE is assigned a region of the United States to cover all 50 states and the U.S. territories. The TB COEs in this report include those funded during the years 2018–2022: Curry International TB Center (CITC), Heartland National TB Center (HNTC), Rutgers Global TB Institute

(GTBI), and Southeastern National TB Center (SNTC). Support for the TB workforce is provided through training, education, and medical consultation services made available to all health sectors within TB COE-assigned geographic regions.

To keep abreast of the diverse and evolving training needs of the U.S. TB public health workforce, the TB COEs routinely conduct training and medical consultation needs assessments in their respective regions to inform their programmatic offerings (CDC, 2004). Needs assessments are a key component of the health education process and help inform training development. They provide a firm foundation for planning training and education activities by helping to describe the priority audience and to identify gaps, priorities, and existing resources. Needs assessments can also help establish support for educational activities as well as provide a basis for evaluation (CDC, 2020). In 2018, the TB COEs conducted a multiphased assessment among U.S. staff involved in TB service delivery to identify needs related to TB training, resources, and medical consultation to inform development of health education, trainings, and other products for use by the U.S. TB workforce. A trained TB workforce is critical to achieving the TB elimination goal in the United States (Institute of Medicine [US] Committee on the Elimination of Tuberculosis in the United States & Geiter, 2000).

The needs assessment was conducted following the approach outlined in CDC's Quality Training Standards (QTS) (CDC, 2020). The QTS is a series of eight standards that guide the development of a quality training. The first standard is that a training needs assessment informs training development. The focus of the QTS needs assessment is the collection and analysis of information to inform which technical topics to cover, the primary learning audience, and what learning methods will best serve the audience (CDC, 2020). We report the results of the needs assessment and implications of results for TB education and training offerings.

METHOD

Representatives from each TB COE and CDC's Division of TB Elimination formed a workgroup to guide the design of the needs assessment. The group selected a mixed-methods approach for data collection using an online survey and key informant interviews. The workgroup developed survey and key informant interview questions based on previous assessments and knowledge of the TB workforce landscape. This report focuses on results of the survey. One of the TB COE's affiliate universities received an exemption, and one received a non-research determination from their respective local Institutional Review Boards (IRBs). The other TB COE's affiliate universities did not require submission of the project to their local IRB. Informed consent was obtained for all participants. This activity was reviewed by the CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy [see, e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.].

The survey had 46 questions—40 closed- and 6 open-ended. The survey included 3 sections: (1) background demographics, such as location, occupation, and years working in TB, (2) training and education needs, and (3) medical consultation needs. Respondents could choose

to complete either or both of the last two sections based on the services applicable to their job duties. Eight public health staff volunteered to pilot-test the survey prior to launching, to assess survey length, clarity, and ease of the online platform. A link to the survey was sent via email to the TB COE distribution lists. The survey was open to individuals working in some capacity on TB within the United States, Puerto Rico, and the U.S. Virgin Islands. Staff could be in non-public health settings (e.g., community health center, hospital, laboratory, and private practice) or public health settings (state or local health department staff responsible for TB) and did not have to be clinical health care providers. The survey remained open for 3 weeks, took approximately 20 minutes to complete, and was administered via the Qualtrics platform. Participants could skip questions.

This article focuses on the training and education data from the assessment. Questions about preferred training topics were presented in a matrix-style series. Each matrix had multiple row item questions with three available response categories: “not needed,” “needed,” and “highly needed.” We analyzed how ranking of preferred training topics varied when looking at “highly needed” responses. We also examined preferred training topics by individual row items and averages across training topic categories. Averages were calculated by dividing the mean number of responses of “highly needed” by the mean number of responses to individual row items. We used Pearson’s chi-square tests of statistical significance to examine associations between responses of “highly needed” training topics and demographic characteristics (i.e., profession, years working in TB, percent effort on TB activities, local TB epidemiology, and public health versus non-public health sector), and those with *p*-values <.05 were considered significant. Survey responses were analyzed using SPSS (version 27; IBM). We used an inductive approach to code open-ended questions and counted repeated themes to capture prevalence.

RESULTS

Of individuals who were sent the survey link, 1,706 initiated the survey. Response rates are not available because the number of people invited to the survey is unknown, as staff were asked to share the survey link with colleagues who also work on TB. Those who did not begin the training and education section were dropped from the sample. This removed 224 respondents (13% of the sample), leaving a total of 1,482 participants for analysis. Group analysis revealed no significant differences in the final sample. No TB COE region or demographic group was disproportionately affected by this removal.

Demographics

A total of 1,482 participants were included in the final sample. The sample included participants from all 50 states as well as Puerto Rico and the U.S. Virgin Islands. Table 1 provides an overview of key demographics across the sample and by the four COEs.

Seventy percent of the respondents were nurses (any license), and 10% were physicians. Seventy-four percent reported working primarily in a health department, 12% “other,” 8% in a hospital, and only 1% in private practice. A little over half of the sample reported spending less than 50% of their time on TB-related activities. This number was significantly smaller in one TB COE (HNTC at 40% working less than 50% on TB). Finally, 44% of the sample

had more than 10 years of experience working in TB, and another 30% reported having between 1 and 5 years of experience.

Focusing on Key Topics

The first priority area we identified was focusing on key topics. The average percentage of “highly needed” responses to items within training categories was 21.8% for TB treatment, 21.1% for specific populations, and 20.9% for TB comorbidities as the top three training categories (Table 2). When individual training items within categories were ranked for importance by the percentage of responses that were “highly needed,” the highest percentage was within the TB diagnostics category: new diagnostic tools on the horizon (33.7%) (Table 3). The second-highest item was within the TB case management category: coordinating care for patients with complex medical issues (28.4%). The following three highest-ranked items were within the TB treatment category: new treatment options on the horizon (27.7%), treating drug-resistant TB (27.5%), and managing adverse reactions to TB treatment drugs (27.2%). Finally, the next three items were within the LTBI category: recommendations for effectively using the Tuberculin Skin Test and Interferon Gamma Release Assays (27.0%), engaging private providers (26.8%), and treatment adherence strategies (25.8%). Based on these analyses, we identified five priority training topics: (1) complex medical issues, (2) TB treatment, (3) diagnostic tests, (4) partnering with private providers, and (5) working with diverse populations.

Tailor Training

A second priority area centered on the importance of tailoring training to suit different audience needs. In an open-ended survey question asking for additional suggestions for training and education, tailoring training was the top suggestion. This theme captured any reference to making training more specific rather than a one-size-fits-all approach. For example, while one physician asked for “more radiography-related trainings,” an epidemiologist asked for “a little more epi-focused trainings.” This is reflected in training topic preferences by profession as well. The topic that received the highest percentage of “highly needed” responses among nurses and epidemiologists was new diagnostic tools (34% and 39%), among health educators and outreach workers was engaging private providers (65% and 46%), and among physicians was working with the elderly (37%).

In addition, we observed statistically significant differences in training preferences by other participant characteristic subgroups. This included differences in training preferences for topics within the TB comorbidity training category by time spent working on TB. Among the 704 participants who spent 50% effort or more on TB activities, 22.4% felt they highly needed training on diabetes, 22.4% on HIV/AIDS, 23.0% on liver disease, 24.4% on immunosuppressive therapy, 26.8% on psychiatric conditions, 19.9% on renal failure, 18.0% on solid organ transplant, 26.0% on substance use, and 21.2% on viral hepatitis (Figure 1). Among the 778 participants who spent less than 50% effort on TB activities, 15.8% felt they highly needed training on diabetes, 15.3% on HIV/AIDS, 16.8% on liver disease, 16.8% on immunosuppressive therapy, 16.5% on psychiatric conditions, 12.9% on renal failure, 8.7% on solid organ transplant, 21.1% on substance use, and 15.6% on viral hepatitis. The largest differences between those who spent 50% effort or more on TB activities and those who

spent less than 50% effort on TB activities were for psychiatric conditions, which also had the highest percentage of “highly needed” responses of all comorbidities and solid organ transplant. The participants who spent 50% effort or more on TB activities were significantly more likely to be interested in training on comorbidities than participants who spent less than 50% effort on TB activities.

Staying Updated on Latest Resources and Best Practices

A third priority area was staying updated on the latest resources and best practices. This pattern came through in two ways. First, two specific survey questions used the word “new”: “new diagnostic tools on the horizon” and “new treatment options on the horizon.” These two items scored in the top 3 most preferred training topics overall, suggesting that participants want to keep abreast of cutting-edge technology and the latest clinical guidelines and public health recommendations (Table 2). Second, an open-ended question on suggestions for improving training and education revealed a strong desire to stay updated. Participants wanted courses to be better advertised, more entry-level training for the growing number of new staff, and more training on advanced topics. Both themes underscore the larger issue of staying up-to-date.

Mix of Training Methods and Formats

The fourth priority area was to provide a mix of training methods and formats. Overall, results varied between a preference for in-person versus remote training and paper versus online formats. The top two preferred training methods were trainings tailored to the state (in-person) and live webinars (remote). The top two preferred formats for professional development materials were factsheets with 56% of responses as “highly needed” (paper or online) and PDFs with 54% of responses as “highly needed” (online). Figure 2 illustrates responses to the preferred format for professional education materials. By contrast, preferred patient education materials were largely print-based formats with factsheets and brochures as the top two formats.

DISCUSSION

The purpose of this needs assessment was to identify gaps related to TB training, resources, and medical consultation among the U.S. TB workforce to inform the development of educational resources. Preferences for TB education and training were additionally examined by demographic and professional subgroups. The results highlighted four priority areas for training and education:

1. Focus on key topics, including managing comorbidities, TB diagnostics, TB treatment and adherence, and engaging private providers on LTBI.
2. Tailor training to different professions, groups, settings, and skill/specialization levels.
3. Keep staff updated on the latest resources and best practices.
4. Provide a mix of training methods and formats and maintain print resources.

Results of the TB COE needs assessment survey provide critical information on workforce needs to advance TB elimination efforts in the United States. Findings highlight the importance of engaging in a dual approach to tackle TB and LTBI. Partnership between the public health sector and private providers is a recommended strategy for U.S. TB prevention and control by the Advisory Council for the Elimination of Tuberculosis and the National Tuberculosis Coalition of America (formerly the National Tuberculosis Controllers Association) (Cole et al., 2020). Our findings suggest a need for education and training resources specifically designed to help public health entities engage with private providers. In addition, respondents indicated an ongoing need to update TB providers with information about the changing treatment options for drug-susceptible and drug-resistant TB. As TB cases have historically declined in the United States, cases become more complex (Vaisman et al., 2020) and resources are needed that address comorbidities and specific populations, including for LTBI.

Regarding preferred training and education formats, survey results demonstrate the need to develop and disseminate resources in a variety of formats. For instance, short, concise job aids focused on key messages can be helpful for busy providers (Grudniewicz et al., 2016). In addition, tailoring training—such as by role, experience level, or setting—was identified as a need by respondents both directly through open-ended survey responses and based on preferences differing by participant subgroups. Previous research that reports assessments of the U.S. public health workforce, while not specific to TB, also identified training needs related to multisector partnerships and varying training needs by work setting (Balio et al., 2023; McKeever et al., 2019).

The present needs assessment is subject to at least three limitations. First, survey respondents may not have been representative of all staff involved in TB service delivery. Thus, these findings may not reflect the needs of everyone in the TB workforce. Our sample is largely made up of nurses and staff who work in a health department setting, so our findings may reflect preferences from those groups more than others. Second, the survey was lengthy and may have influenced respondents' choice on which survey sections to complete, further impacting the representative makeup of the survey sample. Third, the assessment was conducted prior to the onset of the COVID-19 pandemic. During this time, many in-person activities shifted to online, virtual, and telephone formats (Burzynski et al., 2020), and this experience may have influenced training preferences. In addition, the pandemic resulted in vast personnel turnover within the public health sector (Leider et al., 2023; Shen et al., 2024), and changes in the TB workforce since the assessment may result in evolving training needs.

Preferences were identified related to TB training and education resources among the U.S. TB workforce, including the format of educational products and topic areas to inform the development of resources. Results were used to guide the TB COEs in planning their yearly training and education offerings and provided CDC with data on national trends. The findings also guided future priorities for TB training and education, and the COEs shared reports of jurisdiction-specific findings with health department TB programs throughout the United States for awareness. In addition, the priorities identified for training and education

among public health staff working at health departments may be applicable across public health program areas, beyond TB.

IMPLICATIONS FOR PRACTICE

The findings from this needs assessment have several implications for public health educational practice. Programs that offer training and education support to health workforce staff should routinely assess the needs of staff to ensure topics of high priority are covered. This work also underscores the preferences of health workforce staff for education and training offerings that are tailored to different staff roles, settings, experience, and skill levels, particularly for those working in disease or health topic areas with a multifaceted workforce. In addition, providing training opportunities in a range of delivery methods and educational materials in a variety of formats may improve staff's ability to engage with education and training offerings. While the instruments used for the present needs assessment were developed specifically for TB, other program areas could consider asking workforce staff about preferences relating to the format and delivery of training and education services in their own assessments. This would follow the approach outlined in CDC's QTS, which could be considered by others planning education and training offerings for health workforce staff, regardless of subject matter. Overall, these findings can help programs plan training and education offerings for health workforce staff development.

Authors' Note:

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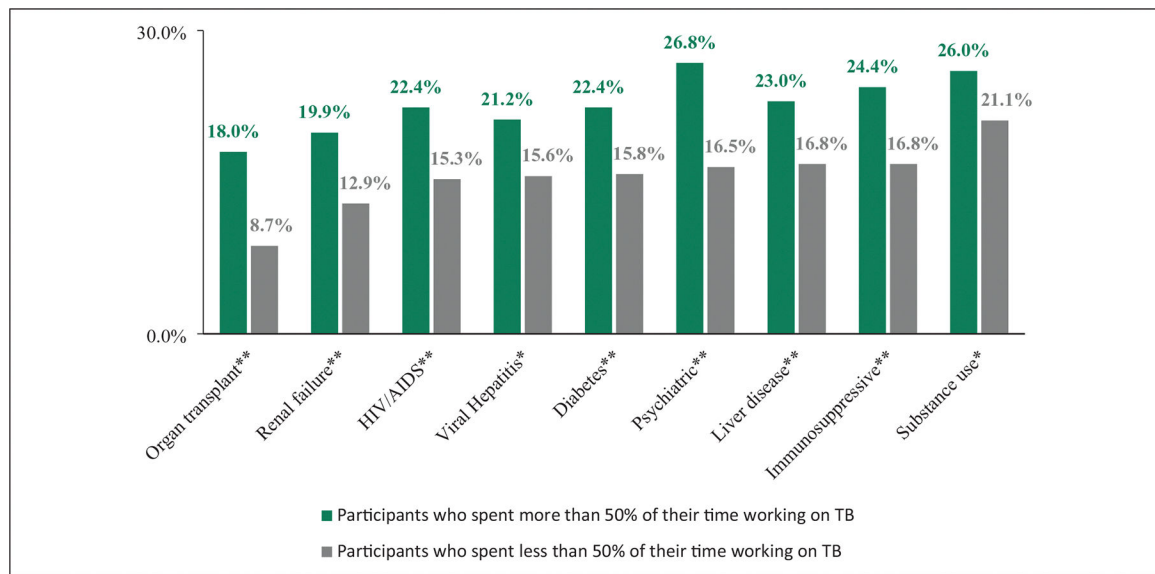


FIGURE 1. Survey Respondent Preferences^a for Trainings on TB Comorbidities by Amount of Time Spent Working on TB, United States, 2018 (N = 1,482).

^a Determined by percentage of responses of “highly needed” to training items (# responses of “highly needed”/sum of responses of “not needed,” “needed,” “highly needed,” and item non-responses).

** $p < .01$. * $p < .05$, Pearson’s chi-square tests of statistical difference for categorical variables.

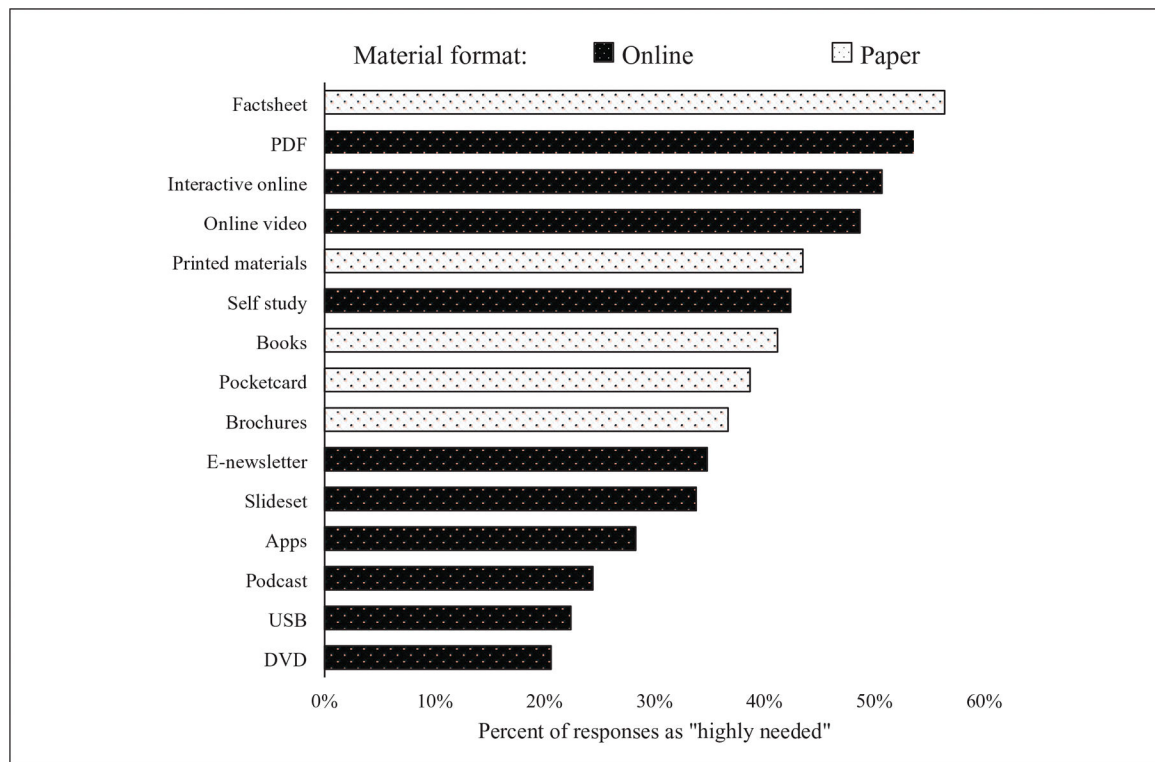


FIGURE 2. Survey Respondent Preferences for Professional Education Material Formats, United States, 2018 (N = 1,482).

TABLE 1
Demographics of Survey Respondents by TB Centers of Excellence Site and Overall, United States, 2018 (*N* = 1,482)

	CITC	GTBI	HNTC	SNTC	Total
Profession					
Epidemiologist	4.4% (15)	4.3% (20)	1.9% (4)	4.1% (19)	3.9% (58)
Health Educator	2% (7)	1.5% (7)	2.4% (5)	2% (9)	1.9% (28)
Nurse	66.4% (227)	71.5% (336)	68.1% (143)	73.3% (337)	70.4% (1,043)
Other	8.8% (30)	7.7% (36)	17.6% (37)	11.5% (53)	10.5% (156)
Outreach/Field Service	4.4% (15)	2.1% (10)	5.7% (12)	3.5% (16)	3.6% (53)
Physician	14% (48)	13% (61)	4.3% (9)	5.7% (26)	9.7% (144)
Work setting					
Community health center	6.4% (22)	4.3% (20)	1.4% (3)	2% (9)	3.6% (54)
Health department	71.3% (244)	77.7% (365)	75.2% (158)	71.1% (327)	73.8% (1,094)
Hospital	9.4% (32)	9.4% (32)	6.7% (14)	8.3% (38)	7.8% (116)
Laboratory	0.9% (3)	0.6% (3)	1.4% (3)	1.1% (5)	0.9% (14)
Other	11.1% (38)	7.7% (36)	15.2% (32)	17% (78)	12.4% (184)
Private practice	0.9% (3)	3% (14)	0% (0)	0.7% (3)	1.3% (20)
% Time spent on TB					
< 50%	54.4% (186)	57% (268)	38.1% (80)	53% (244)	52.5% (778)
≥ 50%	45.6% (156)	43% (202)	61.9% (130)	47% (216)	47.5% (704)
Years working in TB					
< 1 year	10.2% (35)	5.5% (26)	7.1% (15)	10.2% (47)	8.3% (123)
1–5 years	30.1% (103)	28.5% (134)	33.3% (70)	29.3% (135)	29.8% (442)
6–10 years	15.5% (53)	17.2% (81)	17.6% (37)	20.2% (93)	17.8% (264)
> 10 years	44.2% (151)	48.7% (229)	41.9% (88)	40.2% (185)	44.1% (653)

Note. TB = tuberculosis; CITC = Curry International TB Center; HNTC = Heartland National TB Center; GTBI = Rutgers Global TB Institute; SNTC = Southeastern National TB Center.

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TABLE 2
Survey Respondent Preferences for TB Training Categories^a, United States, 2018 (N = 1,482).

Training category	Responses to items within category (mean)	Responses of “highly needed” (mean)	Average % “highly needed” responses
Long-term care	1,201.3	160.8	13.4%
Correctional facilities	1,228.5	183.0	14.9%
Homeless shelters	1,198.7	183.3	15.3%
TB case management	1,291.9	202.6	15.7%
Partnerships	1,298.1	205.6	15.8%
TB infection control	1,192.1	195.4	16.4%
TB program activities	1,142.9	193.6	16.9%
Latent TB infection (LTBI)	1,368.9	258.0	18.8%
TB diagnostics	1,261.1	242.1	19.2%
Comorbidities	1,348.6	281.3	20.9%
Specific populations	1,193.8	252.1	21.1%
TB treatment	1,155.3	252.0	21.8%

^aCategories are not mutually exclusive.

TABLE 3

Top 10 TB Training Topics^a That Received the Highest Percentage of “Highly Needed” Responses Among Survey Respondents, United States, 2018 (*N* = 1,482).

<i>Training category</i>	<i>Training item</i>	<i>Total responses (N)</i>	<i>Not needed, N (row %)</i>	<i>Needed, N (row %)</i>	<i>Highly needed, N (row %)</i>
Specific populations	Immigrants	1,211	273 (22.5%)	644 (53.2%)	294 (24.3%)
Comorbidities	Substance use	1,360	200 (14.7%)	812 (59.7%)	348 (25.5%)
Latent TB infection	Treatment adherence strategies	1,387	237 (17.1%)	792 (57.1%)	358 (25.8%)
Latent TB infection	Engaging private providers	1,379	353 (25.5%)	657 (47.7%)	369 (26.8%)
Latent TB infection	Recommendations for effectively using the Tuberculin Skin Test and Interferon Gamma Release Assays	1,389	341 (24.6%)	673 (48.5%)	375 (27.0%)
TB treatment	Managing adverse reactions to TB treatment drugs	1,174	178 (15.2%)	677 (57.7%)	319 (27.2%)
TB treatment	Treating drug-resistant TB	1,169	168 (14.4%)	680 (58.2%)	321 (27.5%)
TB treatment	New treatment options on the horizon	1,175	96 (8.2%)	753 (64.1%)	326 (27.7%)
TB case management	Coordinating care for patients with complex medical issues	1,324	229 (17.3%)	719 (54.3%)	376 (28.4%)
TB diagnostics	New diagnostic tools on the horizon	1,279	81 (6.3%)	767 (60.0%)	431 (33.7%)

^aCategories are not mutually exclusive.