

Tuberculosis in the United States: Medical Consultation Services Provided by 5 Tuberculosis Regional Training and Medical Consultation Centers, 2013–2017

Neela D. Goswami,¹ Sundari Mase,² David Griffith,³ Rajita Bhavaraju,⁴ Alfred Lardizabal,⁴ Michael Lauzardo,⁵ Lisa Chen,⁶ John Wilson,⁷ Courtney Chappelle,¹ and Connie A. Haley⁵

¹US Centers for Disease Control and Prevention, Atlanta, Georgia; ²World Health Organization, India-WHO Country Office, Delhi, India; ³Heartland National TB Center and the University of Texas Health Science Center, Tyler, San Antonio, Texas; ⁴Global Tuberculosis Institute at Rutgers, The State University of New Jersey, Newark, New Jersey; ⁵Southeastern National Tuberculosis Center, University of Florida, Gainesville, Florida; ⁶Curry International Tuberculosis Center, University of California, San Francisco, Oakland, California; ⁷Mayo Clinic Center for Tuberculosis, Rochester, Minnesota

With only 9105 new US tuberculosis (TB) cases reported in 2017, expert consultation is essential for TB care. Data were captured 2013–2017 from consultations by 5 CDC-funded centers, now the TB Centers of Excellence (COEs). 14 586 consultations were provided to TB providers, most related to TB disease and treatment regimens.

Key words: CDC; consultation; medical; national; Tuberculosis.

Since a tuberculosis (TB) resurgence in the United States (US) in the late 1980s and early 1990s, the overall US TB rate has declined, plateauing over the past several years with a current incidence rate of 2.8 cases per 100 000 population, with 9105 new cases reported in 2017. Socioeconomic factors and medical co-morbidities pose a barrier to TB elimination in the US. Of patients with TB in 2016, 5% reported recent homelessness and 10% reported excessive alcohol use within the year prior to TB diagnosis. More than 10% had some form of drug-resistant TB, over 16% had diabetes, and 5% were co-infected with HIV [1]. Additionally, medication side effects necessitate close management [2]. In this context, expert consultation may help identify and manage social and medical complexities early on to facilitate appropriate treatment completion.

In addition to reducing TB-related mortality and transmission, US research and programmatic interventions focused on

reducing TB-related morbidity. New TB treatments for drug-resistant disease and in other situations where second-line TB medications are used demonstrated comparable efficacy to traditional regimens with less potential for adverse effects [3, 4]. New diagnostic and therapeutic tools spurred revision of the Centers for Disease Control and Prevention (CDC), Infectious Diseases Society of America, and American Thoracic Society national TB guidelines on diagnostics and treatment of drug-susceptible TB, and the National TB Controllers Association and Association of Public Health Laboratories release of updated guidance on TB isolation practices [2, 5, 6]. In the setting of rapidly advancing science and subsequent updates to national TB guidelines, expert consultation may be essential in providing optimal clinical care to TB patients.

Since 2003, the CDC's Division of Tuberculosis Elimination has funded Regional Training and Medical Consultation Centers (RTMCCs) to provide education, training, and no-cost medical consultation services for healthcare providers and public health departments managing patients with TB or latent tuberculosis infection (LTBI). From 2013–2017, these centers included the Curry International TB Center at University of California, San Francisco (Oakland, CA); the Mayo Clinic Center for Tuberculosis at the Mayo Clinic (Rochester, MN); the Global TB Institute at Rutgers, The State University of New Jersey (Newark, NJ); the Heartland National TB Center at the University of Texas Health Science Center at Tyler (San Antonio, TX); and the Southeastern National TB Center at University of Florida (Gainesville, FL). In 2018, the RTMCCs were renamed TB Centers of Excellence (COEs), with continued provision of similar services (https://www.cdc.gov/tb/education/tb_coe/default.htm). In addition to serving primarily US-based providers, the RTMCCs received funds from the CDC Division of Global Migration and Quarantine to provide medical consultation for overseas panel physicians. These panel physicians screen and treat people living abroad for TB disease who are applying for immigrant or refugee status, as well as non-immigrants who are required to have an overseas medical examination.

RTMCCs, now known as COEs, enter standardized medical consultation data into an electronic national medical consultation database (MCD). Consultations in the MCD were accessible to other medical consultants at the same center and to a CDC medical officer for quality assurance reviews. By analyzing 2013–2017 data from the MCD, this study aims to (1) characterize national trends in TB expert consultation services utilized over a recent 5-year period and (2) identify areas where increased education or guidance may impact TB clinical practices.

Received 6 February 2019; editorial decision 26 March 2019; accepted 29 March 2019.

Correspondence: N. D. Goswami, MD, MPH, US Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop US 12-4, Atlanta, GA 30329-4027 (nef7@cdc.gov).

Open Forum Infectious Diseases®

Published by Oxford University Press on behalf of Infectious Diseases Society of America 2019. This work is written by (a) US Government employee(s) and is in the public domain in the US. DOI: 10.1093/ofid/ofz167

METHODS

Inclusion Criteria

We reviewed all consultations entered into the MCD from January 1, 2013, through December 31, 2017, for this analysis. Consultation information entered into the MCD originated from phone conversations via the COEs' hotlines or from written email inquiries. International panel physician consultations were initiated through a dedicated website (<https://www.cdc.gov/panelphysicians/tb-medical-consultation-service.html>), and a coordinator based at the CDC Division of Migration and Quarantine triaged consultations to each COE based on a rotating schedule.

Data Collection and Analysis, and Definitions

For each medical consultation, the following were collected: clinical TB question to address, occupation and clinical setting of caller, patient type (pediatric vs adult), and country or US state of caller. Caller occupation options included physician, nurse, other (eg, physician assistant, nurse practitioner, TB program administrator), or unknown. Clinical setting of the caller was defined as state or local county health department, hospital, private clinic, academic institution, community health center, correctional facility, nursing home, substance abuse center, HIV clinic, or other. Geographic region of the caller was defined as the US state of the caller, based on the address of the clinic setting provided for correspondence. Each consultation was identified broadly as related to 17 different call categories. Data were aggregated and analyzed with Microsoft Excel for summary statistics.

Ethics Review

The project was determined to be a program evaluation and not human subjects' research by the US CDC and, therefore, did not require review by the Institutional Review Board.

RESULTS

From 2013–2017, the COEs provided 14 586 medical consultations to providers caring for patients with TB or LTBI or conducting TB prevention and control activities, or both. Although the majority of services were to US-based providers, the Centers provided 191 consultations to panel physicians in 32 countries. Physicians and nurses were the primary users of these medical consultation services, with the proportion of each varying by center. The majority of callers to the Curry International TB Center and the Global TB Institute were physicians (64% and 58% respectively), whereas nurses and physicians were represented equally among callers to the Southeastern National TB Center, the Heartland National TB Center, and the Mayo Clinic Center for Tuberculosis. Over half of all calls came from state and local health departments (55%, $n = 8073$), followed by hospitals (13%, $n = 1824$). Fewer calls

came from private clinics (6%, $n = 881$), academic clinics (4%, $n = 591$), community health centers (3%, $n = 463$), correctional facilities (2%, $n = 316$), nursing homes (<1%, $n = 14$), substance abuse centers (<1%, $n = 7$), and HIV clinics (<1%, $n = 6$). Consultation requests came from every state. Corresponding with national TB morbidity statistics, Texas and California provided the highest volume of consultation requests.

About 83% of consultations were adult-related questions ($n = 12 113$), and 17% ($n = 2473$) were pediatric queries. Of all consultations, 12 186 (82%) were given a high-level label of TB disease or LTBI, while the remainder were marked only with a sub-TB-related category (eg, high-level label missing). Among the 12 186 inquiries, 8762 (72%) were for TB disease, compared with 3424 (28%) for LTBI. The proportion of consultations for TB disease versus LTBI was relatively stable from year to year over the 5-year study period.

Independent of the direct TB disease or LTBI label, 13 163 consultations were labeled with a separate TB-related category. The 5 most common categories asked of the consultation service were (1) choice of treatment regimen or pharmacology of TB medications ($n = 3384$); (2) TB disease diagnostic or laboratory questions ($n = 2539$); (3) case management logistics ($n = 2158$); (4) multi-drug resistant (MDR) or extensively drug resistant (XDR)-related questions ($n = 1508$); and (5) use or interpretation of the tuberculin skin test (TST) or interferon- γ release assay tests ($n = 1026$). Additional consultation topics included contact investigation; HIV or TB, or both; nontuberculous mycobacterial infection; adverse effects (hematologic, hepatotoxic, and dermatologic); drug resistance other than MDR or XDR; infection control; and program or policy ($n = 2548$).

There were 191 consultations (1% of the total 14 586 consultations) requested by panel physicians over the 5-year period. Most consultations from panel physicians were from Malaysia ($n = 44$, 23%), Vietnam ($n = 17$, 9%), Mexico ($n = 11$, 6%), India ($n = 10$, 5%), and the Philippines ($n = 10$, 5%). The most frequent consultation topics for panel physician calls were MDR or XDR ($n = 48$, 25%), technical or logistical assistance ($n = 30$, 16%), laboratory or diagnosis ($n = 26$, 14%), drug resistance other than MDR or XDR ($n = 25$, 13%), and hepatotoxic adverse events ($n = 12$, 6%).

DISCUSSION

The data presented here illustrate medical consultation services provided by the COEs were well-utilized by US healthcare workers over the 5-year study period. Other local and international TB medical consultation services exist for TB clinicians and providers [7, 8], but they have not been extensively evaluated. As these Centers have been CDC-funded to collaborate closely with city and state health departments for TB control and elimination, it is not unexpected that primary users of the service are embedded in public health departments. The

service, however, has potential for increased reach to providers in private and community clinics, as well as academic health centers, public and private hospitals, and correctional settings. Strategic partnerships between the Centers of Excellence and local health departments may need to be developed to reach providers in these settings, who may not be readily aware of or able to access TB medical consultation services.

There are important limitations to this analysis. First, although each COE used the same MCD system and topic categories, standardized definitions of each category were not established, and individual consultants were given the flexibility to document topics using their own clinical judgement. A second limitation was that the MCD did not maintain unique and consistent patient identifiers, so the total number of patients receiving consultation could not be measured. Finally, consultations described here represented only a sampling of all US TB expert medical consultations, as many experienced TB medical consultants who provide TB clinical advice (eg, state or local experts, academic faculty, CDC medical officers, large urban clinician expert groups, international experts) were not affiliated with a COE medical consultant roster during the 2013–2017 period.

Consults documented in the MCD represent a snapshot of expert TB advice provided through COEs to US TB healthcare providers, and they highlight the topics where increased medical training, education, and national guidelines may impact future TB clinical practices. The creation of a TB network of expert centers may serve as an effective template for other countries to replicate.

Acknowledgments

We thank the CDC Division of TB Elimination, including project officer Dawn Tuckey and Dr. Terence Chorba Field Services Branch Chief, in particular, for supporting COE Medical Consultation Services and this analysis. We particularly thank Dr. Barbara Seaworth and Dr. David Ashkin, who were and continue to be principle investigators at the Heartland National TB Center and Southeastern National TB Center, respectively, as they provided

inspiration for and dedication to the consultation service and reviewed content summarized in this paper. We additionally acknowledge Donna Setzer and Stephen Ryan for incredible logistical support of the MCD. Finally, we acknowledge all staff and consultants who served and continue to serve at the Centers, as well as the patients, providers, and health departments involved in consultations that provided substance of the MCD.

Author Contributions. N.D.G., S.M., and C.A.H. contributed to the inception, design, and implementation of the study. N.D.G. and C.A.H. were also involved in writing of the paper. D.G., R.B., A.L., M.L., L.C., J.W., and C.C. participated in data collection and the interpretation of data. All authors critically reviewed and approved the content of the manuscript.

Financial support. This work was supported by funding from CDC RFA PS-15–501.

Potential conflicts of interest. All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

1. Centers for Disease Control and Prevention. Reported tuberculosis in the United States, 2016. <https://www.cdc.gov/tb/statistics/reports/2016/default.htm>. Accessed August 28, 2018.
2. Nahid P, Dorman SE, Alipanah N, et al. Official American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America clinical practice guidelines: treatment of drug-susceptible tuberculosis. *Clin Infect Dis* 2016; 63:e147–95.
3. Centers for Disease, C. and Prevention. Provisional CDC guidelines for the use and safety monitoring of bedaquiline fumarate (Sirturo) for the treatment of multidrug-resistant tuberculosis. *MMWR Recomm Rep* 2013; 62:1–12.
4. World Health Organization. Rapid communication: key changes to treatment of multidrug- and rifampin-resistant tuberculosis (MDR/RR-TB), August 2018. http://www.who.int/tb/publications/2018/rapid_communications_MDR/en/. Accessed August 28, 2018.
5. Lewinsohn DM, Leonard MK, LoBue PA, et al. Official American Thoracic Society/Infectious Diseases Society of America/Centers for Disease Control and Prevention clinical practice guidelines: diagnosis of tuberculosis in adults and children. *Clin Infect Dis* 2017; 64:1111–5.
6. National Tuberculosis Controllers Association and Association of Public Health Laboratories. Consensus statement on the use of Cepheid Xpert MTB/RIF assay in making decisions to discontinue airborne infection isolation in healthcare settings, April 2016. http://www.tbcontrollers.org/docs/resources/NTCA_APHL_GeneXpert_Consensus_Statement_Final.pdf. Accessed August 28, 2018.
7. Shah NS, Westenhouse J, Lowenthal P, et al. The California multidrug-resistant tuberculosis consult service: a partnership of state and local programs. *Public Health Action* 2018; 8:7–13.
8. Blasi F, Dara M, van der Werf MJ, Migliori GB. Supporting TB clinicians managing difficult cases: the ERS/WHO Consilium. *Eur Respir J* 2013; 41:491–4.