Published in final edited form as:

Int J Tuberc Lung Dis. 2020 April 01; 24(4): 409–413. doi:10.5588/ijtld.19.0515.

Multidrug-resistant tuberculosis care in the United States

A. N. Gobaud[1], **C. A. Haley**[2], **J. W. Wilson**[3], **R. Bhavaraju**[4], **A. Lardizabal**[4], **B. J. Seaworth**[5], **N. D. Goswami**[6]

[1]Rollins School of Public Health, Emory University, Atlanta, GA

[2]Southeastern National TB Center at University of Gainesville, Gainesville, FL

[3]Mayo Clinic Center for Tuberculosis, Rochester, MN

[4]Global TB Institute at Rutgers, The State University of New Jersey, Newark, NJ

[5]Heartland National Tuberculosis Center and University of Texas Health Science Center, Tyler, TX

[6]US Centers for Disease Control and Prevention, Atlanta, GA, USA

Abstract

BACKGROUND: To examine the utilization of the Tuberculosis (TB) Centers of Excellence (COE) medical consultation service and evaluate how these services were being employed for patients in relation to multidrug-resistant TB (MDR-TB).

METHODS: Medical consults are documented in a secure database. The database was queried for MDR-TB consultations over the period 1 January 2013–31 December 2017. All were analyzed to assess provider type, center, setting, year of call, and type of patient (pediatric vs. adult). A subgroup was randomly selected for thematic analysis.

RESULTS: The centers received 1560 MDR-TB consultation requests over this period. Providers requesting consults were primarily physicians (55%). The majority of requests were from public health departments (64%) and for adult patients (80%). Four major topic areas emerged: 1) initial management of MDR-TB, 2) MDR-TB longitudinal treatment and complications, 3) management of persons exposed to MDR-TB, and 4) MDR-TB treatment completion.

CONCLUSIONS: Analysis of these consultations provides insight into the type of expert advice about MDR-TB that was provided. These findings highlight topics where increased medical training and education may help to improve MDR-TB-related practices.

RÉSUMÉ

Nous avons examiné l’utilisation du service de consultation médicale des centres d’excellence de la tuberculose (COE) financés par le Centers for Disease Control and Prevention (CDC) pour la MDR-TB. Evaluer comment et par qui les services de consultation ont été utilisés pour les patients atteints de MDR-TB ou exposés à elle et identifier les thèmes majeurs de 2013–2017.

Correspondence to: Ariana N Gobaud, Rollins School of Public Health, Emory University, Atlanta, GA, USA. agobaud@gmail.com.

Conflicts of interest: none declared.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC and of the authos’ affiliated institutions.

Les consultations médicales sont documentées dans une base de données sûre sous forme de documents texte. La base de données a été examinée pour les consultations de MDR TB réalisées entre le 1er janvier 2013 et le 31 décembre 2017. Elles ont toutes été analysées pour vérifier le type de prestataire, le centre, le contexte, l'année d'appel et le type de patient (pédiatrique ou adulte). Un sous-groupe a été sélectionné de façon aléatoire pour une analyse thématique.

Les centres ont reçu 1560 demandes de consultation pour MDR TB de 2013–2017. Les prestataires de soins demandant ces consultations ont été avant tout des médecins (55%). La majorité des demandes ont émané de départements de santé publique (64%) et ont concerné des patients adultes (80%). Quatre questions principales ont émergé : 1) prise en charge initiale de la MDR TB, 2) traitement longitudinal de la MDR TB et ses complications, 3) prise en charge des personnes exposées à la MDR TB, et 4) achèvement du traitement de MDR TB.

L'analyse de ces consultations éclaire le type de conseil d'expert qui a été fourni. Ces résultats mettent en lumière les sujets pour lesquels une meilleure formation et information médicales pourraient avoir un impact sur les pratiques liées à la MDR-TB.

RESUMEN

Se examinó la utilización del servicio de interconsultas sobre tuberculosis multidrogorresistente (MDR-TB) de los Centros de Excelencia financiados por los Centros para el Control y la Prevención de Enfermedades (CDC).

Evaluar de qué manera y quién utiliza los servicios de interconsulta para los pacientes con diagnóstico de MDR-TB o con exposición a la misma y definir los principales elementos del análisis temático del 2013 al 2017.

Las interconsultas mádicas se registran en una base de datos segura en documentos de texto. Se interrogó la base de datos sobre las interconsultas efectuadas del 1 enero 2013 al 31 diciembre 2017. En todos los casos se examinó el tipo de proveedor de atención, el centro, el entorno, el año de la llamada y el tipo de paciente (pediátrico o adulto). Se escogió de manera aleatoria un subgrupo para el análisis temático.

Los centros recibieron 1560 solicitudes de interconsulta sobre la MDR-TB del 2013 al 2017. Los profesionales que solicitaban interconsulta eran principalmente médicos (55%). La mayoría de las solicitudes provenía de los departamentos de salud pública (64%) y se refería a pacientes adultos (80%). Las principales esferas temáticas fueron: 1) el manejo inicial de la MDR-TB; 2) el tratamiento longitudinal de la MDR-TB y sus complicaciones; 3) el manejo de las personas expuestas a la MDR-TB; y 4) la compleción del tratamiento de la MDR-TB.

El análisis de estas interconsultas ayuda a comprender el tipo de asesoramiento técnico que se ha prestado en materia de MDR-TB. Estos resultados destacan las esferas temáticas en las cuales una mejor capacitación y educación médica podrían tener una e repercusión sobre las prácticas en materia de MDR-TB.

Keywords

treatment efficacy; drug resistance; CDC

MULTIDRUG-RESISTANT TUBERCULOSIS (MDR-TB), defined as TB resistant to at least isoniazid and rifampin, poses significant morbidity and mortality.[1] In 2017, there were an estimated 460000 incident cases of MDR-TB worldwide.[2] In the same year, 9105 cases of TB cases were reported in the United States, 123 of which were MDR-TB.[1] The proportion of US TB cases that are drug-resistant has not significantly changed over the past 20 years.[1] Although low in incidence, the negative health outcomes of MDR-TB are more severe than drug-susceptible TB.[3] Inappropriate management can have poor outcomes, including MDR-TB transmission, treatment failure, treatment-related morbidity, further acquisition of drug resistance, relapse, or death.[4–6]

Since 2003, the Centers for Disease Control and Prevention (CDC) has funded a national network of TB Centers of Excellence (COEs) to assist healthcare providers in the United States and panel physicians abroad manage patients effectively with complicated TB disease, including MDR-TB.[7,8] Panel physicians are appointed by US embassies or consulates and are responsible for TB screening for immigrants and refugees prior to departure for the United States. When active TB is diagnosed through overseas screening, immigrants and refugees are treated in their country of origin using US treatment standards.[9]

To date, the utilization of the COEs for medical management of MDR-TB has not been analyzed in depth. Similar assessments of consultation modalities, including teleconsultation, internet, and video-assisted methods, have led to improvements in the quality of care in diverse fields of medicine.[10,11] Knowledge about how consultation services are being used for MDR-TB patients in the United States may provide insight into challenges that providers face on treating these patients and how medical consultations can be used as a resource for managing patients.

The objectives of this assessment were to describe how and by whom the medical consultation services provided by the COEs were being employed for patients with or exposed to MDR-TB, and to identify main themes of consultations from 2013 to 2017.

METHODS

Physicians, nurses and other healthcare professionals contact their regional TB COE for medical and nursing consultation for patient care, as well as technical assistance with various aspects of TB control.[8] Consultations can be made over the phone or via email. The CDC TB COE website provides a link to each of the existing four centers, where there is a consultation tab to submit a consult request for their region (https://www.cdc.gov/tb/education/tb_coe/default.htm). Data for each medical consultation are entered into a Medical Consultation Database (MCD), a web-based database on a secure server hosted by the Southeastern National TB Center.

For this assessment, we queried the MCD for medical consultations categorized as ‘MDR-TB’ provided between 1 January 2013 and 31 December 2017 by the five centers funded during this period. These centers included the Curry International TB Center (CITC) at the University of California, San Francisco in Oakland, CA; the Mayo Clinical Center for Tuberculosis (MCCT) at Mayo Clinic in Rochester, MN; the Global TB Institute (GTBI)

at Rutgers, The State University of New Jersey in Newark, NJ; the Heartland National TB Center (HNTC) at the University of Texas Health Science Center at Tyler in San Antonio, TX; and the Southeastern National TB Center (SNTC) at University of Florida Gainesville in Gainesville, FL, USA.

All MDR-TB consultations were analyzed quantitatively to assess the type of provider, center call was placed, setting of the provider, year call was placed, and type of patient (pediatric vs. adult) (SAS v9.4; SAS Institute, Cary, NC, USA). Categories of requesting provider included nurses, physicians, other, or not identified. Provider settings included academic institutions, community health centers, correctional facilities, hospitals, panel physicians, local health departments, private practices, regional health offices, state health departments, other, or not specified. The date noted on the consult text was used to reference what year the consult was made. Consultations involving patients under the age of 18 years were categorized as pediatric consults.

Of the total number of MDR-TB related calls, a subgroup was randomly selected for analysis using Excel random number generator (MicroSoft, Redmond, WA, USA). We conducted quantitative analysis on the subgroup of consults and used a difference in proportions *t*-test with an alpha value of 0.05 to see if the subgroup was representative of the total. The subgroup was then read to gather aggregate data for thematic analysis. Themes were identified from recurring unifying concepts or coded statements. Codes were developed inductively and deductively, through relationship codes, which tag data that link concepts to each other and aggregated in a codebook for parsimony (AG; nVivo 11.0; QSR International, Chatstone, VIC, Australia).[12] Text was coded “follow-up call” when the question/recommendation referred to a previous consult regarding the same patient, and/or the words “follow-up” (or “F/U”), “update”, “earlier,” or “in reference to” was included. Each text document was coded based on the final codebook. We used a 5% cut off as the minimum frequency required to be considered a theme/topic to report. We excluded consultations if the case did not involve TB that was both isoniazid- and rifampin-resistant, or part of the text was missing or cut off.

Ethics review

In ethics review, this project was determined to be program assessment, not to be human subjects research, by the CDC, Atlanta, GA, and Emory University, Atlanta, GA, USA.

RESULTS

Quantitative analysis

During 2013–2017, the centers provided 1560 medical consultations to providers caring for patients with MDR-TB (Table 1). The majority of consults were to US-based providers; however, 42 were international consults provided to panel physicians.

Physicians and nurses are the primary users of COE medical consultation services (54.6% and 36.1%, respectively). The three most common settings for callers were local health departments (33.5%, $n = 523$), state health departments (30.1%, $n = 470$), and hospitals (17.5%, $n = 273$). Of the five centers, the most calls were placed to HNTC (60.3%, $n = 940$),

followed by MCCT (19.4%, *n* = 302), SNTC (8.0%, *n* = 124), GTBI (5.7%, *n* = 89) and CITC (3.7%, *n* = 57). Although HNTC represents the greatest proportion of consults, the recommendations were consistent across all five centers. Over 80% of consultations were related to adult MDR-TB questions.

Thematic analysis

After reading the consultations, 50 of the 500 consults were excluded based on exclusion criteria described above (10% missing data). With our thematic analysis, we found that consultations in the sample fell into four major topic areas: 1) initial management of MDR-TB, 2) MDR-TB longitudinal treatment and complications, 3) management of persons exposed to MDR-TB, and 4) MDR-TB treatment completion (Table 2). For this analysis, adult and pediatric consultations were considered together.

Initial management of MDR-TB

The majority of consults were related to "initial management of MDR-TB" (*n* = 214, 47.6%). Consults were included in this topic area if the question asked for guidance on what anti-TB drugs should be used in the patient's initial treatment regimen and how to monitor patients during therapy.

Regarding initial MDR-TB treatment, COE TB experts often recommended obtaining molecular testing (*n* = 86) or epidemiologic history (*n* = 106) before full treatment recommendation could be provided. In some cases, a requesting provider needed help analyzing drug-resistance test results to determine a treatment plan. The request to analyze test results was most common with discordant laboratory tests (*n* = 15) for which COE consultants recommended samples be referred to the CDC for the Molecular Detection of Drug Resistance Service prior to recommending a MDR-TB treatment regimen (https://www.cdc.gov/tb/topic/laboratory/mddrusersguide.pdf).

In addition to providing specific treatment management suggestions, COE consultations included supplementary information to educate the requesting provider on current TB treatment guidelines and other standards of care for MDR-TB.[13–15]

MDR-TB longitudinal management and complications

Of the 450 consults, 172 (38.2%) were follow-up consultations for a patient already discussed, which we classified as "longitudinal management'. A portion included a recommendation to continue the current MDR-TB regimen if the patient was tolerating treatment without adverse events and responding well based on clinical and microbiological indicators (*n* = 22).

The majority of follow-up consultations documented questions or recommendations regarding dosage adjustment (*n* = 122). Specific drug and dosage suggestions depended on the individual patient, their medical history, and drug susceptibility testing (DST) profile. The most common questions about specific drug regimens involved: 1) how to modify prescription dosages in children (49%), and 2) how to adapt treatment when adverse reactions to a specific drug occurred (31%). Examples of recommendations to improve

tolerance of MDR-TB treatment included changing times of delivery, giving a small snack prior to delivery of medication, giving an anti-emetic prior to treatment, giving medication prior to bedtime if hospitalized, or changing dosing schedule to twice daily. The three most documented drugs in the consult text were linezolid (n = 71), moxifloxacin (n = 46), and cycloserine (n = 45). When a specific drug regimen or dose was recommended, educational information for that drug was provided to support the consultation.[13,16]

Follow-up treatment strategies were modified for patients with MDR-TB and medical comorbidities (n = 23). In patients with diabetes, COE consultants encouraged rigorous attention to monitoring for neuropathy, serum drug levels, slow treatment response, and adherence to diabetes regimens. Education was provided regarding the potential for decreased absorption of TB medications and increased likelihood of treatment failure, relapse, acquired drug resistance, and death.[15]

The most common complication addressed in MCD “follow-up” consults related to side effects and toxicity of TB medications (n = 128). Commonly encountered reactions included, but were not limited to, nausea, headaches, dizziness, depression, vision loss, and general musculoskeletal discomfort. Consultants stressed the importance of early detection and response to medication related toxicity and recommended the importance of discontinuing the specific TB medication suspected of causing the issue, at least until the toxicity resolved. Medication was restarted unless progressive neuropathy, hearing or vision loss occurred, in which case the medication would be removed from treatment and replaced. When medication changes were needed, medical consultations made dosing recommendations to ensure that the patient’s regimen remained adequate to prevent drug resistance, failure or relapse.

Management of persons exposed to MDR-TB

Consults documented questions about treatment for contacts exposed to MDR-TB or presumed to have latent tuberculous infection (LTBI) due to exposure to a source with MDR-TB (n = 96, 21.3%). Treatment regimens were recommended based on the DST pattern of the source case. Fluoroquinolone monotherapy for presumed LTBI due to exposure to MDR-TB was most often recommended (68%), although combination therapy with a fluoroquinolone and pyrazinamide was occasionally recommended (32%), especially if DST data of the index MDR-TB isolate were not available. When the individual was treated for LTBI following an MDR-TB exposure, follow-up assessment was recommended every 6 months for 2 years to assess potential progression of LTBI to TB disease. Consults also noted the importance of educating the patient on signs or symptoms associated with the development of TB disease and the importance of seeking care immediately.[15,16]

MDR-TB treatment completion

This topic area addressed consults that advised on timing for completion of adequate therapy (n = 31, 6.9%). Healthcare providers were concerned with identifying when MDR-TB treatment was complete. Specifically, providers inquired whether there was sufficient evidence to stop treatment. Consultants recommended follow-up assessment of MDR-TB

patients at intervals over the 2 years following completion with a medical assessment, sputum culture, and chest radiograph, to ensure a lasting cure without relapse.[16]

DISCUSSION

Our findings demonstrate the complexity of the treatment and management of MDR-TB. The majority of the COE consultations on MDR-TB focused on four areas: 1) initial management of MDR-TB, 2) MDR-TB longitudinal treatment and complications, 3) management of persons exposed to MDR-TB, and 4) MDR-TB treatment completion. These topic areas reflect the principal unresolved issues around individualized MDR-TB treatment and management in the literature.[3,17]

Public health departments are likely the main users of COE MDR-TB consultation services, because of the partnership between public health agencies and private health providers. TB and MDR-TB are nationally notifiable diseases as defined by the National Notifiable Disease Surveillance System (NNDSS).[18] As such, public health departments are often first to hear about a case and likely to reach out for medical advice. Some state TB programs and local health departments, also provide MDR-TB consultation. The utilization of the COE medical consultation service might be notably lower for GTBI and CITC, in part because California and New York City have their own internal consultation services.

Looking forward, the utility of the COEs will be increasingly important as declining rates of US cases of TB, especially MDR-TB, have led to a generation of healthcare providers with relatively low TB management, little direct patient-care experience, and usually no MDR-TB management experience.[16] The fall in TB epidemiology rates in the United States have also led to decline in TB training and patient experience opportunities for current physician trainees, further reducing experience in TB management. Published guidelines are an important resource, but no substitute for direct clinical experience.[16]

Our assessment has several limitations. We lacked feedback about the COE service from the providers who requested the consultations. Information about whether consultations were helpful and whether recommendations were implemented is currently being collected from the TB COEs in order to inform improvements in the quality of consultations. These recommendations will be the basis of future studies. We also did not collect patients' outcome data and therefore do not know if patients with COE consultation had better outcomes than patients without. Other studies have shown an improvement in outcome with medical consultation for MDR-TB.[19] Because we obtained only de-identified data from the MCD, the only way to determine if a consultation referred to a previously identified patient was if there was reason to believe it was a follow-up call. Given the complexity and changing landscape that typically occurs during MDR-TB therapy, finding a way to link calls in order to track the progression of longitudinal case management might benefit future assessments. Finally, we could not account for missing data, as it is possible that consults were not documented if the call went directly to a consultant who did not create an MCD entry.

Despite these limitations, our findings suggest that providers in public health and other settings would benefit from increased education in the form of training courses and webinars to provide knowledge of patient MDR-TB care and management. This should occur in conjunction with the creation of pamphlets and infographics that are technically accurate and appropriate for target audiences. As US TB case rates decline and providers become less knowledgeable about the complexity of MDR-TB diagnosis and management, the medical consultation and training materials provided by the TB COEs may play an increasingly important role in improved patient outcomes and TB prevention.

Acknowledgements

The authors thank TB control programs and local and state health departments and all staff at the regional TB centers for their support.

This work was supported by funding from the Centers for Disease Control and Prevention, Atlanta, GA, USA (RFA PS-15–501).

References

1. Centers for Disease Control and Prevention. Trends in tuberculosis, 2017. Atlanta, GA, USA: CDC, 2017. https://www.cdc.gov/tb/publications/factsheets/statistics/tbtrends.htm. Accessed October 2018.
2. World Health Organization. Global tuberculosis report, 2018. WHO/CDS/TB/2018.20. Geneva, Switzerland: WHO, 2018.
3. Ormerod L Multidrug-resistant Tuberculosis (MDR-TB): epidemiology, prevention and treatment. Br Med Bull 2005; 73–74(1): 17–24.
4. Iseman M Management of multidrug-resistant tuberculosis. Chemotherapy 1999; 45(Suppl 2): 3–11. [PubMed: 10449892]
5. Caminero J Treatment of multidrug-resistant tuberculosis: evidence and controversies. Int J Tuberc Lung Dis 2006; 10(8): 829–893. [PubMed: 16898365]
6. Kim J Drug-susceptibility testing in tuberculosis: methods and reliability of results. Eur Respir J 2005; 25: 181–185. [PubMed: 15640340]
7. Centers for Disease Control and Prevention. TB Centers of Excellence for Training, Education and Medical Consultation. Atlanta, GA, USA: CDC, 2018. https://www.cdc.gov/tb/education/tb_coe/default.htm. Accessed October 2018.
8. Goswami N D, Mase S, Griffith D, et al. Tuberculosis in the United States: medical consultation services provided by 5 Tuberculosis Regional Training and Medical Consultation Centers, 2013–2017. Open Forum Infect Dis 2019; 6(6).
9. Centers for Disease Control and Prevention. Panel Physician Portal. Atlanta, GA, USA: CDC, 2017. https://www.cdc.gov/panelphysicians/index.html. Accessed October 2018.
10. Mousa A Y, Broce M, Davis E, et al. Telehealth electronic monitoring to reduce post discharge complications and surgical infections after arterial revascularization with groin incision. J Vascular Surg 2017; 66(6): 1902–1908.
11. Salami A C, Barden G M, Castillo D L, et al. Establishment of a regional virtual board program to improve the process of care for patients with hepatocellular carcinoma. J Oncology Pract 2015; 11(1): e66–74.
12. Bradley E, Curry L, Devers K. Qualitative data analysis for health services research: developing taxonomy, themes, and theory. Health Serv Res 2007; 42(4): 1758–1572. [PubMed: 17286625]
13. Centers for Disease Control and Prevention. Provisional CDC guidelines for the use and safety monitoring of bedaquiline fumarate (Sirturo) for the treatment of multidrug-resistant tuberculosis. MMWR 2013; 62(RR-09): 1–12.
14. American Thoracic Society, CDC, Infectious Diseases Society America. Treatment of Tuberculosis. MMWR 2003; 52 (RR–11):

15. Curry International Tuberculosis Center and California Department of Public Health. Drug-resistant tuberculosis: a survival guide for clinicians. Oakland, CA, USA: University of California, San Francisco, 2016.
16. Centers for Disease Control and Prevention. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. MMWR 2005; 54.
17. Mitchison D How drug resistance emerges as a result of poor compliance during short course chemotherapy for tuberculosis. Int J Tuberc Lung Dis 1998; 2(1): 10–15. [PubMed: 9562106]
18. Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System (NNDSS). Atlanta, GA, USA: CDC, 2019. https://wwwn.cdc.gov/nndss/. Accessed April 2019.
19. Marks S, Flood J, Seaworth B, et al. Treatment practices, outcomes, and costs of multidrug-resistant and extensively drug-resistant tuberculosis, United States, 2005–2007. Emerg Infect Dis 2014; 20(5): 812–821. [PubMed: 24751166]

Table 1

Summary of multidrug-resistant TB[*] consultations provided by all five centers,[†] 2013–2017

Characteristic	Total (*n* = 1560) *n* (%)		Subgroup[‡] (*n* = 500) *n* (%)		*P* value[§]
Occupation of caller[¶]					
Nursing	563	(36.1)	168	(33.6)	0.3
Physician	854	(54.6)	283	(56.6)	0.4
Other	140	(9.0)	45	(9.0)	1.0
NA	6	(0.4)	4	(0.8)	0.3
Type of consultation					
Pediatric[#]	236	(15.1)	70	(14.0)	0.5
Adult	1324	(84.9)	430	(86.0)	0.5
Setting of caller					
Academic institution	56	(3.6)	21	(4.2)	0.5
Community health center	8	(0.5)	2	(0.4)	0.8
Corrections	34	(2.2)	11	(2.2)	1.0
Hospital	273	(17.5)	97	(19.4)	0.3
Panel physician site	42	(2.7)	19	(3.8)	0.2
Local health department	523	(33.5)	160	(32.0)	0.5
Private practice	43	(2.8)	12	(2.4)	0.6
Regional Health Office	65	(4.2)	18	(3.6)	0.4
State Health Department	470	(30.1)	144	(28.8)	0.6
Other	40	(2.6)	12	(2.4)	0.8
NA	6	(0.4)	4	(0.8)	0.3
Year of consultation					
2013	254	(16.3)	83	(16.6)	0.9
2014	275	(17.6)	92	(18.4)	0.7
2015	317	(20.3)	95	(19.0)	0.5
2016	408	(26.2)	128	(25.6)	0.8
2017	306	(19.6)	102	(20.4)	0.7

[*] TB resistant to at least two of the main drugs used to treat TB, isoniazid and rifampin.

[†] Curry International TB Center, University of California, San Francisco in Oakland, CA; Heartland National TB Center, at the University of Texas Health Science Center at Tyler in San Antonio, TX; Southeastern National TB Center, at University of Florida Gainesville in Gainesville, FL; the Global TB Institute at Rutgers, The State University of New Jersey in Newark, NJ; and Mayo Clinic Center for TB, Rochester, MN, USA.

[‡] Of the 500 randomly sampled consults, 50 were excluded.

[§] A difference in proportions *t*-test with an alpha of 0.05 was used to compare the subgroup to the total.

[¶] The occupation of caller in the total column adds to 1563 because some callers identified as two occupations.

[#] Defined as patients aged <18 years.

TB tuberculosis; NA not available.

Table 2

Summary of themes and related tonics for MDR-TB* consultations

Code	Description
Theme 1: Initial management of MDR-TB (*n* = 214, 47.6%)	
Molecular testing	Treatment advice for new MDR-TB patient based on molecular testing
Epidemiological history	Treatment advice for new MDR-TB patient based on epidemiological history
Isolation	Advice on need to isolate MDR-TB patient
Theme 2: MDR-TB longitudinal management and complications (*n* = 172, 38.2%)	
Follow-up	Follow-up information of previous patient and treatment advice
Continuation	Continue same regimen for MDR-TB patient already on treatment if patient is tolerating it without adverse events
Dosage	Treatment advice with specific dosage recommendations
Comorbidities	Treatment advice for patients with MDR-TB and comorbidities
Toxicity	Advice for how to avoid or deal with complications due to toxicity
Theme 3: Management of persons exposed to MDR-TB (*n* = 96, 21.3%)	
Contact	Treatment for individual who had contact to MDR-TB patient
MDR LTBI†	LTBI treatment plan for patient who was a contact of MDR-TB patient
Theme 4: MDR-TB treatment completion (*n* = 31, 6.9%)	
Stop treatment	Advice on stopping MDR-TB treatment

*TB resistant to at least two of the main drugs used to treat TB, isoniazid and rifampin.

†Presence of *Mycobacterium tuberculosis* in the body without signs and symptoms, or radiographic or bacteriologic evidence of TB disease

MDR-TB = multidrug-resistant TB; LTBI = latent TB infection.