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Background. Internal medicine physicians are often the first providers to encounter patients with a new diagnosis of tuberculosis. Given the public health risks of missed tuberculosis cases, assessing internal medicine residents' ability to diagnose tuberculosis is important.

Methods. Internal medicine resident knowledge and practice patterns in pulmonary tuberculosis diagnosis at 7 academic hospitals were assessed utilizing (a) a 10-item validated pulmonary tuberculosis diagnosis assessment tool and (b) a retrospective chart review of 343 patients who underwent a pulmonary tuberculosis evaluation while admitted to a resident-staffed internal medicine or infectious disease service. Our primary outcomes were the mean score and percentage of correct responses per assessment tool question, and the percentage of patients who had Centers for Disease Control and Prevention–recommended tuberculosis diagnostic tests obtained.

Results. Of the 886 residents who received the assessment, 541 responded, yielding a response rate of 61%. The mean score on the assessment tool (SD) was 4.4 (1.6), and the correct response rate was 57% (311/541) or less on 9 of 10 questions. On chart review, each recommended test was obtained for ≤43% (148/343) of patients, other than chest x-ray (328/343; 96%). A nucleic acid amplification test was obtained for 18% (62/343) of patients, whereas 24% (83/343) had only 1 respiratory sample obtained. Twenty patients were diagnosed with tuberculosis.

Conclusions. Significant knowledge and practice gaps exist in internal medicine residents' abilities to diagnose tuberculosis. As residents represent the future providers who will be evaluating patients with possible tuberculosis, such deficiencies must be addressed.

Keywords. diagnosis; medical education; resident; tuberculosis.

Tuberculosis (TB) remains a public health concern in the United States. After nearly 2 decades of progressive decline, between 2013 and 2015 the number of new TB cases in the United States plateaued at 3.0 cases per 100 000 people [1]. Subsequently, between 2015 and 2016, only a slight decline to 2.9 cases per 100 000 people occurred, representing 9272 new cases and a total cost to the United States of $451 million [2]. At this rate, TB elimination in the United States will not be achieved in this century.

Interrupting ongoing TB transmission through case detection is an important aspect of TB control; unfortunately, missed and delayed TB diagnoses in the United States are not uncommon [1, 3, 4]. Even a single missed case has important public health implications, as 1 untreated person with active pulmonary TB can infect up to 15 people per year [5]. Providers must remain vigilant about recognizing and diagnosing TB, particularly as the use of immune suppressants and number of foreign-born persons living in the United States rise [6–9].

Patients with TB often initially present to primary care providers and hospitalists, rather than health providers focused on TB care; some studies have shown 45% of US TB patients are diagnosed while hospitalized [10]. General internists are thus critical to TB control. Recognizing this, the American Thoracic Society, the Centers for Disease Control and Prevention (CDC), and the Infectious Diseases Society of America have jointly tasked hospitals with educating medical providers and trainees in TB evaluation [11]. In addition, TB has been recognized as a core infectious disease (ID) topic for internists and has been included as a content category in the American Board of Internal Medicine certification examination [12].

Prior work has shown that in some urban areas most internal medicine (IM) residents see at least 1 patient with active TB annually [13]. Given that care patterns learned during training are reflected in future practice and many IM residents will go on to careers as outpatient general internists or hospitalists, ensuring that residents are skilled in TB diagnosis may have long-term benefits for TB control [13]. Unfortunately, to our knowledge, the only study to assess IM resident knowledge and practice regarding TB diagnosis was limited by a low survey response rate (29%) and the lack of an assessment tool with sources of validity [13, 14].

Using a retrospective chart review and an assessment tool we previously developed and evaluated, we assessed IM resident practice patterns and knowledge in active pulmonary TB diagnosis among 7 IM residency programs located at urban tertiary care academic centers in the northern and southeastern regions of the United States [15].

METHODS

This study was conducted between May and September of 2015 and was approved by the institutional review board of each participating site.

Assessment Tool Evaluation

Our development of a validated tool to assess resident knowledge of active pulmonary TB diagnosis has been previously described [15]. The tool consists of 10 multiple choice items, each of which is linked to a core competency of TB diagnosis, per the CDC's Core Curriculum on TB (Table 1) [16]. Using Qualtrics software, we e-mailed a link to the tool to 886 IM residents. We also included questions about demographics, experience performing TB diagnostic evaluations, and prior TB education. Participation was voluntary and incentivized by a $10 electronic gift card. Responses were anonymous. We assessed our response rate using the American Association for Public Opinion Research's (AAPOR's) type 1 method, which includes only fully completed tools [17].

We dichotomized each resident's answers as correct or incorrect and expressed each resident's score as the number correct out of 10. Scores by residency program site were expressed as means, whereas performance on each question was expressed as the percentage of correct responses among all respondents. We used 1-way analysis of variance to compare differences in mean scores by study site, postgraduate year (PGY), self-reported prior TB education, and self-reported prior experience evaluating patients for active pulmonary TB. All P values were 2-sided, and a result of $\leq.05$ was considered significant. Analyses were done using STATA, version 13.0 (StataCorp LP, College Station, TX).

Chart Review of Resident Practice

To assess residents' documented clinical practice, we conducted a retrospective chart review of 343 inpatients evaluated for

pulmonary TB across the sites in 2014. These patients were all admitted to either an inpatient general IM or ID team staffed by residents, and all had at least 1 respiratory sample sent for acid-fast bacilli (AFB) smear and culture. Patients who died before discharge and whose charts stated they were undergoing evaluation for a mycobacterial infection other than TB were excluded. The review assessed the frequency with which CDC-recommended TB diagnostic tests were obtained. These tests included 3 sputum specimens for AFB smear and culture collected 8–24 hours apart, with 1 being sent for nucleic acid amplification testing (NAAT), and a chest x-ray (CXR) [16]. We also assessed how often latent TB infection (LTBI) tests were obtained; such tests have previously been recommended as part of the evaluation of active pulmonary TB but are not included in more recent guidelines [18]. We also evaluated how many patients had ID physician involvement (either through consultation or admission to a primary ID service staffed by residents), how many sites had NAAT available on-site, and, when available, discharge diagnoses.

At each site, the review was conducted by an ID fellow or IM resident member of the study team using a uniform data abstraction protocol. The number of charts reviewed at each site was proportional to the site's contribution to the total number of patients evaluated for TB across the sites. Each site used a random number generator to identify charts for review, evaluated which recommended tests were obtained per patient (with each sputum sample being recorded as an independent result), and then calculated the percentage of patients for whom each test was collected. The reviews captured the practices of the study PGY-2 and -3 residents.

RESULTS

Assessment Tool Results

Of 886 residents, 541 (61%) responded (Table 2). There was no significant difference in response rates by PGY level ($P = .30$). The majority of residents reported directly caring for at least 1 patient with active TB in the prior 12 months (56%; 304/541) and reported evaluating a patient for TB in the prior 12 months (90%; 489/541). Most residents reported not obtaining an NAAT in the last 12 months (63%; 342/541) but reported obtaining an LTBI test (79%; 430/541). More than half of the residents reported that they had not participated in any TB education in the prior 12 months (57%; 307/541).

The overall mean assessment tool score (SD) was 4.4 (1.6). Mean scores among the sites ranged from 4.0 to 4.8. Residents who obtained 6–10 NAATs in the prior 12 months had a significantly higher mean score of 5.25 (SD, 1.66; $P = .02$) than residents who obtained 5 or fewer NAATs in the prior 12 months. There was no difference in mean score by PGY level ($P = .12$), number of self-reported patients with TB directly cared for in the last 12 months ($P = .35$), number of self-reported patients evaluated for TB in the last 12 months ($P = .85$), number of

Table 1. TB Competencies Evaluated by Assessment Tool With Questions and Correct Response Percentages

CDC Competency and Assessment Tool Question [16]	No. of Residents With Correct Answer (%)	Most Common Incorrect Answer, No. (%)
Identify risk factors for TB disease: Ms. Rose has a past medical history of hepatitis C, uncontrolled diabetes mellitus, and cigarette smoking. Which of the following does NOT put Ms. Rose at risk for developing active TB disease? a. Having hepatitis C virus infection[a] b. Cigarette smoking c. Having diabetes mellitus	201 (37)	c 143 (26)
Correctly interpret TST results in a patient with abnormal chest imaging: Mr. Raj recently emigrated from Nepal and presents to your office due to a positive TST. His chest x-ray shows a left-sided pleural effusion. He reports BCG vaccination. He is feeling well. What is the next best step in caring for Mr. Raj? a. No further follow-up is needed b. Obtain an IGRA test to confirm the TST c. Treat for latent tuberculosis infection d. Obtain a thoracentesis for AFB smear and culture[a]	311 (57)	b 169 (31)
Correctly interpret IGRA results in a patient with symptoms of TB: Mr. Smith is currently homeless and presents with 4 weeks of a productive cough and fevers. He is febrile to 38.0. A chest x-ray shows an infiltrate in the right lower lobe. An IGRA test is negative. What is the next best step in caring for Mr. Smith? a. Begin levofloxacin b. Obtain sputum for AFB smear/culture[a] c. Repeat the IGRA d. Obtain a tuberculin skin test	297 (55)	a 217 (40)
Identify the correct microbiologic workup of pulmonary TB: Ms. Williams is admitted with a productive cough for 4 months and a 20-pound weight loss. You are concerned she could have TB. Per CDC guidelines, what is the next best step in caring for Ms. Williams? a. Obtain sputum samples for AFB smear/culture b. Obtain sputum samples for NAAT c. Obtain bronchoscopy samples for AFB smear/culture d. Obtain sputum samples for AFB smear/culture and an NAAT[a]	208 (38)	a 306 (57)
Identify the correct indication for NAAT testing in the diagnostic workup of pulmonary TB: Per CDC guidelines, which of the following is TRUE regarding the use of TB NAATs when evaluating a patient for active pulmonary TB? a. NAATs are only available through research laboratories b. NAATs can be performed on AFB smear-positive samples, but not AFB smear-negative ones c. NAATs should be performed on the first sputum sample[a] d. No NAAT provides information about drug resistance	141 (26)	b 193 (36)
Identify the correct sputum type in the diagnostic workup of pulmonary TB: You are evaluating a patient for active pulmonary TB. He has had a productive cough for 4 weeks. What kind of sputum samples should you obtain? a. Expectorated[a] b. Induced c. Bronchoscopic	208 (38)	b 313 (58)
Identify the correct way to obtain sputum samples in the diagnostic workup of pulmonary TB: Mr. Lee presents to your clinic with 4 months of weight loss, fevers, and cough. You want to evaluate him for pulmonary TB. Per CDC guidelines, what is the next best step in caring for Mr. Lee? a. Obtain 3 sputum samples, 1 every other day at different times b. Obtain 3 sputum samples 8–24 hours apart, at least 1 of which should be a morning specimen[a] c. Obtain 3 sputum samples at least 24 hours apart from each other, each collected at the same time of day	411 (76)	c 102 (19)
Correctly interpret TB diagnostic results in a patient at risk for active TB: Which of the following is TRUE when evaluating a patient for pulmonary TB disease? a. A positive AFB smear on bronchoscopy is diagnostic of TB disease b. A positive IGRA is diagnostic of TB disease c. A positive NAAT on a sputum sample is diagnostic of TB disease[a] d. An upper lobe cavity on a PA and lateral chest x-ray is diagnostic of TB disease	235 (43)	a 257 (48)
Identify criteria for noninfectiousness in a patient with smear-positive TB: Mr. Chen is on your inpatient team; you diagnosed him with smear-positive pulmonary TB disease. He has been on TB therapy for 10 days, and his symptoms are improving (a CDC criterion to consider a patient noninfectious). Per CDC guidelines, which of the following is another criterion to consider Mr. Chen noninfectious? a. He has been on treatment for 2 weeks or longer[a] b. His chest radiography has improved c. He's had at least 1 negative AFB sputum smear	240 (44)	c 270 (50)
Identify criteria for discharge in a patient with smear-positive TB: Mr. Richardson is a patient on your medical team with smear-positive pulmonary TB disease. He has received 12 days of treatment. Per CDC guidelines, can you send Mr. Richardson home at this time? a. No, he must have 3 negative sputum smears b. Yes, as long as there isn't a child under 5 in his household[a] c. No, he must have been on treatment for at least 14 days d. Yes, as long as he is willing to wear a mask at all times	112 (21)	c 226 (42)

Abbreviations: AFB, acid-fast bacilli; BCG, Bacillus Calmette-Guérin; CDC, Centers for Disease Control and Prevention; IGRA, interferon gamma release assay; NAAT, nucleic acid amplification test; PA, posterior-anterior; TB, tuberculosis; TST, tuberculin skin testing.

[a]Correct answer.

Table 2. Characteristics and Self-Reported TB Experiences of Resident Responders to the Assessment Tool (n = 541)

Variables	Total (n = 541), No. (%)
PGY level[a]	
PGY-1	195 (36)
PGY-2	174 (32)
PGY-3	161 (30)
PGY-4[b]	11 (2)
Sites[c]	
Site 1	17 (3)
Site 2	63 (12)
Site 3	112 (21)
Site 4	76 (14)
Site 5	52 (9)
Site 6	123 (23)
Site 7	98 (18)
No. of patients with active TB directly cared for in last 12 mo	
0	237 (44)
1–5	278 (51)
6–10	19 (4)
>10	7 (1)
No. of patients directly cared for who had sputum obtained for AFB smear/culture in last 12 mo	
0	52 (10)
1–5	291 (54)
6–10	100 (18)
>10	98 (18)
No. of patients directly cared for who had NAAT obtained for AFB smear/culture in last 12 mo	
0	342 (63)
1–5	182 (34)
6–10	12 (2)
>10	5 (1)
No. of patients directly cared for who had IGRA or TST obtained in last 12 mo	
0	111 (21)
1–5	306 (56)
6–10	64 (12)
>10	60 (11)
No. of residents who participated in TB education in last 12 mo	
Yes	234 (43)
No	307 (57)

Abbreviations: AFB, acid-fast bacilli; IGRA, interferon gamma release assay; NAAT, nucleic acid amplification test; PGY, postgraduate year; TB, tuberculosis; TST, tuberculin skin test.

[a]No difference in response rates per PGY level by site (P = .30).

[b]PGY-4 residents were fourth-year medicine/pediatrics residents, of which there were 20 in the entire sample.

[c]Total of 886 survey recipients, 31 survey recipients at site 1, 131 at site 2, 169 at site 3, 110 at site 4, 131 at site 5, 171 at site 6, 143 at site 7.

self-reported LTBI tests obtained in the last 12 months (P = .90), and self-report of having participated in TB education in the last 12 months (P = .30).

The correct response rate was 57% (311/541) or less on 9 of the 10 questions (Table 1). The CDC-recommended competency of how to obtain sputum samples when evaluating a patient for pulmonary TB had the highest correct response rate (411/541; 76%), whereas the question pertaining to criteria for discharge of a patient with smear-positive pulmonary TB had the lowest correct response rate (112/541; 21%). Few residents

knew the correct indication for NAAT testing in the diagnostic workup of pulmonary TB (26%; 141/541). Twenty-six percent (143/541) of the residents did not recognize diabetes as a risk factor for TB, and 40% (217/541) chose to prescribe levofloxacin to a patient with a negative LTBI test but risk factors, signs, and symptoms for active TB (Table 1). Thirty-one percent (169/541) of residents incorrectly relied upon LTBI testing to determine next steps in a patient with risk factors for TB and an abnormal CXR, whereas 57% (306/541) did not recognize NAATs as part of the microbiologic evaluation for pulmonary TB. Fifty percent (270/541) of residents incorrectly believed that 1 negative AFB smear implied noninfectiousness in a patient with smear-positive pulmonary TB, and 42% (226/541) incorrectly believed that a patient with smear-positive pulmonary TB must be hospitalized for 2 weeks of therapy before discharge.

Chart Review Results

A total of 2136 patients were evaluated for pulmonary TB across the study sites in 2014. The mean length of stay was 10 days and did not differ by site (P = .49). With the exception of CXRs, each CDC-recommended test was obtained for 43% (148/343) or fewer of patients, with an NAAT being obtained for 18% (62/343) of the overall sample and 14% (44/323) of smear-negative patients (Table 3). Four of the sites had an NAAT available on-site, whereas 3 sites sent the test to an off-site location. Patients evaluated at sites with on-site NAAT capacity were more likely to receive this testing (P < .01); this was also true when examining only patients who were smear-negative (P < .01). The site that most often ordered NAAT did so only 33% of the time (113/343). Nearly one-quarter of the 261 patients who had only sputa obtained (no bronchoscopy) had a single sample collected.

Table 3. Chart Review of Resident Practice Patterns (n = 343)

Test	Test Obtained, No. (%)
Sputa and/or bronchoscopy[a]	
1 specimen	83 (24)
2 specimens	112 (33)
3 specimens or more	148 (43)
Sputa only[b]	
1 specimen	57 (17)
2 specimens	91 (27)
3 specimens or more	113 (33)
IGRA or TST	121 (35)
NAAT[c]	62 (18)
Chest x-ray	328 (96)
Infectious disease service involvement[d]	161 (47)

Abbreviations: IGRA, interferon gamma release assay; NAAT, nucleic acid amplification test; TST, tuberculin skin test.

[a]Patients who had a bronchoscopy and/or sputa obtained.

[b]Expectorated or induced sputa only obtained (no bronchoscopy performed).

[c]There was a significant difference in the ordering of NAATs by residency program if the NAAT was available on-site (P < .01).

[d]Either infectious disease consult obtained or admitted to infectious disease service.

Twenty (6%) of the 343 randomly selected patients whose charts were evaluated were microbiologically diagnosed with TB; of these patients, 60% (12/20) had an NAAT, 65% (13/20) had at least 3 respiratory specimens, 20% (4/20) had 2 specimens, and 15% (3/20) had 1. Two of the patients were not diagnosed before discharge. One of these patients had 1 sputum sample obtained, which later became culture-positive for TB, and did not have an NAAT. The other patient had 2 sputa, 1 bronchoscopy, and an NAAT; this patient's NAAT was positive before discharge yet was not diagnosed as having TB. There was no significant difference in the number of patients diagnosed with TB by site ($P = .76$).

Discharge diagnoses (as documented by the medical team) were available for 6 of the sites, representing 62% (214/343) of the sample (Table 4). Of the patients who had a discharge diagnosis available, 5% (10/214) were diagnosed with TB, 18% (38/214) had no diagnosis specified upon discharge, 26% (55/214) received a diagnosis of "pneumonia" or "bronchitis" with no pathogen identification, and 52% (111/214) were thought to have a nonpulmonary diagnosis. Of the patients with a nonpulmonary diagnosis, 1 had a culture turn positive for TB after discharge.

DISCUSSION

We found that despite a majority of residents in our study self-reporting experience evaluating and caring for patients with active pulmonary TB, most were unable to identify risk factors for TB, recognize how to evaluate patients for TB, and correctly interpret TB diagnostics. They also chose treatment actions that could delay diagnosis and limit future treatment options (such as prescribing levofloxacin to a patient at risk for active TB). In addition, when residents evaluated patients for TB, they often did not complete a CDC-recommended diagnostic evaluation.

To our knowledge, this is the first study to assess IM resident knowledge of TB diagnosis using an objective assessment tool with sources of validity and the first study to attain a high enough response rate to allow for an accurate interpretation of results. It is also the first study to evaluate IM resident practice patterns with regard to TB diagnosis. Given that the majority of residents performed poorly on our knowledge assessment, there is clearly a need to improve education related to TB diagnosis. In our study, prior TB education was not associated with improved TB knowledge, nor was prior experience caring for patients with TB, performing TB diagnostic evaluations, or PGY level. It is likely that an innovative approach will be required to successfully address this problem. Determining how to leverage health system resources to facilitate TB-related education and evaluations may be of particular value. Prior work has found that the use of prompts and clinical decision support tools in electronic medical records can assist in improving diagnostic evaluations of ID-related conditions, such as chronic hepatitis

Table 4. Discharge Diagnosis and Diagnostic Evaluation

Discharge Diagnosis	Total (n = 214) n (%)
No diagnosis[a]	
Sputa and/or bronchoscopy[b]	
1 specimen	14 (7)
2 specimens	7 (3)
3 or more specimens	17 (8)
Sputa only[c]	
1 specimen	7 (3)
2 specimens	5 (2)
3 specimens or more	8 (4)
NAAT	1 (1)
Defined nonpulmonary diagnosis[a]	
Sputa and/or bronchoscopy[b]	
1 specimen	39 (18)
2 specimens	24 (11)
3 or more specimens	48 (22)
Sputa only[c]	
1 specimen	25 (12)
2 specimens	13 (6)
3 specimens or more	40 (19)
NAAT	15 (7)
Pneumonia or bronchitis[a]	
Sputa and/or bronchoscopy[b]	
1 specimen	19 (9)
2 specimens	8 (4)
3 or more specimens	28 (13)
Sputa only[c]	
1 specimen	17 (8)
2 specimens	5 (2)
3 specimens or more	23 (11)
NAAT	8 (4)
Tuberculosis[a]	
Sputa and/or bronchoscopy[b]	
1 specimen	1 (1)
2 specimens	0 (0)
3 or more specimens	9 (4)
Sputa only[c]	
1 specimen	0 (0)
2 specimens	0 (0)
3 specimens or more	7 (3)
NAAT	5 (2)

Abbreviations: NAAT, nucleic acid amplification test.

[a]Thirty-eight patients with no diagnosis; 111 patients with a defined nonpulmonary diagnosis; 55 patients with a pneumonia or bronchitis diagnosis; 10 patients with a TB diagnosis.

[b]Patients who had a bronchoscopy and/or sputa obtained.

[c]Expectorated or induced sputa only obtained (no bronchoscopy performed).

C virus and asymptomatic bacteriuria [19, 20]. Such prompts related to both key and commonly used TB diagnostics, such as NAATs and LTBI tests, may be both educational and functional. Residents should also be encouraged to seek the advice of TB experts housed at their local health departments and/or 1 of the 4 CDC TB Centers of Excellence for Training, Education, and Medical Consultation, particularly for complicated diagnostic and management questions [21]. The Centers of Excellence

also have educational resources that can be utilized by training programs.

A majority of patients in our chart review did not have a complete TB evaluation, yet this was not due to the discovery of a documented alternate diagnosis; nearly half of the patients at sites where a discharge diagnosis was available were sent home either without a diagnosis or with a diagnosis of "pneumonia." Unfortunately, we were unable to assess if these persons received a TB diagnosis at a later time. Given the limitations of available diagnostic tests (the sensitivity of a single sputum AFB culture and smear ranges between 80%–85% and 50%–80%, respectively, whereas the sensitivity of NAATs among smear-negative patients who are culture-positive is 50%–80%), such incomplete evaluations may miss some patients with TB [22, 23]. Upon investigating protocols for discontinuing airborne isolation precautions in hospitalized patients at our study sites, we found that all but 1 accepted a single smear-negative-induced sputum or bronchoscopy sample to be sufficient to remove airborne isolation precautions; the remaining site accepted 2 negative smears to remove isolation. If residents' understanding of how to diagnose TB is incomplete, they may be more susceptible to confusion between what is required to diagnose TB and what is required to discontinue isolation; clear messaging on these differences may be needed.

Hospital policies may also affect resident understanding of how and when to use NAATs. At each of our sites, an NAAT is reflexively done on smear-positive samples, but for smear-negative samples, NAATs must be requested and then approved by another division (such as infectious diseases or microbiology). Given that many of the residents in our study thought NAATs could only be obtained on smear-positive samples and the majority were unaware that an NAAT should be part of every active pulmonary TB evaluation, it is possible hospital policies negatively affect resident understanding of how and when to use NAATs. Future research should assess this and the effect of airborne isolation policies on residents' interpretation of TB diagnostics.

Our study was not without limitations. It would have been ideal to assess whether residents' knowledge deficits directly drove practice deficiencies, but proving this would have required an assessment of individual knowledge, practice, and reasons for decision-making, which was beyond the scope of this paper. The small number of TB evaluations per resident annually also made it impractical to link individual residents' performance on the assessment tool to patients they had cared for in the chart review. The chart review of the practice of the training program was therefore used as a surrogate assessment of resident practice. In addition, the patients whose charts were reviewed underwent evaluation for possible TB in 2014, whereas our tool deployment to residents occurred in 2015; we cannot exclude the possibility that the residents of 2014 and 2015 were qualitatively different with regards to TB diagnostics knowledge. Lastly, given that residents work in teams, it would have been ideal to assess the impact of other team providers (such as attending physicians) on the diagnostic process, but it was not possible to measure this reliably via a chart review. Future research should directly evaluate the impact of residents' TB knowledge and diagnostic reasoning on their clinical practice and should also assess the impact of care team members on residents' TB diagnosis practice patterns. Such findings may be applicable to other diagnostic challenges that arise among trainees and practicing clinicians.

CONCLUSIONS

Our findings indicate important IM resident knowledge and practice gaps in TB diagnosis. Given the public health risks of missed TB cases and that internists are often on the front lines of TB evaluations, further research is needed to determine the most effective way to train residents in TB diagnosis.

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