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Improving Tuberculosis Screening and Isoniazid Preventative Therapy in an HIV Clinic in Addis Ababa, Ethiopia

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Summary

Setting—An HIV clinic in Addis Ababa, Ethiopia.

Objective—The World Health Organization (WHO) recommends active tuberculosis (TB) case finding among people living with HIV (PLHIV) in resource-limited settings using a symptom-based algorithm and those without active TB disease should be offered isoniazid preventive therapy (IPT). We evaluated rates of adherence to these recommendations and the impact of a quality improvement (QI) intervention.

Design—A prospective study design was utilized to compare TB symptom screening and IPT administration rates before and after a QI intervention consisting of 1) educational sessions, 2) visual reminders and 3) use of a screening checklist.

Results—A total of 751 HIV-infected patient visits were evaluated. The proportion of patients screened for TB symptoms increased from 22% at baseline to 94% following the intervention (P<0.001). Screening rates improved from 51% to 81% (P<0.001) for physicians and from 3% to 100% (P<0.001) for nurses. Of the 281 patients with negative TB symptom screens and eligible for IPT, 4% were prescribed IPT before the intervention compared to 81%(P<0.001) afterward.

Conclusions—We found a QI intervention significantly increased WHO recommended TB screening rates and IPT administration. Utilizing nurses can help increase TB screening and IPT provision in resource-limited settings.

Keywords

Quality Improvement; Implementation Science; Checklists; Task shifting

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INTRODUCTION

Tuberculosis (TB) is a major global public health problem among people living with HIV (PLHIV).[1] HIV increases the progression from latent TB infection (LTBI) to active TB disease.[2] The increased disease burden caused by the co-infection of TB and HIV makes it critically important to detect TB among PLHIV; highlighted by reports of high TB related mortality among HIV-infected patients started on antiretroviral (ART) therapy.[3] TB detection via active screening prompts earlier treatment initiation, reducing the burden of disease.[4]

The World Health Organization (WHO) has recommended routine screening for active TB in all PLHIV.[5] Those found to have active TB should be given standard treatment and WHO has recommended that those in whom active TB is excluded should be presumptively given isoniazid preventive therapy (IPT) to prevent progression to active TB disease in high burden, resource-limited areas.[6] However, as of 2011, among the 33.3 million PLHIV, it is estimated that only 3.2 million (9.6%) have been screened for TB, and only 450,000 of those screened and without active TB were offered IPT.[7]

In a recent meta-analysis, Getahun et al reported that lack of four TB-related symptoms (cough, fever, night sweats, weight loss) identified PLHIV who were at extremely low risk for active TB disease (negative predictive value of 97.7%) and could be offered IPT.[8] In this study, having a positive symptom screen had a sensitivity of 78.9% and a specificity of 49.6% in settings with 5% prevalence of TB among PLHIV. Based on these observations, the WHO adopted these screening criteria for active TB case finding among all PLHIV in 2011, and recommended offering IPT in those who screen negative.[5]

Ethiopia is one of 22 high burden TB countries that account for more than 80% of all global TB cases. In 2011, the estimated TB incidence in Ethiopia was 237 cases per 100,000 people,[7] with a higher incidence of 311 cases per 100,000 person-years in some regions.[9] Additionally, there are approximately 800,000 PLHIV in the country.[10] Shah et al reported a prevalence of active TB of 7% among PLHIV attending an urban HIV clinic in Addis Ababa.[4] The Ethiopian Federal Ministry of Health guidelines recommend TB screening in PLHIV by symptom screening, sputum smear microscopy, and chest radiography.[4] However, estimates from 2011 suggest that only 21% of PLHIV are screened for TB, with 31,000 PLHIV being provided with IPT.[7]

A major challenge to improving health in the community is translating evidence-based findings into implementable policies.[11] Often scientific evidence in support of effective interventions exist; however, incorporating them into practice lags years behind.[12] In this study, we attempted to address this challenge by assessing rates of adherence to the WHO screening criteria for active TB case finding among PLHIV in Addis Ababa, Ethiopia. We further evaluated the impact of a cost-effective quality improvement (QI) intervention targeting active TB case finding and provision of IPT among those without active TB disease.

STUDY SETTING

The study took place in the HIV clinic of Tikur Anbessa Hospital in Addis Ababa, Ethiopia. Tikur Anbessa is the teaching hospital for the Addis Ababa University (AAU) School of Medicine and is the largest tertiary referral center in Ethiopia. The HIV clinic cares for 3000 HIV-infected patients annually.

At the clinic, HIV-infected patients are seen by nurses, resident physicians, and attending physicians. Nurses are permanently assigned to the clinic and provide ART medication refills. Physicians see newly diagnosed HIV patients, patients with symptomatic complaints, and patients on second line ART medications. Resident physicians from the AAU Internal Medicine Residency rotate through the HIV clinic. Attending physicians perform patient visits and provide resident oversight. Per clinic policy, active TB suspects are requested to provide sputum for an AFB smear; performance of a chest radiograph is left to the discretion of the physician. AFB or bacterial sputum cultures are not available for diagnostic purposes.

METHODS

The study was implemented in three phases from June to August 2012. We received an exemption from the Emory Institutional Review Board (IRB) and an approval from the AAU IRB as a baseline assessment of a study on enhanced TB case finding among PLHIV. The first phase included four weeks of baseline data collection. Medical charts of all HIV-infected clinic patients were reviewed to determine if they were screened for TB using the WHO symptom screen comprised of four questions (cough, fever, night sweats, weight loss). The HIV clinic utilizes a standard clinic flow sheet for each patient encounter including a record of the TB symptom screening result. Additionally, chart review was used to determine if patients had previously been prescribed or were currently taking IPT. Basic demographic information regarding each patient's history of TB and HIV was collected.

The second study phase consisted of a two-week QI intervention focused on improving TB screening rates and initiation of IPT. The intervention included four 45 minute education sessions (two with nurses and two with resident and attending physicians) reviewing the revised WHO guidelines for TB screening. Education sessions were given as PowerPoint lectures in Amharic and English by one of the authors (AT) who is an Infectious Diseases physician. The QI intervention included the placement of reminder posters containing the four screening questions and recommendations for the initiation of IPT throughout the HIV clinic. Finally, a screening checklist [Figure 1] was added to each patient's medical chart, asking providers to record if a patient was symptom screen positive. Providers also marked if chest radiography and three sputum AFB smears were ordered for patients who were symptom screen positive or if IPT was started for patients who were symptom screen negative. Exclusion criteria for IPT use (allergy, active hepatitis, heavy alcohol use, symptoms compatible with active TB but not confirmed, peripheral neuropathy) were listed. Patients were not given IPT if they had received IPT within the past three years. Per WHO protocol, patients were asked to return to clinic monthly for monitoring and IPT refills.

The final phase of the project was a three-week post-QI intervention period in which data regarding the TB symptom screen and IPT prescription were collected via medical chart review. For patients who were symptom screen positive, we recorded whether they had chest radiography and AFB smear ordered and performed.

DATA MANAGEMENT AND ANALYSIS

All data were entered into an online REDCap database. Data analysis was performed using SAS software (v.9.3).[13] Data collected included demographics, information regarding TB screening and current or past IPT use, and TB and HIV history. The primary study outcomes were the rates of TB symptom screening and IPT administration before and after the QI intervention. These rates were compared using a χ^2 test. A p value < 0.05 was considered statistically significant.

RESULTS

Baseline Socio-demographic and Clinical Information

A total of 751 HIV-infected patient visits were evaluated during the study period; 429 patients were seen before and 322 patients were seen after the QI intervention. Baseline characteristics are summarized in Table 1. The mean age of the study population was 39 years and the majority (64%) of patients were female. Patients had been enrolled and receiving care at the clinic for a mean of 30 months. In regards to the type of healthcare worker providing care, 480 patients (64%) were seen by a nurse and 271 (36%) were seen by a physician.

Most patients (95%) were receiving antiretroviral therapy (ART) therapy and had been on ART for an average of 57 months. Patients had a mean pre-ART CD4 count of 162 cells/μL and an average current CD4 count of 386 cells/μL. Thirteen patients were receiving treatment for active TB at baseline and were excluded from further analysis. Thirty-one percent (234/751) of patients had a history of active TB disease and 74 (10%) patients had a history of being prescribed IPT.

TB Symptom Screening and IPT Administration

At baseline, 22% of patients underwent a symptom screen for active TB disease. After the QI intervention, 94% of patients underwent a symptom screen for active TB (P<0.001). Physicians initially screened 51% (84/165) of patients for TB, improving to a screening rate of 81% (76/94) after the QI intervention (P<0.001). Nurses originally screened 3% (7/258) of patients, increasing to a screening rate of 100% (221/221) after the QI intervention (P<0.001) [Table 2]. The magnitude of change between physicians (30%) and nurses (97%) was significant (P<0.001).

Of the 91 patients screened in the pre-intervention phase, 46% were symptom screen positive compared to 22% in the post-intervention phase (P<0.001). Among the 106 total patients who had a positive symptom screen, health care workers ordered AFB smears at a significantly higher rate after the QI intervention compared to before the intervention (69% vs. 26%, P<0.001). Among 28 patients that had AFB sputum smears performed out of the

106 patients with a positive screen, one patient was AFB sputum smear positive. Four additional patients were given a clinical diagnosis of active TB disease and started on anti-TB therapy. Orders for chest radiography increased from 74% (31/42) before the intervention to 88% (56/64) after the intervention but this difference was not statistically significant (P = 0.07) [Table 3].

Among the 278 patients with a negative symptom screen who were eligible for IPT, IPT was prescribed at a significantly higher rate after the QI invention (81%) than before the intervention (4%) (P<0.001). Physician initiation of IPT among those eligible increased from 2% prior to the intervention to 38% after the intervention (P<0.001). Nurse initiation of IPT also increased significantly from 17% before the intervention to 90% after the intervention (P<0.001) [Table 2]. A total of 11 patients did not receive IPT due to reported contraindications including current hepatitis (3 patients) and peripheral neuropathy (3 patients).

DISCUSSION

We found that a QI intervention consisting of education sessions, reminder posters, and the use of a checklist can significantly improve rates of TB screening and IPT administration among PLHIV in a resource-limited setting. By increasing TB screening rates and the use of IPT prophylaxis to over 80%, this QI intervention likely provided public health benefit. Evidence has shown that the use of IPT prophylaxis in HIV positive patients is clinically and cost-effective in preventing active TB.[14–17] Our study also demonstrates the important role of nurses who showed significant improvement in TB screening rates and prescription of IPT. These findings may be applicable to other HIV clinics in resource-limited settings, where nurses have a presence in clinic operations and there are physician shortages.

Several studies have shown the benefit of using checklists to improve global public health outcomes including surgical safety and safe childbirth;[18–20] however scarce data exists for TB screening and IPT provision. The only prior report that demonstrated the effectiveness of a symptom-screening checklist that led to routine TB screening was reported from five Botswana medicine clinics.[21] Our study provides important data confirming that the introduction of a simple checklist can increase rates of TB screening and IPT administration. We believe that the checklist led to an improved mechanism to implement screening, making it easier to track whether a patient had been screened for TB and initiated on IPT previously.

While TB screening rates and IPT provision increased at the HIV clinic in Addis Ababa following the intervention, this occurred most dramatically among nurses. The low baseline rate among nurses may have resulted from a system that was not designed for nurses to screen for TB. The intervention empowered nurses to perform TB screening and prescribe IPT. Nurse patient visits were generally shorter and less complicated than physician patient visits, giving nurses more time to perform TB symptom screening. Additionally, nurses were present in clinic daily, allowing them to make TB screening part of their routine practice. Resident physicians rotated through the clinic monthly, perhaps making them less likely to incorporate the screening protocol.

Our findings support emerging literature on task shifting in public health. Recent studies from South Africa have suggested that shifting traditionally physician-oriented tasks such as ART initiation to other health care workers can be done effectively, decreasing the burden on the health care system and providing cost effective care.[22, 23] Additionally, by task shifting, health care systems can better cope with an increasing number of patients and the lack of physicians and other medical providers.[24] This study suggests that TB screening and initiation of IPT are tasks that can successfully be carried out by nurses. This is important given the limited number of physicians in Ethiopia (0.027 per 1000 population).[25, 26]

Our study had several limitations. Health care workers were not originally aware of the role of the study investigator present at the clinic; however, after the intervention, they became cognizant of the study aims and the presence of the investigator may have led to bias in the post-intervention results. Such bias could be attributed to the Hawthorne effect, where individuals change their behavior when they know they are being observed.[27] We attempted to minimize this bias by having the investigator collect data out of direct eyesight. Additionally, the follow-up period after the intervention period was limited to three weeks, so we are unable to assess long-term sustainability. We tried to establish a sustainable system through use of the written checklist and a plan to train new nurses and physicians on checklist use. Ongoing surveillance is needed to document whether the intervention continues to be successful. Furthermore, this study did not assess adherence to a minimum duration of IPT, which is critical for the prevention of active TB. Future work should examine and aim to improve adherence factors.

Finally, it is important to acknowledge that while patient assessment showing a negative four symptom TB screen has a high negative predictive value, having a positive symptom screen has moderate sensitivity (around 80%) and lower specificity (about 50%) for TB8 and is not necessarily indicative of active TB. At our study site, the laboratory infrastructure was limited as is the case throughout most of sub-Saharan Africa. Sputum AFB culture and molecular diagnostic tests for TB were not available, making chest radiography and AFB smear, which has a low sensitivity especially among PLHIV,[28] the only available diagnostics for working up suspected active TB. Our study highlights that even though these tests may be ordered they are not always performed. This may be attributed to factors including cost and the lack of a systemic mechanism to track if tests have been performed. Further QI work is needed to ensure AFB smears ordered are carried out.

CONCLUSION

In conclusion, this QI project including an intervention consisting of a brief education phase and the use of a screening checklist was associated with a significant improvement in TB screening rates (from 22% to 94%) and administration of IPT among PLHIV (from 4% to 81%). Nurses played a large role in this intervention and provide evidence for task shifting in resource-limited settings. This is especially important in Ethiopia given the physician shortage. Finally, interventions based on operational research can improve health care systems in resource-limited settings. This specific intervention has the potential to make a large impact, but must first be tested in other settings to see if the findings are replicable.

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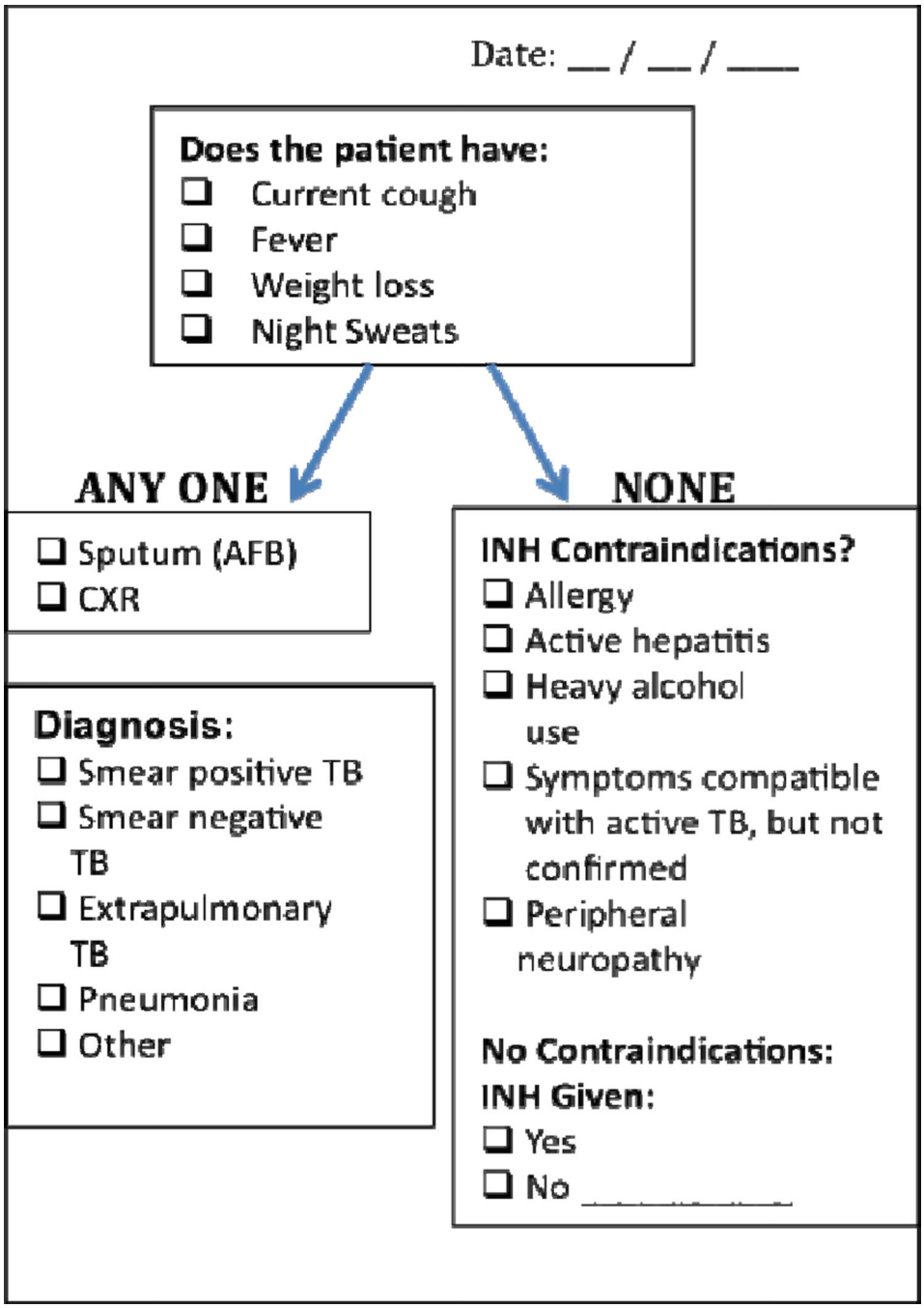

Figure 1.
Checklist Added to Charts

Table 1

Baseline Characteristics of all 751 HIV infected patients

Characteristic	Total n=751 (%)
Mean Age, (IQR)	39 (33–45)
Male	267 (36)
Pregnant (n=484)	8 (2)
Mean months enrolled in Clinic (IQR)	30 (25–36)
Type of Provider at Study Visit	
Nurse	480 (64)
Physician	271 (36)
HIV History	
Mean months since HIV diagnosis, (IQR)	67 (43–86)
Mean Initial CD4 count, (IQR)	162 (69–207)
Mean Current CD4 count, (IQR)	386 (233–515)
Receiving HAART	710 (95)
Mean Months on ART (IQR) (n=710)	57 (36–78)
TB History	
Currently receiving TB treatment	13 (2)
Currently on INH Prophylaxis	6 (1)
Prior History of active TB Treatment	234 (31)
Type of Prior TB (n=153)	
Pulmonary	77 (50)
Extra Pulmonary	70 (46)
Both	6 (4)
History of IPT	74 (10)
IPT > 3 years ago	5/74 (7)

Table 2

Comparison of TB Screening During the Pre- and Post-Intervention Periods (n=738)

Characteristic	Pre-Intervention	Post-Intervention	P Value
	N (%)	N (%)	
Overall TB Symptom Screened*	**91/423 (22)**	**297/315 (94)**	**<.0001**
Physician TB Symptom Screen (n=259)	84/165 (51)	76/94 (81)	<.0001
Nurse TB Symptom Screen (n=479)	7/258 (3)	221/221 (100)	<.0001
Presented with TB Symptoms	37/423 (9)	31/315 (10)	0.61
No presenting symptoms and screened (n=670)	54/386(14)	266/284 (94)	<.001
Physician TB Symptom Screen (n=192)	48/129 (37)	45/63 (71)	<.0001
Nurse TB Symptom Screen (n=478)	6/257 (2)	221/221 (100)	<.001
TB Symptom Screen Result (n=387) [1 missing]			
Positive	42/91 (46)	64/296(22)	<.0001
Negative	49/91 (54)	232/296 (78)	
Specific TB Symptoms+ (n=296)			
Cough	-	49/296 (17)	
Fever	-	27/296 (9)	-
Night Sweats	-	18/296 (6)	-
Weight Loss	-	14/296 (5)	-
TB Symptom Screen Negative Patients and eligible for IPT (n=278)**			
Started on IPT	**2/48 (4)**	**187/230 (81)**	**<.0001**
Physician Started on IPT (n=79)	1/42 (2)	14/37 (38)	<.0001
Nurse Started on IPT (n=199)	1/6 (17)	173/193 (90)	<.0001
Contraindication to IPT	-	11/43 (26)^	-

*Includes those presenting with symptoms consistent with TB symptoms (cough, weight loss, fever, night sweats);

+Specific symptoms not recorded in pre intervention phase;

^3 with current hepatitis based on laboratory diagnosis, 3 peripheral neuropathy, 5 other;

**4 patients deleted either due to being on IPT or having received IPT in last 3 years

Table 3

Follow Up of TB Symptom Screen Positive Patients (N=106)

Characteristic	Overall	Pre -Intervention	Post -Intervention	P Value
	N (%)	N (%)	N (%)	
CXR*				
HCW^ ordered CXR	87/106 (82)	31/42 (74)	56/64 (88)	0.07
CXR performed	60/106(57)	26/42 (62)	34/64 (53)	0.37
Abnormal CXR (n=60)	14/60 (23)	7/26 (27)	7/34 (21)	0.62
Sputum AFB+ Smear				
HCW ordered sputum AFB	55/106 (52)	11/42 (26)	44/64 (69)	<.0001
AFB Sputum Smear performed	28/106 (26)	8/42 (19)	20/64 (31)	0.16
Sputum AFB Positive (n=28)	1/28 (4)	1/8 (13)	0/20 (0)	0.11
Post Intervention Follow (n=64)				
Clinical TB diagnosis/started on RIPE	4/64 (6)	1/29 (4)	3/35 (9)	0.40
TB ruled out and IPT Started	13/64 (20)	0/29 (0)	13/35 (37)	0.0002
Clinical PNM diagnosis and treatment	30/67 (45)	18/32 (56)	12/35 (34)	0.07

*CXR, chest radiography;

^HCW, health care worker;

+AFB, acid fast bacillus; PNM, pneumonia