Published in final edited form as:

J Community Health. 2014 June ; 39(3): 494–502. doi:10.1007/s10900-013-9783-9.

HIV Testing of Tuberculosis Patients by Public and Private Providers in New York City

Pamela W. Klein, PhD[1,2], **Tiffany G. Harris, PhD**[3], **Peter A. Leone, MD**[4], and **Audrey E. Pettifor, PhD**[1]

[1]Department of Epidemiology, The University of North Carolina at Chapel Hill, Gillings School of Global Public Health, Chapel Hill, NC

[2]Center for AIDS Intervention Research, Department of Psychiatry and Behavioral Medicine, Medical College of Wisconsin, Milwaukee, WI

[3]Bureau of Epidemiology Services, New York City Department of Health and Mental Hygiene, Queens, NY

[4]Division of Infectious Diseases, The University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, NC

Abstract

Thirty percent of tuberculosis (TB) patients in New York City in 2007 were not tested for HIV, which may be attributable to differential testing behaviors between private and public TB providers. Adult TB cases in New York City from 2001–2007 (n=5172) were evaluated for an association between TB provider type (private or public) and HIV testing. Outcomes examined were offers of HIV tests and patient refusal of HIV testing, using multivariate logistic and binomial regression, respectively. HIV test offers were less frequent among patients who visited only private providers than patients who visited only public providers (males: adjusted odds ratio [aOR]=0.33, 95% confidence interval (CI): 0.15–0.74; females: aOR=0.26, 95% CI: 0.12–0.57). Changing from private to public providers was associated with an increase in HIV tests offered among male patients (aOR=1.96, 95% CI: 1.04–3.70). Among patients who did not use substances, those who visited only private providers were more likely to refuse HIV testing than those who visited only public providers (males: adjusted prevalence ratio [aPR]=1.26, 95% CI: 0.99–1.60; females: aPR=1.78, 95% CI: 1.43–2.22). Patients of private providers were less likely to have an HIV test performed during their TB treatment. Education of TB providers should emphasize HIV testing of all TB patients, especially among patients who are traditionally considered low-risk.

Keywords

HIV testing; tuberculosis; medical providers

Corresponding Author's Contact Information: Pamela W. Klein, PhD, Center for AIDS Intervention Research, Medical College of Wisconsin, 2071 North Summit Avenue, Milwaukee, WI 53202, Phone: 414-955-7744, paklein@mcw.edu.

INTRODUCTION

TB is an AIDS-defining illness, and HIV is the single strongest risk factor for progression from latent TB infection to active TB disease.[1, 2] Antiretroviral therapy (ART) for HIV infection can reduce the risk for progression from latent to active TB, rates of TB relapse, and risk of death from TB.[3–5] Therefore, knowledge of a patient's HIV status is essential to effectively manage both TB and HIV infections, as well as prevent future cases of TB.

From 2001 through 2007, there were over 7,200 cases of tuberculosis (TB) verified by New York City (NYC).[6] NYC TB cases account for approximately 10% of all TB cases in the United States. Nationally, 7% of TB patients reported to the Centers for Disease Control and Prevention (CDC) in 2007 were HIV-infected; in NYC, 13% of TB patients were HIV-infected.[6, 7]

In 1989, CDC recommended that all TB patients be tested for HIV infection.[8] Nationally, the number of TB patients with an HIV test result increased from 35% in 1993 to 68% in 2003. However, in 2007, 30% of TB patients in the US still did not have an HIV test result, 22% of TB patients were not offered an HIV test, and 8% refused HIV testing.[7]

Most evaluations of HIV testing of TB patients in the U.S. and other developed countries were conducted in the mid-1990s. TB patients in Los Angeles and Canada with traditional HIV risk factors were more likely to have an HIV test result on record than other patients.[9–11] In North Carolina, providers were more likely to offer HIV testing to patients who were non-Hispanic black, users of non-injection drugs, or living in a high HIV incidence county; patients who were male, non-Hispanic black, or users of non-injection drugs were more likely to accept HIV testing.[12] More recently in the mid-2000s, providers in London were more likely to offer HIV testing to younger, foreign-born TB patients; male and younger patients were more likely to accept HIV testing.[13]

Adherence to national TB diagnostic and treatment guidelines varies by TB medical provider type.[14–17] Public clinics and hospitals serve as safety net providers for many publically insured or uninsured, often minority, populations.[18] As these populations are also at greatest risk for HIV infection, public providers may be more aware of recommendations for TB and HIV medical care.[19, 20] In Los Angeles in 1993, HIV testing was more common among patients who initially sought care from public providers than private providers (69% vs. 44%).[11] Recent data exploring the relationship between the type of TB medical provider and adherence to HIV testing recommendations are predominately descriptive and did not differentiate a provider's failure to offer an HIV test and a patient's test refusal.[21]

This study examines if TB patients of private medical providers have varying HIV testing practices than TB patients of non-private medical providers in NYC during the ART era (2001–2007). Two specific hypotheses are posited: (1) private TB providers are less likely to offer HIV testing to their patients than public TB providers, and (2) when offered HIV testing, patients of private TB providers are more likely to refuse HIV testing than patients of public medical providers.

METHODS

Patients included in this analysis consisted of all active, laboratory-confirmed TB cases verified by the NYC Department of Health and Mental Hygiene (DOHMH) Bureau of Tuberculosis Control between January 1, 2001 and December 31, 2007. Patients were excluded if they were diagnosed with TB at death (n=149), under the age of 18 years (n=417), resided outside NYC at diagnosis (n=6), or sought TB care outside of NYC (n=456). Since the HIV testing outcome under study was a cumulative measure that incorporates all HIV testing encounters during the course of TB treatment, patients who failed to complete TB treatment were also excluded from analysis (n=1066). An additional 46 individuals with missing HIV test information were excluded, resulting in a final sample size of 5172 TB patients. No statistical differences were observed in the demographics of patients included or excluded by the complete case analysis. Data used in this study were obtained from the TB surveillance registry, which includes data from standardized patient interviews and chart reviews.

HIV Testing Protocol for TB Patients

In the TB surveillance registry, HIV testing status was categorized as: HIV-infected, HIV-uninfected, indeterminate test result, pending result, not offered HIV testing, and refused HIV testing. (Figure 1)

A patient's HIV status was first obtained through patient self-report to medical staff, patient chart review, or designation on the initial TB report. TB patients who self-reported being HIV-infected were confirmed through a documented positive and confirmed HIV antibody test. TB patients who self-reported as HIV-uninfected were confirmed via documentation of a negative HIV test performed within one year of TB diagnosis.

Per DOHMH protocol, all patients who had an unknown HIV status at TB diagnosis or who were unable to provide documentation of their self-reported HIV status should be offered an HIV test. Patients who accepted HIV testing were tested using an enzyme-linked immunosorbent assay or a rapid HIV antibody test with confirmation of reactive results via Western blot. All test results were documented in the TB surveillance registry. Patients who refused HIV testing were re-offered testing during the course of treatment.

Exposure Assessment

Providers who supplied care to NYC TB patients ("TB providers") were dichotomized as "private" (exposed) or "public" (unexposed) for the purpose of this study. "Private" providers included private physician offices, private hospitals, and nursing homes. All other TB providers were categorized as non-private or "public" providers. "Public" providers included DOHMH public chest clinics, Health and Hospitals Corporation (HHC) facilities (publicly financed inpatient and outpatient facilities), and the Veteran's Administration (VA). HHC and VA facilities were categorized as "public" because their patients are demographically similar to that of public NYC DOHMH chest centers and they accept patients regardless of their ability to pay.[22, 23] Only data regarding a patient's first and last TB medical provider were available for this analysis.

Outcome Assessment

Two primary outcomes were assessed in this study: the offer of an HIV test to a TB patient and the refusal of HIV testing by the TB patient.

In the analysis of the first outcome, patients were categorized as “not offered HIV testing” or “offered HIV testing”. Patients who were “not offered HIV testing” were documented as such in the TB surveillance registry and lacked a confirmed HIV test result. Patients who were “offered HIV testing” included patients who either refused HIV testing, had a known HIV test result, or had an indeterminate/pending lab result.

In the analysis of the second outcome, patients were categorized as either “refused HIV testing” or “accepted HIV testing”. Patients who were categorized as “refused HIV testing” were not tested at any point during the course of TB treatment as documented in the TB surveillance registry. Patients who accepted HIV testing had a known HIV test result or an indeterminate/pending lab result in the TB surveillance registry.

Patients whose self-reported HIV status was confirmed as either HIV-infected or HIV-uninfected could not be distinguished in the TB registry from patients who received a HIV test during the course of being diagnosed and treated for TB treatment. Patients with confirmed self-reported HIV status were considered to have been successfully tested and were therefore coded as “offered HIV testing” in the analysis of HIV test offers and “accepted HIV testing” in the analysis of HIV test refusal.

Covariates

Covariates included in this analysis were patient sex (male, female), age (continuous), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian), birth in the US (yes, no), any history of homelessness (yes, no), substance use (yes, no), TB drug resistance (any, none), and extrapulmonary TB diagnosis (any, none). Patients of other race/ethnicity categorizations (e.g., multiple race or other race, n=26) were excluded due to small numbers.

Statistical Analyses

Due to the restrictions of the TB surveillance registry, we could not determine which TB provider ordered an HIV test on a patient; only a cumulative measure of a TB patient’s HIV status at the completion of TB treatment was available. Therefore, analyses were restricted to cross-sectional associations of a patient’s type of TB provider and final HIV status at TB treatment completion.

Three regression models were used to assess the association between TB provider type and HIV testing outcomes; each regression model incorporated different assumptions regarding a patient’s pattern of contact with TB providers. The Initial Provider Model (Model 1) assumed that the patient’s HIV testing encounter occurred during a visit with the first provider from whom the patient sought TB treatment. The Provider Change Model (Model 2) allowed for patients to change their type of TB provider during the course of TB treatment using 3-level, categorical exposure variable: only private providers, only public providers, and a change in the type of provider during treatment based on the first and last TB medical provider documented in the TB surveillance registry. The Directional Provider

Change Model (Model 3) accounted for the directionality of provider type changes during the course of TB treatment using a 4-level categorical exposure variable: only private providers, only public providers, change from private to public provider, or change from public to private provider.

The provider's offer of HIV testing to patients was modeled using unconditional logistic regression; patient refusal of HIV testing was modeled using binomial regression. Generalized estimating equations were included in all models to account for correlated observations between patients visiting the same provider. Stratification covariates were identified via Wald chi-square statistic ($p<0.10$); confounders were identified for model inclusion via backwards, stepwise elimination (change in effect estimate >10%).

This study was approved by the Internal Review Boards of both the University of North Carolina at Chapel Hill and the New York City Department of Health and Mental Hygiene.

RESULTS

From 2001–2007, 5,172 TB patients in NYC met the eligibility requirements for analysis, nearly 25% (n=1243/5172) of whom did not successfully complete the HIV testing protocol for TB patients (Figure 1). Over half of patients initially engaged in TB care with a private provider (53%, n=2722/5172); 28.4% (n=772/2722) were not tested for HIV during their TB treatment (Table 1).

Among the 47% of patients initially engaged in TB care with a public provider (n=2450/5172), 18% (n=441/2450) were not tested for HIV. Approximately one-third of TB patients changed provider type during the course of TB treatment (32.0%, n=1656/5172). Only 3% (n=162/5172) of TB patients were not offered an HIV test during the course of TB treatment; of these, 103 (64%) first engaged in TB treatment with a private provider. Nearly one-third (28%, n=1081/5172) of TB patients who were offered an HIV test subsequently refused HIV testing; 699 (65%) of these patients first engaged in TB care with a private provider. Over 700 TB patients were HIV-infected (15%, n=733/5172); 377 (51%) of these first engaged in care with a private TB provider. Among the 3,193 HIV-uninfected patients, 1541 (48%) initially visited a private TB provider.

Among patients who were not offered an HIV test, 23% (n=37/162) were non-Hispanic white and 17% (n=27/162) were Hispanic. The majority of patients refusing an HIV test were Asian (52%, n=599/1081), and a high proportion were foreign-born (83%, n=899/1081). Older patients were less likely to be offered an HIV test and accept an HIV test when offered than younger patients.

HIV Test Offers

The relationship between TB provider type and not being offered an HIV test differed by gender (test for interaction $p<0.10$). All results are therefore stratified by gender, even though the same overall direction of the association was observed for both genders.

The Initial Provider Model (Model 1), which examined the cross-sectional association of first TB provider type and failure to offer an HIV test, did not show an association for male

TB patients (adjusted odds ratio [aOR] = 1.01, 95% confidence interval [CI]: 0.76–1.33; Table 2). Female patients of private providers were less likely to be offered an HIV test during the course of treatment than female patients of public providers, although the association was not statistically significant (aOR = 0.78, 95% CI: 0.60–1.02).

The Provider Change Model (Model 2) incorporated the potential for a patient to change TB provider type during the course of treatment. Patients who made any change in provider type during the course of treatment were no more or less likely to be offered an HIV test during the course of treatment than patients who only visited public providers (males: aOR = 1.09, 95% CI: 0.73–1.61; females: aOR = 1.12, 95% CI: 0.72–1.75; Table 2). However, patients who only visited private providers were significantly less likely to be offered an HIV test than patients who only visited public providers (males: aOR = 0.46, 95% CI: 0.23–0.90; females: aOR = 0.37, 95% CI: 0.19–0.70).

The Directional Provider Change Model (Model 3) examined not only changing provider type during treatment, but also the directionality of provider type change (private to public, or public to private). Male patients who changed from a public provider to a private provider during the course of TB treatment were significantly less likely to be offered an HIV test during treatment (aOR = 0.14, 95% CI: 0.05–0.40) than patients who only visited a public provider (Table 2). Males who changed from a private provider to a public provider during TB treatment were more likely to be offered an HIV test (aOR = 1.96, 95% CI: 1.04–3.70) than patients who only visited a public provider. Patients who visited only a private TB provider were over three times less likely to be offered an HIV test as patients who only visited public providers (males: aOR = 0.33, 95% CI: 0.15–0.74; females: aOR = 0.26, 95% CI: 0.12–0.57).

Refusal of HIV Testing

Similar to what was observed in the evaluation of HIV test offers, the relationship between TB provider type and patient refusal of HIV testing differed by gender; therefore, all results were stratified by gender. However, in the Provider Change and Directional Provider Change Models (Models 2 and 3), the relationship between TB provider type and patient refusal of HIV testing also differed significantly by substance use status (test for interaction $p<0.10$). In these models, results were additionally stratified by substance use status.

In the Initial Provider Model (Model 1), female patients of private TB providers were more likely to refuse HIV testing than patients of public TB providers (adjusted prevalence ratio [aPR] = 1.38, 95% CI: 1.20–1.58; Table 3).

The Provider Change Model (Model 2) indicated that, among women who did not abuse substances, those who changed provider type during treatment were more likely to refuse HIV testing than patients who only visited public providers (aPR = 1.28, 95% CI: 1.10–1.49; Table 3). Among both men and women who did not use substances, those who visited only private providers were more likely to refuse HIV testing than those who visited only public providers (men: aPR = 1.24, 95% CI: 0.99–1.56; women: aPR = 1.75, 95% CI: 1.40–2.20).

In the Directional Provider Change Model (Model 3), substance-using men who changed from a private provider to a public provider were marginally less likely to refuse HIV testing than substance-using men who only visited public providers (aPR = 0.65, 95% CI: 0.42–1.01). Among women who did not use substances, those who changed from private to public providers were more likely to refuse HIV testing than those who only visited public providers (aPR = 1.27, 95% CI: 1.09–1.47). Among both men and women who did not report substance use, patients who only visited private providers were more likely to refuse HIV testing than patients who only visited public providers (men: aPR = 1.26, 95% CI: 0.99–1.60; women: aPR = 1.78, 95% CI: 1.43–2.22).

DISCUSSION

HIV testing of TB patients is crucial to the effective clinical management and control of both diseases. However, approximately 30% of the TB patients in the US do not have an HIV test result on record, predominantly due to providers failing to offer or patients refusing HIV testing.[7] Although the type of TB medical provider (public vs. private) has been implicated in the failure to adhere to other clinical guidelines for the diagnosis and treatment of TB, the potential association between a patient's provider type and specific poor HIV testing outcomes (failure of a provider to offer a test, patient refusal of a test) has not been examined in the ART era.[14–17, 21] This study framed the issue of HIV testing and TB providers within the high TB and HIV incidence area of NYC, focusing on the ART era (2001–2007).

TB patients who only visited private providers were less likely to be offered HIV testing than individuals who only visited public providers. Private providers may be less aware of HIV testing guidelines, because their general population differs from the population typically portrayed as at-risk for TB and HIV. These providers may not realize the high-HIV risk status of their TB patients or be aware of current HIV testing recommendations.[24–26] Some private providers may harbor internal HIV-related stigma and may not feel comfortable discussing HIV with their patients.[24, 26–28]

Among men, changing from private to public provider during the course of TB treatment increased the chances of being offered an HIV test. HIV testing is typically performed during the initial visit with a TB medical provider. If a patient switches TB providers and has not yet been offered an HIV test, the first encounter with a new provider provides another opportunity for HIV testing to occur.

The association between provider type and patient refusal of HIV testing was weaker than the association between provider type and not being offered an HIV test. Among TB patients who did not report substance use, patients who visited only private providers were more likely to refuse HIV testing than patients who visited only public providers. HIV test acceptance was greater among men than among women, which could be attributed to self-perceived HIV risk if women who do not report substance use do not view themselves as at risk for HIV acquisition. Our observations concur with prior studies that identified higher rates of HIV test refusal among female patients.[12, 13, 29]

Among substance users, however, provider type was generally not associated with refusal of HIV testing. Substance use is considered a risk factor for HIV acquisition, and has been previously associated with HIV test acceptance.[12] Patients who do not use substances and visit private providers may have a lower perceived risk of HIV infection.[24, 30] Additionally, providers may recommend HIV testing more strongly to patients with a history of substance use.[24, 28]

The effects of provider type on HIV testing behaviors were more pronounced for women than for men. The differential impact of changing provider type in men and women could be due to provider beliefs that males are more at risk for HIV than females.[24, 26] Despite the high burden of HIV among men who have sex with men, providers who treat TB patients should be trained to acknowledge that all male and female TB patients are at higher-risk for HIV infection than the general population.

One of the primary limitations of this study is that TB patients may have multiple providers between their first and last providers and this information was not available for this study. Theoretically, every visit with a new provider presents another opportunity for HIV testing. Therefore, if a patient visited more than two TB providers, our analysis may not have identified all HIV testing encounters for that patient. Details regarding each provider's medical specialty were not available; such provider characteristics could influence the provider's comfort level with HIV testing. Additionally, due to small numbers this study was not able to examine whether there were differences between private providers and private hospitals.

Additionally, the date of the patient's HIV testing encounter was not included in the TB Registry. These limitations restrict the analysis to prevalence measures based upon data at the conclusion of a TB treatment. Patients who do not complete TB treatment may have poor healthcare seeking and adherence behaviors; the exclusion of these persons may underestimate HIV test refusal. Also, individuals who were HIV tested as part of their TB provider encounter could not be distinguished from patients with documentation of a prior HIV test result.

Routinely-collected public health surveillance datasets are a rich source of information. However, missing data and limited variables are significant hurdles, which can be overcome with data collection improvements. Since the time of this study, the NYC TB surveillance registry has been expanded to collect the date of HIV testing encounter, capture multiple testing encounters, and record all of a patient's TB providers, which will allow for future analyses involving the assessment of time-to-HIV testing, describe multiple testing encounters and estimates of HIV seroconversion during TB treatment.

The TB Registry did not capture the reasons why a patient refused an HIV test. Future studies evaluating HIV testing should include patient interviews to identify potential points of intervention to increase HIV test acceptance.

Despite these limitations, this study not only examines the association between TB providers and successful HIV testing of TB patients in the ART era, but specifically addresses the failure to offer HIV testing and HIV test refusal as two separate outcomes and directionality

of TB provider engagement. The setting for the study, NYC, is ideal because of its high HIV and TB prevalence and strong surveillance infrastructure for the longitudinal follow-up of patients. The diverse TB patient population NYC allows these results to be generalizable to other urban centers within the US. This study is an improvement upon prior analyses of TB provider adherence to HIV testing recommendations because of its recognition of the fact that patients can change TB providers during the course of treatment.

Nearly 25% of TB patients in NYC in 2001–2007 were not tested for HIV, despite national guidelines that all TB patients be tested for HIV. This analysis showed that HIV testing behaviors were associated with a patient's provider type and whether or not the patient changed provider type during the course of treatment. While only 3% of patients were not offered an HIV test, 64% of those who were not offered testing first engaged in care with a private TB provider. Efforts must be made to ensure that all TB patients are offered an HIV test by their providers.

Although refusal of HIV testing by TB patients was not found to be strongly associated with provider type, 28% of patients offered HIV testing refused the test. A better understanding of the barriers to HIV testing and why TB patients refuse HIV testing is needed to improve HIV testing acceptance. Educational campaigns for TB patients can emphasize the relationship between TB and HIV in disease progression, as well as describe treatment options and support services available for HIV-infected persons.

Recent modifications of HIV testing legislation in New York State to allow for routine, opt-out HIV testing without separate written consent may further increase HIV test acceptance. For the duration of this study until 2010, New York State required written informed consent for HIV testing, despite the HIV testing recommendations by the CDC in 2006 supporting routine, opt-out HIV testing and a waiver of separate written consent in clinical settings.[31] Written informed consent procedures can act as a barrier to routine HIV testing in clinical settings.[24, 26, 32] An increase in HIV testing has been observed in states that have changed their HIV testing guidelines, removing requirements for separate written informed consent.[33, 34] Additionally, the presentation of HIV testing in an "opt-in" rather than an "opt-out" fashion could influence HIV testing acceptance by patients.

Both private and public providers should strongly urge all of their patients to accept HIV testing. Traditional risk-based HIV testing often fails to identify HIV-infected individuals and is not an acceptable testing protocol in a population of TB patients who are inherently at an increased risk for HIV acquisition.[35] Educational campaigns for providers, both private and public, must emphasize the necessity of HIV testing for all TB patients, regardless of the patient's actual or provider-perceived risk profile.

Acknowledgments

Funding: This project was supported, in part, by an NRSA predoctoral training grant (T32-AI070114) from the National Institute of Allergy and Infectious Diseases and an NRSA postdoctoral training grant (T32-MH19985) from the National Institute of Mental Health.

References

1. Daley CL, Small PM, Schecter GF, et al. An outbreak of tuberculosis with accelerated progression among persons infected with the human immunodeficiency virus. An analysis using restriction-fragment-length polymorphisms. N Engl J Med. 1992; 326(4):231–235. [PubMed: 1345800]
2. De Cock KM, Grant A, Porter JD. Preventive therapy for tuberculosis in HIV-infected persons: international recommendations, research, and practice. Lancet. 1995; 345(8953):833–836. [PubMed: 7898232]
3. Girardi E, Sabin CA, d'Arminio Monforte A, et al. Incidence of Tuberculosis among HIV-infected patients receiving highly active antiretroviral therapy in Europe and North America. Clin Infect Dis. 2005; 41(12):1772–1782. [PubMed: 16288403]
4. Nahid P, Gonzalez LC, Rudoy I, et al. Treatment outcomes of patients with HIV and tuberculosis. Am J Respir Crit Care Med. 2007; 175(11):1199–1206. [PubMed: 17290042]
5. Severe P, Leger P, Charles M, et al. Antiretroviral therapy in a thousand patients with AIDS in Haiti. N Engl J Med. 2005; 353(22):2325–2334. [PubMed: 16319381]
6. Annual Summary 2008: New York City is Stopping TB. New York, NY: New York City Department of Health and Mental Hygiene; 2009.
7. CDC. Reported Tuberculosis in the United States, 2010. Atlanta, GA: Department of Health and Human Services, CDC; 2011.
8. Tuberculosis and human immunodeficiency virus infection: recommendations of the Advisory Committee for the Elimination of Tuberculosis (ACET). MMWR Morb Mortal Wkly Rep. 1989; 38(14):236–238. 243–250. [PubMed: 2494425]
9. Harris T, Panaro L, Phypers M, Choudhri Y, Archibald CP. HIV Testing among Canadian Tuberculosis Cases from 1997 to 1998. Can J Infect Dis Med Microbiol. 2006; 17(3):165–168. [PubMed: 18418494]
10. Geduld J, Brassard P, Culman K, Tannenbaum TN. Testing for HIV among patients with tuberculosis in Montreal. Clin Invest Med. 1999; 22(3):111–118. [PubMed: 10410833]
11. Asch SM, London AS, Barnes PF, Gelberg L. Testing for human immunodeficiency virus infection among tuberculosis patients in Los Angeles. Am J Respir Crit Care Med. 1997; 155(1):378–381. [PubMed: 9001340]
12. Stout JE, Ratard R, Southwick KL, Hamilton CD. Epidemiology of human immunodeficiency virus testing among patients with tuberculosis in North Carolina. South Med J. 2002; 95(2):231–238. [PubMed: 11846251]
13. Rodger AJ, Story A, Fox Z, Hayward A. HIV prevalence and testing practices among tuberculosis cases in London: a missed opportunity for HIV diagnosis? Thorax. 2010; 65(1):63–69. [PubMed: 19996347]
14. Rozovsky-Weinberger J, Parada JP, Phan L, et al. Delays in suspicion and isolation among hospitalized persons with pulmonary tuberculosis at public and private US hospitals during 1996 to 1999. Chest. 2005; 127(1):205–212. [PubMed: 15653985]
15. Golub JE, Bur S, Cronin WA, et al. Patient and health care system delays in pulmonary tuberculosis diagnosis in a low-incidence state. Int J Tuberc Lung Dis. 2005; 9(9):992–998. [PubMed: 16158891]
16. Liu Z, Shilkret KL, Finelli L. Initial drug regimens for the treatment of tuberculosis: evaluation of physician prescribing practices in New Jersey, 1994 to 1995. Chest. 1998; 113(6):1446–1451. [PubMed: 9631776]
17. Richardson NL. Evaluating provider prescribing practices for the treatment of tuberculosis in Virginia, 1995 to 1998: an assessment of educational need. J Contin Educ Health Prof. 2000; 20(3):146–155. [PubMed: 11232250]
18. Fraze, T.; Elixhauser, A.; Holmquist, L.; Johann, J. Public Hospitals in the United States, 2008: Agency for Healthcare Research and Quality, Healtcare Cost and Utilization Project. 2010.
19. Bliss EB, Meyers DS, Phillips RL Jr, Fryer GE, Dovey SM, Green LA. Variation in participation in health care settings associated with race and ethnicity. J Gen Intern Med. 2004; 19(9):931–936. [PubMed: 15333057]

20. Forrest CB, Whelan EM. Primary care safety-net delivery sites in the United States: A comparison of community health centers, hospital outpatient departments, and physicians' offices. JAMA. 2000; 284(16):2077–2083. [PubMed: 11042756]
21. Kong DG, Watt JP, Marks S, Flood J. HIV Status Determination Among Tuberculosis Patients From California During 2008. J Public Health Manag Pract. 2013; 19(2):169–177. [PubMed: 23358296]
22. Siegel B. Re-engineering the public hospital system: saving the safety net. Bull N Y Acad Med. 1996; 73(2):357–369. [PubMed: 8982526]
23. Roselle GA, Danko LH, Kralovic SM, Simbartl LA, Kizer KW. Tuberculosis in the veterans healthcare system: a six-year review and evaluation of programme effectiveness. Epidemiol Infect. 2000; 125(2):315–323. [PubMed: 11117955]
24. Jain CL, Wyatt CM, Burke R, Sepkowitz K, Begier EM. Knowledge of the Centers for Disease Control and Prevention's 2006 routine HIV testing recommendations among New York City internal medicine residents. AIDS Patient Care STDS. 2009; 23(3):167–176. [PubMed: 19866534]
25. Hansen L, Barnett J, Wong T, Spencer D, Rekart M. STD and HIV counseling practices of British Columbia primary care physicians. AIDS Patient Care STDS. 2005; 19(1):40–48. [PubMed: 15665634]
26. Burke RC, Sepkowitz KA, Bernstein KT, et al. Why don't physicians test for HIV? A review of the US literature. Aids. 2007; 21(12):1617–1624. [PubMed: 17630557]
27. Kinsler JJ, Wong MD, Sayles JN, Davis C, Cunningham WE. The effect of perceived stigma from a health care provider on access to care among a low-income HIV-positive population. AIDS Patient Care STDS. 2007; 21(8):584–592. [PubMed: 17711383]
28. Worthington C, Myers T. Factors underlying anxiety in HIV testing: risk perceptions, stigma, and the patient-provider power dynamic. Qual Health Res. 2003; 13(5):636–655. [PubMed: 12756685]
29. Liddicoat RV, Losina E, Kang M, Freedberg KA, Walensky RP. Refusing HIV testing in an urgent care setting: results from the "Think HIV" program. AIDS Patient Care STDS. 2006; 20(2):84–92. [PubMed: 16475889]
30. Mahendradhata Y, Ahmad RA, Lefevre P, Boelaert M, Van der Stuyft P. Barriers for introducing HIV testing among tuberculosis patients in Jogjakarta, Indonesia: a qualitative study. BMC Public Health. 2008; 8:385. [PubMed: 19014468]
31. Branson BM, Handsfield HH, Lampe MA, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. MMWR Recomm Rep. 2006; 55(RR-14):1–17. quiz CE11–14. [PubMed: 16988643]
32. Bokhour BG, Solomon JL, Knapp H, Asch SM, Gifford AL. Barriers and Facilitators to Routine HIV Testing in VA Primary Care. Journal of General Internal Medicine. 2009; 24(10):1109–1114. [PubMed: 19690923]
33. Ehrenkranz PD, Pagan JA, Begier EM, Linas BP, Madison K, Armstrong K. Written Informed-Consent Statutes and HIV Testing. American Journal of Preventive Medicine. 2009; 37(1):57–63. [PubMed: 19423271]
34. Zetola NM, Grijalva CG, Gertler S, et al. Simplifying Consent for HIV Testing Is Associated with an Increase in HIV Testing and Case Detection in Highest Risk Groups, San Francisco January 2003–June 2007. Plos One. 2008; 3(7)
35. Duffus W, Kettinger L, Stephens T, et al. Missed opportunities for earlier diagnosis of HIV infection - South Carolina, 1997–2005. Morbidity and Mortality Weekly Report. 2006; 55(47): 1269–1272. [PubMed: 17136020]

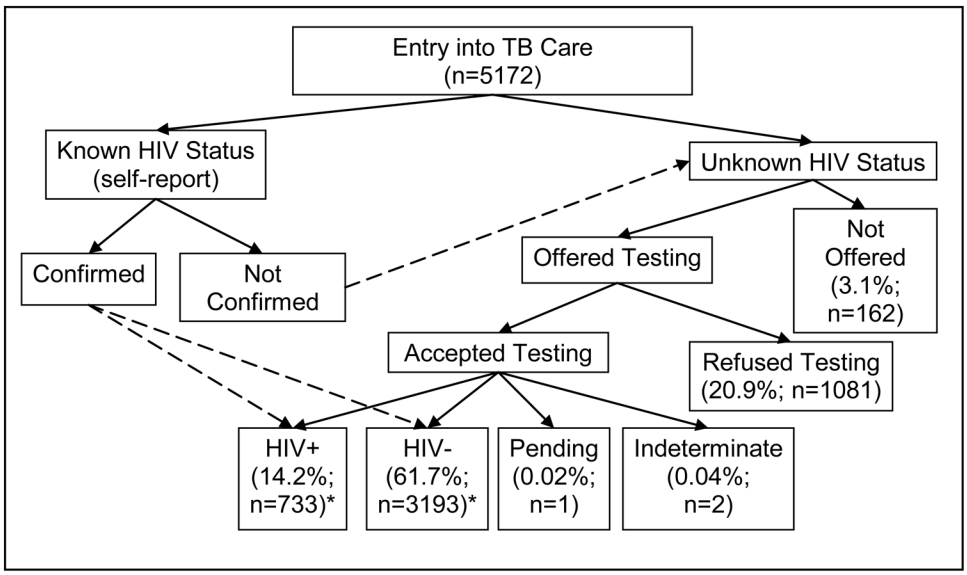

Figure 1. HIV Testing Outcomes for TB Patients in NYC, 2001–2007

*Includes patients for whom a self-reported HIV-status was confirmed through medical record review, previous test documentation, or retesting

Table 1

Demographic and Clinical Characteristics of NYC TB Patients, 2001–2007

	All TB Patients (n=5172)		Not Offered HIV test (n=162)		Offered HIV test (n=5010)		Refused HIV test (n=1081)		Accepted HIV test (n=3929)	
	N	%	N	%	N	%	N	%	N	%
Initial Provider Type*										
Private	2722	53	103	64	2619	52	699	67	1920	49
Public	2450	47	59	36	2391	48	382	35	2009	51
Sex										
Male	3161	61	96	59	3065	61	590	55	2475	63
Female	2011	39	66	41	1945	39	491	45	1454	37
Race/Ethnicity										
Non-Hispanic white	424	8	37	23	387	8	108	10	279	7
Non-Hispanic black	1567	30	42	26	1525	31	217	20	1308	33
Hispanic	1520	30	27	17	1493	30	190	18	1303	33
Asian	1633	32	56	35	1577	32	599	52	1018	26
Age (years)										
18–29	1194	23	11	7	1183	24	164	15	1019	26
30–39	1246	24	19	12	1227	24	175	16	1052	27
40–49	1075	21	23	14	1052	21	188	17	864	22
50–59	732	14	27	17	705	14	173	16	532	14
60+	925	18	82	51	843	17	381	35	462	12
Birth in US										
Yes	3820	74	113	70	3707	74	899	83	2808	72
No	1348	26	49	30	1299	26	181	17	1118	28
Ever Homeless										
Yes	315	6	6	4	309	6	21	2	288	7
No	4857	94	156	96	4701	94	1060	98	3641	93
Substance Use										
Yes	967	19	18	11	949	19	112	10	837	21
No	4205	81	144	89	4061	81	969	90	3092	79
Drug Resistance										

	All TB Patients (n=5172)		Not Offered HIV test (n=162)		Offered HIV test (n=5010)		Refused HIV test (n=1081)		Accepted HIV test (n=3929)	
	N	%	N	%	N	%	N	%	N	%
Any	613	12	14	9	599	12	129	12	470	12
None	4559	88	148	91	4411	88	952	88	3459	88
Extrapulmonary TB										
Any	1659	32	63	39	1596	32	313	29	1283	33
None	3475	68	99	61	3376	68	763	71	2613	67

* "Private" providers included private physician offices, private hospitals, and nursing homes. All other TB providers were categorized as non-private or "public" providers. "Public" providers included DOHMH public chest clinics, Health and Hospitals Corporation (HHC) facilities (publicly financed inpatient and outpatient facilities), and the Veteran's Administration (VA).

Table 2

TB Provider Type and Likelihood of HIV Test Offers, NYC 2001–2007

Offered HIV Testing	Adjusted OR (95% CI)†
Initial Provider Model (Model 1)*	
Private Initial Provider	
Male	1.01 (0.76, 1.33)
Female	0.78 (0.60, 1.02)
Provider Change Model (Model 2)*	
Any Change	
Male	1.09 (0.73, 1.61)
Female	1.12 (0.72, 1.75)
Only Private	
Male	0.46 (0.23, 0.90)
Female	0.37 (0.19, 0.70)
Directional Provider Change Model (Model 3)*	
Public to Private	
Male	0.14 (0.05, 0.40)
Female	0.41 (0.06, 2.86)
Private to Public	
Male	1.96 (1.04, 3.70)
Female	1.32 (0.66, 2.63)
Only Private	
Male	0.33 (0.15, 0.74)
Female	0.26 (0.12, 0.57)

*Referent exposure categories are: public initial provider (Model 1) and only public initial provider (Models 2 and 3); adjusted for patient age (continuous) and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian)

†OR: odds ratio; CI: confidence interval

Table 3

TB Provider Type and Patient Refusal of HIV Testing, NYC 2001–2007

Refused HIV Testing	PR[†] (95% CI)
Initial Provider	
Model (Model 1)[*]	
Private Initial Provider	
Male	0.97 (0.84, 1.11)
Female	1.38 (1.20, 1.58)
Provider Change Model (Model 2)[*]	
Any Change	
Male, SA[‡]	0.65 (0.43, 0.99)
Female, SA	0.43 (0.13, 1.34)
Male, No SA	0.90 (0.77, 1.06)
Female, No SA	1.28 (1.10, 1.49)
All Private	
Male, SA	0.93 (0.57, 1.53)
Female, SA	0.84 (0.41, 1.74)
Male, No SA	1.24 (0.99, 1.56)
Female, No SA	1.75 (1.40, 2.20)
Directional Provider Change Model (Model 3)[*]	
Public to Private[§]	
Male	1.20 (0.68, 2.12)
Female	1.27 (0.67, 2.40)
Private to Public	
Male, SA	0.65 (0.42, 1.01)
Female, SA	0.45 (0.14, 1.51)
Male, No SA	0.88 (0.74, 1.04)
Female, No SA	1.27 (1.09, 1.47)
Only Private	
Male, SA	0.95 (0.57, 1.58)
Female, SA	0.86 (0.42, 1.76)
Male, No SA	1.26 (0.99, 1.60)
Female, No SA	1.78 (1.43, 2.22)

[*] Referent exposure categories are: public initial provider (Model 1) and only public initial provider (Models 2 and 3); adjusted for age (continuous) and race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian)

[†] PR: prevalence ratio; CI: confidence interval

[‡] SA = substance abuse

[§] Due to cells with zero counts, the exposure stratum for patients changing from public to private providers could only be stratified by gender