Thorax Online First, published on December 8, 2009 as 10.1136/thx.2009.122754

HIV prevalence and testing practices among tuberculosis cases in London – A missed opportunity for HIV diagnosis?

Authors
Alison J Rodger[1,2], Alistair Story[3], Zoe Fox[1,4], Andrew Hayward[1] for the London Tuberculosis Nurses Network

Affiliations
1. Research Department of Infection & Population Health, University College London, London, UK
2. Royal Free Centre for HIV Medicine, Royal Free Hampstead NHS Trust, London, UK
3. Centre for Infections, Health Protection Agency, London, UK
4. Copenhagen HIV Programme, Copenhagen, Denmark

Abstract: 246 words

Text: 2984

Tables: 3

Figures: 2

Keywords: HIV infection, Tuberculosis, TB, HIV testing, Opportunistic Disease

Correspondence and requests for reprints should be addressed to

Dr Andrew Hayward
Research Department of Infection & Population Health
Royal Free Campus, UCL Medical School
University College London (UCL)
Rowland Hill Street
London, NW3 2PF
UK
Tel: +44 (0)20 7472 6754
Fax: 020 7794 1224
Email : a.hayward@pcps.ucl.ac.uk

Footnote page

Competing interest statement

The authors do not have a commercial or other association that might pose a conflict of interest.

Acknowledgements

The authors would like to thank all the TB nurses, allied professionals and other staff in London who contributed data.

Abstract

Aim: Universal testing for HIV in tuberculosis (TB) patients has been advocated for over a decade. Our aim was to describe HIV prevalence and testing practices among tuberculosis centres in London.

Methods: A cohort study was undertaken of all TB patients in Greater London in 2003 to 2004 (n=1941). Logistic regression was used to assess factors affecting being offered and accepting testing and having a positive HIV result.

Results: The overall known prevalence of HIV was 9.9% (193/1941). In those with a test result (including those diagnosed previously) it was 25.6%. Overall, 50.8% of patients ≥20 yrs without previous testing were offered HIV testing and of these 73% accepted. In multivariable analysis, factors associated with being HIV positive were aged 20-49 years, of black ethnicity and born overseas. Those with smear negative disease and with a poor understanding of English were significantly less likely to be offered HIV testing. Factors associated with refusal of an offered test were; being female or aged >49 years. HIV status was not associated with smear status, drug resistance or death, but was associated with CNS disease (OR 1.8, 95% CI: 1.0-3.0, p=0.003).

Conclusions: Nearly half of TB patients in London in 2003/04 were not offered HIV testing. In those offered testing, uptake was high. Patients in higher risk groups were more likely to be offered testing, but even within the highest-risk groups testing was not universally offered. This represents a missed opportunity for diagnosing HIV in TB patients in London.

Introduction

The natural histories of *Human Immunodeficiency Virus* (HIV) and *Mycobacterium tuberculosis* (TB) infection are interlinked, and the global HIV epidemic has had a dramatic impact on rates of TB infection.[1-3] In HIV-infected individuals, active TB is caused by reactivation of endogenous latent disease as well as re-infection with a new strain and is estimated to account for 9% of all new tuberculosis cases worldwide.[1] HIV is the strongest known risk factor for reactivation of latent TB to active disease with a risk of reactivation of approximately 10% per year.[4] In 2004, 15% of deaths that occurred as a result of TB were in HIV-infected individuals.[1]

Incidence of TB in London has doubled over the past decade and was estimated at 41.3/100,000 in 2003.[5] Much of the increase is thought to be fueled by migration from areas of high prevalence for HIV and TB and the burden of disease remains concentrated in urban areas and in high risk groups. Previous linkage of TB and HIV data bases estimated 5.7% of TB cases in E&W in 2003 were co-infected with HIV,[6] however the true prevalence of HIV/TB co-infection is unknown.

TB is an AIDS defining illness (ADI) and often occurs at higher levels of immune functioning in HIV positive patients than other ADIs.[3] Any TB patient not offered an HIV test is a missed opportunity for testing undiagnosed HIV-infected patients, but there is little non surveillance data on what proportion of TB patients are offered an HIV test in low prevalence countries and what factors are associated with being offered and accepting an HIV test.

The aim of our study was to measure prevalence of HIV in TB patients in London in 2003-2004, the proportion of TB patients offered a test and what factors were associated with accepting an HIV test if offered.

Methods

The methods of this study have been published previously.[7] A cohort study was undertaken in TB patients known to TB services on 1st July 2003 in Greater London (n=1995). Eligible patients were identified from the London TB register and local clinic records. Data was collected for 97% of eligible patients (1941/1995) from case notes and other clinical records by case managers for patients on TB treatment or who should have been on TB treatment at baseline and then 12 months later on 1st July 2004. Cases subsequently found not to have TB were excluded from the analysis. Only anonymised information left TB clinics and the study was approved by the London Metropolitan Research Ethics Committee.

Data collected at baseline and at 12 months included information on risk factors for TB, age, sex, ethnicity, clinical presentation of disease, resistance data (in terms of rifampicin or isoniazid resistance), compliance with therapy, date of arrival in UK, country of birth, level of spoken English, socioeconomic data in terms of housing status and whether DOT was required. In terms of HIV testing information was obtained from the case notes and TB records on whether an HIV test was offered, whether the offered HIV was accepted, the HIV test result if known and whether the patient had been previously diagnosed with HIV prior to the TB diagnosis and whether they were on antiretroviral therapy (ART) at time of TB diagnosis.

Denominator data on size of UK populations at risk was obtained from published sources.[7] In the case of HIV this was from the Survey of Prevalent HIV Infections Diagnosed (SOPHID) database which is a cross-sectional survey of all individuals with diagnosed HIV infection who attend for HIV-related care within the NHS in England, Wales, and Northern Ireland within a calendar year.

Poisson distribution was used to calculate TB prevalence and 95% confidence intervals per 100,000 population on 1st July 2003 for HIV positive populations and other risk groups. Logistic regression analyses were used to assess factors associated with being HIV-positive; factors associated with being offered an HIV test; and among those who were offered a test, factors associated with accepting the HIV test. Unadjusted and multivariable analyses were performed where all variables were included in the multivariable models. Statistical analyses were performed using STATA (StataCorp). 2001. Stata Statistical Software: Version 10.0, College Station, Texas, USA). All reported p-values are 2-sided, a p-value<0.05 was considered to be significant.

Results

A total of 1995 patients were identified giving an overall prevalence of TB of 27.1 per 100,000, however this varied considerably by risk group. The highest observed prevalence was in those HIV positive at 877.8 per 100,000 (95% CI: 756.8-1012.6) (*Figure 1)*. TB prevalence per 100,000 and 95% CI for other population groups are demonstrated for comparison and were published in the original study paper.[7]

From all 1941 eligible patients who we have data on, 193 (9.9%) were identified as HIV positive (88 had a positive test at the time of TB diagnosis and 87 had a previously positive test without a repeat test. There were 18 patients who tested positive at the time of TB diagnosis even though they had tested positive previously). This is likely to be an underestimate of the number of HIV positive individuals, as of those unaware of their HIV status at TB diagnosis (n=1836) only 48.2% (n=884) were offered HIV testing. HIV prevalence in those with a test result (including those with a previous diagnosis) was 25.6% (193/755).

In unadjusted analysis, TB/HIV co-infected patients were significantly younger than those who were not co-infected: 93% of co-infected patients were aged 20-49 yrs compared to 68% of those who were not co-infected (p<0.0001). Co-infected patients were more likely to be female (52% vs. 43%, [OR 1.43 , 95% CI: 1.06, 1.94, p=0.02]) and more likely to have been born overseas (90% vs. 77% HIV negative [OR 2.65, 95% CI: 2.60, 4.38, p<0.0001) compared to patients who were not co-infected, with 80% born in SSA (compared to 49% HIV negative, [OR 7.57, 95% CI: 4.8,11.8 , p<0.001]) reflecting the epidemiology of HIV and tuberculosis in their countries of birth. They were also a vulnerable population with 15% having active asylum applications compared to 7% of those who were HIV negative and more likely to be unemployed (OR 1.78, 95% CI: 1.29,2.39, p<0.001). In terms of disease presentation they were more likely to present with CNS disease (OR 1.75, CI: 1.02, 3.02, p=0.003), but were not more likely to have sputum smear positive pulmonary disease (20.7% vs 19.5%, p=0.69), drug resistant disease (9.7% vs 11.9%, p=0.403), require DOT (4.5% vs 7.3%, p=0.09), or have poorer outcomes including death (1.7% vs 0.93%, p=0.334) compared to those HIV negative.

After adjustments in a multivariable analysis, factors significantly associated with being HIV positive were age (OR: 2.29; 95% CI: 1.48, 3.54 for those aged 30-39 years compared to 20-29 years and OR: 2.30; 95% CI: 1.34, 3.95 for those aged 40-49 years compared to 20-29 years), of black African ethnicity and born overseas. *Table 1*

In spite of current guidance not all patients were offered an HIV test at the time of their TB diagnosis or within 12 months of follow up. In those unaware of their HIV status at TB diagnosis (n=1836), only 48.2% (n=884) were offered HIV testing. On multivariable analysis the following were significantly more likely to be offered HIV testing; those aged 20-49 years (OR: 0.49; 95% CI: 0.32, 0.74 for those aged 50-59 years compared to 20-29 years and OR: 0.35; 95% CI: 0.23, 0.53 for those aged ≥60 years compared to 20-29 years), of black ethnic group (OR 2.76. 95% CI: 2.08, 3.67 for blacks versus Indian/Sri Lankan/Bangladeshi or Pakistan, p<0.001), with smear positive PTB (OR 1.45, 95% CI: 1.08, 1.96, p=0.01) and with a good understanding of English (OR 2.03, 95% CI: 1.37, 3.02 for good English reading vs no English reading, p=0.005). *Table 2*

There was considerable variation between TB centres in terms of offering HIV testing with only one centre offering HIV tests to over 80% of TB patients. Over half of TB treatment centres offered HIV testing to less than half of their TB patients (*Figure 2*).

Among those who were ≥20 years who were unaware of their HIV status at time of TB diagnosis 72.9% (603/827) of patients accepted HIV testing if offered. The HIV prevalence among those previously unaware of their HIV status who accepted an HIV test was 14.3% (86/603). There was no difference in terms of ethnic group in acceptance of an HIV test if offered. The only factors associated with refusal of an offered test were; being female (OR 2.1, 95% CI: 1.4 to 3.0) or aged >49 years (OR: 2.3; 95% CI: 1.2, 4.5 for those aged 50-59 years compared to 20-29 years and OR: 3.8; 95% CI: 1.9, 7.7 for those aged ≥60 years compared to 20-29 years). *Table 3*

In terms of timing of HIV diagnosis to TB diagnosis, approximately half (99/193, 51.3%) of HIV/TB co-infected patients had been tested previously for HIV and were aware of their HIV status at the time of TB diagnosis. Forty two percent (81/193) were tested and diagnosed with HIV at the time of their TB diagnosis. The remaining 16.7% (13/193) patients had an unknown time of HIV diagnosis in relation to their TB diagnosis.

Discussion

The HIV epidemic is likely to have contributed heavily to the rise in TB cases observed in London over the past decade.[5] This study reports that prevalence of HIV co-infection in TB patients in London in 2003/04 was high at 10% overall, although this is likely to be an underestimate as over half of TB patients in our study were not offered HIV testing. In those with an HIV test result HIV prevalence was 25.6%. We found that HIV infection in those tested was generally concentrated in expected at-risk groups with the highest HIV prevalence found in those of black African ethnicity reflecting the epidemiology of TB and HIV in those countries.

Studies linking TB and HIV surveillance databases estimated the proportion of adults with HIV and TB co-infection in the UK as 3.3% in 1998[5] and 5.7% between 1999 and 2003.[6] Studies in other low prevalence countries have estimated ranges of HIV/TB co-infection of 4.4% in 1999-2001 in a study of surveillance data in the Netherlands,[8] 8% in surveillance data in the USA in 2004[9] and 3% in a Canadian study of all TB notifications in 1997/98.[10] The use of routine surveillance to report rates of HIV co-infection in TB patients is limited however by the inherent restrictions in all surveillance systems. In addition it is also likely that low HIV testing rates in TB patients resulted in an under-estimate of prevalence rates of HIV in TB patients. HIV/TB co-infection rates of 11.4% were found in a de-linked anonymous survey of south London TB patients in 1999[11] which are more reflective of our findings.

HIV infection is the strongest known risk factor for reactivation of latent TB and multiple guidelines in the UK and internationally recommend universal HIV testing for all TB patents.[12-14] Despite this we found that only half of patients diagnosed with TB in our study were offered HIV testing indicating a gap between national guidance in this area and practice. A small study in London two centres in 2002 identified low rates of testing with only just over half (131/236, 56%) of TB patients were offered HIV testing.[15] This observation has also been noted in other studies from low TB prevalence countries who identified sub-optimal HIV testing rates in TB patients. Over three quarters of TB patients in a Canadian study of all TB cases in Canada from 1997 to 1998 were not tested for HIV.[10]

We found in our study that patients in recognized higher risk groups for HIV, such as individuals of Black African origin, those born overseas and those aged between 20-49 years, were significantly more likely to be offered testing, but even within the highest-risk groups testing was not universally offered and testing varied considerably by TB centre from 0% of TB patients offered HIV testing in one, to 94% offered testing in another. This implies that testing practices are highly dependent on the local culture of the clinics and the individual practices of health care workers.

Encouragingly, in those offered HIV testing, uptake was high. This implies that barriers to HIV testing may rest with health care staff possibly because of lack of confidence in offering an HIV test or because of preconceived ideas about the likelihood of patents to accept the test. Stigma related to HIV infection is thought likely to reduce uptake of HIV testing in some communities particularly of African origin and that this stigma is the greatest deterrent to HIV testing even when offered at the time of a TB diagnosis.[16,17] However we found no association between ethnicity and acceptance of HIV testing if offered and that those of black African ethnicity, were no less likely to accept testing than those of white ethnicity with approximately three quarters in both groups accepting testing if offered.

One barrier that we identified to being offered an HIV test was a patient's level of spoken English. TB patients who had poor spoken English skills were significantly less likely to be offered an HIV test compared to those with good spoken English, yet this group are likely to be at high risk of HIV infection. Staff may have found the need to find interpreting services independent of the patient's family and friends too much of a barrier to offering testing for HIV in a busy clinical setting. TB centres should ensure staff have access to

adequate interpreting facilities to facilitate HIV testing in all patients. Further work is required to address attitudes and practice of health care staff towards universal HIV testing and to determine barriers behind failure to comply with guidance. There is also a need to identify barriers to acceptance of testing especially in women.

It is estimated that approximately 30% of HIV-infected individuals in the UK are unaware of their infection and so unable to benefit from access to antiretroviral therapy or prevent further transmission of HIV by protecting others from infection [18, 24-26]. Late diagnosis is also associated with increased mortality with 24% of deaths in HIV-positive adults attributable to late HIV diagnosis in a UK audit in 2005. [20] It has been shown in a number of studies that people presenting with severe HIV-related disease frequently have a history of repeated previous contacts with medical services, both in primary and secondary care, but were not tested for HIV.[20,21,22] Clinical judgment alone cannot be relied upon to ensure that individuals at risk of HIV infection are correctly identified.[19] As TB occur at relatively preserved levels of immune function it may be the presenting feature of HIV and TB patients in this study not offered HIV testing represent a missed opportunity. In addition a recent review of TB patients in one London centre noted that HIV co-infection in TB patients appeared to impact upon incidence of hepatotoxicity, suggesting that routine testing for HIV is also required to identify patients at risk of hepatic complications of TB treatment. [27]

In line with international initiatives the UK Chief Medical Officer recently called upon doctors in the UK to increase uptake of HIV testing.[28,12] One approach advocated is the use of universal opt out testing where HIV testing is considered to be part of routine medical care and offered routinely to all or selected patient populations. BHIVA Guidelines for HIV Testing (2008) recommend routine opt-out testing in certain patient groups who are identified by risk or clinical indicators including all patients with TB.[13]

Opt-out testing is currently used successfully in the UK in GUM clinics where uptake rates >85% have been demonstrated.[29] In the antenatal setting in the late 1990s uptake of HIV testing was highly variable and dependent upon the individual practice of healthcare worker.[13] In 2000, Health Authorities were asked to put arrangements in place for universal opt-out testing in antenatal care as an integral part of care. This led to a dramatic increase in testing rates to 93.2% in 2007 with a corresponding reduction in babies born with HIV.[31] Similar approaches through the commissioning process could be used to establish universal opt out HIV testing in TB clinics

This study has considerable strengths in that it is a large, highly complete and representative sample of TB patients in London. The information was obtained directly from case managers so is likely to be of high quality and avoids the limitations of matching based estimates and enables collection of detailed risk factor information.
Our study also has some limitations. Our data is 5 years old, but the recommendation to test TB patients for HIV were already in place at the time of the study.[30,14] It is unclear whether recent guidance from the CMO and the BHIVA to improve HIV testing has had an impact on improved testing rates for HIV in TB patients. It is also possible that patients were asked to undergo HIV testing by different clinical staff who did not record this information in the clinical records. We were also unable to determine possible reasons for

staff not offering the test and for patient's refusal if offered and further qualitative work is required in this area.

In summary, our study reveals TB centres in London failed to offer HIV testing to half of patients diagnosed with TB indicating multiple missed opportunities for testing those with potentially undiagnosed HIV. Those who were offered HIV testing had high uptake rates. To reduce avoidable HIV related morbidity and mortality, universal opt out HIV testing in TB patients should be a key quality indicator for TB services and greater interaction between TB and HIV services encouraged. The manner of offering HIV testing to TB patients, by whom and when in the diagnostic and treatment process to achieve best uptake of HIV testing also needs explored.

References

1. **Nunn P**, Reid A, De Cock KM. Tuberculosis and HIV infection: the global setting. J Infect Dis 2007;**196** Suppl 1:S5-14.
2. **Selwyn PA**, Hartel D, Lewis VA, et al. A prospective study of the risk of tuberculosis among intravenous drug users with human immunodeficiency virus infection. *N Engl J Med* 1989;**320**:545–50.
3. **Antonucci G**, Girardi F, Raviglione MC, et al. Risk factors for tuberculosis in HIV-infected persons: a prospective cohort study. *JAMA* 1995;**274**:143–8.
4. **Lienhardt C**, Rodrigues LC. Estimation of the impact of the human immunodeficiency virus infection on tuberculosis: tuberculosis risks re-visited? *Int J Tuberc Lung Dis* 1997;**1(3)**:196-204.
5. **Rose AM**, Sinka K, Watson JM, et al. An estimate of the contribution of HIV infection to the recent rise in tuberculosis in England and Wales. *Thorax* 2002;**57(5)**:442-5.
6. **Ahmed AB**, Abubakar I, Delpech V, et al. The growing impact of HIV infection on the epidemiology of tuberculosis in England and Wales: 1999 2003.*Thorax* 2007;**62(8)**:672-6.
7. **Story A**, Murad S, Roberts W, et al. Tuberculosis in London: the importance of homelessness, problem drug use and prison. *Thorax* 2007;**62**:667-671.
8. **Haar CH**, Cobelens FG, Kalisvaart NA, et al. HIV prevalence among TB patients in the Netherlands, 1993-2001: trends and risk factors. *Inj J Tuberc Lung Dis* 2006;**10**:768-774.
9. **Albalak R**, O'Brien RJ, Kammerer JS, et al. Trends in TB/HIV virus co-morbidity, US 1993-2004. *Arch internal Medicine* 2007;**167(22)**:2443-2452.
10. **Harris T**, Panaro L, Phypers M, et al. HIV testing among Canadian tuberculosis cases from 1997 to 1998. *Can J Infect Disease Med Microbial* 2006;**17(3)**: 165-168.
11. **Bowen EF**, Rice PS, Cooke NT, et al. HIV seroprevalence by anonymous testing in patients with Mycobacterium tuberculosis and in tuberculosis contacts. *Lancet* 2000;**356**:1488–99.
12. **Branson BM**, Handsfield HH, Lampe MA, et al. Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health-Care Settings. *MMWR* 2006;**55 (14)**:1-17.
13. **British HIV Association**. *UK National Guidelines for HIV testing*. London, 2008. http://www.bhiva.org/files/file1031097.pdf
14. **Blumberg HM**, Burman WJ, Chaisson RE, et al. American Thoracic Society, Centers for Disease Control and Prevention and the Infectious Diseases Society. American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America: Treatment of tuberculosis. *Am J Respir Crit Care Med* 2003;**167(4)**:603-62
15. **Dart S**, Alder D, Mamdani M, et al. HIV testing in TB clinics: a problem in practice? *Thorax* 2006;**61(3)**:271-2.
16. **Erwin J**, Morgan M, Britten N, et al. Pathways to HIV testing and care by black African and white patients in London. *Sex Transm Infect* 2002;**78(1)**:37-9.
17. **Nnoaham KE**, Pool R, Bothamley G, et al. Perceptions and experiences of tuberculosis among African patients attending a tuberculosis clinic in London. *Int J Tuberc Lung Dis* 2006;**10(9)**:1013-7.

18. **Marks G**, Crepaz N, Janssen RS. Estimating sexual transmission of HIV from persons aware and unaware that they are infected with the virus in the USA. *AIDS*. 2006;**20(10)**:1447-50.
19. **Hamill M**, Burgoine K, Farrell F, et al. Time to move towards opt-out testing for HIV in the UK. *BMJ* 2007; 30;**334(7608)**:1352-4
20. **British HIV Association (BHIVA)**. Clinical Audit Report 2005–6. *HIV-related deaths in the HAART era*. 2006. http://www.bhiva.org/files/file1030338.pdf
21. **Liddicoat RV**, Horton NJ, Urban R, et al. Assessing missed opportunities for HIV testing in medical settings. *J Gen Intern Med* 2004;**19**:349--56.
22. **Centers for Disease Control and Prevention (CDC).** Missed opportunities for earlier diagnosis of HIV infection - South Carolina, 1997-2005. *MMWR* 2006;**55**:1269-1272.
23. **Klein D**, Hurley LB, Merrill D,et al. Review of medical encounters in the 5 years before a diagnosis of HIV-1 infection: implications for early detection. *JAIDS* 2003;**32**:143--52.
24. **Girardi E**, Sabin CA, Monforte AD. Late diagnosis of HIV infection: epidemiological features, consequences and strategies to encourage earlier testing. *JAIDS* 2007;**46** Suppl 1:S3-8.
25. **Marks G**, Crepaz N, Senterfitt JW, et al. Meta-analysis of high-risk sexual behavior in persons aware and unaware they are infected with HIV in the United States: implications for HIV prevention programs. *JAIDS* 2005;**39(4)**:446-53
26. **Castilla J**, Del Romero J, Hernando V, et al. Effectiveness of highly active antiretroviral therapy in reducing heterosexual transmission of HIV. *JAIDS* 2005;**40(1)**:96-101
27. **Walker N**, Kliner M, Turner D, Bhagani S, Cropley I, Hopkins S, Lipman S. Hepatotoxicity and anti-tuberculosis therapy: time to revise UK guidelines? *Thorax* 2009 *In press*
28. **Sir Liam Donaldson**, CMO & Christine Beasley, CNO. *Improving the detection and diagnosis of HIV in non-HIV specialties including primary care*. Department of Health, London. 2007
29. **Health Protection Agency.** The UK collaborative group for HIV and STI surveillance. *Testing Times. HIV and other sexually transmitted infections in the United Kingdom.* London: Health Protection Agency Centre for Infections, 2007. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1203084355941
30. **Iskander R**, Wass T, Jones J, *et al. Communicable Disease Surveillance Centre Annual Report 2001*. London: London Regional Office, 2001
31. **Health Protection Agency & UK National Screening Committee.** Infectious diseases in pregnancy screening programme: report on 2005-2007 data. London: Health Protection Agency, March 2009. Infectious Diseases in Pregnancy Screening Programme: 2007/08 Annual Report and 2005-2007 Surveillance Data (PDF, 285 KB)

Table 1: Characteristics of all 1941 TB patients in London, according to HIV status

	All (N=1941)	HIV positive (N=193)	Not HIV positive (N=1748)*	Unadjusted analysis		Multivariable analysis	
				Odds ratio (95% CI) for having a positive HIV test	P-value**	Odds ratio (95% CI) for having a positive HIV test	P-value**
Age group: (N=1932)							
<20 years	208	2 (1.0%)	206 (11.9%)	0.10 (0.02, 0.42)	<0.0001	0.10 (0.02, 0.42)	<0.0001
20-29 years	602	53 (27.5%)	549 (31.6%)	Ref		Ref	
30-39 years	512	90 (46.6%)	422 (24.3%)	2.21 (1.54, 3.17)		2.29 (1.48, 3.54)	
40-49 years	234	36 (18.7%)	198 (11.4%)	1.88 (1.20, 2.96)		2.30 (1.34, 3.95)	
50-59 years	173	9 (4.7%)	164 (9.4%)	0.57 (0.27, 1.17)		1.21 (0.51, 2.86)	
≥60 years	203	3 (1.6%)	200 (11.5%)	0.16 (0.05, 0.50)		0.37 (0.11, 1.27)	
Gender: (N=1911)							
Male	1064	90 (47.6%)	974 (56.6%)	Ref	0.02	Ref	0.07
Female	847	99 (52.4%)	748 (43.4%)	1.43 (1.06, 1.94)		1.41 (0.97, 2.03)	
Ethnic group: (N=1941)							
White	303	24 (12.4%)	279 (16.0%)	17.78 (5.31, 59.53)	<0.0001	32.14 (7.04, 146.74)	<0.0001
Black African	748	157 (81.4%)	591 (33.8%)	54.90 (17.42, 173.02)		63.35 (15.44, 259.96)	
Chinese/Far East	83	2 (1.0%)	81 (4.6%)	5.10 (0.84, 31.00)		6.03 (0.82, 44.15)	
ISBP* **	623	3 (1.6%)	620 (35.5%)	Ref		Ref	
Other/Unknown	184	7 (3.6%)	177 (10.1%)	8.17 (2.09, 31.93)		13.08 (2.54, 67.51)	
Time since arrival in UK: (N=1720)							
UK Born	376	18 (10.2%)	358 (23.2%)	Ref	<0.0001	Ref	0.004
Non-UK Born	1344	158 (89.8%)	1186 (76.8%)	2.65 (2.60, 4.38)		2.90 (1.41, 5.94)	
Level of English reading: (N=1779)							
None	285	9 (4.9%)	276 (17.3%)	Ref	<0.0001	Ref	<0.0001
Basic	326	29 (15.8%)	297 (18.6%)	2.99 (1.39, 6.44)		4.08 (1.47, 11.32)	
Good	1168	146 (79.4%)	1022 (64.1%)	4.38 (2.21, 8.70)		8.87 (3.15, 25.01)	
Interpreting required (N=1941)							
No	1717	180 (93.3%)	1537 (87.9%)	Ref	0.03	Ref	0.25
Yes	224	13 (6.7%)	211 (12.1%)	0.53 (0.29, 0.94)		1.72 (0.67, 4.39)	
TB Classification							
PTB smear positive (N=1941)	381	40 (20.7%)	341 (19.5%)	1.08 (0.75, 1.56)	0.69	0.60 (0.37, 0.96)	0.03
Extrapulmonary TB (N=1941)	828	70 (36.3%)	758 (43.4%)	0.74 (0.55, 1.01)	0.06	0.71 (0.47, 1.08)	0.11
Previous TB (N=1941)	202	23 (11.9%)	179 (10.2%)	1.18 (0.75, 1.88)	0.47	1.06 (0.60, 1.87)	0.84

* The non-HIV-positive group contains patients who tested negative and those in whom the HIV status is unknown

** P-values compare patients who were HIV-positive against those who were not HIV-positive using logistic regression analysis.

*** ISBP: Contains patients from Inida, Sri Lanka, Bangladesh or Pakistan

Note: A test for an interaction between gender and ethnicity provides a p-value of 0.004 indicating a significant interaction.
Among females there was an OR of 5.45 (95% CI: 0.50, 59.85) for whites vs ISBP; OR: 69.21 (95% CI: 9.26, 517.43) for blacks vs ISBP; and OR: 5.05 (0.50, 50.79) for others vs ISBP.Among males there was an OR of 69.56 (95% CI: 8.53, 567.23) for whites vs ISBP; OR: 61.18 (95% CI: 8.31, 450.14) for blacks vs ISBP; and OR: 4.27 (1.67, 10.92) for others vs ISBP.

Table 2: Factors associated with being offered an HIV test among those who had not tested positive previously (all 1836 patients who did not know they were HIV positive prior to the TB diagnosis)

			Unadjusted analysis		Multivariable analysis	
	No HIV test offered N=952	Test offered N=884	Odds ratio (95% CI) for being offered a test	P-value	Odds ratio (95% CI) for being offered a test	P-value
Age group: (N=1827)						
<20 years	151 (16.0%)	57 (6.5%)	0.29 (0.21, 0.41)	<0.0001	0.25 (0.17, 0.38)	<0.0001
20-29 years	250 (26.5%)	322 (36.5%)	Ref		Ref	
30-39 years	177 (18.7%)	290 (32.9%)	1.27 (0.99, 1.63)		1.27 (0.94, 1.71)	
40-49 years	113 (12.0%)	97 (11.0%)	0.67 (0.49, 0.92)		0.72 (0.50, 1.05)	
50-59 years	106 (11.2%)	62 (7.0%)	0.45 (0.32, 0.65)		0.49 (0.32, 0.74)	
≥60 years	148 (15.7%)	54 (6.1%)	0.28 (0.20, 0.40)		0.35 (0.23, 0.53)	
Gender: (N=1808)						
Male	509 (54.3%)	503 (57.8%)	Ref	0.13	Ref	0.36
Female	429 (45.7%)	367 (42.2%)	0.87 (0.72, 1.04)		0.90 (0.71, 1.13)	
Ethnic group: (N=1836)						
White	165 (17.3%)	121 (13.7%)	1.28 (0.96, 1.71)	<0.0001	1.34 (0.90, 1.98)	<0.0001
Black African	250 (26.3%)	418 (47.3%)	2.92 (2.33, 3.66)		2.76 (2.08, 3.67)	
Chinese/Far East	46 (4.8%)	36 (4.1%)	1.37 (0.86, 2.18)		1.15 (0.69, 1.94)	
ISBP	395 (41.5%)	226 (25.6%)	Ref		Ref	
Other/Unknown	96 (10.1%)	83 (9.4%)	1.51 (1.08, 2.11)		1.61 (1.06, 2.43)	
Time since arrival in UK: (N=1629)						
UK Born	213 (25.7%)	152 (19.0%)	Ref	0.001	Ref	0.04
Non-UK Born	615 (74.3%)	649 (81.0%)	1.48 (1.17, 1.87)		1.43 (1.01, 2.02)	
Level of English reading: (N=1681)						
None	177 (21.0%)	105 (12.5%)	Ref	<0.0001	Ref	0.005
Basic	157 (18.7%)	154 (18.4%)	1.65 (1.19, 2.30)		1.33 (0.88, 2.02)	
Good	508 (60.3%)	580 (69.1%)	1.92 (1.47, 2.52)		2.03 (1.37, 3.02)	
Interpreting required (N=1836)						
No	823 (86.5%)	794 (89.8%)	Ref	0.03	Ref	0.96
Yes	129 (13.6%)	90 (10.2%)	0.72 (0.54, 0.96)		0.99 (0.64, 1.53)	
TB Classification						
PTB smear positive (N=1836)	143 (15.0%)	221 (25.0%)	1.89 (1.49, 2.38)	<0.0001	1.45 (1.08, 1.96)	0.01
Extrapulmonary TB (N=1836)	424 (44.5%)	358 (40.5%)	0.85 (0.70, 1.02)	0.08	1.02 (0.79, 1.32)	0.86
Previous TB (N=1836)	90 (9.5%)	95 (10.8%)	1.15 (0.85, 1.56)	0.36	1.11 (0.76, 1.60)	0.60
Risk groups (N=1836)**						
No risk factors	795 (83.5%)	688 (77.8%)	Ref	0.002	Ref	0.31
≥ one risk factor	157 (16.5%)	196 (22.2%)	1.44 (1.14, 1.82)		1.17 (0.86, 1.58)	

A test for an interaction between gender and ethnicity provides a p-value of 0.38 indicating no interaction

Table 3: Factors associated with refusing an HIV test (among the 827 patients who were >20 years, without a previous HIV diagnosis and were offered an HIV test)

			Unadjusted analysis		Multivariable analysis	
	Accepted an HIV test (N=603)	Refused an HIV test (N=224)	Odds ratio (95% CI) for refusing a test	P-value	Odds ratio (95% CI) for refusing a test	P-value
Age group: (N=825)						
20-29 years	241 (40.0%)	81 (36.5%)	Ref	<0.0001	Ref	0.0003
30-39 years	226 (37.5%)	64 (28.8%)	0.84 (0.58, 1.23)		0.90 (0.58, 1.40)	
40-49 years	72 (11.9%)	25 (11.3%)	1.03 (0.61, 1.74)		1.12 (0.62, 2.03)	
50-59 years	39 (6.5%)	23 (10.4%)	1.75 (0.99, 3.12)		2.33 (1.19, 4.54)	
≥60 years	25 (4.2%)	29 (13.1%)	3.45 (1.91, 6.23)		3.80 (1.88, 7.70)	
Gender: (N=813)						
Male	364 (61.5%)	107 (48.4%)	Ref	0.0008	Ref	<0.0001
Female	228 (38.5%)	114 (51.6%)	1.70 (1.25, 2.32)		2.06 (1.41, 3.01)	
Ethnic group: (N=827)						
White	85 (14.1%)	34 (15.2%)	0.77 (0.48, 1.26)	0.02	0.65 (0.33, 1.28)	0.29
Black African	297 (49.3%)	81 (36.2%)	0.53 (0.36, 0.77)		0.66 (0.41, 1.05)	
Chinese/Far East	24 (4.0%)	11 (4.9%)	0.89 (0.41, 1.91)		1.19 (0.51, 2.77)	
ISBP	143 (23.7%)	74 (33.0%)	Ref		Ref	
Other/Unknown	54 (9.0%)	24 (10.7%)	0.86 (0.98, 1.50)		0.85 (0.42, 1.71)	
Time since arrival in UK: (N=747)						0.15
UK Born	96 (17.1%)	44 (23.7%)	Ref	0.05	Ref	
Non-UK Born	465 (82.9%)	142 (76.3%)	0.67 (0.45, 1.00)		0.64 (0.34, 1.18)	
Level of English reading (N=786):						
None	63 (11.0%)	30 (14.1%)	Ref	0.17	Ref	0.82
Basic	112 (19.6%)	31 (14.6%)	0.58 (0.32, 1.05)		0.79 (0.39, 1.63)	
Good	398 (69.5%)	152 (71.4%)	0.80 (0.50, 1.29)		0.85 (0.43, 1.66)	
Interpreting required (N=827):						
No	546 (90.6%)	201 (89.7%)	Ref	0.73	Ref	0.53
Yes	57 (9.5%)	23 (10.3%)	1.10 (0.66, 1.83)		1.27 (0.60, 2.66)	
TB Classification:						
PTB smear positive (N=827):	153 (25.4%)	53 (23.7%)	0.91 (0.64, 1.30)	0.61	1.02 (0.65, 1.62)	0.92
Extrapulmonary TB (N=827):	248 (41.1%)	90 (40.2%)	0.96 (0.70, 1.31)	0.81	0.94 (0.62, 1.43)	0.77
Previous TB (N=827):	66 (11.0%)	23 (10.3%)	0.93 (0.56, 1.54)	0.78	1.01 (0.57, 1.78)	0.98
Risk groups (N=827)**						
No risk factors	461 (76.5%)	178 (79.5%)	Ref	0.36	Ref	0.74
≥ one risk factor	142 (23.6%)	46 (20.5%)	0.84 (0.58, 1.22)		1.09 (0.66, 1.79)	

A test for an interaction between gender and ethnicity provides a p-value of 0.83 indicating no interaction

Figure 1: Prevalence of TB in different groups in London (95% confidence intervals)

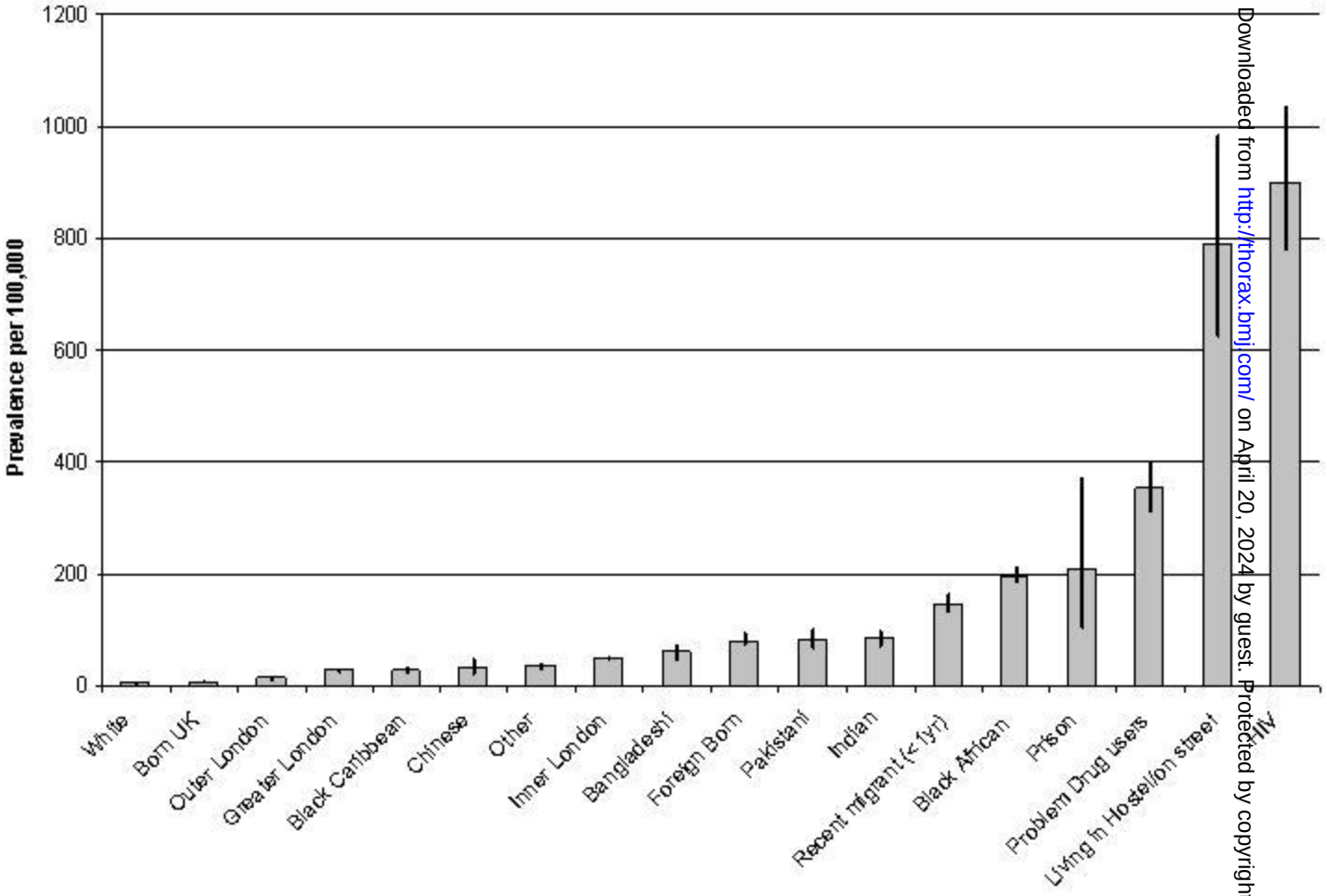

Figure 2: Percentage (%) of TB patients offered HIV testing by TB centre in London