HHS Public Access

Author manuscript

Int J Tuberc Lung Dis. Author manuscript; available in PMC 2019 December 01.

Published in final edited form as:

Int J Tuberc Lung Dis. 2018 December 01; 22(12): 1443–1449. doi:10.5588/ijtld.18.0108.

HIV testing uptake among the household contacts of multidrug-resistant tuberculosis index cases in eight countries

V. S. Opollo[*], **X. Wu**[†], **M. D. Hughes**[†], **S. Swindells**[‡], **A. Gupta**[§], **A. Hesseling**[¶], **G. Churchyard**[#], **S. Kim**[†,**], **R. Lando**[*], **R. Dawson**[††], **V. Mave**[‡‡], **A. Mendoza**[§§], **P. Gonzales**[¶¶], **N. Kumarasamy**[##], **F. von Groote-Bidlingmaier**[***], **F. Conradie**[†††], **J. Shenje**[‡‡‡], **S. N. Fontain**[§§§], **A. Garcia-Prats**[¶], **A. Asmelash**[¶¶¶], **S. Nedsuwan**[###], **L. Mohapi**[****], **R. Mngqibisa**[††††], **A. C. Garcia Ferreira**[§§§§], **E. Okeyo**[*], **L. Naini**[¶¶¶¶], **L. Jones**[**], **B. Smith**[####], and **N. S. Shah**[*****] **A5300/I2003 Study Team**

[*]Kenya Medical Research Institute, Kisumu, Kenya [†]Harvard T. H. Chan School of Public Health, Boston, Massachusetts [‡]University of Nebraska Medical Center, Omaha, Nebraska [§]Johns Hopkins Medical Institutions, Baltimore, Maryland, USA [¶]Desmond Tutu TB Centre, Stellenbosch University, Tygerberg [#]The Aurum Institute, Johannesburg, South Africa [**]Frontier Science & Technology Research Foundation, Amherst, New York, USA [††]University of Cape Town Lung Institute, Mowbray, South Africa [‡‡]Byramjee Jeejeebhoy Government Medical College Clinical Trials Unit, Pune, India [§§]Asociacion Civil Impacta Salud y Educacion, Barranco Clinical Research Site, Lima, [¶¶]Asociación Civil Impacta Salud y Educación, San Miguel Clinical Research Site (CRS), Lima, Peru [##]Chennai Antiviral Research and Treatment CRS, Chennai, India [***]TASK Applied Science CRS, Bellville [†††]University of the Witwatersrand, Helen Joseph Hospital, Johannesburg [‡‡‡]South African Tuberculosis Vaccine Initiative, Cape Town, South Africa [§§§]GHESKIO (Groupe Haïtien d'Etude du Sarcome de Kaposi Centers Institute of Infectious Diseases and Reproductive Health, Port-au-Prince, Haitiet des Infections Opportunistes) [¶¶¶]Gaborone CRS, Gaborone, Botswana [###]Prevention and Treatment of HIV infection, Chiangrai Prachanukroh Hospital, Chiangrai, Thailand [****]Soweto CRS, Johannesburg [††††]Durban International CRS, Durban, South Africa [§§§§]Instituto Nacional de Infectologia/Fundação Oswaldo Cruz, Brazil [¶¶¶¶]Social & Scientific Systems, Inc, Silver Springs, Maryland [####]National Institutes of Health, Bethesda, Maryland [*****]Centers for Disease Control and Prevention, Atlanta, Georgia, USA

Abstract

SETTING: The household contacts (HHCs) of multidrug-resistant tuberculosis (MDR-TB) index cases are at high risk of tuberculous infection and disease progression, particularly if infected with the human immunodeficiency virus (HIV). HIV testing is important for risk assessment and clinical management.

Correspondence to: Valarie Opollo, Kenya Medical Research Institute, PO Box 1578-40100, Kisumu, Kenya. vopollo@kemricdc.org. SS, AG, AH, GC and NSS were study co-chairs

Conflicts of interest: SS reports research grants to her institution from ViiV Healthcare, Brentford, UK and Merck, Kenilworth, NJ, USA. AH reports a research grant to her institution from Otsuka Pharmaceuticals, Tokyo, Japan. No conflict of interest is reported for any other author.

METHODS: This was a cross-sectional, multi-country study of adult MDR-TB index cases and HHCs. All adult and child HHCs were offered HIV testing if never tested or if HIV-negative > 1 year previously when last tested. We measured HIV testing uptake and used logistic regression to evaluate predictors.

RESULTS—A total of 1007 HHCs of 284 index cases were enrolled in eight countries. HIV status was known at enrolment for 226 (22%) HHCs; 39 (4%) were HIV-positive. HIV testing was offered to 769 (98%) of the 781 remaining HHCs; 544 (71%) agreed to testing. Of 535 who were actually tested, 26 (5%) were HIV-infected. HIV testing uptake varied by site (median 86%, range 0–100%; $P<0.0001$), and was lower in children aged ,18 years than in adults (59% vs. 78%; adjusted for site P < 0.0001).

CONCLUSIONS: HIV testing of HHCs of MDR-TB index cases is feasible and high-yield, with 5% testing positive. Reasons for low test uptake among children and at specific sites—including sites with high HIV prevalence—require further study to ensure all persons at risk for HIV are aware of their status.

RÉSUMÉ

Les contacts domiciliaires (HHC) des cas index de tuberculose multirésistante (TB-MDR) ont un risque élevé d'infection tuberculeuse et de progression vers la maladie, particulièrement en cas d'infection au virus de l'immunodéficience humaine (VIH). Le test VIH est important pour l'évaluation du risque et de la prise en charge clinique.

Ceci est une étude transversale, multi-pays d'adultes cas index de TB-MDR et de HHC. Tous les HHC adultes et enfants ont été invités à faire un test VIH s'ils n'avaient jamais été testés ou si leur dernier test VIH négatif remontait à plus d'un an. Nous avons mesuré la couverture du test VIH et utilisé la régression logistique afin d'évaluer les facteurs de prédiction.

Ont été enrôlés 1007 HHC de 284 cas index dans huit pays. Le statut VIH était connu lors de I'enrôlement pour 226 (22%) HHC, dont 39 (4%) ont été VIH positifs. Le test VIH a été offert à 769 (98%) des 781 HHC restants dont 544 (71%) ont accepté le test. Sur les 535 qui ont réellement été testés, 26 (5%) ont été VIH positifs. La couverture du test VIH a varié en fonction du site (médiane 86%, fourchette 0–100% ; $P < 0{,}0001$) et a été plus faible chez les enfants d'âge <18 ans (59%) que chez les adultes (78%) après ajustement sur le site ($P<$, 0,0001).

Le test VIH des HHC des cas index de TB-MDR est faisable et a un rendement élevé, avec 5% de tests positifs. Les raisons d'une couverture faible du test parmi les enfants et dans des sites spécifiques—incluant les sites ayant une prévalence élevée du VIH—justifient d'autres études afin de s'assurer que toutes les personnes à risque de VIH ont connaissance de leur statut.

RESUMEN

Los contactos domiciliarios (HHC) de casos índices con tuberculosis multiresistente (TB-MDR) tienen un alto riesgo de infección por TB y progresión de la enfermedad, particularmente si están infectados por el virus de inmunodeficiencia humana (VIH). La prueba del VIH es importante para la evaluación del riesgo y el manejo clínico.

Este es un estudio transversal y multinacional de casos índices adultos con TB-MDR y HHC. A todos los HHC, adultos y niños, se les ofreció una prueba de VIH, si nunca se había realizado la

prueba o si la última vez que se realizó la prueba de VIH fue hace más de 1 año. Medimos la aceptación de pruebas de VIH y utilizamos la regresión logística para evaluar predictores.

Fueron enrolados 1007 HHC de 284 casos indices en ocho países. El estatus de VIH era conocido en el enrolamiento para 226 (22%) HHC; 39 (4%) eran VIH-positivos. Se ofrecieron pruebas de VIH a 769 (98%) de los 781 HHC restantes; 544 (71%) estuvieron de acuerdo con las pruebas. De 535 a quienes se realizó la prueba de VIH, 26 (5%) estaban infectados por el VIH. La aceptación de pruebas de VIH varió según la sede (mediana 86%, rango 0–100%; $P < 0{,}0001$) y fue menor en niños de edad <18 años (59%) que en adultos (78%, ajustado por sede $P < 0{,}0001$).

Realizar pruebas de VIH de HHC de casos indices de TB-MDR es factible y de alto rendimiento, con un 5% de pruebas positivas. Las razones para la baja tasa de pruebas entre los niños y en sedes específicas—incluidas las sedes con alta prevalencia del VIH—requieren más estudios para garantizar que todas las personas en riesgo de contraer el VIH conozcan su estado.

Keywords

willingness to test; HCT testing; barriers

TUBERCULOSIS (TB) IS THE LEADING cause of morbidity and mortality among people living with the human immunodeficiency virus (PLHIV).[1] Multidrug-resistant TB (MDR-TB; defined as TB resistant to at least isoniazid and rifampicin) is a growing public health threat, with particularly high mortality among PLHIV.[2] As TB transmission is facilitated by close or prolonged contact, the household contacts (HHCs) of MDR-TB index cases are at high risk of tuberculous infection and disease.[3] Screening HHCs of MDR-TB index cases is recommended by the World Health Organization (WHO). In addition, guidelines recommend routine HIV testing for persons with TB, including their partners and family members.[1] However, limited data exist on the uptake of HIV testing among HHCs of MDR-TB index cases from diverse global settings.

HIV testing is the cornerstone of the Joint United Nations Programme on HIVand AIDS (UNAIDS) 90–90-90 strategy and a critical entry point for early HIV treatment, care and prevention. Although HIV testing capacity has increased, uptake remains as low as 3.2– 21% in many sub-Saharan African countries.[4] There is a notable paucity of data on HIV testing approaches that extend beyond the health care facility for children and adolescents.[5]

Several barriers have been reported to contribute to poor HIV testing uptake, including fear of stigma and discrimination,[6] lack of awareness of the importance of testing, poor access to testing sites,[7] education level,[8] age,[9] sex,[10] marital status,[11] confidence in health personnel[12] and low perception of risk.[13] Low HIV testing rates have traditionally been linked to voluntary counselling and testing (VCT), which is a client-initiated approach.[14] Current HIV testing strategies are either facility-based or community based, including testing in homes.[15] Several countries use the ‘opt-out’ approach or ‘provider-initiated testing and counselling (PITC)’ whereby a person is notified he/she will be tested but may decline or defer testing.[16]

Although the strong association between HIV infection and TB has been known since the 1980s, in 2015, only 55% of TB patients worldwide and 81% in sub-Saharan Africa had

documented HIV test results.[17] The low uptake of HIV testing among TB patients could be attributed to a low self-perceived risk from HIV, lack of surety by service providers to offer HIV testing to TB patients, or poor referral and documentation processes. Furthermore, data on HIV testing of the HHCs of TB patients or MDR-TB patients from diverse settings are limited.

As part of a multi-country study conducted in preparation for a trial of preventive therapy for the HHCs of MDR-TB index cases, we sought to evaluate 1) the proportion of children and adult HHCs who accepted HIV testing, and 2) participant- and site-related factors associated with uptake of HIV testing.

METHODS

Study design and setting

We conducted a cross-sectional study at sites in low-and middle-income countries that will be participating in the PHOENIx (Protecting Household On Exposure to Newly Diagnosed Index Multidrug-Resistant Tuberculosis Patients) trial. PHOENIx is a randomised controlled trial that will enrol high-risk adult (aged ⩾18 years) and child (aged < ,18 years) HHCs of adult MDR-TB index cases to test the safety and efficacy of a novel drug, delamanid, for the prevention of TB.[18] This feasibility study was conducted to inform logistics for the trial, including HIV test uptake and barriers that could be addressed to improve uptake. Sixteen sites from eight countries participated in this study: South Africa (7 sites), Kenya, Botswana, India (2 sites), Peru (2 sites), Brazil, Haiti and Thailand.

Study population

We enrolled a convenience sample of adult MDR-TB index cases and their HHCs from October 2015 to April 2016. Index cases with isolates that were confirmed as MDR-TB, or with isolates that were rifampicin (RMP) resistant on Xpertw MTB/RIF (Cepheid, Sunnyvale, CA, USA) with pending results for isoniazid resistance, were eligible for enrolment. Index cases were asked to provide informed consent to access the household. The number of index cases and households enrolled varied by site, in part due to a pre-specified constrained period of enrolment imposed when the study met its overall accrual goal. HHCs were enrolled at their homes, mobile clinics, clinical research sites or other convenient settings. A HHC was defined as any person who lived or had lived in the same dwelling unit or plot of land and shared the same housekeeping arrangements as the index case, and who reported exposure within 6 months before the index case started MDR-TB treatment. At each household, we enumerated persons who met the definition of a HHC to determine the number potentially eligible.

Data collection

HIV status of index cases was obtained by self-report. HHCs were asked about their current HIV status, willingness to be tested and, if unwilling, reasons for declining testing. HIV testing was offered to HHCs with unknown HIV status or who had tested HIV- negative more than 1 year before study entry. Children aged < 2 years were not required to be offered HIV testing if the mother had tested HIV- negative in the previous 12 months, unless there

was clinical suspicion of HIV infection. Participants who agreed to HIV testing had samples collected and tested using the site's approved HIV testing algorithm. HIV test results were given to participants; those who were HIV-positive were referred for care to routine services.

A structured questionnaire was administered to site study coordinators to assess site variations in HIV testing approaches as part of routine medical care and for the PHOENIx study. Questions sought to identify potential site-level or participant-level barriers to HIV testing that were not captured in participant interviews. Site study coordinators' responses were grouped into emerging themes.

Statistical analysis

We used logistic regression models to evaluate variations in the proportion of HHCs who agreed to HIV testing among sites and to evaluate the association of this proportion with other variables adjusted for site. These models were fitted using generalised estimating equation (GEE) methods with a robust variance estimator using a working exchangeable correlation structure to take account of the clustering of contacts within households. To enable models to be fitted, for sites with 100% of HCCs agreeing to being tested, one HCC was chosen at random to have declined testing. Conversely, for sites with 0% agreeing to testing, one HCC was chosen at random to have agreed to testing. Statistical analysis was carried out using SAS 9.4 (Statistical Analysis System, Cary, NC, USA).

Ethical considerations

The study protocol was approved by the institutional review board (IRB)/ethics committee and local health departments, as appropriate, at each site. Written informed consent was provided by all study participants. For adolescents and children, parental informed consent and child assent was obtained, as appropriate. As the sites in Brazil and Kenya did not have IRB approval to enrol children, children were not enrolled at these sites.

RESULTS

Among the 305 MDR-TB index cases enrolled, 1324 HHCs were enumerated. Overall, 308 HHCs were not included in the study because 39 (3%) did not meet the 6-month window of MDR-TB exposure, 1 (,1%) was enrolled but had no data collected, and 268 (21%) were not enrolled for several reasons, including unwillingness to participate, inability to contact the household member and too busy to participate. A total of 1016 (77%) HHCs were enrolled, of whom nine had been diagnosed with active TB before enrolment and were excluded. The remaining 1007 HHCs of 284 MDR-TB index cases comprised our study population.

Characteristics of MDR-TB index cases and household contacts

Of 284 MDR-TB index cases, 120 (42%) were female; the median age was 35.9 years (interquartile range [IQR] 25.1–45.6) (Table 1). A total of 102 (36%) index cases were HIV-infected (range 0–88% by site), 144 (51%) had previous HIV-negative test results within the past year and 38 (13%) had unknown HIV status or were HIV-negative .1 year before study entry when last tested.

Among the 1007 HHCs, 593 (59%) were female (Table 1). The median age was 25.5 years (IQR 12.1–43.1); 102 (10%) were < 5 years, 250 (25%) were 5–17 years, 481 (48%) were 18–49 years, and 174 (17%) were ⩾50 years of age. Of 1007 HHCs, HIV status was known for 226 (22%), including 39 (4%) who were HIV-infected and 187 (19%) who selfreported that they had tested HIV-negative within the past year; 781 (78%) had unknown HIV status (Figure 1).

The proportion of HHCs with unknown HIV status varied by site, from 36% at one site in South Africa to 100% at one site in India, with a median of 77% ($P < 0.0001$; Table 2). There was a significantly higher proportion of HHCs with unknown HIV status among children aged<18 years than among adults (86% vs. 73%; $P > 0.0001$, adjusted by site); the median difference by site in the proportion with unknown HIV status was 12% higher for children than for adults. A significantly higher proportion of male HHCs than female HHCs had unknown HIV status (83% vs. 74%; $P = 0.003$, adjusted by site); the median difference between males and females at the same site in proportion with unknown HIV status was 5% (higher for male than female HHCs).

Human immunodeficiency virus testing uptake and predictors of testing

Among the 781 HHCs with unknown HIV status, testing was offered to 769 (98%). Of the 12 HHCs not offered testing, all were children. For 3 (25%) of 12 children not offered testing, the site did not have IRB approval for HIV testing in children. For the remaining 9 (75%) children, the reasons cited reflected parent or guardian perceptions of low risk (e.g., child aged <13 years, child not sexually active, HIV-negative parents).

Among 769 HHCs who were offered HIV testing, 544 (71%) agreed. The proportion agreeing varied significantly across sites, ranging from 0% to 100%, with a median of 86% ($P < 0.0001$) (Table 2). Overall, the proportion of HHCs agreeing to undergo HIV testing was 59% for children (age <18 years) compared with 78% for adults ($P < 0.0001$, adjusted by site). This difference was driven by lower proportions among children at a subset of sites: eight of the 14 sites that enrolled both children and adults had small differences between children and adults in the proportions agreeing to undergo testing (between 5% lower and 2% higher), whereas the other six sites that enrolled both children and adults had larger differences (between 9% and 30% higher).

There were no significant differences in the proportion of HHCs agreeing to HIV testing according to sex (74% of females vs. 67% of males; $P = 0.20$, adjusted by site) or by the HIV status of the MDR-TB index cases (68% among HHCs of both HIV-positive and HIV-negative index cases; $P = 0.10$, adjusted by site). Among the 225 HHCs who declined to undergo HIV testing, 119 (53%) provided a reason. The most common category of reasons cited was ‘perception of [low] risk’ (HHCs, n=52, 23%; Table 3).

A total of 535 HHCs were actually tested as part of the study, 26 (5%) of whom were found to be HIV-positive. Among the 369 adults tested, 22 (6%) were HIV-positive. In contrast, among the 166 children tested, 4 (2%) were HIV-positive ($P = 0.018$ adjusted by site). Thirteen (8%) of the 153 HHCs tested who were from households with an HIV-positive MDR-TB index case were HIV-positive, compared with 6 (2%) of the 273 HHCs tested who

were from households with an HIV-negative index case; however, this difference was not statistically significant when adjusted by site ($P = 0.63$).

Figure 2 shows the proportion of HHCs with known HIV status before and after study testing by site. Also shown is the proportion with known HIV-positive status; for sites with less than 100% with known HIV status, this proportion provided a lower value for the prevalence of HIV infection among HHCs.

Site practices and responses to human immunodeficiency virus testing uptake at sites

Nine sites employed an opt-out approach to HIV testing, five used the opt-in approach, and two used both opt-in and opt-out testing for routine care. Among the 14 sites that followed either an opt-in or opt-out testing strategy outside of the study, there was no significant difference in the proportion of HHCs agreeing to HIV testing in the study (71% among HHCs at the five opt-in sites [median 86%] and 69% at the nine opt-out sites [median 76%]; $P = 0.20$ not adjusted for site).

All sites provided HIV counselling as part of HIV testing. Counselling was performed by trained nurses (7/16 sites), trained counsellors (5/16 sites) or a combination of staff (i.e., doctors, social workers and study investigators; 4/16 sites). Among four sites with <50% uptake, there were no identified differences in HIV counselling or testing approach to explain the low uptake. Some of the barriers to HIV testing mentioned by site coordinators included participants' fear of testing or knowing their result despite counselling, perception of low risk and parents' refusal to provide consent for their children to be tested (Table 3).

DISCUSSION

We conducted HIV testing of the HHCs of MDR-TB index cases in eight countries and found that HIV testing was feasible and high-yield. Before our study, only 22% of HHCs had a known HIV status. Of those offered HIV testing, 71% agreed to the test and, of these, 5% were identified as HIV-positive. HIV testing uptake varied markedly by site, and was lower in children than in adults. Participant (or parent/ guardian) perceptions of low HIV risk were a common reason for lack of testing, and may have been one of the reasons that contributed to the low uptake of testing among HHCs, indicating that HIV counselling and testing in a household was both an individual decision and a parent/guardian decision.[19]

HIV testing of MDR-TB HHCs was feasible and acceptable in diverse geographic and epidemiologic contexts, including high and low HIV prevalence settings. Our uptake rate of 71% was higher than that reported from two large studies of HHCs in South Africa, where 35–55% agreed to testing.[20,21] HIV testing uptake was also low (39%) in a study of over 4000 contacts in the United States and Canada.[22] One of the reasons for the high uptake in our study may have been the multiple approaches to access HHCs, including in homes, facilities, mobile van clinics or other settings based on stated preferences. A study in Zimbabwe supported the use of community-based approaches for HIV testing, as it may reduce HIV-related stigma while also offering prevention interventions for HIV and other diseases.[23] Another potential reason for high testing uptake was the bundling of HIV testing within TB screening, thus supporting integration of HIV services and reducing stigma

towards HIV testing. Finally, the use of an opt-out approach has been associated with increased uptake[24] and was used by the majority of study sites.

The HHCs of TB patients in high HIV prevalence sites are at high risk for tuberculous infection and disease, but may also be more likely to have HIV infection.[25] In contrast to 90% of MDR-TB index cases knowing their HIV status (either positive or negative within the past year), the majority of HHCs (78%) did not know their HIV status or had not been recently tested. Of the HHCs agreeing to HIV testing, 5% were diagnosed with HIV in the present study, suggesting this was a critical population for targeted HIV testing. Indeed, the proportion of HIV infection in this population is on par with proportions seen among other high-risk populations[26] that are more intensively screened through current programmes.

Our findings indicate that the perception of low risk was a contributing factor to HIV testing uptake. Among HHCs who provided a reason, 52/119 (44%) declined HIV testing because they believed they were at low risk of being HIV-infected. A similar finding was reported among married women in Nigeria, where HIV testing was associated with knowing someone who was HIV-infected.[27] These findings also support guidelines[28] that recommend routine opt-out testing in the effort to diagnose persons who may underestimate their HIV risk. It is important to note, however, that among the three sites with 0–7% uptake, two had the lowest ‘unknown’ rate before the study (36% and 39%). Therefore, the study was offering HIV testing in an environment where the majority were already tested. Some of the unknowns’ may have had older negative tests (i.e., >.1 year previously), but considered themselves still likely to be negative. Also, 71% of HHCs who declined testing in Botswana were children; for many of these children, the parent or guardian declined testing the child again even if he/she had been tested >1 year before. The perception of low risk should therefore be interpreted as among a subset of the HHCs who did not already know their status.

Our study had three main limitations. First, this was a multisite study in which sites used various HIV testing strategies, rather than a single standardised approach, which may have led to observed differences in uptake. Second, other unmeasured site-level factors may have also contributed. For example, two sites in Brazil and Kenya did not have IRB approval to enrol children, and therefore children were not enrolled at these sites. Indeed, substantial site variation in HIV testing uptake was noted that could not be directly explained by HIV prevalence or other site-level factors. Third, we were limited in our ability to fully assess the reasons for declining testing, as 47% did not provide a specific reason. HIV testing uptake in our study may not reflect this parameter in all MDR-TB HHCs, as testing was conducted as part of a study, rather than under programmatic conditions. Reliance on self-report of HIV status among index cases may have underestimated HIV prevalence in this group; this could affect measures of association between the HIV status of index cases and HHCs testing uptake and yield.

HIV testing uptake was high overall in TB-affected households, although it varied markedly among sites and was lower in children (for whom parental consent was required) than in adults. Global efforts to date for HIV testing have primarily targeted adults through prevention of mother-to-child transmission programmes, partner-based testing and testing of key populations. A perceived low risk of HIV infection was one of the barriers to HIV

testing uptake in this population, the greatest barrier being site-dependent, and these may have undermined the benefits of the numerous HIV screening interventions available locally and worldwide. Addressing participant perceptions of risk among TB-affected households and focusing on household HIV testing may improve the HIV testing uptake needed to reach global 90–90-90 targets.

Acknowledgements

The authors thank the study participants and their families; the site investigators, study teams and protocol team of A5300/I2003; and the following study team members: A-M Demers, R Chaisson, M Harrington, S Kanade, J Nicotera, P Anthony, C Lane, U A Kadam, R Ssenyonga, A Shahkolahi and A Manzella.

Research reported in this publication was supported by the National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH) under Award Number UM1 AI068634, UM1 AI068636 and UM1 AI106701. Overall support for the International Maternal Pediatric Adolescent AIDS Clinical Trials Network (IMPAACT) was provided by the NIAID with co-funding from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) and the National Institute of Mental Health (NIMH), all components of the NIH, under Award Numbers UM1AI068632 (IMPAACT LOC), UM1AI068616 (IMPAACT SDMC) and UM1AI106716 (IMPAACT LC), and by NICHD contract number HHSN275201800001I. Additional support for this project was provided by the President's Emergency Plan for AIDS Relief (PEPFAR) through the Centers for Disease Control and Prevention (CDC) and by NIH/NIAID under award number UM1AI069418 (Emory-CDC Clinical Trials Unit).

Disclaimer: The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the funding agencies.

References

1. World Health Organization. Updated WHO policy on collaborative TB/HIV activities: guidelines for national programmes and other stakeholders Geneva, Switzerland: WHO, 2016.
2. World Health Organization. Global tuberculosis report, 2016 WHO/HTM/TB/2016.13. Geneva, Switzerland: WHO, 2016.
3. Shah NS, Yuen CM, Heo M, Tolman AW, Becerra MC. Yield of contact investigations in households of patients with drug-resistant tuberculosis: systematic review and meta-analysis. Clin Infect Dis 2014; 58: 381–391. [PubMed: 24065336]
4. World Health Organization/Joint United Nations Programme on HIV and AIDS /United Nations Childrens' Fund. Towards universal access: scaling up priority HIV/AIDS interventions in the health sector. Progress Report Geneva, Switzerland: WHO, 2009.
5. Govindasamy D, Ferrand RA, Wilmore SM, et al. Uptake and yield of HIV testing and counselling among children and adolescents in sub-Saharan Africa: a systematic review. J Int AIDS Soc 2015; 18: 20182. [PubMed: 26471265]
6. Musheke M, Ntalasha H, Gari S, et al. A systematic review of qualitative findings on factors enabling and deterring uptake of HIV testing in Sub-Saharan Africa. BMC Public Health 2013; 13: 220. [PubMed: 23497196]
7. Peralta L, Deeds BG, Hipszer S, Ghalib K. Barriers and facilitators to adolescent HIV testing. AIDS Patient Care STDS 2007; 21: 400–408. [PubMed: 17594249]
8. 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]
9. Peltzer K, Matseke G, Mzolo T, Majaja M. Determinants of knowledge of HIV status in South Africa: results from a population-based HIV survey. BMC Public Health 2009; 9: 174. [PubMed: 19500373]
10. Venkatesh KK, Madiba P, De Bruyn G, Lurie MN, Coates TJ, Gray GE. Who gets tested for HIV in a South African urban township? Implications for test and treat and gender-based prevention interventions. J Acquir Immune Defic Syndr 2011; 56: 151–165. [PubMed: 21084993]

11. Wringe A, Isingo R, Urassa M, et al. Uptake of HIV voluntary counselling and testing services in rural Tanzania: implications for effective HIV prevention and equitable access to treatment. Trop Med Int Health 2008; 13: 319–327. [PubMed: 18397395]
12. Meiberg AE, Bos AE, Onya HE, Schaalma HP. Fear of stigmatization as barrier to voluntary HIV counselling and testing in South Africa. East Afr J Public Health 2008; 5: 49–54. [PubMed: 19024410]
13. European Centre for Disease Prevention and Control. HIV testing: Increasing uptake and effectiveness in the European Union Stockholm, Sweden: ECDC, 2010.
14. Jürgens R. 'Routinizing' HIV testing in low- and middle-income countries: background paper New York, NY, USA: Public Health Program of the Open Society Institute, 2006.
15. World Health Organization. Service delivery approaches to HIV testing and counselling (HTC): a strategic HTC policy framework Geneva, Switzerland: WHO, 2012.
16. World Health Organization, Joint United Nations Programme on HIV/AIDS. Guidance on provider-initiated HIV testing and counseling in health facilities Geneva, Switzerland: WHO, 2007.
17. World Health Organization. Global tuberculosis report, 2015 WHO/HTM/TB/2015.22. Geneva, Switzerland: WHO, 2015.
18. International Maternal Pediatric Adolescent AIDS Clinical Trials Network. IMPAACT 2003B: (PHOENIx) (DAIDS ID 12041): Protecting households on exposure to newly diagnosed index multidrug-resistant TB patients Durham, NC, USA: IMPAACT, 2015.
19. Lugada E, Levin J, Abang B, et al. Comparison of home and clinic-based HIV testing among household members of persons taking antiretroviral therapy in Uganda: results from a randomized trial. J Acquir Immune Defic Syndr 2010; 55: 245–252. [PubMed: 20714273]
20. Shapiro AE, Variava E, Rakgokong MH, et al. Community- based targeted case finding for tuberculosis and HIV in household contacts of patients with tuberculosis in South Africa. Am J Respir Crit Care Med 2012; 185: 1110–1116. [PubMed: 22427532]
21. Velen K, Lewis JJ, Charalambous S, et al. Household HIV testing uptake among contacts of TB patients in South Africa. PLOS ONE 2016; 11: e0155688. [PubMed: 27195957]
22. Hirsch-Moverman Y, Cronin WA, Chen B, et al. HIV counseling and testing in tuberculosis contact investigations in the United States and Canada. Int J Tuberc Lung Dis 2015; 19: 943–953. [PubMed: 26162361]
23. Chirawu P, Langhaug L, Mavhu W, Pascoe S, Dirawo J, Cowan F. Acceptability and challenges of implementing voluntary counselling and testing (VCT) in rural Zimbabwe: evidence from the Regai Dzive Shiri Project. AIDS Care 2010; 22: 81–88. [PubMed: 20390484]
24. Becker J, Tsague L, Sahabo R, Twyman P. Provider initiated testing and counseling (PITC) for HIV in resource-limited clinical settings: important questions unanswered. Pan Afr Med J 2009; 3: 4. [PubMed: 21532713]
25. World Health Organization. Guidelines for intensified tuberculosis case-finding and isoniazid preventive therapy for people living with HIV in resource-constrained settings Geneva, Switzerland: WHO, 2011.
26. Joint United Nations Programme on HIV and AIDS/World Health Organization. Guidelines on estimating the size of populations most at risk to HIV Geneva, Switzerland: WHO, 2010.
27. Lepine A, Terris-Prestholt F, Vickerman P. Determinants of HIV testing among Nigerian couples: a multilevel modelling approach. Health Policy Plan 2015; 30: 579–592. [PubMed: 24906362]
28. Kellerman SE, Lehman JS, Lansky A, et al. HIV testing within at-risk populations in the United States and the reasons for seeking or avoiding HIV testing. J Acquir Immune Defic Syndr 2002; 31: 202–210. [PubMed: 12394799]

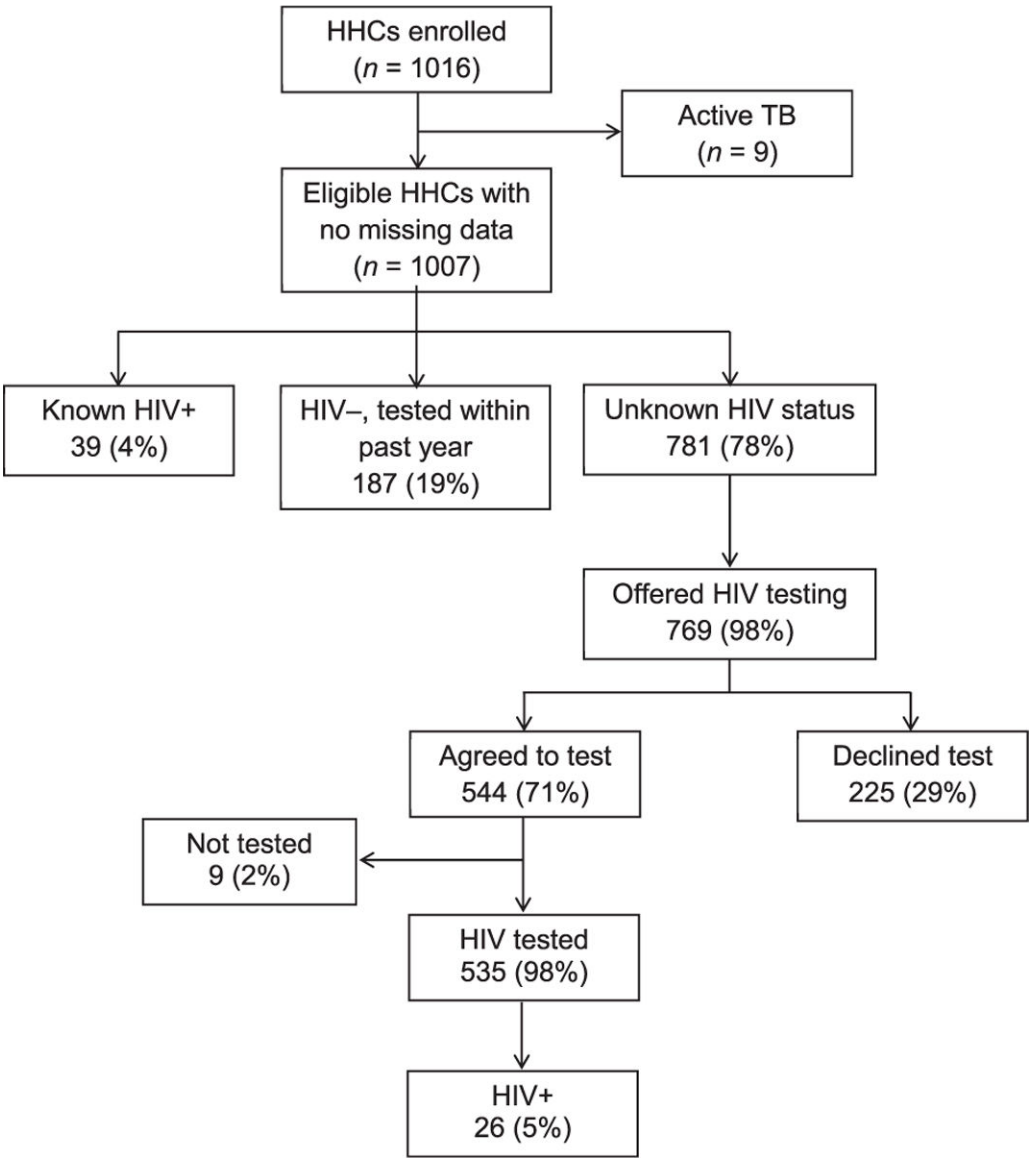

Figure 1.

HIV test uptake and HIV positivity among HHCs of index cases with multidrug-resistant tuberculosis. HHC = household contact; TB = tuberculosis; HIV = human immunodeficiency virus; −= negative; += positive.

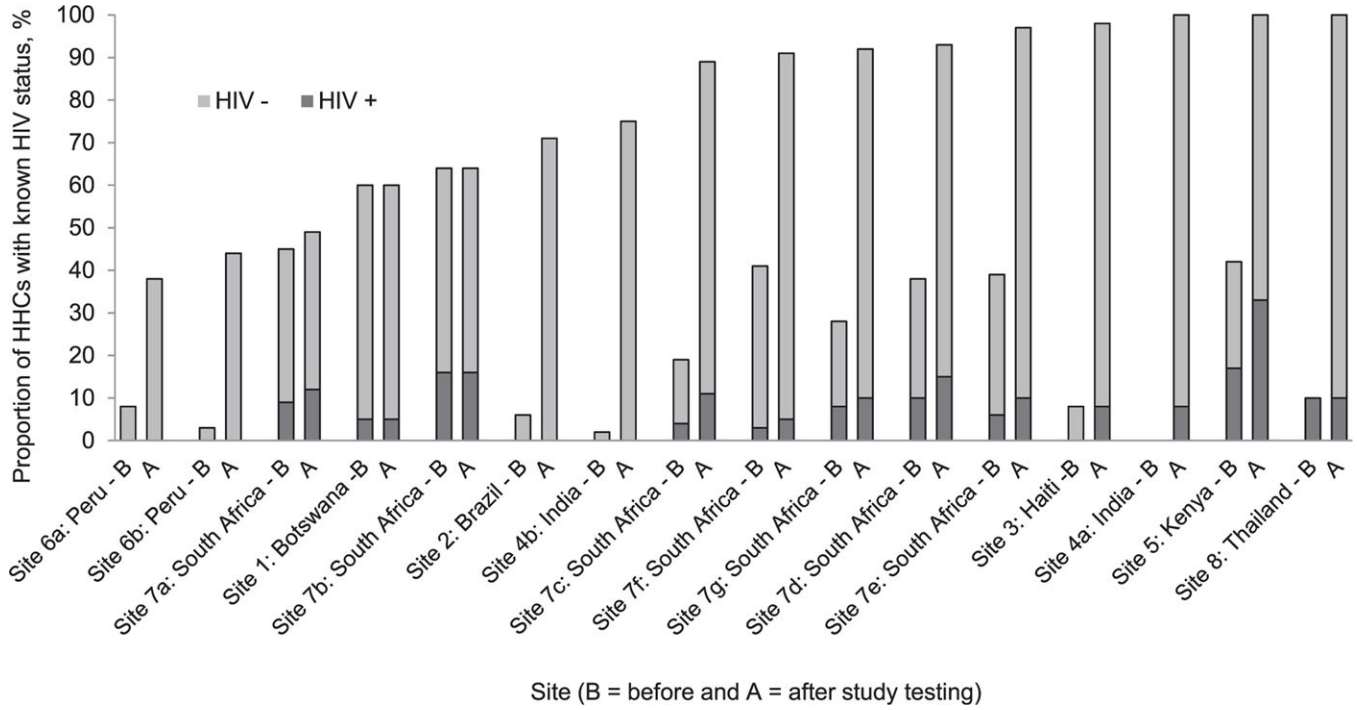

Figure 2.

Percentage of household contacts with known HIV status before (self-report) and after study testing (combining self-report and study testing), by site. Sites are ordered from left to right from lowest to highest proportion with known HIV status after study testing. HIV = human immunodeficiency virus; − = negative; + = positive.

Table 1

Baseline characteristics of index cases with multidrug-resistant tuberculosis and their household contacts

	Index cases				Household contacts			
	n	**Female sex *n* (%)**	**Age, years median [IQR]**	**HIV-infected* *n* (%)**	***n***	**Female sex *n* (%)**	**Age, years median [IQR]**	**HIV-infected* *n* (%)**
Overall	284	120 (42)	35.9 [26.1–45.6]	102 (36)	1007	593 (59)	25.5 [12.1–43.1]	39 (4)
Site 1: Botswana	10	6 (60)	38.3 [33.9–52.8]	6 (60)	38	26 (68)	15.5 [5.1–32.2]	2 (5)
Site 2: Brazil	10	2 (20)	46 [36.5–49]	0	17	12 (71)	41.9 [35.3–53.3]	0
Site 3: Haiti	14	7 (50)	40.7 [27.7–52.7]	5 (36)	52	30 (58)	23 [13.6–33.1]	0
Site 4a: India	23	5 (22)	40.7 [29.4–51.7]	3 (13)	87	56 (64)	35.7 [23.7–50.7]	0
Site 4b: India	35	14 (40)	30.3 [23.4–37.2]	1 (3)	118	55 (47)	25.9 [13.5–42.2]	0
Site 5: Kenya	7	1 (14)	36.6 [29.1–41.5]	6 (86)	12	12 (100)	29.6 [25.8–69.2]	2 (17)
Site 6a: Peru	26	12 (46)	25.2 [21.2–33]	1 (4)	112	61 (54)	22.4 [8.8–42.3]	0
Site 6b: Peru	28	8 (29)	24.1 [20–39.8]	1 (4)	91	53 (58)	27.4 [12.9–49.3]	0
Site 7a: South Africa	26	13 (50)	37 [27.9–40.8]	23 (88)	76	45 (59)	25.1 [14–49.8]	7 (9)
Site 7b: South Africa	9	6 (67)	39.6 [30.9–48.3]	6 (67)	25	18 (72)	21.4 [12.5–40.5]	4 (16)
Site 7c: South Africa	10	5 (50)	43.6 [34.2–52.1]	8 (80)	27	17 (63)	28.6 [17.5–39.8]	1 (4)
Site 7d: South Africa	21	10 (48)	36.8 [31.3–41.8]	11 (52)	86	54 (63)	24.8 [9.6–34.7]	9 (10)
Site 7e: South Africa	14	9 (64)	39.3 [27.2–45.8]	9 (64)	52	36 (69)	19.3 [8–29.2]	3 (6)
Site 7f: South Africa	27	18 (67)	35.5 [23.5–43.9]	12 (44)	133	75 (56)	20.9 [7.7–33.4]	4 (3)
Site 7g: South Africa	14	2 (14)	41.1 [36.1–46.2]	8 (57)	51	27 (53)	31.8 [11.6–44.6]	4 (8)
Site 8: Thailand	10	2 (20)	47.6 [36.6–60.3]	2 (20)	30	16 (53)	49.6 [29–61.8]	3 (10)

*Based on self-report before study entry. The denominator of the proportion is all index cases, or all household contacts, including those with unknown status who were later found to be HIV-positive on testing.

HIV = human immunodeficiency virus; IQR = interquartile range.

Table 2

HIV testing uptake by site among enrolled household contacts

Study site	Enrolled *n*	Unknown HIV status before study entry *n* (% of those enrolled)	HIV testing offered *n* (% of those with unknown status)	Contacts agreed to HIV testing *n* (% of those offered)
Overall	1007	781 (78)	769 (98)	544 (71)
Site 1: Botswana	38	15 (39)	14 (93)	0
Site 2: Brazil	17	16 (94)	16 (100)	11 (69)
Site 3: Haiti	52	48 (92)	48 (100)	48 (100)
Site 4a: India	87	87 (100)	87 (100)	87 (100)
Site 4b: India	118	116 (98)	113 (97)	86 (76)
Site 5: Kenya	12	7 (58)	7 (100)	7 (100)
Site 6a: Peru	112	103 (92)	103 (100)	38 (37)
Site 6b: Peru	91	88 (97)	80 (91)	38 (48)
Site 7a: South Africa	76	42 (55)	42 (100)	3 (7)
Site 7b: South Africa	25	9 (36)	9 (100)	0
Site 7c: South Africa	27	22 (81)	22 (100)	19 (86)
Site 7d: South Africa	86	53 (62)	53 (100)	47 (89)
Site 7e: South Africa	52	32 (62)	32 (100)	31 (97)
Site 7f: South Africa	133	79 (59)	79 (100)	68 (86)
Site 7g: South Africa	51	37 (73)	37 (100)	34 (92)
Site 8: Thailand	30	27 (90)	27 (100)	27 (100)

HIV = human immunodeficiency virus.

Table 3

Reasons for declining human immunodeficiency virus testing by household contacts and by site

	n **(%)**
Household contacts' responses (*n*=225 contacts)	
Perception of low risk	52 (23)
Did not want repeat testing	20 (9)
Did not want to participate in research	15 (7)
Not ready to be tested	11 (5)
Fear of disclosure	7 (3)
Other (specified)	14 (6)
No reason specified	106 (47)
Site coordinators' responses (*n*=16 sites [*])	
Stigma/fear of disclosing status	9 (56)
Fear of testing/knowing the result	5 (31)
Perception of low risk	5 (31)
Previously tested	3 (19)
Blood volume	1 (16)
Consent for children	2 (13)
Privacy	1 (6)

[*] As sites could give multiple responses, the total is .100%.