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Association between distance to HIV testing site and uptake of HIV testing for tuberculosis patients in Cambodia

N. Kanara,* K. P. Cain,† V. Chhum,‡ B. Eng,*‡ S. Kim,‡ S. Keo,‡ T. A. Heller,* J. K. Varma†§

*United States Centers for Disease Control and Prevention (CDC) Global AIDS Program–Cambodia, Phnom Penh, Cambodia; †US CDC, Atlanta, Georgia, USA; ‡Banteay Meanchey Provincial Health Department, Sereysophon, Cambodia; §Thailand Ministry of Public Health, US CDC Collaboration, Nonthaburi, Thailand

SUMMARY

SETTING: Banteay Meanchey Province, Cambodia.

OBJECTIVE: Cambodia has the highest incidence of tuberculosis (TB) in Asia. Not all TB patients are tested for human immunodeficiency virus (HIV). We assessed the association between distance to HIV testing facility and HIV testing rates.

METHODS: We analyzed data on TB patients from 11 clinics to determine the proportion tested for HIV infection. We categorized each TB clinic as having a voluntary confidential counseling and testing (VCCT) center onsite, or being at <15 min, 15–30 min or >30 min driving distance to the nearest VCCT.

RESULTS: Of 1017 TB patients not previously tested for HIV, 708 (70%) were tested. Of 481 TB patients without onsite VCCT, 297 (62%) were tested, compared to 410 (77%) of 535 TB patients with onsite VCCT (RR 0.6, 95%CI 0.5–0.7). When the VCCT site was >15 min from the TB clinic, HIV testing occurred only half as frequently as when onsite VCCT was available.

CONCLUSION: TB patients treated at clinics without onsite or nearby HIV testing are less commonly tested for HIV infection. Making HIV testing available to TB patients without the necessity of traveling to a distant HIV testing site is likely to increase HIV testing rates.

KEY WORDS: tuberculosis; Cambodia; epidemiology; HIV

HUMAN IMMUNODEFICIENCY VIRUS (HIV) infection is the most potent risk factor for tuberculosis (TB) disease, and is thus more common in TB patients than in the general population.[1] While HIV prevalence among TB patients is lower in South-East Asia than in sub-Saharan Africa, HIV-infected TB patients in South-East Asia are often more immunodeficient at the time of TB diagnosis. At the time of TB diagnosis, the median CD4+ T-lymphocyte (CD4) count is between 50 and 60 cells/mm^3 in South-East Asian HIV-infected TB patients (compared to 186–393 in sub-Saharan Africa),[2–9] and case fatality is reported to be 26–56% during TB treatment without antiretroviral treatment (ART),[2,4,10–12] with up to half of all deaths occurring within the first 2 months of treatment.[13]

To address the TB-HIV syndemic, the World Health Organization (WHO) recommends that all TB patients and suspects visiting health facilities be offered HIV testing.[14] To access HIV testing, TB patients in South-East Asia must often travel to an offsite facility, which may be located far away from the TB treatment facility, a potentially large barrier to HIV testing.

In 2006, the estimated prevalence of HIV infection in Cambodia's general population was 0.9%.[15] Cambodia has the highest TB incidence rate in Asia (508 per 100 000 population in 2005),[16] and HIV prevalence among TB patients is 10%.[17] HIV testing is recommended for all TB patients in Cambodia. Banteay Meanchey is a rural province in northwest Cambodia on the border with Thailand with an estimated population of 795 000. There are five referral hospitals and 53 health centers that serve as TB clinics. The population is generally poor and consists of many migrant workers. There are eight voluntary, confidential HIV counseling and testing (VCCT) sites, all of which are co-located with health centers or referral hospitals. Five VCCT sites were open as of January 2006. HIV testing is only performed at VCCT sites. Testing is not available at TB clinics, and TB patients must therefore be referred to the nearest VCCT site for HIV testing. Patients, including those who are smear-positive, are generally referred for VCCT immediately after TB diagnosis. Patients who cannot afford to pay for the transport (over half of all patients) receive reimbursement for the cost of round-trip transportation to a VCCT site, and HIV testing is free of charge.

Reimbursement rates for transportation follow a standardized schedule for all health facilities in the province. The typical amount reimbursed is US$1–7 but is based on the actual round-trip cost from the

Correspondence to: Kevin P Cain, US Centers for Disease Control and Prevention, 1600 Clifton Rd, MS-E-10, Atlanta, GA 30333, USA. Tel: (+1) 404 639 2247. Fax: (+1) 404 639 1566. e-mail: kcain@cdc.gov

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patient's home to the VCCT facility by motorcycle taxi (unpublished data, Banteay Meanchey Provincial Health Department).

In Banteay Meanchey, the US Centers for Disease Control and Prevention (US CDC) and the United States Agency for International Development (USAID) have collaborated to support HIV testing of TB patients within government health facilities. This support includes ongoing staff training, standardized counseling from TB staff, and financial support for patient transportation to the nearest HIV testing facility. The TB-HIV program in Banteay Meanchey was evaluated in 2005, at which time certain patient and provider-related barriers to HIV testing among TB patients were identified, including suboptimal counseling messages from providers about why testing was needed, and inaccurate perceptions of HIV risk among providers and patients.[18] These barriers were addressed by developing a standardized counseling script and holding regular meetings with the TB and HIV staff for ongoing training.[18] We analyzed data from this province to determine whether distance to the HIV testing facility was a barrier to HIV testing of TB patients.

STUDY POPULATION AND METHODS

We conducted a cross-sectional survey to measure the proportion of TB patients tested for HIV infection and to determine the impact of distance to the nearest VCCT site on uptake of HIV testing. In September 2007, we collected data retrospectively from April 2005 through July 2007, after the previously identified barriers to HIV testing uptake had been addressed.[18] We collected routinely available public health data on all TB patients from the 11 TB clinics and the three VCCT sites trained in TB-HIV collaborative activities as of April 2005.[18] TB patients who were either known to have HIV infection or had tested negative for HIV within the preceding 3 months were defined as 'previously tested' and excluded from further analysis. Standard WHO definitions were used for TB registration category and treatment outcome.[19] Details of the data collection methods and definitions have been reported elsewhere.[20]

TB cases recorded in the TB registers were diagnosed and treated using standard national guidelines.[21] VCCT sites in Cambodia routinely use rapid HIV testing assays (Determine™ HIV-1/2, Abbott Diagnostic Division, Hoofddorp, The Netherlands) with confirmatory rapid testing (HIV 1/2 Stat-Pak®, Chembio Diagnostic Systems, Medford, NY, USA) for positive results.

To determine whether the distance to VCCT was associated with uptake of HIV testing, we compared the distance from the TB clinic to the VCCT site for TB patients tested for HIV infection with those who were not HIV-tested. We included demographic and TB disease characteristics to control for potential confounding. We compared HIV testing rates at TB clinics with onsite VCCT to those without an onsite VCCT, and we also categorized distance to VCCT according to the time it takes to get from the TB clinic to the nearest VCCT site by motorcycle taxi, as this is the most common method of transportation in the province. Standardized travel times (in the dry season) were obtained from the Provincial Health Department. We categorized each TB clinic as having VCCT on site, or being at <15 min, 15–30 min or >30 min driving distance to the nearest VCCT site.

We calculated and compared the frequencies of each variable for TB patients tested and not tested for HIV infection. In bivariate analysis, we compared the proportions using χ^2 and Mantel-Haenszel tests. For multivariate analysis, we used log-binomial regression. All variables were initially included in the multivariate model; those that remained significant at the $P < 0.05$ level were retained. We created two different multivariate models, dichotomizing VCCT on site vs. not on site in the first model, and stratifying by distance to VCCT in the second model. With the sample size of our study, we would only be able to detect a difference between testing rates for onsite VCCT compared to those <15 min away if the difference in testing exceeded 10%.

The protocol for this project was reviewed by the CDC and found to be surveillance and public health program implementation, and not human subject research requiring oversight by an institutional review board. Throughout the process of reviewing and recording patient data, we protected the privacy of patients by storing all records containing personally identifying information in secure locations and by excluding names from the electronic database.

RESULTS

During the period reviewed, 1642 TB patients were registered for TB treatment, of whom 625 (38%) were either previously diagnosed with HIV infection or tested negative within the previous 3 months, and thus did not need referral for HIV testing. Of the remaining 1017 patients, 708 (70%) were tested for HIV infection, of whom 43 (6%) had a positive test result (Figure).

The median age of the 1017 patients included in our analysis was 46 years (range 0–89); 427 (42%) were female. Smear-positive pulmonary disease was the most common diagnosis, while 323 (32%) patients had smear-negative pulmonary disease and 223 (22%) had extra-pulmonary disease. Only 4% had a previous history of TB treatment (Table 1).

In bivariate analysis, we found no differences in HIV testing rates by age, sex or type of TB diagnosed (Table 2). HIV testing was less common at facilities without onsite VCCT; of 481 TB patients treated at clinics without onsite VCCT, 297 (62%) were HIV-

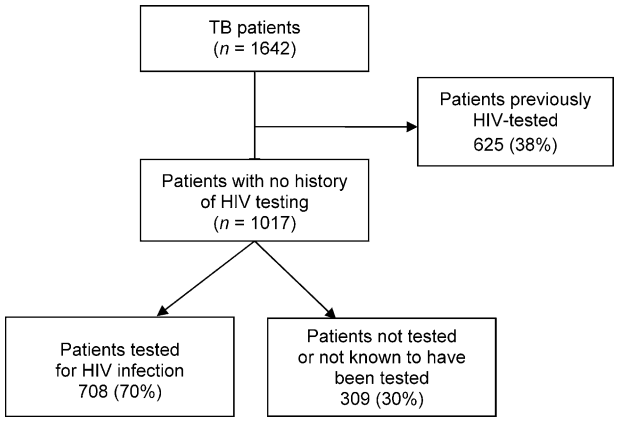

Figure Uptake of HIV testing among TB patients during the period of study. TB = tuberculosis; HIV = human immunodeficiency virus.

tested, compared to 410/535 (77%) at clinics with onsite VCCT (relative risk 0.6, 95% confidence interval [CI] 0.5–0.7). When the VCCT site was >15 min away by motorcycle taxi, far fewer patients were tested for HIV than at TB clinics with onsite VCCT.

In multivariate analysis, using the dichotomous variable 'onsite VCCT' to assess the impact of distance to VCCT, no other variable was significantly associated with testing, and thus the relative risk for this association was the same as reported in the bivariate analysis. In a multivariate model using the multi-level 'distance to VCCT' variable to assess the impact of VCCT location, HIV testing was less common for all TB patients treated at sites 15–30 min and >30 min from the VCCT site (for both associations, adjusted relative risk [aRR] 0.5, CI 0.4–0.6) (Table 2). While the proportion of TB patients tested for HIV infection was lower for all TB clinics >15 min from a VCCT site, uptake of HIV testing did not decrease with fur-

Table 1 Characteristics of patients with no previous history of HIV testing (N = 1017)

Characteristic	*n* (%)
Median age, years [range]	46 [0–89]
Sex*	
Male	589 (58)
Female	427 (42)
Diagnosis*	
Smear-positive pulmonary TB	470 (46)
Smear-negative pulmonary TB	323 (32)
Extra-pulmonary TB	223 (22)
Type of case	
Not recorded	19 (2)
New patient	855 (84)
Transferred in	28 (3)
Return after default	2 (0)
Relapse	28 (3)
Failure	6 (1)
Other	79 (8)
HIV testing result	
Not tested/not recorded	309 (30)
Positive	43 (4)
Negative	663 (65)
Indeterminate	2 (0)

* Sex and diagnosis were each missing for one patient.
HIV = human immunodeficiency virus; TB = tuberculosis.

Table 2 Characteristics associated with testing for HIV among TB patients with no previous history of HIV testing (N = 1017)

Characteristics	HIV tested *n/N* (%)	RR (95%CI)	aRR (95%CI)
Age, years			
<18	31/44 (70)	1.1 (0.7–1.8)	NS
18–34	156/229 (68)	Referent	NS
⩾35	521/744 (70)	1.1 (0.9–1.3)	NS
Sex*			
Male	411/589 (70)	1.0 (0.9–1.1)	NS
Female	296/427 (69)	Referent	NS
Diagnosis*			
Extra-pulmonary TB	151/223 (68)	0.9 (0.7–1.1)	0.9 (0.7–1.1)
Smear-negative TB	224/323 (69)	1.0 (0.8–1.2)	0.8 (0.6–1.0)†
Smear-positive TB	332/470 (71)	Referent	Referent
VCCT on site*			
No	297/481 (62)	0.6 (0.5–0.7)†	0.6 (0.5–0.7)†§
Yes	410/535 (77)	Referent	Referent
Distance to VCCT*			
>30 min travel distance	95/174 (55)	0.5 (0.4–0.6)†	0.5 (0.4–0.6)†
15–30 min	51/99 (52)	0.5 (0.4–0.6)†	0.5 (0.4–0.6)†
<15 min	151/208 (73)	0.8 (0.6–1.1)	0.8 (0.6–1.1)
On site	410/535 (77)	Referent	Referent

* Data on sex, diagnosis and VCCT site for one patient were missing and were excluded from multivariate analyses.
† $P < 0.05$.
§ This relative risk was obtained by replacing the 'distance to VCCT' variable with this dichotomous variable. In the multivariate model, no other variables were significant at a level of $P < 0.05$ when the dichotomous 'onsite VCCT' variable was used.
HIV = human immunodeficiency virus, TB = tuberculosis; RR = relative risk/risk ratio; CI = confidence interval; aRR = adjusted relative risk; NS = not retained in final multivariate model, because not significant at $P < 0.05$; VCCT = voluntary confidential counseling and testing.

ther increases in travel time to VCCT. In this model, HIV testing was slightly less common among patients with smear-negative pulmonary TB compared to those with smear-positive pulmonary TB (Table 2).

DISCUSSION

A previous study in this rural Cambodian province found that patient and provider-related factors were contributing to reduced uptake of HIV testing. These barriers were addressed with a programmatic intervention, after which HIV testing rates increased from 60% to 78%.[18] The data for this report, which were collected from the period after the barriers had been addressed, demonstrate that the factors previously associated with lower uptake of HIV testing (including patient age and type and location of TB) are no longer associated with HIV testing uptake. Instead, the only factor that we evaluated which was strongly associated with uptake of HIV testing in this study is the availability of testing in close proximity to the TB clinic. Smear-negative disease was marginally significant in the multivariate analysis, but the magnitude of this association was small, and the rationale for this finding is not clear.

Payment for transportation to VCCT was provided to patients because onsite HIV testing through provider-initiated testing and counseling (PITC) was not routinely available in Cambodia. As all health facilities offer such reimbursement, it is not possible to determine the impact of such payment on testing rates. However, as approximately half of all patients referred for testing required financial support, the impact is likely to be substantial. Disadvantages of this approach, compared to onsite testing, include the difficulty for patients who are too sick to be easily transported to access HIV testing and the risk of TB transmission associated with sending infectious TB patients to HIV testing facilities.[22]

Onsite HIV testing has been shown to be both acceptable and successful in other countries. In Guyana, after HIV testing was implemented in six public chest clinics (where most TB patients are treated), 91% of TB patients offered onsite testing at those clinics chose to be tested.[23] After the Botswana government implemented an 'opt out' approach to HIV testing, in which HIV testing was routinely provided in all clinical settings including TB clinics, a population-based survey found that 81% of respondents were extremely or very much in favor of routine testing, 89% believed that the policy would reduce barriers to testing, and 93% believed it would increase access to ART.[24] Rwanda and Kenya implemented countrywide onsite PITC for TB patients, and the proportion of patients tested increased from respectively 46% and 32% to respectively 81% and 64% by the third quarter of 2006.[16] In South-East Asia, onsite PITC has been used countrywide in Malaysia, where 81% of TB patients were tested for HIV in 2007.[25] In four provinces in Thailand, 70% of the nearly 5000 TB patients with unknown HIV status were tested when onsite PITC was implemented.[6] The strategy has now been expanded to cover nearly the entire country.[26] Onsite PITC has also been used in Ho Chi Minh City, Vietnam, where 93% of nearly 10 000 TB patients with previously unknown status underwent onsite testing from mid 2006 through 2007, and it has been piloted in Papua New Guinea and China.[25]

A variety of approaches can provide TB patients with access to HIV testing without travel to an offsite facility. Implementation of such services requires training providers about HIV counseling and testing, onsite follow-up and supervision of staff, and quality assurance of laboratory testing. With the introduction of sensitive, specific, simple-to-use rapid antibody tests that do not require sophisticated laboratory services, running water or electricity, and can be used by trained lay persons, providers can be trained to perform counseling and testing on site.[14] However, trained laboratory supervisors are needed for quality assurance, including biosafety and quality control of testing.[14] This could be logistically challenging for wide scale-up, but the challenges have been successfully met in other settings. The cost-effectiveness of this approach compared to the current approach of paying for transportation should be considered to maximize sustainability.

Alternatively, providers can provide pre-test HIV information, collect blood on site, and then transport the blood to the nearest HIV testing facility. The disadvantages of this approach are the need for a system to transport specimens and the potential for delays in providing results to patients. The benefit is that it allows the use of a laboratory that is already supervised and quality assured. Mobile VCCT, in which a counselor regularly visits selected TB clinics, is another option that shares this potential benefit. However, mobile VCCT is often logistically challenging, and HIV testing at the site is limited to the times when the counselor is visiting that site.

The data presented here are subject to certain limitations. First, as with all retrospective studies, we were limited by the data present in public health and clinical records. We could not control for other factors, such as socio-economic status and other patient HIV risk factors that may have been correlated with HIV testing rates. A study in Zambia recently found that onsite testing offered by TB staff resulted in higher uptake than even onsite VCCT.[27] As sites in Cambodia do not offer this approach, we were not able to make this comparison. We are unable to determine with certainty whether HIV testing rates at sites with onsite VCCT and those <15 min from the nearest VCCT are truly the same or whether our study has insufficient power to detect a difference. Finally, our data are from one province in Cambodia. We believe that lessons learned from this province can be applied

successfully in other parts of Cambodia, as has been done with previous lessons learned from this province.

CONCLUSION

Through increased training, regular follow-up, improved HIV testing information delivery by TB staff and provision of transportation costs to TB patients for travel to the nearest VCCT site, the proportion of TB patients tested for HIV infection in Banteay Meanchey has reached its highest rate ever.[18] Increasing testing rates, however, remains a high priority because of the high early mortality rate in HIV-infected TB patients and the proven benefits of HIV care and treatment in reducing mortality in South-East Asia.[2,4,12] Even though the cost of transportation to the nearest HIV testing center was supported, HIV testing rates at TB clinics without onsite or nearby HIV testing sites were substantially lower than sites with onsite or nearby testing. Making HIV testing available to TB patients without the necessity to travel to a distant HIV testing site is likely to increase HIV testing rates of TB patients in Cambodia.

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RÉSUMÉ

CADRE : Province de Banteay Meanchey, Cambodia.

OBJECTIF : En Asie, c'est au Cambodge que se situe l'incidence la plus élevée de la tuberculose (TB). Les tests pour le virus de l'immunodéficience humaine (VIH) ne concernent pas tous les patients TB. Nous avons évalué l'impact de la distance entre le dispensaire TB et les sites de tests VIH sur les taux de tests VIH réalisés.

MÉTHODES : Nous avons analysé les données concernant les patients TB nouvellement diagnostiqués dans 11 dispensaires pour déterminer la proportion de patients TB testés pour l'infection VIH. Nous avons classé chacune des dispensaires TB comme suit : présence d'un centre de test et d'accompagnement confidentiel volontaire (VCCT) sur place ou durée du trajet de <15 min, de 15 à 30 min, ou >30 min de trajet vers le VCCT le plus proche.

RÉSULTATS : Parmi les 1017 patients TB n'ayant pas été testés préalablement pour le VIH, 708 (70%) ont fait l'objet d'un test VIH. Sur les 481 patients sans VCCT sur place, 297 (62%) ont subi un test VIH, par comparaison à 410 (77%) des 535 patients TB disposant d'un VCCT sur place (RR 0,6% ; IC95% 0,5–0,7). Lorsque le site du VCCT se situe à >15 min du dispensaire TB, le test VIH n'a eu lieu qu'à une fréquence moitié moindre par rapport aux cas où le VCCT est disponible sur place.

CONCLUSION : Les patients TB traités dans des polycliniques sans test VIH disponible sur place ou à proximité font l'objet de tests VIH moins fréquents. Rendre plus disponible le test VIH pour les patients TB sans imposer un voyage vers un site de test VIH éloigné est susceptible d'améliorer les taux de tests VIH.

RESUMEN

MARCO DE REFERENCIA : Provincia de Banteay Meanchey, Camboya.

OBJETIVO : Camboya exhibe la más alta incidencia de tuberculosis (TB) en Asia. No todos los pacientes con TB reciben la prueba diagnóstica del virus de la inmunodeficiencia humana (VIH). Se evaluó la repercusión de la distancia entre el consultorio de TB y los centros de diagnóstico del VIH, sobre los índices de aplicación de la serología.

MÉTODOS : Se analizaron los datos de pacientes con diagnóstico reciente de TB en 11 consultorios con el fin de determinar la proporción de pacientes en quienes se practicó la prueba serológica del VIH. Las categorías de los consultorios de TB fueron : consultorio con centro integrado de orientación y diagnóstico voluntario del VIH (VCCT), o a <15 min, entre 15 y 30 min y a >30 min de distancia en automóvil del centro VCCT más próximo.

RESULTADOS : Se practicó la prueba serológica del VIH en 708 (70%) de los 1017 pacientes tuberculosos que no contaban con ella. De los 481 pacientes de consultorios sin VCCT integrado, 297 (62%) contaban con la prueba del VIH, comparados con 410 (77%) de los 535 pacientes tuberculosos de consultorios que contaban con VCCT (RR 0,6 ; IC95% 0,5–0,7). Cuando el VCCT se encontraba a >15 min del consultorio de TB, la proporción de pacientes con prueba del VIH disminuyó de 50%, en comparación con los pacientes de consultorios con VCCT.

CONCLUSIÓN : Los pacientes tuberculosos tratados en consultorios que no cuentan con un centro diagnóstico del VIH integrado o en sus cercanías, reciben con menor frecuencia la prueba diagnóstica de VIH. El suministro de la prueba VIH a los pacientes tuberculosos, sin la necesidad de desplazamiento hasta un centro distante, puede aumentar las tasas de aplicación de la serología del VIH.