HIV testing and Counselling Among Tuberculosis Suspected Patients in Kassala State, Sudan: A Determinant Study

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Abstract

**Background:** Acceptance and use of HIV Testing and Counselling (HTC) services of Tuberculosis (TB) suspected patients is low, which limit the opportunities of detecting those in need of HIV treatment and care. This study aimed to assess the psychosocial beliefs related to intention to use HTC services among TB suspected patients and the relevance of these beliefs for behaviour change intervention in Sudan.

**Methods:** TB suspected patients (N= 383) completed a cross-sectional questionnaire from five separate TB facilities. The questionnaire was based on the Reasoned Action Approach (RAA) model. Eligibility criteria included attending Tuberculosis Management Units (TBMUs) in Kassala State as suspected TB patients and aged 18-64 years. A Confidence Interval Based Estimation of Relevance (CIBER) analysis approach was employed to investigate the effects of beliefs on the intention to use HTC services and to establish their relevance regarding interventions.

Result: The CIBER results showed the beliefs included in the study accounted for 59% to 70% of the variance in intention to use HTC services. The participants' beliefs "My friends think I have to use HTC services" is highly relevant for behaviour change interventions because it had a relatively low average score and is strongly associated with intention to use HTC services. The belief "If I would fear to be stigmatized if I get HIV positive result " on average had a relatively high score. It was negatively associated with intention to use HTC services, so it is highly relevant for intervention development. The "Health care providers will keep my HIV test result confidential " belief was positively associated with intention to use HTC services with an average score on the middle at the scale and needs reinforcement in interventions. The mean score of the belief "I could have the cost to reach HTC services " was in the middle of the scale but it was not associated with intention and therefore is not a variable to be targeted for interventions.

**Conclusion:**

The study revealed that the relevance of salient beliefs of intention to use HTC services varies among TB suspected patients. It is essential to develop interventions to enhance the intention to use HTC services based on beliefs (sub-determinants) that are most relevant.

**Background**

Human Immunodeficiency Virus (HIV) is considered a common cause of morbidity and mortality among individuals infected with tuberculosis (TB)(1, 2). Globally in 2018, it was estimated that 81 million TB cases are attributable to HIV infection, and it accounted for 251 thousands of TB deaths(3). In Sudan where TB is an endemic disease, the estimated prevalence of TB was 59/100,000 (TB survey, 2014) with a co-infection rate of 2.3 per 100,000 people in 2019 (4), in contrast to a consistent low HIV prevalence below 1% among the general population (5). The death rate among Sudanese TB co infected cases increased by 29% between 2018 (6) and 2019(3). Without an early diagnosis of HIV infections among this group, the death of co infected patients cannot be reduced.
To facilitate early detection of TB-HIV infected patients, the World Health Organization (WHO) recommends provider-initiated HIV testing and counselling (PITC) for diagnosed and suspected TB patients (7, 8). According to these recommendations, healthcare providers offer HIV testing to patients attending TB health facilities as a standard part of their medical care, with the right to refuse if they do not want to be tested (9). The TB suspect is any patient who presents with symptoms suggestive of TB (i.e., productive cough for two weeks or more, fever) (10, 11).

Prevalence of HIV infection appears to be quite high among TB suspected patients. For instance, in an Ugandanian study among TB suspected patients, an HIV prevalence of 42% was reported (12). Also, a study from Kenya found a prevalence of 63% among TB suspected patients (13). Although evidence had shown that HIV testing among TB suspects is acceptable when offered (13, 14), most TB suspected patients are not tested for HIV (13). Consequently, a large proportion of the TB suspects remains unaware of their HIV status.

In Sudan, Tuberculosis Management Units (TBMUs) which are distributed across the country, serve as a referral point for patients with TB suggestive symptoms. The TBMUs provide diagnosis services for all TB suspects and case management for those who receive a TB diagnosis (10). Since 2009, most of these facilities offer HIV testing service to their clients (15) and link HIV infected patients to HIV treatment and care facilities. Despite the quite high number of TB suspected patients attending TBMUs, which exceeds thirty thousand, testing has been limited only to TB patients rather than all TB suspects. However, there are no data on the acceptance rates of HIV testing among Sudanese TB suspected patients.

To increases HIV testing rates among TB suspected patients, it is required to understand the factors that may influence suspected patients' decision to test or not to test for HIV at their initial contact with TBMUs. Some evidence has highlighted the importance of psychological factors on HIV-testing behaviour (16). They included perception of HIV infection risk (17–20), fear of Acquired Immune Deficiency Syndrome (AIDS)-related stigma (21, 22), social support from family and friends (23–25), confidentiality concerns (26, 27), perceived susceptibility (25), and attitude towards HIV-testing (28, 29), as well as perceived behavioural control and intention to test (29, 30). Also, HIV-related knowledge may influence HIV testing behaviour (31, 32).

Psychological theories have shown to be useful in interpreting and predicting many health behaviours (33, 34), including HIV testing behaviour (29, 30). Also, they provide a base to develop effective interventions to increase the use of HIV testing (35, 36).

Many of these theories, including the Reasoned Action Approach (RAA) (37), propose that intention is the most proximal determinant of performing a particular behaviour (37, 38). The intention is predicted by other factors, including attitude, which is about evaluating the benefits of performing the behaviour (39), subjective norms, or the social pressure on the person to do or not to do the behaviour, and perception of control over doing the behaviour (40, 41). The attitude, subjective norms and perceived behavioural control are a function of behavioural beliefs, normative beliefs, and control beliefs, respectively (40, 42–
44). Also, the RAA-model can include other factors which may influence engaging in behaviour such as HIV risk perception and past experiences(45).

There is a lack of information on psychosocial (sub-) determinants of HIV testing behaviour among suspected TB patients in Sudan. This study employed the RAA-model to explore the psychosocial beliefs regarding HIV-testing intention and to assess their relevance for future behaviour change interventions for TB suspected patients in Kassala State, Sudan.

**Methods**

The study is reported along with the STROBE Statement for reporting observational studies(46).

**Study design and settings**

A cross-sectional survey was conducted among TB suspects in Kassala State, which is one of the 18 states of Sudan. It is located in the Eastern part of the country, extended over an area of 42,282 kilometres divided into 11 localities. The total estimated population in 2018 was 2.5 million and consisted of multi-ethnic communities. At least 70% of the state's population is living in rural areas, and the TB disease is endemic in the state. There are 22 TBMUs that receive all TB suggestive cases in the state who require sputum smear microscopic examination for Mycobacterium bacilli(47) and TB treatment.

The ethical approval for the study was obtained from the Research Ethics Committee in the Kassala State Ministry of Health. Also, selected study sites provided permission to access participants' information.

**Data Collection And Participants**

Trained data collectors gathered the study-related data using a structured questionnaire. The questionnaire was formulated in line with the RAA-model, previous studies(48–52) and results of an elicitation study(53). The elicitation study included 20 participants from the study population, and they were asked to list the advantages, disadvantages, the people who would approve or disapprove of testing, and the possible factors that might facilitate or impede their HIV testing in the next three months. Seventeen beliefs were included in the questionnaire.

The study was carried out from July 2017 to February 2018 in five randomly selected TBMUs. Eligibility criteria were TB suspects referred to TBMUs for TB diagnosis and who were aged 18 years and above. The survey instrument was piloted before the start of the study.

An in-site systematic sampling approach(54) was employed to recruit potential participants. Potential participants were randomly chosen from the clinic registers. Any participant that refused to participate was replaced by the immediate next one until reaching the required sample size. Data collectors informed participants about the study objectives and data confidentiality before they were enrolled in the study. All
participants provided informed consent before they were asked to answer the questionnaire in a private room.

**Variables And Measurements**

In this study, the outcome variable was the intention to use HTC services in TBMUs in Kassala State in the next three months. The explanatory variables were behavioural beliefs, normative beliefs, control beliefs, risk perception regarding HIV testing in the same context and time. Also, past exposure to HIV testing information was measured.

Sociodemographic characteristics were assessed by six questions on age, gender, residence, marital status, level of education, and working status. Five structured questions about HIV and HTC related-knowledge were used to determine the level of knowledge among the participants. The response options for each question were yes, no, and I don't know. The answers were coded as 1 for 'yes' and 0 for 'no' or 'don't know'.

The intention to use HTC services was measured by three items which were: I intent, I expect, and I want to use HTC services in the next three months and were measured on a 7-point scale. The higher score indicated a more positive intention.

The behavioural beliefs were measured by asking the participants to rate five statements regarding using HTC services in the next three months. The statements were: "I will Know my HIV status", "Facilitates my treatment if I have positive test result", "I could prevent infecting my family from HIV infection", "I would feel worries about HIV test result", and "I would have information about HIV infection". The participants replied on a seven-point Likert scale ranging from 1(unlikely) to 7, likely). The normative beliefs were evaluated by asking the respondents to indicate the extent to which their friends, doctor, partner, and parent thought they should use HTC services in the next three months. The participants answered on a seven-point Likert scale (with disagree (1) and agree (7) as anchors).

The control beliefs, assessed by five items: "Health care providers will keep my HIV test result confidential", "I would fear to be stigmatized if I get HIV positive result", "I would fear losing my partner if I infected with HIV infection", "I would find it difficult to disclose my HIV positive result to others", and "I could have the cost to reach HTC services". Responses were on a seven-point unipolar (unlikely (1) -likely (7)) scale.

Two items assessed the perceived HIV risk: "I think I myself may be infected with HIV infection", and "I think my partner may be infected with HIV infection" scored on a seven points (disagree(1)-agree(7)) scale.

Previous exposure to HIV testing information was measured by one item: "In the last year I had experience with HTC services" In the last year I had experience with HTC services", responses ranged from disagree (1) to agree (7).
Social desirability bias is a potential problem in a self-reported questionnaire, particularly when examining a sensitive behaviour (55). To reduce the impact of the social desirability bias, we used well-trained data collectors and each participant was assured about the confidentiality of the information he would provide. Participants were asked to sit in a private room to complete the questionnaire.

Sample Size

The sample size for the study was planned for correlation analysis, with a 95% confidence interval (56). For a correlation of .05 with 95% confidence interval width of .10, the required sample size was 383 participants.

Analysis

For descriptive statistics, frequencies and proportions were computed for the sociodemographic variables. Averages were calculated for age and knowledge about HTC and HIV

A Confidence Interval Based Estimation of Relevance (CIBER) analytical approach was used to assess whether beliefs were relevant to the dependent variable in terms of intervention development (57). The CIBER is a useful approach that helps in visualizing a univariate distribution of each sub-determinant, their association with the outcome variable and confidence interval of both in one plot. It uses a diamond shape with fills colour. The left-hand panel diamonds represent each sub-determinants' mean and its 99.99% confidence interval. The diamond fill colour provides more information about the item means: redder colour stands for lower means, blue colour for middle scale means and green colour for a higher item means. The right-hand diamonds are indicative of the association with a 95% confidence interval. The diamonds fill colours indicate association strength and direction: the redder colour of the diamond indicates a stronger and more negative association, greyer colour shows a weaker association and greener colour indicates a strong and more positive association. Also, the CIBER provides the confidence interval of the explained variance ($R^2$) in the outcome variable based on sub-determinants (beliefs) that were included in the analysis. Data analyses were conducted using R version 3.6.1 (58) and Statistical Package for Social Sciences (SPSS) version 21 for analysis.

Results

In total, 383 of TB suspected patients attending TBMUs in Kassala took part in this study of whom fifty-eight percent were male, and 42% were female. The sociodemographic characteristics of the participants are shown in Table 1. The participants mean age was 41.2 (SD = 11.6) years. Men and women in the age group 44 to 49 and 50 to 54 represented 33% of the participants. Less than 9% were from the age group 55 years and more. Of the participants, 44.1% were married. Thirty-seven percent of the respondents were illiterate, 39% had primary education, and 23% had secondary or higher education. Fifty-three percent of the participants reported they were non-working. The participants were from Kassala Locality (29.5%), New Halfa Locality (27.4%), Khashm Elgriba locality (24.5%), and WadElheliw Locality (18.5%). The mean
score of five questions on knowledge about HIV and HTC services was 3.2 (SD = 1.2) with 231 (60.3%) of the participants having scored equal or above the mean.

Figure 1 shows the output of the CIBER analysis. The statements in the left were used to assess the beliefs (sub-determinants) each statement anchors are displayed on both sides of the left-hand panel. The Diamonds in the left-hand panel represent the mean of beliefs regarding HIV testing within a 99.99% confidence interval. Diamonds in the right-hand panel show the association of those beliefs with the intention to use HTC services with a 95% confidence interval, as mentioned earlier.

All beliefs included in the study explained between 59–70% of the variance in the intention to use HTC services among suspected TB patients.

The result shows that the items "If I use HTC services I will Know my HIV status", and "I could prevent infecting my family from HIV infection" have a positive association with the intention to use HTC services. Still, their scores are in the middle of the scale. The item "My using HTC services facilitates my treatment if I have positive test result" is positively associated with intention and its mean score is in the middle of the scale. The belief "If I use HTC services, I would feel worries about HIV test result", this belief is negatively associated with intention and scores around the middle of the scale.

The result also showed that the belief "If I use HTC services health care providers will keep my HIV test result confidential" is positively associated with intention and the scores are in the middle of the scale. The items: "If I use HTC services I would fear to be stigmatized if I get HIV positive result" and "If I use HTC services I would fear losing my partner if I infected with HIV infection" and also "I would find it difficult to disclose my HIV positive test result to others" showed a negative association with intention. Their scores appeared in the middle of the scale. Although the scores of the item "I could have the costs to reach HTC services" is in the middle of the panel, this belief is not associated with intention.

Regarding the perceived risk items: "I think I myself may be infected with HIV infection", and "I think my partner may be infected with HIV infection" are negatively associated with intention and the scores are distributed around the middle of the panel.

There was a weak positive association between the item "In the last, year, I had experience with HTC services" and intention. This belief scores in the middle of the scale.
| Variables                  | Number (%) |
|----------------------------|------------|
| **Gender**                 |            |
| Male                       | 221 (A%)   |
| Female                     | 162 (42.3%)|
| **Age Group**              | Mean 41.2 (± 11.6) |
| < 25 years                 | 36 (9.4%)  |
| 25–29 years                | 42 (10.9%) |
| 30–34 years                | 39 (10.3%) |
| 35–39 years                | 49 (12.8%) |
| 40–44 years                | 59 (15.4%) |
| 45–49 years                | 63 (16.4%) |
| 50–54 years                | 64 (16.7%) |
| ≥ 55 years                 | 31 (8.1%)  |
| **Marital status**         |            |
| Married                    | 169 (44.1%)|
| Divorce                    | 63 (16.4%) |
| Widow                      | 47 (12.3%) |
| Single                     | 104 (27.2%)|
| **Education level**        |            |
| Illiterate                 | 143 (37.3%)|
| Primary                    | 151 (39.4%)|
| Secondary or higher        | 89 (23.2%) |
| **Occupation Status**      |            |
| Non-working                | 204 (53.3%)|
| Employed workers           | 68 (17.7%) |
| Not employed workers       | 111 (28.9%)|
| **Residence per localities**|        |
| Variables                        | Number (%) |
|---------------------------------|------------|
| Kassala Locality                | 113 (29.5%)|
| New Halfa Locality              | 105 (27.4%)|
| WadElheliw Locality             | 71 (18.5%) |
| Khashm Elgriba Locality         | 94 (24.5%) |
| Knowledge about HIV infection and HTC services | Mean 3.2(± 1.2) |
|                                  | (Range 1–5) |

Figure 1: CIBER plot of psychosocial beliefs of intention to use HTC services of TB suspect patients in Kassala State (N=383)

**Discussion**

The results of the study show insight into the relevance of several psychosocial beliefs to be targeted for future behaviour change interventions among TB suspected patients in Kassala State, Sudan. The variance in the intention to use HTC services explained by the beliefs included in our study ranged between 59%-70%. This is quite high compared to the previous two studies, which showed explained variance in intention to use HIV testing of 27%(33) and 35%(59).

As shown by the CIBER results, intention to use HTC services was strongly associated with the beliefs "If I use HTC services, I will know my HIV status" among the study sample. Which means that intention to use HTC services is influenced by the participants’ desire to know their HIV status. This result fits in with findings from previous studies (60, 61) conducted among Canadian pregnant women and Ugandan rural men. The relatively high score of the participants on this scale would mean that they are already convinced that HIV testing helps them to know their status. Consequently, it is a relatively low relevant belief to be targeted with intervention and should mainly be reinforced.

Also, in our results, the belief " My using HTC services facilitates my treatment if I have a positive test result" appears to have a strong positive association with the intention to use HTC services. This finding is in line with a previous study (62), which reported that knowledge of getting treatment would facilitate testing. In terms of planning interventions, the relevance of this belief is relatively low because participants scored on the middle of the scale, meaning that participants are already convinced that using HTC facilitates getting treatment if they were infected. However, if included in an intervention, the focus should be on those who are not convinced with the belief that using HTC services facilitates their treatment. Furthermore, the intention appears to be positively associated with the belief " If I use HTC services, I could prevent infecting my family from HIV infection". It was cited in the previous study as a belief that may influence HIV testing intention(29). A middle-scored scale of this belief implies that roughly half of the participants are convinced that HIV testing makes it possible for them to prevent
infecting their families with HIV. This may be a result of their previous exposure to HIV testing interventions.

The study indicates a strong positive relationship between the statement "My friends think I have to use HTC services" with scores clustered in the low end of the scale. This combination suggests that this belief is highly relevant to be targeted in the intervention. In agreement with our result, a previous study indicated that friends might have an important role in individual intention to test. This is because an individual is more likely to discuss their concerns and decision regarding HIV test with their friends (23, 63). This implies that an intervention to enhance the intention to use HTC services of TB suspects may need to consider promoting awareness about the effects of HIV infection in the lives of the patient with TB among their most important social groups, such as friends.

Our study findings clearly showed a strong association between intention to use HTC services and the belief "If I use HTC services healthcare providers will keep my HIV test result confidential" which is in line with previous studies (64, 65). It is crucial to augment the skills of the health care providers in HIV testing and counselling services on confidentiality requirements (i.e., adherence to confidentiality standards) as well as to alleviate their clients fear regarding sharing of their HIV status (66, 67)

Also, this study showed that the belief "If I use HTC services I would fear to be stigmatized if I get HIV positive test result" had a strong negative association with the use of HTC intention. It scores was relatively clustered in the upper end of the scale, so there were a quite number of the participant who feared being stigmatized. This suggests that there may be a room to mitigating the stigmatized beliefs among suspected TB patients. The negative link between HIV related stigma and intention to be tested for HIV was reported in different studies (28, 68, 69). Also, the current study indicated that the beliefs "I think I may be infected with HIV infection", and "I think my partner may be infected with HIV infection" are negatively associated with intention to use HTC services. These findings are different from the results of a study from Tanzania (29), which reported no association between HIV risk perception and intention to seek HIV testing. In Sudan, there is a low-risk perception for getting an HIV infection as most of the individuals do not admit of an HIV infection in themselves, families and friend. This low perception together with prevailing HIV related stigma in the country (70) more likely prevent individuals from being tested for HIV. Partially, the low HIV risk perception may be explained by two reasons namely, lack of awareness about HIV infection and fear of HIV infection, which might make an individual avoid thinking about their risk of the disease. In that way, HIV-related stigma reduction interventions may contribute to increasing the risk perception among individuals. For an HIV-related stigma intervention to be effective, it should be guided by theory and evidence which provides insight into what are the specific values and beliefs that fuel HIV-related stigma (71) in the Sudanese context.

The results also suggest a weak association between the belief "In the last year, I had experience with HTC services" and intention to use HTC services, which makes it a relatively low relevant belief. This finding is contradicted by another study which reported no association between intention to be tested for HIV and past experiences and HIV testing intention (33). The past behaviour might predict future
behaviour (37, 40) and behavioural intention (72). However, this depends on whether the prior experience
with HIV testing was bitter or pleasant. The previous use of HTC services among this sample may be very
low, as indicated by the low HIV testing rates in the country.

This study has some limitations. No causal relationship between the dependent and independent
variables in this study can be drawn due to the cross-sectional study design. Also, the research focused
on the intention to use HTC services rather than actual testing. To translate intention to get tested for HIV
to action among this group, it is required to identify the facilitating factors, i.e., presence of HTC services
and the barriers (i.e., relevant HIV testing information, stigma) regarding HIV testing. Then adequately
targeted each of them to reduce intentions-behaviour gap.

Given the social norms regarding HIV, social desirability bias is likely to occur. We were assuring
participants about anonymity and confidentiality during data collection, and self-administered data
collection is more likely to reduce that bias. Despite this limitation, our study provides a base for a new
area of future research: investigating the relevance of sub-determinants of intention and behaviour in
Sudan.

In brief, the study results suggest that the intention to use HTC services is associated with various salient
beliefs (sub-determinants) which differ in term of relevance for interventions. The CIBER is a useful
approach to establish the relevance of salients beliefs (sub-determinants) of intention to use HTC
services that included in interventions that aim to promote intention to use HTC services among this
group. Further research is required to provide more insights into the relevance of the beliefs related to
intention to use HTC services among TB suspected patients in Sudan.

Abbreviations

| Abbreviation | Description                          |
|--------------|--------------------------------------|
| AIDS         | Acquired Immune Deficiency Syndrome  |
| CIBER        | Confidence Interval Based Estimation of Relevance |
| HIV          | Human Immunodeficiency Virus         |
| HTC          | HIV Testing and Counselling          |
| PITC         | Provider-initiated HIV testing and counselling |
| RAA          | Reasoned Action Approach             |
| STROBE       | STrengthening the Reporting of OBservational studies in Epidemiology |
| TB           | Tuberculosis                         |
| TBMUs        | Tuberculosis Management Units        |
| WHO          | World Health Organization            |
Declarations

Ethics approval and consent to participate

The ethical approval for the study was obtained from the Research Ethics Committee in the Kassala State Ministry of Health. All participants provided written consent before included in the study.

Consent for publication

Not applicable

Availability of data and materials

The datasets of this study are available from the corresponding author on request.

Competing interests

No competing interest is declared

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Authors' contributions

The AI, RC, and HV-B develop the study idea and design, AI, collected the data. All the authors analyzed and interpreted the study results and prepared the manuscript. They reviewed and approved the final manuscript.

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Authors' information (optional)

References

1. Saraceni V, King B, Cavalcante S, Golub JE, Lauria L, Moulton LH, et al. Tuberculosis as primary cause of death among AIDS cases in Rio de Janeiro, Brazil. Int J Tuberc Lung Dis. 2008;12(7):769–72.

2. Lawn SD, Harries AD, Anglaret X, Myer L, Wood R. Early mortality among adults accessing antiretroviral treatment programmes in sub-Saharan Africa. AIDS (London, England). 2008;22(15).

3. WHO. Global Tuberculosis Report 2019. Geneva: World Health Organization; 2019.
4. Organization WH. Sudan TB country profile 2018. Geneva World Health Organization; 2018; Available from: https://extranet.who.int/sree/Reports?op=Replet&name=/WHO_HQ_Reports/G2/PROD/EXT/TBCountryProfile&ISO2=SD&outtype=html.

5. UNAIDS. Sudan. Global AIDS Response Progress Reporting 2012–2013. Khartoum, Sudan: Sudan federal ministry of health, 2014.

6. WHO. Global tuberculosis report 2018. Geneva: World Health Organization; 2018.

7. Organization WH. WHO policy on collaborative TB/HIV activities: guidelines for national programmes and other stakeholders. Geneva: World Health Organization; 2012.

8. UNAIDS WU. WHO policy statement on HIV testing. Geneva: UNAIDS; 2004.

9. HIV/AIDS WNJPo. Guidance on provider-initiated HIV testing and counselling in health facilities. Geneva: World Health Organization; 2007.

10. El-Sony A, Enarson D, Khamis A, Baraka O, Bjune G. Relation of grading of sputum smears with clinical features of tuberculosis patients in routine practice in Sudan. Int J Tuberc Lung Dis. 2002;6(2):91–7.

11. De Cock KM, Odhiambro J. HIV testing in patients with TB. Tropical doctor. 2006;36(2):71–3.

12. Srikantiah P, Lin R, Walusimbi M, Okwera A, Luzze H, Whalen C, et al. Elevated HIV seroprevalence and risk behavior among Ugandan TB suspects: implications for HIV testing and prevention. The international journal of tuberculosis lung disease. 2007;11(2):168–74.

13. Odhiambro J, Kizito W, Njoroge A, Wambua N, Nganga L, Mbuku M, et al. Provider-initiated HIV testing and counselling for TB patients and suspects in Nairobi, Kenya. Int J Tuberc Lung Dis. 2008;12(3):63-S8.

14. Achanta S, Kumar AM, Nagaraja SB, Jaju J, Shamrao SRM, Uppaluri R, et al. Feasibility and effectiveness of provider initiated HIV testing and counseling of TB suspects in Vizianagaram district, South India. PLoS ONE. 2012;7(7):e41378.

15. Abdallah TM, Ali AA, Adam I. Provider-initiated HIV testing and counseling among tuberculosis patients in Kassala, Eastern Sudan. J Infect Public Health. 2012;5(1):63–6.

16. Evangeli M, Pady K, Wroe AL. Which psychological factors are related to HIV testing? A quantitative systematic review of global studies. AIDS Behav. 2016;20(4):880–918.

17. 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(1):81–8.

18. Råssjö E-B, Darj E, Konde-Lule J, Olsson P. Responses to VCT for HIV among young people in Kampala, Uganda. African Journal of AIDS Research. 2007;6(3):215–22.

19. de Paoli MM, Manongi R, Klepp KI. Factors influencing acceptability of voluntary counselling and HIV-testing among pregnant women in Northern Tanzania. AIDS Care. 2004;16(4):411–25. Epub 2004/06/19.
20. Ayenew A, Leykun A, Colebunders R, Deribew A. Predictors of HIV testing among patients with tuberculosis in North West Ethiopia: a case-control study. PLoS ONE. 2010;5(3):e9702.
21. Daftary A, Padayatchi N, Padilla M. HIV testing and disclosure: a qualitative analysis of TB patients in South Africa. AIDS care. 2007;19(4):572–7.
22. Meiberg AE, Bos A, 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(2):49–54.
23. Denison JA, McCauley A, Dunnett-Dagg W, Lungu N, Sweat M. The HIV testing experiences of adolescents in Ndola, Zambia: do families and friends matter? AIDS care. 2008;20(1):101–5.
24. Nuwaha F, Kabatesi D, Muganwa M, Whalen C. Factors influencing acceptability of voluntary counseling and testing for HIV in Bushenyi district of Uganda. East Afr Med J. 2002;79(12):626–32.
25. Creel AH, Rimal RN. Factors related to HIV-testing behavior and interest in testing in Namibia. AIDS care. 2011;23(7):901–7.
26. Urassa P, Gosling R, Pool R, Reyburn H. Attitudes to voluntary counselling and testing prior to the offer of nevirapine to prevent vertical transmission of HIV in northern Tanzania. AIDS care. 2005;17(7):842–52.
27. Bwambale FM, Ssali SN, Byaruhanga S, Kalyango JN, Karamagi CA. Voluntary HIV counselling and testing among men in rural western Uganda: implications for HIV prevention. BMC Public Health. 2008;8(1):263.
28. Kalichman SC, Simbayi LC. HIV testing attitudes, AIDS stigma, and voluntary HIV counselling and testing in a black township in Cape Town, South Africa. Sex Transm Infect. 2003;79(6):442–7.
29. Mtenga SM, Exavery A, Kakoko D, Geubbels E. Social cognitive determinants of HIV voluntary counselling and testing uptake among married individuals in Dar es Salaam Tanzania: Theory of Planned Behaviour (TPB). BMC Public Health. 2015;15(1):213.
30. Kakoko DC, Astrom AN, Lugoe WL, Lie GT. Predicting intended use of voluntary HIV counselling and testing services among Tanzanian teachers using the theory of planned behaviour. Soc Sci Med. 2006;63(4):991–9.
31. Teklehaimanot HD, Teklehaimanot A, Yohannes M, Biratu D. Factors influencing the uptake of voluntary HIV counseling and testing in rural Ethiopia: a cross sectional study. BMC Public Health. 2016;16(1):239.
32. Ali A, Osman E. Factors influencing HIV voluntary counseling and testing (Vct) among pregnant women in Kassala, Eastern Sudan. J Women's Health Care. 2014;3(198):2167–0420.
33. Abamecha F, Godesso A, Girma E. Predicting intention to use voluntary HIV counseling and testing services among health professionals in Jimma, Ethiopia, using the theory of planned behavior. Journal of multidisciplinary healthcare. 2013;6:399.
34. Ajzen I, Albarracin D, Hornik R. Prediction and change of health behavior: Applying the reasoned action approach. 2nd ed. New York: Psychology Press; 2012.
35. Ajzen I. Behavioral interventions based on the theory of planned behavior. 2002; Available from: https://people.umass.edu/aizen/pdf/tpb.intervention.pdf.
36. Fishbein M. The role of theory in HIV prevention. AIDS care. 2000;12(3):273–8.
37. Fishbein M, Ajzen I. Predicting and changing behavior: The reasoned action approach: Taylor & Francis; 2012.
38. Ajzen I, Madden TJ. Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. J Exp Soc Psychol. 1986;22(5):453–74.
39. Ajzen I. From intentions to actions: A theory of planned behavior. Action control: Springer; 1985. pp. 11–39.
40. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179–211.
41. Conner M, Armitage CJ. Extending the theory of planned behavior: A review and avenues for further research. Journal of applied social psychology. 1998;28(15):1429–64.
42. Ajzen I. Nature and operation of attitudes. Ann Rev Psychol. 2001;52(1):27–58.
43. Ajzen I. The theory of planned behavior: reactions and reflections. Taylor & Francis; 2011.
44. Ajzen I, Fishbein M. The influence of attitudes on behavior. The handbook of attitudes. 2005;173(221):31.
45. Omer S, Haidar J. Applicability of the theory of planned behavior in predicting intended use of Voluntary HIV Counseling and Testing services among teachers of Harari Region, Ethiopia. Ethiopian Journal of Health Development. 2010;24(2).
46. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Ann Intern Med. 2007;147(8):573–7.
47. El-Sony A, Khamis A, Enarson D, Baraka O, Mustafa S, Bjune G. Treatment results of DOTS in 1797 Sudanese tuberculosis patients with or without HIV co-infection. Int J Tuberc Lung Dis. 2002;6(12):1058–66.
48. Abamecha F, Godesso A, Girma E. Intention to voluntary HIV counseling and testing (VCT) among health professionals in Jimma zone, Ethiopia: the theory of planned behavior (TPB) perspective. BMC Public Health. 2013;13(1):140.
49. Ayodele O. The Theory of Planned Behavior as a Predictor of HIV Testing Intention. Am J Health Behav. 2017;41(2):147–51.
50. Corby NH, Jamner MS, Wolitski RJ. Using the theory of planned behavior to predict intention to use condoms among male and female injecting drug users. J Appl Soc Psychol. 1996;26(1):52–75.
51. Vermeer W, Bos AE, Mbwambo J, Kaaya S, Schaalma HP. Social and cognitive variables predicting voluntary HIV counseling and testing among Tanzanian medical students. Patient Educ Couns. 2009;75(1):135–40.
52. Westmaas AH, Kok G, Vriens P, Götz H, Richardus JH, Voeten H. Determinants of intention to get tested for STI/HIV among the Surinamese and Antilleans in the Netherlands: results of an online
survey. BMC Public Health. 2012;12(1):961.

53. Ajzen I. Constructing a theory of planned behavior questionnaire. 2011; Available from: https://people.umass.edu/aizen/pdf/tpb.measurement.pdf.

54. IDRC
   Designing and conducting health systems research projects
   Varkevisser CM, Pathmanathan I, Brownlee AT. Designing and conducting health systems research projects: IDRC; 2003.

55. Grimm P. Social desirability bias. Wiley international encyclopedia of marketing. 2010.

56. Moinester M, Gottfried R. Sample size estimation for correlations with pre-specified confidence interval. The Quantitative Methods for Psychology. 2014;10(2):124–30.

57. Crutzen R, Peters GY, Noijen J. Using Confidence Interval-Based Estimation of Relevance to Select Social-Cognitive Determinants for Behavior Change Interventions. Front Public Health. 2017;5:165.

58. Team RC. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing. 2019; Available from: URL https://www.R-project.org.

59. Ayodele O. The theory of planned behavior as a predictor of HIV testing intention. Am J Health Behav. 2017;41(2):147–51.

60. Sherr L, Lopman B, Kakowa M, Dube S, Chawira G, Nyamukapa C, et al. Voluntary counselling and testing: uptake, impact on sexual behaviour, and HIV incidence in a rural Zimbabwean cohort. AIDS. 2007;21(7):851–60. Epub 2007/04/07.

61. Iqbal S, De Souza LR, Yudin MH. Acceptability, predictors and attitudes of Canadian women in labour toward point-of-care HIV testing at a single labour and delivery unit. Canadian Journal of Infectious Diseases Medical Microbiology. 2014;25(4):201–6.

62. Weiser SD, Heisler M, Leiter K, Percy-de Korte F, Tlou S, DeMonner S, et al. Routine HIV testing in Botswana: a population-based study on attitudes, practices, and human rights concerns. PLoS medicine. 2006;3(7).

63. Denison JA, McCauley AP, Dunnett-Dagg WA, Lungu N, Sweat MD. HIV testing among adolescents in Ndola, Zambia: how individual, relational, and environmental factors relate to demand. AIDS Education Prevention. 2009;21(4):314–24.

64. Kipp W, Kabagambe G, Konde-Lule J. HIV counselling and testing in rural Uganda: communities’ attitudes and perceptions towards an HIV counselling and testing programme. AIDS care. 2002;14(5):699–706.

65. De Paoli MM, Manongi R, Klepp K-I. Factors influencing acceptability of voluntary counselling and HIV-testing among pregnant women in Northern Tanzania. AIDS care. 2004;16(4):411–25.

66. Dalal S, Lee C-w, Farirai T, Schilsky A, Goldman T, Moore J, et al. Provider-initiated HIV testing and counseling: increased uptake in two public community health centers in South Africa and implications for scale-up. PLoS ONE. 2011;6(11).
67. Fylkesnes K, Haworth A, Rosensvård C, Kwapa PM. HIV counselling and testing: overemphasizing high acceptance rates a threat to confidentiality and the right not to know. Aids. 1999;13(17):2469–74.

68. Smith RA, Morrison D. The impact of stigma, experience, and group referent on HIV risk assessments and HIV testing intentions in Namibia. Soc Sci Med. 2006;63(10):2649–60.

69. Babalola S. Readiness for HIV testing among young people in northern Nigeria: the roles of social norm and perceived stigma. AIDS Behav. 2007;11(5):759–69.

70. Mohamed BA, Mahfouz MS. Factors associated with HIV/AIDS in Sudan. BioMed research international. 2013;2013.

71. Bos AE, Schaalma HP, Pryor JB. Reducing AIDS-related stigma in developing countries: The importance of theory-and evidence-based interventions. Psychology Health Medicine. 2008;13(4):450–60.

72. Hagger MS, Chatzisarantis N, Biddle SJ. The influence of self-efficacy and past behaviour on the physical activity intentions of young people. Journal of sports sciences. 2001;19(9):711–25.

**Figures**
### Means and associations (r) with Intention to get tested for HIV (R² = [0.59; 0.70]) in next three months

| Statement                                                                 | Unlikely | Likely |
|---------------------------------------------------------------------------|----------|--------|
| 1. If I use HTC services I will know my HIV status                        |          |        |
| 2. My using HTC services facilitates my treatment if I have a positive test result |          |        |
| 3. If I use HTC services I could prevent infecting my family from HIV infection |          |        |
| 4. If I use HTC services I would feel worried about the test result        |          |        |
| 5. If I have used HTC services I would have information about HIV infection |          |        |
| 6. My friends think I have to use HTC services                            |          |        |
| 7. My doctor thinks I should use HTC services                             |          |        |
| 8. My partner thinks I should use HTC services                             |          |        |
| 9. My parent thinks I should use HTC services                              |          |        |
| 10. If I use HTC services the Healthcare providers will keep my HIV-test result confidential |          |        |
| 11. If I used HTC services I would fear to be stigmatized if I get HIV positive test result |          |        |
| 12. If I use HTC services I would fear losing my partner if I infected with HIV |          |        |
| 13. If I use HTC services I would find it difficult to disclose my HIV positive test result to others |          |        |
| 14. I think I could have the cost to reach HTC services                    |          |        |
| 15. I think I myself may be infected with HIV infection                    |          |        |
| 16. I think my partner may be infected with HIV infection                  |          |        |
| 17. In the last year I had experience with HTC services                    |          |        |

**Figure 1**

CIBER plot of psychosocial beliefs of intention to use HTC services of TB suspect patients in Kassala State (N=383)

**Supplementary Files**
This is a list of supplementary files associated with this preprint. Click to download.

- Questionnaire.docx