

Relevant beliefs for HIV Testing and Counselling Services among Tuberculosis Suspected patients in Kassala State, Sudan

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Abstract

Background: There is limited information about the psychosocial (sub-) determinants regarding the use of HIV Testing and Counselling (HTC) services among Tuberculosis(TB) suspected patients in Sudan. This study aimed to assess the psychosocial beliefs related to the intention to use HTC services among TB suspected patients and to establish the relevance of these beliefs for developing behaviour change interventions.

Methods: TB suspected patients (N= 383) completed a cross-sectional questionnaire from four separate TB facilities. The questionnaire was based on the Reasoned Action Approach theory. Eligibility criteria included attending Tuberculosis Management Units 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 the beliefs on the intention to use the HTC services and to establish their relevance to be targeted in behaviour change interventions.

Results: 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 belief "My friends think I have to use the HTC services" was positively associated with the intent to use HTC, and it is highly relevant for interventions. The belief "If I would fear to be stigmatized if I get HIV positive result" was negatively related to the intention to use the HTC services and highly relevant belief. The belief "If I use HTC services, the health care providers will keep my HIV test result confidential" was strongly associated with the intention to use HTC services. However, it was not a very low relevant belief. Past experience with HTC services was weakly associated with the intention to use HTC services.

Conclusion: The intention to use HTC was a function of psychosocial beliefs. The belief investigated varied in their relevance for interventions designed to encourage the use of HTC services. Interventions to intention to use HIV testing and counselling services should address the most relevant beliefs (sub-determinants). Further study is needed to establish the relevance of sub-determinants of the intention to use HTC services.

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, TB infection is an endemic disease, a national TB survey in 2014, estimated the TB prevalence at 59/100,000 population. The incidence rate of TB patients with HIV was 2.3 per 100,000 people in 2019 [3]. The death rate of TB co-infected patients increased by 29% between 2018 and 2019 [3, 4]. The country has a low HIV prevalence [5]. Unless co-infected TB patients are diagnosed and treated early, death among them remains high.

To facilitate early detection of HIV infection among TB patients, the World Health Organization (WHO) recommends Provider-Initiated HIV Testing and Counselling (PITC) for diagnosed and suspected TB patients [6, 7]. The PITC is a practice in which health care providers offer HIV testing and counselling routinely to all patients presenting at the health facility; patients have the right to refuse testing if they do not want [8]. The TB suspected patients are those patients who are presenting with symptoms and signs of TB disease (i.e., productive cough for two weeks or more, fever) and require diagnosis [9, 10]. However, in Sudan, HIV testing and counselling is offered routinely to TB patients but not to TB suspected patients. The national policy dictates that HIV testing should be provided to TB patients; a policy evident in many countries with low HIV burden due to resources implications [11].

In Sudan, the diagnosis and management of TB are provided in Tuberculosis Management Units (TBMUs) which are distributed across the country [9]. In most TBMUs, the PITC was introduced in 2009 [12], and co-infected patients are referred for HIV related treatment and care. TB Program data showed that annually the number of TB suspected patients attending all TBMUs in Sudan exceeds thirty thousand. Evidence from low HIV prevalence countries, such as Sudan has indicated that the prevalence of HIV infection in TB suspected patients is high [13, 14]. The same is observed in African countries that reported a high HIV burden [15, 16].

Routine HIV testing of suspected TB patients offers an opportunity for early detection of HIV and treatment, and this is associated with decreased morbidity and mortality [17]. However, there are no data on the HIV testing rates of Sudanese TB suspected patients.

Different factors can influence the suspected TB patients' decision to test or not test for HIV at their initial encounter with TBMUs including lack of knowledge about HIV testing, no previous testing experience about HIV testing [18] confidentiality of HIV testing [19], training of health care provider and availability of HIV testing guidelines [16].

Furthermore, growing evidence suggests that HIV testing and counselling behaviour is predicted by social-cognitive factors such as subjective norms [20-22], attitude [23, 24], perceived behavioural control and intention [24, 25] regarding HIV testing, as well as risk perception [26-29] and perceived susceptibility of HIV infection [22].

Social cognitive theories are useful in understanding the (sub-) determinants of HIV testing behaviour [24, 25] and for developing an intervention to change the behaviour [30, 31]. Applying these theories to behaviour change programs may increase their potential to change HIV testing behaviour.

Reasoned Action Approach (RAA) [32] is one of the theories and proposes that intention is the most proximate determinant of performing a particular behaviour [32, 33]. The intention is predicted by three sub-determinants, including attitude, which is about evaluating the benefits of performing the behaviour [34], 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 [35, 36]. The attitude, subjective norms and perceived behavioural control are a function of behavioural beliefs, normative beliefs, and control beliefs,

respectively [35, 37-39]. Also, the RAA can be extended to include other factors which may influence engaging in HIV testing behaviour such as HIV risk perception and past experiences [40].

There is a lack of information on psychosocial sub-determinants regarding HIV testing behaviour among suspected TB patients in Sudan. This study employed the RAA to explore the psychosocial beliefs that influence the suspected TB patients' intention to use HTC services and to assess their relevance for interventions enhancing that intention in Kassala State, Sudan.

Methods

The study follows the STROBE Statement for reporting observational studies [41] guidelines.

Study design and settings

This was a cross-sectional study design and was conducted from July 2017 to February 2018, to assess the psychosocial beliefs related to the intention to use HTC services among suspected TB patients in Kassala State, Sudan. The Kassala State is one of the eighteen states of Sudan, situated in the eastern region of the country. The State is divided into eleven localities and extended over an area of 42,282 square kilometres. In 2018, the population of the State was estimated at 2.5 million based on the 2008 population census. According to reports in Kassala State TB program, the TB prevalence in the State was around 71 per 100000 population in 2018. The TB/HIV burden among TB patients appears to be high, with an estimated 18.6% of the TB patients being infected with HIV [12]. At the time of the study, twenty-two TBMUs were provided diagnostic services for TB suspected patients and treatment for TB patients. All TBMUs offered HTC services.

Study population and recruitment

A three-sampling stage was performed. The first stage was simple random sampling to select four localities from the sampling frame of all localities in Kassala State. The second stage was a selection of one TBMUs from each locality chosen by simple random sampling. A total of four TBMUs were selected. The third was in-site systematic sampling for selection of participants from each TBMUS where the first participant was randomly selected from the clinic registers. Then every third was interviewed using a constant numeric interval. The number of participants chosen for sampling from each TBMUs was proportional to the number of suspected TB patients attending that TBMU. Any participant who refused to participate for any reason was replaced by the immediate next one until we reached the required sample size. All the TB suspected patients who were attending TBMUs for diagnosis purposes during the study period were considered eligible for this study. We included patients suspected of TB whose age was 18-64 years in the selected TBMUs. A sample size of 383 participants was computed by sample estimation for correlation with pre-specified 95% confidence interval [42]. This sample size allows estimation of a correlation of .05 with a width of .10.

Study variables

The independent variable of in this study 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, and control beliefs regarding the use of HTC services in the TBMUs in the next three months, risk perception of HIV infection, and exposure to HTC services during the last year. Information regarding demographic and socioeconomic variables, including age, gender, residence, marital status, education, working, HIV and HTC related-knowledge, were also collected.

Data collection and Measurements

After attaining consent to participate in the study, trained data collector used a structured questionnaire to collect data from the participants. Uneducated participants were interviewed, and educated ones fill out the questionnaire by themselves.

The questionnaire was based on the RAA, previous studies [43-47] and results of the beliefs elicitation study [48] on the study population.

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 each measured on a 7-point Likert 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 HIV positive test result", "I could prevent infecting my family from HIV infection", "I would feel worries about my 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 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).

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

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

Previous exposure to HTC services was measured by one item:" In the last year I had an experience with HTC services". Responses were ranged from disagree (1) to agree (7).

Statistical analyses

Data analyses were carried out by R version 3.6.1 [49] and Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics of the participants demographic and socioeconomic characteristics were presented as frequencies and proportions. Averages were calculated for age and HIV and HTC related-knowledge. The relevance of all studied beliefs regarding the intention to use HTC was assessed by performing Confidence Interval Based Estimation of Relevance (CIBER) analysis [50].

The CIBER is a data visualization method which presents different information on

a diamond plot to facilitate selection of the sub-determinants for intervention. The diamond plot is divided into a left-hand panel and right-hand panels with diamonds. One diamond shape in the left-hand panel represents both the means of the sub-determinants (in this study, the beliefs regarding the use of the HTC services) and its 99.99% confidence interval. While each diamond in the right-hand panel presents the associations (e.g., correlation) between the beliefs and the outcome variable (In this study the intention to use HTC services) with a 95% confidence interval together. The dots around the left-hand panel diamonds are all the participants' item scores. The question used to assess each belief with its anchors is shown on the side of the left-hand panel. At the top, the plot provides the confidence interval of the explained variance (R^2) in the intention to use HTC services based on beliefs that are included in the analysis.

Results

Three hundred and eighty-three TB suspected patients are included in the study. The descriptive statistics of the study respondents are presented in Table 1. The mean age of the participants was 41.2 (± 11.6) years, and 221 (58%) were male. Among the study participants, 16.4% were in the age group 45 to 49 years, and 44.1% were married. Of the All study participants, 29.5% were from Kassala Locality, 27.4% from New Halfa Locality, 24.5% Khashm Elgriba locality, and 18.5% from WadElhelwi Locality. One hundred and forty-three (37.3%) of the participants were illiterate. Of the participants, 151 (39.4%) reported receiving primary education, and 89 (23.2%) said they had secondary or higher education. The majority of the participants were unemployed, 17% were employed, and 29% were self-employed. The mean score of knowledge about HIV infection and HTC services of the participants was 3.2 (± 1.2).

Figure 1 presents the results of the CIBER analysis. 59% to 70% of the variance in the intention to use HTC services among TB suspected patients was explained by the beliefs included in the study. The results show that participants beliefs regarding knowing their HIV status if they use HTC services scored in the middle of the scale, and it had a strong positive relationship with the intention to use HTC services. The mean of the participants who think that "health care providers keep their HIV test results confidential" was in the mid of the scale, and this belief a had positive and strong association with the intention to use HTC services. Also, the mean of the participants' belief that "using HTC services could prevent infecting their family from HIV infection" was roughly in the middle of the panel and had a strong positive

association with measurement of intention. The item scores of the belief "my friends think I have to use the HTC services" was relatively low; however, this belief was strongly associated with HTC services use related intention. The belief "My doctor thinks I should use the HTC services" was positively associated with the intention to use HTC services and had a low mean score. The mean score of the belief "My using HTC services facilitates my treatment if I have HIV positive test result" was relatively on the middle of the range, and this belief was strongly positively associated with the intention to use HTC services.

The participants on the average believed that if they use the HTC services, they would feel worried about their HIV test result are in the middle of the scale. However, this belief was negatively associated with the intention of the use of HTC services. The participants' belief regarding the "fear to be stigmatized if they get HIV positive test result", scored relatively in the middle of the scale and was negatively associated with the intention to use HTC services. The item scores of the beliefs "I think my partner or I may be infected with HIV infection" were negatively associated with intention to use HTC services and their means were in the middle of the scale. All participants who believed to have "difficulties in disclosing their HIV positive test result" scored in the middle of the scale, and this belief was negatively associated with the intention to use HTC services. As figure 1 shows, the mean score of the belief "If I use HTC services I would fear losing my partner if I have HIV positive test result" was in the middle of the scale and was negatively associated with the intention to use HTC services.

Also, our results show that the mean of the belief that "my parent thinks I should use HTC services" among the participants was relatively low. However, this belief was weakly associated with the intention to use HTC services. The mean of item "In the previous year, I had an experience with HTC services" was in the middle of the scale and also it weakly associated with the intention to use HTC services.

Participants believe that by using HTC services, they would "have information about HIV infection" scored in the centre of the scale and was not associated with the intention. The participants had a low average score regarding the costs to reach the HTC services, and the belief was not associated with the intention to use HTC services.

Discussion

Previous studies on TB suspects have focused on assessing the prevalence of HIV infection [15, 16] and feasibility [14] of HIV testing rather than investigating the psychosocial (sub-) determinants influencing the use of HTC services. This study purpose was to explore the psychosocial beliefs that influence the suspected TB patients' intention to use the HTC services and to assess their relevance for interventions to enhance HTC service-related intention among this group in Kassala State, Sudan.

The findings of our study suggest that several psychosocial beliefs seem to influence the intention of the TB suspected patients to use the HTC services and they vary in terms of their relevance to possible interventions promoting this intention among this group. In general, the variance in the intention to use HTC services explained by all beliefs included in our study ranged from 59% to 70%. This explained variance is higher in comparison to previous studies [51, 52].

Our analysis (Figure1) suggests a significant positive association between the intention to use the HTC and the participants' belief " If they use the HTC services, I will know my HIV status". This means that Sudanese TB suspected patients who hold this belief are more likely to intend to use the HTC services. The mid-scale scores for this belief indicate that almost half of the participants are already convinced that use of HTC services results in knowing their HIV status, and this may be due to the influence of previous exposure of the participants to HIV related interventions. The combination of the mid-scale of the belief scores and its strong positive association with the intention to use HTC services makes it a relatively low relevant belief for intervention. Knowing the HIV status is relevant for accepting the HIV test. This is supported by the result of a previous study conducted in different settings [53].

This study also, demonstrates a strong positive relationship between the belief "My friends think I have to use HTC services" and the intention to use HTC services. This association suggests that perception of TB suspects of what their friends think may have a great influence on their intention to utilize HIV counselling and testing services. The finding may be compared with the result of a previous study in which the effect of peer pressure on HIV testing was reported among adolescent [20]. The observed low mean of the belief score is another significant finding as it indicates that a large proportion of the study participants did not believe that their friends think they should do so. These findings make this a highly relevant belief. They suggest that the intention to use HTC services may improve by behaviour change interventions that target the interpersonal environment of TB suspected patients.

The belief "My using HTC services facilitates my treatment if I have a positive test result" was identified to be positively associated with the intention to use HTC services. Previous research[54]found that the availability of HIV treatment may influence the willingness of the individuals to test for HIV. In term of intervention development, the belief is relatively low relevant beliefs due to that the mean of the response scores in the middle of the scale. The mid-scale mean indicates that respondents are already convinced that using HTC services would help them to receive treatment if they were infected with HIV. This implies that this belief needs to be sustained or tailored to an intervention message to target those who are not convinced that HTC services assist them to have treatment if they have an HIV infection.

The belief " If I use HTC services, I could prevent infecting my family from HIV infection" was significantly associated with the intention to use HTC services, the relevance is low because the scores are in the middle of the scale, which indicates that most of the participants were convinced that by using HTC services they could prevent their families from HIV infection. The influence of the belief preventing family form HIV infection on use of HTC was also documented in a study among married individuals in Tanzania [24].

Our study finds a strong association between the belief "If I use the HTC services health care providers keep my HIV test result confidential" and the intention to use HTC services. The combination of the strong association and response scores distributed around the middle of the scale means this belief is of relatively low relevance. Interventions that increase belief in the confidentiality of the HIV test and test result are likely to improve HTC utilization [55-57]. Therefore, targeting this belief in interventions to

promote HTC services use intention would mean reinforcing it among the participants. Confidentiality is influenced by the characteristics of the HIV testing health providers [58]. Lack of training of the HTC providers and the HIV testing guidelines may result in compromising the confidentiality of HIV test and test result [58]. In another study [16] training of the health providers and availability of testing and counselling guidelines were suggested to mitigate the fear related to breach the confidentiality of test and testing result.

According to our study findings, the belief " If I use the HTC services I would fear to be stigmatized if I get HIV positive test result" was found to be strongly negatively associated with the intention to use HTC services. Response scores are in the upper part of the scale, which indicates that most of the participants believe that HIV infection is linked to stigma. Among Sudanese communities, HIV infection is commonly associated with stigma and discrimination [59]. These findings suggest that this belief is highly relevant and imply a need for change. Other studies describing stigma as a barrier for HIV testing [23, 60, 61] have been carried out in different settings.

Our study shows that the belief "I think I may be infected with HIV infection" was significantly and negatively associated with the intention to use HTC services. The fact that participants' scores are in the middle of the panel, suggesting that about half of the participants convinced they might be infected with HIV. The majority of the individuals in Sudan perceive themselves as not at risk of HIV infection [59], and this could be attributed to the low prevalence of HIV infection among the general population in the country [5]. However, the combination of the negative association and middle scale scores makes this belief a low relevant intervention target. A study among pregnant women reported that perception of susceptibility to HIV infection might be a reason to test for HIV [62].

The study demonstrates a weak correlation between the participants' previous experience concerning HTC, and the participants' scores are in the middle of the panel, meaning that quite a number of them had no prior experience. The past behaviour represents particular knowledge about the behaviour that individual hold, and it influences both intention and future behaviour [63]. A previous study among TB suspected patients suggested that past HIV testing may influence the uptake of HIV testing services [18]. However, the combination of the weak association and middle scale scores indicate a low relevance of this belief for intervention among our target group.

A number of limitations are present in our study; first, the use of a cross-sectional study design limited ability to establish causality. Future prospective research would be useful to establish causality. Secondly, the study focused on the intention to use HTC services rather than the actual use of the services. Therefore, future research on actual behaviour is needed. The third limitation was the self-reporting of all beliefs in the study and the intention in the study. However, explaining the study objectives to all participants and ensuring anonymity and confidentiality is expected to encourage them to provide honest and accurate responses.

The fourth limitation was that the participants with no education were interviewed in person so that they may tend to provide more socially acceptable answers. The familiarity of our data collectors with

participants characteristics and their understanding of the study objectives is anticipated to reduce this limitation.

Despite these limitations, our study findings highlight some relevant beliefs for developing intention enhancing intervention among suspected TB patients in Sudan and other countries with similar epidemiological and social contexts. Also, it provides a base for future researches on establishing the relevance of the sub-determinants to be targeted with interventions to promote the use of HTC services.

Conclusion

The psychosocial beliefs are important in understanding the intention to use HTC services and developing interventions to enhance that intention. The current study findings suggest that the intention to use HIV testing and counselling services was a function of different beliefs. The relevance of the beliefs for intervention development to enhance the intention to use HTC services differed. The beliefs "My friends think I have to use HTC services" and "fear to be stigmatized if I get HIV positive test result" were associated with intention and highly relevant beliefs for interventions development. However, the relevance of the beliefs of "confidentiality of test result" and "perceived personal risk for HIV infection" were relatively low. The belief "I will know my HIV status" was associated with the intention to use the HTC services, but it a low relevant belief for intervention. Past experience of HTC services was weakly associated with intention to use HIV testing and counselling services. Interventions targeted at promoting the intention to use HIV testing and counselling should address the most relevant beliefs (sub-determinants). Further study is needed to establish the relevance of sub-determinants of the intention to use HTC services.

Abbreviations

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 this study was acquired from the Kassala State Ministry of Health Research and Ethics Committee. Before the study, a written and verbal consent were obtained from educated and uneducated (illiterate) participants, respectively.

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 read and approved the final manuscript.

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References

1. Saraceni V, King B, Cavalcante S, Golub JE, Lauria L, Moulton LH, Chaisson RE, Durovni B: **Tuberculosis as primary cause of death among AIDS cases in Rio de Janeiro, Brazil.** *The International Journal of Tuberculosis and Lung Disease* 2008, **12**(7):769-772.
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.** In. Geneva: World Health Organization; 2019.
4. WHO: **Global tuberculosis report 2018.** In. Geneva: World Health Organization; 2018.

5. UNAIDS: **Sudan: Global AIDS Response Progress Reporting 2012–2013**. In. Khartoum, Sudan: Sudan federal ministry of health; 2014.
6. Organization WH: **WHO policy on collaborative TB/HIV activities: guidelines for national programmes and other stakeholders**: Geneva: World Health Organization; 2012.
7. UNAIDS WU: **WHO policy statement on HIV testing**. Geneva: UNAIDS 2004.
8. HIV/AIDS WNJPo: **Guidance on provider-initiated HIV testing and counselling in health facilities**. In: . . . Geneva: World Health Organization; 2007.
9. 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**. *The International Journal of Tuberculosis and Lung Disease* 2002, **6**(2):91-97.
10. De Cock KM, Odhiambo J: **HIV testing in patients with TB**. *Tropical doctor* 2006, **36**(2):71-73.
11. Nagai S, Robinson R, Rahamefy JR, Randriambeloson SJ, Ranaivomanana DA, Razafindranaivo T, Rakotobe L, Ranaivo A, Hinderaker SG, Harries AD: **Provider-initiated HIV testing and counselling for TB in low HIV prevalence settings: is it worthwhile?** *Trans R Soc Trop Med Hyg* 2014, **108**(3):173-175.
12. Abdallah TM, Ali AA, Adam I: **Provider-initiated HIV testing and counseling among tuberculosis patients in Kassala, Eastern Sudan**. *Journal of infection and public health* 2012, **5**(1):63-66.
13. Kumar AM, Gupta D, Kumar A, Gupta R, Kanchar A, Rao R, Shastri S, Suryakanth M, Rangaraju C, Naik B: **HIV testing among patients with presumptive tuberculosis: how do we implement in a routine programmatic setting? Results of a large operational research from India**. *PLoS ONE* 2016, **11**(5):e0156487.
14. Achanta S, Kumar AM, Nagaraja SB, Jaju J, Shamrao SRM, Uppaluri R, Tekumalla RR, Gupta D, Kumar A, Satyanarayana S: **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. Srikantiah P, Lin R, Walusimbi M, Okwera A, Luzzé H, Whalen C, Boom W, Havlir D, Charlebois E: **Elevated HIV seroprevalence and risk behavior among Ugandan TB suspects: implications for HIV testing and prevention**. *The international journal of tuberculosis and lung disease* 2007, **11**(2):168-174.
16. Odhiambo J, Kizito W, Njoroge A, Wambua N, Nganga L, Mburu M, Mansoor J, Marum L, Phillips E, Chakaya J: **Provider-initiated HIV testing and counselling for TB patients and suspects in Nairobi, Kenya**. *The International Journal of Tuberculosis and Lung Disease* 2008, **12**(3):S63-S68.
17. Schwarcz S, Richards TA, Frank H, Wenzel C, Chin Hsu L, Chin C-SJ, Murphy J, Dilley J: **Identifying barriers to HIV testing: personal and contextual factors associated with late HIV testing**. *AIDS Care* 2011, **23**(7):892-900.
18. Deribew A, Negussu N, Kassahun W, Apers L, Colebunders R: **Uptake of provider-initiated counselling and testing among tuberculosis suspects, Ethiopia**. *The international journal of tuberculosis and lung disease* 2010, **14**(11):1442-1446.
19. Munthali L, Mwaungulu J, Munthali K, Bowie C, Crampin A: **Using tuberculosis suspects to identify patients eligible for antiretroviral treatment**. *The international journal of tuberculosis and lung*

disease 2006, **10**(2):199-202.

20. 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):101-105.
21. Nuwaha F, Kabatesi D, Muganwa M, Whalen C: **Factors influencing acceptability of voluntary counseling and testing for HIV in Bushenyi district of Uganda.** *East African medical journal* 2002, **79**(12):626-632.
22. Creel AH, Rimal RN: **Factors related to HIV-testing behavior and interest in testing in Namibia.** *AIDS care* 2011, **23**(7):901-907.
23. 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):442-447.
24. 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.
25. 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):991-999.
26. 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):81-88.
27. 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):215-222.
28. 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):411-425.
29. 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.
30. **Behavioral interventions based on the theory of planned behavior**
[<https://people.umass.edu/aizen/pdf/tpb.intervention.pdf>]
31. Fishbein M: **The role of theory in HIV prevention.** *AIDS care* 2000, **12**(3):273-278.
32. Fishbein M, Ajzen I: **Predicting and changing behavior: The reasoned action approach** New York: Psychology Press; 2010.
33. Ajzen I, Madden TJ: **Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control.** *Journal of experimental social psychology* 1986, **22**(5):453-474.
34. Ajzen I: **From intentions to actions: A theory of planned behavior.** In: *Action control.* edn.: Springer; 1985: 11-39.
35. Ajzen I: **The theory of planned behavior.** *Organ Behav Hum Decis Process* 1991, **50**(2):179-211.
36. 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):1429-1464.

37. Ajzen I: **Nature and operation of attitudes.** *Annual review of psychology* 2001, **52**(1):27-58.
38. Ajzen I: **The theory of planned behaviour: reactions and reflections.** In.: Taylor & Francis; 2011.
39. Ajzen I, Fishbein M: **The influence of attitudes on behavior.** *The handbook of attitudes* 2005, **173**(221):31.
40. 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).
41. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandebroucke JP: **The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies.** *Ann Intern Med* 2007, **147**(8):573-577.
42. Moinester M, Gottfried R: **Sample size estimation for correlations with pre-specified confidence interval.** *The Quantitative Methods for Psychology* 2014, **10**(2):124-130.
43. 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.
44. Ayodele O: **The Theory of Planned Behavior as a Predictor of HIV Testing Intention.** *Am J Health Behav* 2017, **41**(2):147-151.
45. 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.** *Journal of Applied Social Psychology* 1996, **26**(1):52-75.
46. 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):135-140.
47. 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.
48. **Constructing a theory of planned behavior questionnaire**
[<https://people.umass.edu/aizen/pdf/tpb.measurement.pdf>]
49. **A language and environment for statistical computing.** Vienna, Austria: R Foundation for Statistical Computing [URL <https://www.R-project.org>]
50. 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.
51. 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.
52. Ayodele O: **The theory of planned behavior as a predictor of HIV testing intention.** *American Journal of Health Behavior* 2017, **41**(2):147-151.

53. 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.
54. Phakathi Z, Van Rooyen H, Fritz K, Richter L: **The influence of antiretroviral treatment on willingness to test: a qualitative study in rural KwaZulu-Natal, South Africa.** *African Journal of AIDS Research* 2011, **10**(2):173-180.
55. Mukolo A, Villegas R, Aliyu M, Wallston KA: **Predictors of late presentation for HIV diagnosis: a literature review and suggested way forward.** *AIDS and Behavior* 2013, **17**(1):5-30.
56. 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.
57. Elsheikh IE, Crutzen R, Van den Borne H: **Perceptions of Sudanese women of reproductive age toward HIV/AIDS and services for Prevention of Mother-to-Child Transmission of HIV.** *BMC public health* 2015, **15**(1):674.
58. Njau B, Ostermann J, Brown D, Mühlbacher A, Reddy E, Thielman N: **HIV testing preferences in Tanzania: a qualitative exploration of the importance of confidentiality, accessibility, and quality of service.** *BMC Public Health* 2014, **14**(1):838.
59. Mohamed BA, Mahfouz MS: **Factors associated with HIV/AIDS in Sudan.** *BioMed research international* 2013, **2013**.
60. 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):2649-2660.
61. Babalola S: **Readiness for HIV testing among young people in northern Nigeria: the roles of social norm and perceived stigma.** *AIDS and Behavior* 2007, **11**(5):759-769.
62. Maman S, Mbwambo J, Hogan N, Kilonzo G, Sweat M: **Women's barriers to HIV-1 testing and disclosure: challenges for HIV-1 voluntary counselling and testing.** *AIDS Care* 2001, **13**(5):595-603.
63. Sommer L: **The theory of planned behaviour and the impact of past behaviour.** *International Business & Economics Research Journal (IBER)* 2011, **10**(1).

Tables

Table 1 Demographic and Socioeconomic characteristics of the study participants (N=383)

Variables	Number (%)
Gender	
Male	221(58%)
Female	162 (42.3%)
Age Group	Mean 41.2 (\pm 11.6)
< 25years	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%)
\geq 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	
Unemployed	204 (53.3%)
Employed workers	68 (17.7%)
Self-employed workers	111 (28.9%)
Residence per localities	
Kassala Locality	113 (29.5%)
New Halfa Locality	105 (27.4%)
WadElhelwi Locality	71(18.5%)
Khashm Elgriba Locality	94(24.5%)
Knowledge about HIV infection and HTC services	Mean 3.2 (\pm 1.2)

Figures

Means and associations (r) with the intention to use HIV Testing and Counseling Services ($R^2=[0.59;0.70]$)

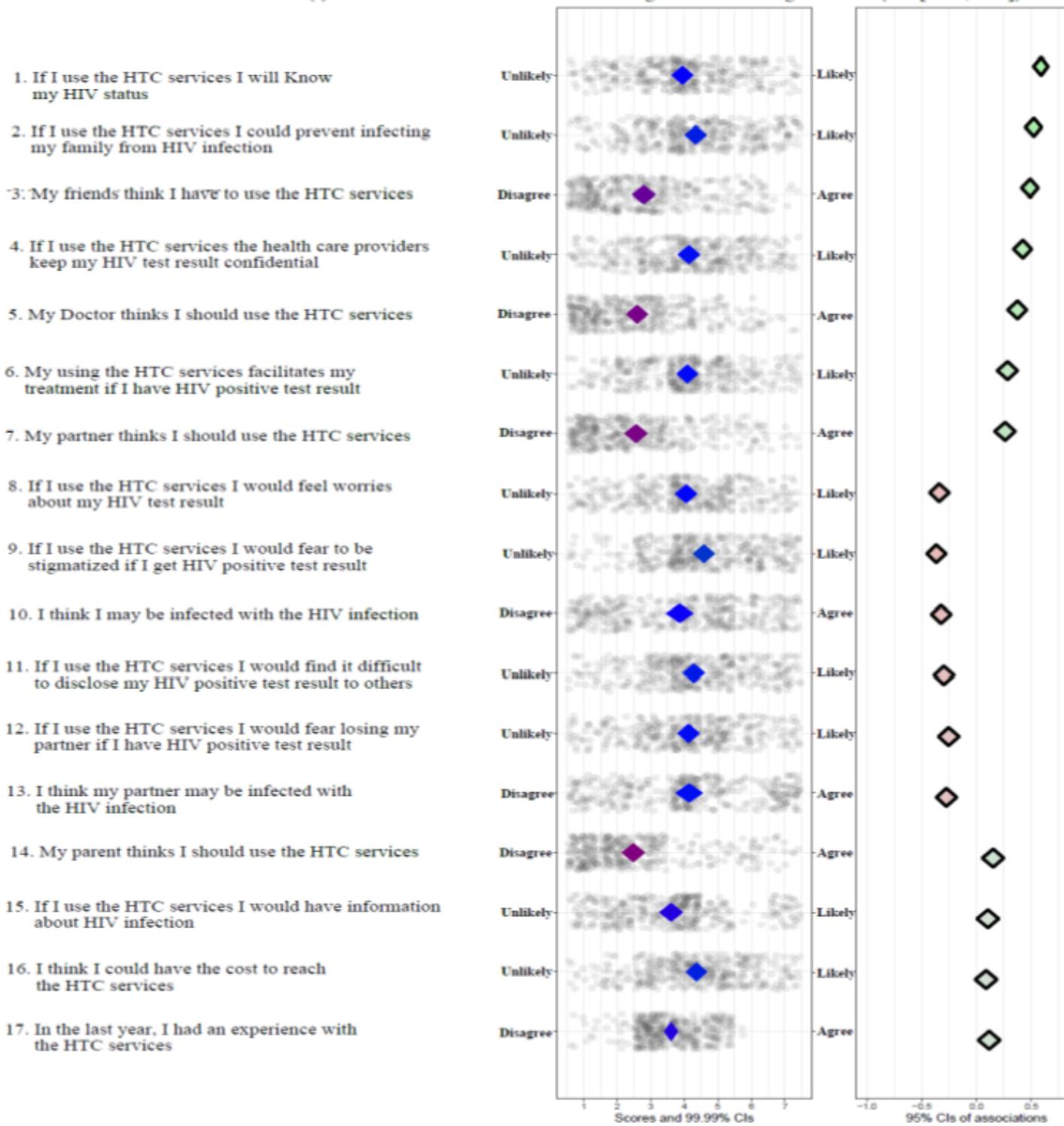


Figure 1

CIBER plot of psychosocial beliefs of the intention to use HTC services and past HTC experience 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](#)