

Outcomes of and factors associated with partner notification and HIV testing in Northeastern Tanzania.

CURRENT STATUS: UNDER REVIEW

BMC Public Health  BMC Series

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10.21203/rs.3.rs-21694/v1

SUBJECT AREAS

Health Policy *Infectious Diseases*

KEYWORDS

HIV testing and counseling, partner notification, Tanzania

Abstract

Background: There is growing evidence of high effectiveness of partner notification (PN) in reaching previously undiagnosed sexual partners. As a result, there is increasing implementation of PN in sub-Saharan Africa. Tanzania, like other countries in the region, has recently expanded PN in HIV testing services. However, this approach is unlikely to yield the expected results if not well implemented. This study aimed to identify gaps and provide recommendations to improve routine implementation of PN in Tanzania.

Methods: A cross-sectional study was conducted across seven care and treatment centers (CTCs) in the Kilimanjaro region from November 2018 to April 2019. A total of 297 newly diagnosed HIV infected clients with sexual partner(s) in the past 24 months were recruited at 2 months of their CTC enrollment. Interviews using structured questionnaires were conducted. Descriptive statistics, bivariate and multivariate regression analyses were done.

Results: Two-thirds (195) were females. The majority 165 (85%) of those counseled and had partner(s) not previously tested for HIV consented to PN. They all chose passive PN with 102 (62%) reporting successful HIV status disclosure to their partner(s). Reporting disclosure was associated with; being married adjusted odds ratio (aOR 5.1, 95%CI: 2.4-10.9, $p < 0.001$), in a relationship for > 10 years (aOR 4.9, 95%CI: 1.3-17.6, $p = 0.02$) and living with the partner(s) (aOR 3.4, 95%CI: 1.3-9.1, $p = 0.02$). Fifty-three clients (27%) of those with partners not previously tested for HIV reported partner HIV testing following PN, associated with being married (aOR 3.4, 95%CI: 1.3-9, $p < 0.02$) and living with the partner (aOR 4.5, 95%CI: 1.3-15, $p < 0.02$). Male partner(s) had lower odds of successful HIV testing (aOR 0.4, 95%CI: 0.2-0.9, $p = 0.02$). Thirty-seven (67%) of those tested were HIV infected.

Conclusions: Detection rate of previously undiagnosed HIV infection among clients referred for HIV-testing through PN was high. However, a significant number of partners did not report for HIV testing after 2 months of index clients CTC enrollment. Initiatives to improve PN are needed with special attention towards those who are single, not living with their partners, in a relationship for < 10 years as well as male sexual partners.

1. Background:

The success across the Human Immunodeficiency Virus (HIV) care continuum highly depends on effective HIV testing services (HTS) as a critical gateway to prevention and support services, accessing HIV care and antiretroviral treatment (ART) [1–3]. In recognition of the need for effective HTS, major steps have been taken to improve the testing strategies over the past two decades. Currently, more than three quarters (67–92%) of all people living with HIV (PLHIV) worldwide are estimated to know their HIV status. Although it is a great milestone, there are still more than 8 million undiagnosed PLHIV Worldwide [4]. This calls for more coordinated efforts to achieve not only the UNAIDS 90-90-90 target by 2020 (90% of PLHIV diagnosed; 90% of those diagnosed on ART and 90% of all people receiving ART having viral suppression) but also to end the AIDS epidemic by 2030 [5]. To address this gap there is an urgent need to ensure adequate implementation of effective HTS approaches [6, 7].

Moreover, reaching undiagnosed PLHIV becomes more challenging as the proportion of undiagnosed PLHIV decreases [7]. Targeting the general population for HIV testing is likely to yield low HIV positive rates [6]. One of the potential ways of addressing this is through notifying and testing sexual partners of recently diagnosed PLHIV. When efficiently implemented, partner notification (PN) is a proven effective and feasible differentiated HIV testing strategy [6–10]. It has been shown to yield HIV positive rates, which are more than twice those of all other HIV testing approaches combined [11]. Despite this body of evidence PN is still underutilized in sub-Saharan Africa (SSA) [7, 9, 12]. In some areas, partners of PLHIV are not tested systematically [6].

In Tanzania, data from 2016–2017 estimated that less than two-thirds (61%) of PLHIV knew their HIV status [13]. Since then PN has been made a standard of care and has recently been scaled up as one of the attempts to reach the first 90 in UNAIDS 90-90-90 target [5, 14]. PN comprises several steps as recommended by the national comprehensive guidelines on HTS. The first step requires the HTS providers (HTSPs) to counsel and obtain consent for PN from all newly diagnosed HIV clients. If the clients consent, their sexual partners may be referred for HTS through either passive or assisted voluntary disclosure methods. Upon choosing the former, the index clients have to disclose their HIV

status and suggest HTS to their partners on their own. Conversely, if they choose the latter the provider has to anonymously notify the sexual partner(s) using one of the following three approaches [14]. The provider can anonymously contact the index client's partner(s) directly or after entering a contractual agreement (contract referral) in case of unsuccessful passive partner referral within the agreed period of time. Moreover, the client can opt to disclose their HIV status to their partners in the presence of the provider, who will support the client during the disclosure process (dual referral) [14]. The implementation of differentiated HIV testing strategies including PN must be assessed to identify missed opportunities for HIV testing [6]. The current study examined all the steps recommended by the Tanzanian National guidelines on HTS [14]. It offers a unique opportunity to identify gaps and provide recommendations to improve routine implementation of PN in care and treatment centers (CTCs) after its scale up countrywide.

2. Methods

Study design and setting

A cross-sectional study was conducted across seven CTCs in the Kilimanjaro region, Northeastern Tanzania between November 2018 and April 2019. The included CTCs were located at different health facility levels and geographical locations in a region with an estimated HIV prevalence of 2.6% [13]. The included sites; were Kilimanjaro Christian Medical Centre (Northeastern zonal referral hospital), Mawenzi regional hospital (regional referral hospital) and St. Joseph hospital (designated district hospital) from Moshi urban district. Lower level health facilities in the same district were Majengo and Pasua health centers. In Hai district, Hai district hospital and Machame hospital were in the periurban and rural settings, respectively. The seven facilities were selected due to a high HIV testing volume. Four are government owned and the rest are facilities run by faith-based institutions.

Population and eligibility criteria

All newly diagnosed PLHIV 15 years and above, who disclosed having sexual partner(s) within 24 months prior to being diagnosed with HIV and consented to participate in the study were recruited at a clinical visit two months after their enrollment in care.

Sample size:

The study is part of a parent study aiming at determining challenges and effects of the implementation of differentiated HIV service delivery (DSD) across the continuum of care from HIV diagnosis, referral, linkage, ART initiation, retention in care and HIV viral load suppression. The DSD was implemented countrywide at different health facilities starting from September 2018. The parent study has two arms before and after the implementation of DSD and this study falls under differentiated HIV testing after the implementation of DSD in the country and the calculated sample size was 297 clients.

Study procedures.

Onsite researchers identified all newly diagnosed PLHIV ≥ 15 years from clients' attendance list. Interviewer administered questionnaires were conducted to obtain socio-demographic information, information on number of sexual partners within the past 24 months as well as evaluation of the conduct of the whole process and outcomes of PN process relative to the recommendations stipulated by the guidelines on HTS [14]. The outcomes were consent for PN, partner disclosure and suggesting HTS, partner referral & HIV testing, and proportion of individuals tested through PN identified with HIV-infection.

Data management and analysis.

Data were collected using paper forms, entered, cleaned and analyzed using STATA version 15.1. Descriptive statistics were performed to describe participants' characteristics, proportion with successful HIV status disclosure and sexual partner referral for HIV testing. Chi-square test was used to identify significant differences. Bivariate and multivariate logistic regressions were done to identify the number of sexual partners asked by the HTSPs, clients' consent, disclosure, partner HIV testing and their associated factors. The final analysis models included covariates with p value < 0.25 . A p value < 0.05 was regarded as significant.

3. Results

Study overview and socio-demographic characteristics.

A total of 351 newly diagnosed HIV clients were assessed for the eligibility criteria. Out of these 297 (85%), reported to have had sexual partners in the past 24 months and all of them were enrolled in the study. They were mainly females 195 (66%) and married 159 (54%) with a mean age of 38 years (Table 1). The majority 292 (98%) reported to have been counseled about PN by the HTSP at the time of HIV diagnosis. These included index clients 198 (68%), those who came for couple HIV testing and counseling (CHTC) 62 (21%) and partners of previously tested clients (PPTC) 32 (11%). Eight clients reported that their partner(s) had died at the time of their HIV diagnosis leaving 284 clients with partner(s), who were alive at the time of HIV diagnosis. Moreover, 164 (85%) of index clients reported to have current sexual partner(s) (Figure 1).

The number of sexual partners counseled by the HTSP.

The median number of sexual partners reported was 1 (interquartile range: 1-3), and 1 (interquartile range: 1-9) among those who reported to have current partners and those who reported to have partners within the past 24 months respectively. Eighty-seven percent (248/284) of those with sexual partners within the past 24 months, who were counseled about PN and whose partners were alive at the time of their CTC enrollment reported to have been counseled only about PN of the current partners. Moreover, during the interview almost half of them (132/284) admitted having had multiple sexual partners (concurrent or serial monogamy) within the past 24 months, however only a quarter (70/284) reported to have been counseled to notify more than one partner at the time of their CTC enrollment (Table 2).

Those who came for CHTC had lower odds (OR 0.4 95% CI: 0.2-0.8, $p=0.02$) of being counseled to notify other partner(s) relative to those who came for HIV testing as index clients at the time of CTC enrollment. Furthermore, married and widowed clients had lower odds of being counseled about PN of more than one sexual partner (aOR 0.2 95% CI: 0.1-0.4, $p<0.001$) and (aOR 0.3 95% CI: 0.1-0.9, $p=0.04$), respectively compared to those, who were single or never married. However, during the

interview 27 (44%) of those who came for CHTC, 69 (44%) of those married and 14 (70%) of those widowed admitted to have had more sexual partner(s) within the past 24 months (Table 2).

Consent for partner notification.

One-hundred-and-sixty-five (85%) of index clients reporting having had sexual partners within the past 24 months, and counseled for PN, consented to bring their partners for HIV testing (Figure 2). They all chose the passive PN method i.e. they had to notify and bring their partner(s) for counseling and testing before or during their next clinic visit without assistance from the HTSPs. Among those in a current relationship higher consenting odds were observed for those in a relationship for longer than ten years (aOR 5.1 95% CI: 1.5-17.7, p=0.01) and those who were living with their partner (aOR 3.3 95% CI: 1.2-8.8, p=0.02) (Table 4).

Table 1: Socio-demographic characteristics of clients, who reported ≥ 1 sexual partner in the 24 months prior to their HIV diagnosis (n=297)

Characteristics	Clients	
	Number	%
Age groups		
15-24	28	9.4
25-34	104	35.0
35-44	92	31
45 and above	73	24.6
Sex		
Female	195	65.6
Male	102	34.4
Relationship status		
Single-never married	67	22.6
Married/Cohabiting	159	53.5
Divorced/Separated	43	14.5
Widowed	28	9.4
Level of education		
No formal education	2	0.7
Primary school	209	70.4
Secondary school	75	25.2
Post-secondary school	11	3.7
Main economic activity		
Peasant	41	13.8
Formally employed	12	4
Small business/Self employed	209	70.4
House wife/husband	33	11.1
Others	2	0.7
Residence		
Moshi urban	153	51.5
Moshi rural	72	24.2
Hai	57	19.2
Others	15	5.1

Characteristics	Number of partners		Number of partners counseled	
	N (%)		N (%)	
	One	Multiple	One	More than one
Age groups				
15-24	15 (57.7)	11 (42.3)	16 (61.5)	10 (37.5)
25-34	49 (48.0)	53 (52.0)	80 (78.4)	22 (21.6)
35-44	47 (55.3)	38 (44.7)	64 (75.3)	21 (24.7)
45 and above	41 (57.8)	30 (42.2)	54 (76.1)	17 (23.9)
Sex				
Female	108(59)	75 (41)	138 (75.4)	45 (24.6)
Male	44(43.6)	57 (56.4)	76 (75.2)	25 (24.8)
Relationship status				
Single-never married	36(56.3)	28(43.7)	34 (53.1)	30 (46.9)
Married/cohabiting	89 (56.3)	69 (43.7)	135 (85.4)	23 (14.6)
Divorced/Separated	21 (50)	21 (50)	29 (69.1)	13 (30.9)
Widowed	6 (30)	14 (70)	16 (80)	4 (20)
Level of education				
No formal education	2 (100)	0 (0)	2 (100)	0 (0)
Primary school	112(56.8)	85 (43.2)	149 (75.6)	48 (24.4)
Secondary school	31 (41.9)	43 (58.1)	54 (73)	20 (27)
Post secondary school	7 (63.6)	4 (36.4)	9 (81.8)	2 (18.2)
Clients category				
Index clients	101(52.1)	93 (47.9)	139 (71.7)	55 (28.3)
Couple HIV testing and counseling	35 (56.5)	27 (43.5)	54 (87.1)	8 (12.9)
Partners of previously tested Clients	16 (57.1)	12 (42.9)	21 (75)	7 (25)

Table 2: The characteristics of clients with sexual partners within the past 24 months, who were counseled for partner notification, whose partners were alive at the time of their HIV diagnosis and the number of sexual partners counseled by the HIV testing service provider (n=284)

CI: Confidence interval

Successful partner HIV disclosure and suggesting HTS.

Only fifty-two percent of all index clients (102/194) who had partner(s) within the past 24 months, whose partners were alive and who were counseled about PN at the time of their HIV diagnosis reported to have successfully disclosed their HIV status to their sexual partners within two months of their initial consultation. This was sixty-two percent (102/165) of those, who consented to PN at their initial visit (Figure 2). Married clients had five times higher odds (aOR 5.1 CI: 2.4-10.9, p<0.001) of reporting successful disclosure and suggesting HTS to their partners than those who were single or never married (Table 3). Furthermore, among those in a current relationship higher odds for reporting

successful disclosure and suggesting HTS to their partners were observed for those in a relationship of more than ten years duration (aOR 4.9 95%CI: 1.3-17.6, p=0.02) and those who were living with their partners (aOR 3.4 95%CI: 1.3-9.1, p=0.02) (Table 4). None (n=29) of those who did not consent reported partner HIV disclosure.

There were a total of 143 clients, who still had the opportunity to notify at least one sexual partner. These included those who reported that they were yet to notify a single sexual partner 92 (64%) and those, who had notified at least one sexual partner but had other partner(s), who were not yet notified 51 (36%). However, less than two-thirds (85/143) reported that they had the intention to inform partners. The majority of these 79 (93%) stuck with the passive PN method as their preferred method, while only six (7%) declared that they needed assistance from the HTSPs. Those who had multiple partners and had notified at least one of them had 10 times higher odds of reporting plans to notify the other(s) as compared to those, who had not yet notified a single partner (OR 10.2, 95% CI 4-26.2, p< 0.001).

Successful sexual partner(s) clinic referral and HIV testing.

Only twenty-seven percent (53/194) of the index clients with sexual partner(s) requiring testing reported successful referral of sexual partner(s) to the clinic at the interview two months after counseling about PN. This was fifty-two percent (53/102) of index clients, who reported successful disclosure and suggesting HTS to their partners (Figure 2).

Table 3: Factors associated with consent for partner notification, successful disclosure to at least one partner, clinic referral and partner HIV testing among index clients who were counseled about partner notification (n=194)

Clients' characteristics	Consented for partner notification N (%)		Crude Odds ratio 95% (CI)	p-value	Successful disclosure to at least one partner N (%)	
	Yes	No			Yes	No
Age groups						
15-24	14 (87.5)	2 (12.5)	1		7 (43.7)	9 (56.3)
25-34	51 (77.3)	15 (22.7)	0.5(0.1-2.4)	0.37	31 (47)	35 (53)
35-44	50 (89.3)	6 (10.7)	1.2(0.2-6.6)	0.84	28 (50)	28 (50)
45 and above	50 (89.3)	6 (10.7)	1.5(0.3-8.3)	0.67	36 (64.3)	20 (35.7)
Sex						
Male	48 (80)	12 (20)	1		33 (55)	27 (45)
Female	117(87.3)	17 (12.7)	1.8(0.8-4.1)	0.14	69 (51.5)	65 (48.5)
Relationship status						
Single-never married	48 (81.4)	11 (18.6)	1		20 (33.9)	39 (66.1)
Married/ cohabiting	79 (91.9)	7 (8.1)	2.6 (0.9-7.1)	0.07	64 (74.4)	22 (25.6)
Divorced/Separated	24 (72.7)	9 (27.3)	0.6 (0.2-1.7)	0.34	12 (36.4)	21 (63.6)
Widowed	14 (87.5)	2 (12.5)	3.4 (0.4-8.9)	0.26	6 (37.5)	10 (62.5)
Current relationship						
Yes	140(85.4)	24 (14.6)	1		93 (56.7)	71 (43.3)
No	26(86.7)	4 (13.3)	1.1 (0.4-3.5)	0.85	9 (30)	21 (70)

Table 4: Factors associated with consent for partner notification, successful disclosure to at least one partner, clinic referral and partner HIV testing among index clients in a current relationship (n=164)

Clients' characteristics	Consented for partner notification N (%)		Crude Odds ratio 95% (CI) [‡]	p-value	Successful disclosure to at least one partner N (%)	
	Yes	No			Yes	No
Age groups						
15-24	10 (83.3)	2 (16.7)	1		5(41.7)	7(58.3)
25-34	42 (76.4)	13 (23.6)	0.6 (0.1-3.3)	0.60	28(50.9)	27(49.1)
35-44	44 (88)	6 (12)	1.5 (0.3-8.4)	0.67	26 (52)	24 (48)
45 and above	44 (93.6)	3 (6.4)	2.3(0.4-19.9)	0.27	34(72.3)	13(27.7)
Relationship status						
Single-never married	32 (76.2)	10(23.8)	1		16(38.1)	26(61.9)
Married/ cohabiting	79 (92.9)	6 (7.1)	4.1(1.4-12.3)	0.01	64(75.3)	21(24.7)
Divorced/Separated	16 (69.6)	7 (30.4)	0.7 (0.2-2.2)	0.56	7 (30.4)	16(69.6)
Widowed	13 (92.9)	1 (7.14)	4.1 (0.5-35)	0.20	6 (42.9)	8 (57.1)
Relationship duration						
<1 year	15 (65.2)	8 (34.8)	1		6 (26.1)	17(73.9)
1-5 years	44 (80)	11 (20)	2.1 (0.7-6.3)	0.17	25(45.5)	30(54.6)
6-10 years	24 (92.3)	2 (7.7)	6.4(1.2-34.3)	0.03	15(57.7)	11(42.3)
> 10 years	57 (95)	3 (5)	10.1(2.4-43)	0.002	47(78.3)	13(21.7)
Living together						
Yes	90 (95.7)	4 (4.3)	9 (2.9-27.8)	<0.001	70(74.5)	24(25.5)
No	50 (71.4)	20(28.6)	1		23(32.9)	47(67.1)

Those who were married had more than three times higher odds of reporting successful sexual partner(s) clinic referral and HIV testing (aOR 3.4 95% CI: 1.3-9, p<0.02) than those who were single.

Moreover, being in a current relationship was not significantly associated with higher odds of successful clinic referral and HIV testing (aOR 1 95%CI 0.3-3.5, p=0.98) (Table 3). However, among those in a current relationship higher odds of referral and testing were observed for those who were living with their partners (aOR 4.5 95% CI: 1.3-15, p<0.02) (Table 4). On the other hand male sexual partner(s) were associated with 60% lower odds of successful clinic referral and HIV testing after being notified (aOR 0.4 95%CI: 0.2-0.9, p=0.02) (Table 3).

Sexual partner's HIV test results and CTC enrollment.

All 53 clients, who reported successful sexual partner(s) clinic referral, reported successful sexual partner HIV testing (Figure 2) with a total of 55 sexual partners tested for HIV (two clients each reported two sexual partners successfully tested for HIV). Thirty-seven (67%) of the sexual partners were diagnosed with HIV. The rate of HIV infection was 18 (78 %) and 19 (59 %) among female and male sexual partners, respectively. All partners who were reported to be HIV infected were enrolled in care and started on ART. There were no major significant differences on the study outcome variables after assessing for differences between sites. Moreover, there were no significant differences in area of residence, level of education and the main economic activities of the participants and the observed outcomes.

Discussion

This study determined the outcomes of and factors associated with all the steps of PN process as recommended by the Tanzania National guidelines on HTS [14]. The study was conducted in Northeastern Tanzania after scaling up of PN in HTS countrywide with the aim of identifying gaps and providing recommendations to improve PN as a differentiated HIV testing strategy urgently needed to address the first 90 of the UNAIDS 90-90-90 target [5].

The initial step of PN is for HTSP to counsel all newly diagnosed HIV clients on the importance and the need to notify their partners to be HIV tested. Two percent of clients reported to have not been counseled about PN at the time of their HIV diagnosis. This might have been due to failure of HTSPs to

do counseling or due to inability of the clients to recall being counseled about PN. We also found some discrepancies in the type of partner discussed during the counseling sessions. Most of the counseling was reported to focus on the current partner(s). It is possible that the HTSPs' counseling focused on the current partner(s) or the clients wrongly perceived that they were counseled only about the current partner(s). This might also be due to the fact that the guidelines do not specify the type of partner to be notified in terms of current versus past or within what time frame [14]. Moreover, it was noted that the number of current partners was half those within the past 24 months and there was no significant difference in PN success rate between current and previous partners. Although some studies have reported higher PN success rate among current partners [7,15], restricting PN to current partners will restrict the success of the PN initiative.

Furthermore, the counseling among married, widowed and those who came for CHTC should explore the possibility that clients in these groups may have other partner(s) as it was noted that a significant proportion of these clients had > 1 sexual partner. It seems that HTSPs assumed that married or widowed have/had only one partner, alternatively HTSPs might have found it hard to discuss the possibility of more sexual partners. HTSPs are supposed to counsel and encourage those who come for CHTC to receive their test results together [14]. This reduces the disclosure burden and has the potential to improve linkage to care among partners [14,16]. However, the presence of a partner might hinder the clients from disclosing more partners (previous/current). Counseling individual clients when it comes to PN might be a potential solution to this challenge. Moreover, those who reported successful notification of at least one partner also reported higher willingness to notify other partner(s) than those who had not notified a single partner. This underscores the importance for open and non-judgmental discussions of all possible current and previous sexual partner(s).

It is crucial to obtain clients' consent before proceeding with PN. The proportion of those, who had sexual partners but did not consent for PN services was higher (15%) than previously reported from Tanzania (3.6%) and Mozambique (1%) [7,17]. This might be due to the difference in study settings

and therefore, there is a need to explore the barriers for consenting to PN in this population.

Furthermore, those who provided consent were given the option of either assisted or passive PN methods. Although all clients chose the latter, this method has been shown to have a relatively lower success rate as compared to the former [15,17–20]. This might be because assisted PN does not require HIV status disclosure as compared to passive PN. Preference for passive PN among index clients has also been reported in other studies from SSA [7]. However, some studies have also reported preference for other PN methods i.e. in Nigeria, where contract referral accounted for more than two-thirds of the partner referrals done [21].

Referral for HIV testing after successful PN was by far the step with the highest dropout rate (48%) in this study. This might be due to over-reporting of successful notification among index clients to hide their inability to disclose their HIV status to the partners. Unsuccessful referral was associated with male sexual partners, single or never married and those living away from their partner(s). Male sexual partners and unstable relationships have also previously been reported as a hindrance to PN in SSA [7,23]. In Malawi, behavioral skill-building training for healthcare providers successfully increased HIV testing among male sexual partners using the passive PN method [24].

In the current study, all partners who were reported successfully referred were also reported tested for HIV. This study underscores the high effectiveness of PN in reaching previously undiagnosed PLHIV with a very high HIV prevalence (67%) among sexual partners successfully referred and tested for HIV. It adds to the existing evidence from countries such as Malawi, Cameroon, Vietnam and Nigeria, where HIV prevalence among sexual partners successfully referred for testing was 64%, 50%, 42% and 51%, respectively [9,12,21,25]. Furthermore, in a systematic review, the HIV prevalence among sexual partners successfully tested for HIV ranged from 12-86 % [26].

More importantly, the study points out the weakest links in the PN process. The fact that only 27% of

index clients successfully referred their partners for HIV testing after two months of CTC enrollment is of concern. This may partly be due to the fact that all index clients chose the passive PN method. In Malawi, successful partner referral after three months of index clients CTC enrollment was 24% and 51% among those who used the passive and assisted PN method, respectively [9], consistent findings were also reported in Uganda [15].

Conclusions

Our study has added to the existing evidence on the effectiveness of partner notification in reaching previously undiagnosed PLHIV. It has highlighted the missed opportunities in the routine implementation of PN and provides an opportunity for improvement. After implementation of the new guidelines strengthening the importance of PN in Tanzania almost all newly diagnosed HIV infected clients reported being advised about PN. However, almost half reported not having disclosed to their sexual partner(s) two months later and even fewer partners reported for HIV testing and counseling.

We recommend that all clients should be counseled for PN to exhaust all partners (previous and current) regardless of their marital status. Furthermore, it is important that counseling for PN should be repeated at follow-up visits to assist disclosure and that the possibility for assisted PN is ventilated. To increase the proportion of partners referred and tested we recommend more focus on those who are single, not living with their sexual partner(s) and in a relationship of < 10 years. Furthermore, we recommend more studies to understand the barriers to PN of male sexual partners in Northeastern Tanzania.

Abbreviations

ART - Antiretroviral therapy

CHTC - Couple HIV testing and Counseling

CTC - Care and treatment Center

DSD - Differentiated Service Delivery

HIV - Human Immunodeficiency virus

HTS - HIV testing services

HTSP - HIV testing services provider

PLHIV - People living with HIV

PN - Partner notification

PPTC - Partners of previously tested clients

SSA - sub-saharan Africa

Declarations

Ethics approval and consent to participate

The study was conducted with ethics approval from the Kilimanjaro Christian Medical University

Ethical Review Board (CRECN0.2294) and Tanzanian National Institute of Medical Research

(NIMR/HR/R.8a/Vol.IX/3064) with support from the Kilimanjaro regional medical authorities. All

participants signed a written informed consent. None of the participants was below 18 years of age.

Consent for publication:

Not applicable

Competing interests:

There are no conflicts of interest for any author.

Availability of data and materials:

Data has been uploaded as a supporting document

Funding:

Building stronger universities who had no any role in the study design, data collection, analysis, data interpretation or manuscript writing.

Authors' contributions:

FL: Development of the proposal, data collection, data entry, analysis and writing.

EM: Development of the proposal, planning of analysis and writing.

RM: Development of the proposal and writing.

DM: Development of the proposal and writing.

IK: Development of the proposal.

TK: Development of the proposal, planning of analysis and writing.

ZT: Development of the proposal, planning of analysis and writing.

All authors have read and approved the manuscript

Acknowledgements:

Statisticians Mr. Gibson Kapanda and Dr. Michael Mahande

References

1. Hlongwa M, Mashamba-thompson T, Makhunga S, Hlongwana K. Mapping evidence of intervention strategies to improving men ' s uptake to HIV testing services in sub-Saharan Africa: A systematic scoping review. BMC Infect Dis. 2019;19:496.
2. Ministry of Health. Community Development, Gender, Eldery and Children (MoHCDGEC). Mapping HIV Service Delivery Strategies in Tanzania. Report 2017. https://www.go2itech.org/wp-content/uploads/2017/07/SDM_Tanzania_Mapping-Report_FINAL_June2017_-with-Signature.pdf. Accessed 30 Sep 2018.
3. Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC). National Guideline for the Management of HIV and AIDS, Sixth Edition. October 2017. <http://www.nacp.go.tz/guidelines/>. Accessed 15 Sep 2018.
4. UN Joint Programme on HIV/AIDS (UNAIDS). Global HIV & AIDS statistics – 2019 fact sheet. <https://www.unaids.org/en/resources/fact-sheet>. Accessed 12 Aug 2019.
5. UN Joint Programme on HIV/AIDS (UNAIDS). 90-90-90 An ambitious treatment target

to help end the AIDS epidemic.

http://files.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2014/90-90_90-en.pdf. Accessed 21 Mar 2018.

6. The International AIDS Society. Differentiated Service Delivery for HIV: A Decision Framework for HIV testing services.
[http://www.differentiatedservicedelivery.org/Portals/0/adam/Content/DCwLmrNFcUuLU4jWitQ/File/DSD for HIV- A decision framework for HIV testing services.pdf](http://www.differentiatedservicedelivery.org/Portals/0/adam/Content/DCwLmrNFcUuLU4jWitQ/File/DSD%20for%20HIV-20A%20decision%20framework%20for%20HIV%20testing%20services.pdf). Accessed 19 Feb 2019.
7. Kahabuka C, Plotkin M, Christensen A, Brown C, Njozi M, Kisendi R, et al. Addressing the First 90: A Highly Effective Partner Notification Approach Reaches Previously Undiagnosed Sexual Partners in Tanzania. *AIDS Behav.* 2017;21(8):2551-60.
8. Hosseinipour M, Rosenberg N. HIV Partner Notification: Possible and Essential. *Sex Transm Dis.* 40(12):915-6.
9. Brown LB, Miller WC, Kamanga G, Nyirenda N, Mmodzi P, Pettifor A, et al. HIV partner notification is effective and feasible in sub-Saharan Africa: Opportunities for HIV treatment and prevention. *J Acquir Immune Defic Syndr.* 2011;56(5):437-42.
10. Sharma M, Smith JA, Farquhar C, Ying R, Cherutich P, Golden M, et al. Assisted partner notification services are cost-effective for decreasing HIV burden in western Kenya. *AIDS.* 2018;32(2):233-41.
11. Scaling Up Testing for Human Immunodeficiency Virus Infection Among Contacts of Index Patients-20 Countries, 2016-2018. *Morbidity and Mortality Weekly Report* Accessed on 2 Apr 2019.
Lasry A, Medley A, Behel S, Mujawar MI, Cain M, Diekmann ST, et al. Scaling Up Testing for Human Immunodeficiency Virus Infection Among Contacts of Index Patients-20 Countries, 2016-2018. *Morbidity and Mortality Weekly Report.* Vol. 68.

2019. <https://www.cdc.gov/mmwr/volumes/68/wr/pdfs/mm6821a2-H.pdf>. Accessed on 2 Apr 2019.
12. Henley C, Forgwei G, Welty T, Golden M, Adimora A, Shields R, et al. Scale-up and case-finding effectiveness of an HIV partner services program in Cameroon: An innovative HIV prevention intervention for developing countries. *Sex Transm Dis.* 2013;40(12):909-14.
 13. Ministry of Health. Community Development, Gender, Eldery and Children. (MoHCDGEC). Tanzania HIV Impact Survey (THIS) 2016-2017. https://phia.icap.columbia.edu/wp-content/uploads/2017/11/Tanzania_SummarySheet_A4.English.v19.pdf. Accessed 26 Oct 2018.
 14. Ministry of Health, Community Development, Gender, Elderly and Children. National Comprehensive Guidelines on HIV Testing Services. 2019. <http://www.nacp.go.tz/guidelines/>. Accessed 25 Apr 2019.
 15. Buhikire K, Voss J, Kigozi J, Nyakato P, Ankunda N, Kalebbo B, et al. Reaching the First 90 in Uganda: Predictors of Success in Contacting and Testing the Named Sexual Partners of HIV + Index Clients in Kiboga District. *AIDS Behav.* 2018. doi.org/10.1007/s10461-018-2137-y.
 16. Muhindo R, Nakalega A, Nankumbi J. Predictors of couple HIV counseling and testing among adult residents of Bukomero sub-county, Kiboga district, rural Uganda Health behavior, health promotion and society. *BMC Public Health.* 2015;15(1):1-6.
 17. Myers RS, Feldacker C, Cesár F, Paredes Z, Augusto G, Muluana C, et al. Acceptability and Effectiveness of Assisted Human Immunodeficiency Virus Partner Services in Mozambique: Results from a Pilot Program in a Public, Urban Clinic. *Sex Transm Dis.* 2016;43(11):690-5.

18. Tih PM, Temgbait Chimoun F, Mboh Khan E, Nshom E, Nambu W, Shields R, et al. Assisted HIV partner notification services in resource-limited settings: experiences and achievements from Cameroon. *J Int AIDS Soc.* 2019;22(S3):31-9.
19. Little KM, Kan M, Samoylova O, Rsaldinova A, Saliev D, Ishokov F, et al. Implementation experiences and insights from the scale-up of an HIV assisted partner notification intervention in Central Asia. *J Int AIDS Soc.* 2019;22(S3):e25313.
20. Masyuko SJ, Cherutich PK, Contesse MG, Maingi PM, Wamuti BM, Macharia PM, et al. Index participant characteristics and HIV assisted partner services efficacy in Kenya: results of a cluster randomized trial. *J Int AIDS Soc.* 2019;22(S3):49-56.
21. Katbi M, Adegboye A, Adedoyin A, Yunusa F, Kayode G, Bello M, et al. Effect of clients Strategic Index Case Testing on community-based detection of HIV infections (STRICT study). *Int J Infect Dis.* 2018;74:54-60.
22. Genet M, Sebsibie G, Gultie T. Disclosure of HIV seropositive status to sexual partners and its associated factors among patients attending antiretroviral treatment clinic follow up at Mekelle Hospital, Ethiopia: A cross sectional study. *BMC Res Notes.* 2015;8(1):4-9.
23. Tibbels NJ, Hendrickson ZM, Naugle DA, Dosso A, Van Lith L, Mallalieu EC, et al. Men's perceptions of HIV care engagement at the facility- and provider-levels: Experiences in Cote d'Ivoire. *PLoS One.* 2019;14(3):1-12.
24. Tembo TA, Kim MH, Simon KR, Ahmed S, Beyene T, Wetzel E, et al. Enhancing an HIV index case testing passive referral model through a behavioural skills-building training for healthcare providers: a pre-/post-assessment in Mangochi District, Malawi. *J Int AIDS Soc.* 2019;22(S3):90-7.
25. Nguyen VTT, Phan HT, Kato M, Nguyen Q, Le Ai KA, Vo SH, et al. Community-led HIV testing services including HIV self-testing and assisted partner notification services

in Vietnam: lessons from a pilot study in a concentrated epidemic setting. *J Int AIDS Soc.* 2019;22(S3):40-8.

26. Dalal S, Johnson C, Fonner V, Kennedy CE, Siegfried N, Figueroa C, et al. Improving HIV test uptake and case finding with assisted partner notification services. *Vol. 31, AIDS.* 2017. p. 1867-76.

Figures

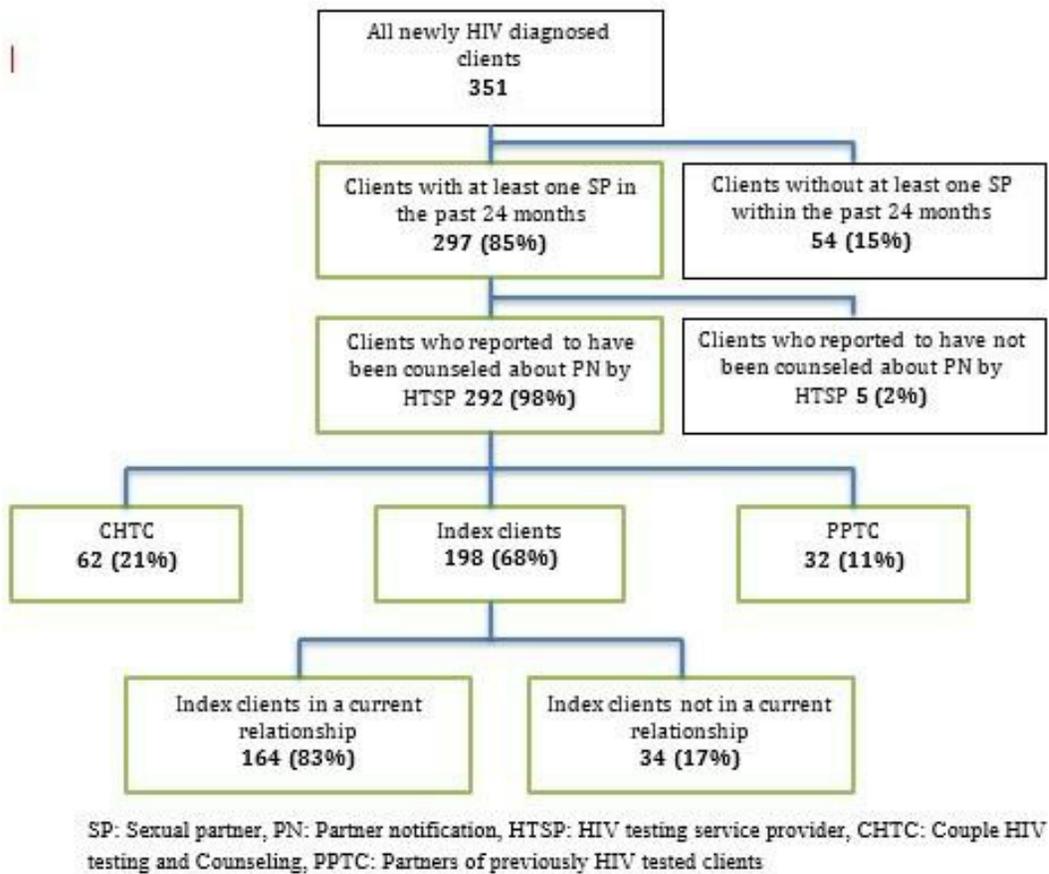


Figure 1

Overview of the main categories of the study client

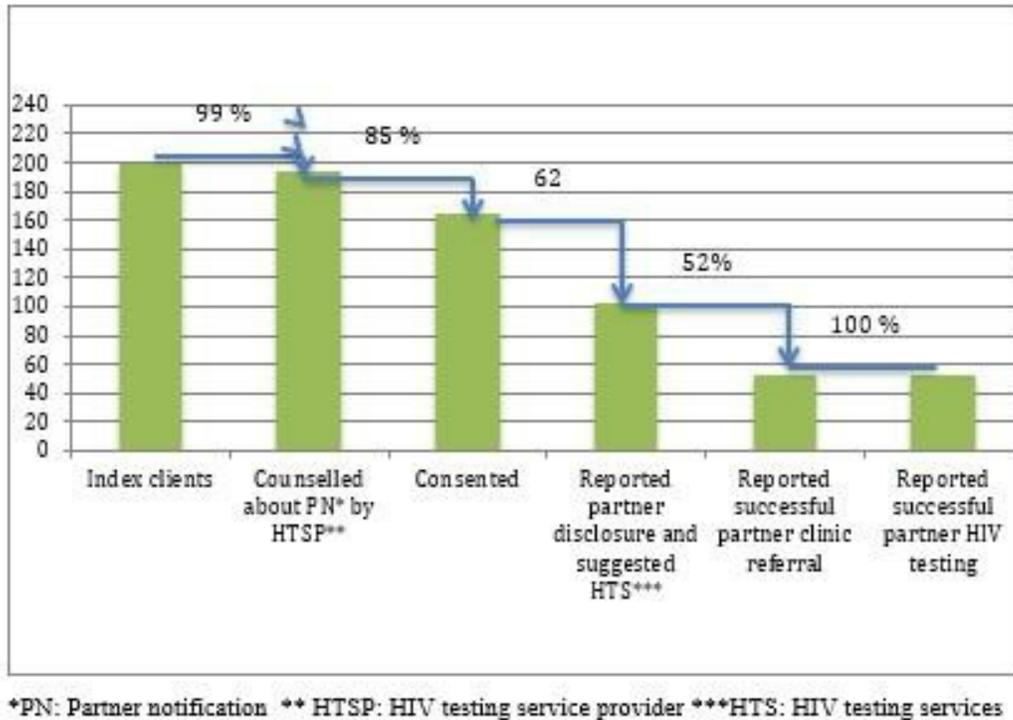


Figure 2

The cascade showing the proportion of index clients, who had sexual partner(s) within the past 24 months and whose partners were alive, from when they were counseled about PN at the time of their HIV diagnosis to successful sexual partner HIV testing at two months.

Supplementary Files

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