Factors Associated with Notification and Testing among Partners of HIV Positive Index Clients in Kigali City

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ABSTRACT

Introduction: Notification of sexual partners of persons diagnosed HIV infection is a vital tool in identifying those at risk of infection. This study assessed determinants of being notified and case-finding effectiveness among sexual partners of HIV infected individuals in Rwanda.

Methods: A cross-sectional study was conducted in Kigali city, Rwanda analyzing data of individuals newly diagnosed HIV infection who listed their sexual partners for referral to HIV test services (HTS) through one of three methods of partner notification: passive referral, contract referral, or provider referral. Data were extracted from the national HIV case-based surveillance dataset.

Results: In this study, 2104 index patients named 3791 sexual partners and provided locator information for 2689 partners. Among successfully notified partners, 2402 returned for HIV counseling and testing; among them, 267/2409 were spouses (aOR: 1.43; 95% CI; 1.11–1.82). Index clients with 2-5 partners were 2.53 times more likely (95%CI 1.60-3.99) to successfully notify their sexual partners; also, partners that had been listed as spouses of index clients were 2.1 imes more likely to get notified of their exposure to HIV than any other partners (95%CI; 1.54-2.89) (p=0.000).

Conclusion: This study's findings support the notion that partner notification among index clients is associated with the relation between HIV positive patients and their partners, marital status, number of sexual partners, and referral method used.

INTRODUCTION

HIV/AIDS continues to be one of the major public health problems today. The number of people infected with HIV globally was estimated to be 36 million by the end of 2017. Of these, 75% remained undiagnosed [1].To address this gap in knowledge of HIV status and to achieve Unites Nations (UN) testing and treatment goals, in particular, the first of the 90–90–90 goals to diagnose 90% of people with HIV infection by 2020, new approaches such as notification of sexual partners of HIV-positive index clients were put in place to enhance the efficiency and coverage of testing [2]. Partner referral or notification is an essential component of HIV control programs and one of the few means of tracking, identifying, and notifying sexual partners of people living with HIV (Index clients) with the sole aim of testing them to determine their HIV status and linking partners who are positive to antiretroviral therapy (ART). This approach provides an opportunity for prevention and an entry point to clinical care. The Sub-Saharan Africa region itself is home to almost 70% of all

HIV infections. These individuals may not know that they are at risk of HIV infection and hence miss the opportunity to receive life-prolonging antiretroviral therapy and continue engaging in risky behaviors leading to ongoing HIV transmission. One of the reasons why HIV control is hampered in this region is the difficulty in reaching high-risk individuals for treatment, particularly those with asymptomatic infections. One way to reach this group is through tracing partners of patients who present with HIV. Increasing counseling and testing rates among high-risk populations provides an opportunity to increase early diagnosis and treatment outcomes. Partners of individuals testing positive while seeking treatment for sexually transmitted infections are an important population to target for increased counseling and testing, as HIV discordance within couples is common in Africa, and infectiousness is high in HIV-infected individuals with a concurrent STI. Providing counseling and testing to partners of individuals recently diagnosed with HIV infection is an important way to target prevention strategies and provide early care to a very high-risk population [1].

Partner notification involves informing the sexual partners of HIV-positive persons that they have been exposed to HIV and encouraging them to seek counseling, testing, and other prevention and treatment services in case they are found HIV positive. The effectiveness of partner notification is unknown in low-income countries. However, disclosure of HIV status by women in antenatal and post-partum clinics often increases prevention behaviors since its obligatory. In these settings, successful partner notification leads to greater use of antiretroviral drugs to avoid perinatal HIV transmission, greater adherence to advice to avoid breastfeeding, and higher levels of condom use. Despite the potential benefits, very little is known about the effectiveness of partner notification by men and non-pregnant women in increasing counseling and HIV testing rates in Africa. In Cameroon, an evaluation of the partner services program showed that partner notification yielded a high proportion of partners where 67% of sexual partners of HIV positive index clients came in for testing, and 50% of them tested HIV positive [3]. Also, studies conducted in the East African region have shown that the implementation of targeted index testing and partner notification services

have yielded high HIV positivity rates in Uganda (32%) [4], Kenya (67%), and Tanzania (54%) [5]. Multiple studies reported having linked HIV partner notification to factors such as; gender, marital status, number of sexual partners [6], level of education [5], stage of disease [6], duration of illness, being on ART and others [8].

Rwanda, as one of the few countries in Africa that have adopted partner notification strategies, has an HIV prevalence of 3% among the general population, 3.7% among women, and 2.2% among men aged from 15 to 49 years [9]. Although Rwanda has registered a decline in HIV prevalence within the last two decades, identifying new HIV cases remains challenging and grossly inadequate. According to the Joint United Nations Programs on HIV/AIDS UNAIDS report of 2017, Rwanda had 7400 new HIV infections and 3100 AIDS-related deaths [10]. Many HIV infected clients in Rwanda remain unaware of their HIV status; this is because HIV Testing Service (HTS) is more often offered to specific high risk and priority population groups. There is an increasing focus on key Population groups such as Men who have Sex with Men (MSM) and Female Sex Workers (FSW). However sexual partners of positive index clients have been largely kept unnotified in Rwanda due to the unwillingness of HIV positive patients to disclose their HIV status information to them or health workers seeing the disclosure as an extra workload. This high-risk group constitutes a critical mass that must be reached in order to attain HIV epidemic control. Achieving the UNAIDS vision 90-90-90 target to end HIV/AIDS by 2030 requires that 90 percent of those living with HIV are identified and offered Antiretroviral Therapy (ART).

There's hardly any data on factors associated with the notification of sexual partners among HIV-positive index clients in Rwanda. Therefore, this study on HIV index clients was conducted to determine the factors of HIV partner notification to sexual partners among HIV positive index clients in Kigali, Rwanda.

METHODS

Study Design and Setting: A cross sectional study was conducted from October 2018 to June 2019 analysing data from the national HIV case-based surveillance dataset. Data were collected

prospectively from 22 health facilities located in Kigali city and reported to the surveillance system through DHIS2. Kigali has the highest HIV prevalence in Rwanda with 6.3% of its population being infected with HIV (HIV annual report). At each health facility, partner notification services were provided at dedicated Voluntary Counselling and Testing (VCT) centers, and provider-initiated testing (PIT) was offered to inpatients and outpatients.

Study Population: Men and women diagnosed with HIV through VCT or PIT at the 22 study sites newly diagnosed with HIV, 18 years or older, not pregnant, had a current sexual partner, or had a partner in the past 12 months were included. Pregnant women and individuals who consulted through Post-Natal Consultations (CPN) were excluded from the study since partner services already exist within antenatal and postnatal care services in Rwanda—pregnant women are requested to bring their sexual partner in for HIV testing. Referred sexual partners were enrolled in this study if they met the eligibility criteria: 18 years or older, were listed by an index client as having been a sexual partner within the last 12 months, had locator information, and consented to participate.

Study Procedures: During data collection for case-based survellence, enrolled index clients were interviewed using a questionnaire that collected socio-demographic information, and general clinical and sexual history and then was asked to list current or past (within 12 months) sexual partners. During the process, index clients also included locator information (most relevant being the partner's phone number, and type of relationship for each partner and decided how each partner was to be contacted for the referral to HIV test services (HTS) using one of the three partner notification approaches (passive, contract, and provider referral). For passive referral, the healthcare provider and the index client agreed on a timeline for when the index client would bring in or refer listed partners. If they chose, index clients received a pre-printed referral card to give to partners. If index clients did not bring in partners by the agreed date, the healthcare provider contacted the index client by phone to encourage him or her to complete the referral. For contract referral, the healthcare worker initiated partner notification if, after 2 weeks, the index client had failed to bring in their sexual partner for testing.

Whereas provider referral, the healthcare provider contacted partners directly by phone within 24 hours, requesting partners to come for HTS. No information on the identity of the index client was provided to the partner. Partners that came in for HTS were informed of the program, consented, and were linked to the index client using a UPID code and recorded as successful referrals.

Data Management and Analysis: Data were extracted from the Case-based surveillance dataset, cleaned, and analyzed using STATA version 13.1 (StataCorp, College Station, TX). Descriptive statistics were performed to describe the socio-demographic characteristics of index clients and successfully referred partners. Partners were considered successfully referred if they had been informed of their exposure as a result of any notification method, whether or not they tested for HIV. Analysis entailed running frequencies of the main study outcomes. To identify potential factors that predict successful partner notification among index clients, stepwise binary logistic regression was done. Independent variables found to be statistically significant in preliminary analysis by Pearson's chi-square test of independence were entered into the regression model. Odd ratios (OR) with 95% confidence intervals (CI) were calculated. In this study, the significance level was set at a P-value of less than 0.05. Variables dropped out of the original model if they had a P-value greater than 0.05 or a confidence interval including 1.

Ethical consideration: The study was conducted with ethical clearance from the Institutional Review Board (IRB) of the University of Rwanda, College of Medicine and Health Sciences. At every clinic, consent forms had been signed by index clients who were willing to list their partners. UPID codes were used instead of individual names to keep index clients and their partners anonymous. The highest standards of confidentiality, quality assurance and control were maintained in data collection, storage and processing.

RESULTS

Figure 1 shows the number of HIV positive enrolled index clients listed and successfully referred sexual partners by sex. From October 2018 to June 2019, the HIV case-based surveillance system registered a total of 2670 index clients, of whom 566 (21.1%) cases were

discarded due to reasons such as: Having not had a sexual partner within the last 12 months (n=271, 10.1%), having insufficient contact information on a partner (n =142, 5.3%), being pregnant (n = 32, 1.19%), or having consulted through CPN (n = 121, 4.5%). Newly diagnosed HIV patients who consulted through Maternity and PNC were excluded from the analysis as another form of partner notification exists within the antenatal and postnatal care services. The remaining 2104 index clients listed a total of 3791 sexual partners (n=2278, 60.0% female partners and n=1513, 39.9% male partners). The average number of partners listed per index client was 1.8. Of the listed partners, 2689 (70.9%) were successfully notified (i.e., were informed of their exposure to HIV). Overall, 58.4% of female partners and 41.5% of male partners were successfully notified. Among partners who were successfully notified, 2409(89.5%) came in for HIV testing. HIV testing was higher in female partners than males (90.0% and 88.9%, respectively). Among partners who were tested for HIV, 261 (10.8%) tested positive (142 Male vs 119 female). A total of 2015 (83.6%) tested negative and 133 (5.5%) of the referred sexual partners were not tested, and they had previously been diagnosed HIV positive, of which the index client was unaware.

As shown in Table 1 and 2, the proportion of eligible female index clients enrolled compared to males was higher (62.5% of females vs. 37.4% of males), and the proportion of HIV index clients reporting they were single compared to those who were married/cohabiting was much lower (16.4% single vs. 49.0% Married/Cohabiting, p=0.000). The majority of enrolled index clients were adults aged between 25-44 years, whereby they accounted for 68.5% of the total population (1442 of 2104) and the mean age was 36.8 years ranging from 18 to 79 years. Most index clients (64.3%) were unemployed. Most index clients successfully referred 848 (31.5%) sexual partners who were their occasional partners, and most index clients chose client referral for 1,366 (36.0%) partners, provider referral for 1213 (31.9%) partners, and contract referral for 805 (21.2%) partners. (Table 2).

Among index clentis, the referral success significantly correlated with marrital status (p=0.000) and being married was correlated with higher success (51.4%). occupation especially small scale business was associated with unsuccessful referral (34.4%) among HIV positive index clients (p=0.000), while among sexual partners it significantly correlated with the gender (p=0.003), relationship to index client (mostly occusional partners (31.5%) (p=0.000), type of notification used (p=0.000), sex without condom in last 12 months (p=0.004), and number of sexual partners (p=0.007) (Table 2).
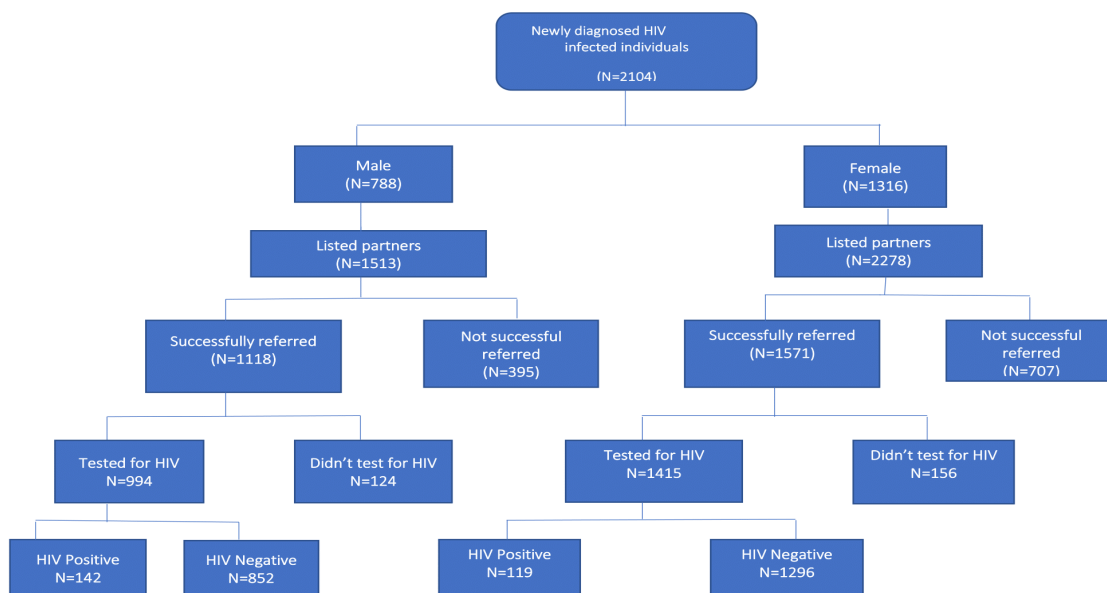

Figure 1: *Socio-demographic characteristics of enrolled index clients and their sexual partners*

Table 1: *Socio-demographic and sexual risk behaviors of HIV positive index clients*

Index client characteristics	Successful referral (*n=1643*)		Unsuccessful referral (*n=461*)		Total (N=2104)		*P*-value
	N	%	N	%	N	%	
Gender							
Female	1008	61.3%	308	66.8%	1316	62.5%	0.033
Male	635	38.6%	153	33.1%	788	37.4%	
Marital status							
Divorced/Separated	196	11.9%	67	14.5%	263	12.5%	0.000
Married/Cohabitant	845	51.4%	187	40.5%	1032	49.0%	
Single	282	17.1%	65	14.1%	347	16.4%	
Widow(er)	169	10.2%	55	11.9%	224	10.6%	
Missing	151	9.19%	87	18.8%	238	11.3%	
Age group							
18-24 years	154	9.38%	51	11.04%	205	9.74%	0.027
25-34 years	545	33.1%	172	37.3%	717	34.08%	
35-44 years	563	34.2%	162	35.1%	725	34.4%	
45-54 years	284	17.3%	60	12.9%	344	16.3%	
55+ years	97	5.91%	16	3.46%	113	5.37%	
Employment status							
Employed	597	36.3%	153	33.1%	750	35.6%	0.212
Unemployed	1,046	63.6%	308	66%	1354	64.3%	
Occupation							
Small scale business	176	29.5%	53	34.4%	229	30.5%	0.000
Farmer	90	15.1%	6	3.90%	96	12.8%	
Construction worker	65	10.8%	7	4.58%	72	9.60%	
Driver	50	8.39%	11	7.14%	61	8.13%	
Domestic worker	35	5.87%	9	5.84%	44	5.87%	
Other	181	30.3%	67	43.5%	248	33.07%	

p<0.05: Statistiacally significant

Table 3 shows the tendency of index clients to list or notify multiple partners by sex and marital status of index clients. Among 2104 index clients, 1044 listed more than one sexual partner. In bivariate analysis, successful notification of partners was lower in male index clients that had listed more than one sexual partner than in females [OR=0.99; (95% CI: 0.83-1.18); p=0.928]. Married index clients were 1.30 times more likely than unmarried index clients to successfully notify at least one partner (95% CI: 1.04-1.63); p=0.021]. Among other factors, age was found to be associated with successful partner notification among index clients aged ≥55years [OR=2.00; (95% CI: 1.08-3.71); p=0.027], followed by 45-54 years [OR=1.56; (95% CI: 1.02-2.38); p=0.037]. Successful partner notification also differed according to occupation, with the highest association observed in farmers [OR=4.5; (95% CI: 1.87-10.9); p=0.001], followed by construction workers [OR=2.7; (95% CI: 1.20-6.46); p=0.016]. Other factors that revealed significant association were; Gender [Male, OR=1.26; (95% CI: 1.01-1.57); p=0.033], Married or cohabiting [OR=1.04;(95% CI:0.76-1.42); p=0.799] and having had 2-5 sexual partners in the last 12 months [OR=1.37 ;(95% CI:1.11-1.69); p=0.003] compared to those that had ≥5 sexual partners [OR=0.66; (95% CI:0.19-2.21); p=0.501]. Successful partner notification was also higher among partners that had been listed as spouses

Table 2: *Socio-demographic and sexual risk behaviors of HIV positive index clients' sexual partners*

Partner Characteristics	Successful referred partners (*n=2689*)		Unsuccessful referred partners (*n=1102*)		Total (N=3791)		*P*-value
	n	**%**	**N**	**%**	**N**	**%**	
Gender of Partner							
Female	1,571	58.4%	707	64.1%	2,278	60.1%	0.003
Male	1,118	41.5%	395	35.8%	1,513	39.8%	
Partner relationship to index client							
Boyfriend/Girlfriend	374	13.9%	112	10.1%	486	12.8%	0.000
Cohabitant	379	14.0%	110	9.98%	489	12.9%	
Occasional Partner	848	31.5%	394	35.7%	1,242	32.7%	
Other	354	13.1%	156	14.1%	510	13.4%	
Paid to have sexual intercourse	432	16.0%	260	23.5%	692	18.2%	
Spouse or fiancé(e)	302	11.2%	70	6.35%	372	9.81%	
Type of notification used							
Client referral	1,060	39.4%	331	30.0%	1,391	36.6%	0.000
Provider referral	1,018	37.8%	269	24.4%	1,287	33.9%	
Contract referral	610	22.7%	338	30.6%	949	25.0%	
Missing	1	0.04%	164	14.8%	165	4.35%	
Sexual risk behaviors of Index clients							
Sex without condom in last 12 months							
Yes	1182	71.9%	300	65.0%	1482	70.4%	0.004
No	461	28.0%	161	34.8%	622	29.5%	
Number of sexual partners in the last 12 month							
1 partner	718	43.7%	237	51.3%	955	45.3%	
2-5 partners	917	55.8%	220	49.7%	1137	54.0%	0.007
> 5 partners	8	0.49%	4	0.87%	12	0.57%	
Sex with multiple partners							
Yes	1198	72.9%	363	78.7%	1561	74.1%	0.012
No	445	27.1%	98	21.2%	543	25.8%	

p<0.05: Statistiacally significant

of index clients [OR=2.00; (95% CI: 1.50-2.67); p=0.000] compared to boyfriends and girlfriends of index clients [OR=1.55; (95% CI: 1.22-1.98); p=0.000]. Index clients that used the provider referral method were 2.06 times more likely to notify their partners than those that opted for the contract referral method (95% CI: 1.66-2.55); p=0.000] (Table 5 and 6).

Successful partner notification continued to be the dependent variable, while residence, number of sexual partners, gender of partner, type of relationship, and type of notification option used were considered independent variables.

The strongest predictors of successful partner notification were: having 2-5 partners, which was associated with an adjusted odds ratio (aOR) of 2.53 (95% CI: 1.60–3.99), followed by the type of relationship whereby partners who were listed as being spouses to index clients were 2.11 times more likely to be notified (95% CI: 1.54–2.89) compared to boyfriends or girlfriends (aOR = 1.50, 95% CI: 1.16–1.95). Controlling for other factors, index clients from Gasabo were associated with higher odds of successful notification (aOR=2.06; 95% CI, 1.05–4.05); p=0.035] compared to those who lived in Kicukiro or Nyarugenge districts. Female sexual partners were less likely to be

Table 3: *Successful notification and multiple partner listing by sex and marital status of index clients*

	Yes		No		Total		Bivariate	
Study outcome	**N**	**%**	**N**	**%**	**N**	**%**	**Crude OR**	***P*-value**
Index client listed more than one sexual partner by sex								
Female (Ref.)	654	62.6%	662	62.4%	1316	62.5%	1	-
Male	390	37.3%	398	37.5%	788	37.4%	0.99{0.83-1.18}	0.928
Index client listed more than one sexual partner by marital status								
Not Married (Ref.)	441	42.2%	393	37.0%	834	39.6%	1	-
Married	513	49.1%	519	48.9%	1032	49.0%	0.88{0.73-1.05}	0.174
Missing	90	8.62%	148	13.9%	238	11.3%	0.54{0.40-0.72}	0.000
Index client notified at least one listed sexual partner by sex								
Female (Ref.)	1008	61.3%	308	66.8%	1316	62.5%	1	-
Male	635	38.6%	153	33.1%	788	37.4%	1.26{1.01-1.57}	0.033
Index client notified at least one listed sexual partner by marital status								
Not Married (Ref.)	647	39.3%	187	40.6%	834	39.6%	1	
Married	845	51.4%	187	40.4%	1032	49.1%	1.30{1.04-1.63}	0.021
Missing	151	9.20%	87	18.8%	238	11.3%	0.50{0.36-0.68}	0.000

Ref.: Reference variable

successfully notified compared to male sexual partners (aOR = 0.80, 95% CI: 0.69–0.94). The effects of factors such as age, gender, occupation, condom use in the last 12 months, having had sex with multiple partners in the last 12 months, having been a commercial sex worker or having had the experience of intimate partner violence, among many other factors were found not to be statistically significant and were not retained in the final model. Other factors that were associated with successful partner notification were: the type of notification option used; index clients that opted for provider referral were 1.92 times more likely to notify their partners [95% CI, 1.54–2.39; p=0.000] than those that opted for a passive referral or contract referral (Table 4).

Table 4 presents HIV testing rates and HIV serostatus of successfully notified sexual partners by sex and relationship status. Among 2409 tested sexual partners, the majority were females, accounting for 60.1% of tested sexual partners. Being a female sexual partner was associated with lower successful notification (OR=0.85; 95% CI, 0.74-0.98). In multivariate analysis, sexual partners listed as spouses were 1.4 times more likely to get tested compared to occasional partners (OR=1.43; 95% CI, 1.11-1.82), followed

by cohabitants (OR=1.32; 95% CI, 1.07-1.64). Of the tested sexual partners, men tested positive at a higher rate than females (54.4% men vs. 45.5% female). In bivariate analysis, the highest HIV infection rate was seen among spouses (OR=1.87; 95% CI 1.26-2.77), followed by those listed as boyfriend/girlfriend (OR=1.12; 95% CI 0.74-1.71). Only sexual partners listed as spouses remained significantly associated with HIV positivity in multivariate analysis (OR=1.83;95% CI;1.26-2.55) (Table 7).

DISCUSSION

The study aimed at identifying the independent predictors of successful notification of sexual partners among HIV positive index clients. Our findings demonstrated that the proportion of partners notified in this study (70.9%) is slightly above the range than what has been described elsewhere in Africa and in other parts of the world [11-13].

Furthermore, previous studies have shown that 17-68% of persons diagnosed with HIV disclose their status to at least 1 sexual partner [14–17]. This was also reflected in our study, whereby the majority (44.5%) of the enrolled index clients notified one sexual partner, highlighting the need to increase

Table 4: *Multivariate analysis showing factors associated with partner notification by background characteristics of index clients and their partners*

Variable	Successful notification N(%)	Univariate Analysis		Multivariate analysis	
		Crude Odds ratio	*P*-value	Adjusted Odds ratio	*P*-value
Socio-demographic characteristics (N=2104)					
1. Current address(N=2104)					
Kicukiro	627/1643(0.38)	**1**	-	**1**	
Gasabo	384/1643(0.23)	1.05{0.76-1.44}	0.742	2.06{1.05-4.05}	0.035
Nyarugenge	599/1643(0.36)	0.45{0.35-0.58}	0.000		
Other	33/1643(0.02)	1.08{0.44-2.65}	0.853		
Sexual risk behaviors (N=2104)					
2. Number of sexual partners in the last 12 months					
1 partner	718/1643(0.43)	**1**	-	**1**	-
2-5 partners	917/1643(0.55)	1.37{1.11-1.69}	0.003	2.53{1.60-3.99}	<0.001
> 5 partners	8/1643(0.004)	0.66{0.19-2.21}	0.501		
Partner Characteristics					
3. Gender of partner					
Male sexual partners	1,118/2689(0.41)	**1**	-	**1**	-
Female sexual partners	1,571/2689(0.58)	0.78{0.67-0.90}	0.001	0.80{0.69-0.94}	0.009
4. Index relationship to partner					
Occasional Partner	848/2689(0.31)	**1**	-	**1**	-
Boyfriend/ Girlfriend	374/2689(0.13)	1.55{1.22-1.98}	0.000	1.50{1.16-1.95}	0.002
Cohabitant	379/2689(0.14)	1.60{1.25-2.04}	0.000	1.43{1.11-1.84}	0.005
Spouse or fiancé(e)	302/2689(0.11)	2.00{1.50- 2.67}	0.000	2.11{1.54-2.89}	0.000
5.Type of notification option					
Contract referral	610/2689(0.22)	**1**	-	**1**	-
Provider referral	1,018/2689(0.37)	2.06{1.66-1.2.55}	0.000	1.92{1.54-2.39}	0.000
Client referral	1060/2689(0.39)	1.89{1.54-2.32}	0.000	1.73{1.39-2.15}	0.000

the number of notified and tested partners. This could be achieved considering notification steps, including assessing one's notification skills, adjusting to the diagnosis, deciding whom to notify, evaluating partner's reaction and establishing effective notification strategies. Counseling and education of both partners and HIV patients before nofification could also help increase parner notification rates [10].

Most previous studies evaluating determinants for successful notification of sexual partners of HIV index clients have mainly measured socio-demographic, type of relationship or sexual risk behavior as predictor variables. Among factors reported to have favored sexual partner notification are: steady relationships or partnerships [11,12], [18], index clients being male[19], being married, older age [12,20] and a number of sexual partners [13]. Most of these factors were also statistically significant in our study, where married index

clients were 2.1 times more likely to successfully notify their partners than unmarried index clients, while male index clients were 1.26 times more likely than female index clients to successfully notify at least one sexual partner. These findings are also in line with other studies previously conducted among HIV index clients in countries such as South Africa and Tanzania that showed at gender dynamics as one of the major factors influencing partner notification. These studies indicated that some female index clients were reluctant to discuss partner notification issues to avoid negative reactions such social harm, stigma, discrimination and fear of male partner violence to mention but a few [20,21]. This might be attributed to the varying gender norms among different cultures and societies where masculinity is equated with dominance and femininity is equated with subordination and dependency to men [22]. Though sex and gender power differentials have

Table 5: *Bivariate analysis on factors associated with successful partner notification by background characteristics of index clients*

Variable	Successful notification n /N (%)	Univariate Analysis	
Index client socio-demographic characteristics			
1. Gender(N=2104)		**Crude Odds ratio**	***P*-value**
Female	1008/1643(0.61)	1	-
Male	635/1643(0.38)	1.26{1.01-1.57}	0.033
2. Age group(N=2104)			
18-24 years	154/1643(0.09)	1	-
25-34 years	545/1643(0.33)	1.04{0.73-1.50}	0.793
35-44 years	563/1643(0.34)	1.15{0.80-1.65}	0.446
45-54 years	284/1643(0.17)	1.56{1.02-2.38}	0.037
55+ years	97/1643(0.05)	2.00{1.08-3.71}	0.027
3. Marital status(N=2104)			
Single	282/1643(0.17)	1	-
Married/Cohabitant	845/1643(0.51)	1.04{0.76-1.42}	0.799
Divorced/Separated	196/1643(0.11)	0.67{0.45-0.99}	0.046
Widow(er)	169/1643(0.10)	0.70{0.47-1.06}	0.096
Missing	151/1643(0.09)	0.40{0.27-0.58}	0.000
4. Occupation (N=2104)			
Small scale business	176/1643(0.10)	1	-
Farmer	90/1643(0.05)	4.5{1.87-10.9}	0.001
Construction worker	65/1643(0.039)	2.7{1.20-6.46}	0.016
Driver	50/1643(0.03)	1.36{0.66-2.81}	0.697
Domestic worker	35/1643(0.02)	1.17{0.52-2.59}	0.394
Other	181/1643(0.11)	0.81{0.53-1.23}	0.331
5. Sexual risk behaviors (N=2104)			
Number of sexual partners in the last 12 months			
1 partner	718/1643(0.43)	1	-
2-5 partners	917/1643(0.55)	1.37{1.11-1.69}	0.003
> 5 partners	8/1643(0.004)	0.66{0.19-2.21}	0.501
Sex without condom in last 12 months	1182/1643(0.71)	1.37{1.10-1.71}	0.004
Sex with HIV+ person	561/1643(0.34)	1.63{1.18-2.25}	0.003

long been associated with HIV-related risk factors, decision-making, testing, and partner notification consequences, our study did not measure or analyze these gender norms, attitudes, or power dynamics in relationships as one of the factors related to the willingness of index clients to notify their partners. However, other studies found evidence that these attitudes are one of the impacting factors to HIV disclosure and partner notification [5,24].

This study also suggested that sexual risk behavior factors are more critical in influencing sexual partner notification. Although variables such as having anal or vaginal sex without condom use, having sex with an HIV positive, having sex with a commercial sex worker, having had sex with multiple partners, and having had sex with injecting drug users, among many others, were statistically significant in univariate analysis, none of these variables reached significance in the multivariate analysis except the number of sexual partners had by the index client in the past

12 months. This means that the effect of socio-demographic variables is mediated through the sexual risk behavior factors as assumed by applied socio-sexual risk behavior models [25].

In Multivariate analysis, characteristics such as index client's relationship to partner, type of notification approach used, index client's residency, number of sexual partners had in the last 12 months, and partner's gender were also statistically associated with successful partner notification. Spouses were more likely to be notified by their partners, indicating that partner notification in Rwanda could be particularly effective. Since most partners (848/2689) were occasional partners (i.e., were having a sexual relationship with the index client while also having an ongoing relationship), this indicates that index clients could also reach these occasional partners; however, there is more need to assist index clients in reaching this group of partners. These findings are inconsistent with most other studies, which indicate that most index

Table 6: *Bivariate analysis on factors associated with successful partner notification for partners of index clients*

	Successful referred partners (*n=2689*)	Univariate	
		Crude Odds ratio	***P*-value**
Partner Characteristics			
6.Gender of partner			
Female	1,571/2689(0.58)	1	-
Male	1,118/2689(0.41)	1.27{1.10-1.47}	0.001
7. Index relationship to partner			
Occasional Partner	848/2689(0.31)	1	-
Boyfriend/Girlfriend	374/2689(0.13	1.55{1.22-1.98}	0.000
Cohabitant	379/2689(0.14)	1.60{1.25-2.04}	0.000
Other	354/2689(0.13	1.05{0.84-1.32}	0.626
Paid to have sexual intercourse	432/2689(0.16)	0.77{0.64- 0.94}	0.012
Spouse or fiancé(e)	302/2689(0.11)	2.00{1.50- 2.67}	0.000
8.Risk of Intimate Partner Violence			
Yes	121/2689(0.04)	1	
No	2545/2689(0.94)	3.46{2.70-4.45}	0.000
Missing	24/2689(0.008)	2.18{1.08-4.39}	0.029
9.Type of notification option			
Contract referral	610/2689(0.22)	1	-
Provider referral	1,018/2689(0.37)	2.06{1.66-2.55}	0.000
Client referral	1060/2689(0.39)	1.89{1.54-2.32}	0.000
Missing	1/2689(0.04)	0.00{0.00-0.01}	0.000

Table 7: *HIV serostatus among notified sexual partners by sex and relationship status*

Study outcome	Yes		No		Total		Bivariate	Multivariate
	N	%	N	%	N	%	Crude OR	Adjusted OR
Partners successfully tested for HIV(n=2409)								
1.Sex								
Male sexual partner	994	41.2%	519	37.5%	1,513	39.9%	1	1
Female sexual partner	1,415	58.7%	863	62.4%	2,278	60.1%	0.85{0.74-0.98}	
2.Relationship status								
Occasional Partner	789	32.7%	453	32.7%	1,242	32.7%	1	1
Boyfriend/Girlfriend	323	13.3%	163	11.9%	486	12.8%	1.13{0.91-1.41}	
Cohabitant	348	14.4%	141	10.1%	489	12.9%	1.41{1.12-1.77}	1.32{1.07-1.64}
Other	342	14.1%	168	12.3%	510	13.4%	1.16{0.94-1.45}	
Paid to have sexual intercourse	340	14.1%	352	25.4%	692	18.2%	0.55{0.45-0.66}	0.49{0.41-0.59}
Spouse or fiancé(e)	267	11.0%	105	7.60%	372	9.81%	1.45{1.13-1.88}	1.43{1.11-1.82}
Partners diagnosed with HIV infection (n=261)								
1.Sex								
Male sexual partner	142	54.4%	852	39.6%	994	41.2%	1	1
Female sexual partner	119	45.5%	1296	60.3%	1415	58.7%	0.55{0.42-0.71}	0.56{0.43- 0.72}
2.Relationship status								
Occasional Partner	79	30.2%	710	33.0%	789	32.7%	1	1
Boyfriend/Girlfriend	36	13.7%	287	13.3%	323	13.3%	1.12{0.74-1.71}	
Cohabitant	32	12.2%	316	14.7%	348	14.4%	0.91{0.59-1.40}	
Other	36	13.7%	306	14.2%	342	14.1%	1.05{0.69-1.60}	
Paid to have sexual intercourse	32	12.2%	308	14.3%	340	14.1%	0.93{0.60-1.43}	
Spouse or fiancé(e)	46	17.6%	221	10.2%	267	11.0%	1.87{1.26-2.77}	1.80{1.26-2.55}

patients are reluctant to notify other partners who are not their spouses about their exposure to HIV [26]. This may be explained as a lack of emotional attachment or emotional responsibility to these partners. Another possible reason would be index clients are likely to notify their partner if their financial support depends on their spouses. Several studies have also shown strong evidence that key populations [27] and people with casual/occasional partners [14] may be less able or willing to notify partners, while partners listed as spouses or steady partners are more likely to get notified [7,14]. This may be due to the inability to recall contact information for partners, since recall of partner information is reported to be better among steady partners than unsteady partners [28,29]. Strategies to reach spouses and other partners should include providing good counseling, assessing one's notification skills, deciding whom to notify, and evaluating partner's reaction.

Our study also indicated an association between successful partner notification and the type of referral approach used, indicating that provider referral had a comparatively good uptake as a passive referral. In our study, partners who were notified via provider referral approach (37.8%, aOR: 1.92) and passive or client referral (39.4%, aOR: 1.73) were more likely to return for HIV testing and counseling than those that were notified via contract referral approach. This shows that there is room for success in the application of both provider and passive referral approaches to partner notification. Results obtained from this study are generally consistent with other studies. For example, a randomized trial study conducted in North Carolina, USA, showed 50% of partners notified via the provider referral arm returned for HIV testing and counseling. Another study in Kenya revealed that provider referral was more effective at increasing partner testing, and 67% of sexual partners came in for HIV testing following contact with a healthcare provider. In addition to this, recent studies conducted in low and middle-income countries revealed that the pooled proportion of partners returning for HIV testing after partner notification was above 50% [14,30–33]. Although most index clients in our study preferred passive referral over provider referral, there was a greater successful notification among partners who were notified via provider notification approach as opposed to those who were notified via the passive referral approach. It is, therefore, evident

that, even though passive referral was the most preferred approach, the majority of index clients still lack the confidence to approach their sexual partner. This may be brought about by fears of rejection, abandonment or gender-related barriers, which may prevent them from following through with self-disclosure. Other studies conducted on the effectiveness of different referral methods have shown varying results, highlighting that assisted notification (provider or contract referral) results in more partners receiving testing and counseling services than in the passive referral method. For example, a study conducted in Malawi highlighted passive referral as one of the approaches that was not yielding promising outcomes with only 24% of partners notified compared to 51% in the provider referral and contract referral arm, respectively [7]. A study in Kenya showed that 67% of sexual partners contacted using via provider-assisted partner notification came in for testing, when offered the service early [34], and only 6.7% of partners in the Cameroon study were notified by passive referral [14].

Our study did not assess uptake or compare different referral methods but evaluated which method would effectively increase HIV notification to partners. Our study showed that establishing more purposeful provider partner notification strategies that would be helpful in increasing partner notification rates. Majority of index clients (56.2%) had more than one sexual partner and both bivariate and multivariate analysis, showed that the number of sexual partners had by an index client within the past 12 months was significantly associated with partner notification.

Generally, we found that nearly 90% of referred index clients came in for testing. The increase in the number of partners tested may be due to counseling opportunities and support provided to partners. However, findings from our study also showed that there is still a need to bring in female partners for testing. Globally, sex and gender norms have long been known to be relevant in decision-making around HIV testing and treatment, whereby characteristics such as male masculinity, self-reliance, and power are known to be associated with poor health outcomes, including decisions on HIV testing. In Lesotho and South Africa, a study pointed out that men were found to have an individual-held stigma around HIV testing because they are perceived as powerful, dominant, and controlling; hence illnesses due to HIV would

be interpreted as "weakness" [23]. In our study, female partners had lower odds of testing for HIV (aOR=0.85) compared to male partners, contrary to evidence from most studies [23,35]. The possible explanation for this difference could be fear of relationship disruptions or fear of physical and emotional violence that women could encounter if found to be HIV positive. Previous studies have also shown that women cannot openly discuss sex and HIV testing with their partners due to the notion that HIV is seen as a disease brought into relationships by women, reducing testing acceptance among women to avoid conflicts within their relationships [35,36]. Our study also showed that spouses of HIV index clients were more likely to undergo HIV testing than unmarried partners. Similar findings have been documented elsewhere in the world [37]. This could be due to the level of comfort and increased spousal communication in discussing sex and HIV. Also, death or illness of a spouse from suspected AIDS may motivate the surviving spouse to seek testing for HIV. However, our study didn't assess factors motivating partners to test for HIV. This could be a gap to be addressed by future studies.

Our study had some limitations. Our sample was only limited to Kigali city; thus, this may not represent the true picture of all the index clients and partners involved in Rwanda. Secondly, the data was collected from an HIV case-based surveillance system for which individual patient-level data were routinely reported. As such, not all desired variables were available. In addition, there was a lot of missing or poorly collected data. The data also consisted of a high number of HIV positive individuals ineligible because they did not have a partner in the last 24 months. However, some HIV positive individuals may have been using this response as a way to politely opt out of the partner notification process.

Additionally, this study was not designed to capture testing or referral outside the study facilities. If partners went to another facility to test following partner notification, we would not know about that partner's decision to test. This could mean that our estimates of the successful notifications in the study could be lower than the actual ones.

Finally, our study was not designed to assess the safety of the partner notification approach regarding intimate partner violence (IPV). We recognize that even though no cases of IPV were reported, unreported cases may have occurred. Our findings on the sex-related differences that create barriers to partner notification and HIV serostatus disclosure undermine the importance of principles described in the World Health Organization tool for integrating gender into HIV/AIDS programs in the health sector. Programs scaling up partner notification should consult this tool closely. For example, by discussing the benefits and potential disadvantages of disclosure, programs can help women disclose their HIV status safely. Programs can also help those at risk of violence with safety planning and mediated disclosure

CONCLUSION

As the proportion of undiagnosed PLHIV decreases, reaching those who are asymptomatic and not engaged with the health system is a critical challenge. Our study confirms that partner notification could dramatically increase the number of previously undiagnosed PLHIV who learn their status and are linked to care. Expanding partner notification services to be performed in health facilities outside Kigali could also reduce the burden of HIV and greatly expand access to testing and linkage to care among people at high risk of infection. Allowing index clients to choose their preferred referral method may also have led to increased notification success, resulting in more partners being tested.

We recommend partner notification as a priority HIV testing strategy and that provision of a package for prevention for serodiscordant couples be included as part of the service. Because of the heterogeneity in the successes and preferences associated with partner notification in different studies, no single partner notification strategy stands out as the recommended approach. Majority of index clients only limited notification to one partner. Therefore, further research is needed to evaluate partner notification strategies that could

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