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Partner Notification Approaches for Sex Partners and Children of Human Immunodeficiency Virus Index Cases in Côte d'Ivoire

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Background: Four partner notification approaches were introduced in health facilities in Côte d'Ivoire to increase human immunodeficiency virus (HIV) testing uptake among the type of contacts (sex partners and biological children younger than 15 years). The study assessed the 4 approaches: client referral (index cases refer the contacts for HIV testing), provider referral (health care providers refer the contacts), contract referral

(index case-provider hybrid approach), and dual referral (both the index and their partner are tested simultaneously).

Methods: Program data were collected at 4 facilities from October 2018 to March 2019 from index case files and HIV testing register. We compared uptake of the approaches, uptake of HIV testing, and HIV positivity percentages, stratified by contact type and gender.

Results: There were 1089 sex partners and 469 children from 1089 newly diagnosed index cases. About 90% of children were contacted through client referral: 85.2% of those were tested and 1.4% was positive. Ninety percent of the children came from female index cases. The provider referral brought in 56.3% of sex partners, of whom 97.2% were HIV-tested. The client referral brought in 30% of sex partners, of whom only 81.5% were HIV-tested. The HIV positivity percentages were 75.5% and 72.7%, respectively, for the 2 approaches. Male index cases helped to reach twice as many HIV-positive sexual contacts outside the household (115) than female index cases (53). The contract and dual referrals were not preferred by index cases.

Conclusions: Provider referral is a successful and acceptable strategy for bringing in sex partners for testing. Client referral is preferred for children.

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The human immunodeficiency virus (HIV) continues to be a major public global health problem. Sub-Saharan Africa is the most affected region with over two thirds of the global total of new HIV infections.¹ Côte d'Ivoire is one of the countries most affected by the HIV epidemic in West Africa. In Côte d'Ivoire, approximately 390,000 people aged 15 to 64 years are living with HIV.² The HIV/AIDS indicators in Côte d'Ivoire show a trend of declining prevalence in the country from 3.7% in 2012 to 2.6% in 2018.³ A 2017 population-based HIV impact assessment (CIPHIA) survey in Côte d'Ivoire found that only 37% of adults (15–64 years) were aware of their HIV status, highlighting substantial gaps toward achieving HIV epidemic control.²

The World Health Organization recommends HIV testing of sex partner(s) as well as children of HIV index cases, who are unaware of their HIV status.⁴ Index testing strategy consists of enumerating the contacts (sex partners and biological children younger than 15 years) of an HIV index case, and reaching out to those contacts to offer them HIV testing services (HTS) and, as needed, link them to care. Children younger than 15 years are contacts of index cases, but they are not sex partners. In Côte d'Ivoire, the number of newly HIV-infected children is decreasing, but remains high: from 3200 in 2016, it fell to 2700 in 2017 and then to 2600 in 2018.³ In addition, only 40% of children needing antiretroviral therapy (ART) were receiving it in 2018.³ Thus, there is a need to find and test children for HIV as early as possible to reduce new infections among them. To achieve this goal, integrating child testing in partner notification programs is an effective

strategy, but it has not been widely implemented in Africa. The Mozambique's study found that child testing into assisted partner services (APS) was an acceptable strategy, even if only 2% of children HIV tested were positive.⁵ In the Zimbabwe HIV Care and Treatment project, based on the APS, the testing of sex partners and biological children resulted in an increase in the HIV positivity percentages (46% for sex partners and 17% for children younger than 15 years), compared with the old strategy of testing every family member in the household.⁶

In the context of HIV, index testing consists of enumerating the contacts of an HIV index case, and reaching out to those contacts to offer them HTS and, where needed, linking them to care. Partner notification is an HTS strategy that may contribute to prevention of HIV transmission and reduction of HIV-related morbidity and mortality, and this can support epidemic control, particularly when combined with a "HIV treat all" approach, in which all people living with HIV (PLHIV) are eligible to start ART immediately.⁷

Four partner notification approaches are typically utilized under programmatic conditions: (a) client referral, (b) contract referral, (c) provider referral, and (d) dual referral (see Table 1 for definition).^{8–11} Partner notification refers to the contact tracing of sex partners and children younger than 15 years of index cases. The HIV partner notification has been highly utilized in the United States and Europe, but not widely used in sub-Saharan Africa.^{12,13} Provider-initiated testing and counseling is an effective way for promptly identifying PLHIV and prioritizing their care.^{14–16} A study conducted in Malawi has provided evidence about the effectiveness, feasibility, and acceptability of provider-assisted methods of HIV partner notification in sub-Saharan Africa.¹⁷ This study also showed that partners of index cases returned for HIV testing were 24% for the client referral, 51% for the contract referral, and 51% for the provider referral.¹⁷ Another study conducted in Kenya showed that APS have increased HIV testing and case-finding among 1305 people with HIV infection.¹⁸ Moreover, during a pilot APS program in Maputo, Mozambique, it was found that APS helped to notify 22 additional partners, to HIV-testing of 83 partners and to 43 new HIV diagnoses, compared with the results before the program.⁵ Thus, APS increased partner notification, testing, and HIV case-finding, respectively, by 13%, 101%, and 125%.⁵ In Central Africa, a study led in Cameroon revealed that 44.3% of 1224 sex partners reached out were notified through provider referral and 43.7% through patient referral.¹⁹ Also, a study in Zimbabwe showed that 95.1% of index cases identified during the study period (March 2016 to May 2018) listed 55,149 contacts, of whom 29% (15,944) were tested HIV positive.⁶ All these studies highlight that partner notification services are an effective way to reach sex partners of individuals diagnosed with HIV (index cases).

In sub-Saharan Africa, specifically in Côte d'Ivoire, limited evidence is available on the acceptability of partner notification in

identifying sex partners of HIV-diagnosed clients. Fondation Ariel Glaser developed the *Espoir d'Ariel* project (2018–2023) to improve identification, initiation, and retention of PLHIV into care and treatment to achieve viral suppression and reduce HIV/AIDS-associated mortality in the Republic of Côte d'Ivoire. These 4 different partner notification approaches are offered in supported health care centers. In our regional context, this index testing strategy has not been systematically studied.

The study therefore aimed to measure: (1) which of the 4 different HIV partner notification approaches was preferred by the index cases; (2) the number of contacts named, tested, and testing positive per index case, for each approach; (3) the number of index cases divided by the number of partners newly diagnosed with HIV infection; (4) the subsequent enrollment into care, in the 4 supported health centers in Côte d'Ivoire over 6 months from October 2018 to March 2019.

MATERIALS AND METHODS

Study Design

This was a cohort study using preexisting routinely collected program data.

Setting

General Setting

The study was conducted in Côte d'Ivoire. Located in West Africa, Côte d'Ivoire had an estimated population of 22.6 million in 2014, with 48.3% of the population being females.²⁰ Fondation Ariel Glaser works in close collaboration with the national Ministry of Health and Public Hygiene by supporting sites and health districts in HIV prevention, care, support and treatment activities. Through its "Espoir d'Ariel" Project, since April 1, 2018, with funding from the US Centers for Disease Control and Prevention/US President's Emergency Plan for AIDS Relief (CDC/PEPFAR), Fondation Ariel Glaser supports 11 health districts in 3 health regions. The foundation has 273 HIV HTS supported sites. The Gboklè Nawa San Pedro, with 7 health districts, represents one of the most important regions supported by the Fondation Ariel Glaser (Fig. 1).

Site Specific

The study sites were 4 urban health facilities in the area of Gboklè Nawa San Pedro where we collected data. One health center (urban health center of Yabayo), with 190 people tested HIV positive, and 3 hospitals (Regional Hospital Center of San Pedro, General Hospital of Soubré and Hospital of Méagui), with, respectively, 129, 658, and 112 people tested HIV positive in the study period. All people HIV-positive attended the facilities. Health

TABLE 1. The 4 Different Partner Notification Approaches

Name of Approach	Description
1 Client referral	Health workers* encourage index cases to notify and refer their partners for HTS on their own.
2 Contract referral	Health workers encourage index cases to refer their partners for HIV testing, with the understanding that a health worker will contact partners who do not visit the site by an agreed-upon date (1 month).
3 Provider referral	A trained health worker locates and notifies partners immediately and directly by telephone, while maintaining the anonymity of the index case. The contacts then decide to visit the health care facility to be tested for HIV according to the national HIV testing guidelines.
4 Dual referral	The counselor/provider will interview the index case and his/her sex partner (s). He will support the index case when he speaks about his serology to his partners.

*Health worker is named also trained health worker or provider or counselor. All of them are called health care providers. They were trained on the different partner notification approaches.

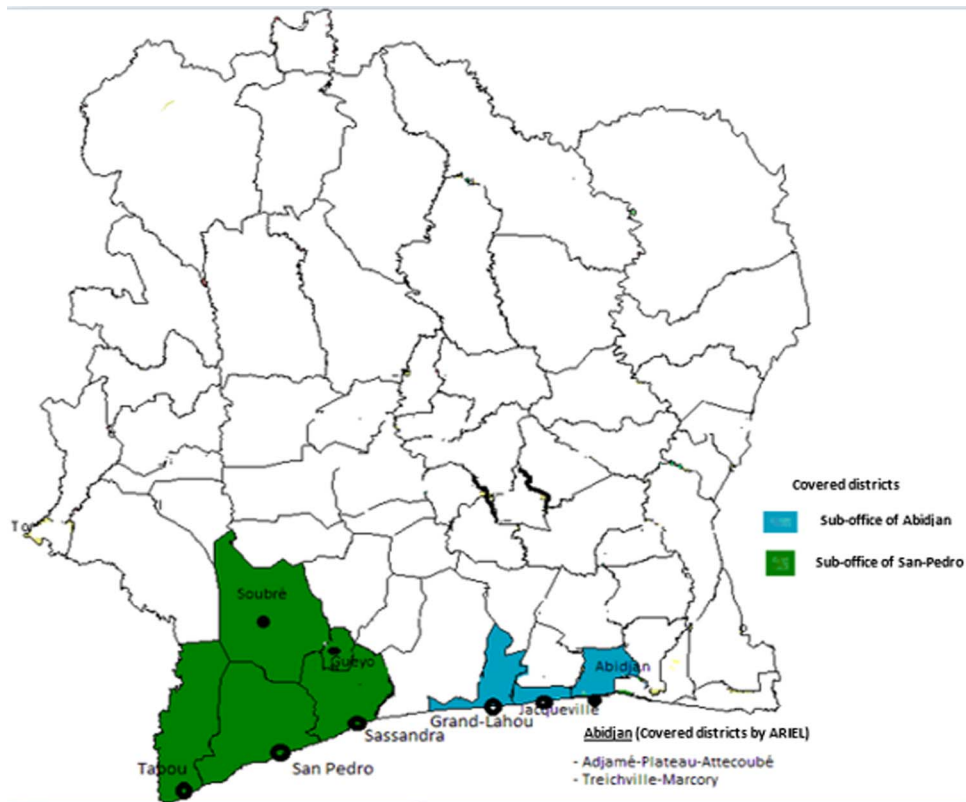


Figure 1. Fondation Ariel Glaser's intervention areas. Blue: Abidjan area; Green: Gboklè Nawa San Pedro area.

centers are outpatient clinics with medical day treatment, and hospitals have patients hospitalized overnight and several health specialties. In addition, the Regional Hospital Center of San Pedro, the Urban Health Center of Yabayo, the General Hospital of Soubre, and the Urban Health Center of Méagui serve, respectively, 1515, 950, 2171, and 688 people with HIV. All the health care workers were trained on the different partner notification approaches. The partner notification process begins during clinical consultations and psychosocial support meetings, where trained community counselors and health care providers sensitize all HIV-infected adult patients, about the importance of getting their sex partner(s) and biological children younger than 15 years, tested for HIV. All index cases received partner notification services in the HIV clinic. We did not collect information on the date of the HIV diagnosis for index cases. Thus, we cannot specify the number of old HIV diagnosis, and we cannot specify the number of new HIV diagnosis.

Following oral consent, an HIV counselor conducts an enumeration of sex partner(s) with the index case in the patient record. During the enumeration interview, information on all sex partners and biological children younger than 15 years, their gender, age, HIV status, ART initiation status for those positive and relationship to the index case is entered in the index testing register and index client's chart. Each page of the index testing register lists 1 index case, with 1 line for 1 contact (sex partner or biological child younger than 15 years) and columns that give sociodemographic information on the contacts. For each sex partner and biological child younger than 15 years who are enumerated and whose HIV status is reported as negative or unknown, index cases are asked to refer them for HTS by selecting 1 of the 4 HIV partner notification approaches as described in Table 1. The selected

approach is used to inform and notify their contacts and refer them to care. The approach used to notify partners can change during the process. The contacts then visit the health care facility to be tested for HIV according to Côte d'Ivoire's National HIV testing guidelines.²¹ All PLHIV are eligible to start ART immediately.

Study Population

Index cases who were diagnosed with HIV between October 1, 2018, and March 31, 2019, their sex partners in the past 24 months and their biological children younger than 15 years, listed by the index cases were included in the study.

Data Collection and Data Variables

The sources of data were the individual patient records and the index testing register. Data were collected into a structured questionnaire. Before starting the study, the data collection tool was pretested for 1 day at 1 health facility (National Institute of Public Health, INSP) in Abidjan. Data collectors participated in a 1-day training on data collection procedures. The following variables were collected:

For the index case: age at admission (by the time when the patient arrived at the facility), gender, nationality, religion, employment status, level of education, and marital status.

For the contact: age, gender, type of contact (conjoint/spouse, other sexual partner, biological children), HIV status at admission (HIV positive, HIV negative, unknown), HIV partner notification approaches (client referral, contract referral, provider referral, dual referral), HIV results (positive, negative), HIV testing code, linkage to ART, and ART identification code.

RESULTS

TABLE 2. Sociodemographic Characteristics of Index Cases Identified in Health Centers Supported by the Foundation Ariel Glaser in Côte d'Ivoire From October 2018 to March 2019

Characteristics	n (%)
Total	1089 (100)
Gender	1089
Male	575 (52.8)
Female	514 (47.2)
Age, y	1089
0–14	7 (<1)
15–24	21 (1.9)
25–49	801 (73.6)
50	260 (23.9)
Median [IQR]	42 [36–49]
Pregnancy status at registration	368
Yes	6 (1.6)
No	362 (98.4)
Marital status	1082
Lives in couple	849 (78.5)
Single	220 (20.3)
Widower	10 (0.9)
Divorced	3 (<1)
Level of education	1087
Primary	441 (40.6)
Secondary	155 (14.3)
Tertiary	37 (3.4)
None	454 (41.8)
Employment status	1082
Employed	1057 (97.7)
Unemployed	15 (1.4)
Retired	10 (<1)

IQR, interquartile range.

Data Analysis and Statistics

Data were entered from paper-based registers (index testing register and individual client record) kept at the health centers, in Census and Survey Processing System version 7. Data cleaning was performed to remove inconsistencies, and the database was analyzed using STATA version 14 (Stata Corporation, College Station, TX). Descriptive univariate and bivariate analyses were performed for the index cases and their contacts, stratified by HIV partner notification approach. We calculated the number of persons having been referred, tested, testing positive, linked to care, and initiated on ART, by type of partner notification approaches and by relationship to the index case. All people tested HIV positive are eligible to start ART immediately, according to the “HIV treat all” approach. Human immunodeficiency virus testing was calculated as the proportion of persons listed as contacts that were effectively tested. Seropositivity was calculated as the percentage of HIV positive tests among all sex partners and biological children younger than 15 years who were HIV-tested.

We used bivariate analysis to examine associations between selected demographic factors and HIV testing uptake, HIV positivity, linkage to care, and ART initiation. Multivariate models were tried but not used due to evidence of important effect modification. Stratification with the effect modifier was used instead. *P* values were set at the 5% level of significance.

Ethics Approval

Ethics approval was obtained from the National Committee of Ethics of Life Sciences and Health of Côte d'Ivoire, and the Ethics Advisory Group, International Union Against Tuberculosis and Lung Disease, Paris, France.

Sociodemographic Characteristics of Index Cases and Their Contacts

Table 2 presents sociodemographic characteristics of index cases identified in the 4 health centers. The index cases were fairly distributed in terms of gender, and about three quarters (73.6%) were aged between 25 and 49 years. The majority of index cases lived as couples (78.5%). Among all index cases, 42% had no formal education and 41% only had primary education. Data on the employment status indicated that approximately 98% of index cases were employed, and a few of them were retired (less than 1%).

Table 3 describes the characteristics of contacts listed by index cases in the health centers. Index testing strategy consists of enumerating the contacts (sex partners and biological children younger than 15 years) of an HIV index case, and reaching out to those contacts to offer them HTS and, as needed, link them to care immediately. Health care workers of all centers present options to patients by using the same definitions and the same methods learned during their index testing training. There were 1647 contacts listed, where more than two thirds (approximately 68%) were sex partners (spouses/other partners with whom the index cases live and other sexual partners). Just under a third (31%) represented biological children of index cases who were younger than 15 years. Children younger than 15 years are contacts of index cases, but they are not sex partners. Among those children, there were more female children (266 [52%]) than male children (245 [48%]) reached by partner notification services in the 4 facilities of the study. This mirrors the male/female ratio observed in the general population in Côte d'Ivoire. Concerning

TABLE 3. Characteristics of Contacts Listed by Index Cases and the HIV Partner Notification Approach Selected in 4 Health Centers Supported by the Foundation Ariel Glaser in Côte d'Ivoire From October 2018 to March 2019

Characteristics	n (%)
Total	1647
Type of contacts	147 (100)
Partner	503 (30.5)
Other sexual partner	619 (37.6)
Biological children <15	511 (31.0)
• Male	245 (47.9)
• Female	266 (52.1)
Parents	12 (<1)
Gender	1647 (100)
Male	715 (43.4)
Female	932 (56.6)
Age, y	1647 (100)
0–14	510 (31.0)
15–24	32 (1.9)
25–49	843 (51.2)
50+	262 (16.0)
Median [IQR]	36 [12–46]
Information available in index register	1647 (100)
Yes	1571 (95.4)
No	76 (4.6)
HIV partner notification approaches	1571 (100)
Client referral	566 (36.0)
Contract referral	3 (<1)
Provider referral	302 (19.2)
Dual referral	29 (1.9)
Already HIV+ (not recorded)	626 (39.8)
Not recorded	45 (2.9)

Partner, sexual partners living in the household.

HIV partner notification approaches, the client referral was the most used to identify contacts in health centers (36%, more than one third). This was followed by the provider referral, which was used in 19% of cases. Of the 671 contacts for whom the HIV partner notification approaches were not recorded, 626 knew that they were already HIV positive at admission, so the HIV partner notification approaches were not applicable to them.

Figure 2A shows that 1089 HIV-positive index cases have listed 1122 sexual partners (503 partners and 619 other sexual partners) and 511 biological children younger than 15 years. Among the 1122 sexual partners enumerated, only 1089 sexual partners had information in the register, and they were included in our study. Therefore, the contact/index ratio was 1.5 (1633/1089). In other words, an index case identified and listed 1.5 sex partners on average. All the 1089 index cases helped to reach out 1089 sex partners. Of these sex partners, more than a half (58.9%) already knew their HIV status (641/1,089). The remaining 83.7% (375/448) were HIV tested, and 284 (75.7%) were diagnosed with HIV. All of them were enrolled in care and treatment.

Figure 2B gives information about biological children younger than 15 years. Five hundred eleven were listed by the index cases, and 469 (91.8%) were reached out. Only 2 of those reached out had a known HIV positive diagnosis. The remaining 83.3% of children (389/467) were HIV tested, and only 5 were found to be positive. Four (80%) of them were enrolled in care and treatment.

Therefore, the overall proportion of contacts (sex partners and biological children younger than 15 years) HIV-tested was 83.5% (764/915), and of those, 289 (37.8%) contacts were HIV positive. The number of contacts enrolled into care and treatment was 288 (99.7%).

Uptake of HTS by Contacts Through Partner Notification Approaches

In Tables 4 and 5, spouses and other sexual partners were grouped into 1 variable named “sex partners” as only slight differences were observed between the 2 groups.

Table 4 presents HIV partner notification approaches stratified by the type of contacts. The client referral was mainly used for biological children, whereas the provider and the contract referrals were mainly used for sex partners of index cases, though only 3 index cases selected the contract approach. There was a highly significant correlation between the type of approach selected and the type of contact ($P < 0.001$). Furthermore, slightly more girls than boys were not already tested for HIV (respectively, 240 and 227). Of the 420 children (203 male and 217 female) who came through the client referral, an analysis by gender revealed that 90.2% of those biological children were notified by their mothers and came to the hospital to be tested.

Table 5 shows that 97.2% of sex partners of the index cases who were notified through the provider approach came in and were HIV-tested, compared with only 81.5% of sex partners who were notified through the client approach. This difference was statistically significant ($P < 0.001$). In contrast, 85.2% of biological children of the index cases who were notified through the client approach came in and were HIV-tested, compared with 75.8% of the biological children who were notified through the provider approach, but the difference was not statistically significant ($P = 0.24$). The same tendency highlighted among male and female children reached out was observed here among children: the proportions of female children HIV tested through client and provider referrals were slightly higher than the proportions of boys tested (respectively, 53.3% compared with 46.7% for the client referral, and 53.5% against 46.5% for the provider referral).

This table also presents the HIV status of contacts, as tested at the clinic, stratified by HIV partner notification approaches and by type of contacts (sex partners or biological children younger than 15 years) of index cases. More HIV positive sex partners were found through the provider approach (185) compared with the client approach (80); HIV positivity percentages were similar for both approaches (75.5% vs 72.7%, respectively; $P = 0.67$). The client approach brought in 358 biological children, but only 5 (1.4%) were HIV positive. Moreover, more girls than boys were diagnosed with HIV among all children tested for HIV. The client

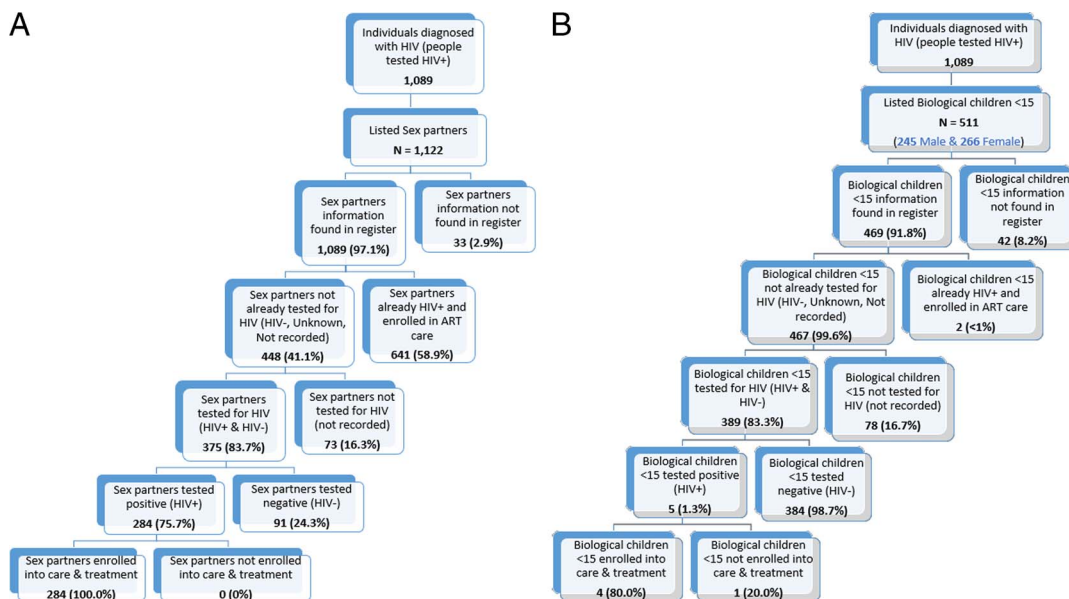


Figure 2. A, Flowchart of partner notification approach implementation for Sex partners in the GNS region (October 2018 to March 2019). B, Flow chart of partner notification approach implementation for Biological children <15 in the GNS region (October 2018 to March 2019). GNS, Gboklè Nawa San Pedro.

TABLE 4. HIV Partner Notification Approaches Stratified by Type of Contacts (Tested and Not Tested) of Index Cases Identified in the GNS Region, Côte d'Ivoire (October 2018 to March 2019)

HIV Partner Notification Approaches	Type of Contacts					
	Sex Partners	Biological Children		Siblings	Parents	Total
		Male	Female			
n (%)	n (%)	n (%)	n (%)	n (%)	N (%)	
Client referral	135 (24.1)	203 (36.3)	217 (38.7)	2 (<1)	3 (<1)	560 (100)
Provider referral	252 (88.1)	14 (4.9)	19 (6.6)	0 (0)	1 (<1)	286 (100)
Contract referral	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)
Dual referral	21 (77.8)	3 (11.1)	3 (11.1)	0 (0)	0 (0)	27 (100)
Not recorded	37 (82.2)	7 (15.6)	1 (2.2)	0 (0)	0 (0)	45 (100)
Total	448 (48.6)	227 (24.7)	240 (26.1)	2 (<1)	4 (<1)	921 (100)

referral, which was the approach mostly used for children, helped to reach 80% (4/5) HIV children who were female ones.

Furthermore, the table shows that the number of sex partners with a known HIV-positive status was approximately twice (1.71) the number of newly sex partners tested for HIV (641 compared with 375).

Table 6 shows that the number of sex partners living in the household brought in by the index cases was similar for male (96) and female contacts (109), where 54 and 62 were HIV-positive, respectively. In addition, the number of other female sexual partners was almost twice (158) that of the number of other male sexual partners (85), of which 115 and 53 tested HIV-positive, respectively, in the uptake of partners notification services.

DISCUSSION

To our knowledge, this is one of the few studies on HIV partner notification approaches in West Africa and one of the first studies in Côte d'Ivoire. This study assessed key HTS, which are important in addressing the challenges of HIV testing among sex partners and biological children younger than 15 years of index cases. This study found that 2 HIV partner approaches were

mostly used by the index case: the passive referral and the provider referral.

The client referral was the most commonly used approach to identify more than three quarters of the biological children younger than 15 years into the health centers (203 male and 217 female). Moreover, of the children who came through this client referral, over 90% of those biological children were identified and brought to HTS through the female index cases. This is possibly because women in this context are more accustomed to accompanying children to hospital compared with men. The client referral brought many biological children into the health centers to get HIV tested, with 1.4% of these children testing HIV positive (80% were girls). These results were similar to the findings in Mozambique where 99% of children younger than 5 years were tested for HIV, and only 2% were found to be HIV positive.⁵ In the Zimbabwe HIV Care and Treatment project, the HIV positivity among children younger than 15 years was much higher than the HIV positivity that we observed in this study (17% compared with 1.4%).⁶

In addition, when a trained health worker located and notified partners immediately and directly, while maintaining the anonymity of the index case as per the provider approach, the

TABLE 5. Number and Percentage of Patients Tested for HIV With Their Final HIV Status, Stratified by HIV Partner Notification and Type of Contacts

Tested for HIV and Final HIV Status	HIV Partner Notification Approaches					
	Client	Contract	Provider	Dual	Not Recorded	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	N (%)
Sex partners						
Yes	110 (81.5)	2 (66.7)	245 (97.2)	17 (81)	1 (2.7)	375 (20.3)
• HIV+	80 (72.7)	2 (100)	185 (75.5)	16 (94.1)	1 (100)	284 (75.7)
• HIV-	30 (27.3)	0 (0)	60 (24.5)	1 (5.9)	0 (0)	91 (24.3)
Unknown	25 (18.5)	1 (33.3)	7 (2.8)	4 (19)	36 (97.3)	73 (16.3)
Total	135 (100)	3 (100)	252 (100)	21 (100)	37 (100)	448 (100)
Known HIV+	6 (<1)	0 (0)	16 (2.5)	2 (<1)	617 (96.3)	641 (100)
Biological children < 15 y						
Yes	358 (85.2)	0 (0)	25 (75.8)	4 (66.7)	2 (25)	389 (83.3)
• HIV+	5 (1.4)	0 (0)	0 (0)	0 (0)	0 (0)	5 (1.3)
Male	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)	1 (20)
Female	4 (80)	0 (0)	0 (0)	0 (0)	0 (0)	4 (80)
• HIV-	353 (98.6)	0 (0)	25 (75.8)	4 (66.7)	2 (25)	384 (98.7)
Male	166 (47)	0 (0)	11 (44)	2 (50)	1 (50)	180 (46.9)
Female	187 (53)	0 (0)	14 (56)	2 (50)	1 (50)	204 (53.1)
Unknown	62 (15.8)	0 (0)	8 (24.2)	2 (33.3)	6 (75)	78 (16.7)
• Male	36 (58.1)	0 (0)	3 (37.5)	1 (50)	6 (100)	46 (59)
• Female	26 (41.9)	0 (0)	5 (62.5)	1 (50)	0 (0)	32 (41)
Total	420 (100)	0 (0)	33 (100)	6 (100)	8 (100)	467 (100)
Known HIV+	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)

TABLE 6. HIV Test Results Stratified by Contacts Gender Identified in GNS Region, Côte d'Ivoire (October 2018 to March 2019)

Contacts Gender	HIV Test Result			
	HIV+	HIV-	Unknown	Total
	n (%)	n (%)	n (%)	N (%)
Partners				
Male	54 (56.3)	17 (17.7)	25 (26)	96 (100)
Female	62 (56.9)	24 (22)	23 (21.1)	109 (100)
Total	116 (56.6)	41 (20)	48 (23.4)	205 (100)
Other sexual partners				
Male	53 (62.4)	17 (20)	15 (17.6)	85 (100)
Female	115 (72.8)	33 (20.9)	10 (6.3)	158 (100)
Total	168 (69.1)	50 (20.6)	25 (10.3)	243 (100)

majority of sex partners came to be HIV tested. Of the sex partners of the index cases, 97.2% who were notified through the provider approach were tested, compared with only 81.5% of sex partners who were notified through the client approach. However, HIV positivity percentages were similar for sex partners found through the client approach and through the provider approach (respectively 72.7% and 75.5%). In general, the HIV positivity was 75.7% for sex partners. This percentage is much higher than the percentage observed in Zimbabwe among sex partners during the Zimbabwe HIV Care and Treatment project, with an HIV positivity of 46% and the highest percentage among sex partners aged 45 to 49 years.⁶ The HIV prevalence measured in the study conducted in Cameroon was lower than the HIV positivity in this study (51.7% in 2005, and the highest measure of 58% in 2010).¹⁹

The present study also revealed that the contact/index ratio was 1.5, and the partner/index ratio, equal to 1.03. Compared with the ratios got in the study led in Cameroon in 2019 (ranging from 1.1 to 1.3),¹⁹ the partner/index ratio in this study is approximately the same. Another study led in Zimbabwe found a contact/index ratio greater than 2,⁶ which is much higher than the ratio found in this study (1.5). In the study conducted in Kenya, the partner/index ratio was lower than 1 (0.97).¹⁸ This result is not far from the partner/index ratio that we found in the current study (1.03).

Moreover, the results highlighted that the number of the sex partners who already knew their HIV status was approximately twice the number of sex partners newly tested for HIV. Indeed, 641 sex partners who were reached had a known HIV-positive status, compared with only 375 newly HIV tested. It is possible that a part of the index cases was in fact notified by a partner that knew their status.

The strengths of this study were the large sample size, the same standardized method of extracting information with a data extraction form, and the fact that data were collected in a routine setting that reflects the reality in the field. The reporting of the study followed international guidelines (Strengthening the Reporting of Observational Studies in Epidemiology).²²

There were, however, some limitations in this study. There were missing values across all variables. In addition, we had no information about adherence to treatment of the HIV-positive contacts once enrolled into the ART program. For the contacts listed by the index case as HIV positive, we did not confirm their HIV-positive status by bringing them in for retesting. Furthermore, we could not compare the effectiveness of each approach as index cases were given free choice of the 4 approaches, so their motivation to bring in contacts may have been different depending on the notification approach that they chose. Besides, the program needs to coach health care providers on how to

conduct telephone calls with contacts during the provider approach. Finally, as the study was conducted in 1 region of the country (southwest and southern part of the country), we do not know if the study findings are generalizable to the country's population at large. In fact, during the study period, the Côte d'Ivoire had 20 health regions and Fondation Ariel Glaser supported 3 health regions (Abidjan 2, Abidjan 1 Grands Ponts, and Gboklè-Nawa-San Pedro).

There were remarkable differences in the gender of index patients in the study conducted in Malawi¹⁷ compared with our study. The Malawi study showed that the majority of index patients were female.¹⁷ However, both studies found that the majority of index cases lived as couples (78.5% for the Malawi study and 71.2% for the present study).

Similarly to our findings, a systematic review conducted by World Health Organization showed that a high proportion of partners came for HIV testing when contacted by health care providers.²³ They also found that when the index cases were offered support or assistance in notifying their sex partners of their exposure to HIV infection, it resulted in a higher uptake of partner HIV testing and a higher proportion of HIV-infected persons identified than usual.²³ This reflects what was found in Côte d'Ivoire. When health care providers notified sex partners directly to come to the hospital for HIV testing (the provider approach), a great number of HIV positive sex partners were brought in.

Our study found that the number of spouses brought in by the index cases was similar for male and female contacts. On the other hand, the number of other female sexual partners was twice the number of other male sexual partners with respect to the uptake of partner notification services. This result was similar to what has been reported from the Zimbabwe HIV Care and Treatment project that showed that there were no significant differences in uptake of partner notification services between males and females.⁶ These results differ from findings in Tanzania where male index cases were 2 times more likely than female index cases to get at least 1 sex partner to come for HIV testing.²⁴

The proportion of partners coming for testing through the provider referral was higher than the client referral (97.2% vs 81.5%). This may be due to the fact that the health care provider approach increases the likelihood that a sex partner is brought in, but it may also be due to a selection bias as the profile of the partner and the motivation of the index case may be different, depending on the approach chosen by the index case.

This study highlights that the provider referral is the approach most likely to persuade sex partners to come to the health centers for HIV testing. In Cameroon, 44.3% of contacts were notified through provider referral and for those contacts tested for HIV, the overall HIV prevalence was 41.6%.¹⁹

Most children were brought in the hospital by female index cases through the client referral. This may be because it is considered customary for female index cases to bring their children to the hospital to be tested, compared with male index cases. In addition, health care providers may not systematically ask males index cases to enumerate their biological children, as they focus most of the time on their sex partners. This result is similar to a study in Cameroon where index cases brought children aged 0 to 19 years to be tested for HIV at health centers.²⁵

In this study, the results revealed that 38% of contacts were tested HIV positive. These results do not differ greatly from those found in Cameroon and Tanzania. In Cameroon, 399 (51.1%) of 781 contacts detected were HIV positive.¹⁹ In Tanzania, 91 female partners of 137 (66.4%) screened were HIV positive, and 57 (55.9%) male partners of 102 tested were HIV positive.²⁴ These findings show that partner notification approaches can identify more contacts living with HIV than usual. Based on our study

findings, we suggest that clinical counselors focus on the provider referral, which is a successful strategy for bringing in sex partners of index cases in health centers for HIV testing.

With regard to enrollment in care, the present study showed that 99.7% of HIV-positive contacts were prescribed ART. This can be explained by the fact that Côte d'Ivoire follows the 90-90-90 guidelines of UNAIDS that recommends that all HIV positive patients must be automatically enrolled in care and treatment.²⁶ Therefore, all contacts who test HIV positive are enrolled in care. In this same context, the CIPHIA survey conducted in Côte d'Ivoire in 2017– to 2018 revealed that 88.1% of PLHIV were put on ART.² This result is similar to a study conducted in Cameroon where 100% of HIV-positive contacts tested HIV-positive were enrolled in care and treatment.¹⁹ The HIV testing of sex partner (s) as well as children of HIV index cases, who are unaware of their HIV status, which reduces the chain of HIV transmission by the HIV testing and linkage to care of all the contacts of index cases, is already a national public health practice.

In this study, assisted partner notification helped to improve partner testing and diagnosis of HIV positive partners. The HIV testing programs struggle to find contacts, and partner notification approaches may address the HIV case-finding issue among index cases. To improve the efficiency of HIV index testing services, there is a need to maintain differentiated models and tailor specific approaches to the preferences of the index cases. This is more likely to result in higher HIV testing uptakes than usual among sex partners and biological children younger than 15 years of the index cases.

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