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Cervical cancer screening Uptake and correlates among HIV-infected women on antiretroviral treatment: a cross-sectional survey in Côte d'Ivoire, West Africa

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Cervical cancer screening Uptake and correlates among HIV-infected women on antiretroviral treatment: a cross-sectional survey in Côte d'Ivoire, West Africa

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ABSTRACT

Objectives: Despite the increasing number of interventions aiming to integrate cervical cancer (CC) screening into HIV clinics in sub-Saharan Africa, Women living with HIV (WLHIV) still have a high risk of developing cervical cancer. The aim of this study was to estimate the coverage of CC screening and associated factors among HIV infected women.

Design: Cross-sectional survey conducted from May to August 2017.

Settings: Outpatient setting in the four highest volume HIV clinics in Côte d'Ivoire.

Participants: All WLHIV, aged 25 to 55 years, followed up since at least one year, selected through a systematic sampling procedure.

Intervention: A standardized questionnaire administered to each participant by trained healthcare workers.

Outcome: Coverage of cervical cancer screening and factors associated with uptake of screening among WLHIV.

Results: A total of 1991 WLHIV were included in the study, aged in median 42 years [(IQR): 38-47], and a median CD4 count (last known) of 560 [379-773] cells/mm3. Among the participants, 1913 (96.7%) had ever heard about CC, 1444 (72.5%) had been offered CC screening, mainly in the HIV clinic for 1244 (88.9%), and 1148 reported a personal history of CC screening for an overall coverage of 59.7% [CI 57.6 - 62.0]. In multivariable analysis, university level (aOR=2.1[1.4;3.1], p<0.001), being informed on CC at the HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), receiving information (self-considered) clear and understood on CC (aOR=1.7[1.4;2.2], p<0.001), identifying HIV as a risk factor for CC (aOR=1.4[1.1;1.8], p=0.002) and proposition of CC screening in the HIV clinic (aOR=10.1 [7.6;13.5], p<0.001), were associated with uptake of CC screening.

Conclusion: Initiatives to support CC screening in HIV care programs resulted in effective access to more than half of the WLHIV on ART in Abidjan. Efforts are still needed to provide universal access to CC screening, especially among socio-economically disadvantaged WLHIV.

Key words: Cervical cancer; screening Uptake; HIV; ART

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Strengths and limitations of this study

- This study reports the cervical cancer coverage among women living with HIV in Côte d'Ivoire, a country with one of the highest HIV prevalence among women.
- The data were collected in almost 2000 participants selected through a daily systematic sampling procedure during a period of four months, allowing participation of patients on multi months ART dispensation.
- The reasons for not being screen are appropriately explored as well as the factors associated to cervical cancer screening uptake.
- The specificity of rural area is not clearly emphasized with this population although can be extrapolated.

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Introduction

Cervical cancer (CC) is the fourth most common cancer in women worldwide, with an estimated incidence of 570 000 new cases and approximately 311 000 new associated deaths in 2018 [1]. In sub Saharan Africa, CC account for 20.8% of all cancers in women and 14.2% of all cancer related death in women [2]. In Côte d'Ivoire, after breast cancer, CC is the second most common cancer among women accounting for 28.6% of all women's cancers and the leading cause of cancer deaths with 22.2% of all cancer related deaths [2].

The persistent infection with oncogenic Human Papilloma Viruses (HPV) is a necessary cofactor for CC, responsible for the development of precancerous lesions that lead to invasive CC if left untreated [3]. Infection with human immunodeficiency virus (HIV) is another cofactor identified to accelerate the occurrence of CC [4,5]. HIV is also associated with severe abnormalities such as extensive cervix lesions, three times more common in women living with HIV/AIDS (WLHIV) than in those with no history of HIV [6,7]. In addition, a two-fold increase in the risk of death was reported among HIV-infected women compared to their HIV-negative counterparts [8].

The long asymptomatic phase and slow disease progression from the persistent infection with oncogenic HPV to invasive carcinoma, characterizing the CC make it a highly preventable cancer through screening and HPV immunization [9] . Since 2012, a CC prevention strategy based on integration of visual inspection of the cervix with acetic acid (VIA) in reproductive health and family planning services was adopted in many African countries in order to increase access to CC screening services [10,11]. While CC screening uptake among women in developed settings is relatively high, overall more than 50% (79.4% in Brazil [12], 60% in United States [13], 89.1% in France [14]) mainly by Pap smears, data on access to CC screening in developing countries are still scarce. Recent studies conducted in Ethiopia and Uganda revealed a low CC screening uptake of 23.5% and 30.3%, respectively [15,16] and pointed out the role of sociodemographic factors and attitude of healthcare providers on the decision of beneficiaries to attend CC screening units [16,17].

In West and Central Africa region, Cote d'Ivoire is the fourth country with the highest HIV prevalence among women (4.1%) [19], and there is no data available on the coverage of CC screening among HIV positive women. This study aimed at estimating the uptake of CC screening and correlates among WLHIV in Abidjan, the economic capital of Côte d'Ivoire.

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Method

Study design and setting

A cross-sectional survey was conducted from May to August 2017 among WLHIV followed in the four major HIV clinics in Abidjan, Côte d'Ivoire. During the study period, all women aged 25 to 55 years, followed up in the HIV clinic since at least one year, were eligible to participate.

Sampling

Participants were selected through a systematic sampling procedure. For every woman presenting at the HIV clinic for a routine follow-up visit, eligibility criteria were checked at the entrance desk and a sequential number was given to each eligible participant according to the arrival order. The first eligible participant of the day was selected and a sampling interval of three was applied to select subsequent participants. This procedure was repeated every day in each participating HIV clinics and a sticker was pasted on medical record of participants to avoid multiple enrolments of same participant.

Data collection

A standardized questionnaire was administered to each participant by previously trained nurses, midwives or social workers. This questionnaire allowed the collection of data on demographics (age, education, marital status, monthly income), knowledge of CC (existence of the disease, risk factors and prevention), personal history of CC screening (date, place, provider, screening method, number of screening done). Additional HIV data (date of HIV infection diagnosis, history of CD4 count measures, clinical stage at enrolment into HIV care and antiretroviral therapy use) were extracted from the electronic records of the respective HIV clinics.

Outcomes and variables

The educational level was categorized in two modalities: "less educated" for women with no formal or primary or secondary level education and "more educated" for those with university education level. To perform the logistic regression, we use the dichotomic variable "ever had a CC screening" yes/no as dependent variable and the independent variables where demographic characteristics, HIV follow up characteristics and knowledge of cervical cancer.

Statistical analysis

Qualitative variables were described as frequencies with percentages and quantitative variables were described as medians with interquartile range (IQR). Chi square test and Fisher exact test were used for the comparison of qualitative variables. For all the results, $p<0.05$ was

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considered statistically significant. Logistic regression analysis using a step-wise backward procedure was performed to assess factors associated with uptake of cervical cancer screening among women living with HIV. Multivariable analysis was performed including all variables associated with uptake of cervical cancer screening with a significance level ≤0.25 in univariate analysis. All Analysis were performed using STATA V12.0 (StataCorp, College Station, Texas).

Patient and public involvement

Patients and public were not involved in the design of the study, but the questionnaire was submitted to a panel of Women living with HIV to identify unclear or confusing questions. They made some amendment and recommendation that were taken into account in the final version of the questionnaire.

Ethic statement

Ethical approval was obtained from the national ethic committee for research in health of Côte d'Ivoire, the country national IRB. Each participant was given comprehensive information on the protocol of the study and had to provide a written consent before being enrolled.

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RESULTS

Sociodemographic and HIV follow up characteristics

Overall, 1,991 participants were interviewed with a median age of 42 years (Inter Quartile Range IQR [37-47]). Among them, 1,736 (87.2%) had no formal or primary level or secondary education, 1 055 (53.0%) were married or living with a partner, and 1 052 (52.8%) had no income or earned less than the national minimum wage ($109). For HIV characteristics, 971 (48.8%) of participants were enrolled in the cohort with a WHO clinical stage I or II. The median CD4 count at enrolment in the cohorts was 287 cell/mm^3 (IQR [140-459]), and the last known median CD4 count was 563 cell/mm^3 (IQR [378-773]). The median follow-up duration was 8 years (IQR [4-11]). Most participants (94.9%) initiated antiretroviral treatment (ART) and the median duration on ART was 7 years (IQR [3-10]).

Knowledge on cervical cancer

Among the participants 1,913 (96.7%) had previously heard about CC, and 1,451 (75.8%) heard about it in their follow up HIV clinic. The information received about CC was clear and understood for 1 167 (61.0%) participants. More educated women were more likely to receive a clear and understandable information about CC than those who were less educated (78.4% vs 58.3%; p<0.001). CC was known as a preventable disease by 1,450 (75.8%) participants, and screening and HPV vaccine were identified as preventive methods by 939 (90.4%) and 423 (29.7%) participants, respectively. More educated women were more likely to identify screening as preventive method than the less educated ones (75.2% vs 73.0% respectively, p=0.001). Regarding risk factors for CC, multiple sexual partner and early sexual initiation were identified by 1,238 (64.7%) and 1,113 (58.2%) participants, respectively. Only 814 (42.5%) participants identified HIV infection as a risk factor for CC, mainly more educated women (53.3% vs 40.9%; p<0.001) (Table 1).

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Table 1: knowledge on cervical cancer and screening according to education level among women living with HIV in Côte d'Ivoire, West Africa

Characteristics	Total N =1 991		Less educated N =1 936		University level N= 255		P value
	N (%)		N (%)		N (%)		
Ever Heard about CC							
Yes	1,913	(96.7)	1,658	(96.2)	255	(100.0)	0.002
Heard about CC in Hospital* (N=1,913)							
In my follow up HIV clinic	1,451	(75.8)	1,257	(75.8)	194	(76.1)	0.927
Heard about CC in the media* (N=1,913)							
Yes	1,236	(64.6)	1,029	(62.1)	207	(81.2)	<0.001
The information received was* (N=1,913)							
Not clear / I did not understand	746	(39.0)	691	(41.7)	55	(21.6)	<0.001
Very Clear / I understand it	1,167	(61.0)	967	(58.3)	200	(78.4)	
CC is a preventable (N=1,913)							
Yes	1,450	(75.8)	1,240	(74.8)	210	(82.4)	0.009
Means of prevention for CC¥ (N=1,450)							
Screening	939	(90.4)	781	(63.0)	158	(75.2)	0.001
Vaccine	423	(29.7)	332	(26.8)	91	(43.3)	<0.001
Risk factors for CC¥ (N=1,913)							
HIV infection	814	(42.5)	678	(40.9)	136	(53.3)	<0.001
Multiple sexual partners	1,238	(64.7)	1,060	(63.9)	178	(69.8)	0.068
Early sexual initiation	1,113	(58.2)	943	(56.9)	170	(66.7)	0.004

CC: Cervical Cancer

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Access to cervical cancer screening

Among the 1,913 participants, 1,188 have ever been screened and the overall CC screening coverage among WLHIV was estimated to 59.7% [95%CI (57.6 - 62.0)]. Overall, 1,444 (72.5%) participants had ever been offered CC screening, most of them in their follow up HIV clinic (88.9%). The main screening methods were VIA for 1,050 (88.4%) participants and Pap smear for 120 (10.1%) participants. After CC screening, results were given to 1,146 (96.5%) women and only 778 (65.5%) of them declared having received advises for repeated screening over time. Half of screened participants (48.8%) declared having done the screening because it was advised by the healthcare workers, 328 (27.6%) declared that it was their personal decision and 188 (15.8%) declared having accept it because it was part of a research project in which they were involved. Among the 803 (40.3%) women with no history of CC screening, the lack of information about CC (54%), the fear of the result of CC screening (22%), Negligence (15%), and fear of induced cost (10%) were the main reasons (Figure 1).

Factors associated with cervical cancer screening uptake

In univariable and multivariable analysis, almost the same variables were significantly associated with the uptake of CC screening at least once among WLHIV. In multivariate analysis, being aged ≥45 years old (aOR=1.4 [1.1;1.8], p=0.012), having the university education level (aOR=2.1 [1.4;3.1], p<0.001), being informed on CC in the follow up HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), having received information on CC self-considered as clear and understood (aOR=1.7 [1.4;2.2], p<0.001), being followed up in the HIV clinic for at least ten years (aOR=1.4 [1.0 ; 1.8], p=0.043), identifying HIV as a risk factor of CC (aOR=1.4 [1.1;1.8], p=0.002) and having being proposed CC screening in the participant HIV follow up clinic (aOR=10.1 [7.6;13.5], p<0.001), were associated with access to CC screening (Table 2).

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Table 2: Factors associated with access to cervical cancer screening among women living with HIV in Côte d'Ivoire, West Africa

Variables	n/N	Uni variable model		Multivariable model (final)	
		aOR (CI 95%)	p-value	aOR (CI 95%)	p-value
Age (years)					
<45	747/1293	1	-	1	-
≥45	441/698	1.3 (1.0 – 1.5)	0.019	1.4 (1.1 – 1.8)	0.012
Marital status					
Living alone	623/1083	1	-	-	-
living with a partner	565/908	1.2 (1.0 - 1.4)	0.033	1.3 (1.0 – 1.6)	0.046
Educational level					
No formal / primary level	568/1057	1	-	1	-
Secondary level	430/679	1.5 (1.2 – 1.8)	<0.001	1.2 (0.9 - 1.5)	0.211
University	190/255	2.5 (1.8 – 3.4)	<0.001	2.1 (1.4 - 3.1)	<0.001
Information on CC					
Informed elsewhere	135/535	1		1	-
Informed in usual HIV clinic	1053/1456	7.7 (6.2 – 9.7)	<0.001	1.5 (1.1 – 2.0)	0.017
Clarity of information					
Not clear for me	341/820	1	-	1	-
Very clear for me	847/1171	4.0 (3.0 – 4.4)	<0.001	1.7 (1.4 – 2.2)	<0.001
Proposition of screening					
Proposed elsewhere	147/700	1	-	1	-
Proposed in usual HIV clinic	1041/1291	15.7 (12.5 – 19.7)	<0.001	10.1 (7.6 – 13.5)	<0.001
Clinical Stage					
III-IV/C	254/519	1	-	1	-
I-II/ A-B	572/971	1.5 (1.2 – 1.9)	<0.001	1.6 (1.2 – 2.0)	0.001
Missing values	362/501	2.7 (2.1 – 3.5)	<0.001	1.8 (1.3 - 2.5)	<0.001
Follow up duration					
1-4	231/512	1	-	1	-
5-9	431/720	1.8 (1.4- 2.3)	<0.001	1.2 (0.9 – 1.7)	0.156
≥10	526/759	2.7 (2.1 – 3.4)	<0.001	1.4 (1.0 – 1.8)	0.043
Knowing HIV as a risk factor					
No	631/1172	1	-	1	-
Yes	557/819	1.8 (1.5 – 2.2)	<0.001	1.4 (1.1 – 1.8)	0.002

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DISCUSSION

This study assesses the CC screening coverage among women living with HIV in Abidjan, aged 42 years old in median, with low education level and socioeconomic situation, and a clinically and immunologically stable HIV disease. Most of the women were aware of cervical cancer screening, and the information received was clear and understood by less than one third of them. The uptake of cervical cancer screening was around 60% and was associated with education level, clarity of information, offer of CC screening in the follow up HIV clinic and identification of HIV as a risk factor for CC. In addition, lack of information and fear of being diagnosed with CC were the main reasons for not being screened among women living with HIV.

This study reports that three over five women living with HIV in our study population had been screened for cervical cancer at least once during the last three years. This result is higher than previous reports from Nigeria, Ethiopia and Uganda, where the CC screening uptake rates were 9.5%, 23.5% and 30.3%, respectively [15,16,20]. This result support the successful integration of CC screening services in HIV clinics in Cote d'Ivoire. Indeed, since 2010, the national cancer control program and the national aids control program have been involved in the pilot phase of the cervical cancer prevention project (CECAP) supported by MOH and implementing partners. The aim was to integrate CC screening in HIV clinics and improve access to screening for women living with HIV, highly exposed to cervical cancer. From 2010 to 2015, almost all the HIV clinics in Abidjan and the hinterland were equipped for CC screening and their staffs trained to provide CC screening and treatment of eligible precancerous lesions free of charge [21]. The collaboration between AIDS and cancer control programs led to this successful integration of services that has been describe in other SSA countries as a game changer for the prevention of cervical cancer among HIV-infected women [22,23] . The positive effect of this service integration is emphasized in our study by the association between screening uptake and the offer of CC screening in the HIV clinic were the participant is usually followed. Indeed, half of the screened women declare having accept the screening because it was advised by the healthcare worker at the HIV clinic.

Despite the important coverage of CC screening reported in this study, around 40% of WLHIV have never been screened despite their high risk of developing an invasive cervical cancer, usually diagnosed at an advanced stage in SSA [24,25]. Lack of information was the main reason reported by HIV-positive women never screened for CC in Abidjan. This result suggests that despite efforts from the national cancer program to increase awareness of CC among

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women (either in hospital-based strategy by training healthcare workers to offer CC screening or in community-based strategy through awareness campaign involving community mobilizers), messages to raise awareness on CC and its prevention remain poorly understood.

When analyzing factors associated to CC screening uptakes, it appears that highly educated women and those who identified HIV as a risk factor for CC were more likely to attend CC screening. Thus, misunderstanding of information on CC remain an important barrier to screening among HIV-positive women as reported in other studies [26,27]. In addition, the important gap (36%) observed between the numbers of women who had been offered CC screening and those who have been effectively screened, reported in our population is consistent with previous study from Uganda [15]. This result underline the importance of a tailored communication strategy to take into account factors that influence the decision to undergo CC screening, such as low education level, and cultural beliefs reported in other SSA countries [26]. In addition to participants related barriers, providers related barriers such as lack of knowledge and failure to inform or encourage women to get screened were reported in other SSA countries, and could also play an important role in Côte d'Ivoire, although not specifically explored in this study [28].

The WHO guideline for prevention and care of CC among women recommend for low- and middle-income countries to perform VIA screening for all HIV-positive women between 30-49 years old or older for those with visible transformation zone and to repeat the screening Test within three years. They also have to attend screening unit one year after treatment for a control [29]. To improve the uptake of CC screening, it is critical to improve health education and awareness among WLHIV, by reshaping the hospital-based communication approach for CC. A recent systematic review on strategies implemented in SSA to improve CC screening reported that about three fourth of these strategies include education and awareness activities, but most of them failed to demonstrate the effectiveness of the strategy [30]. Most of these interventions had anticipated solution for financial barriers for clients, materials supply and capacity building of staff, while the main problem is to improve beneficiaries understanding of CC prevention messages. Usually, the level of communication on CC prevention services is standardized and not adapted to all the social categories. A specific educational program which use culturally sensitive and linguistically appropriate strategies to deliver tailoring CC prevention messages could enhance awareness of PLHIV and increase CC screening rates. Furthermore, a collaboration between CC screening providers and community health educators is critical to improve the understanding of health education message as already reported in SSA [31].

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This study was conducted among women living with HIV and followed up in HIV clinics of Abidjan, an urban area. These results may thus mostly reflect the feature in urban settings where people are more educated and more exposed to cervical cancer awareness activities than in rural settings. In addition, this study was conducted in the largest and oldest HIV clinics in Abidjan, where cervical cancer screening is provided free of charge since the initiation of CECAP in 2010. However, the survey was conducted in the four largest (high volume) HIV clinics in the country, using a daily-repeated systematic random selection procedure over a period of three months. This makes it possible to consider the variability of the population attending these HIV clinics and help mitigate the risk of selection bias.

CONCLUSION

Initiatives to support CC screening in HIV care programs have resulted in effective access to more than half of the WLHIV on ART follow up in Abidjan. Nevertheless, efforts are still needed to provide universal access to CC screening, which remains a cancer defining AIDS that is poorly prevented by antiretroviral treatments. Promoting CC screening among socio-economically disadvantaged WLHIV by addressing client barriers still need to be prioritized.

Figure legend caption

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

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Competing interest
The authors have no conflict of interest to declare.

Authors Contribution

BT and AJ designed the study. BT, SB, JJK, DKE, AH, AT, EM, IA and AJ supervised the study implementation and data collection. Statistical analysis was performed by BT, SB and AJ. Data interpretation and first draft of manuscript was done by BT, SB, JJK and AJ. Critical revision of the manuscript for important intellectual content was provided by all the coauthors who read and commented on the original manuscript and all agreed on the version finalized by BT, SB and AJ for submission.

Data availability statement
No additional data available

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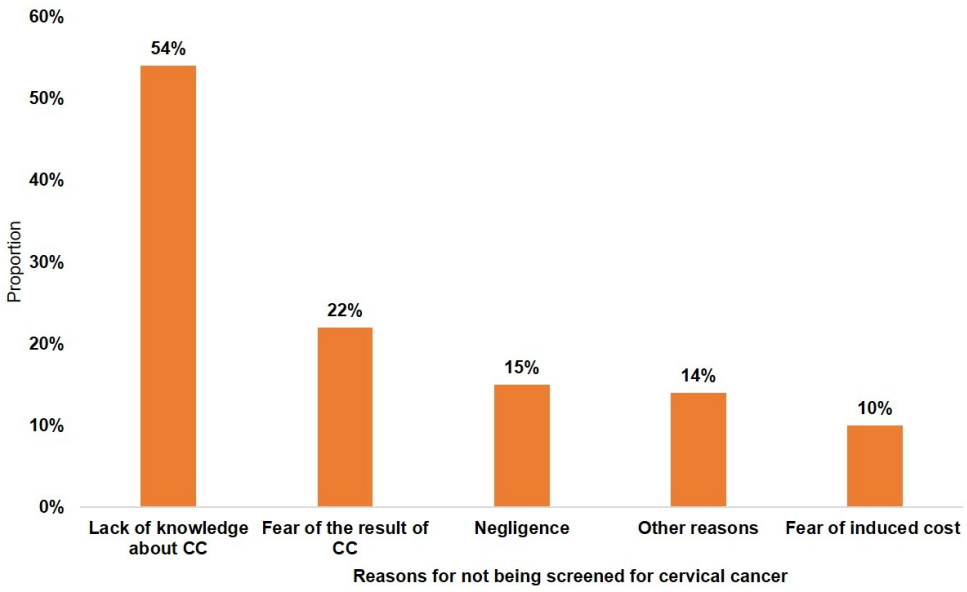

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

207x125mm (150 x 150 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	4
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6

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		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Cervical cancer screening Uptake and correlates among HIV-infected women: a cross-sectional survey in Côte d'Ivoire, West Africa

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Cervical cancer screening Uptake and correlates among HIV-infected women: a cross-sectional survey in Côte d'Ivoire, West Africa

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ABSTRACT

Objectives: Despite the increasing number of interventions aiming to integrate cervical cancer screening into HIV clinics in sub-Saharan Africa, Women living with HIV (WLHIV) still have a high risk of developing cervical cancer. The aim of this study was to estimate the coverage of CC screening and associated factors among WLHIV in Abidjan, Côte d'Ivoire.

Design: Cross-sectional survey conducted from May to August 2017.

Settings: Outpatient setting in the four highest volume urban HIV clinics of government's or NGO's sector in Côte d'Ivoire.

Participants: All WLHIV, aged 25 to 55 years, followed since at least one year, selected through a systematic sampling procedure.

Intervention: A standardized questionnaire administered to each participant by trained healthcare workers.

Outcome: Cervical cancer screening uptake

Results: A total of 1,991 WLHIV were included in the study, aged in median 42 years [(IQR): 38-47], and a median CD4 count (last known) of 560 [379-773] cells/mm3. Among the participants, 1,913 (96.7%) had ever heard about cervical cancer, 1,444 (72.5%) had been offered cervical cancer screening, mainly in the HIV clinic for 1,244 (88.9%), and 1148 reported a personal history of cervical cancer screening for an overall coverage of 59.7% [CI 57.6 - 62.0]. In multivariable analysis, university level (aOR=2.1 [1.4;3.1], p<0.001), being informed on cervical cancer at the HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), receiving information self-perceived as "clear and understood" on cervical cancer (aOR=1.7[1.4;2.2], p<0.001), identifying HIV as a risk factor for cervical cancer (aOR=1.4[1.1;1.8], p=0.002) and being proposed cervical cancer screening in the HIV clinic (aOR=10.1 [7.6;13.5], p<0.001), were associated with cervical cancer screening uptake.

Conclusion: Initiatives to support cervical cancer screening in HIV care programs resulted in effective access to more than half of the WLHIV in Abidjan. Efforts are still needed to provide universal access to cervical cancer screening, especially among socio-economically disadvantaged WLHIV.

Key words: Cervical cancer; screening Uptake; HIV; ART

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Strengths and limitations of this study

- This study reports the cervical cancer screening coverage among women living with HIV in Côte d'Ivoire, a country with one of the highest HIV prevalence among women.
- The methodological approach used in this study allowed the enrolment of a quite representative sample of WLHIV visiting the participating HIV clinics.
- Reasons for not being screened and factors associated with cervical cancer screening uptake were explored through face-to-face interviews.
- The specificity of rural area was not directly explored with this population.
- The data collected are declarative information, collected through face-to-face interviews with possible memory and social desirability bias.

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Introduction

Cervical cancer is the fourth most common cancer in women worldwide, with an estimated incidence of 570 000 new cases and approximately 311 000 new associated deaths in 2018 [1]. In sub Saharan Africa, cervical cancer account for 20.8% of all cancers in women and 14.2% of all cancer related deaths in women [2].

Persistent infection with oncogenic Human Papilloma Viruses (HPV) is a necessary cofactor for cervical cancer, responsible for the development of precancerous lesions that lead to invasive cervical cancer, if left untreated [3]. Infection with human immunodeficiency virus (HIV) is known to accelerates the development of precancerous lesions leading to a higher risk of cervical cancer [4,5]. Infection with HIV is also associated with more extensive lesions of the cervix, three to five times more common in women living with HIV/AIDS (WLHIV) than in those with no history of HIV [6–8]. In addition, a two-fold increase in the risk of death due to cervical cancer was reported in WLHIV compared to their HIV-negative counterparts [9].

The long asymptomatic phase and slow disease progression from the persistent infection with oncogenic HPV to invasive carcinoma, make cervical cancer a highly preventable cancer through screening and HPV immunization [10]. Since 2012, a cervical cancer prevention strategy based on integration of visual inspection of the cervix with acetic acid (VIA) in reproductive health and family planning services has been adopted in many African countries in order to increase access to cervical cancer screening services [11–13]. Cervical cancer screening uptake among women in developed settings is relatively high, 79.4% in Brazil [14], 60% in United States [15], and 89.1% in France [16], mainly with Pap smears. In developing countries, recent studies conducted in Ethiopia and Uganda revealed a low cervical cancer screening uptake of 23.5% and 30.3%, respectively [17,18] and emphasized the importance of sociodemographic factors and attitude of healthcare providers on the decision of beneficiaries to attend cervical cancer screening units [18,19].

In West Africa, Cote d'Ivoire has the highest HIV prevalence among women (4.1%) [20]. Cervical cancer is the second most common cancer among women accounting for 28.6% of all women's cancers and the leading cause of cancer deaths with 22.2% of all cancer related deaths [2]. The national guidelines on cervical cancer screening in the country are aligned with WHO guidelines for low- and middle-income countries, and recommend the screen-and-treat approach based preferentially on visual inspection with acetic acid or pap smear and cryotherapy or electrocoagulation, respectively. This recommendation targets women between 25 and 55 years old in the general population, and those diagnosed with HIV who should be systematically offered a screening per year once linked to HIV care [21]. These guidelines

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relied on the screening program that was piloted in HIV clinics from 2008 to 2012 before being scaled up in all the government health facilities and at national level. However, data on the national coverage of cervical cancer screening among women in Côte d'Ivoire are currently not available. The only data available on the coverage of cervical cancer screening among WLHIV is the 10% UNAIDS estimates based on the data from 2011-12 Demographic and Health Survey [22]. The aim of this study was to estimate the uptake of cervical cancer screening and its correlates among WLHIV in Abidjan, the economic capital of Côte d'Ivoire.

METHOD

Study design and setting

A cross-sectional survey was conducted from May to August 2017 among WLHIV followed in the four HIV clinics with the highest number of persons actively followed in Abidjan, Côte d'Ivoire. During the study period, all women aged 25 to 55 years, followed in these HIV clinics since at least one year, were eligible to participate.

Sampling

Participants were selected through a systematic sampling procedure. For every woman presenting at the HIV clinic for a routine follow-up visit, eligibility criteria were checked at the entrance desk and a sequential number was given to each eligible participant according to the arrival order. The first eligible participant of the day was selected and a sampling interval of three was applied to select subsequent participants. This procedure was repeated every day in each participating HIV clinics and a sticker was pasted on medical record of participants to avoid multiple enrolments of same participant.

Data collection

A standardized questionnaire was administered to each participant by trained nurses, midwives or social workers (psychosocial agents). This questionnaire allowed the collection of data on demographics (age, education, marital status, monthly income), awareness of cervical cancer (existence of the disease, risk factors and prevention), personal history of cervical cancer screening (date, place, provider, screening method, number of screening conducted). Additional HIV data (date of HIV infection diagnosis, history of CD4 count measures, clinical stage at enrolment into HIV care and antiretroviral therapy use) were extracted from the electronic records of the respective HIV clinics.

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Outcomes and variables

To perform the logistic regression analysis, we defined the uptake of cervical cancer screening using the dichotomic variable “at least one lifetime cervical cancer screening” (yes/no) as the dependent variable. Independent variables where demographic characteristics, HIV follow up characteristics and variable related to awareness of cervical cancer (having heard about cervical cancer, being aware of the relationship with HIV, being aware of the cervical cancer prevention by screening, having been proposed the screening). The educational level was categorized in three modalities: “No formal education or primary level” for women with no formal or primary education level, “secondary level” for women who attend at least one class in secondary school and “university level” for those with university education level. Age of participants was categorized into two modalities (<45 / ≥45) based on previous reports. The marital status was dichotomized as living alone (single, divorced, widowed) or living with a partner (married or engaged with a life partner). To characterize information of cervical cancer, we combine two variables (having heard about cervical cancer and source of information) to create a new variable indicating if the participants has been informed in the HIV clinic or elsewhere “information on cervical cancer”. The time since first positive HIV serology was categorized into three modalities (1-4; 5-9; ≥10 years). We also created a variable to assess the influence of the place and the category of person who proposed the screening, this variable “proposition of screening” has two modalities for participants who had ever been proposed a screening (proposed elsewhere/ proposed in the HIV clinic). The clinical stage was dichotomized into I-II/A-B for the participants with the corresponding WHO or CDC clinical stage in their medical records, and III-IV/C for those with advanced stage disease.

Statistical analysis

Qualitative variables were described as frequencies with percentages and quantitative variables were described as medians with interquartile range (IQR). Chi square test and Fisher exact test were used for the comparison of qualitative variables. The 95% confidence interval of the proportion of WLHIV covered by cervical cancer screening was estimated using the following formula: $p +/- Z^*\sqrt{p (1-p)/n}$ where n=sample size, p=ratio of the number of WLHIV covered by cervical cancer screening in the sample to the sample size and the Z-value=1.96 for 95% confidence. Logistic regression analysis using a step-wise backward procedure was performed to assess factors associated with uptake of cervical cancer screening among WLHIV. Multivariable analysis was performed including all available variables selected based on their potential association with uptake of cervical cancer screening from the existing literature. All Analyses were performed using STATA V12.0 (Stata Corp, College Station, Texas).

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Patient and public involvement

Patients and public were not involved in the design of the study, but the questionnaire was submitted to a panel of WLHIV to identify unclear or confusing questions. Additional insights generated from this panel of women were taken into account in the final version of the questionnaire.

Ethic statement

Ethical approval was obtained from the “Comité National d’Ethique des Sciences de la Vie et de la Santé (CNESVS)”, that is the National Ethic Committee for life Science and Health, the country’s national IRB. The registry number of our study is “IORG00075”. Each participant was given comprehensive information on the protocol of the study and had to provide a written consent before being enrolled.

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RESULTS

Sociodemographic and HIV follow-up characteristics

During the study period, 1,921 women attending their usual HIV clinic for routine follow-up visit where selected and proposed the study, among which eight (0.04%) refused to participate because of lack of time. Overall, 1,991 participants were interviewed with a median age of 42 years (Inter Quartile Range IQR [37-47]). Among them, 1,736 (87.2%) had no formal or primary level or secondary education, 1,055 (53.0%) were married or living with a partner, and 1,052 (52.8%) had no income or earned less than the national minimum wage ($109). For HIV related characteristics, among the 1,991 participants, 971 (48.8%) were enrolled in the cohort with a WHO clinical stage I or II. The median CD4 count at enrolment in the cohorts was 287 cell/mm^3 (IQR [140-459]), and the last known median CD4 count was 563 cell/mm^3 (IQR [378-773]). The median follow-up duration was 8 years (IQR [4-11]). Most participants (94.9%) initiated antiretroviral treatment (ART) and the median duration on ART was 7 years (IQR [3-10]).

Knowledge on cervical cancer

Off the 1,991 participants 1,913 (96.1%) had previously heard about cervical cancer, among which 1,451 (75.8%) heard about it in their follow up HIV clinic. Among the 1,913 participant who ever heard about cervical cancer, 1,167 (61.0%) stated that the information provided about cervical cancer was understandable and clear. Women with a university education level were more likely to receive a clear and understandable information about cervical cancer than those who were less educated (78.4% vs 63.1% and 55.1%; p<0.001). Cervical cancer was recognized as a preventable disease by 1,443 (75.4%) participants, and screening and HPV vaccine were identified as preventive methods by 1,299 (90.0%) and 423 (29.3%) participants, respectively. Women who reached university were more likely to identify screening as preventive method than the less educated ones (94.8% vs 91.4% and 87.6% respectively, p=0.007). Regarding risk factors for cervical cancer, multiple sexual partner and early sexual initiation were identified by 1,238 (64.7%) and 1,113 (58.2%) participants, respectively. Only 814 (42.5%) participants identified HIV infection as a risk factor for cervical cancer, mainly women at university education level (53.3% vs 41.5% and 40.5%; p<0.001) (Table 1).

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Table 1: knowledge on cervical cancer and prevention according to education level among women living with HIV in Côte d'Ivoire, West Africa

Characteristics	Total		No formal or Primary level		Secondary level		University level		P value
	1,991 (100%)		1,057 (53.1%)		679 (34.1%)		255 (12.8%)		
Ever Heard about CC									
Yes	1,913	(96.1)	991	(93.8)	667	(98.2)	255	(100.0)	0.000
Heard about CC in HIV clinic (N=1,913)									
Yes	1,451	(75.8)	745	(75.2)	512	(75.8)	194	(76.1)	0.758
Heard about CC in the media (N=1,913)									
Yes	1,236	(64.6)	570	(57.5)	459	(68.2)	207	(81.2)	<0.001
Clarity of information received (N=1,913)									
Not clear / I did not understand	743	(39.0)	445	(44.9)	246	(36.9)	55	(21.6)	<0.001
Very Clear / I understood it	1,167	(61.0)	546	(55.1)	421	(63.1)	200	(78.4)	
CC is a preventable disease (N=1,913)									
Yes	1,443	(75.4)	707	(71.3)	526	(78.9)	210	(82.4)	0.001
Means of prevention for CC (N=1,443)									
Screening	1,299	(90.0)	619	(87.6)	481	(91.4)	199	(94.8)	0.007
Vaccine	423	(29.3)	199	(28.1)	131	(24.9)	91	(43.3)	<0.001
Risk factors for CC (N=1,913)									
HIV infection	814	(42.5)	401	(40.5)	277	(41.5)	136	(53.3)	<0.001
Multiple sexual partners	1,238	(64.7)	612	(61.8)	448	(67.2)	178	(69.8)	0.002
Early sexual initiation	1,113	(58.2)	519	(52.4)	424	(63.8)	170	(66.7)	<0.001

CC: cervical cancer

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Cervical cancer screening uptake

Among the 1,913 participants, 1,188 have ever been screened and the overall cervical cancer screening coverage among WLHIV was 59.7% [95%CI (57.6 - 62.0)]. Overall, 1,444 (72.5%) participants had ever been offered cervical cancer screening, most of them in their follow-up HIV clinic (88.9%). The main screening methods were VIA for 1,050 (88.4%) participants and Pap smear for 120 (10.1%) participants. After cervical cancer screening, results were given to 1,146 (96.5%) women and only 778 (65.5%) of them declared having received advise for repeated screening over time. Half of screened participants (48.8%) declared having done the screening because it was advised by the healthcare workers, 328 (27.6%) declared that it was their personal decision and 188 (15.8%) declared having accept it because it was part of a research project in which they were involved. Among the 803 (40.3%) women with no history of cervical cancer screening, the lack of information about cervical cancer (54%), the fear of the result of cervical cancer screening (22%), negligence (15%) and fear of induced cost (10%) were the main reasons (Figure 1).

Factors associated with cervical cancer screening uptake

Being aged ≥45 years old (aOR=1.4 [1.1;1.8], p=0.012), having a university education level (vs no or primary level education) (aOR=2.1 [1.4;3.1], p<0.001), receiving information on cervical cancer through their HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), having received information on cervical cancer self-perceived as “clear” (aOR=1.7 [1.4;2.2], p<0.001), attending their HIV clinic for at least ten years (aOR=1.4 [1.0 ; 1.8], p=0.043), identifying HIV as a risk factor of cervical cancer (aOR=1.4 [1.1;1.8], p=0.002) and being proposed cervical cancer screening in their HIV clinic (aOR=10.1 [7.6;13.5], p<0.001) were associated with cervical cancer screening uptake (Table 2).

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Table 2: Factors associated with uptake to cervical cancer screening among women living with HIV in Côte d'Ivoire, West Africa

Variables	n/N	Uni variable model		Multivariable model (final)	
		aOR (CI 95%)	p-value	aOR (CI 95%)	p-value
Age (years)					
<45	747/1293	1	-	1	-
≥45	441/698	1.3 (1.0 – 1.5)	0.019	1.4 (1.1 – 1.8)	0.012
Marital status					
Living alone	623/1083	1	-	-	-
Living with a partner	565/908	1.2 (1.0 - 1.4)	0.033	1.3 (1.0 – 1.6)	0.046
Educational level					
No formal / primary level	568/1057	1	-	1	-
Secondary level	430/679	1.5 (1.2 – 1.8)	<0.001	1.2 (0.9 - 1.5)	0.211
University	190/255	2.5 (1.8 – 3.4)	<0.001	2.1 (1.4 - 3.1)	<0.001
Information on CC					
Informed elsewhere	135/535	1		1	-
Informed in usual HIV clinic	1,053/1456	7.7 (6.2 – 9.7)	<0.001	1.5 (1.1 – 2.0)	0.017
Clarity of information					
Not clear for me	341/820	1	-	1	-
Very clear for me	847/1171	4.0 (3.0 – 4.4)	<0.001	1.7 (1.4 – 2.2)	<0.001
Proposition of screening					
Proposed elsewhere	147/700	1	-	1	-
Proposed in usual HIV clinic	1041/1291	15.7 (12.5 – 19.7)	<0.001	10.1 (7.6 – 13.5)	<0.001
Clinical Stage					
III-IV/C	254/519	1	-	1	-
I-II/ A-B	572/971	1.5 (1.2 – 1.9)	<0.001	1.6 (1.2 – 2.0)	0.001
Missing values	362/501	2.7 (2.1 – 3.5)	<0.001	1.8 (1.3 - 2.5)	<0.001
Follow up duration					
1-4	231/512	1	-	1	-
5-9	431/720	1.8 (1.4- 2.3)	<0.001	1.2 (0.9 – 1.7)	0.156
≥10	526/759	2.7 (2.1 – 3.4)	<0.001	1.4 (1.0 – 1.8)	0.043
Knowing HIV as a risk factor					
No	631/1172	1	-	1	-
Yes	557/819	1.8 (1.5 – 2.2)	<0.001	1.4 (1.1 – 1.8)	0.002

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DISCUSSION

This study assesses the cervical cancer screening coverage among 1,991 WLHIV in Abidjan, aged 42 years old in median, with low education level and socioeconomic situation, and a clinically and immunologically stable HIV disease. The great majority of women were aware that cervical cancer was accessible to screening, but information received was clear and understood by less than two fifth of them. Uptake of cervical cancer screening was around 60% and was associated with higher education level, clarity of information, onsite cervical cancer screening and identifying HIV as a risk factor for cervical cancer. In addition, lack of information and fear of being diagnosed with cervical cancer were the main reasons reported by WLHIV for not accessing to CC screening.

This study reports that three over five women living with HIV in our study population had been screened for cervical cancer at least once during the last three years. This result is higher than previous reports from Nigeria, Ethiopia and Uganda, where the cervical cancer screening uptake rates were 9.5%, 23.5% and 30.3%, respectively [17,18,23]. This result support the successful integration of cervical cancer screening services in HIV clinics in Cote d'Ivoire. Indeed, since 2010, the national cancer control program and the national aids control program have been involved in the pilot phase of the cervical cancer prevention project (CECAP) supported by ministry of health and implementing partners. The aim was to integrate cervical cancer screening in HIV clinics and improve access to screening for women living with HIV, highly susceptible to cervical cancer. From 2010 to 2015, almost all HIV clinics in Abidjan and the outlying area were equipped for cervical cancer screening and their staff trained to provide cervical cancer screening and treatment of eligible precancerous lesions free of charge [21]. The collaboration between AIDS and cancer control programs led to this successful integration of services that has been described in other SSA countries as a game changer for the prevention of cervical cancer among HIV-infected women [24–26]. The positive effect of this service integration is emphasized in our study by the association between screening uptake and the offer of cervical cancer screening "onsite", in the HIV clinic were the participant is usually followed. This underlines the importance of scaling up the cervical cancer screening in all HIV clincs, as WLHIV will be more willing to accept the screening when proposed in the health facility they usually attend. Indeed, half of the screened women declared having accept the screening because it was advised by the healthcare worker at the HIV clinic [27].

Despite the important coverage of cervical cancer screening reported in this study, around 40% of WLHIV have never been screened despite their high risk of developing an invasive

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cervical cancer, usually diagnosed at an advanced stage in SSA [28,29]. Lack of information was the main reason reported by WLHIV never screened for cervical cancer in Abidjan. This result suggests that despite efforts from the national cancer program to increase awareness of cervical cancer among women (either in hospital-based strategy by training healthcare workers to offer cervical cancer screening or in community-based strategy through awareness campaign involving community mobilizers), messages to raise awareness on cervical cancer and its prevention remain poorly disseminated.

When analyzing factors associated to cervical cancer screening uptake, it appears that highly educated women and those who identified HIV as a risk factor for cervical cancer were more likely to be screened. Thus, misunderstanding of information on cervical cancer remains an important barrier to screening among WLHIV as reported in other studies [30–33]. In addition, the important gap (36%) observed between the numbers of women who had been offered cervical cancer screening and those who have been effectively screened, reported in our population is consistent with previous study from Uganda [17]. This result underlines the importance of a tailored communication strategy to take into account factors that influence the decision to undergo cervical cancer screening, such as low education level, the need for patient-centered communications and cultural beliefs reported in other SSA countries [30,32]. In addition to participant-related barriers, providers-related barriers such as lack of knowledge and failure to inform or encourage women to be screened were reported as important factors influencing cervical cancer screening uptake in other SSA countries [33]. In our study the role of health care providers appeared to be central in the decision of WLHIV to get screened as highlighted by the strong association between screening uptake and proposition of screening in the usual HIV clinic of the participants. This idea is supported by the association reported between screening uptake and receiving clear and understood information on cervical cancer screening from health care providers. Thus, the high rate of cervical cancer screening uptake reported in this study compared to other SSA countries could be explained by the influence of health care providers, mostly psychosocial agent who are in charge of linkage and retention of WLHIV and who are trained to inform WLHIV and refer them to screening unit. However qualitative studies are needed to deeply explore the provider's related barriers for screening uptake among the 40% of WLHIV who have never been screened in the participating HIV clinics.

The WHO guideline for prevention and care of cervical cancer among women recommend for low- and middle-income countries to perform VIA screening for all WLHIV between 30-49 years old or older for those with visible transformation zone and to repeat the screening test within

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three years if no lesions. In case of precancerous lesions eligible for treatment, they will have to attend the screening unit one year after treatment for a follow up visit with the aim of checking recurrence [34]. To improve the uptake of cervical cancer screening, it is critical to improve health education and awareness among WLHIV, by reshaping the hospital-based communication approach for cervical cancer screening. A recent systematic review on strategies implemented in SSA to improve cervical cancer screening reported that about three quarter of these strategies include education and awareness activities, but most of them failed to demonstrate the effectiveness of the strategy [35]. Most of these interventions had anticipated solution for financial barriers for clients, materials supply and capacity building of staff, while the main problem is to improve beneficiaries understanding of cervical cancer prevention messages. Usually, the level of communication on cervical cancer prevention services is standardized and not adapted to all the social categories. A specific educational program, which uses culturally sensitive and linguistically appropriate strategies to deliver, tailored cervical cancer prevention messages could enhance awareness of WLHIV and increase access to cervical cancer screening. Furthermore, a collaboration between cervical cancer screening providers and community health educators is critical to improve the understanding of health education messages as already reported in SSA [36].

This study was conducted among WLHIV followed in HIV clinics located in the urban area of Abidjan. These results may thus mostly reflect the feature in urban settings where people are more educated and more exposed to cervical cancer awareness activities than in rural settings. In addition, this study was conducted in the largest and oldest HIV clinics in Abidjan, where cervical cancer screening is provided free of charge since the initiation of CECAP in 2010 potentially overestimating the overall cervical cancer screening uptake in Abidjan. The cross-sectional design of the study did not allow us to draw any causal relationship between the uptake of cervical cancer screening and the reported associated factors. Although the questionnaire was administered during face-to-face interviews by previously trained monitors, we cannot exclude bias related to the declarative nature of the collected information, such as memory bias or social desirability bias. However, the survey was conducted in the four largest HIV clinics in the country, using a daily-repeated systematic random selection procedure over a four-month period. This enabled to take into account the heterogeneity of the population attending these HIV clinics and helped mitigate the risk of selection bias.

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CONCLUSION

Initiatives to support cervical cancer screening in HIV care programs have resulted in effective access to more than half of the WLHIV followed in the three major HIV clinics in Abidjan. Nevertheless, efforts are still needed to provide universal access to cervical cancer screening, which remains an AIDS-defining cancer poorly prevented by antiretroviral treatments compared to Kaposi Sarcoma or Non-Hodgkin Lymphomas. Promoting cervical cancer screening among socio-economically disadvantaged WLHIV by addressing client barriers still need to be prioritized.

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Figure legend caption

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

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Competing interest
None declared.

Authors Contribution

BT and AJ designed the study. BT, SB, JJK, DKE, AH, AT, EM, SOK, IA and AJ supervised the study implementation and data collection. Statistical analysis was performed by BT, SB and AJ. Data interpretation and first draft of manuscript was done by BT, SB, JJK and AJ. Critical revision of the manuscript for important intellectual content was provided by all the coauthors who read and commented on the original manuscript and all agreed on the version finalized by BT, SB and AJ for submission.

Data availability statement
All files used in the present analysis will be made available after acceptance of the manuscript at the following URL https://figshare.com/s/aa30384566ff726358ba . Authors may be contacted at boris.tchounga@yahoo.fr and antoine.jaquet@u-bordeaux.fr.

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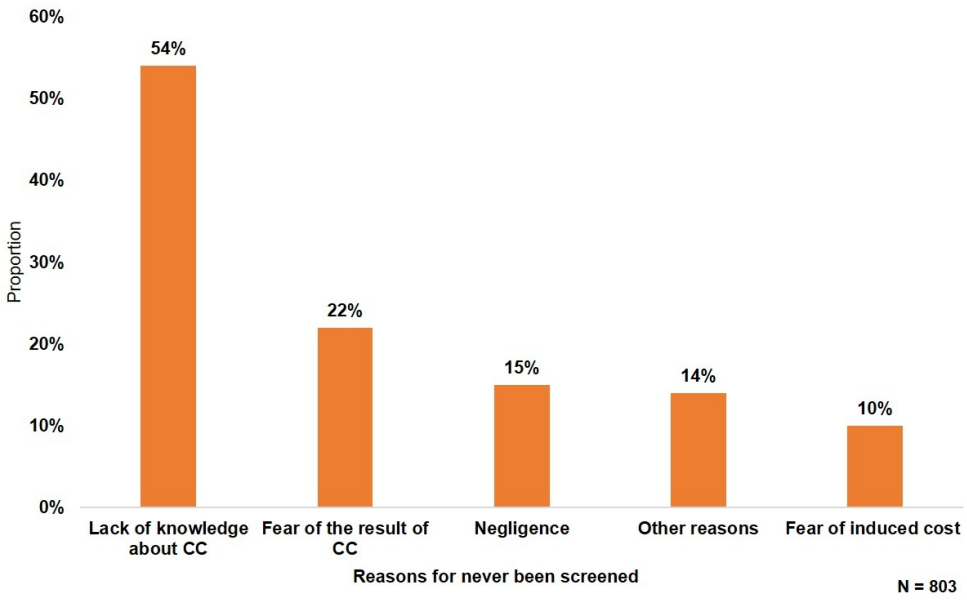

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

207x126mm (150 x 150 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	4
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6

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		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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BMJ Open

Cervical cancer screening Uptake and correlates among HIV-infected women: a cross-sectional survey in Côte d'Ivoire, West Africa

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Secondary Subject Heading:	Epidemiology, HIV/AIDS, Oncology
Keywords:	Cervical cancer, screening uptake, HIV

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Cervical cancer screening Uptake and correlates among HIV-infected women: a cross-sectional survey in Côte d'Ivoire, West Africa

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ABSTRACT

Objectives: Despite the increasing number of interventions aiming to integrate cervical cancer screening into HIV clinics in sub-Saharan Africa, Women living with HIV (WLHIV) still have a high risk of developing cervical cancer. The aim of this study was to estimate the coverage of cervical cancer screening and associated factors among WLHIV in Abidjan, Côte d'Ivoire.

Design: Cross-sectional survey conducted from May to August 2017.

Settings: Outpatient setting in the four highest volume urban HIV clinics of government's or NGO's sector in Côte d'Ivoire.

Participants: All WLHIV, aged 25 to 55 years, followed since at least one year, selected through a systematic sampling procedure.

Intervention: A standardized questionnaire administered to each participant by trained healthcare workers.

Outcome: Cervical cancer screening uptake

Results: A total of 1,991 WLHIV were included in the study, aged in median 42 years [(IQR): 38-47], and a median CD4 count (last known) of 560 [379-773] cells/mm3. Among the participants, 1,913 (96.7%) had ever heard about cervical cancer, 1,444 (72.5%) had been offered cervical cancer screening, mainly in the HIV clinic for 1,244 (88.9%), and 1148 reported a personal history of cervical cancer screening for an overall coverage of 59.7% [CI 57.6 - 62.0]. In multivariable analysis, university level (aOR=2.1 [1.4;3.1], p<0.001), being informed on cervical cancer at the HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), receiving information self-perceived as "clear and understood" on cervical cancer (aOR=1.7[1.4;2.2], p<0.001), identifying HIV as a risk factor for cervical cancer (aOR=1.4[1.1;1.8], p=0.002) and being proposed cervical cancer screening in the HIV clinic (aOR=10.1 [7.6;13.5], p<0.001), were associated with cervical cancer screening uptake.

Conclusion: Initiatives to support cervical cancer screening in HIV care programs resulted in effective access to more than half of the WLHIV in Abidjan. Efforts are still needed to provide universal access to cervical cancer screening, especially among socio-economically disadvantaged WLHIV.

Key words: Cervical cancer; screening Uptake; HIV; ART

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Strengths and limitations of this study

- This study reports the cervical cancer screening coverage among women living with HIV in Côte d'Ivoire, a country with one of the highest HIV prevalence among women.
- The methodological approach used in this study allowed the enrolment of a quite representative sample of WLHIV visiting the participating HIV clinics.
- Reasons for not being screened and factors associated with cervical cancer screening uptake were explored through face-to-face interviews.
- The specificity of rural area was not directly explored with this population.
- The data collected are declarative information, collected through face-to-face interviews with possible memory and social desirability bias.

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Introduction

Cervical cancer is the fourth most common cancer in women worldwide, with an estimated incidence of 570 000 new cases and approximately 311 000 new associated deaths in 2018 [1]. In sub Saharan Africa, cervical cancer account for 20.8% of all cancers in women and 14.2% of all cancer related deaths in women [2].

Persistent infection with oncogenic Human Papilloma Viruses (HPV) is a necessary cofactor for cervical cancer, responsible for the development of precancerous lesions that lead to invasive cervical cancer, if left untreated [3]. Infection with human immunodeficiency virus (HIV) is known to accelerates the development of precancerous lesions leading to a higher risk of cervical cancer [4,5]. Infection with HIV is also associated with more extensive lesions of the cervix, three to five times more common in women living with HIV/AIDS (WLHIV) than in those with no history of HIV [6–8]. In addition, a two-fold increase in the risk of death due to cervical cancer was reported in WLHIV compared to their HIV-negative counterparts [9].

The long asymptomatic phase and slow disease progression from the persistent infection with oncogenic HPV to invasive carcinoma, make cervical cancer a highly preventable cancer through screening and HPV immunization [10]. Since 2012, a cervical cancer prevention strategy based on integration of visual inspection of the cervix with acetic acid (VIA) in reproductive health and family planning services has been adopted in many African countries in order to increase access to cervical cancer screening services [11–13]. Cervical cancer screening uptake among women in developed settings is relatively high, 79.4% in Brazil [14], 60% in United States [15], and 89.1% in France [16], mainly with Pap smears. In developing countries, recent studies conducted in Ethiopia and Uganda revealed a low cervical cancer screening uptake of 23.5% and 30.3%, respectively [17,18] and emphasized the importance of sociodemographic factors and attitude of healthcare providers on the decision of beneficiaries to attend cervical cancer screening units [18,19].

In West Africa, Cote d'Ivoire has the highest HIV prevalence among women (4.1%) [20]. Cervical cancer is the second most common cancer among women accounting for 28.6% of all women's cancers and the leading cause of cancer deaths with 22.2% of all cancer related deaths [2]. The national guidelines on cervical cancer screening in the country are aligned with WHO guidelines for low- and middle-income countries, and recommend the screen-and-treat approach based preferentially on visual inspection with acetic acid or pap smear and cryotherapy or electrocoagulation, respectively. This recommendation targets women between 25 and 55 years old in the general population, and those diagnosed with HIV who should be systematically offered a screening per year once linked to HIV care [21]. These guidelines

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relied on the screening program that was piloted in HIV clinics from 2008 to 2012 before being scaled up in all the government health facilities and at national level. However, data on the national coverage of cervical cancer screening among women in Côte d'Ivoire are currently not available. The only data available on the coverage of cervical cancer screening among WLHIV is the 10% UNAIDS estimates based on the data from 2011-12 Demographic and Health Survey [22]. The aim of this study was to estimate the uptake of cervical cancer screening and its correlates among WLHIV in Abidjan, the economic capital of Côte d'Ivoire.

METHOD

Study design and setting

A cross-sectional survey was conducted from May to August 2017 among WLHIV followed in the four HIV clinics with the highest number of persons actively followed in Abidjan, Côte d'Ivoire. During the study period, all women aged 25 to 55 years, followed in these HIV clinics since at least one year, were eligible to participate.

Sampling

Participants were selected through a systematic sampling procedure. For every woman presenting at the HIV clinic for a routine follow-up visit, eligibility criteria were checked at the entrance desk and a sequential number was given to each eligible participant according to the arrival order. The first eligible participant of the day was selected and a sampling interval of three was applied to select subsequent participants. This procedure was repeated every day in each participating HIV clinics and a sticker was pasted on medical record of participants to avoid multiple enrolments of same participant.

Data collection

A standardized questionnaire was administered to each participant by trained nurses, midwives or social workers (psychosocial agents). The questionnaire was administered in French, the official language of the country, but each participant has the possibility to ask for a translator and a witness to assist in case she was not able to read or understand French. This questionnaire allowed the collection of data on demographics (age, education, marital status, monthly income), awareness of cervical cancer (existence of the disease, risk factors and prevention), personal history of cervical cancer screening (date, place, provider, screening method, number of screening conducted). Additional HIV data (date of HIV infection diagnosis, history of CD4 count measures, clinical stage at enrolment into HIV care and

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antiretroviral therapy use) were extracted from the electronic records of the respective HIV clinics.

Outcomes and variables

To perform the logistic regression analysis, we defined the uptake of cervical cancer screening using the dichotomic variable “at least one lifetime cervical cancer screening” (yes/no) as the dependent variable. Independent variables where demographic characteristics, HIV follow up characteristics and variable related to awareness of cervical cancer (having heard about cervical cancer, being aware of the relationship with HIV, being aware of the cervical cancer prevention by screening, having been proposed the screening). The educational level was categorized in three modalities: “No formal education or primary level” for women with no formal or primary education level, “secondary level” for women who attend at least one class in secondary school and “university level” for those with university education level. Age of participants was categorized into two modalities (<45 / ≥45) based on previous reports. The marital status was dichotomized as living alone (single, divorced, widowed) or living with a partner (married or engaged with a life partner). To characterize information of cervical cancer, we combine two variables (having heard about cervical cancer and source of information) to create a new variable indicating if the participants has been informed in the HIV clinic or elsewhere “information on cervical cancer”. The time since first positive HIV serology was categorized into three modalities (1-4; 5-9; ≥10 years). We also created a variable to assess the influence of the place and the category of person who proposed the screening, this variable “proposition of screening” has two modalities for participants who had ever been proposed a screening (proposed elsewhere/ proposed in the HIV clinic). The clinical stage was dichotomized into I-II/A-B for the participants with the corresponding WHO or CDC clinical stage in their medical records, and III-IV/C for those with advanced stage disease.

Statistical analysis

Qualitative variables were described as frequencies with percentages and quantitative variables were described as medians with interquartile range (IQR). Chi square test and Fisher exact test were used for the comparison of qualitative variables. The 95% confidence interval of the proportion of WLHIV covered by cervical cancer screening was estimated using the following formula: $p +/- Z^*\sqrt{p (1-p)/n}$ where n=sample size, p=ratio of the number of WLHIV covered by cervical cancer screening in the sample to the sample size and the Z-value=1.96 for 95% confidence. Logistic regression analysis using a stepwise backward procedure was performed to assess factors associated with uptake of cervical cancer screening among

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WLHIV. Multivariable analysis was performed including all available variables selected based on their potential association with uptake of cervical cancer screening from the existing literature. All Analyses were performed using STATA V12.0 (Stata Corp, College Station, Texas).

Patient and public involvement

Patients and public were not involved in the design of the study, but the questionnaire was submitted to a panel of WLHIV to identify unclear or confusing questions. Additional insights generated from this panel of women were taken into account in the final version of the questionnaire.

Ethic statement

Ethical approval was obtained from the "Comité National d'Ethique des Sciences de la Vie et de la Santé (CNESVS)", that is the National Ethic Committee for life Science and Health, the country's national IRB. The registry number of our study is "IORG00075". Each participant was given comprehensive information on the protocol of the study and had to provide a written consent before being enrolled.

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RESULTS

Sociodemographic and HIV follow-up characteristics

During the study period, 1,921 women attending their usual HIV clinic for routine follow-up visit where selected and proposed the study, among which eight (0.04%) refused to participate because of lack of time. Overall, 1,991 participants were interviewed with a median age of 42 years (Inter Quartile Range IQR [37-47]). Among them, 1,736 (87.2%) had no formal or primary level or secondary education, 1,055 (53.0%) were married or living with a partner, and 1,052 (52.8%) had no income or earned less than the national minimum wage ($109). For HIV related characteristics, among the 1,991 participants, 971 (48.8%) were enrolled in the cohort with a WHO clinical stage I or II. The median CD4 count at enrolment in the cohorts was 287 cell/mm^3 (IQR [140-459]), and the last known median CD4 count was 563 cell/mm^3 (IQR [378-773]). The median follow-up duration was 8 years (IQR [4-11]). Most participants (94.9%) initiated antiretroviral treatment (ART) and the median duration on ART was 7 years (IQR [3-10]).

Knowledge on cervical cancer

Off the 1,991 participants 1,913 (96.1%) had previously heard about cervical cancer, among which 1,451 (75.8%) heard about it in their follow up HIV clinic. Among the 1,913 participant who ever heard about cervical cancer, 1,167 (61.0%) stated that the information provided about cervical cancer was understandable and clear. Women with a university education level were more likely to receive a clear and understandable information about cervical cancer than those who were less educated (78.4% vs 63.1% and 55.1%; p<0.001). Cervical cancer was recognized as a preventable disease by 1,443 (75.4%) participants, and screening and HPV vaccine were identified as preventive methods by 1,299 (90.0%) and 423 (29.3%) participants, respectively. Women who reached university were more likely to identify screening as preventive method than the less educated ones (94.8% vs 91.4% and 87.6% respectively, p=0.007). Regarding risk factors for cervical cancer, multiple sexual partner and early sexual initiation were identified by 1,238 (64.7%) and 1,113 (58.2%) participants, respectively. Only 814 (42.5%) participants identified HIV infection as a risk factor for cervical cancer, mainly women at university education level (53.3% vs 41.5% and 40.5%; p<0.001) (Table 1).

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Table 1: Knowledge on cervical cancer and prevention according to education level among women living with HIV in Côte d'Ivoire, West Africa

Characteristics	Total		No formal or Primary level		Secondary level		University level		P value
	1,991 (100%)		1,057 (53.1%)		679 (34.1%)		255 (12.8%)		
Ever Heard about CC									
Yes	1,913	(96.1)	991	(93.8)	667	(98.2)	255	(100.0)	0.000
Heard about CC in HIV clinic (N=1,913)									
Yes	1,451	(75.8)	745	(75.2)	512	(75.8)	194	(76.1)	0.758
Heard about CC in the media (N=1,913)									
Yes	1,236	(64.6)	570	(57.5)	459	(68.2)	207	(81.2)	<0.001
Clarity of information received (N=1,913)									
Not clear / I did not understand	743	(39.0)	445	(44.9)	246	(36.9)	55	(21.6)	<0.001
Very Clear / I understood it	1,167	(61.0)	546	(55.1)	421	(63.1)	200	(78.4)	
CC is a preventable disease (N=1,913)									
Yes	1,443	(75.4)	707	(71.3)	526	(78.9)	210	(82.4)	0.001
Means of prevention for CC (N=1,443)									
Screening	1,299	(90.0)	619	(87.6)	481	(91.4)	199	(94.8)	0.007
Vaccine	423	(29.3)	199	(28.1)	131	(24.9)	91	(43.3)	<0.001
Risk factors for CC (N=1,913)									
HIV infection	814	(42.5)	401	(40.5)	277	(41.5)	136	(53.3)	<0.001
Multiple sexual partners	1,238	(64.7)	612	(61.8)	448	(67.2)	178	(69.8)	0.002
Early sexual initiation	1,113	(58.2)	519	(52.4)	424	(63.8)	170	(66.7)	<0.001

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Cervical cancer screening uptake

Among the 1,913 participants, 1,188 have ever been screened and the overall cervical cancer screening coverage among WLHIV was 59.7% [95%CI (57.6 - 62.0)]. Overall, 1,444 (72.5%) participants had ever been offered cervical cancer screening, most of them in their follow-up HIV clinic (88.9%). The main screening methods were VIA for 1,050 (88.4%) participants and Pap smear for 120 (10.1%) participants. After cervical cancer screening, results were given to 1,146 (96.5%) women and only 778 (65.5%) of them declared having received advise for repeated screening over time. Half of screened participants (48.8%) declared having done the screening because it was advised by the healthcare workers, 328 (27.6%) declared that it was their personal decision and 188 (15.8%) declared having accept it because it was part of a research project in which they were involved. Among the 803 (40.3%) women with no history of cervical cancer screening, the lack of information about cervical cancer (54%), the fear of the result of cervical cancer screening (22%), negligence (15%) and fear of induced cost (10%) were the main reasons (Figure 1).

Factors associated with cervical cancer screening uptake

Being aged ≥45 years old (aOR=1.4 [1.1;1.8], p=0.012), having a university education level (vs no or primary level education) (aOR=2.1 [1.4;3.1], p<0.001), receiving information on cervical cancer through their HIV clinic (aOR=1.5 [1.1;2.0], p=0.017), having received information on cervical cancer self-perceived as “clear” (aOR=1.7 [1.4;2.2], p<0.001), attending their HIV clinic for at least ten years (aOR=1.4 [1.0 ; 1.8], p=0.043), identifying HIV as a risk factor of cervical cancer (aOR=1.4 [1.1;1.8], p=0.002) and being proposed cervical cancer screening in their HIV clinic (aOR=10.1 [7.6;13.5], p<0.001) were associated with cervical cancer screening uptake (Table 2).

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Table 2: Factors associated with uptake to cervical cancer screening among women living with HIV in Côte d'Ivoire, West Africa

Variables	n/N	Uni variable model		Multivariable model (final)	
		aOR (CI 95%)	p-value	aOR (CI 95%)	p-value
Age (years)					
<45	747/1293	1	-	1	-
≥45	441/698	1.3 (1.0 – 1.5)	0.019	1.4 (1.1 – 1.8)	0.012
Marital status					
Living alone	623/1083	1	-	-	-
Living with a partner	565/908	1.2 (1.0 - 1.4)	0.033	1.3 (1.0 – 1.6)	0.046
Educational level					
No formal / primary level	568/1057	1	-	1	-
Secondary level	430/679	1.5 (1.2 – 1.8)	<0.001	1.2 (0.9 - 1.5)	0.211
University	190/255	2.5 (1.8 – 3.4)	<0.001	2.1 (1.4 - 3.1)	<0.001
Information on CC					
Informed elsewhere	135/535	1		1	-
Informed in usual HIV clinic	1,053/1456	7.7 (6.2 – 9.7)	<0.001	1.5 (1.1 – 2.0)	0.017
Clarity of information					
Not clear for me	341/820	1	-	1	-
Very clear for me	847/1171	4.0 (3.0 – 4.4)	<0.001	1.7 (1.4 – 2.2)	<0.001
Proposition of screening					
Proposed elsewhere	147/700	1	-	1	-
Proposed in usual HIV clinic	1041/1291	15.7 (12.5 – 19.7)	<0.001	10.1 (7.6 – 13.5)	<0.001
Clinical Stage					
III-IV/C	254/519	1	-	1	-
I-II/ A-B	572/971	1.5 (1.2 – 1.9)	<0.001	1.6 (1.2 – 2.0)	0.001
Missing values	362/501	2.7 (2.1 – 3.5)	<0.001	1.8 (1.3 - 2.5)	<0.001
Follow up duration					
1-4	231/512	1	-	1	-
5-9	431/720	1.8 (1.4- 2.3)	<0.001	1.2 (0.9 – 1.7)	0.156
≥10	526/759	2.7 (2.1 – 3.4)	<0.001	1.4 (1.0 – 1.8)	0.043
Knowing HIV as a risk factor					
No	631/1172	1	-	1	-
Yes	557/819	1.8 (1.5 – 2.2)	<0.001	1.4 (1.1 – 1.8)	0.002

CC: cervical cancer

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DISCUSSION

This study assesses the cervical cancer screening coverage among 1,991 WLHIV in Abidjan, aged 42 years old in median, with low education level and socioeconomic situation, and a clinically and immunologically stable HIV disease. The great majority of women were aware that cervical cancer was accessible to screening, but information received was clear and understood by less than two fifth of them. Uptake of cervical cancer screening was around 60% and was associated with higher education level, clarity of information, onsite cervical cancer screening and identifying HIV as a risk factor for cervical cancer. In addition, lack of information and fear of being diagnosed with cervical cancer were the main reasons reported by WLHIV for not accessing to cervical cancer screening.

This study reports that three over five women living with HIV in our study population had been screened for cervical cancer at least once during the last three years. This result is higher than previous reports from Nigeria, Ethiopia and Uganda, where the cervical cancer screening uptake rates were 9.5%, 23.5% and 30.3%, respectively [17,18,23]. This result support the successful integration of cervical cancer screening services in HIV clinics in Cote d'Ivoire. Indeed, since 2010, the national cancer control program and the national aids control program have been involved in the pilot phase of the cervical cancer prevention project (CECAP) supported by ministry of health and implementing partners. The aim was to integrate cervical cancer screening in HIV clinics and improve access to screening for women living with HIV, highly susceptible to cervical cancer. From 2010 to 2015, almost all HIV clinics in Abidjan and the outlying area were equipped for cervical cancer screening and their staff trained to provide cervical cancer screening and treatment of eligible precancerous lesions free of charge [21]. The collaboration between AIDS and cancer control programs led to this successful integration of services that has been described in other SSA countries as a game changer for the prevention of cervical cancer among HIV-infected women [24–26]. The positive effect of this service integration is emphasized in our study by the association between screening uptake and the offer of cervical cancer screening "onsite", in the HIV clinic were the participant is usually followed. This underlines the importance of scaling up the cervical cancer screening in all HIV clincs, as WLHIV will be more willing to accept the screening when proposed in the health facility they usually attend. Indeed, half of the screened women declared having accept the screening because it was advised by the healthcare worker at the HIV clinic [27].

Despite the important coverage of cervical cancer screening reported in this study, around 40% of WLHIV have never been screened despite their high risk of developing an invasive

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cervical cancer, usually diagnosed at an advanced stage in SSA [28,29]. Lack of information was the main reason reported by WLHIV never screened for cervical cancer in Abidjan. This result suggests that despite efforts from the national cancer program to increase awareness of cervical cancer among women (either in hospital-based strategy by training healthcare workers to offer cervical cancer screening or in community-based strategy through mass media (TV, radio, internet) and awareness campaign involving community mobilizers), messages to raise awareness on cervical cancer and its prevention remain poorly disseminated.

When analyzing factors associated to cervical cancer screening uptake, it appears that highly educated women and those who identified HIV as a risk factor for cervical cancer were more likely to be screened. Thus, misunderstanding of information on cervical cancer remains an important barrier to screening among WLHIV as reported in other studies [30–33]. In addition, the important gap (36%) observed between the numbers of women who had been offered cervical cancer screening and those who have been effectively screened, reported in our population is consistent with previous study from Uganda [17]. This result underlines the importance of a tailored communication strategy to take into account factors that influence the decision to undergo cervical cancer screening, such as low education level, the need for patient-centered communications and cultural beliefs reported in other SSA countries [30,32]. In addition to participant-related barriers, providers-related barriers such as lack of knowledge and failure to inform or encourage women to be screened were reported as important factors influencing cervical cancer screening uptake in other SSA countries [33]. In our study the role of health care providers appeared to be central in the decision of WLHIV to get screened as highlighted by the strong association between screening uptake and proposition of screening in the usual HIV clinic of the participants. This idea is supported by the association reported between screening uptake and receiving clear and understood information on cervical cancer screening from health care providers. Thus, the high rate of cervical cancer screening uptake reported in this study compared to other SSA countries could be explained by the influence of health care providers, mostly psychosocial agent who are in charge of linkage and retention of WLHIV and who are trained to inform WLHIV and refer them to screening unit. However qualitative studies are needed to deeply explore the provider's related barriers for screening uptake among the 40% of WLHIV who have never been screened in the participating HIV clinics.

The WHO guideline for prevention and care of cervical cancer among women recommend for low- and middle-income countries to perform VIA screening for all WLHIV between 30-49 years old or older for those with visible transformation zone and to repeat the screening test within

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three years if no lesions. In case of precancerous lesions eligible for treatment, they will have to attend the screening unit one year after treatment for a follow up visit with the aim of checking recurrence [34]. To improve the uptake of cervical cancer screening, it is critical to improve health education and awareness among WLHIV, by reshaping the hospital-based communication approach for cervical cancer screening. A recent systematic review on strategies implemented in SSA to improve cervical cancer screening reported that about three quarter of these strategies include education and awareness activities, but most of them failed to demonstrate the effectiveness of the strategy [35]. Most of these interventions had anticipated solution for financial barriers for clients, materials supply and capacity building of staff, while the main problem is to improve beneficiaries understanding of cervical cancer prevention messages. Usually, the level of communication on cervical cancer prevention services is standardized and not adapted to all the social categories. A specific educational program, which uses culturally sensitive and linguistically appropriate strategies to deliver, tailored cervical cancer prevention messages could enhance awareness of WLHIV and increase access to cervical cancer screening. Furthermore, a collaboration between cervical cancer screening providers and community health educators is critical to improve the understanding of health education messages as already reported in SSA [36].

This study was conducted among WLHIV followed in HIV clinics located in the urban area of Abidjan. These results may thus mostly reflect the feature in urban settings where people are more educated and more exposed to cervical cancer awareness activities than in rural settings. In addition, this study was conducted in the largest and oldest HIV clinics in Abidjan, where cervical cancer screening is provided free of charge since the initiation of CECAP in 2010 potentially overestimating the overall cervical cancer screening uptake in Abidjan. The cross-sectional design of the study did not allow us to draw any causal relationship between the uptake of cervical cancer screening and the reported associated factors. Given the relatively high prevalence of cervical cancer screening uptake, measures of association reported between this outcome and its correlates through Odd ratio have likely overestimated relative risks usually reported through prevalence ratio. While alternative modeling approaches such as a Log binomial regression would have been more appropriate to provide risk estimates. However, as our main objective was to identify association between our covariates and the measure of cervical cancer screening uptake, a logistic regression model remains an adapted approach in this particular situation [37]. Although the questionnaire was administered during face-to-face interviews by previously trained monitors, we cannot exclude bias related to the declarative nature of the collected information, such as memory bias or social desirability bias. However, the survey was conducted in the four largest HIV clinics in the country, using a daily-repeated systematic random selection procedure over a four-month period. This enabled to

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take into account the heterogeneity of the population attending these HIV clinics and helped mitigate the risk of selection bias.

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CONCLUSION

Initiatives to support cervical cancer screening in HIV care programs have resulted in effective access to more than half of the WLHIV followed in the three major HIV clinics in Abidjan. Nevertheless, efforts are still needed to provide universal access to cervical cancer screening, which remains an AIDS-defining cancer poorly prevented by antiretroviral treatments compared to Kaposi Sarcoma or Non-Hodgkin Lymphomas. Promoting cervical cancer screening among socio-economically disadvantaged WLHIV by addressing client barriers still need to be prioritized.

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Figure legend caption

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

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Competing interest
None declared.

Authors Contribution

BT and AJ designed the study. BT, SB, JJK, DKE, AH, AT, EM, SOK, IA and AJ supervised the study implementation and data collection. Statistical analysis was performed by BT, SB and AJ. Data interpretation and first draft of manuscript was done by BT, SB, JJK and AJ. Critical revision of the manuscript for important intellectual content was provided by all the coauthors who read and commented on the original manuscript and all agreed on the version finalized by BT, SB and AJ for submission.

Data availability statement
All files used in the present analysis will be made available after acceptance of the manuscript at the following URL https://figshare.com/s/aa30384566ff726358ba . Authors may be contacted at boris.tchounga@yahoo.fr and antoine.jaquet@u-bordeaux.fr.

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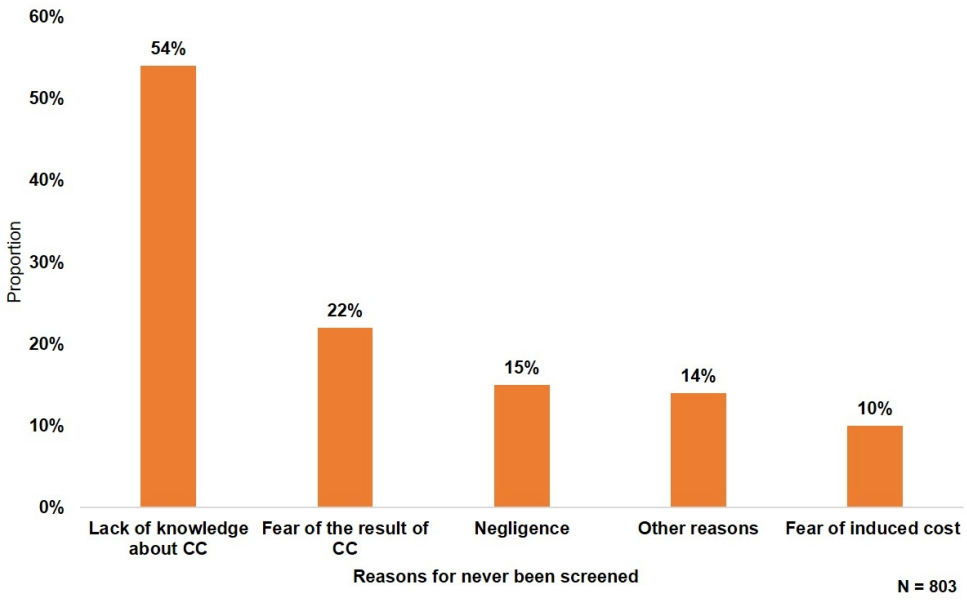

Figure 1: Reasons for not being screened for cervical cancer among women living with HIV in Côte d'Ivoire, West Africa

207x126mm (150 x 150 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	4
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6

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		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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