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Conclusions In West Africa, the incidence of unintended pregnancy was high among female ALHIV and resulted in negative socioeconomic outcomes. HIV care programs should include interventions that improve awareness and access to sexual and reproductive healthcare, including contraception, to meet the needs of ALHIV in West Africa.

Trial registration Registered with the Pan African Clinical Trials Registry on 13 February 2024 (reference no. PACTR202402863175053).

Keywords Sexual and reproductive health, Adolescent, HIV, Côte d'Ivoire, Burkina Faso, Pregnancy, Incidence, Qualitative research

Background

Sub-Saharan Africa has the highest adolescent pregnancy rate in the world [1]. In this region, it is estimated that 20% of female adolescents, aged 15–19 became pregnant in 2019 [2, 3], and at least half of those pregnancies were unintended or unplanned [1]. Unplanned pregnancies

In the three Abidjan centres, in Côte d'Ivoire, we also conducted an exploratory qualitative study between May and July 2023, to assess the knowledge, practices and needs on SRH among ALHIV enrolled in the OPTIMISE-AO project [18]. All the ALHIV who became pregnant during their follow-up were interviewed about their pregnancy experience using semi-structured interviews. Prior to the interview phase, comprehensive information was provided to those eligible during individual or group meetings. Objectives and the topic of the qualitative study were presented by the healthcare professionals from the Abidjan centres and the two interviewers. Adolescents were invited to ask questions and at the end to give their oral consent to participate in this study.

Data collection

At inclusion, an interview updating the sociodemographic data and adolescent knowledge of their own HIV status, a complete clinical examination, and a viral load (VL) test in the absence of recent viral load ($\leq$90 days) were performed for each adolescent. Full HIV-disclosure was defined as an adolescent reporting their HIV status at inclusion. Viral suppression was defined as VL < 50cp/mL. Adolescents included had 3-monthly clinical follow-up visits recording all clinical events, including adverse e ects, and assessment of adherence. VL test was repeated 6-monthly.

In the absence of pregnancy tests availability, incident pregnancies were sought through medical visits and interviews with health professionals. In most cases, they were self-declared and recorded in patient's records. Date of conception was determined using date of last menstrual period (LMP), based on adolescent report.

e semi-structured interviews and the focus group discussion (FGD) were conducted by two trained qualitative researchers: CT, MSc in Public Health from France, mostly as observer and co-interviewer, and JFD, PhD student in Sociology from Côte d'Ivoire, mostly as interviewer. A semi-structured interview guide was developed in collaboration with the research team composed of experts in adolescent global health, HIV and SRH research, as well as the paediatric HIV care professionals and sociologists. Main topics specifically explored with the female adolescents during the interviews were the discovery of their pregnancy and their feelings, the announcement to the family, and their daily life experience as a young mother. e FGD guide was adapted from the interview guide after the interviews conducted with the peer-educators to get their perceptions on the topics to explore with ALHIV (Supplementary file 2).

To ensure confidentiality, the interviews took place in each paediatric centre and the FGD was conducted in a private meeting room. A secured digital audio recorder was used to capture the discussions, along with the notes of the observer. All interviews started with "ice-breaker" activities to help build confidence and trust between adolescents and interviewers. e interviews lasted between 45 and 75 min, and the FGD lasted 4 h.

Data analysis

For the quantitative component, baseline characteristics were defined as the participant characteristics at enrolment in the OPTIMISE cohort. Study participant characteristics are presented as frequencies (percentage) for categorical variables, and median and interquartile ranges (IQR) for continuous variables. We compared baseline characteristics between pregnant and nonpregnant participants using Chi-square or Fisher's exact test for categorical variablesioira.72439.9(s (I)-6(QRp)-68(, an1y-9.8999961

in an isolated room and interviewers o ered to pause at any time if the participant felt uncomfortable. e study participants did not su er any repercussions in their respective countries for expressing their reproductive wishes.

Result

From February to December 2021, among the 224 female ALHIV aged 10 to 17 years enrolled in the OPTMISE-AO project, 111 aged ≥ 14 years (50%) were included in the current analysis (Fig. 1).

Table 1 provides their baseline characteristics according to the pregnancy status. Overall, 78% were enrolled in Abidjan, 71% were older than 15 years, 63% had a middle school education level. Orphanhood was frequently observed at baseline, with overall 26% as paternal orphan, 34% maternal orphan, and 10% are double orphans. Access to tap water (91%) and electricity (85%) did not di er according to whether or not the teenager was pregnant. Most adolescents (83%) were treated with integrase inhibitors-based regimens, and 72% were virologically suppressed.

Among the 111 female ALHIV followed up over 18 months, 107 (96%) adolescents reached 18 months, three died (3%) and one (1%) was transferred out. Over the study period, 12 incident pregnancies were reported over 154 women-years of follow-up. e median age at pregnancy was 16 years (IQR: 15–16). eir partner median age was 21.5 years (IQR: 20.0–25.5). Overall, the pregnancy incidence rate was 7.81 per 100 WY (CI95%: 4.43–13.75). e incidence was highest among 16 year old ALHIV (Fig. 2).

e pregnancy incidence was 2.19 (95%CI: 0.3–15.5), 7.6 (95%CI: 2.8–20.3), 13.1 (95%CI:5.4–31.4), 11.5 (95%CI: 2.8–45.8) per 100 WY in those aged 14, 15, 16, and 17 years, respectively. All adolescents declared that their pregnancy was unintended. All gave birth. All the infants received ART for prevention of HIV mother-to-child transmission, and all infants had a negative HIV test at 6 weeks old.

Overall, eight semi-structured interviews were conducted with the teenagers who experienced a pregnancy in Abidjan, aged between 16 and 19 years. All had given birth by the time of the interview. e FGD was conducted with five peer-educators. e five peer-educators, represented each participating centre in Côte d'Ivoire, and involved two young women, one of whom was a mother and three young men, all of whom had acquired HIV perinatally. e age of the FGD participants ranged between 19 and 31 years.

Theme 1: discovering her pregnancy

None of the eight teenage mothers interviewed said that they had wanted to have a child before they became pregnant. ey all realised they were pregnant by observing physical changes, and then confirmed it with a pregnancy test.

> *"One day, I realised that my breasts were getting bigger and my cheek was starting to pop out [...] so I took a test". (Teenager who got pregnant,*

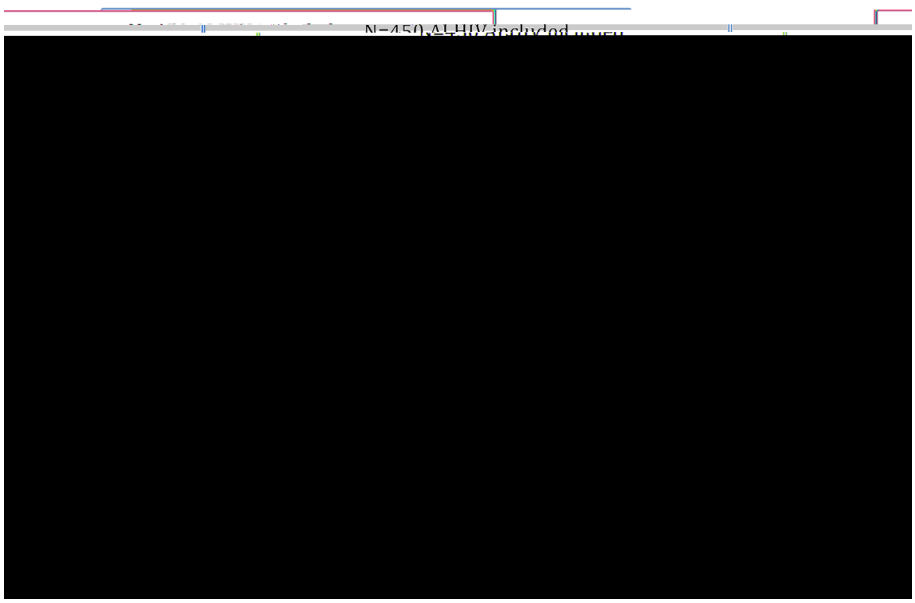

Fig. 1 Flow chart of the inclusion process of female adolescents living with HIV (ALHIV) eligible for the analysis (Burkina Faso, Côte d'Ivoire, 2021–2022)

Table 1 Baseline characteristics of female adolescents living with HIV included, overall and according to incident pregnancy status at the end of follow-up in the OPTIMISE-AO project (Burkina Faso, Côte d'Ivoire, 2021–2022; *n* = 111)

Baseline variables	Total		Pregnancy status				
			Pregnant		Not pregnant		
	N	%	N	%	N	%	-value
Age (years)							0.09
[14–15]	32	28.8	1	8.3	31	31.3	
≥ 15	79	71.2	11	91.7	68	68.7	
Country							0.72
Burkina Faso	24	21.6	3	25.0	21	21.2	
Cote d'Ivoire	87	78.4	9	75.0	78	78.8	
Education level, n (%)							0.54
Primary school	15	13.5	1	8.3	14	14.1	
Middle school	70	63.1	8	66.7	62	62.7	
High school	23	20.7	2	16.7	21	21.2	
Out of school	3	2.7	1	8.3	2	2.0	
Maternal orphan at baseline							0.57
No	67	60.4	8	66.7	59	59.6	
Yes	38	34.2	3	25.0	35	35.4	
Unknown	6	5.4	1	8.3	5	5.0	
Paternal orphan at baseline							1.00
No	73	65.8	8	66.7	65	65.7	
Yes	29	26.1	3	25.0	26	26.3	
Unknown	9	8.1	1	8.3	8	8.0	
Double orphans							1.00
No	97	87.4	11	91.7	86	86.9	
Yes	11	9.9	1	8.3	10	10.1	
Unknown	3	2.7	0	0.0	3	3.0	
With whom does the adolescent live?							1.00
Two parents	24	21.6	2	8.3	22	91.7	
One parent	46	41.4	5	10.9	41	89.1	
Other	41	36.9	5	12.2	36	87.8	
Adolescent main caregiver (*N* = 108)							0.30
Mother	40	37.1	3	25.0	37	38.6	
Father	25	23.1	5	41.7	20	20.8	
Other	43	39.8	4	3.3	39	40.6	
Type of housing (*N* = 107)							0.56
Individual housing	70	65.4	6	54.6	64	66.6	
Shared housing	33	30.8	5	45.4	28	29.2	
Boarding school	4	3.8	0	0.0	4	4.2	
Access to type tap water at home							1.00
No	10	9.0	1	8.3	9	9.1	
Yes	101	91.0	11	91.7	90	90.9	
Access to electricity at home							0.39
No	17	15.3	3	25.0	14	14.1	
Yes	94	84.7	9	75.0	85	85.9	
WHO clinical stage (*N* = 106)							0.72
1 or 2	79	74.5	10	83.3	69	73.4	
3 or 4	27	25.4	2	16.7	25	26.6	
Antiretroviral regimen							0.49
INS-based	92	82.8	11	91.7	81	81.8	
NNRTI-based	12	10.9	0	0.0	12	12.1	
PI-based	7	63	1	8.3	6	6.1	
Viral load at baseline status (*N* = 110)							0.31
Undetectable (< 50cp/mL)	79	71.8	7	58.3	72	73.5	
Detectable	31	28.2	5	41.7	26	26.5	

INS integrase inhibitors, *NNRTI* non-nucleoside reverse transcriptase inhibitors, *PI* protease inhibitor

17-year-old)

When the teenagers realised they were pregnant, they reported conflicting thoughts. Most wondered whether or not they wanted to keep the child, with the desire to be a mother on the one hand, and the fear of this new role, unpreparedness, and their HIV status on the other.

"No, I've never given myself a moment to have a child, I told myself that, as soon as the child came along, I was ready to have it. But, when I saw the circumstances of the thing, I was afraid, at first, I wanted to remove it and then I remembered what I told myself. So, I decided to keep it." (Teenager who got pregnant, 17-year-old)

e majority of participants stated that they had tried to have an abortion after discovering their pregnancy. Abortion or attempted abortion is punishable under Ivorian law, but clandestine abortion is widespread in Côte d'Ivoire [20]. However, the pregnancies were discovered too late to get an abortion. ese teenagers therefore had no choice but to accept their pregnancy.

"I paid for a test and then I did it, but it was already 3 months, I couldn't take it o any more, I couldn't. "(teenager who got pregnant, 17-year-old)

e discovery of pregnancy had an impact on adherence to antiretroviral treatment. Teenagers were in a phase of doubt and lack of knowledge, and had to take new prenatal drugs, which they nicknamed "pregnancy drugs" (dietary supplements with iron and folic acid). As a result, some of them stopped taking antiretrovirals for several weeks, like this teenager:

"When I found out, I stopped taking the medicines, [...] because I was confused, mixed up. I didn't know

bourhood because of me, because if they stay with me, they'll get pregnant". (Teenager who got pregnant, 17-year-old)

Already rejected by some people in the community, some of the teenagers also had to face relationship dif-

one reported previously in the same context ten years ago in Côte d'Ivoire among ALHIV (1.8/100 WY (95% CI: 1.1–2.9) [9], and also in the IeDEA adult cohort in West Africa (incidence rates of 4.8 (4.4–5.2)/100 WY among those aged 25–29) [21]. As a result, we observed a significant trend of increasing unintended pregnancies among ALHIV that reflects the global failure to meet their SRH needs combining several mechanisms. Indeed, female ALHIV lack of awareness regarding their pregnancy risk, and knowledge regarding the contraceptive methods when they become sexually active contribute to this. In addition, limited access to SRH services was common across these cohorts facing growing number of ALHIV [6]. In both countries, some interventions aimed to improve adolescent SRH, although these are not always

di culties with the father of their child and economic hardship, while living with HIV. In our study context, the adolescent mothers were not married, and were not living within the same household as the father of their child, who were in median, five years older than her. Each lived respectively with their parents. Female teenagers shared that they were alone in taking on the responsibilities of parenthood, the father of their child having no active role

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Authors' contributions
DLD and VL are the co-principal investigators conceived and co-wrote the protocol of the OPTIMISE project. DLD conducted the quantitative analysis. CT and JD conducted the qualitative interviews and analyses, under the supervision of JJ and VL. CT and DLD wrote the first draft of the manuscript which was subsequently reviewed, edited and approved by all authors. VL was involved in the pediatric IeDEA cohort coordination and fund raising. KM and JCA were involved in the database management. DLD, CT, CY presented intermediate results in conferences. MSN, KK, FE and CY were in charge of the cohort of patients and the data collection in each clinic involved in the study. CM, PN, BB are psychologists involved in the OPTIMISE-AO project, they especially provided their expertise and support for the development and conduct of the qualitative component. EK and ET are responsible for monitoring the quality of quantitative data. PM contributed to the development of OPTIMISE-AO project and supervised the study activities in Abidjan. All authors reviewed the manuscript.

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