Mediterranean Journal of Hematology and Infectious Diseases

Original Article

Prevalence of Sexually Transmitted Infections and Factors Associated with HIV Status Among Vulnerable Women in Northern Uganda: Baseline Results from Pe Atye Kena Cohort Study

F.V. Segala[1,2], G. Micheli[2], C. Seguiti[1,2], A. Pierantozzi[3], R. Lukwiya[4], B. Odong[6], F. Aloi[5], E. Ochola[7], R. Cauda[1,2], K. De Gaetano Donati[1,2], and A. Cingolani[1,2].

[1] Fondazione Policlinico A. Gemelli, IRCCS, Infectious Diseases, 00168, Roma, Italy.
[2] Catholic University of the Sacred Heart, Infectious Diseases Unit, 00168, Roma, Italy.
[3] AIFA-Italian Medicine Agency, 00187, Roma, Italy.
[4] Comboni Samaritans of Gulu Health Center, 701102, Gulu, Uganda.
[5] Università Cattolica S. Cuore, Special Medical Pathology, 00168, Roma, Italy.
[6] Medical Teams International, Kitgum, Uganda.
[7] Lacor Hospital, Department of HIV, Epidemiology and Documentation, Gulu, Uganda.

Competing interests: The authors declare no conflict of Interest.

Abstract. ***Background and Objectives:*** **HIV infection among vulnerable women (VW) has been attributed to unfavourable power relations and limited access to sexual and reproductive health information and services. This work aims to report sexually-transmitted infections (STI) prevalence and assess the impact of HIV awareness, demographic and socio-behavioural factors on HIV status in a rural area of northern Uganda.**
Methods: **Pe Atye Kena is a longitudinal cohort intervention study enrolling young women aged 18-49 years old living in the municipality of Gulu, Uganda. HIV, HBV, syphilis serologic tests, and a comprehensive electronic questionnaire on sexual high-risk behaviours were administered before intervention. In this work, we report baseline characteristics of the population along with factors associated with HIV status. Statistical analysis was performed by uni- and multivariable regression models.**
Results: **461 VW were enrolled (mean age: 29 (SD7.7)). 40 (8.7%) were found to be positive for HIV, 42 (9.1%) for syphilis and 29 (6.3%) for HBV. Older age (> 34 years vs. < 24 years; OR 4.95, 95% CI: 1.7 to 14); having done the last HIV test > 12m before the interview (OR 5.21, 95% CI: 2.3 to 11); suspecting the male sexual partner to be HIV+ (OR 2.2; 95% CI: 1.1 to 4.3); not having used condom at first sexual intercourse (OR 2.6; 95% CI 1.3 to 5.15) were all factors associated with an incident HIV diagnosis.**
Conclusions: **In this cohort, HIV prevalence is high, and sexual high-risk behaviours are multifaced; future interventions will be aimed to reduce HIV/STIs misconceptions and to promote a sense of community, self-determination and female empowerment.**

Keywords: Sexually transmitted infections; Women; Female empowerment; Uganda.

Citation:. Segala F.V, Micheli G., Seguiti C., Pierantozzi A., Lukwiya R., Odong B., Aloi F., Ochola E., Cauda R., De Gaetano Donati K., Cingolani A. Prevalence of sexually transmitted infections and factors associated with HIV status among vulnerable women in Northern Uganda: baseline results from Pe Atye Kena cohort study. Mediterr J Hematol Infect Dis 2021, 13(1): e2021055, DOI: http://dx.doi.org/10.4084/MJHID.2021.055

Published: September 1, 2021 **Received: May 27, 2021** **Accepted: August 8, 2021**

Correspondence to: Francesco Vladimiro Segala, MD, Division of Infectious Diseases, Catholic University of the Sacred Heart, 00168, Rome, Italy, +39 0630159480. E-mail: fvsegala@gmail.com

Introduction. Despite substantial reduction in sub-Saharan Africa HIV incidence, young women remain at the epicentre of the epidemic, representing one of the populations with the highest number of new cases per year globally.[1,2] According to the 2020 UNAIDS report, adolescent girls and women account for 25% of new infections in Western and Southern Africa.[3] In fact, girls between 14-24 years old are four times more likely to be infected with HIV than their male peers, and HIV prevalence among women below 35 years old in Uganda is 7.5% versus 4.3% among males of the same age.[4] In addition, gender-based violence and inequalities are key drivers of the epidemic.[5]

On the one hand, population-level evidence produced in other African settings[6,7] show that up to 35% of women below 25 years old are involved in age-disparate sex (defined as being at least five years younger than their male partners), identifying this phenomenon as a key risk factor for an earlier acquisition of HIV.[2,8,9] On the other hand, several studies have shown that an older male partner is not only more likely to be HIV positive and have unsuppressed viral loads,[10] but also that age-disparate partnerships are frequently associated with other high risk sexual behaviours (HRSB), such as alcohol consumption, inconsistent condom use, concurrent sexual partnering and engaging in transactional sex.[11-15] Furthermore, 10.8% of females reported having sex before the age of 15.

In addition, existing evidence suggests that socio-economic factors may exacerbate the risk. For example, being out of school has been identified as a significant risk factor for HIV acquisition in Sub-Saharan Africa[16,17] and, in Uganda, women are consistently more at risk to report a lower level of education or no-education at all (10.9% versus 3.8%) compared with their male peers.[4] In addition, according to the 2017 Uganda population-based HIV impact assessment, recent intimate partner violence (IPV) was reported by 15.5% of women under the age of 24, and exposure to IPV has been linked both to increased risk of HIV acquisition and reduced ability to negotiate forms of safe sex.[18] Altogether, these factors contribute to reducing women's personal agency and their ability to define and act upon their healthcare choices.[19] At present, although female empowerment is recognized as a powerful tool in increasing HIV prevention, only limited evidence is available on the impact of community interventions on STI incidence and sexual wellbeing.[20] The present study aims to describe the state of HIV awareness, risky sexual behaviours, STI epidemiology and assess the impact of these factors on HIV status in a population of young women living in a rural area near Gulu, Northern Uganda.

Methods.

Study Design and Objectives. Pe Atye Kena is a longitudinal cohort intervention study enrolling vulnerable young women (VW) aged 18-49 years old living in a rural area in the municipality of Gulu, Uganda. However, in this work, we assess sexually transmitted infections (STI) epidemiology and the impact of HIV awareness, demographic and socio-behavioural factors on HIV prevalence before the intended intervention occurs. Therefore, since it reports data at one precise point in time, the present article is designed to be a cross-sectional study.

The cohort follow-up has a planned duration of 3 years, from 2019 to 2022 (**Figure 1**).

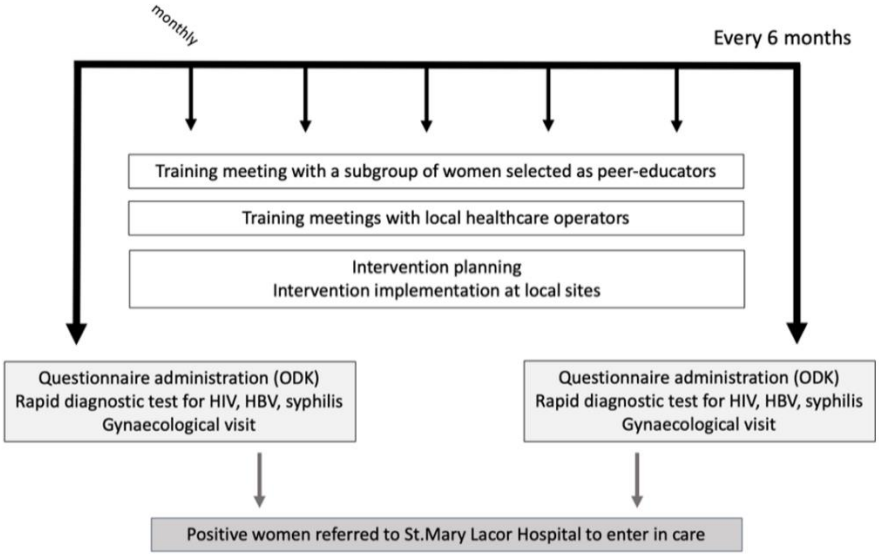

Figure 1. *Pe Atye Kena study design*. Serologic tests for HIV, HBV and syphilis will be administered, along with a full questionnaire investigating HIV awareness, sexual self-determination, stigma and risky behaviours every six months for the whole duration of the study (2019-2022). Educational interventions will be performed on a monthly basis. All women who will be incident cases of HIV, HBV and syphilis will be referred to the St Mary Lacor Hospital for treatment.

We expect to identify population-specific critical issues to develop a permanent, community-based educational service aimed to encourage sexual self-determination, female personal agency, and improve HIV prevention. A full electronic questionnaire about HIV awareness and sexual high-risk behaviours, clinical visits, and laboratory tests (which included screening for HIV, syphilis, and HBV infection) was administered before intervention and will be administered every six months. Behavioural/educational interventions will be delivered monthly by selected peer-women and CSHC health personnel. Planned interventions are structured as educational meetings, focus groups, sharing-experiences groups, and special events involving other community members (e.g., male partners, friends, family members). Results from the baseline evaluation were disseminated to the recruited population during the questionnaire administration and the following educational meetings.

Recruitment and Cohort Description. Recruitment was conducted by selected peer women through community outreach[21] from the 15th to 30th April, 2019. A total of eight peer outreach workers were actively involved in the recruitment phase, who were then selected as peer educators as well. Enrolled participants were then encouraged to recruit other women from their community.

Women were eligible if they were aged between 18 and 49 years old, were living in the area referring to the Comboni Samaritans Health Center (CSHC) and consented to data and specimen collection. Women susceptible to contract HIV infection were defined as "vulnerable" and, therefore, exclusion criteria included knowing to be positive for HIV at the time of the interview or participation in other HIV intervention studies. However, to reinforce the sense of community and prevent stigmatization, women who were already aware of their HIV status were kept in the follow-up surveys and into the intervention plan, but they were excluded from the analysis.

All participants provided written informed consent in accordance with the ethical standards of the Helsinki Declaration. The study was approved by the Lacor Hospital Institutional Research and Ethics Committee.

Data Collection. At study entry, participants received a medical history and full physical examination. The questionnaire was collected through Open Data Kit Collect (ODK Collect software), hosted on portable Android devices. Structured interviews were performed by peer educators and CSHC personnel. The questionnaire was built upon the Uganda AIDS Indicator Survey variables,[4] and it included a total of 115 questions investigating socio-demographical aspects (23 questions), sexual activity and life (34 questions), HIV awareness (41 questions), stigma (10 questions) and sexual self-determination (7 questions). Age disparate sex was defined when the male partner was five years older or more.[22]

HIV status was determined through the 4th Generation Alere HIV1/2 rapid Test. In addition, HBV infection was screened by detection of Hepatitis B surface antigen (HBsAg), an enzyme-linked immunosorbent assay (ELISA), while syphilis was screened using VDRL rapid test-kit. Results were communicated by trained local health personnel the same day the ODK questionnaire was administered. During this phase, health operators provided post-test counselling to all participants. Women who resulted positive for HIV, HBV or Syphilis were then referred to St. Mary's Lacor Hospital for treatment and follow-up. Results of serologic tests and responses to the questionnaire were used as variables for the statistical analysis.

Statistical Analysis. An initial descriptive analysis was applied to the studied population for the major variables. Absolute numbers and percentages are shown in the total sample and subgroups: no known STI; HIV positive; STI positive. The same indicators have been calculated to evaluate the prevalence of HIV, HBV, and syphilis, as well as co-infections (**Table 1**).

Using the HIV status to split the population into two groups, positive and negative, we applied the Chi-Square test to evaluate the difference of all the major variables of **Table 1**. Continuous variables were handled as discrete using the categories reported in **Table 1**. When we found a statistical difference, logistic regressions were performed to assess the contribution of each variable in predicting HIV status in terms of the odds ratio. The crude odds ratio and p-value are shown in **Table 2**. The significant variables of **table 2** have been tested in a Multivariable Multinomial Logistic Regression, forward method (**Table 3**). A p-value < 0.05 was considered statistically significant.

All the analyses were carried out using the SAS (v 9.4) software.

Results.

Study Participants. Over the recruitment period (April 15-30, 2019), 523 women were screened, and 62 were ineligible. Among those, 53 women were already aware of being HIV-infected, and five were excluded because either questionnaire responses or biological data were not available for data analysis. Four women were enrolled twice. Thus, 461 young women were included in the analysis (**Figure 2**).

Overall, the median age (interquartile range; IQR) was 28 years (23 - 34). Two hundred twenty-seven VW (49.2%) attended only primary school, and 183 (39.7%) were able to understand English, and 37.3% (n = 172)

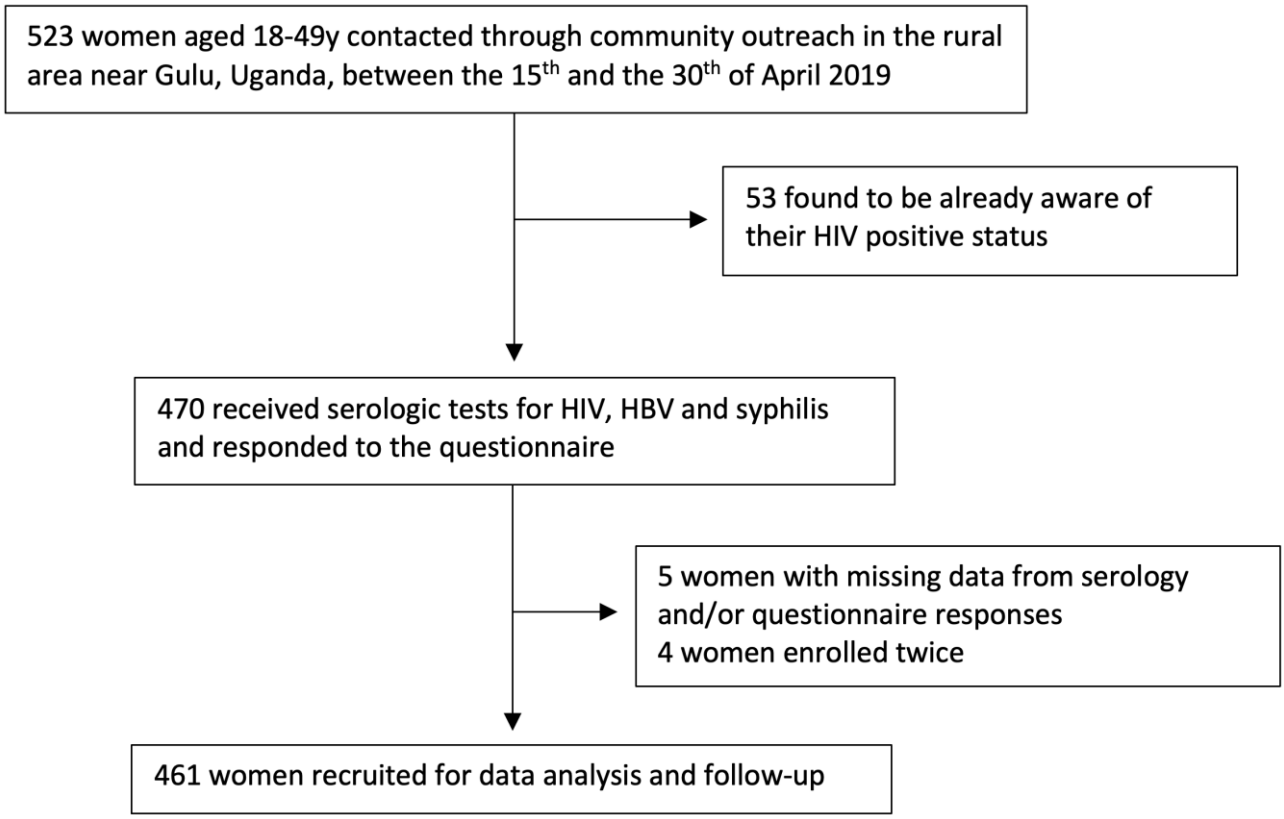

Figure 2. *Recruitment Flow diagram of the study.* 523 women were screened from 15th to 30th April 2019, and 62 were found to be ineligible. Among those, 53 women were already aware to be HIV-infected, 5 were excluded because either questionnaire responses or biological data were not available for data analysis, and 4 women were enrolled twice.

Table 1. Demographic Characteristics and Sexual Behaviour Characteristics of Study Participants

Variable		Total sample (n = 461)		No known STI (n = 363)		HIV positive (n = 40)		STI (any) positive (n = 98)	
Age category									
	< 25*	143	31,00%	124	34,20%	4	10,00%	19	19,40%
	25 – 29	113	24,50%	91	25,10%	6	15,00%	22	22,40%
	30 – 34	103	22,30%	76	20,90%	13	32,50%	27	27,60%
	> 34*	102	22,20%	72	19,80%	17	42,50%	30	30,60%
Age, mean (SD, range)		29	(6.9, 18-45)	28,5	(6.9, 18-45)	32	(6.2, 18-43)	31,4	(7.3, 18-45)
Ethnicity									
	Acholi	416	90,20%	328	90,40%	33	82,50%	89	90,80%
	Other	45	9,80%	35	9,60%	7	17,50%	9	9,20%
Language									
	Able to speak english	183	39,70%	142	39,10%	9	22,50%	30	30,60%
	Not able to speak english	278	60,30%	221	60,90%	31	77,50%	68	69,40%
Religion									
	Catholic	287	62,20%	230	63,40%	23	57,50%	49	50,00%
	Anglican	92	20,00%	69	19,00%	10	25,00%	23	23,50%
	Christian	30	6,50%	22	6,00%	2	5,00%	9	9,20%
	Other	52	11,30%	42	11,60%	5	12,50%	17	17,30%
Education									
	None	45	9,80%	25	6,90%	13	32,50%	20	20,40%
	Primary level	227	49,20%	175	48,20%	18	45,00%	52	53,10%
	Secondary level or above	189	41,00%	163	44,90%	9	22,50%	26	26,50%
Occupation									
	Management/small business	103	22,30%	80	22,10%	17	42,50%	22	22,40%
	Farming	80	17,40%	69	19,00%	6	15,00%	14	14,30%
	Personal service work	66	14,30%	45	12,40%	4	10,00%	15	15,30%
	Teaching	18	3,90%	15	4,10%	1	2,50%	5	5,10%

Other	22	4,80%	16	4,40%	1	2,50%	4	4,10%
Unemployed/Domestic work	172	37,30%	138	38,00%	11	27,50%	38	38,80%
Marital status								
Married	238	51,60%	198	54,50%	15	37,50%	40	40,80%
Separated/divorced or widowed	113	24,50%	83	22,90%	11	27,50%	31	31,60%
Single	110	23,90%	82	22,60%	14	35,00%	27	27,60%
Parity								
0	43	9,30%	35	9,60%	2	5,00%	8	8,20%
≥ 1	418	90,70%	328	90,40%	38	95,00%	90	91,80%
Pregnant at the time of the interview	79	17,10%	56	15,40%	6	15,00%	23	23,50%
Sexually active in the last month	262	56,80%	208	57,30%	24	60,00%	51	52,00%
Age at first sexual intercourse								
< 15	62	13,50%	41	11,30%	9	22,50%	21	21,40%
15-18	290	62,90%	225	62,00%	26	65,00%	62	63,30%
> 18	109	23,60%	97	26,70%	5	12,50%	15	15,30%
Mean age at first intercourse (SD, range)	17,1	(2.6, 10-29)	17,3	(2.8, 10-30)	16,4	(2.4, 13-24)	16,6	(2.3, 12-24)
Mean age sexual partner at first intercourse (SD, range)	23,7	(5.3, 13-56)	23,9	(5.6, 15-56)	23,3	(4.5, 17-32)	23,2	(4.5, 13-35)
Age-disparate sex	276	59,90%	218	60,10%	26	65,00%	58	59,20%
Condom use at first sexual intercourse	245	53,10%	206	56,70%	13	32,50%	39	39,80%
Prior HIV testing								
< 12 months before the interview*	357	77,40%	288	79,30%	22	55,00%	65	66,30%
12-23 months before the interview	57	12,40%	43	11,90%	6	15,00%	15	15,30%
≥ 24 months before the interview	47	10,20%	32	8,80%	12	30,00%	18	18,40%
Aware sexual partner to be HIV+*	13	2,80%	7	1,90%	5	12,50%	6	6,10%
Suspect sexual partner to be HIV+*	18	3,90%	8	2,20%	8	20,00%	10	10,20%
Consistent condom use	107	23,20%	85	23,40%	7	17,50%	22	22,40%
Knows a condom source	402	87,20%	315	86,80%	37	92,50%	88	89,80%
Alcohol use before sex	108	23,40%	78	21,50%	13	32,50%	28	28,50%
Ever experienced sexual violence	71	15,40%	52	14,30%	9	22,50%	19	19,40%
Ever performed transactional sex	30	6,50%	26	7,20%	1	2,50%	4	4,10%
Performed transactional sex in the last year	24	5,20%	20	5,50%	1	2,50%	4	4,10%

SD: Standard Deviation; * P ≤ 0.05

Table 2. Unadjusted multinomial logistic regression analysis of factors associated with HIV status (n = 461).

Variable	OR (95% IC)	P
Age >34 vs <24*	4.95 (1.7-14.1)	< 0.01
Last HIV test performed >12 months prior interview*	5.12 (2.3-11.2)	< 0.01
Sex partner's HIV-positive status known	13.07 (3.7-45.6)	< 0.01
Sex partner's HIV-positive status suspected*	18.1 (6.1-54.2)	< 0.01
Unprotected first sexual intercourse	2.6 (1.3-5.15)	< 0.01
Having performed transactional sex	2.7 (1-7.3)	0.45
Ever experienced sexual violence	1.647 (0.749-3.622)	0.21
Knows a condom source	2.1 (0.729-6.087)	0.17

Reference category: HIV negative. * P < 0.05 also at multivariable regression analysis.

Table 3. Multivariable Multinomial Logistic Regression Analysis of Factors Associated With HIV Status, Pe Atye Kena Study, Gulu, Uganda (n = 461)

Variable	OR (95% IC)	P
Age > 34y vs < 24y	11.4 (1.1-117.3)	0.02
Last HIV timing (>12 months prior interview)	8.8 (1.9-41.6)	0.02
Sex partner's HIV-positive status suspected	40.7 (5.0-334.3)	< 0.001

Reference category: HIV negative.

declared to be unemployed at the moment of the interview. Most women (90.7%; n = 418) had given birth at some point in their lifetime, with 79 VW (17.1%) reporting to be pregnant when the questionnaire was administered. Demographic Characteristics of study participants are shown in **Table 1**.

Out of 461 enrolled women, 40 (8.7%) were found to be HIV positive. Women who tested positive for syphilis and HBV were, respectively, 42 (9.1%) and 29 (6.3%). Eight HIV-infected women (20%) were also found to be infected with syphilis, and two women resulted positive to HIV, HBV, and VDRL serologic tests.

Sexual Activity and Life. Three-hundred fifty-two women (76.4%;) reported having had their first sex by the age of 18, 29.1% (n = 136) by the age of 15 and, at their first sexual intercourse, 53.1% (n = 245) of all women reported not having used condom. One-hundred sixty-one (34.9%) women reported having never been tested for HIV. Also, for 276 women (59.9%), their first male partner was at least five years older than them (i.e., age-disparate sex), with a median age difference of 6 years (IQR: 3-9). Among women who were sexually active in the previous 12 months (87%; n = 401), only 26.7% (n = 107) consistently used condoms, while 26.9% (n = 108) reported having consumed alcohol before or after sex at least once. In addition, 59 women (12.8%) didn't know any place where they could find condoms, and 15.4% (n = 71) of all women reported having experienced sexual assault.

13 VW (2.8%) were aware that their sex partner was HIV-infected, while 18 women (3.8%) suspected their partner of being HIV+. In addition, up to 5% (n = 24) of recruited women reported to have performed transactional sex at least once in the last 12 months, and 6.4% (n = 30) at least once in their lifetime.

Factors Associated with HIV Status. Older age (> 34 years vs < 24 years; OR 4.95, 95% CI: 1.7 to 14, $p < 0.01$), having done the last HIV test more than 12 months before the interview (OR 5.21, 95% CI: 2.3 to 11, $p < 0.01$), knowing (OR 13.7; 95% CI: 3.7 to 45, $p < 0.01$) or suspecting (OR 18.1; 95% CI: 6.1 to 54, $p < 0.01$) their respective male sex partner to be HIV positive, not having used condom at the first sexual intercourse (OR 2.6; 95% CI 1.3 to 5.15, $p < 0.01$), and having performed transactional sex at least once (OR 2.7; 95% CI: 1 to 7.2, $p = 0.45$) were all associated with HIV status in unadjusted multinomial logistic regression analysis (**Table 2**).

The multivariable regression model (**Table 3**) confirmed a statistically significant effect of older age (> 34 years vs < 24 years; OR 11.4; 95% CI: 1.1 to 117.4, $p = 0.02$), infrequent serologic testing (OR 8.8; 95% CI 1.9 to 41.6, $p = 0.02$), and of suspecting one's sexual partner to be HIV+ (OR 40.7; 95% CI 5 to 334.3, $p < 0.001$).

Discussion. To our knowledge, with its 461 recruited women, Pe Atye Kena study represents one of the largest perspective monocentric cohorts investigating the impact of an intervention in HIV prevention among women living in rural areas of Sub-Saharan Africa. Our study found that, in a post-conflict rural area in Northern Uganda, women presented a high prevalence of HIV, HBV, syphilis and infrequent HIV testing, older age, and lack of trust in one partner HIV status are all predictors of being infected with HIV.

With the persistent high HIV prevalence described in this population, there is an urgent need to detect community-specific risk factors for HIV acquisition and, more importantly, to identify strategies effective in averting this epidemiological trend.[23,24] Therefore, the development of population-specific interventions aimed to reduce STI vulnerability among girls and young women is included in 2017/2018 National HIV and AIDS Action Plan.[25]

Our population showed an HIV prevalence similar to the one reported by the 2018 Uganda Population-based HIV Assessment.[4] Also, consonant with other studies in Sub-Saharan Africa,[10] an important portion of women reported age-disparate sex, few years of schooling, inconsistent condom use, early sexual debut, and experience of sexual-related violence.[8,26-28] HIV testing and old age are well-recognized factors associated with HIV-positive status.

Similar to UPHIA assessment was also the rate of self-reported HIV-status awareness, defined as having done the last HIV test within 12 months before the interview. During the screening procedures, 53 women did not meet the inclusion criteria because they already knew to be HIV-infected, for HIV, and they were almost entirely already taking ARV (52/53). Hence, among a total of 93 HIV-positive women who participated in Pe Atye Kena screening activities, 43% was unaware of their HIV status, which is almost twice the rate expected for women living in the region.[4] Since our study targeted women at risk for contracting STIs, this data is likely altered by a selection bias. However, lack of HIV-status awareness represents a critical challenge to achieve UNAIDS 90-90-90 targets.[3] Thus, our study may highlight the need to increase outreach and screening efforts among women living in the Gulu region.

In our view, it is important to emphasize that the data presented here refer to a population that is largely underrepresented in other large, sub-Saharan cohort studies: to our knowledge, the DREAMS partnership is the only study targeting, to some extent, a population of women living in rural areas, where AIDS/HIV education and epidemiological data are most needed.[29] Furthermore, unlike other large cohort studies targeting similar populations, the present study is entirely conducted by a second-level health center (village-based health centre with a target population of 5000 people).[30]

Thus, it may be used as a model for further community-based interventions.

Among women enrolled in Pe Atye Kena study, both the prevalence of ever having had syphilis and prevalence of current HBV infection (acute or chronic, defined as being positive to hepatitis B surface antigen assay) was higher than the one described for women living in the same region by 2018 UPHIA report but lower than the one reported in other studies.[31,32] In our study, 5% (2/40) of HIV-infected women were co-infected with HBV, and 20% (8/40) of HIV-infected women screened positive for syphilis. Interestingly, the two women who resulted positive both to HBV and HIV also had syphilis. Our study did not intend to assess the overall prevalence of sexually transmitted diseases in the population. Therefore, the results are not generalizable to all Gulu female population, but, noteworthy, the burden of co-infections between HIV and other STIs in Sub-saharan Africa remain controversial.[33,34]

Our study has several limitations. First, as mentioned above, the reported prevalence of HIV and other sexually transmitted diseases is not generalizable to the overall population due to both outreach targets and small sample size. Second, we did not include girls below 18 years old, knowing that the risk of HIV acquisition substantially increases from the age of 15.[13] Third, although standardized and administered by trained healthcare personnel, interviews were performed face-to-face, and some interviewer bias, response bias, or misreporting of sexual behaviors is possible. Finally, longitudinal follow-up is expected to clarify risk behaviours and retention in the study and assess the efficacy of a peer-conducted educational intervention in sexual behaviours and HIV/STIs acquisition.

Conclusions. Among the 461 women included in this analysis, the prevalence of HIV and other STIs was high, and the proportion of women who were unaware of their serological status was much higher than the one expected for the region. Also, despite substantial efforts in promoting HIV and sexual prevention, high-risk sexual behaviours were a persistent challenge, also considering that experiences of sexual assault, intimate partner violence, and transactional sex were, most likely, consistently underreported. In response to these findings, we plan to implement targeted interventions to reduce HIV/STIs misconceptions and promote a sense of community, self-determination, and female empowerment. If we would be able to engage and retain women in our project successfully, we expect to reduce the incidence of risky behaviours through the construction of a stable, community-based educational subsidy. Women play an essential role in the socio-economic development of sub-Saharan Africa and, as we proceed to analyse whether our intervention is going to impact sexual health among our population, we recognize the need for future research to focus on the importance of insufficient female personal agency and unequal power relations in the fight for HIV and STI prevention.

Acknowledgements. The authors thank the women of Pe Atye Kena study. Special recognition is due to the "peer educators" whose contribution was essential in recruiting and retention in study. Pe Atye Kena peer educators are: Ajok Gloria, Lamara Barbara, Akello Kevine, Aineligio Irene, Akello Hellen, Aol Nighty, Akello Susan and Lamunu Grace.

Ethics Committee and Consent. The present study was approved by St Mary's Hospital Lacor Ethics Committee (LHIREC, contact n° 0772561783), by written consent (n° 096/05/19). All participants provided written informed consent for data and specimen collection.

References:

1. Dellar RC, Dlamini S, Karim QA. Adolescent girls and young women: key populations for HIV epidemic control. *J Int AIDS Soc. 2015*;18(suppl 1):19408. https://doi.org/10.7448/IAS.18.2.19408
2. Shisana O, Rehle T, Simbayi L, et al. South African National HIV Prevalence, Incidence and Behaviour Survey, 2012. *Cape Town, South Africa: Human Sciences Research Council Press*; 2014. http://hdl.handle.net/20.500.11910/2490
3. UNAIDS. 2020 Global AIDS update. https://www.unaids.org/en/resources/documents/2020/global-aids-report [accessed 2020 Nov 17].
4. Ministry of Health, Uganda. Uganda Population-based HIV Impact Assessment (UPHIA) 2016-2017: Final Report. Kampala: Ministry of Health; July, 2019. https://phia.icap.columbia.edu/wp-content/uploads/2019/07/UPHIA_Final_Report_Revise_07.11.2019_Final_for-web.pdf
5. Robinson JL, Narasimhan M, Amin A, et al. Interventions to address unequal gender and power relations and improve self-efficacy and empowerment for sexual and reproductive health decision-making for women living with HIV: A systematic review. *PLoS One*. 2017 Aug 24;12(8):e0180699. https://doi.org/10.1371/journal.pone.0180699
6. Mabaso M, Sokhela Z, Mohlabane N, et al. Determinants of HIV infection among adolescent girls and young women aged 15-24 years in South Africa: a 2012 population- based national household survey. *BMC Public Health*. 2018;18(1):183. https://doi.org/10.1186/s12889-018-5051-3
7. Evans M, Risher K, Zungu N, et al. Age-disparate sex and HIV risk for young women from 2002 to 2012 in South Africa. *J Int AIDS Soc*. 2016;19(1):21310. https://doi.org/10.7448/IAS.19.1.21310
8. Topazian HM, Stoner MCD, Edwards JK, Kahn K, et al. Variations in HIV risk by young women's age and partner age-disparity in rural South Africa (HPTN 068). *JAIDS*. 2020; 83(4):350-356. https://doi.org/10.1097/QAI.0000000000002270
9. Maughan-Brown B, Kenyon C, Lurie MN. Partner age differences and concurrency in South Africa: Implications for HIV-infection risk among young women. *AIDS Behav*. 2014;18(12):2469-2476. https://doi.org/10.1007/s10461-014-0828-6
10. Maughan-Brown B, George G, Beckett S, Evans M, et al. HIV Risk Among Adolescent Girls and Young Women in Age-Disparate Partnerships: Evidence From KwaZulu-Natal, South Africa. *JAIDS*. 2018; 78(2):155-162 HTTPS://DOI.ORG/10.1097/QAI.0000000000001656

11. Santelli JS, Edelstein ZR, Mathur S, Wei Y, Zhang W, Orr MG, et al. Behavioral, biological, and demo- graphic risk and protective factors for new HIV infections among youth in Rakai, Uganda. *JAIDS*. 2013; 63(3):393–400. https://doi.org/10.1097/QAI.0b013e3182926795
12. Balkus JE, Brown E, Palanee T, Nair G, Gafoor Z, Zhang J, et al. An Empiric HIV Risk Scoring Tool to Predict HIV-1 Acquisition in African Women. *JAIDS*. 2016; 72(3):333–43. https://doi.org/10.1097/QAI.0000000000000974
13. Saul J, Bachman G, Allen S, Toiv NF, Cooney C, Beamon T. The DREAMS core package of interventions: A comprehensive approach to preventing HIV among adolescent girls and young women. *PLoS ONE*. 2018;13(12): e0208167. https://doi.org/10.1371/journal.pone.0208167
14. Gaffoor Z, Wand H, Daniels B, Ramjee G. High risk sexual behaviors are associated with sexual violence among a cohort of women in Durban, South Africa. *BMC Research Notes.* 2013, 6:532 https://doi.org/10.1186/1756-0500-6-532
15. Maughan-Brown B, Evans M, George G. Sexual behaviour of men and women within age-disparate partnerships in South Africa: implications for young Women's HIV risk. *PLoS One*. 2016;11:e0159162. https://doi.org/10.1371/journal.pone.0159162
16. De Neve JW, Fink G, Subramanian SV, Moyo S, Bor J. Length of secondary schooling and risk of HIV infection in Botswana: evidence from a natural experiment. *Lancet Glob Health*. 2015; 3(8):e470–e7. https://doi.org/10.1016/S2214-109X(15)00087-X
17. Behrman JA. The effect of increased primary schooling on adult women's HIV status in Malawi and Uganda: Universal Primary Education as a natural experiment. *Soc Sci Med*. 2015; 127:108–15. https://doi.org/10.1016/j.socscimed.2014.06.034
18. Maman S, Campbell J, Sweat MD, Gielen AC. The intersections of HIV and violence: Directions for future research and interventions. *Soc Sci Med*. 2000 Feb;50(4):459-78.
19. Donald A, Koolwal G, Annan J, Falb K, Goldstein M. Measuring Women's Agency. *World Bank Group.* 2017. https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-8148
20. UNAIDS. Empowering women is critical to ending the AIDS epidemic. *UNAIDS Press Statement*. Available at: https://www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2015/march/20150308_IWD
21. Dancy NC, Dutcher GA. HIV/AIDS information outreach: a community-based approach. *J Med Libr Assoc*. 2007;95(3):323-329. https://doi.org/10.3163/1536-5050.95.3.323
22. UNAIDS. *UNAIDS Terminology Guidelines*. Geneva, Switzerland: UNAIDS; 2015. https://www.unaids.org/sites/default/files/media_asset/2015_terminology_guidelines_en.pdf
23. Pettifor A, Bekker LG, Hosek S, DiClemente R, Rosenberg M, Bull SS, et al. Preventing HIV among young people: research priorities for the future. *JAIDS*. 2013; 63 Suppl 2:S155– 60. https://doi.org/10.1097/qai.0b013e31829871fb
24. UNAIDS. HIV prevention among adolescent girls and young women: Putting HIV prevention among adolescent girls and young women on the Fast-Track and engaging men and boys. *UNAIDS Guidance*. 2016 https://www.unaids.org/sites/default/files/media_asset/UNAIDS_HIV_prevention_among_adolescent_girls_and_young_women.pdf
25. UAC (2015) National HIV and AIDS Strategic Plan 2015/2016-2019/2020, An AIDS free Uganda, My responsibility! *Uganda AIDS Commission Secretariat*. https://uac.go.ug/sites/default/files/National%20HIV%20and%20AIDS%20Strategic%20Plan%202015-2020.pdf
26. Pettifor AE, Rees HV, Kleinschmidt I, Steffenson AE, MacPhail C, Hlongwa- Madikizela L, et al. Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *AIDS*. 2005;19:1525-34. https://doi.org/10.1097/01.aids.0000183129.16830.06
27. Hallman K. Gendered socio-economic conditions and HIV risk behaviours among young people in South Africa. *Afr J AIDS Res*. 2005;4:37-50. https://doi.org/10.2989/16085900509490340
28. Joint United Nations Programme on HIV/AIDS (UNAIDS), Interagency Task Team on HIV and Young People. Guidance brief: HIV interventions for most at-risk young people. *New York: UNFPA*; 2008. https://www.unfpa.org/sites/default/files/pub-pdf/mostatrisk.pdf
29. Birdthistle I, Schaffnit SB, Kwaro D, Shahmanesh M, Ziraba A, et al. Evaluating the impact of the DREAMS partnership to reduce HIV incidence among adolescent girls and young women in four settings: a study protocol *BMC Public Health*. 2018; 18:912 https://doi.org/10.1186/s12889-018-5789-7
30. Ministry of Health, The Republic of Uganda. Guidelines for Designation, Establishment and Upgrading of Health Units. The Health lnfrastructure Working Group, 2011. Available at: https://health.go.ug/docs/guidelines.pdf
31. Ocama P, Seremba E, Apica B, Opio K. Hepatitis B and HIV co-infection is still treated using lamivudine-only antiretroviral therapy combination in Uganda. *African Health Sciences*. 2015; (15) 2: 328-333. https://doi.org/10.4314/ahs.v15i2.4
32. Sun HY, Sheng WH, Tsai MS, Lee KY, Chang SY, Hung CC. Hepatitis B virus co-infection in human immunodeficiency virus-infected patients: A review. *World J Gastroenterol*. 2014;20:14598-614 https://doi.org/10.3748/wjg.v20.i40.14598
33. Barth RE, Huijgen Q, Taljaard J, Hoepelman AIM. Hepatitis B/C and HIV in sub-Saharan Africa: an association between highly prevalent infectious diseases. A systematic review and meta-analysis. *International Journal of Infectious Diseases*. 2010. 14(12):e1024-e1031. https://doi.org/10.1016/j.ijid.2010.06.013
34. Chiesa A, Ochola E, Oreni L, Vassalini P, Rizzardini G, Galli M. Hepatitis B and HIV co-infection in Northern Uganda: Is a decline in HBV prevalence on the horizon? *PLoS ONE* 2020. 15(11): e0242278. https://doi.org/10.1371/journal.pone.0242278