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▶ **To cite this version:**

Aude Jary, Ibrahima Teguete, Younoussa Sidibé, Amadou Kodio, Oumar Dolo, et al.. Prevalence of cervical HPV infection, sexually transmitted infections and associated antimicrobial resistance in women attending cervical cancer screening in Mali. International Journal of Infectious Diseases, 2021, 10.1016/j.ijid.2021.06.024 . hal-03266724

HAL Id: hal-03266724

https://hal.sorbonne-universite.fr/hal-03266724v1

Submitted on 22 Jun 2021

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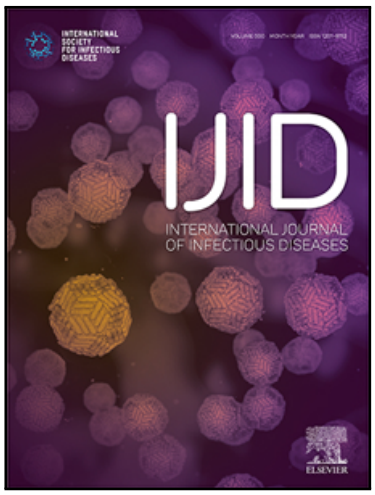

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PII: S1201-9712(21)00515-4
DOI: https://doi.org/10.1016/j.ijid.2021.06.024
Reference: IJID 5494

To appear in: *International Journal of Infectious Diseases*

Received date: 16 November 2020
Revised date: 23 May 2021
Accepted date: 12 June 2021

Please cite this article as: Aude JARY , Ibrahima TEGUETE , Younoussa SIDIBÉ , Amadou KODIO , Oumar DOLO , Sonia BURREL , David BOUTOLLEAU , Laurianne BEAUVAIS-REMIGEREAU , Sophie SAYON , Mamadou KAMPO , Fatoumata Tata TRAORÉ , Mariam SYLLA , Chad ACHENBACH , Robert MURPHY , Béatrice BERÇOT , Cécile BÉBÉAR , Vincent CALVEZ , Anne-Geneviève MARCELIN , Almoustapha I MAIGA , Prevalence of cervical HPV infection, sexually transmitted infections and associated antimicrobial resistance in women attending cervical cancer screening in Mali, *International Journal of Infectious Diseases* (2021), doi: https://doi.org/10.1016/j.ijid.2021.06.024

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Title: Prevalence of cervical HPV infection, sexually transmitted infections and associated antimicrobial resistance in women attending cervical cancer screening in Mali.

Running title: HPV and STIs in women from Mali

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ABSTRACT

Objectives: To assess sexually transmitted infections (STIs) prevalence, antimicrobial resistance and cervical lesions among women from Sikasso, Mali.

Methods: HIV-infected (n=44) and HIV-uninfected (n=96) women attending cervical cancer screening were included. Human papillomavirus (HPV), *Chlamydia trachomatis* (CT), *Mycoplasma genitalium* (MG), *Neisseria gonorrhoeae* (NG) and *Trichomonas vaginalis* (TV) detections were performed by PCR and herpes simplex virus (HSV-1/2) serological status by ELISA assays. Antibiotics-resistance tests were performed for MG and NG positives cases.

Results. We evidenced a high prevalence of high-risk HPV (hrHPV) infection (63%), associated with cervical lesion in 7.5% of cases and an unusual hrHPV distribution with HPV31, HPV56 and HPV52 being the most prevalent. According to HIV-status, hrHPVs distribution was also different (HIV-positive: HPV35/31/51-52-56 and HIV-negative : HPV31/56/52). HSV-2 seroprevalence was 49%, and prevalence of other STIs as follow: CT: 4%, MG: 9%, NG: 1% and TV: 7%. Five out of 9 MG-positive specimens and the NG strains obtained were fluoroquinolone-resistant.

Conclusions. Our results showed a high prevalence of hrHPV and fluoroquinolone-resistance in several NG and MG strains. Further studies are required to confirm these data in Mali and to improve prevention, screening and management of cervical cancer and others STIs in women.

Keywords: HIV; HPV; cervical lesions; STIs; antimicrobial resistance; Mali

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BACKGROUND

Cervical cancer is the fourth female cancer in the world, and the second one in developing countries, with about 530 000 new cases diagnosed each year and approximately 90% occurring in low and middle-income countries (LMICs) (Cohen et al., 2019; de Martel et al., 2017). In Western Africa, about 32 000 new cervical cancer cases are diagnosed annually and HPV-prevalence in the general population is about 20% (ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre), 2019). However in several countries, dissimilarities exist according to the prevalence and the types of HPV involved in infections, precancerous and cervix cancers (Bah Camara et al., 2018; Ferré et al., 2018; Krings et al., 2019; Piras et al., 2011). Current world health organization (WHO) recommendations endorse national HPV vaccination programs targeting girls aged 9–14 years. If implemented widely, HPV vaccination will probably prevent millions of deaths from cervical cancer, particularly in LMICs. The choice between bi, quadri and nonavalent HPV vaccine is an important decision for decision-makers, who must balance the expected impact of the program against cost considerations in the context of local epidemiologic trends and competing health priorities.

Other STIs remain also a public health concern because they affect the health and lives of people worldwide. The worldwide seroprevalence of herpes simplex virus 2 (HSV-2) in 2012 was estimated to be 11.3%, with the highest prevalence in Africa (31.5%) and consistently higher in females (14.8% *versus* 8.0%) (Looker et al., 2015). In 2016, the WHO estimated that prevalences of *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG) and *Trichomonas vaginalis* (TV) in women living in Africa were 5.0%, 1.9% and 11.7%, respectively (Rowley et al., 2019). Theses prevalences were similar, both globally and by world region, to those in 2012, showing that STIs are persistently endemic worldwide (Rowley et al., 2019). However, there is considerable geographic variation in both the burden of disease and prevalence of resistance and this could influence guidelines for treatment.

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Recent data are not yet available on the HPV burden and other STIs in women from Mali. We performed a study including women screened for cervical cancer in Sikasso, Mali, to assess HPV-infection prevalence, subtypes distribution and associated cervical lesions, HSV-1/HSV-2 seroprevalence and other STIs prevalence as well as antimicrobial resistance.

METHODS

Study population

We conducted a cross-sectional study at the clinic Kénédougou Solidarité, Sikasso, Mali, which is a NGO specialized in HIV counseling, offering HIV screening and managing HIV positive patients. The clinic is fully integrated in the local healthcare system and collaborates with the District Referral Health Centre and the Regional hospital of Sikasso. Regularly, an educational talk is organized for patients who consult in this center and cervical cancer is one of the topics in addition to HIV infection or STIs.

In the present study, we included women who presented at the clinic from May to June 2018. An educational talk on cervical cancer was offered and then, they were invited to be screened if they were eligible (age > 18years, no pregnancy, no immediate post-partum, no hysterectomy, no periods at the time of consultation) and signed consent. The inclusion criteria did not take into account the presence of symptoms for others STIs. All the HIV-positive women included were followed and treated in the clinic. As this center is involved in management of HIV and STIs, the recruited women may also include key population such as female sex workers (FSWs) and intravenous drug users (IDUs), however we did not differentiate them in the study.

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For each woman, cervical cancer screening by visual inspection with acid (VIA) and Lugol's iodine (VILI) was performed, as recommended in LMIC by the WHO, and liquid-based cytology and sera were collected for biological analysis. Socio-demographic data including age, marital status, marital age, number of pregnancy, contraception used, being polygamous or not, education level and geographical setting were also collected during medical consultation.

Cervical cancer screening and HPV testing

Each woman with positive VIA/VILI had a punch biopsy. The specimen was conveyed to Bamako where a histological analysis was performed at the department of pathology at Point G Teaching Hospital, Mali. Before HPV-testing, 1 ml of liquid-based cytology was centrifuged, supernatant discarded and cell pellet stored at -20°C in Mali, then sent to France for analysis at the Virology Department of the Pitié-Salpêtrière hospital.

Cell pellet was re-suspended in 400 µl of PBS 1X and DNA extraction was performed with the NucliSENS EasyMAG total nucleic acid extractor (BioMérieux®) according to manufacturer's instructions. HPV-testing was performed with the AnyplexII HPV28 (Seegene®) which allowed the detection of 28 HPV types; according to the International Agency for Research on Cancer (IARC) classification, (i) 12 HPV were defined as high-risk HPV (hrHPV, category 1): 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58 and 59, (ii) 8 as intermediate-risk (2A and 2B categories): 26, 53, 66, 68, 69, 70, 73 and 82, and (iii) 8 as low-risk HPV (lrHPV) or non-classified HPV: 6, 11, 40, 42, 43, 44 54 and 61.

HSV-1/2 and other STI testing

The sera were tested for the detection of HSV-1/2 IgG antibody with the LIAISON® HSV-1 IgG/HSV-2 IgG (DiaSorin) and HSV-1/2 DNA-genital with the Artus® HSV-1/2 RG PCR kit

(Qiagen) on the same acid nucleic extracts used for HPV detection. Other STIs detection was performed with Allplex STI Essential Assay (Seegene®) able to detect 7 STIs: CT, NG, *Mycoplasma genitalium* (MG), TV, *Mycoplasma hominis* (MH), *Ureaplasma parvum* (UP) and *Ureaplasma urealyticum* (UU). Only the first 4 previous agents were considered as pathogenic STIs in further analysis while MH, UU and UP were considered to reflect vaginal microbiota.

Bacterial resistance testing

The identification of macrolide resistance for MG strains was performed by FRET real-time PCR and 23S rRNA Sanger sequencing (Touati et al., 2014); those whose amplification failed were tested with the ResistancePlus MG (SpeeDx) kit (Le Roy et al., 2017). The identification of fluoroquinolone resistance was performed by amplification and Sanger sequencing of the *parC* gene (Le Roy et al., 2016).

The identification of cephalosporin resistance for NG strains was performed by amplification and Sanger sequencing of the *penA* gene (de Curraize et al., 2016) and resistance to fluoroquinolones by amplification and Sanger sequencing of the *gyrA* gene (Poncin et al., 2019).

Statistical analysis

Continuous variable were described with median and interquartile range [IQR] and discrete variables as number and percentages. Group comparison was performed using Chi-2 or Fisher test for categorical variables and Mann-Whitney U test for continuous variables.

Univariable and multivariable (including age, polygamy, contraception, number of pregnancy, education level, HIV, HSV-2, CT, MG, NG, and TV infections) logistic regression analyses were performed with R (v3.6.1) to identify risk factors associated with hrHPV infection.

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Factors associated with a *p value* <0.20 in univariate logistic regression analyses were included in the multiple logistic regression model.

RESULTS

Patients' characteristics

A total of 144 patients were included with a median age [IQR] of 37 [29-44] years (Supplementary Table 1). The majority lived in urban area (98%, n=141), were married (78%, n=113) with a median marital age of 19 [17-22] years and 34% (n=40) were polygamous. Seventy-eight percent (n=112) of women have completed primary school or less. Forty-four (31%) patients were infected with HIV. Compared to HIV negative people, they tended to be older (*p=0.086*), to use less contraception (*p=0.06*) and to be less educated (*p=0.032*) **(Table 1)**.

HPV prevalence and associated lesions

The prevalence of any HPV-types, hrHPVs, intermediate HPVs and lrHPVs was 74% (n=104), 63% (n=90), 55% (n=55) and 25% (n=36), respectively, and women harbored in median 2 [0-4], 1 [0-2], 0 [0-1] and 0 [0-0.25] different HPV, respectively. Among the hrHPVs, HPV31 was the most prevalent (28%), followed by HPV56 (25%) and HPV52 (18%). HPV16 and HPV18 prevalences were 9.7% and 7.6%, respectively. Among the lrHPVs, HPV42 was the most common (11%), followed by HPV6 (7%) and HPV54 (6%) **(Figure 1)**. Among hrHPV-positive women, 26% (n=23) harbored at least 1 hrHPV included in bi or quadrivalent-vaccine. This percentage rose to 79% (n=71) considering at least 1 hrHPV included in nonavalent-vaccine. However, 72% (n=65) also harbored at least 1 hrHPV not included in any of the HPV-vaccines.

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The hrHPVs prevalence was higher in HIV-infected women compared to HIV-negative women (77% *versus* 55%, *p=0.014*) **(Table 1)** as well as multiple hrHPV infection (55% *versus* 33%, *p=0.03*). In HPV-positive women, the prevalence of hrHPVs differed according to HIV-status. Specifically, among HIV-positive women, HPV35 (36%) was the most prevalent, followed by HPV31 (31%) and HPV51/52/56 (each at 28%) and among HIV-negative women, HPV31 (41%) was the most prevalent, followed by HPV56 (36%) and HPV52 (22%) **(Figure 2A)**.

Twenty patients were positive for VIA/VILI screening. Of these, 1 had normal histology, 6 had cervical intraepithelial neoplasia grade 1 (CIN1), 5 had CIN2 and more. The remaining included 5 women with cervicitis/endocervicitis and 3 for whom the histology of the biopsies did not contribute to the definitive diagnosis. No significance difference according to socio-demographic data was found between women with and without cervical lesions **(Supplementary Table 2)**. Seven of the 11 patients with cervical lesion tested positive for hrHPV and only 1 was infected with HIV. HPV16 was involved in one case and multiple hrHPV infections occurred in 4/7 cases (HPV31/56/73/82, HPV31/33, HPV16/35/58/82 and HPV35/51/52/58/66/68). HPV31, HPV35 and HPV66 mono-infection were involved in the other 3 cases **(Figure 2B)**. Overall, cervical lesions prevalence was 7.5%, with a prevalence of 2.3% (1/44) in HIV-women and 10.4% (10/96) in HIV-negative women.

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Prevalence of other STIs and antimicrobial resistance

Seroprevalences of HSV-1 and HSV-2 antibodies were 99% and 49%, respectively. Among HSV-seropositive women, 7 (11%) were positive for HSV2-DNA but none for HSV1-DNA in the genital tract. Prevalence of NG, CT, MG and TV was 1% (n=2), 4% (n=6), 9% (n=13), and 7% (n=10), respectively. Among analyzed parameters, prevalence of HSV-2 was higher in HIV-infected women than in HIV-negative (84% *versus* 32%, *p<0.0001*) as well as in

those harboring hrHPV infection than in those with non hrHPV (56% *versus* 37%, *p=0.035*) **(Table 1)**. No prevalence differences of HSV-1 or other STIs tested were found according to HIV-infection or hrHPV-infection.

Considering antimicrobial resistance, none of the MG-positive specimens had macrolide resistance-associated mutations but 5 out of 9 sequenced specimens were fluoroquinolone-resistant (mutation Ser83(80)Ile on *parC* gene). Furthermore, the 2 NG strains were also fluoroquinolone-resistant (mutation Ser91Phe on *gyrA* gene) whereas only 1 had a decreased susceptibility to cephalosporin (*penA* 19.01 variant) **(Supplementary Table 3)**.

The presence of UU, UP or MH in cervical tractus was not significantly associated with hrHPV infection (Table 1) or cervical lesions (Supplementary Table 2).

Risk factors associated with hrHPV cervical infection

Univariate and multivariate logistic regression analyses were performed to assess independent associations between socio-demographic data, STI and hrHPV infections. In univariate analysis, HIV and HSV-2 infection were significantly associated with cervical hrHPV infection (odd ratio (OR) =2.76 [95% confidence interval (CI), 1.42-5.61], *p=0.014* and OR=2.14 [95%CI, 1.18-3.92], *p=0.037*, respectively). In multivariate analysis, HIV and MG infections tended to be significantly and independently associated with hrHPV infection (OR=2.17 [95%CI, 1.01-4.78] *p=0.098* and OR=6.55 [95%CI, 1.47-66.6] *p=0.081*, respectively) **(Table 2)**.

DISCUSSION

This is the first study performed in Sikasso, Mali to evaluate HPV and other STIs prevalence in a population of women screened for cervical cancer. We report a high rate of

hrHPV infection associated with cervical lesions in 7.5% of cases. The prevalence of other STIs were similar to data already reported in the literature (Rowley et al., 2019).

We found a high prevalence of any type of HPV as well as hrHPV (74% and 63%, respectively). Previous studies in Mali reported prevalence ranging from 11.9% (95% CI, 8.1%-17.1%) to 23.1% (95% CI, 17.9-29.2) in apparently healthy women with no history of precancerous cervical lesion or cancer (Sankaranarayanan et al., 2004; Schluterman et al., 2013; Tracy et al., 2011). The main differences between our study and these previous studies are based on the HPV test (AnyplexII HPV28 *versus* Digene Hybrid), and on the geographical setting in Mali (Sikasso *versus* Bamako and Naréna, 100 km southwest of Bamako) and may explain the higher prevalence in our population. Indeed, the HPV prevalence in rural areas has been reported to be higher than in urban areas and it has been hypothesized that it may be due to riskier sexual behavior and cultural factors facilitating the transmission of HPV to almost all women quickly after the start of their sexual life (Schluterman et al., 2013). Limited access to the healthcare system for women living in rural areas could also be associated with a high rate of untreated STIs. On the other hand, Sikasso is a town close to the border which could imply more passages, exchanges, truck drivers or sex workers. In the present study, some potential FSW were included, and are therefore at higher risk of being exposed to HPV or other STIs.. Finally, 24% of our population was HIV-infected (HIV status was not available in the 2 others studies) and therefore also contributed to higher hrHPV infection.

Although HPV16 is the most common in women with normal cytology (2.7%) and remains the first hrHPV type identified in LSIL (14.8%), HSIL (23.9%) and cervical cancer (35.5%) (ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre), 2019) in Western Africa, in this study, HPV16 was only found in the sixth position. We also observed an unusual distribution of hrHPV types (HPV31/56/52 were the most prevalent) compared to hrHPVs usually involved in precancerous and cancerous cervical lesions. This unusual

distribution was also observed between hrHPV harbored by HIV-infected or HIV-uninfected women. However, these results are consistent with several studies carried out in Africa which have reported infections or precancerous cervical lesions with a wide variety of hrHPVs, different from conventional HPV16 or HPV18 (Ferré et al., 2018; Mbaye et al., 2014; Piras et al., 2011; Traore et al., 2016).

A modelling study showed that switching from bivalent or quadrivalent to nonavalent HPV vaccine would reduce the incidence of CIN2/3 by 9%–13% in the long term due to the coverage of additional high-risk HPV types (Van de Velde et al., 2012). Our results strongly suggest that nonavalent *versus* quadrivalent vaccine provides better hrHPV coverage (79% *versus* 26%) in our population.

According to extensive research around the world, hrHPV prevalence, as well as hrHPV multi-infection, was higher in HIV-positive women and these finding were also supported by univariate and multivariate regression analysis. Indeed, chronic immunosuppression induced by HIV-infection provides an environment for persistent HPV infection and thus increases the risk of malignant transformation (Liu et al., 2018). However in the present study, associated cervical lesions were mainly found in HIV-negative women (only 1 HIV-women had CIN1) and regardless of any socio-demographic characteristics. Although hrHPV-infection persistence was not evaluated, our results suggested that both HPV-nonavalent vaccination and cervical cancer screening are neccessary in women in Mali.

Considering the other STIs, we found prevalences similar to those previously reported in different studies (Rowley et al., 2019), with a higher seroprevalence of HSV-2 in HIV-infected patients as well as in those with hrHPV infection. In fact, it has been shown that HSV-2 infection increases the risk of HIV-1 acquisition (Kouyoumjian et al., 2018; Looker et al., 2017) and is higher in patients with HPV-infection (Finan et al., 2006). However, the role of HSV-2 in the development of cervical intra-epithelial cancer remains uncertain with

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conflicting results (Finan et al., 2006; Smith et al., 2002). Importantly, this is the first study to report antimicrobial resistance in STIs in Mali. Current international, European and American guidelines recommend treatment with combination therapy with extended-spectrum cephalosporin (ESC) and azithromycin for uncomplicated gonococcal infections to maximize efficacy and theoretically reduce the risk of emergence of resistance in gonococcal isolates. MG has intrinsic resistance to many antibiotics, and the prevalence of resistance to first- and second-line regimens (macrolides and fluoroquinolones) is increasing worldwide, with limited alternative therapeutic options. Here, we found fluoroquinolone-resistance in the two NG strains and in half of MG strains.. This could be related to the extended use of this class of antibiotics, especially ciprofloxacin, in Mali where diagnosis of STIs is based on syndromic approach and the antibiotic use on WHO recommendations. This should be further carefully monitor, as antibiotic resistance surveillance informs optimal empiric antibiotic regimens.

Although the association of vaginal microbiota with an increased risk of HPV-persistence and progression of HPV-related cervical disease has been reported (Parthenis et al., 2018), we did not provide any evidence in this study.

Our study has two main limitations: he small number of women enrolled and the lack of population characterization, specifically the presence of STIs symptoms and the sexual risk factors. The lack of longitudinal follow-up is another important missing element, as we could not assess cervical lesion progression or the persistence of hrHPV infection. Further studies should be performed in large cohort, including also general population and from different centers to confirm these data and to improve the knowledge of cervical cancer, HPV infection and other STIs in women from Mali.

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In conclusion, this study reported a high prevalence of viral and bacterial STIs in HIV-infected and uninfected women, and fluoroquinolone resistance in different strains involved in STIs. Further studies are required to confirm theses data in Mali and to improve prevention, screening and management of cervical cancer and others STIs in women.

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FOOTNOTE

Funding. This work was funded by the *Agence Nationale de Recherche sur le SIDA et les Hépatites Virale*s (ANRS) AC43 "sexually transmitted infections" working group and the foundation GSK France.

Authors contributions: Conception and design of the study: CA, RM, VC, AGM, AIM; patients enrollment and acquisition of the clinical data: IT, YS, AK, OD, MK, FTT, MS; execution of the experiments: SS; analysis of the data: AJ, SB, DB, LBR, BB, CB, drafting of significant portion of the manuscript or figures: AJ, IT, SB, DB, CB. All the authors read, corrected and approved the final manuscript.

Ethics statement. The study was approved by the Comité d'Ethique Institutionnel de la Faculté de Médecine, de Pharmacie et d'Odontostomatologie, Université des Sciences Techniques et des Technologies de Bamako, USTTB.

Conflicts of interest. No conflicts of interest to disclose.

Acknowledgments: We thank Marie Gardette for technical assistance.

Meeting presentation. This work has been presented in part (HPV data) as an oral communication at Eurogin, December 4th to 7th 2019, Monte-Carlo, Monaco (Session: Epidemiology and natural history, *HPV prevalence and type in women attending cervical cancer screening in Sikasso, Mali: a cross-sectional study,* abstract 231).

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Table 1: Characteristics of the 144 women screened for cervical cancer, according to HIV-status and hrHPV infection.

	Total n=144 N	HIV+ n=44	HIV- n=96	*p value*	hrHPV+ n=90 N	hrHPV- n=54 N	*p value*
Age, n, median [IQR]	37 [29-44]	40 [33.75-44]	35 [27-45]	0.086	37 [31-44.75]	38 (28-44]	0.77
Geographical setting, n (%)	144	44	96		90	54	
Urban	141 (98)	42 (95	95 (99)	0.23	87 (97)	54 (100)	0.29
Rural	3 (2)	2 (5)	1 (1)		3 (3)	0 (0)	
Marital status, n (%)	144	44	96		90	54	
Single	4 (3)	0 (0)	4 (4)		2 (2)	2 (4)	
Married	112 (78)	23 (52)	86 (90)	<0.0001	63 (70)	49 (90)	0.01
Widower	24 (16)	17 (39)	6 (6)		22 (25)	2 (4)	
Divorced	4 (3)	4 (9)	0 (0)		3 (3)	1 (2)	
Marital age (years), n, median [IQR]	19 [17-22]	20 [17-25]	18 [16.75-22]	0.18	19 [16.75-22]	20 [17-22]	0.49
Polygamy, n (%)	116	27	86		67	49	
yes	40 (34)	10 (37)	29 (34)	0.75	20 (30)	20 (41)	0.22
no	76 (66)	17 (63)	57 (66)		47 (70)	29 (59)	
Contraception, n (%)	144	44	96		90	54	
yes	34 (24)	6 (14)	27 (28)	0.06	22 (24)	12 (22)	0.76
no	110 (76)	38 (86)	69 (72)		68 (76)	42 (78)	
Duration of contraception (years), n, median [IQR]	3 [1.25-5]	2 [1-3.75]	3 [2-5]	0.51	3 [1.25-5]	2.5 [1.75-4.5]	0.99
Pregnancy, n, median [IQR]	4 [2-6]	4 [2-6]	4 [2-6]	0.94	4 [2-6]	4 [2-6.75]	0.57
Education level, n (%)	144	44	96		90	54	
None	75 (52)	27 (61)	47 (49)		49 (54)	26 (48)	
Primary	37 (26)	13 (30)	23 (24)	0.032	22 (25)	15 (28)	0.42
Secondary	29 (20)	4 (9)	24 (25)		18 (20)	11 (20)	
Higher	3 (2)	0 (0)	2 (2)		1 (1)	2 (4)	
STI, n (%)							
HIV +	140 44	- -	- -	-	87 34 (39)	53 10 (19)	*0.012*
hrHPV +	144 (31)	44 34 (77)	96 53 (55)	*0.012*	- -	- -	-
HSV-1 + (Ab)	135 90 (63)	44 43 (98)	91 90 (99)	*0.55*	84 83 (99)	51 -	*>0.99*
HSV-2 + (Ab)	135 133	44 37 (84)	91 29 (32)	*<0.0001*	84 47 (56)	51 50 (98)	*0.035*
CT +							
MG +							
NG +							

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TV +	144	(99)	44	3 (7)	96	3 (3)	*0.38*	90	4 (4)	54	19 (37)	*>0.99*
UU +	144	66 (49)	44	5 (11)	96	8 (8)	*0.55*	90	11 (12)	54	2 (4)	*0.13*
UP+	144	6 (4)	44	1 (2)	96	1 (1)	*0.53*	90	1 (1)	54	2 (4)	*>0.99*
MH+	144	13 (9)	44	4 (9)	96	6 (6)	*0.72*	90	7 (8)	54	1 (2)	*0.74*
	144	2 (1)	44	17 (39)	96	28 (29)	*0.33*	90	36 (40)	54	3 (5)	*0.005*
	144	10 (7)	44	20 (46)	96	64 (68)	*0.025*	90	57 (63)	54	9 (17)	*0.59*
	144	45 (31)	44	20 (46)	96	32 (34)	*0.18*	90	33 (37)	54	37 (69)	*>0.99*
		84 (58)									19 (35)	
		52 (36)										

Ab: antibody; CT*: Chlamydia trachomatis;* MG*: Mycoplasma genitallium; MH : Mycoplasma hominis ;* NG*: Neisseria gonorrhoeae;* TV*: Trichomonas vaginalis; UP : Ureaplasma parvum ; UU : Ureaplasma urealyticcum ; HIV: human immunodeficiency virus, hrHPV: high-risk human papillomavirus; n= number; STI: sexually transmitted infection; +: positive*

Statistical comparisons were performed using Chi-2 or Fisher test for categorical variables and Mann-Whitney U test for continuous variable.

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Table 2: Risk factors associated with hrHPV cervical infection in women screened for cervical cancer in Kénédougou Solidarité community health center, Sikasso, Mali.

RISK FACTORS	UNIVARIATE ANALYSIS			MULTIVARIATE ANALYSIS		
	OR	**CI 95%**	***p value***	**OR**	**CI 95%**	***p value***
hrHPV INFECTION						
Age	1.00	0.98-1.03	0.80	-	-	-
Polygamy	0.62	0.32-1.18	0.22	-	-	-
Contraception	1.13	0.58-2.25	0.76	-	-	-
Number of pregnancy	0.95	0.86-1.06	0.43	-	-	-
Education level (None and primary vs secondary and higher)	0.84	0.43-1.67	0.68	-	-	-
HIV	2.76	1.42-5.61	0.014*	2.17	1.01-4.78	0.098
HSV-2	2.14	1.18-3.92	0.037*	1.56	0.79-3.1	0.28
NG	0.60	0.04-8.1	0.72	-	-	-
CT	1.21	0.30-6.16	0.83	-	-	-
MG	3.62	1.13-16.7	0.10	6.55	1.47-66.6	0.081
TV	1.43	0.74-5.19	0.61	-	-	-

CI: confidence interval; HIV: human immunodeficiency virus; HSV-2: herpes simplex virus 2; NG: *Neisseria gonorrhoeae;* CT: *Chlamydia trachomatis;* MG: *Mycoplasma genitalium;* TV: *Trichomonas vaginalis; OR= odd ratio; -: parameter not included in multivariate analysis; *<0.05*

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Figure 1: Prevalence of HPV-type among the 144 women screened for cervical cancer. *All types of HPV identifiable by the Anyplex II HPV-28 detection test (Seegene®) are represented on the x-axis and the proportion (in percentage) of each HPV-type identified in our population on the y-axis. Red column correspond to HPV types included in the HPV quadrivalent-vaccine and the one surrounded in red to additional HPV types included in the HPV nonavalent-valent vaccine.*

hrHPV: high risk human papillomavirus, lrHPV: low risk human papillomavirus.

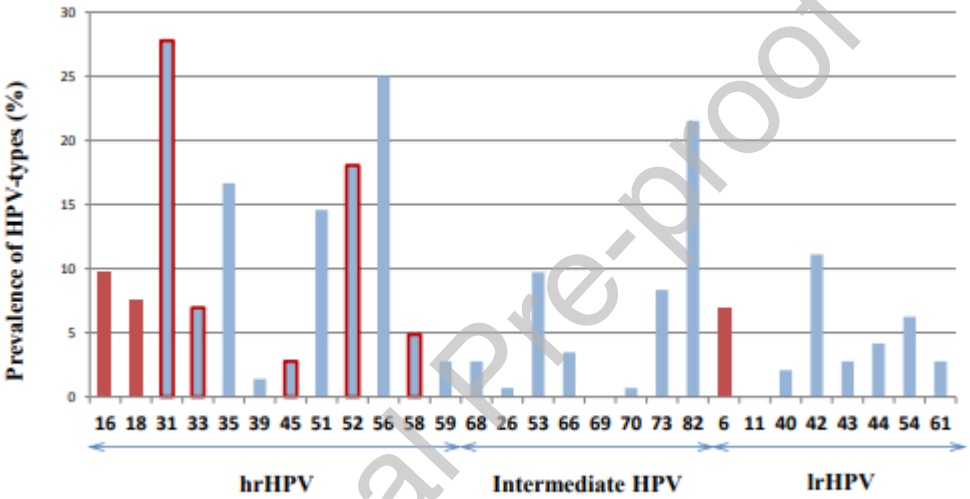

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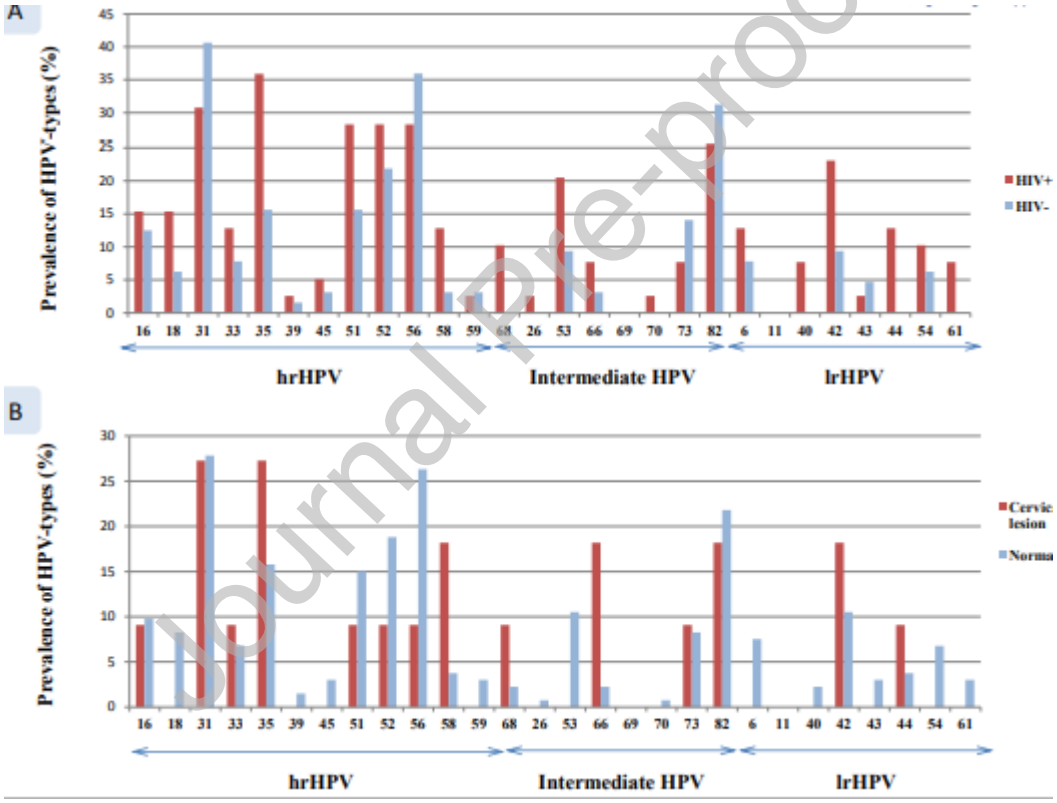
Figure 2: Prevalence of HPV-type according to HIV-status (A) or associated cervical lesion (B). *All types of HPV identifiable by the Anyplex II HPV-28 detection test (Seegene®) are represented on the x-axis and the proportion (in percentage; 2A: among HPV-positive women, 2B: among all women tested) of each HPV-type identified on the y-axis. Red column correspond to the prevalence of each HPV among women HIV-positive (2A) or with cervical lesions (2B) and blue one to the prevalence of each HPV among women HIV-negative (2A) or without cervical lesion (2B). hrHPV: high risk human papillomavirus, lrHPV: low risk human papillomavirus.*



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HIGHLIGHTS

High rate of hrHPV infection was found in women attending cervical cancer screening.

Prevalence of other STIs were similar to those already reported in Western Africa.

Bacterial resistance was found in several strain of *N. gonorrhoeae* and *M. genitalium.*

Improvement of systematic prevention, screening and treatment is needed in Mali.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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