

Knowledge, Sexual Behaviors on Human Papillomavirus Infections and Associated Factors: Survey Among Female Adolescents and Adults in the Republic of Congo

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Abstract: *Background.* Human papillomavirus (HPV) infection is sexually transmitted and responsible for anogenital warts and malignancies but its early diagnosis is hampered by the people's lack of knowledge about the disease and prevention methods, especially in resource-limited countries. *Objective.* The study was designed to determine knowledge; attitudes and practices toward HPV infection in an urban women community, and evaluate the factors that are associated with HPV-related disease's lack of knowledge. *Method.* Between February 2021 and August 2022, a cross sectional and prospective study was conducted in Pointe-Noire (PNR) and Brazzaville (BZV) region within the Republic of Congo. Anonymous questionnaire was used to explore demographics, knowledge, attitudes, and behaviors. Data analysis were performed using StataSE11 software (version 11 SE). *Results.* Overall 250 (96.2%) of 260 people surveyed agreed to participate and of these, 70.4% were recruited in Brazzaville and, the mean age was 20.9 (min-max: 15-35) years. A low proportion (21.6%) of women reported knowing what HPV is and of these, only 40.7% had adequate knowledge of HPV. 17.2% reported a knowledge of cervical cancer, 12.0% an adequate preventive measures and all of them were adults. The mean age of first sexual intercourse was 16.8 (IQ₂₅₋₇₅%; 16-18) years and statistically earlier in the adolescents ($p=0.0001$). The mean number of sexual partners was 2.6 (IQ₂₅₋₇₅%; 1-3). 56.8% of participants use condoms regularly and 10.4% occasionally and, less than one-third used oral contraception. Only 3 participants received HPV vaccine. HPV infection were found in 38.0% of participants, and significantly lower among adults than adolescents (10% vs 45.7%; OR=5.43, 95%CI: 1.97-14.97, $p=0.001$) and, than young adults (42.9%; OR=1.04, 95%CI: 3.24-33.06, $p<0.0001$). Participants with more than two sexual partners are twice for acquiring HPV infection (aOR=2.36, 95%CI: 1.33-4.21, $p=0.003$). Study area (aOR = 0.17, $p = 0.0001$), age > 18 years (aOR = 2.54, $p = 0.03$) and age at first intercourse (17 – 21 years) (aOR = 0.40, p

= 0.04) were determinants of HPV knowledge. Study area (aOR = 0.03, $p = 0.0001$), age > 18 years (aOR = 6.18, $p = 0.009$), concubinage (aOR = 0.14, $p = 0.001$) and 3-4 sexual partners (aOR = 5.18, $p = 0.004$) were determinants of cervical cancer knowledge. *Conclusion.* These results highlight the important of developing and implementing appropriate outreach strategies to improve patient awareness and knowledge of HPV-related diseases and to promote HPV vaccination uptake targeting adolescents and young adults in the Republic of Congo.

Keywords: Sexual Behavior, Knowledge, Human Papillomavirus, Cervical Cancer, Adolescents, Adults, The Republic of Congo

1. Introduction

Human papillomavirus (HPV) infection is the most common viral infection in young girls. Most sexually active women will be infected at some point in their lives, and some are at risk for multiple infections [1]. Oncogenic HPVs are responsible for approximately 604,000 new cases of cervical cancer, with an estimated 342,000 deaths worldwide in 2020 and making cervical cancer the fourth most frequently diagnosed cancer and the fourth leading cause of cancer death in women with the vast majority of the countries found in sub-Saharan Africa, Melanesia, South America, and South-Eastern Asia [2]. This rate has increased to over 25% compared to 2002 [3]. However, although HPV is necessary, it is not sufficient for cause cervical cancer, other important cofactors include some sexually transmittable infections (Human immunodeficiency virus-HIV and chlamydia trachomatis), smoking, a higher number of childbirths, and long-term use of oral contraceptives [4-6].

This cancer is greatly preventable and its prevention relies on early diagnosis of precancerous lesions while its treatment is strongly protective against cervical cancer development [7]. However, it remains the most common cause of cancer-related death in women in developing countries and the mortality profile in women is more heterogeneous and death rates for female cervical cancers were considerably higher in transitioning versus transitioned countries (12.4 vs 5.2 per 100,000, respectively) [2].

Because of the significant burden of cervical cancer worldwide and the growing inequality, the world health organization launched in 2018, a call for global action toward the elimination of cervical cancer (≤ 4 per 100,000 women worldwide) through the triple-intervention strategy 90-70-90; the aim was to vaccinate 90% of all girls by age 15 years, to screen 70% of women twice in the age range of 35 to 45 years, and to treat at least 90% of all precancerous lesions detected during screening [8]. This goal is projected to be achieved by 2055 to 2059 in highest Human Development Index (HDI) countries, whereas in low HDI countries, it might take until the end of the 21st century [9]. Factors linked to either increasing average socioeconomic levels or a diminishing risk of persistent infection with high-risk HPV due to improvements in genital hygiene, reduced parity, owing to early detection of precancerous lesions and mass vaccination against HPV and a diminishing prevalence of sexually transmitted disease have declined incidence and mortality rates of the cervical cancer in most areas of high

HDI [10-12].

In resource-limited settings, some studies suggest that implementation of the combined vaccination and cervical cancer screening strategy which has proven to be cost effective across several low-and middle-income countries (LMICs) [13-15], should accelerate achievement of the goal in a shorter time frame than is expected in low-HDI countries as this has proven to be cost effective across several LMICs [9, 16, 17].

Despite the high prevalence of cervical cancer, many studies have reported a low level of knowledge among young girls about HPV infection, cervical cancer and its screening [18-20]. Whereas, knowledge and awareness among women about cervical cancer are pillars of cancer screening adoption and success [20]. Also, the risk factors for acquiring HPV infection include multiple sexual partners, early age of sexual initiation, receptive anal intercourse, unprotected sex, previous history of sexually transmitted diseases, and HIV-positive homosexual men [21, 22]. Moreover, because adolescence is an age of intense sexual activity, some young girls tend to be unaware of HPV infection and may engage in risky sexual behaviors, which can put them at risk of developing cervical cancer, when HPV infection persists [23]. This lack of knowledge on HPV infection is an obstacle to preventive and control efforts such as safe sex advice and HPV vaccination uptake [24]. The lack of knowledge regarding HPV-related malignancies can increase morbidity and mortality due to these conditions as people are unaware of underlying risks associated with HPV. Despite the high rates of HPV infection amongst girls and women and rising incidences of cancers attributed to its infection, health promotion systems and preventive strategies targeting high-risk women in Africa are still facing several obstacles jeopardizing efficient delivery of such preventive measures [25].

In the Republic of Congo, according to data from the cancer registry, cervical cancer is the second most common cancer in women after breast cancer, with a frequency of 26.6%, and is the second leading cause of cancer deaths in women [26]. There is dearth of studies addressing HPV control and prevention in the Republic of Congo, especially on sexual behavior of girls and women [27], which limit development, implementation and evaluation of control strategies articulated on information, education and communication (IEC), for better fight against HPV-infection

associated UCC. Assessing women's knowledge and awareness of HPV infections will foster successful preventive strategies as some of these HPV subtypes are vaccine preventable. The present study aimed to assess sexual risk behaviors, knowledge regarding HPV-related diseases and its associated factors among adolescents and adult women. This information could provide substantial insight regarding the high-risk women and facilitate policy planning regarding vaccine-preventable diseases among Congolese girls and women.

2. Materials and Methods

2.1. Study Design and Study Population

A prospective cross-sectional study was carried out over a 3-year period from 2019 to 2022, in two cities of the Republic of Congo namely Brazzaville and Pointe-Noire. This study was conducted following ethics directives related to research on humans in the Republic of Congo. The study received ethical clearance from the Institutional Committee of Ethics for Research for Human Health from the Ministry of Scientific Research of Congo Brazzaville and, an administrative agreement (N°216 MEPSA-CAB, dated August 14th, 2020) was obtained from the Ministry in charge of education of the Republic of Congo. Before enrollment and the administration of the questionnaire, subjects were informed of on the purpose and process of the investigation (background, goals, methodology, study constraints, data confidentiality, and rights to opt-out from the study), and a signed informed consent was obtained from the participants over 18 years of age and from children's parents/guardians in accordance with the Helsinki Declaration.

The target population was all women of childbearing age attending high schools in both selected cities and the gynecological department of the Reine Elisabeth medical center, a reference health facility in Brazzaville. Convenience and non-probabilistic sampling are applicable in the study when members of the population are convenient to sample. To reduce selection and information biases, participants were enrolled consecutively, voluntary, anonymously and without remuneration.

The administered questionnaire was done following a one-week pre-test with 15 parents/guardians in a different neighborhood to assess: i) the understanding and acceptability of the participants and the parents/guardians in the study and ii) the standardizing and homogenizing data collection in the two areas. The pre-tested structured questionnaire was administered to participants and parents/guardians during a 15-20 minute one-to-one interview to collect data. The questionnaire was administered independently on the same day by two investigators to estimate the inter-reproducibility of the interviewer. The interview questions have been worded in such a way that

they do not influence the participants in their answers.

2.2. Study Questionnaire

These were open (OEIQ) and closed (CEIQ) interview questions, including single answer and, multiple-choice questions. Data collection sheets were used to collect data on i) sociodemographic characteristics and sexual behavior, ii) knowledge level about HPV, cervical cancer, and the HPV vaccine, and iii) clinical history of the girls and women. For instance, information such as age, education level, and age of first sexual intercourse, condom use, number of sexual partners, and use of contraceptive methods were collected. Interviews were conducted in French or the country's national languages (Lingala and Kituba). During interviews, if the participant had never heard of HPV, she was asked if she had ever heard of cervical cancer. If the answer to these questions was "no", she was asked about her history of sexually transmitted infections-STIs (e.g., HIV, mycoplasma, mycosis, condyloma, genital herpes, chlamydia trachomatis). Conversely, those who had heard terms like "cervical cancer" or "HPV" or "cervical cancer screening" were asked, in addition to their STI history, if they were aware of the HPV vaccine.

2.3. Statistical Analysis

Data were keyed, coded and checked for consistency using an Excel spreadsheet, and then exported to Stata v13 and GraphPad v5.03 software for statistical analysis. Categorical variables were expressed as frequencies, while numeric variables were presented as means +/- standard deviation (SD) or 95% CI (95% confidence interval) if they were normally distributed. Fisher's exact test was used to compare qualitative variables. After checking the non-Gaussian distribution, the nonparametric Mann-Whitney U test was used to compare the variables between two independent groups. Logistic regression analysis was used to identify the effect of demographic characteristics on the level of knowledge about cervical cancer and HPV. The crude and adjusted odds ratio (cOR and aOR) along with their confidence intervals at 95% (95%CI) were used to identify the strength of association. Associations were considered statistically significant at $p < 0.05$.

3. Results

3.1. Sociodemographic Characteristics and Sexual Behavior

A total of 250 girls, aged 20 ± 4 years (range 15 to 35 years), volunteered to participate in the study. The mean age of the study population was 20 ± 4 years with extremes ranging from 15 to 35 years and, the most (68%) represented group was adults (>18 years old) (Figure 1).

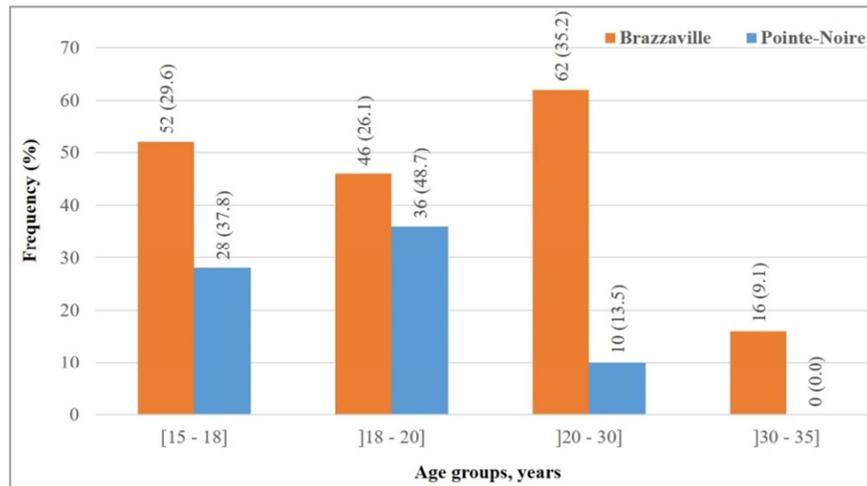


Figure 1. Age distribution of girls in the study population.

More than 90% of interviewees had completed secondary studies while only 2.8% had completed university studies. More than 82% of minors (≤ 18 years old) were in couples. Regarding sexual behavior, 64.4% of participants had their first sexual intercourse before 18 years. More than half (56.8%) reported not using condoms regularly while, 35.6% of participants had only one sexual partner and most of them did not use contraceptive methods (Table 1). The protected sex

(condom use by male partners) was more common among women living in the Brazzaville area ($p=0.0001$). The same observation was made for oral contraceptive pills use by the women ($p=0.024$). No significant difference was observed in the use of contraceptive methods according to age group (adult vs minor). Most of women who have safe sex are those who use the most oral contraceptives and, this difference is statistically significant -33.5% vs 20.7%, $p=0.021$).

Table 1. Description of the study population according to area.

Variables	Brazzaville (n = 176)		Pointe Noire (n = 74)		Total (N = 250)		p-value
	n	%	n	%	N	%	
Sociodemographic information							
Age group							
Minors (≤ 18 years old)	52	29.5	28	37.8	80	32	0.373
Adults (>18 years old)	124	70.4	46	62.2	170	68	
Level of education							
Primary	2	1.14	0	0	2	0.8	0.187
Secondary	167	94.9	74	100	241	96.4	
University	7	3.9	0	0	7	2.8	
Marital status							
Single	35	19.9	10	13.5	45	18.0	0.154*
Married	75	42.6	54	73.0	129	51.6	
Concubine	66	37.5	10	13.5	76	30.4	
Risk behaviors							
Age at 1 st sexual intercourse							
Mean (IQ ₂₅₋₇₅), years	16.8 (15-18)		16.9 (16-18)		16.8 (16-18)		0.662
[11 - 15] years	47	26.7	15	20.3	62	24.8	
[15 - 17] years	65	36.9	34	45.9	99	39.6	
[17 - 21] years	64	36.4	25	33.8	89	35.6	
Contraceptives methods							
Condom use by male							
Never	57	32.4	25	3.8	82	32.8	0.470 [£]
Always	110	62.5	32	43.2	142	56.8	
Often	9	5.11	17	22.97	26	10.4	
Oral contraceptive pills							
Yes	59	33.5	15	20.3	74	29.6	0.024
No	117	66.5	59	79.7	176	70.4	
Number of sexual partners							
Mean (IQ ₂₅₋₇₅), years	2.5 (1-2)		2.7 (1-2)		2.6 (1-3)		0.356
1	66	37.5	23	31.1	89	35.6	
2	46	26.1	19	25.7	65	26	
3 - 4	39	22.2	23	31.1	62	24.8	
> 4	25	14.2	9	12.2	34	13.6	

* , single women compared to women in couples; [£] , never condom use vs use condoms (always or often)

3.2. Level of Knowledge and Clinical History of the Study Population

The level of knowledge about HPV, cervical cancer, HPV vaccination, and clinical history of participants is depicted in Table 2.

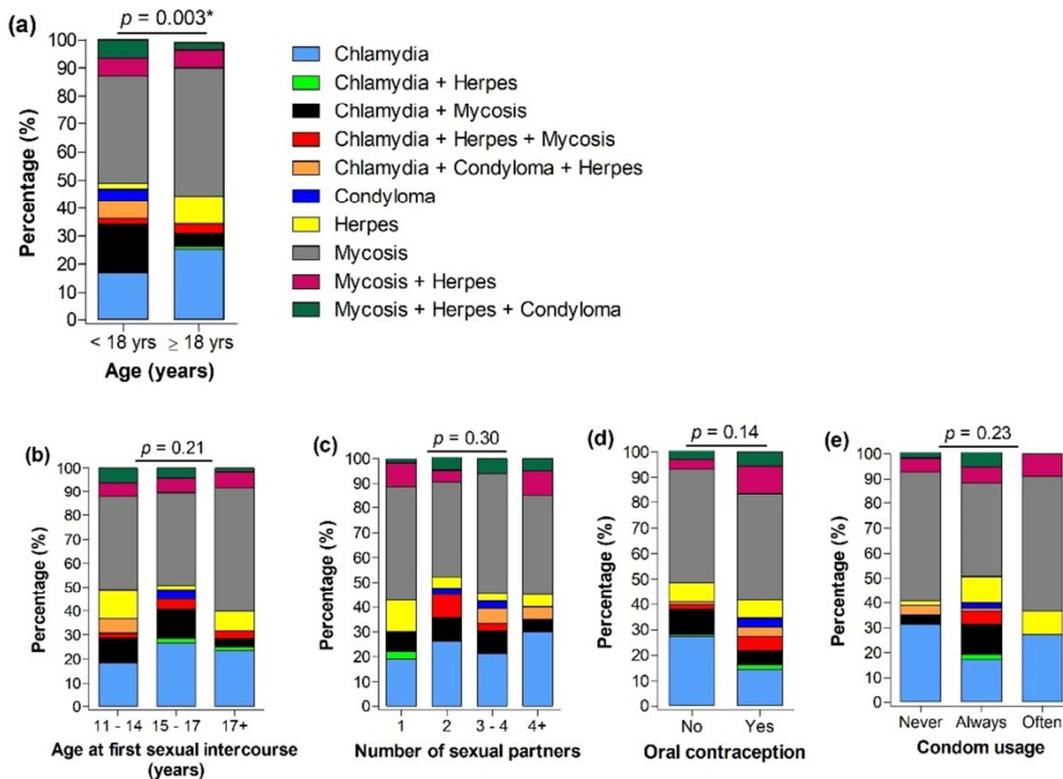
Of the 250 study participants, 78.4% were unaware of HPV, 82.8% reported being unaware of cervical cancer and, 98.8% of the same population had never been vaccinated against cervical cancer. Television was the main source of

HPV knowledge among knowledgeable women (94.4%) while minor communication sources included radio (1.9%), education by community health worker (1.9%), and social media such as TikTok (3.8%) and Facebook (24.1%).

Also, 78.4% of our study population had ever been tested for HIV. To be noted, 63.2% of population had already contracted an STI, with a predominance of mycosis followed by chlamydia (Table 2).

Table 2. Level of knowledge and STIs history according to the selected areas.

Variables	Brazzaville (n = 176)		Pointe Noire (n = 74)		All (N = 250)	
	n	%	n	%	N	%
Level of knowledge						
Knowledge on HPV, yes	50	28.4	4	5.4	54	21.6
Knowledge on cervical cancer, yes	42	23.9	1	1.3	43	17.2
Knowledge on cervical cancer vaccine, yes	2	1.1	1	1.3	3	1.2
Has ever had an HIV test, yes	141	80.1	55	74.3	196	78.4
History and types of STIs						
STI history, yes	143	81.2	15	20.3	158	63.2
Chlamydia, yes	33	18.7	3	4.05	36	14.4
Condyloma, yes	2	1.1	0	0	2	0.8
Herpes, yes	11	6.2	1	1.3	12	4.8
Mycosis, yes	60	34.1	9	12.2	69	27.6
Chlamydia-Herpes, yes	1	0.6	1	1.3	2	0.8
Chlamydia-Mycosis, yes	12	6.8	1	1.3	13	5.2
Mycosis-Herpes, yes	10	5.7	0	0	10	4
Chlamydia-Mycosis-Herpes, yes	5	2.8	0	0	5	2
Chlamydia-Mycosis-Herpes-Condyloma, yes	3	1.7	0	0	3	1.2
Mycosis-Herpes-Condyloma, yes	6	3.4	0	0	6	2.4



*Statistically significant at $p < 0.05$.

Figure 2. Prevalence of STIs by age (a), age at first sexual intercourse (b), number of sexual partners (c), oral contraception (d) and condom usage (e). Pearson's chi square test was used for comparisons.

The prevalence of these STIs was significantly higher in younger women compared to older ones (Figure 2a). No significant variation was found between prevalence of STIs and risky sexual behavior (Figures 2 b–e).

3.3. Association Between Socio-Demographic Variables and Knowledge about HPV and Cervical Cancer

According to the socio-demographic variables, a

statistically significant association were found between oral contraceptive use and knowledge about HPV (Table 3). An association was observed between age, high education level, high number of sexual partners, oral contraceptive use and knowledge about cervical cancer ($p < 0.05$) (Table 3). Moreover, age at first sexual intercourse was significantly associated with STI history ($p = 0.0001$) (Table 3).

Table 3. Association between socio-demographic, HPV knowledge, cervical cancer and STI history.

Variables	Knowledge about HPV			Knowledge of the cervical cancer			History of STIs		
	No, n (%)	Yes, n (%)	p	No, n (%)	Yes, n (%)	p	No, n (%)	Yes, n (%)	p
Age groups									
Minors (≤ 18 years old)	68 (85)	12 (15)	0.055	77 (99.5)	3 (3.75)	$< 10^{-4}$	33 (41.25)	47 (58.75)	0.195
Adults (> 18 years old)	128 (75.29)	42 (24.71)		130 (76.47)	40 (23.53)		59 (34.71)	111 (65.05)	
Level of education									
Primary	1 (50)	1 (50)	0.374	1 (50)	1 (50)	0.001	1 (50)	1 (50)	0.429
Secondary	190 (78.84)	51 (21.16)		204 (84.65)	37 (15.35)		87 (36.10)	134 (63.9)	
University	5 (71.43)	2 (28.57)		2 (28.55)	5 (71.43)		4 (57.14)	3 (42.86)	
Age of 1 st sexual intercourse									
[11 - 15] years	44 (70.97)	18 (29.03)	0.279	56 (90.32)	6 (9.68)	0.184	13 (20.97)	49 (79.03)	$< 10^{-4}$
[15 - 17] years	80 (80.81)	19 (19.19)		79 (79.80)	20 (20.20)		50 (50.51)	49 (49.49)	
[17 - 21] years	72 (80.90)	17 (19.10)		72 (80.90)	17 (19.10)		29 (32.58)	60 (67.42)	
Condom use									
Never	65 (79.27)	17 (20.73)	0.382	62 (75.61)	20 (24.39)	0.074	28 (34.15)	54 (65.85)	0.077
Always	108 (76.06)	34 (23.94)		124 (87.32)	18 (12.68)		49 (34.51)	93 (65.49)	
Often	23 (88.46)	3 (11.54)		21 (80.77)	5 (19.23)		15 (57.69)	11 (42.31)	
Number of sexual partners									
1	71 (79.78)	18 (20.22)	0.674	79 (88.76)	10 (11.24)	0.02	26 (29.21)	63 (70.79)	0.156
2	49 (75.38)	16 (24.62)		57 (87.69)	8 (12.31)		23 (35.38)	42 (64.62)	
3 - 4	51 (82.26)	11 (17.74)		44 (70.97)	18 (29.03)		29 (46.77)	33 (53.23)	
> 4	25 (73.53)	9 (26.47)		27 (79.41)	7 (20.59)		14 (41.18)	20 (58.82)	
Use of oral contraceptive methods									
No	148 (84.09)	28 (15.91)	0.001	139 (78.98)	37 (21.02)	0.008	73 (41.48)	103 (58.52)	0.01
Yes	48 (64.86)	26 (35.14)		68 (91.89)	6 (8.11)		19 (25.68)	55 (74.32)	

Data are number and/or proportion (%), unless otherwise indicated; p-value at $p < 0.05$ showing the statistical significant. HPV: Human papillomavirus, STI: Sexually transmitted infection; Pearson's chi-square test was used to compare percentages.

3.4. Determinants of HPV and Cervical Cancer Knowledge

Three determinants of HPV knowledge were identified namely study area, participant's age and age at first sexual intercourse (Table 4). Indeed, the chances of adequate knowledge on HPV infection were reduced by 83% (aOR = 0.17, 95%CI 0.06 - 0.49, $p = 0.001$) in women living in Pointe Noire compared to those from Brazzaville. Women aged > 18 years had more than two-fold higher of adequate knowledge as compared to their younger counterparts (aOR = 2.54, 95%CI 1.09 - 5.91, $p = 0.03$). The chances of getting adequate knowledge on HPV were by 60% (aOR = 0.40,

95%CI 0.17 - 0.99, $p = 0.04$) in women having had their first sexual intercourse at age of 17 -21 years compared to those having had their first intercourse at 11 - 15 years (Table 4). Regarding cervical cancer knowledge, four determinants were identified on analysis of multivariate logistic regression findings viz. study area, participant's age, marital status and number of sexual partners. For instance, women aged > 18 years (aOR = 6.18, 95%CI 1.55 - 24.57, $p = 0.009$) and those having 3- 4 sexual partners (aOR = 5.18, 95%CI 1.66 - 16.15, $p = 0.03$) were more knowledgeable on cervical cancer compared to those aged below 18 and having one sexual partner (Table 4).

Table 4. Determinants of knowledge towards HPV and cervical cancer.

Factors	Knowledge on HPV		Knowledge on cervical cancer		Knowledge on HPV		Knowledge on cervical cancer	
	cOR (95%CI)	p	aOR (95%CI)	p	cOR (95%CI)	p	aOR (95%CI)	p
Study sites								
Brazzaville	1		1		1		1	
Pointe Noire	0.14 (0.05 - 0.42)	0.0003*	0.17 (0.06 - 0.49)	0.001*	0.04 (0.01 - 0.32)	0.02*	0.03 (0.00 - 0.26)	0.001*
Age								
≤ 18 years	1		1		1		1	
> 18 years	1.86 (0.92 - 3.77)	0.08	2.54 (1.09 - 5.91)	0.03*	7.90 (2.36 - 26.40)	0.0008*	6.18 (1.55 - 24.57)	0.009*

Factors	Knowledge on HPV			Knowledge on cervical cancer				
	cOR (95%CI)	<i>p</i>	aOR (95%CI)	<i>p</i>	cOR (95%CI)	<i>p</i>	aOR (95%CI)	<i>p</i>
Level of education								
Primary	1		1		1		1	
Secondary	0.26 (0.02 - 4.28)	0.34	0.63 (0.03 - 11.60)	0.75	0.18 (0.01 - 2.89)	0.22	0.14 (0.01 - 2.91)	0.21
University	0.60 (0.03 - 13.59)	0.74	0.92 (0.04 - 23.94)	0.96	3.00 (0.12 - 73.67)	0.51	2.14 (0.07 - 69.11)	0.67
Marital status								
Single	1		1		1		1	
Concubinage	1.34 (0.56 - 3.17)	0.51	1.21 (0.48 - 3.02)	0.68	0.30 (0.12 - 0.76)	0.01*	0.14 (0.04 - 0.46)	0.001*
Married	0.76 (0.33 - 1.75)	0.51	0.89 (0.36 - 2.21)	0.81	0.41 (0.18 - 0.93)	0.02*	0.44 (0.16 - 1.19)	0.11
Age at 1 st sexual intercourse								
[11 - 15] years	1		1		1		1	
[15 - 17] years	0.58 (0.28 - 1.22)	0.15	0.55 (0.24 - 1.25)	0.15	2.36 (0.89 - 6.26)	0.08	1.75 (0.54 - 5.70)	0.35
[17 - 21] years	0.58 (0.27 - 1.24)	0.15	0.40 (0.17 - 0.99)	0.04*	2.20 (0.82 - 5.96)	0.11	1.62 (0.48 - 5.42)	0.43
Number of sexual partners								
1	1		1		1		1	
2	1.29 (0.60 - 2.77)	0.51	1.46 (0.62 - 3.47)	0.3	1.11 (0.41 - 2.98)		1.89 (0.57 - 6.31)	0.29
3 - 4	0.85 (0.37 - 1.95)	0.71	0.89 (0.36 - 2.25)	0.81	3.23 (1.37 - 7.61)	0.007*	5.18 (1.66 - 16.15)	0.004*
> 4	1.42 (0.57 - 3.57)	0.46	1.11 (0.40 - 3.08)	0.84	2.05 (0.71 - 5.91)	0.18	2.10 (0.58 - 7.53)	0.25

95%CI: Confidence interval at 95%, aOR/cOR: Adjusted/Crude odds ratio, HPV: Human papillomavirus. Univariate and multivariate logistic regression analyses were used to identify determinants: *The level of statistical significance was set at $p < 0.05$

4. Discussion

Cervical cancer is a major public health problem worldwide and the major pathogenic agent remains the HPV. Knowledge related to the involvement of HPV in the development of cervical cancer and cervical cytology programs have reduced the incidence and mortality of cervical cancer have led to improved public health programs for the prevention and fight against this disease in high-income countries [28]. Assessing women's knowledge and awareness of HPV infection and cervical cancer risk is a prerequisite for effective preventive strategies and to our knowledge, this work is the first published data conducted in the Congolese population while according to data from the cancer registry, cervical cancer is the second most common cancer in women with a frequency of 26.6%, and the second leading cause of cancer deaths in women [26]. This high prevalence was reported in the only previous study published in the republic of Congo, a hospital-based study that showed a prevalence of 23.5% of this cancer among 204 women in southwestern Congo [27]. Otherwise, the real lack of a vaccination policy against HPV and the risky sexual behaviors may constitute triggering factors for HPV infection and the occurrence of cervical cancer among women in this country. The current study assessed knowledge of HPV infection, cervical cancer, and its risk factors among young women in a population based-study in two areas of the republic of Congo.

The study highlighted that the majority (78.4%) of participants in the current study did not know what HPV is and 82.8% what cervical cancer is; thereby suggesting an increased risk of contracting HPV infection in this group of Congolese women. This low level of knowledge of girls and women about cervical cancer and the HPV infection are consistent and similarly with previous studies conducted in

low- and middle-income countries in Africa [29-34] and in some high-income countries [35-37]. Similarly, previous studies conducted in Asia reported also low knowledge of HPV infection [38-41]. In these LMICs, between 50% and 85% lacked adequate knowledge and understanding of HPV infection and knowledge of cervical cancer. Previous hospital-based studies conducted in Africa have looked at whether women could link HPV infection with the development of cervical cancer, and between 1% in and 45.6% were able to linked HPV to cervical cancer [29, 42-44]. The discrepancy might be explained by the differences in the study population, which in some studies included university students who may have had exposure to health education.

Geographical area, woman's age, marital status, age at first sexual intercourse, and number of sexual partners were determinants of knowledge towards HPV infection and/or cervical cancer in this current study. Various other cofactors reported by previous studies may influence the level of HPV infection and/or cervical cancer knowledge as rural residence, women attending tertiary institutions have reported low cervical cancer knowledge [45, 46]. Another study reported that educational level, occupation and higher income of participants were determinants of adequate knowledge of cervical cancer, its screening and HPV [47]. Higher awareness among divorced/separated/widowed women contribute to low cervical cancer knowledge in a study conducted in South Africa [29]. Older women are more willingness to follow health preventive practices towards HPV and cervical cancer as they are more aware on consequences of these pathologies on their life at both individual and family levels. Studies conducted in USA, Gabon and Kenya reported that older age was key determinant on different components of HPV control including HPV knowledge and testing [29, 36, 48, 49].

As reported in the current study, higher lifetime sexual

partner is an important factor for adequate cervical cancer knowledge. It is likely that these women had symptoms of cervical cancer or HPV infection and had previously sought for medical consultation or treatment. Hence, it is not surprising that these group of young women seemed to have better knowledge, they may have been exposed to accurate information during the period of having their diagnostic test. Indeed, previous studies reported that women who had previously accessed cervical cancer screening services were more likely to have better knowledge of HPV compared to those who had never been screened and women who underwent a cervical cancer test following treatment with large loop excision of the transformation zone were more likely to have better knowledge of HPV and cervical cancer risk factors [29, 50, 51].

Regarding risk sexual behaviors, multiple sexual partners, early age at first sexual intercourse, absence of contraceptive methods and no usage of condoms were the more reported in this study. All these risk sexual behaviors with the lack of HPV and cervical cancer knowledge could be a barrier to implement preventive strategies and reduce HPV-related disease and malignancies among Congolese women.

Counselling women attending HIV and STIs clinics coupled with community campaigns may improve patient's awareness and knowledge on HPV related diseases and promote HPV vaccination uptake. Few (1.2%) participant were vaccinated against HPV as reported in previous studies in Nepal (3%) [39] and in Nigeria (3.5%) [52]. Several reasons including fear, misconceptions or hesitancy to vaccination, lack of awareness regarding the availability and purpose of HPV vaccine, along with lack of implementation/scaling up of effective awareness campaigns and a national screening program could explain this worrying levels of HPV vaccination in our study and elsewhere [53-56]. An estimated 67% of 2.3 billion women aged 20-70 years, including 64% of 1 billion women aged 30-49 years, had never been screened for cervical cancer and 84% of 158 million women aged 30-49 years living in high-income countries had been screened ever in lifetime, compared with 48% of 404 million women in upper-middle-income countries, 9% of 397 million women in lower-middle-income countries, and 11% of 74 million in low-income countries [57].

Furthermore, 78.4% of the study respondents had already been tested for HIV, whereas Grondina *et al.* reported value a prevalence of 81% in a survey on adolescents' knowledge and behavior regarding sexuality, sexually transmitted infections and human papillomavirus vaccination in France [58]. In the same study, these authors reported poor knowledge of STI with 24.8% of boys and 15% of girls and this insufficient knowledge was significantly associated with male gender, age under 18 years, lack of dialogue with parents on these topics, low parental socioeconomic level, and lack of health education [58]. We found that 63.2% of women was aware of testing and had contracted an STI, with a predominance of fungal infections followed by chlamydia. The prevalence of these STIs was significantly higher in

younger women compared to older ones but no significant variation was found between prevalence of STIs and risky sexual behavior. In the globe, most predominant and frequent STIs include *Chlamydia trachomatis* (the leading cause of tubal infertility), genital warts and herpes in the adolescent [59].

5. Conclusion

Our study highlights the lack of HPV and cervical cancer knowledge among few young Congolese women in PNR and BZV. Furthermore, the study found that very few young Congolese women got HPV vaccine. Geographical area, woman's age, marital status, age at first sexual intercourse, and number of sexual partners were the main determinants of knowledge of HPV infection and/or cervical cancer. Government policies must prioritize an effective national cervical cancer control program based on accurate information and awareness to the public on HPV and cervical cancer. Eliminating knowledge-related barriers is important to ensure acceptance of vaccination among the Congolese female population and to achieve the goal of reducing cervical cancer incidence and mortality rates in this at-risk population group.

Availability of Data and Materials

All data underlying the findings described in this manuscript have been fully presented in the manuscript.

Abbreviations

95%CI: Confidence interval at 95%, aOR: Adjusted odds ratio, cOR: Crude odds ratio, HIV: Human immunodeficiency infection, HPV: Human papillomavirus, IEC: Information – Education – Communication, STI: Sexually transmitted infection.

Consent for Publication

Consent to publish has been obtained from all included persons in the study.

Conflict of Interests

The authors declare that they have no competing interests.

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