





# Knowledge and awareness of Human Papillomavirus (HPV) and HPV vaccines among Caribbean youth: the case of the Bahamas

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## ABSTRACT

There is a high burden of cervical cancer in the Caribbean region, particularly in the Bahamas, yet there are few studies of Human Papillomavirus (HPV) and HPV vaccine in the region. The objective of this study was to assess the knowledge and awareness of HPV and the HPV vaccine among school-aged youth (15–18 years) living in the Bahamas.

Cross-sectional data were obtained from the “Getting to Zero” HIV study in the Bahamas conducted in 2014/2015 ( $n = 1553$ ). The questionnaire elicited information on knowledge of HPV and HPV vaccines, using previously validated scales. Data analysis included Chi-square tests and Mann Whitney U test.

In this sample of school-aged youth, only 10.7% (146/1364) had ever heard of HPV. With respect to those who were sexually active ( $n = 685$ ), only 10.7% had ever heard of HPV. For those who had heard of HPV, knowledge of HPV and HPV vaccines was assessed on an HPV Knowledge and HPV Vaccine Knowledge scale, respectively. There was no statistically significant difference in mean HPV knowledge score between males and females, or HPV vaccine knowledge scores, between males and females.

There was a general lack of awareness of HPV and HPV vaccines among school-aged youth in the Bahamas. This is an important gap in the HPV vaccine strategy and cancer prevention, as this is the age at which most people acquire HPV. It emphasizes the importance of developing a careful implementation plan, with an evaluation of knowledge and attitudes, in order to have an effective HPV vaccine uptake.

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## 1. Introduction

Human Papillomaviruses (HPV) cause genital, anal, and oropharyngeal cancers in men and women. In the United States, HPV is responsible for approximately 91% of cervical cancers in women and 90% of anal cancers in men and women.<sup>1</sup> In the Caribbean region, cervical cancer accounts for 18% of deaths among women.<sup>2</sup> There is a paucity of research on the burden and the distribution of anal cancers in men and women in the Caribbean region, including the Bahamas. Studies in US populations have demonstrated a higher incidence of anal cancer among Black men compared to White and Hispanic men,<sup>3,4</sup> particularly among those living with HIV.<sup>5,6</sup>

Most HPV-associated cancers are preventable as there are safe and effective vaccines available.<sup>7</sup> HPV acquisition is common among sexually active individuals,<sup>1</sup> and in 2011–2014 its prevalence in the USA was estimated at 42% (45% men, 39.9% women) in the general population but 64.1% (65% men; 63% women) among non-Hispanic Blacks.<sup>8</sup> HPV infection is highest among sexually active youth but many will spontaneously clear the infection.<sup>9</sup> However, about one in ten will develop genital warts.<sup>10</sup> Among women, 1.5% of HPV infection will persist and they

may develop cervical intraepithelial neoplasia CIN2/3 and invasive cancer.<sup>11</sup>

In the Bahamas in 2018, the estimated number of new cervical cancer cases diagnosed annually was 29, with an age-standardized incidence (ASI) of 10.9 per 100,000, compared to an ASI of 13.1 per 100,000 for the rest of the world.<sup>12</sup> Cervical cancer is the second most common female cancer in the Bahamas among those 15 to 44 years of age.<sup>12</sup> Youth in the Bahamas, as in many other areas of the world, become sexually active at an early age. Early sexual debut is a risk factor for cervical cancer,<sup>13</sup> perhaps due to longer and/or persistent HPV infection.<sup>14</sup> High numbers of sexual partners are known to increase the risk of exposure to HPV and the risk of genital and oropharyngeal cancers.<sup>15</sup> Sexually active youth often practice oral sex and while there is no clear evidence independently linking oral sex to oropharyngeal cancers,<sup>16</sup> there is evidence that HPV can be transmitted through oral sex.<sup>17</sup>

Since 2011, HPV vaccine programs for young men and women have become widespread in many countries including some countries in the Caribbean region. However, there are still countries in that region that have not yet implemented HPV vaccine programs.<sup>18</sup> The Bahamas introduced its HPV vaccine program in 2015 for 9–12-year-old females and

males.<sup>19</sup> Since then, the program has been extended to all women under 26 years of age, upon request. A study conducted between 2008 and 2010 among adults in the Bahamas revealed that only 46% of participants had heard of HPV and 35% had heard of the HPV vaccine.<sup>20</sup>

The current study was conducted in 2014–15, prior to the introduction of an HPV vaccine into the national schedule of the immunization program in the Bahamas.<sup>19</sup> At the time of this study, Cervarix and Gardasil had become available in private physicians' offices for a fee and there were widespread discussions in the media about the future government-funded program.<sup>19</sup> This study assesses youth's understanding of HPV and HPV vaccine at a time when the HPV vaccine strategy was being rolled out – an important factor in HPV vaccine uptake.<sup>21</sup> More importantly, for countries that have not yet implemented their HPV Vaccine strategy, this study provides important lessons on the importance of assessing HPV and HPV vaccine knowledge prior to program implementation. It also provides important information for improving HPV vaccine uptake in other jurisdictions, including the US and Canada, where programs are not meeting their targets.<sup>22,23</sup>

## 2. Methods

This study is based on a sub-analysis of a larger study on male circumcision, HIV prevention and sexual health among Bahamians. The main study employed a stratified sampling of Bahamian high school students based on school distribution within the Bahamas. This was achieved through the support of the government's Statistical Division and the Ministries of Health and Education. Ethical approval for the study was obtained from the Bahamas National Research Ethics Board and the Research Ethics Board of the University of Ontario Institute of Technology.

### 2.1. Recruitment and study administration

The established rapport between the Ministry of Health (MOH), the Bahamas National AIDS Program (NAP) and the Ministry of Education (MOE) was used to facilitate student recruitment through *The Focus on Youth Program*.<sup>24</sup> This program involves working with parents and their children to improve sexual health communication and has a well-established presence throughout the Bahamas.

The Bahamas consists of many islands with 90% of the population and its immigrant diversity residing on the islands of New Providence, Grand Bahama, and Abaco. The sample size was calculated by the Department of Statistics for the main research outcome for male circumcision. Based on the student population in the country, a sample size of 910 was calculated for gathering data for the subset of those 15–17 years of age.

Government public senior high schools were approached in New Providence (n = 7), Abaco (n = 3) and Grand Bahama (n = 2) and all participated. Students were recruited through standard procedures established by the MOE. Following obtaining the Ministry's permission, each school principal was approached to obtain agreement for recruiting a specific class. Students consent was then obtained before administering the

printed questionnaire under exam-like conditions. The original study was not designed for young women but was later modified to include them as was desired by stakeholders. As such, recruitment occurred in more classes than was previously planned to ensure female participation. Students were informed that they could refuse to answer any or all of the questions. An honorarium of a \$5 phone card was offered.

#### 2.1.1. Study instrument

The questionnaire elicited information on students' socio-demographic status including age and sex, sexual behavior and HIV knowledge. As religiosity is an important aspect of Bahamian life, we asked about religious affiliation and frequency of religious service attendance. For this paper, our main instrument included a battery of questions to determine general HPV knowledge and HPV vaccine knowledge.<sup>25</sup>

The general HPV Knowledge Scale, a 16-item questionnaire and the HPV Vaccine Knowledge Scale, a 7-item questionnaire, developed by Waller et al.,<sup>25</sup> were used to measure HPV and HPV vaccine knowledge. Participants were first asked, "Before today, had you ever heard of human papillomavirus?" Those who responded "yes" were asked to complete the HPV Knowledge Scale in a "True/False/don't know" format. In creating a composite score for HPV knowledge, the scale developers suggested scoring "true" as 1, and "false and don't know" as 0. As such, the general HPV knowledge score could range from 0 to 16. One of the original scale questions "HPV causes HIV/AIDS" was excluded from this scale since, as suggested by the authors of the scale, its poor performance on the scale may suggest that it may be more informative as an individual item rather than part of the subscale.<sup>25,26</sup> As such participants could score between 0 and 15 on the general knowledge scale. Cronbach alpha for the original scale was 0.849 and test-retest reliability value was 0.68.

The HPV Vaccine Knowledge Scale is comprised of 7 items. As above, participants scored 1 for each correct response and 0 for each incorrect or "I don't know" response. HPV vaccine knowledge score could vary between 0 and 7. Cronbach alpha for the original scale was 0.561 suggesting some heterogeneity of item content, and test-retest reliability value was 0.62 showing fair reliability.<sup>25</sup> Based on the developers exploratory principal factor analysis, four items did not load strongly (*HPV vaccines require three doses; The HPV vaccines are most effective if given to people who have never had sex; The HPV vaccines offer protection against most cervical cancers; One of the HPV vaccines offers protection against genital warts*). However, the developers stated that a follow-up EFA showed that removing items that did not load strongly did little to improve unidimensionality.<sup>25</sup>

We also asked a series of questions on sexual behavior such as "Have you ever had sex?" "When was the last time you had sex?" "Have you ever had oral sex?" "In the past year, how many different people did you have sex with?" "How old was the last person you had sex with?" to juxtapose HPV and HPV vaccine knowledge against sexual behavior. Sexual intercourse was defined as anal or vaginal intercourse.

#### 2.2. Data analysis

Data analysis included univariate and bivariate analysis in IBM SPSS (version 25). Chi-square tests were done to

determine whether there was an association between HPV awareness, main outcome variable, sociodemographic (such as sex, age, place of birth) and sexual characteristics of participants (such as sexual initiation, HIV testing, condom use). Mann Whitney U test was also used to determine differences in HPV knowledge and HPV vaccine knowledge (outcome variables) by sociodemographic and sexual characteristics of the group.

### 3. Results

There were 1,553 completed questionnaires (100% completion rate). Of these, 797 (51.4%) were males and two individuals did not indicate their sex. As expected, 1287 (84.5%) of the sample resided in New Providence (7 schools), 154 (10.1%) lived in Grand Bahama (2 schools) and 82 (5.3%) lived in Abaco (3 schools). Most students (91.3%) were born in the Bahamas, 1.1% were born in Haiti, 3.6% and 3.0%, were born in the USA and Jamaica, respectively. More than half of the sample (51.2%) reported that they attend religious services frequently (once or more often per week).

With regards to sexual activity ( $n = 1456$ ), 778 (53.4%) of the sample responded “yes” to ever having sex (42.9% or 298/695 females and 63.1% or 479/759 males). Thirty-eight males and 116 females did not respond to the question “Have you ever had sex”. Fifty-seven (11.2%) of those who reported never having sexual intercourse reported having oral sex.

#### 3.1. Factors associated with ever hearing of HPV

With regards to the question “Before today, had you ever heard of Human Papillomavirus (HPV)?,” 146 (10.7%, 95% CI 9.1%-12.5%) responded “yes” (87/638, 13.6% females; 59/726, 8.1% males), and 1218 (89.3%) responded “no”. There were 188 who did not respond to this question and they were removed from further analyses. As such, 1364 individuals were available for further analysis. Table 1 shows the characteristics of participants who had heard and had not heard of HPV. Between those who had heard and not heard of HPV, only “ever tested for HIV” ( $p = .01$ ), “engaging in oral sex” ( $p = .04$ ) and being female ( $p < .01$ ) were statistically significant in Chi-Square analyses.

#### 3.2. Sexual activity and awareness of HPV

As infection by HPV occurs most frequently through sexual activity, it was important to determine HPV awareness for those who had already initiated sexual activities and responded to the question on HPV awareness ( $n = 685$ ). Of those who had initiated sex, 10.7% (73/685) had heard of HPV. Of this sexually active group, 23.1% reported sexual activity within the last week; 35.2% had three or more sexual partners in the past year; 57% always used condoms; 71.1% had a most recent sexual partner of their age group; 68.6% had never tested for HIV but of those who tested for HIV, 64% had done so within the last year. In bivariate analysis (Table 2) being female, testing for HIV, oral sex, recent sexual activity, and frequent condom use, were associated with being aware of HPV (all  $p < .05$ ).

**Table 1.** Sociodemographic and sexual characteristics of school-aged youth who had heard and not heard of HPV ( $N = 1364$ , Chi Sq. test).

Variable	Not Heard of HPV (n = 1218)	%	Heard of HPV (n = 146)	%	Pvalue
<b>Sex</b>					
Male	667	54.8	59	40.4	
Female	551	45.2	87	59.6	0.001
<b>Residence</b>					
New Providence	1001	83.8	122	84.1	
Grand Bahama	128	10.7	15	10.3	
Family Islands	65	5.4	8	5.5	NS
<b>Age (years)</b>					
15–16	910	75.2	106	72.6	
17 plus	300	24.8	40	27.4	NS
<b>Ever had sex</b>					
No	535	46.6	67	47.9	
Yes	612	53.4	73	52.1	NS
<b>Oral sex</b>					
No	633	66.7	67	57.3	
Yes	316	33.3	50	42.7	0.04
<b>Ever tested for HIV</b>					
No	970	87.5	111	79.9	
Yes	138	12.5	28	20.1	0.01
<b>Religiosity</b>					
Non-frequent	613	51.3	73	51.4	
Frequent	581	48.7	69	48.6	NS

**Table 2.** Sexual behavior characteristics of the sample who reported ever having sex by awareness (had heard vs. not heard) of HPV ( $n = 685$ , Chi Sq. test).

Variable	Unaware of HPV		Aware of HPV		Pvalue
	N	%	N	%	
<b>Sex</b>					
Male	404	66.0	29	39.7	
Female	208	34.0	44	60.3	<0.0001
<b>Age (years)</b>					
15–16	427	70.5	48	65.8	
17 plus	179	29.5	25	34.2	NS
<b>Oral sex</b>					
No	245	48.1	22	35.5	
Yes	264	51.9	40	64.5	0.06
<b>Tested for HIV</b>					
No	462	81.9	47	67.1	
Yes	102	18.1	23	32.9	0.003
<b>Condom use</b>					
< Half of the time	141	23.5	25	34.7	
≥Half of the time	460	76.5	47	65.3	0.036
<b>Condom used at last sexual intercourse</b>					
No	208	34.8	34	47.2	
Yes	390	65.2	38	52.8	0.038
<b>Number of Sexual partners (past year)</b>					
None or 1	258	43.4	38	52.1	
Two	121	20.3	9	12.3	
≥Three	216	36.3	26	35.6	0.20
<b>Recent sexual activity</b>					
< 1 month	254	44.3	30	44.1	
1 month – < 6 month	146	25.4	9	13.2	
≥ 6 months	174	30.3	29	42.6	0.036

#### 3.3. HPV general and HPV vaccine knowledge

Individuals who had heard of HPV were asked to respond to a 16-item general HPV knowledge and 7-item HPV vaccine knowledge scale.<sup>25</sup> Table 3 shows the performance of each item on the scale. About 55% of the participants did not know that HPV causes cervical cancer; only 40.7% (50/123) correctly answered that HPV is the cause of genital warts; 38.5%

(50/130) correctly stated that HPV is quite common; 43.4% (56/129) correctly responded that it can be passed on through skin to skin contact and 43.1% (56/130) were correct in indicating that men could get HPV. Although 68.2% (88/129) knew that someone could have HPV for many years without knowing it, only 33.6% (44/131) correctly answered that HPV may not have visible sign or symptoms. 77.1% (101/131) knew that having many sexual partners increases the risk of HPV. Only 18.3% knew that HPV cannot cause HIV and 23% were aware that HPV cannot be cured by antibiotics. Less than 10% knew that HPV can sometimes spontaneously clear without treatment.

As suggested by the authors of the HPV scale, "HPV can cause HIV/AIDS" was removed from the global knowledge scale due to its different psychometric properties and tested as a separate item.<sup>25</sup> HPV knowledge (n = 111, 44 males and 67 females) ranged from 0 to 13 (not correctly answering any of the questions to correctly answering 13 of the 15 questions). No participant correctly answered all the 15 questions. A Welch t-test was run to determine if there were differences in HPV knowledge between males and females due to the assumption of homogeneity of variances being violated, as assessed by Levene's test for equality of variances ( $p = .01$ ). The HPV knowledge score was not appreciably higher among males (M = 6.77, SD = 4.19) than females (M = 6.48, SD = 3.24). Male mean HPV knowledge score was 0.30, 95% CI

[-1.19 to 1.77] higher than female's mean HPV knowledge score. However, there was no statistically significant differences in mean HPV knowledge score between males and females,  $t(75.67) = 0.40$ ,  $p = .069$  (Table 4).

For the item "HPV can cause HIV/AIDS", there was a similar distribution in selecting the incorrect response for both males and females.

With regards to HPV vaccine knowledge, 121 participants responded to the questions on HPV vaccine (45 males and 76 females). HPV vaccine knowledge ranged from 0 to 6 (not correctly answering any of the questions to correctly answering 6 of the 7 questions). No participant correctly answered all the seven questions. An independent t-test was run to determine if there were differences in the HPV Vaccine Knowledge score between males and females. There was homogeneity of variance as assessed by Levene's test for equality of variance ( $p = .40$ ). HPV vaccine knowledge was not appreciably higher in females (Mean score = 1.76, SD = 1.64) compared to males (mean score = 1.69) (SD = 1.62) (Table 4). Male HPV vaccine knowledge score was -0.07, 95% CI [-0.68 to 0.53] lower than females. There was no statistically significant difference in mean HPV vaccine knowledge

**Table 3.** Frequency distribution of knowledge of HPV (N = 146) and HPV vaccine (N = 121) for those who had heard of HPV.

Questionnaire item	Correct*	N#	N	%
HPV can cause cervical cancer	Yes	58	127	45.4
A person could have HPV for many years without knowing it	Yes	88	129	68.2
Having many sexual partners increases the risk of getting HPV	Yes	101	131	77.1
HPV is very rare	No	50	130	38.5
HPV can be passed on during sexual intercourse	Yes	82	129	63.6
HPV always has visible signs or symptoms	No	44	131	33.6
Using condoms reduces the risk of getting HPV	Yes	74	131	56.5
HPV can cause HIV/Aids	No	24	131	18.3
HPV can be passed on by genital skin-to-skin contact	Yes	56	129	43.4
Men cannot get HPV	No	56	130	43.1
Having sex at an early age increases the risk of getting HPV	Yes	62	129	48.1
There are many types of HPV	Yes	41	127	32.3
HPV can cause genital warts	Yes	50	123	40.7
HPV can be cured with antibiotics	No	28	121	23.1
Most sexually active people will get HPV at some point in their lives	Yes	35	122	28.7
HPV usually doesn't need any treatment	Yes	12	123	9.8
Girls who have had an HPV vaccine do not need a Pap test when they are older	No	49	123	39.8
One of the HPV vaccines offers protection against genital warts	Yes	39	122	32.0
HPV vaccines offer protection against all sexually transmitted infections	No	32	121	26.4
Someone who has an HPV vaccine cannot develop cervical cancer	No	34	122	27.9
HPV vaccines offer protection against most cervical cancers	Yes	27	122	21.1
The HPV vaccine requires three doses	Yes	12	122	9.8
HPV vaccines are most effective if given to people who have never had sex	Yes	36	122	29.5

\*Correct = The correct response for the item

#n = Number who correctly identified the response

% Frequency of correct response

**Table 4.** Frequency distribution of HPV general knowledge and vaccine knowledge among school-aged youth. Chi Sq. test.

	Men (n)	%	Women (n)	%	pvalue
HPV can cause cervical cancer	15	30.6	43	55.1	NS
A person could have HPV for many years without knowing it	33	67.7	55	70.5	NS
Having many sexual partners increases the risk of getting HPV	39	78.0	62	76.5	NS
HPV is very rare (F)	25	50.0	25	31.3	<b>0.03</b>
HPV can be passed on during sexual intercourse	33	66.0	49	62.0	NS
HPV always has visible signs or symptoms (F)	22	44.0	22	22.7	<b>0.05</b>
Using condoms reduces the risk of getting HPV	26	52.0	48	59.3	NS
HPV can cause HIV/AIDS (F)	9	18.0	15	18.5	NS
HPV can be passed on by genital skin-to-skin contact	20	40.8	36	45.0	NS
Men cannot get HPV (F)	19	38.8	37	45.7	NS
Having sex at an early age increases the risk of getting HPV	21	42.9	41	51.2	NS
There are many types of HPV	15	31.9	26	32.5	NS
HPV can cause genital warts	18	39.1	32	41.6	NS
HPV can be cured with antibiotics (F)	14	31.1	14	18.4	NS
Most sexually active people will get HPV at some point in their lives	10	21.7	25	32.9	NS
HPV usually doesn't need any treatment	4	8.7	8	10.4	NS
Girls who have had an HPV vaccine do not need a Pap test when they are older (F)	15	32.6	34	44.2	NS
One of the HPV vaccines offer protection against genital warts	14	31.1	25	32.5	NS
HPV Vaccines offer protection against all sexually transmitted infections (F)	13	28.9	19	25.0	NS
Someone who have had an HPV vaccine cannot develop cervical cancer (F)	12	26.7	22	28.6	NS
HPV vaccine offer protection against most cervical cancers	3	6.7	7	9.1	NS
The HPV vaccine requires 3 doses	5	11.1	7	9.1	NS
HPV vaccines are most effective if given to people who have never had sex	14	31.1	22	28.6	NS

score between males and females,  $t(119) = -0.242$ ,  $p = .81$ .

## 4. Discussion

Sexual intercourse is the most important risk for HPV infection<sup>15</sup> and as such, it was important to evaluate the sexual behavior and sexual health practices that may put youth at risk for HPV. In this study, a proportionally large number of these youth (42.9% female, 63.1% males) were sexually active with almost a quarter reporting sexual intercourse within the past week and more than one-third reporting having three or more sexual partners within the past year. Multiple sexual partners is a confirmed independent risk factor for HPV related cervical cancer<sup>15</sup> and may be a risk factor for HPV-associated oropharyngeal cancers.<sup>27</sup> In their meta-analyses, Lui et al. observed a significant increased risk of cervical disease among women with multiple sexual partners.<sup>15</sup> As the number of sexual partners increased, the risk of invasive cervical cancer also increased. It was also argued that there may be other factors associated with multiple partners that may increase cancer risk.<sup>15</sup>

Many in our sample were oral sex experienced, including some who had not had sexual intercourse. Oral sex is a risk factor for some oropharyngeal cancers.<sup>27,28</sup> While we did not test these youths' knowledge of oral sex as an HPV risk, it is likely that few knew of the link with HPV and oral sex. Awareness of HPV acquisition through oral sex has been shown to modify future desire for HPV vaccine uptake<sup>29</sup> and may be an important area to include in the Bahamas school-based health education curricula.

### 4.1. HPV awareness

Only 10% of the sample reported that they had previously heard of HPV. This was an unexpected result as the study was conducted at a time when there was much discussion in the media about the merits of HPV vaccines, but also about the potential increased sexual compensatory behaviors among adolescent girls.<sup>19,30</sup> While we did not ask participants for their source of HPV knowledge, previous research noted that greater media information may have an impact on HPV awareness.<sup>31</sup> In an earlier study among adults drawn from mostly clinical settings in the Bahamas, 46% had heard of HPV.<sup>20</sup> The setting of that study and the different age group sampled, may in part, explain the differences in knowledge between that study and the current one. However, Bahamian youth are not unique in their low HPV knowledge. In a study conducted in China in 2016–2017, only 15.5% of middle school children had heard of HPV.<sup>32</sup> Despite the widespread use of HPV vaccine in Europe, only 29.8% of European boys knew of HPV compared to 51.7% European girls.<sup>33</sup> Our results indicate that unfocused information on HPV may not reach the target audience. As such, it may be important to include information on HPV in school-based health education programs.

Young men's awareness of HPV was lower than that of young women, perhaps because, in 2013, most of the debate on HPV had focused on a female-only HPV vaccine

program.<sup>34</sup> Further, it was only in December 2014 that Gardasil was approved in the USA for males,<sup>35</sup> so males were not included in the knowledge sphere. For some time, the discussion of a male HPV vaccine strategy focused only on men who have sex with men,<sup>36</sup> a topic that would not be given much media attention in Caribbean societies. It would be important for future research (such as our follow-up study later in 2019) to determine whether sexuality issues have an impact on current HPV vaccine uptake for young men in the region.

### 4.2. HPV and HPV vaccine knowledge

Awareness of HPV does not translate into knowledge and understanding of HPV as a risk factor for anogenital and oropharyngeal cancers or genital warts. None of the youth in our study who had heard of HPV were able to correctly answer all the knowledge questions and, in particular, there was a large gap in knowledge of the relationship between HPV and cervical cancer, genital warts and other HPV related infections. This indicates that general information about HPV had not penetrated this youth group, despite US media discussions. Our data demonstrate that the misunderstanding that "men cannot get HPV" was prevalent, an issue seen in other research.<sup>37</sup> This may have been because of the previous focus on HPV as a women's health issue.<sup>36</sup> As such, it is imperative that the health promotion programs and the media include men in the rhetoric of HPV prevention.

There was also poor understanding of how HPV is manifested (signs and symptoms of HPV), its relationship to HIV (HPV causes HIV/AIDS) and the general ubiquity of HPV (HPV is very rare). This fragmented information may lead youth (and parents) to consider HPV vaccines as a low priority. Studies oriented to the Health Belief Model have identified that, if HPV is not evaluated as a risk to personal health, it is less likely that individuals will take actions to protect themselves.<sup>21,38</sup> Knowledge of the link between HPV and HIV infection<sup>39</sup> and vice versa<sup>40</sup> may have an impact on HPV vaccine uptake and should be explored.

A poor understanding of HPV was also prevalent with regards to sexual health. The majority of those who completed the questions on HPV did not know that most sexually active individuals will get HPV during their lifetime; that early sexual debut is associated with increased HPV risk or that HPV causes genital warts. Sexual behaviors are known to be the most important risk factor for HPV.<sup>15</sup> Further, it is well established that improved knowledge of HPV and HPV vaccines can lead to improved HPV vaccine uptake.<sup>21,23</sup>

Youth had poor knowledge of the HPV vaccine, including being unaware of its association with cervical cancer prevention, dosing (at the time of the study, the recommended dosage was 3), and timing. Studies have reported that poor understanding of the HPV vaccine can lead to resistance to vaccine uptake or poor adherence to vaccine dosage.<sup>23,41</sup> However, motivated youth may have an influence on their parents' consenting to the HPV vaccine.<sup>42</sup> Since the implementation of the HPV vaccine, many countries have reported poor HPV vaccine uptake which may lead to lower optimal coverage for herd effect.<sup>43</sup>

In the Bahamas, the HPV vaccine program was implemented after this study was conducted. Initial uptake of the HPV vaccine was poor (personal communication) reflecting our findings of poor knowledge and understanding. It also emphasizes the need for countries in the region who have not yet implemented a program, to create well-designed, multifaceted, intensive educational strategies to maximize HPV vaccine uptake. This education must target youth, educators, health-care providers and parents.<sup>44–46</sup>

## 5. Limitations

There are several limitations to this study. Unlike the original scale which asked, “Have you ever heard of HPV vaccine?” followed by the scale items, we skipped this question and directly asked about HPV vaccines. Only 40 (3.3%) students who had never heard of HPV responded to this HPV vaccine scale and 97% of the responses were “I don’t know” to the items.

The main instrument measuring HPV knowledge scale test–retest reliability was reported as 0.68,<sup>25</sup> suggesting that the measure had low consistency. However, this reliability may be acceptable for this type of non-clinical research study.

As this study is based on data emanating from the male circumcision study, the sampling strategy for that study included only boys. However, due to stakeholder’s interest in knowing young girls’ opinion about male circumcision, the sample strayed from cluster sampling to convenience sampling. We will soon be implementing an HPV follow-up study in the Bahamas, post-vaccine implementation and will determine whether HPV and HPV vaccine knowledge has an impact on the low HPV vaccine uptake.

The survey recruited students from the government (public) senior high schools and did not include those attending private or religion affiliated high schools. As knowledge of sexual health is often poorer among students attending schools that promote abstinence-based sexual education only, it is not believed that including these students would have improved the study’s results.<sup>47</sup>

## 6. Conclusion

There was a significant lack of awareness of HPV among school-aged youth in the Bahamas. This is an important gap in the HPV vaccine strategy and cancer prevention, as this is the age at which most people acquire HPV. However, awareness alone does not lead to positive actions toward health.<sup>48</sup> The results of the study indicate that, while youth are sexually active, they do not have sufficient knowledge of HPV as a risk for anogenital and oropharyngeal cancers and that there are safe and effective vaccines available. As such, it is important to develop education strategies specifically targeting this age group. There is a need to educate youth that HPV is a risk factor for many cancers and genital warts in both men and women and that men have a role to play in the prevention of HPV transmission. Having an enhanced knowledge of HPV will not only increase HPV vaccine uptake but may support the uptake of preventive measures such as Pap smear testing and condom use. For

health officials, it is important to measure HPV and HPV vaccine knowledge as part of HPV prevention program planning.

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