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Awareness, knowledge and beliefs about HPV, cervical cancer and HPV vaccines among nurses in Cameroon: An exploratory study

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ABSTRACT

Background: While it is known that sub-Saharan African countries face multiple obstacles such as cost in adopting vaccination against human papillomavirus (HPV), the crucial role nurses can play in implementing such programs has not been adequately examined.

Objectives: To investigate the knowledge and awareness of HPV, primary cause of cervical cancer and HPV vaccine among nurses working at four Cameroon Baptist Convention Health Services facilities, and to explore what factors influence nurses' willingness to inform and recommend HPV vaccine to adolescents and parents attending clinics.

Design and setting: A structured questionnaire survey was administered to a convenience sample of nursing staff working at the four health facilities.

Results: Of 192 eligible nurses 76 (39.6%) participated in the study. There were moderately low levels of knowledge about HPV infection and prevention of cervical cancer, but a moderately high level of knowledge about HPV vaccine. Although 90.8% acknowledged that cervical cancer is directly linked to HPV infection, nearly 32% failed to identify it as a sexually transmitted infection (STI), while 43.4% believed it is an uncommon infection. Willingness to recommend the HPV vaccine was moderate, with 69.7% intentionally initiating discussions with patients about the subject. The most important factors considered when deciding to recommend the vaccine included effectiveness (56.6%) and side effects/safety (11.8%). Cost was less of a concern (6.6%), likely due to the availability of donated vaccine.

Conclusion: Despite high awareness about HPV, more education about the virus, cervical cancer and the vaccine are required to further increase nurses' willingness to recommend the vaccine and strengthen strategies for reaching adolescents through nurses in Cameroon.

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What is already known about the topic?

- The direct involvement of nurses in the implementation of human papillomavirus immunization programs has been shown to be tremendously useful in contributing to success in various high-income countries but evidence from developing countries is limited.

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What this paper adds

- This small structured survey shows that nurses' own level of knowledge with regard to HPV, cervical cancer and the HPV vaccine is a critical dynamic that influence their willingness to recommend vaccination to patients.
- More education about HPV, cervical cancer and HPV vaccine is required to further increase nurses' willingness to recommend the vaccine and strengthen strategies of reaching patients through nurses in a low-income country setting in Cameroon.

1. Background

Globally, cervical cancer is the third most commonly diagnosed cancer and the fourth leading cause of cancer mortality among women, responsible for 275,100 in 2008 (Jemal et al., 2011). Among developing regions, sub-Saharan Africa has the highest global incidences (Bruni et al., 2010). Furthermore, in the sub-continent, cervical cancer is the leading cause of cancer mortality among women (Ferlay et al., 2010; Jemal et al., 2011). Developed countries have greatly reduced the burden of cervical cancer through secondary prevention by implementing widespread screening and treatment of pre-cancer lesions (Lyng and Rebolj, 2009; PATH, 2006; Saslow et al., 2002) and primary prevention through HPV vaccines that prevent infections caused by genotypes 16 and 18, which are responsible for about 70% of cervical cancers worldwide (Bosch et al., 2002; Zur Hausen, 2002). However, sub-Saharan African countries are still experiencing high mortality due to limited access to these preventive measures (Goldie et al., 2005; Sitas et al., 2008).

In Cameroon, available data indicate cervical cancer accounts for 23.3% of all cancers affecting women (WHO, 2010), and 31.7% of cancers among women aged 50 years and above (Mbakop et al., 1997). Current estimates show that at least 1500 Cameroonian women are diagnosed with cervical cancer and about 1000 die from the disease annually (WHO, 2010). Multiple risk factors for HPV infections in lower-income sub-Saharan African countries such as Cameroon are thought to be associated with the high incidence of cervical cancer. These include demographic and socio-economic variables such as age, education, income, sexual behavior, high parity, low levels of cancer screening and human immuno-deficiency virus (HIV) status (Atashili et al., 2011; De Vuyst et al., 2008; Hawes et al., 2006; Massad et al., 2001; Mogtomo et al., 2009; Parkin et al., 2003; Schuman et al., 2003).

Although Cameroon developed a "National Cancer Control Plan" in 2004, which includes cervical cancer screening to reduce incidence and mortality (McC Carey et al., 2011), the plan does not yet include HPV immunization, and HPV vaccine is not included in the current Ministry of Public Health's "Mid-Term Health Expenditure Framework 2011–2013" nor the immunization schedule through the year 2018 (Wamai et al., 2012). In Cameroon intermittent screening campaigns are conducted in larger cities using both Pap smear and visual inspection with acetic acid (Doh et al., 2005; Robyr

et al., 2002). Use of visual inspection with acetic acid is consistent with the practice in many developing countries due to inadequate supply of the required equipment, reagents and technical expertise (trained cyto-technicians and cyto-pathologists) to make Pap smear screening available to all women, and particularly to rural women (Maine et al., 2011; Perkins et al., 2007; Sankaranarayanan et al., 2009).

Two promising developments may motivate Cameroon and other resource poor countries to take up universal coverage of HPV vaccine. Rwanda, the only country to do so in Africa recently successfully completed a national HPV vaccination campaign with Merck's donation of Gardasil[®] reaching 93% of all sixth grade girls with three doses. This was after extensive education of nurses and other health workers, and after community sensitization through a public-private partnership (Binagwaho et al., 2012). In addition, the Global Alliance for Vaccines and Immunizations recently announced the opportunity for developing countries to introduce HPV vaccine at a low cost (Tsui et al., 2009) and the Cameroonian Ministry of Health is submitting an application to receive Global Alliance for Vaccines and Immunizations subsidized HPV vaccine. The mobilization of nurses and use of effective communication strategies will play a critical role in the implementation of immunization programs.

Nurses are often the first point of contact with patients and play a critical role in promoting and delivering immunization programs globally (Gellin et al., 2000; Jakeway et al., 2008; Lindley et al., 2008; Nkowane et al., 2009; Robinson et al., 2001). Nurses play pivotal roles in educating patients and their families, mobilizing communities, and administering vaccines (Jakeway et al., 2008; Nkowane et al., 2009; WHO, 2008). Their direct involvement in the implementation of HPV immunization programs has contributed to vaccine acceptability in various countries including Canada (Duval et al., 2009; Erickson et al., 2005), the United Kingdom (Hopkins et al., 2009), the Netherlands (Kimman et al., 2006) and Nigeria (Makwe and Anorlu, 2011). Through health education, nurses can also influence parents' decisions to allow their children to be vaccinated (Dinh et al., 2007; Matin and LeBaron, 2004; Stone et al., 2002). Thus, as frontline healthcare personnel in Cameroon, nurses will be an important entry point for national cervical cancer initiatives, particularly in creating awareness and educating adolescents and their families.

In support of the Cameroonian government initiatives, the Cameroon Baptist Convention Health Services (CBCHS), a faith-based health care organization providing integrated health services in several regions of Cameroon, successfully launched a Women's Health Program that includes cervical cancer screening using visual inspection with acetic acid enhanced by digital cervicography, modeled after a similar program in Zambia (Mwanahamuntu et al., 2011; Wamai et al., 2012). CBCHS has about 80 health care facilities in six of the Cameroon's 10 regions. These include five large hospitals, 24 integrated health centers and about 50 primary health care centers in both urban and rural areas. Since 2007, the organization has screened over 15,000 women for cervical cancer at six Women's Health

Program clinics. To augment their cervical cancer prevention effort, in 2010 CBCHS implemented an HPV vaccination program with HPV vaccine (Gardasil®) donated by Axios International to immunize girls of ages 9–13 years (Wamai et al., 2012). The vaccine was offered at no cost, though CBCHS charged an administrative user fee of US\$ 8 for the three doses to those who could afford it. Six trained nurses who worked for the CBCHS' Women's Health Program sensitized parents/guardians, adolescents and the general public about HPV and cervical cancer and administered the vaccine in clinics, schools, churches, and communities (Ayissi et al., 2012).

Nurse education in Cameroon varies from 1 year (for auxiliary nurses) to 4 years for state registered nurse (Fongwa, 2002). There are five different grades of nursing staff in Cameroon: (i) Bachelor in Nursing Sciences, (ii) specialized state registered nurses (2 years college training after state registration as a nurse), (iii) state registered nurses, (iv) nursing assistants/auxiliary, and (v) assistant midwives. To date there are no reports on the role nurses play in implementing a HPV vaccination program in Cameroon. Furthermore, HPV vaccination is unique since it is new, administered only to adolescent girls and has not been integrated into other vaccination programs in Cameroon. This is particularly challenging, owing to the massive shortage of nurses in sub-Saharan African countries including Cameroon (Kinfu et al., 2009; Naicker et al., 2009; Narasimhan et al., 2004) hence it is important to explore their contribution to promoting a vaccination program.

The specific objectives of this study were: (1) to explore the knowledge and awareness of HPV, primary cause of cervical cancer and HPV vaccine among nursing staff not involved in the HPV vaccine immunization program at the four CBCHS health care facilities and (2) to explore the factors that may influence nurses willingness to inform and recommend HPV vaccine to patients. The significance of the study lies in showing the critical role that nurses' knowledge and awareness of HPV, cervical cancer, and HPV vaccines could play on efforts to introduce HPV vaccination programs in Cameroon with possible implications in similar low-income settings.

2. Methods

2.1. Study design and setting

This exploratory survey of nursing staff working in various departments was conducted at four CBCHS health care facilities. Two of these are outpatient facilities (health centers) in urban areas, which provide general adult, pediatric, and antenatal outpatient care, including laboratory services and HIV–tuberculosis care and treatment, but no blood transfusions or overnight services. The two hospitals, in rural areas, are both 250-bed facilities that provide both inpatient and outpatient adult, pediatric, and obstetric care, general surgery, ophthalmology, HIV care and treatment, physical therapy, laboratory and X-ray services, and other ancillary services in addition to supporting general surgery and internal medicine residency programs. The two hospitals and one outpatient facility

are located in North West Region, an Anglophone region. The other outpatient facility is located in Yaoundé, Cameroon's capital city in Center Region, a Francophone region. All health facilities in Cameroon, including CBCHS facilities, charge patient fees to pay for the costs of services provided.

2.2. Ethical considerations

Ethical approval was obtained from both Northeastern University (Boston, MA) and the CBCHS review committees. The nurses surveyed were assured about the confidentiality and informed that their participation was anonymous and voluntary and they had the full right not to participate or to withdraw from the study at any point after reading the consent form. Participants' approval to participate in the study was expressed by filling out the questionnaire.

2.3. Data collection

A three part structured self-administered questionnaire based on both literature review and expert opinion was administered in January and February 2011 to nursing staff who consented to participate. The first part collected socio-demographic information about the participants. The second part focused on understanding their knowledge of HPV, cervical cancer, and HPV vaccine. The last part explored willingness to inform patients about the vaccine. The draft questionnaires were pretested at one CBCHS facility (not included in the study) in Yaoundé with 40 nurses in order to determine the clarity and comprehensibility of the questionnaire.

Data were collected with the assistance of the Women Health Program staff comprising the supervisor, two peer educators, and two Women Health Program nurse-coordinators. The researchers briefed these Women Health Program staff members on the purpose of the study and data collection methods prior to study commencement and supervised them during data collection.

2.4. Recruitment strategy and sampling

We used a convenience sample of the nursing staff. The nurse coordinators introduced the researchers to the nursing staff present during the nurses' daily meeting at each health facility before beginning their daily clinical duties. Nursing staff who accepted to participate in the study were approached during their work breaks in the break room. The researchers and Women Health Program peer educators explained the study to the nursing staff, distributed the consent form to read and sign, and distributed the self-administered questionnaire to complete in private. The researchers and the peer educators then collected the consents and questionnaires. Study participants eligible for the study included all the four categories of nurses (Bachelor in Nursing Sciences, specialized state registered nurses, state registered nurses and nursing assistants/auxiliaries). The study excluded assistant midwives, nursing staff working in ophthalmic and anesthetic departments.

Table 1
Nurses demographic and education information ($n = 76$).

Demographic characteristics	Frequency	Percent
Gender		
Male	17	22
Female	59	78
Total	76	100
Age group		
15–25	12	15.8
26–35	32	42.1
36–45	26	34.2
46–55	4	5.3
56–65	1	1.3
Not specified	1	1.3
Total	76	100
Educational levels		
University education	9	11.8
Nursing diploma education	67	88.2
Total	76	100

2.5. Data analysis

Statistical analysis was performed using SAS 9.2 (SAS Institute Inc., Cary, NC, USA). Descriptive and univariate analyses were performed to look at the characteristics of the population, various factors and awareness, knowledge and beliefs about HPV, cervical cancer and HPV vaccines.

3. Results

3.1. Demographic characteristics of the sample

Out of 192 eligible nurses 76 (39.6%) participated in the study. Among the 76 nurses surveyed, 22% ($n = 17$) were males, 78% ($n = 59$) were females, and the majority were less than 36 years of age (57.9%) (Table 1). A small proportion (11.8%) had university education while the remainder (88.2%) had a nursing diploma from hospital-based training programs. The years of nursing practice among the nurses surveyed ranged from 2 months to 24 years, with the mean being 8 years of practice.

Table 2
Knowledge about HPV, primary cause of cervical cancer and HPV vaccine among nurses ($n = 76$).

Cluster	Knowledge item	Knowledge about HPV, cervical cancer, and prevention of HPV infection among nurses		
		% Knowledge item in brackets		
		True	False	Not specified
HPV infection	A person usually has symptoms when infected with HPV	50 (65.8)	21 (27.6) ^a	5 (6.6)
	Most types of HPV infections cannot clear up on their own	20 (26.3)	53 (69.7) ^a	3 (4.0)
	HPV is usually a sexually transmitted virus	52 (68.4) ^a	23 (30.3)	1 (1.3)
	Only women can get infected with HPV	31 (40.8)	43 (56.6) ^a	2 (2.6)
	Only young people can get infected with HPV	69 (90.8)	6 (7.9) ^a	1 (1.3)
Cervical cancer	Cervical cancer and genital warts are caused by HPV infection	69 (90.8) ^a	6 (7.9) ^a	1 (1.3)
	Prevention of HPV infection	45 (59.2) ^a	29 (38.2)	2 (2.6)
HPV infection	An abnormal Pap test result may indicate an HPV infection	56 (73.7) ^a	16 (21.1)	4 (5.3)
	You need more than one jab to complete HPV vaccination dose	68 (89.5) ^a	6 (7.9) ^a	2 (2.6)
	HPV vaccine prevents infections of most HPV types that cause cervical cancer	60 (78.9) ^a	12 (15.8)	4 (5.3)

^a Represents the correct answer.

3.2. Knowledge of HPV, cervical cancer and HPV vaccine

The overwhelming majority (90.8%) among the 76 nursing staff surveyed acknowledged that cervical cancer is caused by HPV infection, which can affect people regardless of their age. A large proportion (73.7%) was aware that an abnormal Pap smear result may indicate an HPV infection (Table 2). Misconceptions remained about the definition of HPV, gender association to HPV infection, means of protection against the virus and HPV symptoms. A very low proportion (26.3%) of the nurses surveyed were unaware that most types of HPV can clear on their own and 40.8% were unaware that both men and women have an equal risk of infection. Furthermore, about a third (31.6%) did not successfully identify HPV as a sexually transmitted infection (STI), while 43.4% thought that HPV is an uncommon STI. Over half (59.2%) considered condom use as an important means of protection against HPV infection.

Despite the lack of knowledge that HPV is an STI, a high proportion of the nurses surveyed (78.9%) recognized HPV vaccine as an important means of protection against HPV infections (Table 2). On vaccine safety, about half mentioned that they were very concerned about the side effects of the vaccine. Even though 63.2% felt that they have insufficient information about HPV vaccines, 78.9% believed the vaccine is safe. Asked what procedure with regard to reproductive health concerns should be followed prior to vaccination, 42.1% believed pregnancy and HIV tests should be done, but 23.7% did not believe this was necessary (Table 3). Most of the nurses surveyed felt that issues of sexuality should be discussed before recommending the vaccine. In regards to vaccinating HIV-infected women, 52% felt this population should be vaccinated. About one half felt that HPV vaccination might increase adolescent sexual activity and risk-taking.

3.3. Willingness to inform patients about the vaccine

About two thirds (69.7%) of the nurses surveyed stated that they would often recommend HPV vaccination to 9–13 year old girls (Table 3). When deciding to recommend HPV vaccination, 56.6% would base their recommendation

Table 3
Nurses' knowledge about HPV vaccine and willingness to recommend it to their patient (n = 76).

Response statement	% Response				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am very concerned about the side effects of HPV vaccination	7.9 (n = 6)	18.4 (n = 14)	13.2 (n = 10)	35.5 (n = 27)	18.4 (n = 14)
I often recommend HPV vaccination to my patients of age 9–13 years old	3.9 (n = 3)	5.3 (n = 4)	11.8 (n = 9)	44.7 (n = 34)	25 (n = 19)
I feel I know enough about HPV vaccines.	25 (n = 19)	38.2 (n = 29)	14.5 (n = 11)	17.1 (n = 13)	1.3 (n = 1)
A pregnancy test should be done before HPV vaccine is administered.	7.9 (n = 6)	15.8 (n = 12)	25 (n = 19)	25 (n = 19)	17.1 (n = 13)
Women who have been infected with HIV should not be vaccinated against HPV	19.7 (n = 15)	32.9 (n = 25)	14.5 (n = 11)	19.7 (n = 15)	7.9 (n = 6)
It is necessary to discuss issues of sexuality before recommending HPV vaccines	3.9 (n = 3)	6.6 (n = 5)	5.3 (n = 4)	43.4 (n = 33)	32.9 (n = 25)
HPV is a relatively uncommon sexually transmitted disease.	14.5 (n = 11)	17.1 (n = 13)	9.2 (n = 7)	43.4 (n = 33)	5.3 (n = 4)
I think HPV vaccine is safe	5.3 (n = 4)	0	11.8 (n = 9)	52.6 (n = 40)	26.3 (n = 20)
Parents of adolescent patients are concerned that vaccination against a sexually transmitted infection may encourage earlier or riskier sexual behavior	15.8 (n = 12)	15.8 (n = 12)	21.1 (n = 16)	35.5 (n = 27)	5.3 (n = 4)
I think vaccination against a sexually transmitted infection may encourage earlier or riskier sexual behavior in adolescent patients	21.1 (n = 16)	31.6 (n = 24)	10.5 (n = 8)	21.1 (n = 16)	7.9 (n = 6)
HPV vaccines are very cheap in Cameroon	17.1 (n = 13)	28.9 (n = 22)	35.5 (n = 27)	10.5 (n = 8)	0
HPV vaccine is available in most Cameroonian hospitals or pharmacies	2.6 (n = 2)	3.9 (n = 3)	7.9 (n = 6)	32.9 (n = 25)	43.4 (n = 33)

on effectiveness, 53.9% said they were concerned about the side effects and only 6.6% were concerned with the cost of the vaccine. Furthermore, almost half (46.0%) disagreed with the statement that HPV vaccine is cheap in Cameroon, and an additional 35.5% neither agreed nor disagreed. A small proportion (5.3%) said they would consider other factors, such as whether the girl is already sexually active, the importance of the vaccine to the girl, and cooperation and willingness before recommending the vaccine.

4. Discussion

This study explored knowledge and awareness of HPV, primary cause of cervical cancer and HPV vaccine among nurses working at four facilities in Cameroon as well as the factors that might influence nurses' willingness to inform and recommend HPV vaccine. Consistent with previous studies, our data indicate low levels of knowledge about HPV infection, symptoms and prevention of cervical cancer but a moderately high level of knowledge about HPV vaccine as well as identifying multiple factors that could influence nurses' willingness to recommend the vaccines (Ali et al., 2010; Duval et al., 2009; Hopkins et al., 2009; Katahoire et al., 2008; Urasa and Darj, 2011).

Studies among nurses conducted in Uganda (Katahoire et al., 2008), Pakistan (Ali et al., 2010), and Tanzania (Urasa and Darj, 2011) found similar low level of knowledge regarding the symptoms associated with HPV infections, unawareness about HPV infections among males, the high rate of spontaneous remission of HPV infections and the mode of transmission of HPV. Other studies also found that knowledge about HPV among health care providers was highly associated with recommending the vaccine to families (Duval et al., 2009; Hopkins et al., 2009).

Furthermore, the nurses' concern about the effectiveness and the side effects of the vaccine shows that there were considerable gaps in their education about HPV, cervical cancer and the vaccine. Two immediate factors may explain these gaps in knowledge levels. First, the nursing staff who participated in the survey had not undergone similar training on cervical cancer, HPV and HPV vaccine. Additionally, they were working in different departments and only a few were in immunization programs.

While there is a high level of willingness to inform the targeted 9–13 year old girls and their parents about HPV vaccination, the lack of knowledge about the efficacy of the vaccine may negatively influence their approach to patients and other stakeholders. It is probable that willingness to inform adolescents is influenced by the nurse's own level of awareness about vaccine efficacy, side effects and safety. Although 78.9% of the participants in our study believed the vaccine is safe, a report from India shows that doubts and suspicions about vaccine safety negatively affect vaccine implementation and public support (Larson et al., 2010).

On the other hand, the motivation for nurses to counsel adolescents and their parents could potentially be negatively influenced by concerns about the risk of increasing cost and decreasing availability of the vaccine once the donation program ends, since HPV vaccine is not included in the Cameroonian immunization schedule through the year 2018 (Wamai et al., 2012). As shown in one study, nurses tend to be more supportive of HPV vaccine when it is free (Duval et al., 2009).

In our study, low levels of awareness and knowledge about HPV as a STI and its association to cervical cancer is particularly noteworthy, since only 40.8% of participants knew that condom use reduces the risk of acquiring HPV. Owing to the relatively higher prevalence of HIV in

Cameroon affecting 320,000 women aged 15 and up in 2009 (UNAIDS, 2010), health facilities may have prioritized HIV awareness programs, disregarding other growing STIs such as HPV. As reported in some studies, HIV sensitization programs can often overshadow awareness of other STIs, and fail to recognize the increased incidence and mortality of cervical cancer among HIV-infected women and the importance of prevention methods (Denny et al., 2006; Mogtomo et al., 2009; Steen et al., 2009). Considering that HPV is one of the most common STIs among sexually active women, with a rate of 80% in the US alone (Jain et al., 2009), and that sub-Saharan Africa has the highest global incidence of cervical cancer (Bruni et al., 2010), it is imperative that healthcare professionals promote primary prevention, including delaying sexual debut, reducing number of sexual partners, using condoms, and educating youth about HPV vaccine, and motivating governments in the region to make HPV vaccine a routine immunization. All of the above strategies are important, since studies have shown condom use alone does not provide full protection (Winer et al., 2006; Zondervan et al., 1996). Therefore, we recommend an intensive on-the-job continuing education program for current nursing staffs and other health care workers regarding the importance of cervical cancer-screening, HPV as an STI and the role of HPV vaccine in the prevention of cervical cancer. We further recommend that such training be systematically included in nurses' education curricula so that newly trained nurses can effectively promote and provide HPV immunizations when they are universally available.

There were several limitations to this study. First, the low response rate (39.6%) and small sample size of 76 participants and inclusion of only nursing staff working at four CBCHS facilities does not allow us to draw significant conclusions of what is happening nationally in Cameroon. In addition, the self-reported data are subjective and may not reflect actual nursing practice. Furthermore, the association between the self-reported factors and nurses behaviors was outside the scope of this study, which future research could address directly. Nonetheless, this study has shed light on awareness and knowledge of HPV among nursing staff in a major health service system run by a faith-based nongovernmental organization and can be a basis for further studies to inform program and policy development on HPV immunization and cervical cancer in Cameroon and in similar settings in low-income countries in sub-Saharan Africa and elsewhere.

5. Conclusion

This study has highlighted important gaps in awareness and knowledge among nursing staff of all training levels in a faith-based nongovernmental health service system in rural and urban areas of northern and central Cameroon. This demonstrates the need to further integrate this cadre of health care professionals and sub-professionals into the discussion and training surrounding HPV, cervical cancer and HPV vaccine as part of the planning process for incorporating HPV immunization into the National Cancer Control Plan and Expanded Program on Immunization. Low levels of knowledge and misconceptions about HPV

and cause of cervical cancer as well as condom use as a preventive measure contrasted with high levels of knowledge about HPV vaccine, safety and effectiveness supports the need for more education of the nursing staff.

In view of studies showing that most people rely on nurses for information about immunization programs (Dinh et al., 2007; Matin and LeBaron, 2004; Smith et al., 2006; Stone et al., 2002), the reported interest among the nursing staff in our study can further be leveraged in order to increase the already-significant willingness to recommend the vaccine to parents and adolescents. Additionally, with nurses serving as a key source of information for parents and adolescents, it is imperative that they are not only providing accurate information but are also receiving government support and stewardship, a critical pillar for success as demonstrated in Rwanda (Binagwaho et al., 2012). Our results indicate that increasing willingness to recommend HPV vaccine, thereby increasing vaccine uptake, is contingent upon incorporating relevant training in formal educational programs for nurses.

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References

- Ali, S.F., Ayub, S., Manzoor, N.F., Azim, S., Afif, M., Akhtar, N., Jafery, W.A., Tahir, I., Farid-Ul-Hasnain, S., Uddin, N., 2010. Knowledge and awareness about cervical cancer and its prevention amongst interns and nursing staff in Tertiary Care Hospitals in Karachi, Pakistan. *PLoS ONE* 5 (6), e11059.
- Atashili, J., Smith, J.S., Adimora, A.A., Eron, J., Miller, W.C., Myers, E., 2011. Potential impact of antiretroviral therapy and screening on cervical cancer mortality in HIV-positive women in sub-Saharan Africa: a simulation. *PLoS ONE* 6 (4), e18527.
- Ayissi, C.A., Wamai, R.G., Oduwo, G.O., Perlman, S., Welty, E., Welty, T., Manga, S., Ogembo, J.G., 2012. Awareness, acceptability and uptake of human papillomavirus vaccine among cameronian school-attending female adolescents. *Journal of Community Health* 37 (6), 1127–1135.
- Binagwaho, A., Wagner, C.M., Gatera, M., Karema, C., Nutt, C.T., Ngabo, F., 2012. Achieving high coverage in Rwanda's national human papillomavirus vaccination programme. *Bulletin of the World Health Organization* 90 (8), 623–628.
- Bosch, F., Lorincz, A., Munoz, N., Meijer, C., Shah, K., 2002. The causal relation between human papillomavirus and cervical cancer. *Journal of Clinical Pathology* 55 (4), 244.
- Bruni, L., Diaz, M., Castellsagué, M., Ferrer, E., Bosch, F.X., de Sanjosé, S., 2010. Cervical human papillomavirus prevalence in 5 continents: meta-analysis of 1 million women with normal cytological findings. *Journal of Infectious Diseases* 202 (12), 1789–1799.
- D Vuyst, H., Lillo, F., Broutet, N., Smith, J.S., 2008. HIV, human papillomavirus, and cervical neoplasia and cancer in the era of highly active antiretroviral therapy. *European Journal of Cancer Prevention* 17 (6), 545–554.
- Denny, L., Quinn, M., Sankaranarayanan, R., 2006. Chapter 8: screening for cervical cancer in developing countries. *Vaccine* 24 (Suppl. 3), S371–S377.
- Dinh, T.A., Rosenthal, S.L., Doan, E.D., Trang, T., Pham, V.H., Tran, B.D., Tran, V.D., Phan, G.A., Chu, H.K., Breitkopf, C.R., 2007. Attitudes of mothers in Da Nang, Vietnam toward a human papillomavirus vaccine. *Journal of Adolescent Health* 40 (6), 559–563.
- Doh, A.S., Nkele, N.N., Achu, P., Essimbi, F., Essame, O., Nkegoum, B., 2005. Visual inspection with acetic acid and cytology as screening methods for cervical lesions in Cameroon. *International Journal of Gynaecology and Obstetrics* 89 (2), 167–173.

- Duval, B., Gilca, V., Boulianne, N., Pielak, K., Halperin, B., Simpson, M.A., Sauvageau, C., Ouakki, M., Dube, E., Lavoie, F., 2009. Cervical cancer prevention by vaccination: nurses' knowledge, attitudes and intentions. *Journal of Advanced Nursing* 65 (3), 499–508.
- Erickson, L.J., De Wals, P., Farand, L., 2005. An analytical framework for immunization programs in Canada. *Vaccine* 23 (19), 2470–2476.
- Ferlay, J., Shin, H.R., Bray, F., Forman, D., Mathers, C., Parkin, D.M., 2010. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer* 127 (12), 2893–2917.
- Fongwa, M.N., 2002. International health care perspectives: the Cameroon example. *Journal of Transcultural Nursing* 13 (4), 325–330.
- Gellin, B.G., Maibach, E.W., Marcuse, E.K., 2000. Do parents understand immunizations? A national telephone survey. *Pediatrics* 106 (5), 1097–1102.
- Goldie, S.J., Gaffikin, L., Goldhaber-Fiebert, J.D., Gordillo-Tobar, A., Levin, C., Mahé, C., Wright, T.C., 2005. Cost-effectiveness of cervical-cancer screening in five developing countries. *New England Journal of Medicine* 353 (20), 2158–2168.
- Hawes, S.E., Critchlow, C.W., Sow, P.S., Toure, P., N'Doye, I., Diop, A., Kuypers, J.M., Kasse, A.A., Kiviati, N.B., 2006. Incident high-grade squamous intraepithelial lesions in Senegalese women with and without human immunodeficiency virus type 1 (HIV-1) and HIV-2. *Journal of the National Cancer Institute* 98 (2), 100–109.
- Hopkins, T.G., Wood, N.J., West, R.M., Darling, J.C., 2009. UK health professionals' attitudes and knowledge regarding human papillomavirus (HPV) vaccination: a West Yorkshire Study. *Journal of Paediatrics and Child Health* 45 (11), 652–655.
- Jain, N., Euler, G.L., Shefer, A., Lu, P., Yankey, D., Markowitz, L., 2009. Human papillomavirus (HPV) awareness and vaccination initiation among women in the United States. *National Immunization Survey-Adult 2007*. *Preventive Medicine* 48 (5), 426–431.
- Jakeway, C.C., LaRosa, G., Cary, A., Schoenfisch, S., 2008. The role of public health nurses in emergency preparedness and response: a position paper of the association of state and territorial directors of nursing. *Public Health Nursing* 25 (4), 353–361.
- Jemal, A., Bray, F., Center, M.M., Ferlay, J., Ward, E., Forman, D., 2011. Global cancer statistics. *CA: A Cancer Journal for Clinicians* 61 (2), 69–90.
- Katahoire, R.A., Jitta, J., Kivumbi, G., Murokora, D., Arube, W.J., Siu, G., Arinaitwe, L., Bingham, A., Mugisha, E., Tsu, V., LaMontagne, D.S., 2008. An assessment of the readiness for introduction of the HPV vaccine in Uganda. *African Journal of Reproductive Health* 12 (3), 159–172.
- Kimman, T.G., Boot, H.J., Berbers, G.A., Vermeer-de Bondt, P.E., Ardine de Wit, G., de Melker, H.E., 2006. Developing a vaccination evaluation model to support evidence-based decision making on national immunization programs. *Vaccine* 24 (22), 4769–4778.
- Kinfu, Y., Dal Poz, M.R., Mercer, H., Evans, D.B., 2009. The health worker shortage in Africa: are enough physicians and nurses being trained? *Bulletin of the World Health Organization* 87 (3), 225–230.
- Larson, H.J., Brocard, P., Garnett, G., 2010. The India HPV-vaccine suspension. *Lancet* 376 (9741), 572–573.
- Lindley, M.C., Boyer-Chu, L., Fishbein, D.B., Kolasa, M., Middleman, A.B., Wilson, T., Wolicki, J., Wooley, S., 2008. The role of schools in strengthening delivery of new adolescent vaccinations. *Pediatrics* 121 (Suppl. 1), S46–S54.
- Lynge, E., Rebolj, M., 2009. Primary HPV screening for cervical cancer prevention: results from European trials. *Nature Reviews. Clinical Oncology* 6 (12), 699–706.
- Maine, D., Hurlburt, S., Greeson, D., 2011. Cervical cancer prevention in the 21st century: cost is not the only issue. *American Journal of Public Health* 101 (9), 1549–1555.
- Makwe, C.C., Anorlu, R.I., 2011. Knowledge of and attitude toward human papillomavirus infection and vaccines among female nurses at a tertiary hospital in Nigeria. *International Journal of Womens Health* 3, 313–317.
- Massad, L.S., Ahdieh, L., Benning, L., Minkoff, H., Greenblatt, R.M., Watts, H., Miotti, P., Anastos, K., Moxley, M., Munderspach, L.L., Melnick, S., 2001. Evolution of cervical abnormalities among women with HIV-1: evidence from surveillance cytology in the women's interagency HIV study. *Journal of Acquired Immune Deficiency Syndromes* 27 (5), 432–442.
- Matin, M., LeBaron, S., 2004. Attitudes toward cervical cancer screening among Muslim women: a pilot study. *Women and Health* 39 (3), 63–77.
- Mbakop, A., Yomi, J., Yankeu, J., Nkegoum, B., Mouelle Sone, A., 1997. Cancer localisation in men and women aged over 50 in Cameroon. *Bulletin du Cancer* 84 (12), 1119–1122.
- McCarey, C., Pirek, D., Tebeu, P.M., Boulvain, M., Doh, A.S., Petignat, P., 2011. Awareness of HPV and cervical cancer prevention among Cameroonian healthcare workers. *BMC Women's Health* 11 (1), 45.
- Mogtomo, M.L., Malieugoue, L.C., Djiépgang, C., Wankam, M., Moune, A., Ngane, A.N., 2009. Incidence of cervical disease associated to HPV in human immunodeficiency infected women under highly active antiretroviral therapy. *Infectious Agents Cancer* 4, 9.
- Mwanahamuntu, M.H., Sahasrabudhe, V.V., Kapambwe, S., Pfaendler, K.S., Chibwesa, C., Mkumba, G., Mudenda, V., Hicks, M.L., Vermund, S.H., Stringer, J.S.A., 2011. Advancing cervical cancer prevention initiatives in resource-constrained settings: insights from the Cervical Cancer Prevention Program in Zambia. *PLoS Medicine* 8 (5), e1001032.
- Naicker, S., Plange-Rhule, J., Tutt, R.C., Eastwood, J.B., 2009. Shortage of healthcare workers in developing countries – Africa. *Ethnicity & Disease* 19 (1), 60.
- Narasimhan, V., Brown, H., Pablos-Mendez, A., Adams, O., Dussault, G., Elzinga, G., Nordstrom, A., Habte, D., Jacobs, M., Solimano, G., 2004. Responding to the global human resources crisis. *The Lancet* 363 (9419), 1469–1472.
- Nkowane, A.M., Boualam, L., Haithami, S., El Sayed el, T.A., Mutambo, H., 2009. The role of nurses and midwives in polio eradication and measles control activities: a survey in Sudan and Zambia. *Human Resource Health* 7, 78.
- Parkin, D., Ferlay, M., Hamdi-Cherif, J., Sitas, M., Thomas, F., Wabinga, J., Whelan, H., 2003. *Cancer in Africa: Epidemiology and Prevention*. IARC Press (IARC Scientific Publication No. 153), Lyon, France.
- PATH, 2006. *Current and Future HPV Vaccines: Promise and Challenges*. PATH, Seattle.
- Perkins, R.B., Langrish, S.M., Stern, L.J., Figueroa, J., Simon, C.J., 2007. Comparison of visual inspection and Papanicolaou (PAP) smears for cervical cancer screening in Honduras: should PAP smears be abandoned? *Tropical Medicine and International Health* 12 (9), 1018–1025.
- Robinson, J.S., Burkhalter, B.R., Rasmussen, B., Sugiono, R., 2001. Low-cost on-the-job peer training of nurses improved immunization coverage in Indonesia. *Bulletin of the World Health Organization* 79 (2), 150–158.
- Robyr, R., Nazeer, S., Vassilakos, P., Matute, J.C., Sando, Z., Halle, G., Mbakop, A., Campana, A., 2002. Feasibility of cytology-based cervical cancer screening in rural Cameroon. *Acta Cytologica* 46 (6), 1110–1116.
- Sankaranarayanan, R., Nene, B.M., Shastri, S.S., Jayant, K., Muwonge, R., Budukh, A.M., Hingmire, S., Malvi, S.G., Thorat, R., Kothari, A., Chinoy, R., Kelkar, R., Kane, S., Desai, S., Keskar, V.R., Rajeshwarkar, R., Panse, N., Dinshaw, K.A., 2009. HPV screening for cervical cancer in rural India. *New England Journal of Medicine* 360 (14), 1385–1394.
- Saslow, D., Runowicz, C.D., Solomon, D., Moscicki, A.B., Smith, R.A., Eyre, H.J., Cohen, C., 2002. American Cancer Society guideline for the early detection of cervical neoplasia and cancer. *CA: A Cancer Journal for Clinicians* 52 (6), 342–362.
- Schuman, P., Ohmit, S.E., Klein, R.S., Duerr, A., Cu-Uvin, S., Jamieson, D.J., Anderson, J., Shah, K.V., 2003. Longitudinal study of cervical squamous intraepithelial lesions in human immunodeficiency virus (HIV)-seropositive and at-risk HIV-seronegative women. *Journal of Infectious Diseases* 188 (1), 128–136.
- Sitas, F., Parkin, D.M., Chirenje, M., Stein, L., Abratt, R., Wabinga, H., 2008. Part II: cancer in indigenous Africans—causes and control. *The Lancet Oncology* 9 (8), 786–795.
- Smith, P.J., Kennedy, A.M., Wooten, K., Gust, D.A., Pickering, L.K., 2006. Association between health care providers' influence on parents who have concerns about vaccine safety and vaccination coverage. *Pediatrics* 118 (5), e1287–e1292.
- Steen, R., Wi, T.E., Kamali, A., Ndowa, F., 2009. Control of sexually transmitted infections and prevention of HIV transmission: mending a fractured paradigm. *Bulletin of the World Health Organization* 87 (11), 858–865.
- Stone, E.G., Morton, S.C., Hulscher, M.E., Maglione, M.A., Roth, E.A., Grimshaw, J.M., Mittman, B.S., Rubenstein, L.V., Rubenstein, L.Z., Shekelle, P.G., 2002. Interventions that increase use of adult immunization and cancer screening services: a meta-analysis. *Annals of Internal Medicine* 136 (9), 641–651.
- Tsui, J., LaMontagne, D.S., Levin, C., Bingham, A., Menezes, L., 2009. Policy development for human papillomavirus vaccine introduction in low-resource settings. *Open Vaccine Journal* 2, 113–122.
- UNAIDS, 2010. UNAIDS report on the global AIDS epidemic 2010. http://www.unaids.org/globalreport/documents/20101123_GlobalReport_full_en.pdf.
- Urasa, M., Darj, E., 2011. Knowledge of cervical cancer and screening practices of nurses at a regional hospital in Tanzania. *African Health Sciences* 11 (1), 48–57.
- Wamai, R.G., Ayissi, C.A., Oduwo, G.O., Perlman, S., Welty, E., Manga, S., Ogumbo, J.G., 2012. Assessing the effectiveness of a community-based sensitization strategy in creating awareness about HPV, cervical

- cancer and HPV vaccine among parents in north west Cameroon. *Journal of Community Health* 37 (5), 917–926.
- WHO, 2010. Human Papillomavirus and Related Cancers. WHO/ICO/HPV Information Centre, Barcelona, Spain.
- WHO, 2008. The World Health Report 2008: Primary Health Care Now More Than Ever. World Health Organization, Geneva, Switzerland.
- Winer, R.L., Hughes, J.P., Feng, Q., O'Reilly, S., Kiviat, N.B., Holmes, K.K., Koutsky, L.A., 2006. Condom use and the risk of genital human papillomavirus infection in young women. *The New England Journal of Medicine* 354 (25), 2645–2654.
- Zondervan, K.T., Carpenter, L.M., Painter, R., Vessey, M.P., 1996. Oral contraceptives and cervical cancer – further findings from the Oxford Family Planning Association contraceptive study. *British Journal of Cancer* 73 (10), 1291–1297.
- Zur Hausen, H., 2002. Papillomaviruses and cancer: from basic studies to clinical application. *Nature Reviews Cancer* 2 (5), 342–350.