IWK Health Centre

DALHOUSIE UNIVERSITY
TECHNOSCIENCE & REGULATION RESEARCH UNIT

RESEARCH REPORT

The Administration of a Quadrivalent Human Papillomavirus Vaccine for Minors: Challenges and Implications in the Canadian Context

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Abbreviations

DTaP: Diphtheria-Tetanus-acellular Pertussis

HBV: Hepatitis B Virus

HIV: Human Immunodeficiency Virus

HPV: Human Papillomavirus

LGBT: Lesbian, Gay, Bisexual and Transgender

NS: Nova Scotia

STI: Sexually transmitted infections

Executive Summary

Introduction

The introduction of a new vaccine against four Human Papillomavirus (HPV) types into Canadian school-based immunization programs presented challenges. These included controversies surrounding a vaccine to prevent sexually transmitted infections in girls as well as issues related to public health administration. Nova Scotia elected to reorganize their school-based immunization age-cohorts to synchronize the HPV vaccine for school-aged girls with Hepatitis B (Hep B/Hepatitis B Virus/HBV) and Tetanus-Diptheria and Acellular Pertussis (TDaP/DTaP) immunization.

Nova Scotia (NS) has a well organized cervical cancer screening registry to monitor screening rates, identify underscreened populations, issue reminder letters and evaluate gaps and challenges in the program.[1] There is however no integration of records of cytology with those of HPV immunization. Future strategies for monitoring adverse events following immunization, and sectors and rates of uptake of HPV immunization and Pap screens will require these integrated data.[2]

WHAT IS KNOWN

HPV is the leading cause of cervical cancer (HPV 16, 18) and genital warts (HPV 6, 11). It is sexually transmitted.

The quadrivalent HPV vaccine licensed for public delivery in Canada prevents HPV strains 6, 11, 16 and 18.

Fear of cancer promotes HPV vaccine acceptance, but controversy remains surrounding the stigma of sexually transmitted infections.

In Nova Scotia, public health nurses play a key role in the delivery of HPV immunization, through school-based programs.

HPV immunization has 80% uptake in Nova Scotia.

Nova Scotia's Pap registry is not integrated with an HPV immunization registry. This poses a future challenge for obtaining long-term data on HPV disease control in the province.

Our questions

We designed this study with a view to understanding the unique benefits and challenges of introducing HPV vaccine in NS, a province with rates of cervical cancer that are higher than elsewhere in Canada. We asked questions such as: How was this novel vaccine fitted into the existing school-based immunization programs? Did the arrival of the HPV vaccine cause changes in the school-based immunization programs, and if so, how? How did public health authorities engage the public in delivering a new vaccine? What are the conversations among teens, parents and healthcare providers about HPV, a sexually transmitted infection, and about a vaccine against it? How do healthcare providers talk to teens and parents about a new vaccine protecting against an infection spread by intimate contact? What are the practical and social challenges in a 3-dose schedule to deliver the HPV vaccine?

To explore these areas, we conducted in-depth, semi-structured, one-on-one interviews with a health lawyer, 6 nurses and 8 vaccine scientists. Five nurses worked in school-based programs and one worked in a non-profit reproductive health clinic. The clinical scientists were employed in a public-sector university research setting. Our conversations with the participants probed their experiences, knowledge, and opinions about the specific needs, solutions and challenges of HPV immunization and cervical cancer prevention in Nova Scotia. We

studied scientific research papers and Canadian and international policy documents. This helped us to refine our analytical frameworks and perspectives. We prepared a 'content analysis' of the principal themes and patterns that emerged from the interview transcripts. We provided the participants with a preliminary draft of this report and incorporated their suggestions and amendments.

Findings

Introduction of HPV vaccine in Canada

The accelerated implementation of the Merck Gardasil® HPV vaccine limited the usual opportunities for public discussion surrounding the introduction of a novel vaccine. It created decision-making challenges for existing immunization programs and operational challenges for delivery.

Policy discussions about including other vaccines (e.g., a quadrivalent meningococcal vaccine, or a second dose of chicken pox vaccine in NS) may have been sidelined with prioritization of the HPV vaccine.

School based HPV Immunization in Nova Scotia

Advantages

- The introduction of the HPV vaccine led to the clustering of all school vaccines into Grade 7. This streamlined school immunization clinics and created opportunities for knowledge sharing with vaccine recipients and their parents. Grade 7 vaccination improved the chances to manage delivery logistics and needle anxieties. Nurses described how they contain the potential "domino effect" of needle anxiety among teen recipients through friendly conversation, preventing rumor about coercion, giving prior education, and immunizing in small groups in a private, comfortable or friendly setting. Providing juice and cookies after the immunization (done in co-ordination with schools' Breakfast Programs) facilitates immunization clinics.
- Health providers and parents felt more comfortable having a conversation about sexual health protection with teens than with students in Grade 4, although the HBV vaccine had been available before. Parents had reduced anxieties about a vaccine against STIs for older children. Good acceptance of the HPV vaccine was indicated by 80% uptake in Nova Scotia.

Problems

- With several vaccines delivered at one time, some parents saw the HPV vaccine as less urgent than other vaccines and therefore optional;
- While juice and cookies may soothe anxiety and facilitate immunization clinics, availability may depend on public health budgets and the capacity of school-run Breakfast Programs. Interestingly, juice supplies were ample after H1N1, but faced some supply limitations thereafter.
- Despite efforts to present the information and consent form in simple and accessible language, some parents had difficulty understanding the forms. Nurses reported that vaccine refusals were often the result of parents not understanding the form. Privacy requirements prevent the nurses from engaging parents in dialogue and discussion to address refusals or misunderstandings of information forms.

- The shift of vaccines into Grade 7, i.e., adolescence, led, in some cases, to conflicts between recipients, parents and healthcare providers over who had decision-making authority in immunization and informed consent. With Grade 7 immunizations, parental *vs.* recipient consent is not as obvious as with Grade 4 students. The principle of adolescent autonomy (prior to age of legal majority) recognises the capacity of teens to consent to vaccination against HPV and also to other measures to safeguard their reproductive health. In practice, however, immunizations do not usually proceed without the consent or at least the awareness of the parent. A participant said that while she would accept her child obtaining the vaccine without her prior knowledge, she would be unhappy about not being informed and would see it as marking a lack of trust between her and her children.

Gaps in HPV awareness

- There are significant gaps in teen and parent awareness about the rationale and prophylactic limitations of the HPV vaccine and the need to maintain Pap screening;
- Direct-to-consumer advertising of the vaccine is not permitted in Canada. The manufacturer may influence parents, healthcare providers and health advocacy groups, however, through targeted 'educational endorsements', e.g., pharma-funded 'motivational speakers' provide talks about HPV and cervical cancer in Nova Scotia's schools;
- There is debate over whether conversations about the HPV vaccine should emphasize its role as protection against a prevalent sexually transmitted infection or against the relatively rare outcome of virus-induced cancer. Conversations about STI lend controversy to HPV immunization for adolescents. However, an exclusive focus on cancer to the neglect of the role of sexual transmission dodges transparent knowledge transfer and contributes to low public awareness about HPV transmission and risk.

Compliance challenges

- HPV immunization is associated with noteworthy pain in the arm, which may pose a challenge for follow-up dose compliance. Nurses noted, however, that counseling and psychologically preparing the girls for the injection can effectively control needle anxiety.
- Public health authorities in NS have expanded the HPV vaccine reach to any girl born after October 1, 1993 and seek to facilitate schedule-completion through physicians. There are, however, challenges identifying those who have received only part of their dose schedules, as well as those who missed but are still eligible for vaccines. Limited funding, staff shortages and the complex logistics of organizing immunization clinics hamper catch-up immunization. The outbreak of widespread epidemic disease also hampered the delivery of HPV vaccine; e.g., the H1N1/09 pandemic influenza prevented HPV immunization for students in Grade 7 that year. A catch-up effort for a double immunization cohort (Grades 7 and 8) in 2010 was necessary, increasing the workload of public health staff.

Gaps in infrastructure and delivery

- NS immunization records are entered into the provincial Application for Notifiable Disease Surveillance (ANDS), a central immunization registry of the Nova Scotia Department of Health Promotion and Protection. Vaccine providers are required to provide Public Health with a record of immunizations for entry. Post-immunization records are either in reciprocal forms or copies of patient files or a practice-specific post-immunization form. [3] The fragmented state of health surveillance and the current difficulties of migrating information in paper-based record maintenance could impede future efforts to improve the long-term evaluation of HPV vaccine effectiveness and screen hard-to-reach and at-risk females who cannot obtain HPV immunization.
- The recommendations at the 1996 Canadian Immunization Conference were to establish immunization surveillance and tracking systems to identify at-risk populations and to facilitate catch-up.[4] However, Nova Scotia still does not have an electronic immunization registry. Further, privacy laws hamper the creation of an electronic surveillance system based on the integration of HPV immunization and cancer registries.
- There are persistent difficulties in reaching specific vulnerable groups, including abused women, refugees and immigrants, Lesbian, Gay, Bisexual and Transgender (LGBT) persons, and street youth. Teenagers who have dropped out of school and left home may not be able to access the vaccine except through sporadic catch-up programs which have only limited success.

WHAT THIS STUDY SHOWS

Challenges in communication about HPV immunization, healthy sexuality and lifestyle choices for teens in schools.

Need for greater engagement of policymakers, scientists, health care providers and members of the public prior to rollout of novel vaccines.

Need to engage the public about continued Pap screening and complementary health protections to prevent cancer and STI other than HPV.

Need to enlarge access to preventive healthcare for hard-to-reach teens (e.g., street dwellers, school drop outs).

Need to develop HPV immunization registries in Nova Scotia and integrate these with Pap registries.

Future Policy and Action

The analysis of the data from this study highlights, above all, the ongoing need to generate and strengthen HPV prevention not only through screening and immunization but also through the translation of health knowledge. This means the proactive development of capacity around HPV-related communication, enabling specialists to talk with non-specialists about HPV and its prevention, and stimulating curiosity and conversation among the public about an under-discussed health risk to both men and women.

Talk time and knowledge sharing is also important in the practical management of immunization clinics. A participant suggested that face-to-face interaction between nurses, teens, school staff, and parents reduces vaccine anxiety and streamlines clinic flows.

We identify some *knowledge opportunities* to protect residents of Canada from the easily preventable harms from HPV infection.

For the Public

- Creation of opportunities for talk time through, for e.g., radio question-answer sessions, moderated internet forums, newspapers, posters, flyers, and meetings.
- Creation of awareness about how HPV is transmitted, the link of HPV to genital warts, oral and anogenital cancers, who can receive HPV immunization (and how, when and why); and who needs Pap screening (and how often and why).

> As a small contribution towards greater HPV knowledge sharing, we have prepared '**HPV and Cancer,'** a glossary of terms about HPV and its prevention, as well as a list of online resources on HPV. Please find these at the end of this Executive Summary. We welcome your feedback!

For nurses likely to work in immunization

- Forums to meet and/or talk and share views, knowledge, challenges, and lessons learned through interactions with teens and parents around immunization.
- Continuing educational opportunities to upgrade know-how to share knowledge about HPV prevention and healthy sexuality with teens.
- Education and counseling about handling of ethical and legally sensitive situations in immunization; e.g., handling disagreement over school immunization between teens and parents without breaching privacy laws. This speaks to developing compromises between the need for confidentiality of adolescent care-seekers and the involvement of their parents in the consent process.

For physicians and health researchers

- Networks to share research (ongoing and potential) related to HPV vaccine acceptability and delivery.
- Circulation of educational documents and educational opportunities.
- Platforms for collaboration between pediatricians, oncologists, ob-gyn specialists, virologists and immunologists; e.g., webinars requiring basic software, open-access newsletters about debates and changes around screening and immunization guidelines.

For policy makers

- Forums for evidence-based discussions and collaborations with nurses, pediatricians, oncologists, ob-gyn specialists, virologists and immunologists.
- Strategies and mechanisms for public engagement, information exchange and debate prior to vaccine rollout of novel vaccines.
- Epidemiological and legal evidence-based interventions to link HPV immunization data and Pap registries.
- Public funding for longitudinal studies to generate social and clinical evidence towards the best population-based approaches for post-vaccination screening.

References

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[3] Capital District Health Authority, NS: www.cdha.nshealth.ca/system/files/sites/127/documents/reporting-requirements.pdf [Accessed August 4, 2011]
[4] Public Health Agency of Canada: Canadian Immunization Registry Network (CIRN). http://www.phac-aspc.gc.ca/im/cirn-rcri/index-eng.php [Accessed August 4, 2011]
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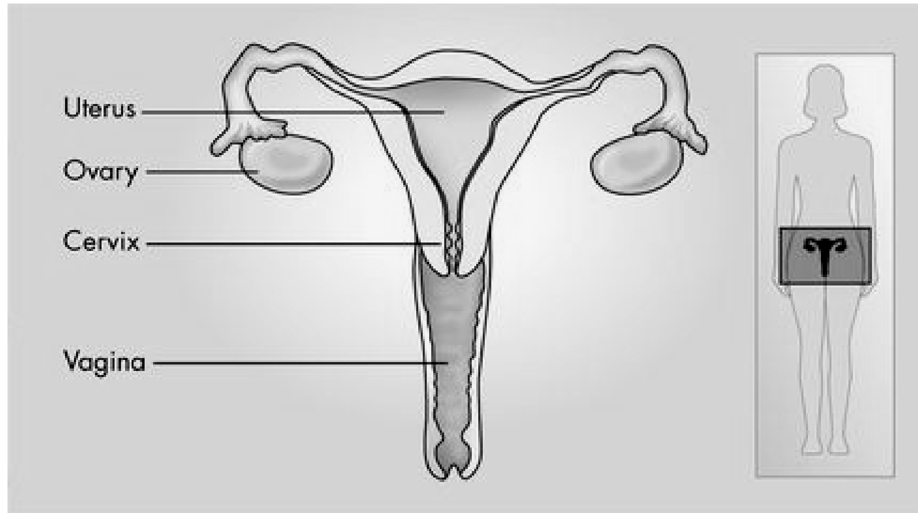
HPV and Cancer — A Glossary [1]



Atypical squamous cells of undetermined significance (ASC-US)
Medical term for an inconclusive Pap test. The squamous cells are flat cells resembling fish scales that are found in various parts of the body, including the cervix. ASC-US cells do not look clearly normal or abnormal. Approximately 3-10% of Pap results are ASC-US. Follow-up examination is needed to show that high-risk HPV is not present and abnormal cells have not formed.

Anal Cancer
Cancer that forms in the anus, which is the opening of the rectum (last part of the large intestine) to the outside of the body.

Anogenital tract
The genital tract encompasses the external and internal sex organs in both men and women.

Biopsy
Removal of a sample of tissue for microscope examination to check for presence of abnormal cells.

Cervical cancer incidence rate
The rate at which new cases of cervical cancer occur in a population. The numerator is the number of newly diagnosed cases of cervical cancer that occur in a defined period. The denominator is the population at risk of a diagnosis of cervical cancer during

[1] *Adapted from: IARC Handbooks of Cancer Prevention Volume 10: Cervix Cancer Screening* *http://www.iarc.fr/en/publications/pdfs-online/prev/handbook10/handbook10-glossary.pdf; Society of Gynecologists and The Society of Obstetricians and Gynaecologists of Canada (SOGC): http://www.hpvinfo.ca/*

this defined period multiplied by the length of this period, sometimes expressed as person-time.

Cervical cancer mortality rate
The rate at which deaths from cervical cancer occur in a population.

Cervical cancer register
Recording of information on all new cases of and deaths from cervical cancer occurring in a defined population.

Cervical Carcinoma in situ (CIS)
Cancerous cells that are confined to the cervix and have not spread to other parts of the body.

Cervicography
Photograph of the cervix taken after the application of 5% acetic acid.The images are interpreted by a specially trained evaluator.

Cervical cancer
Cancer of the entrance to the womb (uterus). The cervix is the lower, narrow part of the uterus, or womb. The uterus is a hollow, pear-shaped organ located in a woman's lower abdomen, between the bladder and the rectum. The cervix forms a canal that opens into the vagina, which leads to the outside of the body. The most common symptom of cancer of the cervix is abnormal bleeding. Regular pelvic exams and Pap testing can detect precancerous changes in the cervix. The Pap test is a procedure to sample the cervix tissue to check for abnormalities in the sample. Precancerous changes in the cervix can be treated with cryosurgery (freezing), cauterization, or laser surgery.

Cervical Intraepithelial Neoplasia (CIN) / Squamous Intraepithelial Lesions (SIL)
CIN and SIL are two commonly used terms to describe precancerous lesions or the abnormal growth of squamous cells observed in the cervix. Numbers from 1 to 3 (as in CIN 1 or CIN 3) are used to describe the degree of abnormal changes that have developed. CIN 1 is equivalent to mild dysplasia (abnormal cells), and often disappears on its own without treatment. CIN 2 or 3 is equivalent to moderate to severe dysplasia (pre-cancerous conditions that require treatment). *See* **Dysplasia**, **Low-grade squamous intraepithelial lesion (LSIL)** and **High-grade cervical lesions (HSIL/ CIN-II / CIN-III / CIS).**

Cervix
The lower, cylindrical end of the uterus (womb) that connects to the vagina.

Colposcopy
Examination of the vagina and the surface of the cervix using a lighted microscope (colposcope) for signs of pre-cancerous cells or cancer. A biopsy is often taken at the same time.

Cryosurgery
Treatment to destroy abnormal tissue on the cervix using an instrument that freezes the targeted cells.

Cytology
The medical term for a Pap test (smear).

Dysplasia
Abnormal cells on the cervix, which in moderate to severe cases may progress to cancer if not treated. ***See*** **Cervical Intraepithelial Neoplasia (CIN).**

Cytologically normal women
No abnormal cells are observed in the samples of their cells from their cervix.

Effectiveness
The reduction in incidence of and/or mortality from invasive cervical cancer due to screening practice, under real conditions and among those in the target population.

False negative result
A test result that appears normal, but in reality is not. In a Pap test, this is when cervical cells are wrongly interpreted as healthy, thus allowing abnormalities to progress unchecked.

False positive result
A test result that appears abnormal, but in reality is not. In a Pap test, this is when cervical cells are wrongly interpreted as abnormal, making additional tests necessary and causing anxiety.

High-grade cervical lesions (HSIL/ CIN-II / CIN-III / CIS)
High-grade cervical lesions are defined by a large number of precancerous cells on the surface of the cervix. These cells are distinctly different from normal cells. They have the potential to become cancerous cells and invade deeper tissues of the cervix. Cervical lesions may be referred to as moderate or severe dysplasia, HSIL, CIN-II, CIN-III, or cervical carcinoma in situ (CIS). Severe abnormalities (CIN 3) may develop into cancer if the cells are not removed. They are diagnosed using a colposcopy and biopsy. (**Note**: The Pap test is for screening, *not* diagnostic purposes)

Human papillomavirus (HPV)
The name for a group of viruses, of which there are more than 150 types. About 30 types of HPV target the genital area (spread through intimate skin-to-skin contact, primarily sexual intercourse), and these affect around 50 percent of adults (80 percent of women) at some point by the time they are 50. In most cases, HPV infection is cleared or becomes undetectable, causing no disease; however, persistent HPV infection is causally related to the development of cancers and genital warts. Almost all cervical cancers are attributed to persistent infection by HPV, particularly types 16 and 18. HPV is also associated with genital warts and head, neck, anal, penile, vulvar and vaginal cancers.

Invasive cervical cancer (ICC) / Cervical cancer
If the high-grade precancerous cells invade deeper tissues of the cervix or to other tissues or organs, then the disease is called invasive cervical cancer or cervical cancer.

Loop electrosurgical excision procedure (LEEP)
A fine wire loop, through which electrical energy flows, used to remove abnormal cervical tissue. The procedure can be done as an outpatient, with local anesthesia.

Low-grade squamous intraepithelial lesion (LSIL)
Mildly abnormal cells, also called CIN 1, diagnosed using a colposcopy and sometimes a biopsy. In most cases, these types of abnormal cervical cells go away on their own without treatment.

Oral cavity cancer
Cancer that forms in tissues of the mouth.

Organized screening
Screening programmes organized at national or regional level.

Opportunistic screening
Screening outside an organized or population-based screening programme, as a result of, for example, a recommendation for screening made during a routine medical consultation for the woman.

Papillomavirus Vaccines
Vaccines or candidate vaccines used to prevent HPV infections. Human vaccines are intended to reduce the incidence of cervical cancer. While they may be often composed of viral coat proteins, they contain no live or dead virus.

Pap Smear
A test in which a sample of cervical cells collected during a gynecologic exam is looked at under a microscope for signs of abnormalities. In a conventional Pap test, a "smear" of cervical cells is placed directly on a slide for examination. In the newer, "liquid-based" Pap the cervical cells are suspended in a solution before being placed on the slide, which some doctors think make them easier to accurately examine. The Pap (abbrev. Papanicolaou) test is named after Dr. George Papanicolaou, a cytopathologist who developed the sampling and staining technique that has become synonymous with cervical screening but is also used for other screening applications.

Penile Cancer
Cancer that forms on the skin or in the tissues of the penis.

Pharyngeal cancer
Cancer that forms in tissues of the pharynx, the hollow tube inside the neck that starts behind the nose and ends at the top of the windpipe and oesophagus.

Recall
Clarification of a perceived abnormality detected at screening, by performance of an additional procedure.

Referral
Physical referral of women to a clinical facility as a consequence of the screening test for diagnostic confirmation, e.g., by histology.

Reflex HPV testing
A test that is performed on a sample of cervical cells following an inconclusive Pap test (also see **ASC-US).**

Risk factor
Something that increases the chance of developing a disease. For example, a smoker with persistent HPV infection is at greater risk of developing cervical cancer.

Vaginal Cancer
Cancer that forms in the tissues of the vagina, the muscular "canal" that extends from the cervix (the opening of the uterus) to the outside of the body.

Vulvar cancer
Cancer of the vulva, the female genital area extending from the pubic mound to the anus. It includes the pubic mound, labia (lips), clitoris and vaginal opening.

HPV TRANSMISSION, HEALTH RISKS, DISEASE AND PREVENTION: ONLINE RESOURCES

Cervical cancer is a unique disease that affects a wide range of people. Alliances and networking are crucial to convey and access knowledge and to raise awareness of the need for HPV-disease prevention. These websites provide links, tools and insights for knowledge exchanges to this end.

> **DISCLAIMER:** The information provided on these sites may change. The material thereon may be subject to copyright and the reproduction of materials may be prohibited in the absence of written permission. The contents of the sites (text, graphics, images, and other material) are for informational purposes only. They are NOT a substitute for professional medical advice, diagnosis, or treatment. **Our listing of these resources as useful information is not to be read as an endorsement of any person or organization.**

- PUBLIC HEALTH AGENCY OF CANADA. **Human Papillomavirus (HPV) Prevention and HPV Vaccines: Questions and Answers**
  This site provides information on HPV risks, effects, modes of transmission, global burdens. It discusses the safety and efficacy of prevention of cervical cancer through HPV vaccination. The information is downloadable in English and French and as a webpage or PDF file.
  [GOTO: http://www.phac-aspc.gc.ca/std-mts/hpv-vph/hpv-vph-vaccine-eng.php
  http://www.phac-aspc.gc.ca/std-mts/hpv-vph/pdf/hpv-vph-vac-eng.pdf]

- THE SOCIETY OF OBSTETRICIANS AND GYNAECOLOGISTS OF CANADA. **HPVInfo**
  This site is provided by The Society of Obstetricians and Gynaecologists of Canada. It presents information (in English and French) for teens, parents, teachers, and health professionals on HPV and other sexual and reproductive health issues.
  [GOTO: http://www.hpvinfo.ca/]

- THE INTERNATIONAL CENTRE FOR INFECTIOUS DISEASES (ICID). **Canadian Network on HPV Prevention**
  The Canadian Network on HPV Prevention seeks to develop collaborations and partnerships to reduce the burden of HPV associated diseases in Canada.
  [GOTO: http://www.icid.com/canadian-network-on-hpv-prevention]

  The site also offers links to a newsletter (*HPV Today*) and to free webinars on HPV prevention (e.g. *The Use of HPV Vaccine and Males)*
  [GOTO: http://www.hpvtoday.com/
  http://vimeo.com/25093472]

- INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC). **GLOBOCAN.**
  The International Agency for Research on Cancer provides a series of cancer site and country-specific fact sheets, which enables quick calculation of the future burden of cancer according to projected population changes up to 2030 in 182 countries and according to world region. Facilities for the tabulation and visual description of the global cancer burden can be accessed via the GLOBOCAN website.
  [GOTO: http://globocan.iarc.fr/]

The IARC also provides summary reports of the incidence and mortality from HPV related cancers in and across countries. e.g., Human Papillomavirus and Related Cancers: World Summary Report – 2010
[GOTO: http://screening.iarc.fr/doc/Human%20Papillomavirus%20and%20Related%20Cancers.pdf]

- PATH: **Stop Cervical Cancer: Advocacy, Information and Communication: Engaging Stakeholders at All Levels to Prepare for the Introduction of HPV Vaccines**
[GOTO: http://screening.iarc.fr/doc/StopCxCa_advocacy_2006.pdf]

- **Cervical Cancer Action (CCA)**
The website provides information (in English, Spanish and French) on the safety of HPV vaccines, vaccine safety reporting systems, the safety profile of HPV vaccines, and the use of HPV vaccines in special populations.
[GOTO: http://www.cervicalcanceraction.org/pubs/CCA_HPV_vaccine_safety.pdf]

- **HPV Vaccine Global Community**
This is an e-forum (requires registration; free of cost) for exchange of news and updates about HPV, for people working in In the field of reproductive health, adolescent health, STI and cancer prevention, and vaccine delivery.
[GOTO: http://hpv-vaccines.net/index.html]

- WORLD HEALTH ORGANIZATION, DEPARTMENT OF REPRODUCTIVE HEALTH AND RESEARCH: **Cervical cancer, human papillomavirus (HPV), and HPV vaccines: Key points for policy-makers and health professionals**
This booklet (English) provides information on HPV risks, effects, modes of transmission, global burdens. It discusses the safety and efficacy of prevention of cervical cancer through HPV vaccination. It outlines strategies for knowledge sharing and partnership development to this end. Furthermore, it suggests that introducing HPV vaccines may provide a platform for the introduction of vaccines against the human immunodeficiency virus (HIV) in the future, given the probable need to vaccinate the same target population of older children and adolescents.
[GOTO: http://www.who.int/reproductivehealth/publications/cancers/RHR_08_14/en/index.html]

- GRAHAM JANICE E, MISHRA, AMRITA. **Global challenges of implementing human papillomavirus vaccines.** *Int J Equity Health*. 2011 Jun 30;10(1):27. doi:10.1186/1475-9276-10-27
[GOTO: http://www.equityhealthj.com/content/pdf/1475-9276-10-27.pdf]