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## Original Research

# Cervical cancer, human papillomavirus and vaccines: assessment of the information retrieved from general knowledge websites in Chile



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## ABSTRACT

**Objectives:** Cervical cancer is the most common gynaecologic malignancy worldwide and is the sixth cause of cancer death in Chile. Human papillomavirus (HPV) is responsible for most cervical cancers. Individuals seeking basic information about HPV frequently turn to health information websites. We hypothesized that some of their data may be inaccurate.

**Study design:** Comparative analysis of information.

**Methods:** We analyze the content of highly accessed websites such as the Spanish version of Wikipedia and Yahoo Answers through the application of a questionnaire, as well as a website managed by the Chilean Ministry of Health (Minsal). The accuracy of each answer was confirmed by comparison with information retrieved from articles published by indexed journals.

**Results:** The information provided by the Spanish version of Wikipedia was accurate; nevertheless a few omissions were detected. The quality of the information provided by the Spanish version of Yahoo Answers was inaccurate and confusing. The Minsal website lacked important information on several topics about HPV even though it is managed and endorsed by the government.

**Conclusions:** We suggest periodical content reviews to increase the completeness, transparency and correctness of the website.

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## Introduction

Cervical cancer is the most common gynaecologic malignancy worldwide with an estimated 528,000 new cases for 2012 and

266,000 deaths worldwide.<sup>1</sup> In Chile, the mortality rate of cervical cancer is four times higher than that of developed countries, mainly affecting women of low socio-economic level.<sup>2</sup> Consequently, the Cervical Cancer Prevention Programme was established in 1987 to screen for cervical cancer by applying

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smear tests to women aged 25–64 years every 3 years.<sup>3</sup> In 2003 the programme was modified, so samples were collected for Papanicolaou, Human papillomavirus (HPV) DNA testing and naked-eye visual inspection of the cervix. Patients who were positive to these tests were referred for appropriate treatment. As a result, the mortality rate due to cervical cancer was reduced from 9.3% in 2000 to 5.8% in 2010. However, it is important to remember that women of low socio-economic level tend to lack biomedical knowledge and have difficulties in accessing health professionals. Therefore, the Internet has become a valuable source of healthcare information. As an example, 74.5% of the Chilean population had access to the Internet either by the use of a smartphone or computer by the end of 2015, removing social access to all-types of information.<sup>4</sup>

Currently, individuals are increasingly using the Internet to search health-related information.<sup>3</sup> A study reported that 82.5% of surveyed individuals used 'key words' with search engines, 33.7% visited general health-related websites and 12.5% accessed specific health information websites. Most surprising was the fact that 98.7% of these participants rated the information extracted from the Internet as understandable and 98.1% as trustworthy.<sup>4</sup> A latter study reported that 35% of the adults in the United States went online to establish what medical condition they might have, and 59% had searched online for health information during the previous year.<sup>5</sup> Already in 2009 it was reported that one of the prominent sources for general health information was Wikipedia, an open-access multilingual online encyclopaedia that receives contributions from its users, surpassing MedlinePlus and NHS Direct online.<sup>6</sup> Nowadays, patients count on the information from Wikipedia before visiting a healthcare professional.<sup>7</sup>

A study published in 2014 revealed a poor coverage of HPV information in other languages besides English.<sup>8</sup> Consequently, we questioned ourselves what information was available to the Chilean population in Spanish regarding the etiological agent responsible of nearly 96% of cervical cancer cases. Hence, we chose Wikipedia, Yahoo Answers and a website managed by the Chilean Ministry of Health (Minsal). The information provided by these websites was compared with scientific information obtained from specialized journals that were indexed by PubMed.

## Methods

In order to select the web pages to be analyzed, we performed an initial search on the website Alexa (March 11, 2015) (<http://www.alexa.com/topsites/countries/cl>) to establish the top 10 websites used by the Chilean population. As sources of general information we selected two websites: Wikipedia (ranked 10th) (<http://es.wikipedia.org>), a free-content virtual encyclopaedia, where information about any topic is loaded by anyone who wants to collaborate. The second website selected was Yahoo Answers (ranked 7th) (<http://espanol.answers.yahoo.com>), site maintained by an online community, and where questions of general interest are raised and answered. This website is also free to access.

We carried out bibliographic searches using PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>) as this database is often utilized by researchers in health science due to its easy

accessibility and free access. The following search terms were used: 'HPV', 'human papillomavirus', 'HPV infection', 'HPV cervical cancer', 'HPV cancer epidemiology', 'cancer cervix', 'HPV vaccine' and 'HPV vaccine safety'. To ensure that the information was reliable, we used the following journals as sources: British Journal of Cancer, The Lancet, The Lancet Oncology, The Lancet Infectious Diseases, Cell, American Journal of Epidemiology, Journal of Virology, Journal of Clinical Pathology, Journal of the National Cancer Institute, Microbiology and Molecular Biology Reviews, The Journal of Clinical Investigation, Clinical Infectious Diseases, Advances in Cancer Research, Vaccine, New England Journal of Medicine and Gynecologic Oncology. The search was restricted for articles published within the preceding 5 years. In case the information extracted from these journals was conflicting, we compared it with data from the Center for Disease Control (CDC) and National Cancer Institute websites to resolve the situation.

The search terms were chosen in order to answer the following questionnaire:

1. What is the papillomavirus?
2. Who can get infected and how is HPV transmitted?
3. What are the health problems caused by HPV infection?
4. What vaccines against HPV are available to the community?
5. How do HPV vaccines work?
6. Who should be vaccinated against HPV?
7. What is the effectiveness and safety of HPV vaccines?

Additionally, Chilean users may access the Chilean Ministry of Health website (Minsal), from this website we downloaded a flyer that was designed to inform the Chilean population about HPV and HPV vaccination ([http://web.minsal.cl/sites/default/files/MANUAL\\_VPH\\_2015\\_final.pdf](http://web.minsal.cl/sites/default/files/MANUAL_VPH_2015_final.pdf)).

The Wikipedia website was accessed from April 7 to April 21, 2015, Yahoo Answers from April 17, 2015, to May 03, 2015, and the Minsal website from January 05, 2015, to January 21, 2016.

## Results

We studied the documents downloaded from PubMed and used them to compose an answer for each of the seven questions. The aim was to formulate answers that were simple and informative at the same time. Afterward, we accessed each of the different sources. For Wikipedia and Yahoo Answers, we typed the question in Spanish inside the query box of each website and analyzed the information that was provided by the website. In the case of the flyer from Minsal, we read the information provided on it. The feedback obtained from the three sources was compared to the answers compiled from the articles downloaded from PubMed and scored depending on its accuracy and reliability (Table 1).

### What is the papillomavirus?

To the first question, inquiring about the papillomavirus, all four sources agreed that HPV was the main etiologic agent of

cervical cancer and that it corresponded to the first agent associated with sexually transmitted disease. As reported by the scientific literature, HPV has been classified according to its genotype and oncogenic potential.<sup>9</sup> Low-risk HPV strains (non-oncogenic) are HPV 6, 11, 42, 43 and 44, while the high-risk group is formed by HPV 16, 18, 31, 33, 34, 39, 45 and 51, among others.<sup>10</sup>

### Who can get infected and how is HPV transmitted?

For the second question about virus transmissibility and people at a greater risk, there were slight differences in the information specific to HPV transmission. According to the scientific literature the main source of HPV infection is through skin contact in the genital area, without the need of sexual intercourse.<sup>11–13</sup> However, as sexual intercourse is the primary route of HPV infection, there is a strong correlation with the number of sexual partners.<sup>11</sup> Despite the fact that the use of a condom offers a high degree of protection against HPV, it is not 100% safe as there are parts of the genitalia that are not covered by it.<sup>14,15</sup> In this regard, Wikipedia mentions that even though HPV infection is one of the most common sexually transmitted infections, the use of a condom has been associated with a lower rate of cervical cancer among women. Nevertheless, it does not make an allusion to skin-to-skin contact as a source of transmission. On the contrary, Yahoo Answers provides complete information to the public about virus transmissibility. In the case of the Minsal website, while it provided correct information about HPV infection, it does not mention the use of condoms as a mechanism to prevent HPV infection. On the subject of people at greater risk, all sources agreed that young people were more vulnerable to infection by HPV.

### What are the health problems caused by HPV infection?

About the disease(s) caused by HPV infection, all sources agreed with the scientific evidence which reports that most HPV infections are benign, asymptomatic and disappear without treatment after 2 years.<sup>16</sup> Moreover, all the websites

indicated that infection with low-risk HPV was responsible of approximately 90% of genital warts.<sup>17</sup> Yahoo Answers was the only website that failed to mention that high-risk HPV infection was responsible for anus, penis and vaginal cancer,<sup>18–20</sup> indicating only that it was responsible for cervical cancer.

### What vaccines against HPV are available to the community?

In regard to the vaccines, the scientific literature revealed that two Food and Drug Administration (FDA)-approved vaccines were available in the market: Cervarix™, a bivalent vaccine manufactured by GlaxoSmithKline, and Gardasil™, a tetravalent vaccine manufactured by Merck. Both vaccines were designed to protect against HPV strains 16 and 18, which are responsible for more than 70% of cervical cancers.<sup>21</sup> Yet, Gardasil™ also offers protection against HPV-6 and HPV-8 that cause genital warts.<sup>22</sup> Only Wikipedia referred to these two vaccines, including information about the HPV strains that they confer protection against (HPV-16 and HPV-18). Even though Yahoo Answers made references to the use of vaccines to protect against HPV infection, it only mentioned Gardasil™ without indicating the HPV strains covered by it. In the case of Minsal, the information available online did not inform the commercial brand of either vaccine against HPV, just one manufacturer (Merck). No information regarding the HPV strains protected against was provided.

### How do HPV vaccines work?

About how HPV vaccines work, the scientific literature explained that vaccines were designed to elicit high titers of antibodies that persist at very high levels for approximately 48 months, hence conferring protection against HPV infection.<sup>23</sup> Only Wikipedia clearly explained that the goal of the vaccine was the induction of high levels of neutralizing antibodies. It also mentioned that the vaccine was generated from a surface antigen, which corresponds to the capsid-protein L1. It is important to point out that the website informs that the viral particles that are present in the vaccine do not contain viral DNA, therefore these non-infectious particles do not present any risk for human health. Unfortunately, the information gathered from Yahoo Answers was very confusing. To begin with, it mentioned that the vaccine induces resistance on the vaccinated subject without providing any details for this resistance (implications, duration, etc). Furthermore, it reports that the vaccine was designed from a virus that is neither alive nor dead. In the case of Minsal, this website lacked any information on how the vaccines worked.

### Who should be vaccinated against HPV?

According to clinical studies, the vaccines need to be delivered pre-exposure to the virus, prior to the initiation of sexual activity.<sup>24</sup> Specifically, Cervarix™ recommends vaccination of boys and girls in the age group of 9–14 years, while Gardasil recommends vaccination of individuals within the age group of 9–26 years.<sup>25</sup> In the case of men, Gardasil™ is used for prevention of anus and penis cancer in addition to genital warts.<sup>23</sup> Wikipedia and Yahoo Answers agree that vaccine administration must be performed in individuals within the

**Table 1 – Accuracy and reliability of the answers collected from each of the three sources in regard to the answers compiled from scientific articles.**

Question	Wikipedia	Yahoo	Minsal
What is the human papillomavirus?	✓✓	✓✓	✓✓
Who can get infected and how is the HPV transmitted?	✓	✓✓	✓
What are the health problems caused by HPV infection?	✓✓	✓	✓✓
What vaccines against HPV are available to the community?	✓✓	✓	✓
How do HPV vaccines work?	✓✓	–	–
Who should be vaccinated against HPV?	✓✓	✓✓	✓
What is the effectiveness and safety of HPV vaccines?	✓✓	✓	–

✓ ✓, Provides accurate and reliable information; ✓, provides incomplete information; –, lacks or provides inaccurate information.

9–26 years age range who have not initiated sexual activity. Even though both websites make reference to the vaccines, neither one indicates these are an option for boys. In the case of Minsal, the information published is vague as it only mentions that vaccination is advisable for 9-year old girls, without any information regarding the age range of individuals that could be protected or the fact that boys may be vaccinated as well. It is also concerning that the Minsal website does not mention Gardasil™ as an option for vaccination.

### **What is the effectiveness and safety of HPV vaccines?**

Finally, in regard to vaccine efficacy and biosafety, clinical trials have demonstrated over 90% vaccine efficacy in preventing cervical precancers due to HPV caused by HPV-16 or HPV-18 in girls and women, while the vaccine efficiency reported for boys and men in preventing the development of external genital lesions and anogenital HPV infection was 47%.<sup>26–28</sup> Protection by both vaccines has proven to be 7.3 years for Cervarix™ and 9 years for Gardasil™.<sup>29</sup> Both Wikipedia and Yahoo Answers indicated that vaccine efficacy was over 90% in women that had not been exposed to the virus. In the case of Minsal, there is no information regarding vaccine efficacy available on their website. None of the three sources presented information about a lower vaccine efficacy as the age of the individual increases. As for biosafety, the most common problem described has been pain or erythema in the injection site for a brief period of time. According to the CDC, only in the case of acute severe febrile illness, vaccine administration should be postponed as well as in the case of patients diagnosed with clotting disorders. However, despite the infrequent and isolated problems registered, both vaccines show a high biosafety profile.<sup>30,31</sup> Minsal and Yahoo Answers indicated that side-effects such as pain in the injection site, fainting, dizziness, nausea, headache and fever have been reported. Only Wikipedia reports the death of 18 girls after being vaccinated, but without substantial evidence that linked the vaccine with the deaths. In fact, the latest study published on this matter reported no deaths related to HPV vaccination in healthy females between 9 and 26 years of age in Sub-Saharan Africa.<sup>32</sup>

## **Discussion**

A large amount of data are available on the Internet, covering every conceivable topic. However, not all health information published online is accurate and reliable. We established that the quality of information provided by the three websites regarding cervical cancer was variable. It is important to remember that while some websites are authored by subject experts, others are written collaboratively by anonymous volunteers. The information provided by the websites is important as it may affect the vaccination willingness of families. In fact, a study showed that parents and their sons were more inclined to receive HPV vaccines if they were aware of the risks related to HPV infection.<sup>33</sup>

To establish the accuracy of the information published by the websites, we used data from articles found with PubMed. Unfortunately, these documents are too technical to be

comprehended by the general public, along with the fact that these are written in English. Therefore, websites such as Wikipedia, Yahoo Answers and the one managed by the Chilean Ministry of Health (Minsal) tend to be a major source of information for individuals seeking information about the disease.

An analysis of the information gathered from Wikipedia reveals that the information contained in the answers was accurate; nevertheless a few omissions were detected like the fact that boys are eligible for HPV vaccination. On the contrary, the quality of the answers provided by the Spanish version of Yahoo Answers was inaccurate and confusing at times. This website is built on the premise that people share their knowledge with individuals that are searching for specific information. The inaccuracy of answers such as ‘the vaccine was designed from a virus that is neither alive nor dead’ could cause serious draw-backs as this information may be used as an argument to support anti-vaccine campaigns. Our results confirm prior studies that have established the superiority of Wikipedia (English version) as a source of health data, in comparison to other websites.<sup>34</sup> It is important to emphasize that Wikipedia articles and Yahoo Answers have no direct authorship, therefore individuals should verify the information obtained online with their doctors before pursuing any action.

Our attention was drawn to the Minsal website since it is managed by the Chilean Ministry of Health, thus it should be a trusted, reliable and valuable source of health information online for the Chilean audience. However, we found it lacked important information on several topics about HPV. For instance, it does not mention that the use of condoms may lower the chances of getting infected by HPV. Nevertheless, the Chilean Ministry of Health recommends the use of condoms to prevent HIV infection through a different governmental website ([www.isl.gob.cl](http://www.isl.gob.cl)). This dichotomy needs to be mended as a previous study about the preventive behaviours of Chilean adolescents towards HPV infection showed that only 31.1% reported the use of condoms during sexual relations.<sup>35</sup>

In regard to vaccination against HPV, the Minsal website reports the existence of only one vaccine manufactured by Merck, without providing its commercial brand. While it only advises vaccination of 9-year old girls, the Advisory Committee on Immunization Practices from the CDC recommends routine vaccinations of boys aged 11 or 12 years with Gardasil™. Another relevant piece of information that is not available on the Minsal website is the method by which vaccines offer protection against HPV. This information is critical as currently there are global anti-vaccination campaigns that are being discussed over the Internet.<sup>36</sup> As a consequence, an increasing number of parents are refusing immunizations of their children. Additionally, some websites focus mainly on the downside of HPV vaccination.<sup>37</sup>

The last topic that needs to be covered by the Minsal website deals with vaccine efficacy. This information is completely absent from the website in contrast to Wikipedia and Yahoo Answers that publish data on this matter.

## **Conclusions**

Internet connectivity has allowed individuals to access health information, without the need of interaction with healthcare



providers. Regrettably, not all websites are accurate and reliable in terms of the information published. The scenario deteriorates if individuals are searching for information in a foreign language. This situation is very similar to the one experienced by Hispanic women living in the United States as for many of them the language barrier reduces access to the HPV vaccine.<sup>38,39</sup>

We found that the website endorsed by the Chilean Ministry of Health would have been more accurate in regard to HPV; unfortunately, it presented information gaps that need to be amended.

## Author statements

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### Competing interests

None declared.

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