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Review Article

Genital human papilloma virus, adolescent and vaccine: a mini-review

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Abstract

Genital human papillomavirus HPV infection is the most common sexually transmitted infection worldwide, involving men and women of all ages, and is associated with poor health outcomes. Particularly during adolescence, this health problem assumes greater proportions due to the behavioral characteristics of adolescents, which make them a person at high risk of contracting this infection. As they are in the process of physical, emotional, sexual, and social maturation, adolescents exhibit risky behaviors due to the beginning of sexual activities driven by pubertal development, most of the time without proper preventive guidance, which predisposes them to contact with several viral and bacterial pathogens. Characteristics such as impulsiveness, indifference to risks and dangers, feeling of invulnerability, motivation to explore and seek novelty, and the need to face challenges and challenge rules and models, are part of the adolescent's emotional development process, whose maturation is established as the limbic system and prefrontal cortex establish their role in controlling emotions. In addition, the possibility of relating to many partners with alternative sexual behaviors, the absence of circumcision, and the non-use of condoms contribute to increasing the risk of many infections. Given this scenario, it is essential that all the circumstances related to HPV, the vaccine, and the difficulties of its wide coverage are known, so that measures are implemented that aim to offer greater protection to the most vulnerable population.

Keywords: Health problem, Viral, Bacterial Pathogens. HPV, Adolescent, and Vaccine

Introduction

HPV is a non-enveloped virus of universal distribution with icosahedral symmetry, which has a genome of approximately 8000 circular base pairs, double-stranded DNA, and a molecular weight of 5.2×10^6 daltons. Viral DNA is associated with histone-like proteins, surrounded by 72 capsomers made up of two structural proteins called L1 and L2. (Ntanasis-Sthopoulos et al., 2020). It is the oldest existing virus, originating from the late Paleozoic Era 330 million years ago. It belongs to the *Papillomaviridae* family and, during its evolution process, acquired the ability to use human cellular proteins for replication, being able to remain latent in the organism for long periods (Syrjanen et al., 2018).

Initially called the human wart virus, HPV penetrates through micro lesions/cracks in the skin or mucosa and infects the cells

of the basal epithelial layer, where it multiplies, causing infections in the skin and mucous membranes of different regions of the body (Manini & Montomoli, 2018). Currently, more than 200 viral types are recognized, and about 40% of them affect the anal and genital regions. Its incubation period varies from 3 weeks to 8 months, being able to remain in the host for long periods and having spontaneous remission in up to 2 years. They are classified into several types and variants, according to the nucleotide sequence, the two main subgroups of greatest interest being the so-called high oncogenic risk (types 16 and 18) and low oncogenic risk (types 6 and 11) (Brianti et al., 2017).

The transmission of HPV occurs by direct skin-skin, skin-mucosal contact, or even indirectly by fomites or secretions, although it is less frequent. It has a higher prevalence among adolescents and young adults and is considered the most

sexually transmitted infection (Fernandes & Fernandes, 2012). HPV acts mainly in two ways: 1) episomal, which leads to the production of viral copies, and 2) form integrated into the host's DNA, which, associating with other cofactors, initiates the oncogenesis process. Because natural infection does not cause viremia, HPV does not stimulate the production of enough antibodies to prevent further infection (Ntanasis-Sthopoulos et al., 2020). The most common lesions caused by HPV are papules, nodules, or vegetations of pink color, soft, filiform, sessile, or pedunculated that can be found in different regions of the skin. In the genital region, warts or condyloma acuminata predominate.

The worldwide prevalence of HPV infections is approximately 12%, with regional variations, with the highest rates verified in Oceania, Africa, and Europe (Kombe et al., 2021), is directly related to social and economic characteristics, ethnicity, sex, age group, habits, and behaviors of the host, as well as conditions of the host's immune system (Shapiro 2022). Infections and the problems associated are also the cause of large financial costs for health services in low- and middle-income countries (Kombe et al., 2021). Women with persistent infection have the highest risk of developing squamous intraepithelial lesions or invasive cervical cancer (Yousefi et al., 2022) and research suggests that HPV is also associated with sinonasal, conjunctival, and lacrimal sac cancer. It is estimated that about 5% of cancers worldwide are caused by HPV, which represents almost 630,000 new cancer cases annually, worldwide (Shapiro, 2022).

Vaccine

Prevention is the most cost-effective mechanism used to reduce HPV infection and its consequences and studies with HPV vaccination have demonstrated impressive efficacy, immunogenicity, and safe results (Dilley & Miller, 2020). To this end, since 2006, vaccines that have been proven to be safe and highly effective have been available (Wilkstrom &

Elfgren 2021; Dilley & Miller, 2020; Sobczek et al., 2022), recommended by the World Health Organization, and which have been used in more than 100 countries on all continents (WHO, 2017; Akumbom et al., 2022).

Vaccines currently available differ in the number of strains they are targeted against. They are produced by means of recombinant DNA technology and recommended for prophylactic use and should be administered before the beginning of sexual life, routinely at 11-12 years of age, and in some situations, their application may be anticipated for 9 years of age (Iliadou et al., 2021).

These vaccines are for prophylactic use, and they are capable to activate humoral immunity and production of virus-neutralizing antibodies, inhibiting entry into host cells, and inducing effective virus protection (Yousefi et al., 2022). Currently, 3 vaccines are available: Gardasil® (quadrivalent HPV 6,11,16,18), Cervarix® (bivalent HPV 16,18), and Gardasil-9® (nine-valent HPV 6,11,16,18,31,33,45,52,58).

The recommended schedule is 2 doses when started between the ages of 9 and 14 years, or 3 doses, depending on the age of onset. It should be applied intramuscularly, in the deltoid or anterolateral region of the hip is generally well tolerated, and may have adverse effects classified as mild to moderate intensity. (Manini et al., 2018).

The most common adverse effects that can be observed up to the fifth day of application are pain at the application site, hyperemia, and heat (Shimabukuro et al., 2019; Phillips et al., 2020). Some systemic effects such as headache, pyrexia, fatigue, nausea, and syncope may also occur but have been reported in fewer cases (Nicol et al., 2016). Contraindications are related to anaphylaxis and sensitivity to any vaccine component that has caused a reaction in a previous dose (Gallego & Pamar, 2022).

Table 1. Myths and barriers against the HPV vaccine

Lack of health services aimed at adolescent care
Lack of knowledge about the importance of the disease and its consequences
Vaccine is not safe
Adolescents 11-12 years old are too young to be vaccinated
Vaccination is unnecessary as most infections resolve spontaneously.
Vaccine has not proven effective in preventing cervical cancer
Vaccine can bring long-term complications and/or worsen pre-existing diseases
Religious factors (encouraging abstinence, encourage having only one sexual partner, do not believe that adolescents initiate sexual relationships)
Cultural factors (vaccine can induce sexual practice)
Social and communication networks do not always disclose correct and reliable information
Media more often highlights adverse effects
Negative views of vaccines spreading on social media platforms
Misinformation and misunderstanding of science

Even considering all the evaluations on the importance, safety, and efficacy of the HPV vaccine, vaccine coverage is still low

in many countries, especially the second dose (Bruni et al., 2021). Therefore, it is essential that all obstacles to vaccination are recognized so that they are understood and overcome. In this sense, several studies have sought to study the myths and barriers against vaccine application (Bednarczyk, 2019; Amboree & Darkoh, 2021; Padilha et al., 2022; Werrell & Gunarsson, 2022), which are presented in Table 1.

Facing the problem

The fundamental point to be resolved is how to increase vaccination coverage in the face of the numerous issues that are presented as barriers to the application of the HPV vaccine.

Acquisition of vaccines, distribution to application sites, and training of health teams are the responsibility of the government, which is also responsible for implementing health policies aimed at the most vulnerable populations. Associated with this are creating and implementing permanent information campaigns and promoting individual and collective health education on the consequences of the disease (Lindsay et al., 2022). Programs aimed at raising awareness about HPV are considered one of the most effective strategies to increase vaccination adherence and eliminate HPV-associated cancers (Chido-Amajuoyi et al., 2021).

Another very important measure is the involvement of the family in understanding the risks caused by the disease and the benefits of the vaccine since parents are directly linked to the adolescent's decision to be vaccinated. Identifying family factors contributing to under-immunization, exploring parents' perspectives on the HPV vaccine, as well as guiding, clarifying, and motivating parents about the importance of the vaccine (Kiner et al., 2022; Sonawane et al., 2021).

Adolescents have low awareness and knowledge about the virus, especially when it comes to cancer risks (Illiadou et al., 2021). Therefore, it is necessary to implement effective health education interventions among them.

Vaccination intentions have been described as a consequence of cognitive and affective perceptions of vaccine-associated risks as well as vaccine-preventable diseases, and the decision-making process is influenced by some individual beliefs and experiences (Karafillakis et al., 2022).

The school environment is an essential target for offering the HPV vaccine to adolescents. School-based information can increase awareness and knowledge about disease prevention and guide sexually transmitted infection prevention behaviors (Lismidiati et al., 2021).

Considering that among adolescents the internet is a potential source of knowledge about HPV vaccination (Ortiz et al., 2019) it is very important to utilize and integrate various types of social media and traditional media to raise awareness and promote HPV vaccination (Veiga et al., 2021).

Conclusion

Given the prevalence and severity of the impact of HPV infection, global vaccination has become a leading public health priority (Rosalik et al., 2021). However, accepting or refusing a vaccine has become a complex phenomenon comprising sociocultural, political, and psychological factors. The search for broad HPV vaccine coverage is a multi-professional and society-wide task.

Physicians and health professionals who provide preventive care to adolescents, the administrative bodies responsible for implementing immunization, schools and educators, family members, and/or caregivers must be trained to increase the level of social awareness about the meaning of vaccination and oppose anti-vaccine propaganda (Czajka, 2018). Still, the communication style can change the way people perceive a certain message. The elaboration of written texts and the intonation of voice with vocabulary accessible to adolescents must always be observed to draw attention to the topic presented.

Adolescents need, deserve, and should receive all the support they need to be vaccinated against HPV in the same way they received all the vaccines that were indicated when they were children.

Conflict of Interest

The author hereby declares no conflict of interest.

Consent for publication

The author declares that the work has consent for publication.

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