HPV Infection and Vaccination: A Question-and-Answer Guide for School Nurses

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ABSTRACT

HPV Infection and Vaccination: A Question-and-Answer Guide for School Nurses

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School nurses frequently interact with school-aged children and their parents/guardians regarding vaccinations. As a trusted source of information, the school nurse is in a unique position to share vaccine information with parents/guardians and school-aged children that may dispel myths and, consequently, improve vaccination rates. Nevertheless, some parents/guardians are still reluctant to vaccinate their school-aged children against Human Papilloma Virus (HPV) for a variety of reasons. Common barriers to HPV vaccination include a lack of understanding of the vaccine’s purpose, concerns regarding the vaccine’s safety, and insufficient recommendation from healthcare workers. However, school nurses have many duties in addition to ensuring vaccine compliance. School nurses may have difficulty remaining up-to-date on evidence-based answers to parents’/guardians’ questions about HPV vaccine. Therefore, the purpose of this paper is to provide school nurses with a quick reference question-and-answer guide to parents’/guardians’ common HPV-related vaccination questions.

Keywords: vaccine; human papillomavirus; parent; hesitancy; education
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Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States (U.S.), affecting approximately 43 million individuals per year, most of whom are in their late teens and early 20s (Centers for Disease Control and Prevention [CDC], 2022a). On average, 85% of sexually active individuals will be infected with one or more strains of HPV during their lifetime (Meites et al., 2019; Stout et al., 2020). Furthermore, most HPV infections are asymptomatic (Aref-Adib & Freeman-Wang, 2016) and, therefore, can be unknowingly transmitted from person-to-person.

HPV strains, with over 200 identified thus far, are classified as either high risk (high probability of causing cancer) or low risk (low probability of causing cancer) (Meites et al., 2020). HPV strains 16 and 18 are the highest risk strains, causing 70% of cervical cancers and precancerous lesions on the cervix (World Health Organization [WHO], 2020a). Approximately 90% of cervical cancers in females are attributed to HPV, although HPV also significantly contributes to many other types of cancer, including anogenital and oropharyngeal (CDC, 2021d).

Currently the U.S. has one HPV vaccine: HPV nine-valent recombinant vaccine (Gardasil 9®) (National Cancer Institute [NCI], 2021b). Gardasil 9® prevents 90% or more of HPV-caused cancers (CDC, 2021d) and is routinely recommended for males and females 11-years-old and older (CDC, 2022b). Approved in 2014 by the Food and Drug Administration (FDA), Gardasil 9® is a two-dose series when administered between 9-14-years-old and a three-dose series when administered to young adults 15 years of age and older (Meites et al., 2019). The vaccine specifically targets HPV strains 6, 11, 16, 18, 31, 33, 45, 52, and 58 (NCI, 2021b).
The 16, 18 HPV strains account for 70% of all cervical cancers and HPV strains 31, 33, 45, 52, and 58 cause another 20% of cervical cancers. While HPV strains 6 and 11 are not cancer-causing, these strains are primarily responsible for causing HPV warts on the mouth, throat, genitals, and anus (Joura et al., 2015).

The HPV vaccine is the single most effective preventative measure, decreasing the risk of HPV infection (Huang et al., 2021) by 88% in teenage girls and 81% in young adult women (CDC, 2021a). Because the HPV vaccine is most effective when administered before sexual debut (Stout, et al., 2020), the HPV vaccine’s target demographic is the school-aged population. While the HPV vaccine effectively prevents HPV infection, it is ineffective as a treatment option for pre-existing HPV infection (CDC, 2022c).

Some parents/guardians are reluctant to vaccinate their school-aged children against HPV despite its effectiveness in preventing HPV infection and HPV-related cancers (Nguyen et al., 2021). In the U.S., childhood vaccination decisions are the responsibility of parents or legal guardians until the child is 18-years-old. Common barriers inhibiting parental consent for HPV vaccine include lack of understanding, incorrect assumptions, and concerns regarding the vaccine’s safety (Cotton, 2018). These factors are primarily responsible for the percentage of children and adolescents that have not and/or will not receive the HPV vaccine.

As part of a critical educational setting, school nurses should be prominent advocates for the HPV vaccine by educating parents/guardians and students who are either sexually active or will become sexually active in the future. School nurses should provide evidence-based guidance to parents/guardians making decisions regarding the HPV vaccine. As a result, school nurses can positively impact HPV vaccination rates among school-aged children and adolescents, leading to improved social and economic outcomes beyond just the prevention of diseases from HPV.
(Rosen et al., 2017). Therefore, the purpose of this paper is to provide school nurses with evidence-based answers to common HPV-related vaccination questions.

**Methods**

A review of the literature was conducted by searching five databases: CINAHL, EBSCO, Medline, PubMed, and Google Scholar. Search terms included human papillomavirus; HPV; HPV vaccines; vaccine questions; vaccine hesitancy; vaccine refusal; parental concerns; and school nurses. In addition, reputable and scientific websites such as the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), National Cancer Institute, National Association of Pediatric Nurse Practitioners, American Academy of Pediatrics, Immunize.org, National Association of School Nurses, Texas Children’s Hospital, and Children’s Hospital of Philadelphia were reviewed. To identify common concerns regarding the HPV vaccine, articles, books, parental group websites, and anti-vaccine group websites were also reviewed. This included information published by the National Vaccine Information Center (VIC), Dangersofvaccines.com, judicialwatch.org, Dr. Joseph Mercola, Dr. Robert Sears, globalpossibilities.org, silentcrownnews.com, thevaccinereaction.org, Eileen Iorio, Kim Rosenberg, Mary Holland, Barbara Loe Fisher, and Del Bigtree.

Inclusion and exclusion criteria were also incorporated. Inclusion criteria comprised articles, books, and websites published in English since 2006, the year the first-generation Gardasil vaccine was approved by the U.S. FDA (2018). Inclusion criteria also encompassed articles focusing on HPV vaccines, HPV infection, and potential sequelae of HPV infection. Exclusion criteria constituted articles about general vaccine hesitancy, early childhood vaccines, other vaccines commonly administered in adolescence, and adults aged 18-years-old or older.
A review of the pro- and anti-vaccine literature was conducted. The four most common questions were included for review.

**HPV Vaccine Questions**

Question 1: Why is the HPV vaccine recommended for children as early as age 9-years-old when it is unlikely children in this age group are sexually active?

Question 2: Is the HPV vaccine really needed?

Question 3: If my child will be in a relationship with only one partner, why does he or she need the HPV vaccine?

Question 4: Does the HPV vaccine cause reproductive challenges in females?

**Findings**

**Question 1: Why is the HPV Vaccine Recommended for Children as Early as Age 9-Years-Old When it is Unlikely Children in this Age Group are Sexually Active?**

**Background:** While the first HPV vaccine was approved for use in 2006, it has not been widely accepted by parents (NCI, 2021a). Some anti-vaccination groups such as the NVIC, publications such as *The Vaccine Reaction*, and books such as *The HPV Vaccine on Trial: Seeking Justice for a Generation Betrayed* have continuously questioned the safety, efficacy, and need for the HPV vaccine. Ten years after the introduction of the first HPV vaccine, the FDA changed the earliest age of HPV vaccine eligibility from 11-12-year-olds to children as young as 9-years-old (Meites et al., 2016). The impetus for the change was multi-factorial but included rationale that it was easier to achieve higher on-time vaccination rates when children were vaccinated as early as age 9-years with a two-dose HPV series (Saslow et al., 2020).

However, some parents believe the change was encouraged by healthcare providers who wanted to vaccinate when parents had more minor concerns about sexual behavior and risk
factors for contracting HPV (The Vaccine Reaction, 2020). Furthermore, books such as *The HPV Vaccine on Trial: Seeking Justice for a Generation Betrayed* promulgate reports that the HPV vaccine caused female recipients to suffer miscarriages, birth defects during future pregnancies, menstrual irregularities, and infertility. To conceal these worrisome vaccine side effects from the public, the vaccine manufacturer lobbied to change the earliest age of HPV vaccine eligibility to prepubescent children as early as age 9-years-old. By convincing the Advisory Committee on Immunization Practices to lower the age of eligibility to prepubescent girls with no menstrual history, it became impossible to establish a vaccine-infertility causation link (Holland et al., 2018).

*Response:* Prevention of HPV infection in the 9 to 26-year-old population is the most effective strategy to prevent more than 36,000 HPV-related cancers. HPV vaccines, when administered prophylactically, effectively prevent HPV-related cancers. The HPV vaccine is effective in preventing the most high-risk oncogenic genotypes, especially HPV 16 and 18, which are primarily responsible for premalignant and malignant lesions that can lead to death. While those vaccinated for HPV may still contract non-cancerous, less high-risk HPV strains, they were significantly less likely to be infected with HPV strains 16 and 18 (Safaeian et al., 2018).

The HPV vaccine is most effective when administered before sexual debut. To be fully protected against HPV infections, individuals must build a healthy immune response to HPV prior to exposure through oral, vaginal, and anal sex (Subasinghe, 2020). However, some may inaccurately perceive their child’s readiness to engage in sex (Rendle & Leskinen, 2017). By 18-years-old, over half of male and female adolescents will have had sexual intercourse (CDC, 2017b). Approximately 17% of adolescents were younger than 15-years-old at the time of their
first sexual encounter (Magnusson, 2019) and 7.1% of adolescents reported having their first
sexual encounter before the age of 13-years-old (Baiden et al., 2021).

The risk of contracting HPV infection may also be the result of unwanted sexual contact. In fact, the rates of sexual violence against adolescents ages 12- to 18-years-old are staggering. In the U.S., 8% of adolescent girls and 0.7% of adolescent boys are survivors of rape (National Sexual Violence Resource Center [NSVRC], 2018). Further, 1 in 4 girls and 1 in 9 boys have been sexually abused before the age of 18 years (NSVRC, 2018). A study conducted by Lindberg et al. (2019) found that among boys whose first sexual experience took place prior to age 13 years, 8.5% reported their first sexual encounter was unwanted.

While some parents/guardians believe the age of eligibility for HPV vaccine was lowered to conceal vaccine-caused infertility, there is no evidence for this claim, regardless of the age of the child when the HPV vaccine was administered (Schmuhl et al., 2020). In 2019, WHO convened the Global Advisory Committee on Vaccine Safety to examine all available evidence regarding HPV vaccine and infertility. A careful review of the evidence published in nine articles showed no causal relationship between HPV vaccine and infertility (WHO, 2020b). Furthermore, in a study by Hviid and Thiesson (2021) of almost 1 million girls and women diagnosed with primary ovarian insufficiency, there was no association between HPV vaccine and primary ovarian insufficiency. In fact, of the 144 subjects diagnosed with primary ovarian insufficiency, 54 had received the HPV vaccine and 90 had not received the HPV vaccine (Hviid & Thiesson, 2021).

Statistically, adolescents interact the least with the healthcare system out of all age groups and therefore struggle with the punctual completion of vaccines (Goleman et al., 2018). If the school-aged child is 14-years-old or younger when vaccinated, he or she only needs a two
instead of three injection series, which is more convenient. Additionally, available evidence demonstrated that a two-dose HPV vaccine series in 9- to 14-year-olds produced a better antibody response than a three-dose HPV vaccine series in those age 15-years-old or older (Saslow et al., 2020). The age for HPV vaccine eligibility was lowered to as early as 9-years-old in 2020; the change was based upon convenience for the parent/guardian and child and the need for fewer vaccines in the series, not to conceal a vaccine-infertility causation link.

**Question 2: Is the HPV Vaccine Really Needed?**

*Background:* Critics of the HPV vaccine question its necessity, reporting that HPV infection is frequently benign and, in many cases, self-resolving (Raines & Fisher, 2018; Sears, 2011). Because the body almost always spontaneously clears the virus within 2 years, and because HPV-related cancers only account for up to 3% of U.S. cancer deaths, some parents suspect Merck’s motivation to create an HPV vaccine was based on potential financial gain rather than concern for preventing cancer (Raines & Fisher, 2018). Another point made by those opposed to the HPV vaccine is that only 0.6% of women in the U.S. will receive a cervical cancer diagnosis and of those diagnosed, the 5-year survival rate is over 90% (Holland et al., 2018). In essence, Merck has been accused of creating a market for an unnecessary vaccine by convincing public health officials that HPV infection is a public health crisis when, in fact, it is a mild, self-limiting infection (Habakus et al., 2012).

Those opposed to the HPV vaccine also cite ethical concerns regarding the need for males to be vaccinated against a virus that predominantly affects females. While the HPV vaccine is hailed for the prevention of HPV-related penile, anal, oral, throat, head, and neck cancer, vaccine critics report there are no clinical trials that demonstrate the effectiveness of the vaccine for these cancers (Holland et al., 2018; Lenzer, 2011). Additionally, HPV vaccine critics
state there is no evidence to prove the HPV vaccine effectively prevents genital warts (Holland et al., 2018).

**Response - Why Men Need the Vaccine.** The CDC (2018) reports there are approximately 18,000 HPV-caused cancers in U.S. men every year. In fact, 40% of HPV-caused cancers occur in males (CDC, 2022b). HPV infections cause approximately 90% of anal cancers and 33% of penile cancers (Harder et al., 2018), both of which have considerable morbidity and mortality rates (Schmeler & Sturgis, 2016). While circumcision is beneficial in reducing the risk of HPV infection (Rodríguez-Álvarez et al., 2018), there is still some risk. Therefore, the HPV vaccine is recommended for both circumcised and uncircumcised males.

The importance of the HPV vaccine in preventing male infertility is also notable. HPV infection in males is related to male infertility (Lyu et al., 2017). High-risk HPV genotypes in semen analyses are associated with a higher prevalence of infertile men than semen analyses in those with low-risk HPV or negative HPV semen samples. Among infertile males, HPV is identified at a rate three to four times higher than that of fertile men (Garolla et al., 2018). It is believed that HPV-positive semen causes the production of anti-sperm antibodies, a glandular dysfunction that alters the balance of prostatic and seminal vesicle fluids, and decreased DNA integrity of the sperm (Boeri et al., 2019).

Men who participate in sexual activities with other men (MSM) are especially susceptible to HPV infection, especially in HIV (human immunodeficiency virus) positive individuals (Stout & Martins, 2019). In fact, MSM individuals are 17-30 times more likely to develop HPV-related anal cancer than heterosexual males (Woestenberg et al., 2020), further underscoring the importance of HPV vaccination in males.
Response - Why Women Need the Vaccine. When considering health promotion activities, vaccination (primary prevention) is more effective than routine screening examinations (secondary prevention). Thus, the prevention of cancer with the HPV vaccine is more effective and cost-efficient than diagnosing and treating cervical cancer (Wong et al., 2017), which is the fourth most common cancer in the world (Vahedpoor et al., 2019). The pap smear is used to screen for cervical cancer and while the pap smear’s specificity is 85%, its sensitivity is only 29% (Vahedpoor et al., 2019). According to experts, the pap smear is a poor-performing screening test and because its sensitivity is low, the presence of abnormal cervical cells may not be accurately detected, thus delaying diagnosis and treatment (Swift et al., 2020). While the low sensitivity of the pap smear can be compensated for by increasing the frequency of routine pap smears, it is counteracted by other problematic barriers such as access to care, the expense of frequent testing, procedural anxiety, and lack of time (Akinlotan et al., 2017) that further reinforce the importance of preventing HPV infection with vaccination.

Why Both Genders Need the Vaccine. In addition to gender-specific needs for the HPV vaccine, there are also non-gender-specific reasons for receiving the vaccine such as the prevention of oropharyngeal cancer. Oropharyngeal squamous cell carcinoma (OSCC) will soon surpass cervical cancer as the most common HPV-related cancer (Khalid et al., 2018). Most of the symptoms of OSCC are challenging to pinpoint and, therefore, will go unnoticed until it reaches late, symptom-manifesting stages (Khalid et al., 2018). Missing the diagnosis of OSCC could delay treatment and result in a poorer prognosis and a higher incidence of unknowingly spreading the virus to partner(s), thus increasing risk of contracting HPV (Lindsay et al., 2022). In fact, between 2018 and 2045 it is projected that the HPV vaccine will prevent 6,334 cases of HPV-caused oropharyngeal cancer (Zhang et al., 2021).
Evidence also shows that the HPV vaccine effectively reduces the occurrence of genital warts in both men and women. While there are treatment options for genital warts, the treatments do not cure an individual of HPV infection. In fact, most genital warts will recur within 3 months of the initial therapy and even if the individual has a latent HPV infection, he or she can still infect their sexual partner with HPV. The morbidity associated with genital warts is notable, including itching and bleeding of lesions, as well as the psychosocial burden of having genital warts (Leslie et al., 2022). HPV vaccine specifically prevents infections of HPV strains 6 and 11, which causes 90% of genital wart cases (Planned Parenthood, 2022). Since the introduction of the HPV vaccine in 2006, genital wart cases have decreased by 88% in teenage girls and 81% in young adult women (CDC, 2021b). Furthermore, in clinical trials, Gardasil 9® prevented genital warts in 99% of females and 89% of males (Merck & Co., INC., 2014).

**Question 3: If My Child Will be in a Relationship with ONLY One Partner, Why Does He or She Need the HPV Vaccine?**

**Background.** Parents may choose to delay HPV vaccination for their child if sexual contact is not perceived as likely for several years. A pediatrician and author who often questions the need for vaccines has stated that if an individual chooses to abstain from sex, he or she does not need the HPV vaccine, especially if the person he or she marries also chooses to abstain from pre-marital sex (Sears, 2011). In fact, research shows that HPV risk perception is strongly influenced by whether the individual is actively dating or currently in a monogamous relationship (Thompson et al., 2019; Waters et al., 2021). Those who are actively dating are more likely to receive the HPV vaccine and those who are currently in a monogamous relationship, meaning one partner for a period of time, are less likely to receive the HPV vaccine (Thompson et al., 2019; Waters et al., 2021).
Response. While many individuals desire and maintain one monogamous relationship throughout life, it is not possible to control all the variables that contribute to the number of sexual partners an individual will have throughout his or her entire life. In the U.S., the average number of lifetime sexual partners for men and women are 6.3 and 4.3, respectively (CDC, 2021c). For those expecting monogamy whilst dating a current partner, the HPV vaccine is recommended for protection against the partner’s past relationships as well as protection against any future partners if the relationship were to end. The term monogamy, while generally defined as sexual and romantic exclusivity to one partner, its application of the term is often confounded. Individuals in committed relationships often do not explicitly communicate one’s sexual boundaries of the relationship, which can lead to misunderstandings about what sexual monogamy entails (Lee & O’Sullivan, 2019).

While an individual, for the most part, has control over how many sexual partners he or she has had (direct sexual partners), the individual cannot control the partner’s number of sexual partners, nor the sexual partners of those people (indirect sexual partners). Essentially, sexual exposure grows exponentially when considering the number of partners of the individual’s current sexual partner. Using a sexual exposure risk formula (see Figure 1) (Simple Online Healthcare Unlimited, 2022), the number of sexual exposures an individual has can be estimated. Thus, an individual and the individual’s partner who have only had each other as a sexual partner would have a total exposure risk of two, while if both individuals have had three sexual partners in their lifetime, the total risk for exposure to an STI would be significantly higher at 1,092 (See Figure 2 and Figure 3).

The death of a sexual partner, divorce, or failure of a sexual relationship may be followed by the addition of another lifetime sexual partner. Among those who were 75 years or older and
married, 58% of women and 28% of men experienced the death of a spouse (Gurrentz & Mayol-Garcia, 2021). The annual divorce rate in the U.S. is 15.5 per 1,000 married women (Reynolds & Profile, 2020). Moreover, about 26% of adults who divorced or lost a spouse in a former marriage would enter a second marriage (Schweizer, 2020). Currently, however, the HPV vaccine is not recommended for adults over the age of 45 years (Advisory Committee on Immunization Practices, 2019). Thus, delaying the HPV vaccine until life circumstances change may mean the individual is no longer eligible to receive the vaccine due to age.

**Question 4: Does the HPV Vaccine Cause Reproductive Challenges in Females?**

**Background.** The concern that the HPV vaccine causes infertility in females by producing primary ovarian insufficiency is common (Hviid & Thiesson, 2021). The concern regarding infertility first surfaced after the publication of a case report in 2012 that questioned whether the HPV vaccine caused premature ovarian failure in a 16-year-old patient (Little & Ward, 2012). Another researcher examined the birth rates of females between the ages of 25- and 29-years-old and determined that if 100% of females had received the HPV vaccine, the number of pregnancies among these women would have decreased by 2 million (DeLong, 2018). This article was retracted shortly after its release (National Library of Medicine, 2019).

The assumption that the HPV vaccine also caused miscarriages and other adverse events involving the reproductive system was then promulgated through various vaccine critic outlets in books such as the *Vaccine Safety Manual for Concerned Families and Health Practitioners* and *Journeys from Trust to Tragedy*, and on websites including *The Vaccine Reaction* and SaneVax, Inc. These skeptics of the HPV vaccine also make claims that 90% of the time infertility is reported as a vaccine side effect, the report involves the HPV vaccine (La Vigne, 2015) and that
there has been a 790% increase in fertility problems since the introduction of the HPV vaccine (Erickson, 2014).

**Response.** No correlation exists between infertility and the HPV vaccine (World Health Organization, 2020b). In contrast, HPV infection is linked to significant reproductive function abnormalities in females (Souho et al., 2015) and in males (McInerney et al., 2017). In a clinical study on women using in-vitro fertilization, there was a significant decline in conception in those currently infected with cervical HPV infection (Garolla et al., 2018). HPV infection also negatively affects fertility in men as it can reduce sperm motility and increase anti-sperm antibodies (McInerney et al., 2017). Furthermore, the HPV vaccine has no adverse effect on oocyte counts and fertilization rates (Demir et al., 2020), and vaccinated women are six times more likely to successfully conceive using intrauterine insemination than those who are unvaccinated (Qaderi et al., 2021).

HPV-vaccinated women, even those with a prior history of STIs and pelvic inflammatory disease, have more successful fecundability compared to women who had not received the HPV vaccine (McInerney et al., 2017). According to the National Health and Nutrition Examination Survey, a self-report survey in which individuals indicate whether they have fertility concerns, a significantly higher percentage of individuals in the unvaccinated HPV group reported fertility concerns than in the vaccinated group Schmuhl et al., 2020).

Risks of pregnancy, including spontaneous abortion, pre-term labor, and premature birth, are also increased with HPV infection. In fact, premature birth is still one of the leading causes of infant mortality worldwide (Niyibizi et al., 2021). HPV DNA also negatively impacts in-vitro-fertilization (IVF) outcomes. The DNA in the HPV infection is closely associated with fewer successful pregnancies and an increased risk for spontaneous abortion (Qaderi et al., 2021).
Moreover, pregnant women with HPV infection have a higher risk for premature rupture of the membrane and pre-term labor (Qaderi et al., 2021). Additionally, HPV infection can cause apoptosis in embryonic cells, leading to miscarriage (Demir et al., 2020).

**Discussion**

“The [National Association of School Nurses] NASN mission is to optimize student health… (National Association of School Nurses [NASN], 2020, para. 2). One strategy for optimizing student health is to ensure students are adequately vaccinated against dangerous and potentially deadly diseases. School nurses are in a unique position to positively influence the vaccination rates of students (Luthy et al., 2015) since they are community leaders (Brand, 2016), powerful change agents (NASN, 2018), and are an important part of the most trustworthy profession (Armstrong et al., 2021). While school nurses successfully improve vaccination rates of all vaccines (McCullough et al., 2020), the HPV vaccine is of particular importance. In fact, according to the CDC (2017b), “School nurses play a critical role in protecting the next generation from cancers caused by HPV…” (para. 1).

Ninety-five percent of school nurses believe they have a role to ensure students receive the HPV vaccine (Bozigar et al., 2020). Nevertheless, school nurses’ lack of time is a formidable barrier to fully engaging in the promotion of the HPV vaccine (Bozigar et al., 2020). Recommendations to overcome the barrier of time include partnering with other community organizations such as school districts, health departments, and the National Cancer Society to coordinate on-site vaccination events and community education (Kaul et al., 2019). Promoting on-time administration of HPV vaccination and co-administering with other age-appropriate vaccines are also proven methods to improve HPV vaccination rates (Vasudevan et al., 2021).
On a macro level, school nurses have a key responsibility to develop health policy and health-related interventions based on the best available evidence (NASN, 2021). Collaborating with local government representatives is another means for school nurses to improve health promotion and prevention efforts (Bergen, 2017). Policymakers want to know how legislative issues affect the health and wellness of their constituents and school nurses can be effective advocates for equal access to vaccines. Whether through an increase in vaccination funding or obtaining resources for at-school vaccination clinics, the school nurse can effectively increase vaccination rates (Szilagyi et al., 2019), including the HPV vaccination (Vercruysse et al., 2016).

**Conclusion**

The purpose of this paper was to provide school nurses with a quick reference question-and-answer guide to parents'/guardians’ common HPV-related vaccination questions. As a trusted source of information, the school nurse is in a unique position to share vaccine information with parents/guardians and school-aged children that may dispel myths and, consequently, improve vaccination rates. Nevertheless, some parents/guardians are still reluctant to vaccinate their school-aged children against Human Papilloma Virus (HPV) for a variety of reasons. With a thorough understanding of the purpose of the HPV vaccine, school nurses can advocate for vaccination while confidently responding to common parental questions regarding the HPV vaccine. School nurses are stalwarts in advocating for the health of children and adolescents and can effectively utilize evidence-based data to counter HPV vaccine myths. As leaders in the community, school nurses can positively influence HPV vaccination rates by providing vaccine-related education, easy access to vaccines, and involvement in healthcare policy.
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Despite proven safety of HPV vaccines, more parents have concerns. [National Cancer Institute](https://www.cancer.gov/news-events/cancer-currents-blog/2021/hpv-vaccine-parents-safety-concerns)

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https://doi.org/10.1016/j.vaccine.2020.03.002


Figure 1

*Sexual Exposure Formula*

\[
\text{sexual exposure} = n \left( \frac{1-n_p^6}{1-n_p} \right)
\]

- \(n\) = number of partners you have had
- \(n_p\) = number of partners your partners have had before you
Figure 2

*Direct versus Indirect Sexual Exposure Chart*

<table>
<thead>
<tr>
<th>Number of Sexual Partners You Have Had</th>
<th>Number of Other Sexual Partners Your Sexual Partner Has Had</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>56</td>
</tr>
<tr>
<td>9</td>
<td>62</td>
</tr>
</tbody>
</table>

Example: If you have had 4 partners and your sexual partner has had 5 partners then the cumulative risk is 15,624 exposures.
**Figure 3**

*Sexual Exposure Cumulative Risk*

<table>
<thead>
<tr>
<th>Number of Other Sexual Partners</th>
<th>Sexual Exposure Chart</th>
<th>Exposures Risk $[n(1-n^y)/(1-n)]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image" alt="Sexual Exposure Chart 1" /></td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td><img src="image" alt="Sexual Exposure Chart 2" /></td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td><img src="image" alt="Sexual Exposure Chart 3" /></td>
<td>364</td>
</tr>
<tr>
<td>4</td>
<td><img src="image" alt="Sexual Exposure Chart 4" /></td>
<td>1,365</td>
</tr>
</tbody>
</table>