Effect of human papillomavirus vaccination on sexual behaviour among young females

Robine Donken PhD Gina S. Ogilvie MD MSc FCFP DrPH Julie A. Bettinger MPH PhD
Manish Sadarangani BM BCh MRCPCH DPhil Ran D. Goldman MD FRCPC

Abstract

Question At the time of implementation of human papillomavirus (HPV) vaccine immunization programs, concerns were raised by parents, clinicians, and public health professionals about HPV vaccination possibly leading to riskier sexual health choices among young females. If HPV vaccination influences sexual behaviour among vaccinated females, this might influence the effect of HPV vaccination programs. What is known about the effects of the HPV vaccination program on sexual behaviour among young females?

Answer Human papillomavirus vaccination has not been associated with increased sexual risk behaviour among young females. However, currently available studies have some important limitations, and future studies should focus on a longitudinal design that includes a prevaccination baseline measurement, adjustment for possible confounders, and measurement of both clinical indicators and behavioural outcomes.

Effets de la vaccination contre le virus du papillome humain sur le comportement sexuel des jeunes femmes

Résumé

Question Au moment de la mise en œuvre des programmes de vaccination contre le virus du papillome humain (VPH), des parents, des cliniciens et des professionnels de la santé publique s'inquiétaient que ces programmes entraînent des choix de comportements sexuels plus à risque chez les jeunes femmes. Si la vaccination contre le VPH influence les comportements sexuels des jeunes femmes vaccinées, cette réalité pourrait influer sur l'effet des programmes de vaccination contre le VPH. Que sait-on des répercussions des programmes de vaccination contre le VPH sur les comportements sexuels des jeunes femmes?

Réponse La vaccination contre le VPH n'a pas été associée à des comportements sexuels plus à risque chez les jeunes femmes. Par ailleurs, les études présentement accessibles comportent certaines limitations importantes. Les études futures devraient adopter une conception longitudinale qui inclut une mesure des données de départ avant la vaccination, un ajustement en fonction des facteurs confusionnels possibles et une mesure à la fois des indicateurs cliniques et des paramètres comportementaux.

Human papillomavirus (HPV) is the most common sexually transmitted infection, with a lifetime risk of acquisition of more than 80% among sexually active female and male populations.[1] Human papillomavirus infections are risk factors for developing genital warts, as well as cervical, anal, penile, oropharyngeal, vaginal, and vulvar cancers.[2] Primary prevention of HPV-related diseases is possible using HPV vaccines.

HPV vaccination in Canada

Currently all Canadian jurisdictions have implemented school-based HPV vaccination into routine immunization schedules, with uptake rates between 52.6% and 89.3% for at least 1 dose.[3,4] At the time of implementation almost a decade ago, parents, clinicians, and public health professionals raised concerns that HPV vaccine programs might lead to riskier sexual health choices among young females.[5] For example, in Canada, 21% of parents or guardians of females aged between 8 and 18 had concerns about the potential influence of HPV vaccination on sexual activity.[6] Roman Catholic bishops in several provinces opposed HPV vaccination because they believed that abstinence was the "only healthy choice" and vaccination would "send a message that early sexual intercourse is allowed."[7] From a public health perspective, if vaccination did result in a different sexual (risk) behaviour pattern among vaccinated females, this could influence the effectiveness of HPV vaccination programs.[8] Therefore, understanding whether HPV vaccination influenced sexual behaviour in young females is an important question for exploration. In the decade since the first HPV immunization programs, data have

emerged on the effect of HPV vaccination programs on the sexual behaviour of young females.

Pregnancy and sexually transmitted infection rates

Using pregnancy and sexually transmitted infection (STI) rates as clinical indicators of sexual behaviour, either no association was found with HPV vaccination, or, in some studies, vaccinated young females were less likely to have been pregnant or infected with *Chlamydia trachomatis* or other STIs (**Table 1**).[3,9-15] In an Ontario-based study, in which outcomes were assessed against a composite outcome of pregnancies and STIs as well as assessed separately, there was no evidence found for an increased risk of pregnancy or STI after HPV vaccination in adolescent girls aged 13 to 17. There was no effect identified when birth cohorts eligible for vaccination were compared with cohorts ineligible for HPV vaccination.[3]

Several US studies also showed no association between HPV vaccination and STI testing, STI diagnosis, or pregnancy.[9-11] Bednarczyk and colleagues reported no increase in the STI and pregnancy rates.[9] In another US study, no associations were found between HPV vaccination and receiving STI services in young females (aged 15 to 24 years) who had received the HPV vaccine.[10] Furthermore, no associations were found between HPV vaccination and positive STI diagnoses in 2 other US studies and a study from Uganda.[12-14] Another study documented a higher rate of *C trachomatis* diagnosis among young females (aged 14 to 20) not vaccinated for HPV compared with vaccinated young females (19.8% vs 9.5%; odds ratio of 2.30, 95% CI 1.06 to 5.00).[15]

Behavioural factors

Most studies examining the association between HPV vaccination and self-reported sexual behaviour used a cross-sectional study design (**Table 2**).[8,10,12,14-16] This is not the preferred method for examining the potential effects of the vaccine on sexual behaviour, as it is hard to correct for past behaviour and pre-existing differences between vaccinated and unvaccinated participants, and causal relationships cannot be examined.

Table 1. Studies that examined the influence of HPV vaccination on pregnancy and STI rates among young females

STUDY*	COUNTRY	DESIGN	PARTICIPANT CHARACTERISTICS	OUTCOMES	
				PREGNANCY	STI
Smith et al,[3] 2015	Canada	6 population-based administrative databases	Age 13-17 y; 128 712 vaccinated and 131 781 unvaccinated	No evidence that vaccination increased the risk of composite end point: RR = 0.96, 95% CI 0.81 to 1.14	
Bednarczyk et al,[9] 2012	United States	Cohort study using medical records	Vaccinated at age 10-12 y; 493 vaccinated and 905 unvaccinated	Risk of composite end point not elevated: IRD = 1.6, 95% CI -0.03 to 2.24, per 100 PY	
				No difference in pregnancy diagnosis: IRD = 0.07, 95% CI -0.20 to 0.35, per 100 PY	No difference in diagnosis of *Chlamydia trachomatis:* IRD = 0.06, 95% CI -0.30 to 0.18
Liddon et al,[10] 2012	United States	Data from the National Survey of Family Growth	Age 15-24 y; 279 vaccinated and 964 unvaccinated	NA	No difference in receiving STI service in past year among those aged 15-19 y (38.7% [95% CI 27.7% to 51.0%] vs 28.9% [95% CI 23.3% to 35.2%])
Rysavy et al,[11] 2014	United States	Cross-sectional survey, using assisted interviews	Age 13-23 y; 153 vaccinated and 70 unvaccinated	Not being vaccinated was associated with pregnancy (20% vs 9%, *P* = .016)	No difference in the proportion of *C trachomatis*, gonorrhea, genital herpes, syphilis, pubic lice, HIV, genital warts, HPV, trichomoniasis, and hepatitis B infections between vaccinated and unvaccinated participants
Kumakech et al,[12] 2017	Uganda	Population-based comparative cross-sectional survey	Age 15-24 y (median age was 18.6 y); 438 females (53% of whom were vaccinated)	NA	No statistically significant difference between vaccinated and unvaccinated participants regarding the history of STD syndrome and the prevalence of syphilis and HIV infections
Jena et al,[13] 2015	United States	Insurance claim database	Age 12-18 y; 21 610 vaccinated and 186 501 unvaccinated	NA	HPV vaccination was not associated with an increase in STIs: OR = 1.05, 95% CI 0.80 to 1.35

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STUDY*	COUNTRY	DESIGN	PARTICIPANT CHARACTERISTICS	OUTCOMES	
				PREGNANCY	STI
Cummings et al,[14] 2012	United States	Comparison of a group of vaccinated adolescent girls with historical controls. Questionnaires and clinician- or self-collected vaginal swabs	Age 14-17 y; 75 vaccinated and 150 matched unvaccinated	NA	No differences in diagnoses for *C trachomatis* and *Trichomonas* infections between vaccinated and unvaccinated adolescent girls: OR = 0.9, 95% CI 0.04 to 2.20, and OR = 5.3, 95% CI 0.7 to 42.3, respectively
Sadler et al,[15] 2015	United Kingdom	Clinical histories from genitourinary medicine clinic visitors	Age 14-20 y; 231 vaccinated and 132 unvaccinated	NA	Not being vaccinated was positively associated with receiving *C trachomatis* diagnosis: OR = 2.30, 95% CI 1.06 to 5.00

HPV—human papillomavirus, IRD—incidence rate difference, NA—not applicable, OR—odds ratio, PY—person-years, RR—relative risk, STD—sexually transmitted disease, STI—sexually transmitted infection.
*Only studies including some participants younger than 18 years of age were included in this table. Studies including only adults were not included in this review.

Table 2. Studies that examined the influence of HPV vaccination on sexual behaviour outcomes among young females

STUDY*	COUNTRY	DESIGN	PARTICIPANT CHARACTERISTICS	OUTCOMES		
				HAS EVER HAD SEXUAL INTERCOURSE	NO. OF SEXUAL PARTNERS	CONDOM USE
Donken et al,[8] 2018	Netherlands	Longitudinal follow-up study using online questionnaires	Age 16-17 y at inclusion; 1938 vaccinated and 1051 unvaccinated	Vaccinated participants were more likely to have ever had sex (OR = 1.19, 95% CI 1.02 to 1.39) and this difference increased over time (OR = 1.06, 95% CI 1.00 to 1.12); however, after correction for sociodemographic factors, no difference was observed	Unvaccinated participants had a slightly higher lifetime number of partners (mean difference of -0.20, 95% CI -0.41 to 0.00)	No difference was observed for condom use with a casual partner. Vaccinated participants were less likely to always use a condom with their steady partner (adjusted OR = 0.71, 95% CI 0.57 to 0.89)
Liddon et al,[10] 2012	United States	Data from the National Survey of Family Growth	Age 15-24 y; 279 vaccinated and 964 unvaccinated	Having had vaginal sex was unrelated to receipt of HPV vaccine	NA	Vaccinated females were more likely to use condoms consistently in the past 4 weeks (OR for always wearing a condom was 3.0, 95% CI 1.1 to 7.9)
Kumakech et al,[12] 2017	Uganda	Population-based comparative cross-sectional survey	Age 15-24 y (median age was 18.6 y); 438 females (53% of whom were vaccinated)	NA	No significant differences between vaccinated and unvaccinated participants in number of sexual partners in the previous 3 mo, the previous 1 y, the previous 4 y, or their lifetime	No significant difference in having ever used a condom between vaccinated and unvaccinated participants

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STUDY*	COUNTRY	DESIGN	PARTICIPANT CHARACTERISTICS	OUTCOMES		
				HAS EVER HAD SEXUAL INTERCOURSE	NO. OF SEXUAL PARTNERS	CONDOM USE
Cummings et al,[14] 2012	United States	Comparison of a group of vaccinated adolescent girls with historical controls. Questionnaires and clinician- or self-collected vaginal swabs	Age 14-17 y; 75 vaccinated and 150 matched unvaccinated	No difference in being sexually active at enrolment between unvaccinated (76.2%) and vaccinated participants (73.6%), *P* = .65.	No significant difference in number of sex partners in the past year (OR = 1.1, 95% CI 0.9 to 1.3) or in the past 2 mo (OR = 1.2, 95% CI 0.9 to 1.5)	Mean instances of vaginal intercourse without a condom in the past 2 mo were significantly lower among vaccinated adolescent girls (OR = 0.5, 95% CI 0.4 to 0.6)
Sadler et al,[15] 2015	United Kingdom	Clinical histories from genitourinary medicine clinic visitors	Age 14-20 y; 231 vaccinated and 132 unvaccinated	NA	No difference was observed in the proportion of participants with >6 lifetime partners between vaccinated and unvaccinated females. Vaccinated females were more likely to have had ≥3 partners in the past 6 mo (OR = 2.12, 95% CI 1.08 to 4.17)	Condom use at first intercourse contact was slightly higher among vaccinated females (OR 0.55, 95% CI 0.32 to 0.96), while condom use at last intercourse contact was not significantly different
Forster et al,[16] 2012	United Kingdom	Cross-sectional and longitudinal surveys	Age 16-17 y; 433 vaccinated and 620 unvaccinated	No difference between the group being offered the HPV vaccine and the group who had not been offered the vaccine (OR 0.98, 95% CI 0.70 to 1.38). Also, no difference in the group becoming sexually active over time (OR 0.80, 95% CI 0.40 to 1.59)	No significant difference in the change in number of sexual partners over time between the 2 groups	No significant difference in change in inconsistent condom use between the 2 groups (OR 0.88, 95% CI 0.58 to 1.33)

HPV—human papillomavirus, NA—not applicable, OR—odds ratio.
*Only some studies including participants younger than 18 years of age were included in this table. Studies including only adults were not included in this review.

It is also important to consider the context of these studies. Young females who receive the HPV vaccine are, by definition, different from those who do not get vaccinated, and women (aged ≥18 years) have different sexual behaviour than adolescents or girls have.[17,18] For this reason, broad inferences should be made with caution. Longitudinal studies offer more reliable findings, but the longitudinal studies available to date have had small sample sizes and might not have had sufficient power to detect changes in sexual behaviour.

In cross-sectional studies among young females (aged 14 to 24), no statistical difference was found in the proportion of females reporting ever having had vaginal intercourse compared with a historical comparable group and an unvaccinated group.[10,14] A study including females (aged 16 to 17 years) did not indicate that being offered the HPV vaccine increased the likelihood of having reached sexual debut (41.6% and 41.2% for the group that had not been offered the vaccine and for the group that had been offered the vaccine, respectively). Using a longitudinal study design, comparing vaccinated with unvaccinated participants, the authors did not observe a difference in the change in the proportion of females being sexually active (relative percentage change 8.3% vs 6.0%, adjusted for baseline response and clustering by school).[16] In another longitudinal study no differences were observed between vaccinated and unvaccinated girls reporting ever having had sex after adjusting for sociodemographic characteristics.[8]

With regard to the association between the number of sex partners and HPV vaccination, either no association or a lower number of sexual partners among vaccinated females was found. A US study did not observe a difference in the mean number of reported lifetime partners (2.6 vs 3.0), or the number of sexual partners in the past year (2.57 vs 2.84) or the past 2 months (1.19 vs 1.44) between the vaccinated and unvaccinated participants.[14] These findings were confirmed in other US cross-sectional studies that examined a relation with the number of lifetime sexual partners.[10,11,19] A longitudinal study showed no association with the total number of partners; the respective change scores for vaccinated and unvaccinated groups were 0.31 and 0.25.[16]

There have been no associations found between HPV vaccination and consistent condom use. In fact, several studies found that among sexually active females, those who had had HPV vaccinations were more likely to use a condom.[10,14,15] In contrast, a Dutch observational cohort study of almost 3000 adolescent girls aged 16 to 17 who were eligible for a catch-up HPV immunization campaign found that vaccinated adolescents were less likely to report always using a condom with their steady partner than unvaccinated adolescents were (odds ratio of 0.71, 95% CI 0.57 to 0.89). However, with casual partners condom usage was similar among the vaccinated and unvaccinated groups.[8] A UK longitudinal study did not find a difference in condom use between vaccinated and unvaccinated adolescent girls.[16]

Conclusion

Within the existing limitations of currently available studies, HPV vaccination has not been associated with increased sexual risk behaviour in young females. For future studies exploring a possible relation between HPV vaccination and sexual behaviour, the focus should be on a longitudinal design that includes a baseline measurement of sexual behaviour before vaccination, that adjusts for possible confounders, and that measures both clinical indicators (STIs and pregnancy) and behavioural outcomes.

Competing interests

Dr Sadarangani has been an investigator on research grants from Pfizer, Merck, and VBI Vaccines but he has received no personal payments, with all monies paid to his institution.

Correspondence

Dr Ran D. Goldman; e-mail **rgoldman@cw.bc.ca**

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