

## Research Article

# Vaccination Decision-Making and HPV Knowledge: How Informed and Engaged Are Young Adult HPV Vaccine Recipients in Australia?

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**Objectives.** To date, there has been limited research on the decision-making process of HPV vaccine recipients. This study aimed to explore HPV-related knowledge, vaccination decision-making, and post vaccination attitudes about sexual behaviour in women who participated in the Australian school- and population-based HPV vaccine program. **Materials and Methods.** 102 female university students who had received the HPV vaccine (<27 years) completed scales on knowledge, vaccination decision-making, and post vaccination sexual attitudes. **Results.** HPV-related knowledge was low ( $M = 57\%$ ), and women felt moderately involved in the vaccination decision ( $M = 62\%$ ). Most women had not changed their sexual attitudes as a consequence of vaccination; however, some reported that since vaccination they feel less concerned about sexual health (19%). There were no significant differences between school- and population-based recipients on HPV knowledge ( $P = .559$ ) or post vaccination sexual attitudes ( $P = .709$ ). School-based recipients were significantly less autonomous in their decision-making ( $P = .001$ ). **Conclusion.** Poor knowledge indicates a need for provision of information about HPV and post vaccination sexual health. Additionally, policy makers and health professionals may benefit from reiterating the importance of continued sexual health practices to HPV vaccine recipients. Future research should assess whether young women need to be more involved in the informed decision-making process for HPV vaccination.

## 1. Introduction

Human Papillomavirus (HPV) has been established as the sexually transmitted agent causally associated with cervical cancer and genital warts [1]. HPV is the most common sexually transmitted infection (STI) in the world, with particularly high infection prevalence among young adults, including university students [2]. However, the recent development and introduction of Gardasil, a quadrivalent prophylactic vaccine against HPV, represent significant progress towards reducing the health burden of HPV [3].

In April 2007, Australia became the first country to commence a government funded HPV vaccination program [4].

Between 2007 and 2009, a catch-up program was introduced; targeting girls aged 13–17 via a school-based initiative and young adult women under 27 years of age via a population-based initiative. A continuing HPV vaccination program for girls aged 12–13 years (Year 7) has been implemented as part of the school-based immunisation schedule [5]. Within New South Wales, the Department of Health has developed an information package tailored to parents/guardians and based on Government guidelines, as only parental consent is required when vaccinating adolescents within the school-based program [6]. Despite recommendations that both adolescents and parents should be involved in the informed consent process [7], school-based recipients were not required

to give informed consent for receipt of the vaccine [5]. In contrast, the population-based program required women to actively seek vaccination from a healthcare provider, such as a primary healthcare physician/general practitioner (GP). The population-based program did not provide a standard information pack or a consent form to recipients. Instead, healthcare providers were responsible for obtaining informed consent from the potential recipient similar to other vaccinations given to the general population.

Data from the Australian National HPV Vaccination Program Register indicates that up to June 2011, uptake of the HPV vaccine within the school-based program was 83% for the first dose, decreasing to 70% for all three doses, for female school students aged 12–17 years [8]. Data from the population-based initiative indicates that for women aged 18–26 years, vaccine uptake rates were between 52–64% at dose one, yet only 30–38% of women received all three doses [9]. Despite the moderate uptake of the HPV vaccine within Australia, there has been little research conducted into the medical decision-making process of vaccine receipt.

While research has been conducted to understand parents' decision to have their daughters vaccinated, there is a paucity of research addressing the decision-making of vaccine recipients themselves. To date, only one quantitative study has explored the decision-making process amongst adolescents. In this school based study, 52% of Californian high school girls reported that they were not actively engaged in the vaccination decision-making and someone else or no one made the HPV vaccine decision [10]. A qualitative study found that while most of the 33 vaccinated girls aged 11–12 interviewed believed that they played a role in the decision to be vaccinated, their mothers mostly believed that the decision was a parental one alone [11]. It appears that many school-based vaccine recipients may not be actively participating in the vaccination decision. Previous studies indicate that adolescent health decision-making can be discordant from their parents' views [10, 12], yet in the Australian school-based program, only parents are required to provide informed consent regarding vaccination receipt. Further research is needed regarding involvement in decision-making throughout the HPV vaccination process within these two vaccinated cohorts.

A key aspect of informed consent is knowledge, but knowledge about the HPV vaccine and cervical cancer has consistently been found to be poor, even amongst those who have received the vaccine. One study found that even amongst first year medical students, less than half were able to identify that HPV causes cervical cancer [13]. A number of quantitative studies have found that knowledge about HPV transmission is poor [14–17]; while two studies of college age students found that the majority were aware of the causal link between HPV and cervical cancer [14, 16], research conducted on high school students seems to indicate that there is little awareness of this link in this younger age group [15, 17, 18].

Two qualitative studies of female adolescents who were offered the HPV vaccine revealed that both Australian and UK adolescents had limited understanding of HPV and HPV vaccination [6, 19]. Within the Australian cohort, a

core theme that emerged was a lack of knowledge about HPV. These adolescent respondents articulated a desire for more information about HPV and the HPV vaccine, [6, 19] and expressed frustration with the lack of age-appropriate informational material provided as a part of the vaccination program [6]. A qualitative study of 11–12 year old girls who had received the vaccine found that only 4 of the 33 girls (12%) reported having discussed sexual health as part of the vaccination decision-making process [20]. These findings are a preliminary indication that the informational materials given to young women upon vaccination or via the HPV immunisation media campaigns may have been suboptimal and indicate the need for further research into HPV knowledge post vaccination amongst this population.

Throughout the HPV vaccine implementation period, concerns have been raised by some parents, antivaccination groups, and religious groups, across a variety of ethnicities that the vaccine will encourage promiscuity and risky sexual behaviours [21–24]. A growing body of evidence suggests that, in general, these concerns are unfounded. A number of quantitative studies have found that vaccination is not associated with having more sexual partners or a lower age of first intercourse [25–28]. Bednarczyk and colleagues [28] followed a cohort of 1398 vaccinated and unvaccinated girls aged 11–12 at baseline and found that four years later, there was no difference in the rates of pregnancy or STD diagnoses between these two groups. In fact, some studies have found that vaccinated women report a more positive attitude to safe sex [27] and are more likely to report using condoms [26]. Despite this promising evidence that vaccination does not make recipients engage in risky sexual behaviour, there are indications that a small but important minority of women might be more likely to have unsafe sex following vaccination. A hypothetical study, conducted in the UK, found that a small but important minority of 328 adolescent girls stated that HPV vaccination would make them more likely to have sex in general (17%) and unprotected sex in particular (8%) [21]. However, since this study was conducted prior to the mass vaccination program, these findings may not reflect actual post vaccination beliefs and practices of women. Similar results are also apparent amongst other STI vaccines, with one study highlighting that 108 out of 140 adolescents (77%) believed that an HIV vaccine would make adolescents in general more likely to participate in risky sexual behaviour [29]. It is important to assess whether there is a small subset of vaccinated women at risk of adverse sexual health outcomes, even if aggregated findings suggest no cause for concern.

This study aimed to explore HPV-related knowledge, autonomy in HPV vaccine decision-making, and post vaccination attitudes about sexual behaviour in women who participated in the school-based and population-based vaccination programs.

## 2. Materials and Methods

The current study was conducted as a component of a larger project assessing cognitive and attitudinal factors of HPV vaccine recipients and non-recipients [30].

**2.1. Participants.** A convenience sample of female first year psychology students from an Australian University, who had received at least one of the HPV vaccine doses in either the school-based or population-based HPV vaccine program, was eligible to participate in the study. Participants received partial course credit for their involvement. Students were invited to participate if they were between the age of 17 and 26 years, as 26 years was the upper cut-off age within the free HPV vaccination initiative. To ensure informed consent, participants were excluded if they did not possess a solid understanding of English.

**2.2. Procedure.** Participants were recruited via an organised research participation system through the University. Following informed consent, all participants completed web-based questionnaires and were assured of the confidentiality of all answers to encourage open expression. The study was approved by the University Human Research Ethics Committee.

**2.3. Measures.** A comprehensive literature review found no standardised validated measures assessing HPV vaccination decision-making or post vaccination sexual attitudes. Therefore the development of purpose-designed measures was informed by a qualitative pilot study involving 18 vaccine recipients (for eligibility criteria see Participants section). The pilot study aimed to verify whether the issues of autonomy and vaccination decision-making as well as post vaccination cognitions about sexual behaviour were relevant to this population. The results of the pilot study revealed that (i) participants largely adopted a passive role in the vaccination decision-making, opting to take the advice of family, friends, teachers, and doctors, and (ii) a small proportion of participants indicated that subsequent to receiving the HPV vaccine they felt less likely to contract an STI, reduced worry about sexual health, and increased sexual freedom, thus verifying a need for the current main study.

**2.3.1. Demographics.** Participants were asked demographic questions including age, ethnicity, religion, number of sexual partners, and prior knowledge of HPV and whether they had received the HPV vaccine at high school or in the population-based (GP led) program.

**2.3.2. Knowledge.** Participants who had previously heard of HPV were asked to complete a HPV knowledge scale comprising 10 true/false questions and 3 yes/no questions developed by Juraskova et al. [31] (see Table 2). Participants received a score of 1 for a correct response. The scores were summed to produce a total score ranging from 0 to 13. A reliability analysis was not deemed appropriate for this scale, as the items were considered independent of each other and were worded in different formats.

**2.3.3. Vaccination Decision-Making.** A purpose-designed scale was included to assess the degree of autonomy when making the vaccination decision. The 12-item Likert-type scale ranged from *very strongly disagree* (1) to *very strongly*

*agree* (7), with total scores ranging from 7 to 84 and a higher score denoting greater personal autonomy regarding HPV vaccination (see Table 3). The scale had adequate internal consistency (Cronbach's  $\alpha = 0.7$ ).

**2.3.4. Post Vaccination Sexual Attitudes.** This section assessed whether receipt of the HPV vaccine decreased health protective behaviours and increased risky sexual behaviours. The 6-item Likert-type scale ranged from *very strongly disagree* (1) to *very strongly agree* (7), with total scores ranging from 6 to 42 and a higher score denoting higher participation in risky sexual behaviours (see Table 4). The scale had good internal consistency (Cronbach's  $\alpha = 0.8$ ).

**2.4. Data Analyses.** Analyses were conducted using SPSS Version 16.0 (SPSS, Inc., Chicago IL). Descriptive statistics were used to characterise the data, and chi-square tests and independent samples *t*-tests were conducted to determine any significant differences between groups. Nonparametric statistics were considered due to the uneven sample sizes between the school- and population-based recipients; however since each scale was normally distributed for both groups, parametric statistics were utilised to assess group differences. According to Cohen [32], the current sample size was adequate to detect large effect sizes ( $ES = 0.35$ ) at  $P < 0.05$ .

### 3. Results

Of the total 133 participants who signed up for the study, 31 women did not attend the research session, corresponding to a response rate of 76.7%. Reasons for nonparticipation were not known. Of the 102 participants, 82 had received the vaccine in the school-based program and 20 in the population-based program.

**3.1. Participant Characteristics.** Participant mean age was 18.6 years ( $SD = 1.2$ ; range: 17–24). The majority reported Christianity as their religious affiliation (47%) followed by nonreligious beliefs (43%). Nearly two thirds of participants identified their ethnicity as Australian (61%) and 16% as North East Asian. Over half of participants stated that they had previously engaged in sexual intercourse (56%), and 6% reported that they had previously been diagnosed with an STI.

An independent samples *t*-test and chi squared tests revealed that population-based recipients were significantly older ( $P < 0.001$ ), had a higher likelihood of previously receiving Pap smears ( $P < 0.001$ ), and were more likely to have heard about the HPV vaccine from a healthcare professional ( $P < 0.001$ ) and from family members ( $P = 0.05$ ) than school-based recipients (see Table 1).

**3.2. HPV-Related Knowledge.** Ten respondents (10%) had never heard of HPV, despite having received the HPV vaccine. Only participants who had previously heard of HPV were asked to complete the knowledge scale ( $n = 92$ ). This was done to avoid meaningless responses from participants

TABLE 1: Demographic characteristics of school-based and population-based HPV vaccine recipients.

	School-based HPV vaccine recipients			Population-based HPV vaccine recipients			Significance	
	<i>N</i>	%	Mean	<i>N</i>	%	Mean	<i>t</i>	<i>P</i>
Age	82	63.4	18.3	20	36.6	20.2	-4.747	<0.001
	<i>N</i>	%		<i>N</i>	%		$\chi^2$	<i>P</i>
Participation in sexual intercourse							3.688	0.055
Yes	42	45.8		15	75.0			
No	40	36.2		5	25.0			
Ever received Pap smear							14.380	<0.001
Yes	8	9.8		9	45.0			
No	74	90.2		11	55.0			
Ever heard of HPV							0.001	0.974
Yes	74	90.2		18	90.0			
No	8	9.8		2	10.0			
Heard of HPV from health professional							15.360	<0.001
Yes	24	29.2		15	75.0			
No	50	61.0		3	15.0			
Have not heard of HPV	8	9.8		2	10.0			
Heard of HPV from media							2.729	0.099
Yes	64	78.0		18	90.0			
No	10	12.2		0	00.0			
Have not heard of HPV	8	9.8		2	10.0			
Heard of HPV from family or friends							3.947	0.047
Yes	48	58.5		16	80.0			
No	26	31.7		2	10.0			
Have not heard of HPV	8	9.8		2	10.0			

who had never heard of HPV. Overall, the mean knowledge score was 7.4 out of 13 (57% correct) ( $SD = 1.7$ , range 3–12) indicating a modest knowledge of HPV. Table 2 outlines participants' performance on the individual items. Although the majority of participants knew that having multiple sexual partners increases the risk of HPV (89%) and that HPV can cause cervical cancer (82%) and is related to abnormal Pap smears (79%), a minority were aware that HPV is highly contagious (36%) and that early age of first sexual intercourse is a risk factor for HPV infection (41%). Data indicated that misconceptions were widely held by respondents, with 62% incorrectly agreeing with the statement that only women can get HPV and 26% incorrectly reporting that HPV can cause herpes. An independent samples *t*-test revealed no significant group difference on HPV-related knowledge ( $t(92) = -0.527$ ,  $P = 0.599$ ), with school- and population-based recipients possessing comparably poor levels of HPV knowledge.

**3.3. Vaccination Decision-Making.** Overall, HPV vaccine recipients felt moderately involved in the vaccination decision ( $M = 52.08$  out of 84). An independent samples *t*-test revealed a significant group difference on the vaccination decision-making scale ( $t(100) = -3.38$ ,  $P = 0.001$ ). Women who participated in the school-based program ( $M = 51.3$ ,  $SD = 7.3$ ) reported that they were significantly less

autonomous in their vaccination decision-making compared to participants in the population-based program ( $M = 57.5$ ,  $SD = 7.2$ ). School-based recipients were significantly more likely to have received the HPV vaccine because the school told them to ( $t(100) = 5.663$ ,  $P < 0.001$ ); and/or all of their friends received it ( $t(100) = 3.477$ ,  $P = 0.001$ ). School-based recipients also felt that they should have thought more about HPV vaccine at the time of receipt ( $t(100) = 2.658$ ,  $P = 0.009$ ) (see Table 3).

**3.4. Post Vaccination Attitudes about Sexual Behaviour.** There were no significant differences between school- and population-based recipients on post vaccination attitudes about sexual behaviour ( $t(100) = -0.374$ ,  $P = 0.709$ ). Descriptive results of the participants indicated that following receipt of the HPV vaccine, 19% ( $n = 19$ ) of all recipients felt less concerned about sexual health, 11% ( $n = 11$ ) felt less need to have regular Pap smears, and 10% ( $n = 10$ ) felt less concerned about protection against STIs.

## 4. Discussion

This study is one of the first studies to compare knowledge, decision-making, and post vaccination sexual attitudes of



TABLE 2: Number and percentage of correct responses on HPV knowledge items.

	Overall sample score ( <i>n</i> = 92)		School-based ( <i>n</i> = 74)		Population-based ( <i>n</i> = 18)	
	Mean	SD	Mean	SD	Mean	SD
Overall knowledge score (Max. score = 13)	7.4	1.7	7.4	1.7	7.6	1.7
Knowledge item	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Multiple sexual partners increases one's risk of HPV (Yes)	82	89.1	67	90.5	15	83.3
HPV can cause cervical cancer (True)	75	81.5	60	81.1	15	83.3
HPV is related to abnormal Pap smear results (True)	73	79.3	59	79.7	14	77.8
Most HPV infections have no visible signs or symptoms (True)	68	73.9	53	71.6	15	83.3
HPV can cause herpes (False)	68	73.9	56	75.7	12	66.7
A history of STIs increases one's risk of HPV (Yes)	66	71.7	54	73.0	12	66.7
Condoms are effective in protecting against HPV (False)	64	69.6	52	70.3	12	66.7
HPV is spread through skin to skin contact during sexual activity	51	55.4	42	56.8	9	50.0
HPV can cause genital warts (True)	50	54.3	39	52.7	11	61.1
Early age of first sexual intercourse increases one's risk of HPV (Yes)	38	41.3	30	40.5	8	44.4
Only women get HPV (False)	35	38.0	27	36.5	8	44.4
HPV is highly contagious (True)	33	35.9	27	36.5	6	33.3
HPV is spread through blood or other bodily fluid (False)	23	25.0	18	24.3	5	27.8

school-based and population-based (i.e., GP led) HPV vaccine recipients. It is also one of the few quantitative studies to examine post vaccination knowledge and/or the decision-making process of women who have participated in a national HPV immunisation program.

There was a widespread lack of HPV knowledge among both school-based and population-based recipients. While most participants knew that having multiple sexual partners increases one's risk of contracting HPV, a large proportion of participants incorrectly believed that only women can get HPV, and few knew that HPV is easily transmitted. This suggests that some women may not be fully aware of how HPV is transmitted. A small proportion (10%) of recipients responded that they had never heard of HPV prior to completing the current study, despite having received the HPV vaccine. Though consistent with previous research suggesting that even vaccinated women have a poor understanding of the HPV vaccine, this widespread lack of knowledge is concerning, considering the current sample involved highly educated women, and therefore the obtained results are likely to represent higher levels of knowledge than would be expected in the general population. The average knowledge score of all recipients (57%) is identical to the average knowledge score found by Juraskova et al. [31] using the same scale on university students prior to commencement of the vaccination program. This suggests that the current sample may possess similar knowledge to the unvaccinated 2007 cohort, despite having received the HPV vaccine. The current

results also echo Licht et al.'s [16] findings, which found that university students demonstrated high levels of knowledge for selected items of HPV disease detection and outcomes (such as the link between HPV and Pap smears/cervical cancer); however they possessed poorer knowledge about the sexual transmissibility and risk factors of HPV.

A possible explanation of this lack of HPV knowledge is that vaccine recipients were not provided with information tailored to their age group at the time of vaccination. In our study, as well as others [6, 19], participants expressed a desire for more information about HPV at the time of vaccination. However, the majority of vaccination information has been directed to adults and not provided in an age-appropriate format (e.g., dot points or in-class video) [6]. In addition, marketing of the vaccine as protecting against cervical cancer may have also circumvented public awareness about HPV as an STI [33]. This public health strategy may have overlooked areas of importance such as the sexual transmissibility and contagious nature of the disease, possibly explaining the lack of knowledge among the current sample. Based on the current sample's poor HPV knowledge, it is important that health professionals and HPV vaccination campaign coordinators provide comprehensive information about HPV tailored to young adult women, which might include online materials, peer education, and school-based sexuality education [34].

Results of the vaccination decision-making scale indicated that school-based recipients were significantly less autonomous in their vaccination decision-making than

TABLE 3: Vaccination decision-making amongst school-based and population-based HPV vaccine recipients.

	School-based recipients (n = 82)			Population-based recipients (n = 20)			Significance	
	Mean	SD	% Agreed <sup>+</sup>	Mean	SD	% Agreed <sup>+</sup>	t	P
Decision-making total	51.3	7.3		57.5	7.2		−3.38	0.001*
<i>Decision-making items</i>								
I received HPV vaccine because parents told me to <sup>#</sup>	4.2	1.4	48.8	4.3	1.7	55.0	−0.244	0.808
I received HPV vaccine because school told me to <sup>#</sup>	5.1	1.4	72.0	3.1	1.7	30.0	5.663	<0.001*
I received HPV vaccine because doctor told me to <sup>#</sup>	3.8	1.4	24.4	4.4	1.8	65.0	−0.687	0.095 <sup>^</sup>
I received HPV vaccine because all of my friends received it <sup>#</sup>	4.5	1.4	58.5	3.3	1.7	25.0	3.477	0.001*
I received HPV vaccine because of government advertisements <sup>#</sup>	5.0	1.2	72.0	4.4	1.8	70.0	1.482	0.152
I did not think about receiving HPV vaccine <sup>#</sup>	3.5	1.7	23.2	2.8	1.4	10.0	1.907	0.059 <sup>^</sup>
I feel I made the decision to receive HPV vaccine	5.3	1.1	85.4	5.8	0.9	95.0	−0.615	0.109
I feel I played a part in the HPV vaccine decision	5.3	1.0	86.6	5.8	1.1	95.0	−1.621	0.108
I feel I should have thought more about the HPV vaccine <sup>#</sup>	3.8	1.5	30.5	2.9	1.4	15.0	2.658	0.009*
I feel I weighed up all of the HPV vaccine information I had	3.8	1.3	26.8	4.0	1.3	35.0	−0.603	0.548
I regret receiving the HPV vaccine <sup>#</sup>	1.7	1.0	1.2	1.6	0.9	0.0	0.711	0.479
I feel I received adequate information at the time of HPV vaccination	4.6	1.3	56.1	4.5	1.5	55.0	0.185	0.854

\* Statistically significant at the  $P < 0.05$  level.<sup>^</sup> Apparent trend however failed to reach statistical significance.<sup>#</sup> Reverse-coded in the overall score; however individual items are not reverse-scored to facilitate direct interpretation of participant responses based on each item.<sup>+</sup> Percentage of participants who answered Agree/Strongly Agree/Very Strongly Agree.

TABLE 4: Descriptive statistics of post vaccination sexual attitude items.

post vaccination item	N (Agreed)*	%	N (Disagreed) <sup>^</sup>	%
I feel less concerned about my sexual health	19	18.6	83	81.4
I feel less need to have regular Pap smears	11	10.8	91	89.2
I feel less concerned about protection against STIs	10	9.8	92	90.2
I feel safer having unprotected sex	3	2.9	99	97.1
I feel less need for the use of condoms (now or in the future)	3	2.9	99	97.1
I feel that my parents would approve of me having sex, because they approved of me receiving the HPV vaccine	3	2.9	99	97.1

\* Number of participants who answered Agree/Strongly Agree/Very Strongly Agree.

<sup>^</sup> Number of participants who answered Disagree/Strongly Disagree/Very Strongly Disagree.

population-based participants. It appears school-based recipients felt influenced by their school and friends and felt that they should have thought more about the HPV vaccine at the time of receipt. These results partially align with past research which found that 52% of American school-based

recipients did not participate in the decision to receive the HPV vaccine [10]. These findings are also supported by a conceptual framework [35], which suggests that sexual health decision-making of adolescents is influenced by external forces such as peers and family members.

In the current study, the average vaccination decision-making score among all participants was 52 out of 84, indicating that most recipients were moderately active within the decision-making process. However, nearly half of recipients (46%) responded that they did not weigh up pros and cons of the HPV vaccine to make the right personal decision and 21% of recipients “did not really think about receiving the HPV vaccine at all” at the time of vaccination. Several of these results indicate ambivalence amongst participants about whether they desire autonomy, or indeed even involvement, in the decision. These results, in addition to recipients’ poor level of knowledge, raise questions regarding informed consent. Despite recommendations for both adolescents and their parents to be involved in the process of informed consent [7], school-based recipients were not required to give informed consent for receipt of the vaccine. This policy may have led to the consequence that young women were poorly informed and demonstrated high ambivalence and low involvement in deliberation about the decision. It is important to acknowledge that the implementation of a mass-administered immunisation program protecting women against HPV is crucial. However, adequate age-appropriate education and informed decision-making opportunities could potentially foster increased knowledge and health protective attitudes and practices whilst maintaining high vaccine uptake and herd immunity.

Additionally, 13% of recipients “did not feel that they played a part in the vaccination decision,” which indicates a lack of shared medical decision-making (SDM) between some school girls and their parents over vaccination. Shared decision-making is defined as an encounter in which the health professional and patient share information, reach consensus on the preferred treatment option, and agree on the plan to be implemented [36]. Research suggests that individuals are most satisfied with the information provided and the overall medical consultation when engaging in SDM [37, 38], whereas a paternalistic style of medical decision-making can lead to less satisfaction [37].

Legislative changes in the United States Senate also emphasise the significance of SDM, highlighting the importance of patients, caregivers, and clinicians engaging in decision-making and discussions about treatment options, risks, and incorporation of patient preferences and values (*Improving the quality and efficiency of health care*, 2010). Promoting active, informed, and value-sensitive participation in decision-making may be a beneficial introductory process for these young women, who may be required to make other medical decisions in the future. Pending further research on SDM in HPV vaccine recipients, policy makers, health professionals, and parents should attempt to provide opportunities for the involvement of young women (who desire an active role) in the HPV vaccination decision.

Results of the post vaccination sexual attitudes scale indicate that the vast majority of young adult women have maintained their prevaccination beliefs about sexual health. This is fitting with past studies that have not found an association between negative sexual health outcomes and receiving the vaccine [25–28]. However, a small but important minority of participants responded that since HPV vaccine receipt

they feel less concerned about sexual health (19%) and less need to practice safe sex (3%). Similar results were found in exploratory studies of post vaccination attitudes [22]. Even if these concerns are unfounded in the majority of vaccinated women, it is important not to ignore a subset of women who may believe that vaccination means they can engage in more risky sexual behaviour. Additionally, 11% of participants in our study reported less need to receive Pap smears after being vaccinated. While studies in Germany [39] and Canada [40] have found that HPV vaccine receipt is positively associated with screening uptake, recent data from Australia have found the opposite [41]. This discrepancy warrants further exploration. However, it is clear that public health initiatives, educational materials, and health professionals need to reiterate the importance of continued sexual health protective behaviours, such as cervical screening and safe sex, to all HPV vaccine recipients.

**4.1. Study Limitations.** Potential limitations of the current study include its limited generalisability to other female populations (e.g., less educated women, younger women) due to the largely Caucasian female university student sample. Further research will need to be undertaken within a more representative sample of women ranging in age, education, ethnicity, and socioeconomic status. However, the current results are useful initial indicators of the knowledge, decision-making processes, and sexual attitudes of highly educated individuals whom we would expect to have higher levels of knowledge and more informed sexual attitudes than the general population. The results therefore are likely to represent an overestimate of knowledge than that observed in the general population. Similarly, the current sample consisted of young women who volunteered to participate in the study, and who may have had a greater interest in women’s health or immunisation. Thus, the findings may be biased to reflect the views of more interested or informed women and it is possible that knowledge and participation in vaccination decision-making may be lower in the general population than found in the current study.

Due to the preliminary nature of this study, the HPV knowledge questionnaire was not validated and omitted several other facets of HPV and the HPV vaccine. However, the knowledge scale utilised provided a rich opportunity to detect any changes in knowledge from a similar cohort of women in 2007 [31] to the current 2009 cohort. Future research on HPV knowledge should include items related to both HPV and the HPV vaccine, to detect gaps in knowledge and misconceptions regarding the HPV vaccine. An additional potential limitation is that the school- and population-based recipient groups were of unequal sizes. However, this uneven sample size is a natural reflection of a young adult cohort, as most women under the age of 20 received the HPV vaccine in the school-based program.

**4.2. Clinical Implications and Conclusions.** As one of the first studies to explore and compare these two cohorts of HPV vaccine recipients, several findings indicate the potential for a shift in public policy and clinical practice regarding the

implementation of vaccination programs. Results highlight that HPV related knowledge among vaccine recipients is low. Therefore, future research should evaluate the effectiveness of provision of age-appropriate educational materials to young adult women. Secondly, HPV vaccine recipients may benefit from being more actively involved in the decision-making and informed consent process for HPV vaccination. Whilst it is crucial that vaccine uptake and herd immunity are maximised, it is also important that women are informed and engaged whilst receiving the vaccine. Future research should assess vaccine decision-making more systematically within representative populations. Finally, policy makers and health professionals need to be aware that, among a small minority of young women, attitudes towards safe sex and sexual health practices may have been altered after HPV vaccination. Therefore, the importance of continued sexual health protective behaviours, such as cervical screening and safe sex, needs to be continuously emphasised to HPV vaccine recipients.

## Conflict of Interests

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