Factors associated with HPV vaccination among adult women in Quebec

Marilou Kiely,^{1,2,3,*} Chantal Sauvageau,^{1,2,3} Ève Dubé,^{1,2,3} Geneviève Deceuninck³ and Philippe De Wals^{1,2,3}

¹Laval University; Quebec City, QC Canada; ²Public Health Quebec Institute; Quebec, QC Canada; ³Research Center of CHU de Québec; Quebec, QC Canada

Keywords: knowledge, attitudes, beliefs, HPV infections, HPV vaccine, sexual activity, cervical cancer screening

Abbreviations: HPV, human papillomavirus; STIs, sexually transmitted infections; OR, odds ratio; CI, confidence interval

Background and objective: Human papillomavirus (HPV) infections are the most common sexually transmitted infections in North America and are associated with cervical cancer. A publicly-funded HPV immunization program was launched in the province of Quebec, Canada, in the fall of 2008.

The aim of this study was to explore factors associated with HPV immunization among young adult women not targeted by this program.

Results: Few women had received at least one dose of HPV vaccine among the 1,347 respondents. Age at first sexual intercourse ≥ 20 y, participating in cervical cancer screening, higher education level, being born in Quebec and some positive beliefs about HPV were associated with vaccination.

Methods: A questionnaire was mailed to 2,400 24-y-old women randomly selected from the Quebec provincial health insurance database and 56% responded. Factors associated with vaccination status were analyzed using a multivariate logistic regression model.

Conclusions: The rate of immunization in women who had to pay for the HPV vaccine was very low and was associated with characteristics that are generally associated with a lower risk for HPV infection and cervical cancer. Efforts are needed to reach at-risk adult women.

Human papillomavirus (HPV) infections are the most common sexually transmitted infections (STIs) in North America¹ and are associated with cervical cancer.² The first vaccine against HPV infections was licensed for use in Canada in 2006³ and immunization programs targeting school-aged girls and young women have now been implemented in all provinces and territories for the primary prevention of cancers related to HPV.⁴ In the province of Quebec, since 2008, routine immunization of girls aged 9–10 y-old has been offered at school in Grade 4 (2 doses 6 mo apart) and a booster dose (third dose) is planned at age 14–15 y in Grade 9. Catch-up vaccination (3 doses) was offered free of charge up to age 18. The Gardasil[®] vaccine is used and includes protection against HPV 6, 11, 16 and 18. Decisions regarding HPV vaccine programs were controversial. In a highly publicized editorial in the CMAJ, Lippman and coauthors (2007) stated that universal vaccination was premature and may have unintended negative consequences for individuals and for society as a whole.⁵ One fear was that vaccination could lead to a reduction in safer sex practices and in Pap screening rates.^{5,6}

In the province of Quebec, evaluation studies are launched and publicly-funded for every new vaccination program.⁷ A series of surveys (once every four years) has been planned to monitor the impact of HPV vaccination on vaccinated women's behaviors.

The first survey was conducted in 2009 and aimed to describe knowledge, beliefs and behaviors related to HPV and HPV prevention.⁸ In this paper, we present the results of an additional analysis of the database with the goal of describing the factors associated with HPV vaccination among adult women in Quebec who had to pay for immunization.

In March–April 2009, the first postal survey was conducted among a random sample of 24-y-old women selected from the Quebec provincial health insurance database. At the time of the survey, women born in 1984–1985 were not eligible for free vaccination and had to purchase the vaccine in pharmacies or in private or public health clinics offering this service.

The Health Belief Model was the principal theoretical framework used to frame the knowledge and beliefs survey constructs.⁹ The questionnaire was also adapted from previously validated surveys used in similar populations and concerning the same topic.^{10–12} Four belief scores were generated from variables collected on a 4-point Likert scale (Strongly disagree/Disagree/Agree/Strongly agree) and were derived from a factorial analysis: a score for perceived risk for HPV and cervical cancer, a score for perceived severity for HPV and cervical cancer, a score for belief in self-efficacy in preventing HPV and cervical cancer and a score for belief in the efficacy of preventive intervention for HPV and cervical cancer. Belief scores were computed by calculating the

*Correspondence to: Marilou Kiely; Email: marilou.kiely@inspq.qc.ca

Submitted: 01/14/13; Revised: 04/02/13; Accepted: 04/08/13

<http://dx.doi.org/10.4161/hv.24603>

Table 1. Independent variables included in univariate analyses

Variables ^a	Univariate	
	OR ^b	95% CI ^c
Marital status: single vs. <i>in relationship or married</i>	2.3	0.7–7.1
Education level $\geq$ college vs. <i>< college</i>	3.4	1.6–7.2
Born in Quebec vs. <i>born outside the province of Quebec</i>	3.2	0.9–11.3
Resident in Montreal vs. <i>resident in other Quebec region</i>	1.9	1.2–3.2
Never practice religious activities vs. <i>practice religious activity occasionally</i>	1.2	0.7–2.0
Main occupation: student vs. <i>at work, student and at work or at home</i>	1.9	1.1–3.3
Age at first sexual intercourse:		
< 15 y vs. $\geq$ 20 y	0.2	0.1–0.5
15–19 y vs. $\geq$ 20 y	0.5	0.3–0.8
Total number of sexual partners:		
$\geq$ 10 vs. 1	0.3	0.1–0.8
2–10 vs. 1	0.7	0.4–1.2
Ever had a gynecological exam, including a Pap test vs. <i>never had this exam</i>	4.2	1.2–14.5
Age at first Pap test < 20 y vs. $\geq$ 20 y	1.3	0.8–2.4
Total number of lifetime Pap tests		
$\geq$ 10 vs. < 5	1.2	0.6–2.3
5–9 vs. < 5	1.2	0.6–2.1
Perceived risk score for HPV and cervical cancer ^d (for each additional point)	0.9	0.6–1.4
Perceived severity score for HPV and cervical cancer ^d (for each additional point)	1.0	0.7–1.4
Belief in self-efficacy in preventing HPV and cervical cancer ^d (for each additional point)	1.6	1.2–2.3
Belief in efficacy of preventive interventions for HPV and cervical cancer ^d (for each additional point)	1.9	1.1–3.1

^aReference in italic. ^bOdds Ratio: a value $\geq$ 1. ^c95% Confidence Interval. ^dA Likert scale (Strongly disagree/Disagree/Agree/Strongly agree) was used for questions related to beliefs and a score was calculated for the analysis. The first score was created with 6 questions and the other three with 2 questions.

mean of answers (from 1 to 4) to each question included in the score. The scores of the first three variables had good internal consistency, with Cronbach's $\alpha > 0.75$. The last variable had an α of 0.45 but was built with only two initial variables.

Variables associated with vaccination status were analyzed using a multivariate logistic regression model. Independent variables included in the model were marital status, education level, place of birth, region of residence, religious practice, main occupation, age at first intercourse, total number of sexual partners, history of ever having a gynecological exam, including a Pap test, age at first Pap test, number of lifetime Pap tests, and belief scores (Table 1). The effect of each independent variable associated in univariate analyses at a level of statistical significance > 0.20 was explored stepwise and the final model included only those that were significantly ($p < 0.05$) associated with HPV vaccination and/or those introducing confusion, defined as a change of $\geq 10\%$ in the value of the Odds Ratio. All analyses were weighted for sampling fractions across the region and were performed using SAS 9.2 software (SAS Institute). More details on the methodology and results may be found in a previous publication and the questionnaire may be made available upon request.⁸

Questionnaires were sent to 2,400 women randomly selected from the Quebec provincial health insurance database. The

response rate was 56% ($n = 1347$).⁸ The sample characteristics of respondents were presented in a previous publication, mentioned above, and, as expected, almost all women were sexually active and half had their first sexual intercourse before 16 y of age.⁸ The distribution of total number of sexual partners was as follows: 1 = 16%, 2 to 4 = 33%, 5 to 10 = 32%, $> 10 = 19\%$. As expected, there was a strong correlation between the age at first intercourse and total number of partners (Pearson's correlation coefficient $r = 0.41$, $p < 0.0001$). As shown in Table 2, after multivariate analyses, HPV vaccination was associated with an older age at first intercourse (> 20 y) and vaccinated women were more likely to have had a gynecological examination including a Pap test (OR = 5.8, CI: 1.6–20.9). Other variables that remained associated with HPV vaccination were education level, place of birth, place of residence and beliefs about self-efficacy in preventing HPV and cervical cancer and the efficacy of preventive interventions for HPV and cervical cancer.

Results clearly show that women who chose to be immunized against HPV were better educated, and were more likely to have had their first sexual intercourse over the age of 20 and to have had a gynecological examination including a Pap test. Similar to this study, higher education level has been associated with safe sexual behaviors and screening practices¹³ and also with a higher

Table 2. Factors associated with HPV vaccination in final multivariate model

Variables ^a	Multivariate	
	OR ^b	95% CI ^c
Education level $\geq$ college vs. $<$ college	2.4	1.1–5.2
Born in Quebec vs. <i>born outside the province of Quebec</i>	5.2	1.4–18.9
Resident in Montreal vs. <i>resident in other Quebec region</i>	2.2	1.3–3.9
Age at first sexual intercourse $<$ 15 y vs. $\geq$ 20 y	0.1	0.0–0.4
Age at first sexual intercourse 15–19 y vs. $\geq$ 20 y	0.4	0.2–0.7
Ever had a gynecological exam, including a Pap test vs. <i>never had this exam</i>	5.8	1.6–20.9
Belief in self-efficacy in preventing HPV and cervical cancer ^d (for each additional point)	1.5	1.0–2.1
Belief in efficacy of preventive interventions for HPV and cervical cancer ^d (for each additional point)	2.0	1.1–3.4

^aReference in italic. ^bOdds Ratio: a value $\geq$ 1. ^c95% Confidence Interval. ^dA Likert scale (Strongly disagree/Disagree/Agree/Strongly agree) was used for questions related to beliefs and a score was calculated for the analysis. The scores were created with 2 questions.

acceptability of HPV vaccination.¹⁴ The respondent's income was not evaluated in this study and we used education level as a proxy for socio-economic status. Income could be a confusion factor for the association between higher education level and HPV vaccination; it is possible that women with a higher education level also had higher income, which further influences their vaccination status. However, many studies found that income level was not associated with the acceptance of HPV vaccine.^{15–17}

In our study, HPV immunization was associated with characteristics that are generally associated with lower risk for HPV infection and cervical cancer.^{18,19} The choice by participants to be vaccinated against HPV seems to reflect health-promoting lifestyle behaviors. Recent studies found no evidence that HPV vaccination has a negative impact on sexual behaviors and screening practices,^{17,20–22} but other studies examining older women with health-promoting lifestyle behaviors are needed to explore if this trend is also observed in this population. Some study findings suggested that vaccinated women perceived a need for continuing safer sexual practices.^{21,23} On the other hand, risky sexual behaviors have been linked to a negative intention to receive the HPV vaccine²⁴ and it is possible that non-vaccinated women may be less motivated to maintain good sexual health, as suggested by Mather et al., 2012.²⁰

Women who regularly see a health professional for a gynecological examination are more likely to receive information on HPV vaccination.²² Contact with a health professional may have facilitated the transmission of information about HPV and the vaccine, particularly to women over the age of 18 where no school program exists and for whom the HPV vaccine is not publicly-funded. A physician's recommendation or influence has been associated with HPV vaccination.²⁵ However, cost remains an important barrier to vaccination.²⁶ Only 5% of participants of this study had received the HPV vaccine and vaccine cost may be a barrier to vaccination (data not collected).⁸ These findings may support the idea of expanding the actual program to older women in order to improve HPV vaccine coverage in this population. In comparison, 76% of girls have been vaccinated in the school-based catch-up program in 2011–2012 (grade 9).²⁷

In our study, knowledge scores were not included in the model as the women were interviewed after immunization and knowledge could be a cause as well as a consequence of being vaccinated; women may have received information about HPV vaccine at the time of vaccination. However, other transversal studies found that knowledge was associated with intention to receive the HPV vaccine or HPV vaccine acceptance.^{14,24} Positive beliefs related to HPV vaccine efficacy were also associated with HPV vaccination status in other studies.^{24,28}

This study has some limitations. First, it was conducted among women aged 24 who had to purchase the vaccine. Indeed, few participants were vaccinated and these women may have particular characteristics, e.g., adoption of more preventive behavior. Second, recall bias and social desirability bias cannot be excluded. However, the fact that the survey was anonymous and that the HPV vaccination had been available for only 3 y at the time of the study should limit these biases. Although our study had a good response rate of 56%, a selection bias is possible related to non-respondents. Women were asked whether they ever had a gynecological exam, including a Pap test. A response bias cannot be excluded because some women may not be aware of Pap testing being performed during a gynecological exam.

Although vaccination rates are less than ideal in Quebec (77% vaccinated in Grade 4 and 76% in Grade 9 in 2011–2012, vs. an objective of 90%),²⁷ this program is certainly more equitable and effective than targeting young adults through a private scheme. As shown by the results of this study, the HPV vaccination rate among older women who have to pay for the vaccine is very low and efforts are needed to improve vaccination uptake among at-risk adult women. Based on this transversal study, it is not possible to draw conclusions about the impact of vaccination on sexual practices and cervical cancer screening. Vaccinated women in our study seem to have health-promoting lifestyle behaviors. Further studies assessing the impact of HPV vaccination on young girls' behaviors are essential.

Acknowledgments

We would like to thank the women who participated in this study and the Quebec Ministry of Health for its financial support.

Conflict of Interest Statement

C.S. has received research grants, honoraria and travel expenses from the following companies: Wyeth (Pfizer), GlaxoSmithKline and Merck and from government agencies, including the Quebec Ministry of Health and Social Services and the Quebec City Health and Social Services Agency. È.D. has received unrestricted research grants from GlaxoSmithKline. P.D.W. has

received unrestricted research grants, honoraria and reimbursement of travel costs by the following companies: Wyeth (Pfizer), GlaxoSmithKline and Merck and by governmental agencies, including the Quebec ministry of Health and social Services and the Public Health Agency of Canada. The other authors declare that they have no conflicts of interest.

References

1. Weinstock H, Berman S, Cates W Jr. Sexually transmitted diseases among American youth: incidence and prevalence estimates, 2000. *Perspect Sex Reprod Health* 2004; 36:6-10; PMID:14982671; <http://dx.doi.org/10.1363/3600604>.
2. Trottier H, Franco EL. The epidemiology of genital human papillomavirus infection. *Vaccine* 2006; 24(Suppl 1):S1-15; PMID:16406226; <http://dx.doi.org/10.1016/j.vaccine.2005.09.054>.
3. National Advisory Committee on Immunization. Statement on human papillomavirus vaccine. *Can Commun Dis Rep* 2007; 33(DCC-2):1-32.
4. Public Health Agency of Canada. Publicly funded Immunization Programs in Canada - Routine Schedule for Infants and Children including special programs and catch-up programs (as of March 2011). Available at: <http://www.phac-aspc.gc.ca/im/primprog-impt/table-1-eng.php> Consulted July 18, 2011.
5. Lippman A, Melnychuk R, Shimmin C, Boscoe M. Human papillomavirus, vaccines and women's health: questions and cautions. *CMAJ* 2007; 177:484-7; PMID:17671239; <http://dx.doi.org/10.1503/cmaj.070944>.
6. Guyon J. The coming storm over a cancer vaccine: Christian conservatives fear that new, amazingly effective cervical-cancer vaccines will spur promiscuity and undermine abstinence. Let the lobbying wars begin. *Fortune* 2005; 152:59-62.
7. De Wals P. Optimizing the acceptability, effectiveness and costs of immunization programs: the Quebec experience. *Expert Rev Vaccines* 2011; 10:55-62; PMID:21162621; <http://dx.doi.org/10.1586/erv.10.151>.
8. Kiely M, Sauvageau C, Dubé E, Deceuninck G, De Wals P. Virus du papillome humain: connaissances, croyances et comportements des femmes québécoises. *Can J Public Health* 2011; 102:303-7; PMID:21913589.
9. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr* 1974; 2:328-35, 354, 386.
10. Ingledue K, Cottrell R, Bernard A. College women's knowledge, perceptions, and preventive behaviors regarding human papillomavirus infection and cervical cancer. *American Journal of Health Studies* 2004; 19:28-34.
11. Statistiques Canada. Enquête sur la santé dans les collectivités canadiennes (ESCC 3.1). 2005.
12. Rodrigues I, Dedobbeleer N, Turcot C. Use of condoms by adolescents seeking oral contraceptives in the Montreal area. *Can J Public Health* 2005; 96:438-42; PMID:16350868.
13. Coe K, Martin L, Nuvayestewa L, Attakai A, Papenfuss M, De Zapien JG, et al. Predictors of Pap test use among women living on the Hopi reservation. *Health Care Women Int* 2007; 28:764-81; PMID:17907006; <http://dx.doi.org/10.1080/07399330701562956>.
14. Dursun P, Altuntas B, Kescu E, Ayhan A. Women's knowledge about human papillomavirus and their acceptance of HPV vaccine. *Aust N Z J Obstet Gynaecol* 2009; 49:202-6; PMID:19432612; <http://dx.doi.org/10.1111/j.1479-828X.2009.00947.x>.
15. Oh JK, Lim MK, Yun EH, Lee EH, Shin HR. Awareness of and attitude towards human papillomavirus infection and vaccination for cervical cancer prevention among adult males and females in Korea: a nationwide interview survey. *Vaccine* 2010; 28:1854-60; PMID:20005860; <http://dx.doi.org/10.1016/j.vaccine.2009.11.079>.
16. Stupiansky NW, Rosenthal SL, Wiehe SE, Zimet GD. Human papillomavirus vaccine acceptability among a national sample of adult women in the USA. *Sex Health* 2010; 7:304-9; PMID:20719219; <http://dx.doi.org/10.1071/SH09127>.
17. Liddon NC, Leichter JS, Markowitz LE. Human papillomavirus vaccine and sexual behavior among adolescent and young women. *Am J Prev Med* 2012; 42:44-52; PMID:22176845; <http://dx.doi.org/10.1016/j.amepre.2011.09.024>.
18. Goggin P, Mayrand MH. Avis sur l'optimisation du dépistage du cancer du col utérin au Québec. Québec: Institut national de santé publique du Québec, 2009, 101 p.
19. Burchell AN, Winer RL, de Sanjose S, Franco EL. Chapter 6: Epidemiology and transmission dynamics of genital HPV infection. *Vaccine* 2006; 24 Suppl 3:S3/52-61.
20. Mather T, McCaffery K, Juraskova I. Does HPV vaccination affect women's attitudes to cervical cancer screening and safe sexual behaviour? *Vaccine* 2012; 30:3196-201; PMID:22425789; <http://dx.doi.org/10.1016/j.vaccine.2012.02.081>.
21. Forster AS, Marlow LA, Stephenson J, Wardle J, Waller J. Human papillomavirus vaccination and sexual behaviour: cross-sectional and longitudinal surveys conducted in England. *Vaccine* 2012; 30:4939-44; PMID:22664223; <http://dx.doi.org/10.1016/j.vaccine.2012.05.053>.
22. Bednarczyk RA, Davis R, Ault K, Orenstein W, Omer SB. Sexual activity-related outcomes after human papillomavirus vaccination of 11- to 12-year-olds. *Pediatrics* 2012; 130:798-805; PMID:23071201; <http://dx.doi.org/10.1542/peds.2012-1516>.
23. Mullins TL, Zimet GD, Rosenthal SL, Morrow C, Ding L, Shew M, et al. Adolescent perceptions of risk and need for safer sexual behaviors after first human papillomavirus vaccination. *Arch Pediatr Adolesc Med* 2012; 166:82-8; PMID:22213755; <http://dx.doi.org/10.1001/archpediatrics.2011.186>.
24. Kahn JA, Rosenthal SL, Jin Y, Huang B, Namakydoust A, Zimet GD. Rates of human papillomavirus vaccination, attitudes about vaccination, and human papillomavirus prevalence in young women. *Obstet Gynecol* 2008; 111:1103-10; PMID:18448742; <http://dx.doi.org/10.1097/AOG.0b013e31817051fa>.
25. Mathur MB, Mathur VS, Reichling DB. Participation in the decision to become vaccinated against human papillomavirus by California high school girls and the predictors of vaccine status. *J Pediatr Health Care* 2010; 24:14-24; PMID:20122474; <http://dx.doi.org/10.1016/j.pedhc.2008.11.004>.
26. Cui Y, Baldwin SB, Wiley DJ, Fielding JE. Human papillomavirus vaccine among adult women: disparities in awareness and acceptance. *Am J Prev Med* 2010; 39:559-63; PMID:21084077; <http://dx.doi.org/10.1016/j.amepre.2010.08.001>.
27. Ministère de la Santé et des Services sociaux. Campagne de vaccination en milieu scolaire contre le VPH. *Flash Vigie* 2012; 7:3-4.
28. Mehu-Parant F, Rouzier R, Soulat JM, Parant O. Eligibility and willingness of first-year students entering university to participate in a HPV vaccination catch-up program. *Eur J Obstet Gynecol Reprod Biol* 2010; 148:186-90; PMID:19926199; <http://dx.doi.org/10.1016/j.ejogrb.2009.10.024>.