


# Human Papillomavirus Vaccine Sources of Information and Adolescents' Knowledge and Perceptions

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## Abstract

Understanding where adolescents obtain information about human papillomavirus (HPV) vaccines may be helpful in designing public health interventions promoting HPV vaccination. This study assessed the following: (1) exposure to specific sources of information about HPV vaccines, (2) self-reported helpfulness of these sources of information, and (3) whether the specific source of information was associated with knowledge and perceptions about HPV vaccines among adolescent girls. There were 339 adolescent girls (mean age = 16.8 years) recruited into the study. Television advertisements, the Internet, doctors/nurses, and mothers were the most frequently reported sources of vaccine information; more than 90% of participants who received information from these sources reported they were helpful. Adolescents who received information about HPV vaccines from television advertisements, the Internet, clinicians, and mothers had higher knowledge about HPV vaccines and more positive perceptions. Assuring the accuracy of messages from these sources will be essential, given their importance in influencing adolescents' knowledge and perceptions about HPV vaccines.

## Keywords

human papillomavirus vaccine, adolescents, knowledge, perceptions, information

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## Introduction

Currently, 3 vaccines, a bivalent, quadrivalent, and 9-valent vaccine, are recommended by the Advisory Committee on Immunization Practices for prevention of infection by human papillomavirus (HPV), a virus that is causally linked with anogenital cancers and condylomata.<sup>1,2</sup> The Advisory Committee on Immunization Practices recommends routine HPV vaccination for boys and girls aged 11 to 12 years, catch-up vaccination for males aged 13 to 21 years as well as vaccination of males aged 22 to 26 years at high risk, and catch-up vaccination for females aged 13 to 26 years.<sup>1</sup> However, current HPV vaccination rates in the United States fall short of *Healthy People 2020*'s objective of 80% coverage for adolescents aged 13 to 15 years.<sup>3</sup>

HPV vaccine uptake has been associated with higher HPV knowledge, more perceived benefits of vaccination,

fewer perceived barriers to vaccination, greater perceived susceptibility to HPV-related disease, and belief that influential individuals would recommend vaccination.<sup>4,5</sup> Despite the importance of knowledge and perceptions in vaccine uptake, little is known about the factors associated with higher knowledge or positive perceptions toward HPV vaccination, especially among adolescent girls. Therefore, determining factors associated with HPV vaccine knowledge and perceptions among adolescents is of interest as interventions affecting change in knowledge and perceptions are needed to increase uptake.<sup>6</sup>

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Individuals, especially parents and clinicians, are likely to influence adolescent girls' vaccine knowledge and attitudes.<sup>7,8</sup> Adolescents tend to have positive attitudes about HPV vaccination when their parents intend to vaccinate them and when adolescents perceive that their parents think vaccination is important.<sup>7,9</sup> Likewise, provider recommendation for vaccination is a critical factor in terms of vaccine acceptability for parents as well as adolescents.<sup>10-13</sup> However, the influence of adolescents' social networks and media on knowledge and perceptions toward the HPV vaccine among adolescent girls have not been examined, to our knowledge.

While mass media is useful in providing information and helping people construct knowledge about the vaccine, the interpersonal interactions of the social network have the potential to be more effective in forming and changing health behavior perceptions.<sup>14,15</sup> For example, if the HPV vaccine is perceived to be risky by parents and adolescents, information provided through websites, presentations, printed public health materials, and one-on-one counseling may lack the required components needed to persuade parents and adolescents to accept and obtain the HPV vaccine.<sup>16,17</sup> Additionally, family members and friends as sources of information have been documented to negatively influence vaccination behaviors; for example, if they share negative experiences of the influenza vaccine making them sick.<sup>18</sup> Thus, HPV vaccine acceptance may be dependent on parents and adolescents obtaining accurate information and positive messages from multiple sources including mass media and people within their social networks.

Therefore, we designed a study among adolescent girls who had received their first HPV vaccine to (1) examine exposure to specific sources of information about HPV vaccines among adolescent girls, specifically media and people within adolescents' social networks; (2) assess self-reported helpfulness of these sources of information; and (3) determine whether the specific source of information, as well as the number of sources of information, were associated with knowledge and perceptions about HPV vaccines.

## Material and Methods

### *Subjects and Study Design*

Participants, aged 13 to 21 years, were consecutively recruited from an urban hospital-based adolescent primary care office for a longitudinal study examining the attitudinal and behavioral impact of HPV vaccination among adolescent girls. The data analyzed for this study were collected at the baseline visit. The study was approved by the hospital's institutional review board.

Participants completed self-administered, paper-and-pencil surveys. The survey included a 13-item validated index assessing knowledge about HPV (10 items) and HPV vaccines (3 items; Table 1).<sup>19</sup> Response options were true, false, and don't know, and scale score was calculated for the number of correct items. The survey also assessed HPV vaccine perceptions of normative beliefs, benefits, and barriers, and perceptions of HPV severity and susceptibility using validated, theory-based scales developed in our previous work among similar populations.<sup>19-21</sup> The 7 scales, each including items measured using a 5-point Likert-type rating, assessed normative beliefs (belief that influential people would want the participant to be vaccinated; 4 items, Cronbach's  $\alpha = .72$ ), barriers to vaccination related to vaccine safety (4 items,  $\alpha = .74$ ), barriers related to insufficient information about the HPV vaccine (2 items,  $\alpha = .88$ ), benefits of vaccination related to vaccine safety (3 items,  $\alpha = .80$ ), benefits of vaccination related to protection against HPV-related disease (2 items,  $\alpha = .60$ ), perceived susceptibility to genital warts and cervical cancer (2 items,  $\alpha = .75$ ), and perceived severity of genital warts and cervical cancer (2 items,  $\alpha = .84$ ).

Participants were asked to indicate whether they had heard about HPV vaccines during the prior 6 months from any of the following sources: 4 media sources (newspaper/magazine, television [TV] advertisements, radio, and the Internet), and 7 individual network sources (mother, father, other relatives, doctor or nurse, teacher, church/synagogue/mosque, and girlfriends or boyfriends). If the participant reported that she heard about HPV vaccines from a given source, she was asked to rate the source as extremely helpful, somewhat helpful, or not helpful to her. Given that only a small percent of participants endorsed any source as somewhat helpful, the 3 categories were collapsed for analysis into not helpful versus somewhat or extremely helpful.

### *Statistics*

Descriptive analyses were performed to examine participants' demographic characteristics, sources of information about HPV vaccines, HPV and HPV vaccine knowledge and perceptions. Univariate analyses using independent *t* tests were performed to compare the mean scores for knowledge and perceptions scales for those who did versus those who did not report having received information about HPV vaccines from each of the 11 possible sources of information. Spearman correlation coefficients were used to determine whether the number of sources of information reported was associated with knowledge and perceptions scale scores.

**Table 1.** HPV and HPV Vaccine Knowledge.

Knowledge Item	Correct Response, n (%)
1. Most women with HPV have problems with menstrual periods. <sup>a</sup>	21 (6.2)
2. HPV infection can cause problems getting pregnant. <sup>a</sup>	24 (7.1)
3. HPV infection can sometimes be cured with antibiotics. <sup>a</sup>	50 (14.8)
4. HPV is spread from person to person by skin to skin genital contact. <sup>b</sup>	97 (28.6)
5. HPV vaccine protects girls and women from all the HPV types that cause cancer. <sup>a,c</sup>	103 (30.4)
6. Smoking increases a woman's chance of getting cervical cancer if she has HPV. <sup>b</sup>	110 (32.5)
7. Genital warts always goes away permanently if a woman gets the right treatment. <sup>a</sup>	132 (38.9)
8. Girls and women who have received the HPV vaccine are protected 100% against cervical cancer. <sup>a,c</sup>	145 (42.8)
9. HPV infection is often detected by a Pap test. <sup>b</sup>	178 (52.5)
10. If a woman's male sexual partners use condoms, she is completely protected against HPV. <sup>a</sup>	195 (57.5)
11. Women with HPV may need to get Pap tests more often than those without HPV. <sup>b</sup>	204 (60.2)
12. Girls and women who have received the HPV vaccine still need Pap tests. <sup>b,c</sup>	235 (69.3)
13. A person may be infected with HPV and not know it. <sup>b</sup>	295 (87.0)

Abbreviations: HPV, human papillomavirus; Pap test, Papanicolaou test.

<sup>a</sup>Correct answer = False.

<sup>b</sup>Correct answer = True.

<sup>c</sup>Vaccine-related knowledge item.

## Results

### Demographics

The mean age of the 339 participants was 16.8 years, and the majority was black ( $n = 259$ , 76.4%), followed by white ( $n = 56$ , 16.5%) and other ( $n = 24$ , 7.1%). Most participants reported having insurance at the time of enrollment ( $n = 284$ , 83.7%) with Medicaid as the primary source ( $n = 194$ , 57.2%). Just more than half of the participants were sexually experienced ( $n = 195$ , 57.5%). Table 1 provides the percentage of participants who responded correctly to the HPV and HPV vaccine knowledge scale. Table 2 provides sources of information about HPV vaccines and helpfulness of each source.

### Associations Between Sources of Information and Knowledge and Perceptions Toward HPV Vaccines

TV advertisements, in addition to being the most commonly reported media source for HPV vaccine information, were also associated with several knowledge and perceptions measures (Table 3). Having received (vs not having received) information from a TV advertisement was associated with higher knowledge

( $t = 5.05$ ,  $P < .0001$ ), higher normative beliefs (ie, belief that important individuals would want her vaccinated;  $t = 2.90$ ,  $P = .004$ ), fewer perceived barriers related to vaccine safety ( $t = 2.55$ ,  $P = .011$ ), greater perceived benefits related to vaccine safety ( $t = 3.05$ ,  $P = .0024$ ), and greater perceived benefits related to vaccine protection ( $t = 2.75$ ,  $P = .0062$ ). In contrast, TV advertisements were associated with lower perceived susceptibility to genital warts and cervical cancer ( $t = 1.98$ ,  $P = .049$ ). Having received information from the Internet was associated with higher HPV knowledge ( $t = 3.23$ ,  $P = .0014$ ), and having received information from the Internet ( $t = 2.06$ ,  $P = .04$ ) and a newspaper ( $t = 4.08$ ,  $P < .0001$ ) were also associated with higher normative beliefs.

Doctors and nurses were the most commonly reported individual source of information about HPV vaccines and the individual source associated with the highest number of scales measuring knowledge and perceptions. Those who indicated that doctors or nurses were sources of information had higher knowledge scores ( $t = 1.98$ ,  $P = .049$ ), higher normative beliefs ( $t = 2.22$ ,  $P = .027$ ), fewer perceived barriers related to vaccine safety ( $t = 3.27$ ,  $P = .0012$ ), and greater perceived benefits related to vaccine safety ( $t = 2.34$ ,  $P = .02$ ). Participants who

**Table 2.** Sources of Information About HPV Vaccines and Helpfulness of Each Source.

Source of Information	Received Information From That Source, n (%)	Information From That Source Somewhat or Extremely Helpful, n (%)
<b>Media sources</b>		
TV advertisements	222 (65.7)	211 (95.0)
The Internet	118 (34.8)	211 (95.0)
Newspaper or magazine	69 (20.3)	57 (82.6)
Radio	68 (20.1)	60 (88.2)
<b>Individual sources</b>		
Doctor or nurse	299 (88.5)	297 (99.3)
Mother	129 (38.1)	125 (96.9)
Other relatives	73 (21.5)	70 (95.9)
Teacher	59 (17.4)	57 (96.5)
Girlfriend/boyfriend	55 (16.2)	47 (85.5)
Father	27 (8.0)	26 (96.3)
Church/synagogue/mosque	13 (3.8)	12 (92.3)

Abbreviations: HPV, human papillomavirus; TV, television.

reported mothers as a source of information had higher normative beliefs ( $t = 2.45$ ,  $P = .015$ ) and fewer perceived barriers related to vaccine safety ( $t = 1.98$ ,  $P = .048$ ). In contrast, the few participants who endorsed fathers as a source of HPV vaccine information had lower knowledge about HPV and HPV vaccines ( $t = 2.25$ ,  $P = .025$ ) and fewer perceived benefits related to vaccine safety ( $t = 3.84$ ,  $P = .0001$ ).

Spearman correlation coefficients between number of information sources reported and knowledge and perceptions are shown in Table 4. Greater number of media sources was associated with higher knowledge ( $r_s = .22$ ,  $P < .0001$ ), higher normative beliefs ( $r_s = .20$ ,  $P_s = .0002$ ), fewer perceived barriers related to vaccine safety ( $r_s = .17$ ,  $P = .0023$ ), greater perceived benefits related to vaccine safety ( $r_s = .14$ ,  $P = .0083$ ), and greater perceived severity of genital warts and cervical cancer ( $r_s = .13$ ,  $P = .02$ ). Higher number of individual sources was associated with higher normative beliefs ( $r_s = .15$ ,  $P = .0067$ ) and fewer perceived barriers related to vaccine safety ( $r_s = .15$ ,  $P = .005$ ). Higher number of total sources was associated with higher knowledge ( $r_s = .16$ ,  $P = .0025$ ), higher normative beliefs ( $r_s = .21$ ,  $P < .0001$ ), fewer perceived barriers related to safety ( $r_s = .17$ ,  $P = .0013$ ), and greater perceived benefits related to safety ( $r_s = .13$ ,  $P = .0201$ ) and vaccine protection ( $r_s = .13$ ,  $P = .0165$ ).

## Discussion

Media sources were highly associated with knowledge about HPV and the vaccine. Media can have a powerful impact on vaccination attitudes and behaviors as demonstrated by negative media coverage of the measles-mumps-rubella vaccine leading to decreased

measles-mumps-rubella vaccination.<sup>22</sup> Given that media and marketing can be biased and can influence knowledge and perceptions, it was encouraging that in this study exposure to TV advertisements was associated with greater HPV and HPV vaccine knowledge and more positive perceptions toward the vaccine. This finding correlates with another study's results that women in the United States demonstrated better understanding of HPV than women in the United Kingdom and Australia; this finding was hypothesized to be related to the direct-to-consumer advertisements by the manufacturer, which are not allowed in the United Kingdom or Australia.<sup>23</sup> While our study demonstrated positive results regarding exposure to TV advertisements, additional data are needed to better understand the relationship between TV advertisements and HPV vaccine perceptions and uptake.

This study also demonstrated that obtaining information about the HPV vaccine from the Internet was associated with higher knowledge and positive normative beliefs. While an increasing number of people utilize the Internet to obtain information about the HPV vaccine,<sup>24,25</sup> websites that are critical of the vaccine enhance negative perceptions and lower vaccination intention.<sup>26,27</sup> Therefore, the participants in this study might have accessed an Internet website providing positive messages about the HPV vaccine. However, people searching the Internet for vaccine information are likely to experience a mix of accurate and inaccurate information. Thus, public health officials should include efforts to help parents and adolescents to distinguish Internet sites that provide medically accurate, evidence-based information from those based on misinformation and myths,<sup>28</sup> thereby increasing positive perceptions of HPV vaccines and intention to vaccinate.

**Table 3.** Association Between Sources of Information About HPV and HPV Vaccines and Knowledge and Perceptions Regarding HPV Vaccines.

Sources of Information About HPV Vaccines (N)	HPV and HPV Vaccine Knowledge <sup>a</sup>	Normative Beliefs <sup>b</sup>	Barriers		Benefits		Susceptibility to Genital Warts and Cervical Cancer <sup>g</sup>	Severity of Genital Warts and Cervical Cancer <sup>h</sup>
			Vaccine Safety <sup>c</sup>	Insufficient HPV Vaccine Information <sup>d</sup>	Vaccine Safety <sup>e</sup>	Vaccine Protection <sup>f</sup>		
TV advertisements								
Yes (222)	5.76****	3.99**	4.01*	3.04	4.23**	3.65**	2.13*	4.24
No (116)	4.33	3.78	3.82	3.08	4.00	3.40	2.34	4.12
The Internet								
Yes (118)	5.88**	4.02*	4.03	3.06	4.20	3.59	2.17	4.27
No (221)	4.95	3.87	3.89	3.05	4.13	3.55	2.21	4.16
Newspaper								
Yes (69)	5.71	4.19****	4.07	2.96	4.32*	3.67	2.12	4.38
No (270)	5.17	3.85	3.91	3.08	4.11	3.54	2.22	4.15
Radio								
Yes (68)	5.35	3.98	4.00	3.00	4.14	3.61	2.18	4.17
No (271)	5.26	3.91	3.39	3.07	4.16	3.55	2.20	4.29
Doctor or nurse								
Yes (299)	5.37*	3.95**	3.99**	3.04	4.19*	3.60	2.17	4.21
No (39)	4.52	3.71	3.62	3.13	3.92	3.34	2.41	4.10
Mother								
Yes (129)	5.23	4.03*	4.03*	3.06	4.21	3.62	2.18	4.24
No (210)	5.30	3.85	3.89	3.05	4.12	3.53	2.21	4.17
Other relatives								
Yes (73)	5.34	4.07*	4.05	3.13	4.07	3.58	2.18	4.12
No (266)	5.26	3.88	3.91	3.03	4.17	3.56	2.20	4.21
Teacher								
Yes (59)	5.76	3.88	3.98	3.18	4.07	3.44	2.10	3.93
No (280)	5.12	3.92	3.93	3.03	4.17	3.59	2.22	4.25
Girlfriends or boyfriends								
Yes (55)	5.76	4.09*	4.05	3.05	4.09	3.77*	2.06	4.17
No (284)	5.18	3.89	3.92	3.05	4.17	3.52	2.22	4.20
Father								
Yes (27)	4.22*	3.82	3.88	2.98	3.69**	3.58	2.46	3.87
No (312)	5.37	3.92	3.95	3.06	4.19	3.44	2.17	4.22
Church/synagogue/mosque								
Yes (13)	4.15	3.63	4.02	3.46	3.87	3.34	2.07	3.92
No (326)	5.32	3.93	3.94	3.04	4.16	3.57	2.20	4.21

Abbreviation: HPV, human papillomavirus.

<sup>a</sup>Measured using a 13-item validated index assessing knowledge about HPV (10 items) and HPV vaccines (3 items). Response options included true, false, and don't know with scale scores being calculated on the number of items correct. Higher scores indicate higher knowledge of HPV and the vaccine.

<sup>b</sup>Measured the belief that influential people would want the participant to be vaccinated. Four items were used in this scale and response options included a 5-point Likert-type rating. Higher scores indicate higher normative beliefs.

<sup>c</sup>Measured perceived barriers to vaccination related to vaccine safety using 4 items. Response options included a 5-point Likert-type rating, and higher scores indicate fewer barriers to vaccination based on vaccine safety.

<sup>d</sup>Measured perceived barriers related to insufficient knowledge about the HPV vaccine using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate fewer barriers because of insufficient information about the HPV vaccine.

<sup>e</sup>Measured perceived benefits to vaccination related to vaccine safety using 3 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived benefits to vaccination based on vaccine safety.

<sup>f</sup>Measured perceived benefits of vaccination related to protection against HPV-related disease using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived benefits to vaccination based on protection against HPV-related disease.

<sup>g</sup>Measured perceived susceptibility to genital warts and cervical cancer using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived susceptibility.

<sup>h</sup>Measured perceived severity of genital warts and cervical cancer using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived severity.

\*\*\*\* $P < .0001$ . \*\*\* $.0001 \leq P < .001$ . \*\* $.001 \leq P < .01$ . \* $.01 \leq P < .05$ .

**Table 4.** Spearman Correlation Coefficients Between Multiple Sources of Information With Knowledge and Perceptions About HPV and HPV Vaccines.

Sources of Information About HPV Vaccines	HPV and HPV Vaccine Knowledge <sup>a</sup>	Normative Beliefs <sup>b</sup>	Barriers		Benefits		Susceptibility to Genital Warts and Cervical Cancer <sup>g</sup>	Severity of Genital Warts and Cervical Cancer <sup>h</sup>
			Vaccine Safety <sup>c</sup>	Insufficient HPV Vaccine Information <sup>d</sup>	Vaccine Safety <sup>e</sup>	Vaccine Protection <sup>f</sup>		
Media sources <sup>i</sup>	.22***	.20***	.17**	-.02	.14**	.09	-.10	.13*
Individual sources <sup>j</sup>	.09	.15**	.15**	-.02	.09	.12*	-.09	.03
Total sources <sup>k</sup>	.16**	.21***	.17**	-.03	.13*	.13*	-.12*	.09

Abbreviation: HPV, human papillomavirus.

<sup>a</sup>Measured using a 13-item validated index assessing knowledge about HPV (10 items) and HPV vaccines (3 items). Response options included true, false, and don't know with scale scores being calculated on the number of items correct. Higher scores indicate higher knowledge of HPV and the vaccine.

<sup>b</sup>Measured the belief that influential people would want the participant to be vaccinated. Four items were used in this scale and response options included a 5-point Likert-type rating. Higher scores indicate higher normative beliefs.

<sup>c</sup>Measured perceived barriers to vaccination related to vaccine safety using 4 items. Response options included a 5-point Likert-type rating, and higher scores indicate fewer barriers to vaccination based on vaccine safety.

<sup>d</sup>Measured perceived barriers related to insufficient knowledge about the HPV vaccine using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate fewer barriers because of insufficient information about the HPV vaccine.

<sup>e</sup>Measured perceived benefits to vaccination related to vaccine safety using 3 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived benefits to vaccination based on vaccine safety.

<sup>f</sup>Measured perceived benefits of vaccination related to protection against HPV-related disease using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived benefits to vaccination based on protection against HPV-related disease.

<sup>g</sup>Measured perceived susceptibility to genital warts and cervical cancer using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived susceptibility.

<sup>h</sup>Measured perceived severity of genital warts and cervical cancer using 2 items. Response options included a 5-point Likert-type rating, and higher scores indicate greater perceived severity.

<sup>i</sup>Media sources included between 0 and 4 sources.

<sup>j</sup>Individual sources included between 0 and 7 people as sources.

<sup>k</sup>Total sources included between 0 and 11 media and people as sources.

\*\*\* $p < .0001$ . \*\* $.0001 \leq P < .001$ . \* $.001 \leq P < .01$ .  $.01 \leq P < .05$ .

Additionally, analyses suggest that exposure to more than one media source was associated with increased knowledge and more positive perceptions. Several studies of adults have demonstrated that greater volumes of media coverage as well as multiple sources of HPV information, including media and people from social networks, were correlated positively with HPV knowledge<sup>29,30</sup>; one found that for each additional source reported, there was a greater odds of having received the vaccine or intention to get the vaccine for themselves (in those vaccine eligible) or for their daughter (if a parent).<sup>29</sup> Despite these efforts, more than one fifth of sixth graders' parents who did not receive the vaccine reported that they did not have enough information about the vaccine to make an informed decision.<sup>5</sup> Furthermore, other studies examining online news stories<sup>31-33</sup> have found key concepts about HPV vaccines to be missing, such as HPV's link to cervical cancer, risk factors, symptoms, and common prognosis. Thus, it is important that media sites providing health information are monitored and have mechanisms in place to provide accurate and comprehensive information. Furthermore, one study utilized a social marketing

approach to better understand how to provide HPV vaccine information to African American girls and their mothers. These participants suggested using several channels of communication, including mass media to provide information about safety and side effects, how HPV is spread, and where to receive more information. Participants also suggested these messages should be catchy yet simple and designed by teens.<sup>34</sup> More research is needed to explore whether media messages that influence perceptions and knowledge are, in turn, directly related to actual vaccine acceptance.

Clinicians were a major source of information about the HPV vaccine, and participants who reported a clinician as a source of information had more positive perceptions and beliefs about HPV vaccines. Other studies have demonstrated similar findings: in one study, high school girls valued HPV vaccine information from nurses and physicians and receiving information from these clinicians was associated with being vaccinated.<sup>35</sup> Physician recommendation and normative beliefs have been shown to be predictors of HPV vaccination in a number of other studies.<sup>4</sup> Thus, encounters with clinicians should be used to fill

vaccine knowledge gaps and open a dialogue about the HPV vaccine with patients and parents.<sup>35</sup> To fill the vaccine knowledge gap and open a dialogue with parents, clinicians should counsel both adolescents and parents about the vaccine's side effects and safety, cite data on HPV-related cancers, explain how HPV is transmitted, and direct patients and parents as to where they can obtain additional information.<sup>34</sup> However, clinicians may not be providing strong, consistent recommendations for adolescents to receive the HPV vaccine, leading to missed clinical opportunities to vaccinate adolescents against HPV.<sup>36</sup> A more recently published National Survey of Pediatricians and Family Physicians reported that more than 40% do not strongly recommend the vaccine to 11- to 12-year-old girls and nearly 50% do not strongly recommend it for males aged 11 to 12 years.<sup>37</sup> Public health efforts need to focus on creating interventions to assist and support clinicians to effectively communicate information about HPV and the vaccine and implement strong and consistent recommendations for all adolescent vaccines.<sup>38</sup> In addition, these interventions must address factors contributing to providers' hesitancy to recommend and provide information about the vaccine (eg, lack of knowledge about HPV, discomfort discussing a sexual health topic, and concerns about parental resistance).<sup>36,39-44</sup>

Only 38% of the participants endorsed their mother as a source of information. This may imply that there is limited communication about the vaccine because of maternal lack of knowledge and understanding,<sup>45</sup> concerns that discussing the vaccine raises issues about sex,<sup>46</sup> discomfort with this subject matter, and/or parents feeling that communication is not warranted because the decision to vaccinate is made by the mother in the interest of her daughter. The literature has supported parent-child communication as a protective factor against high-risk behaviors, including the initiation of vaginal intercourse.<sup>47</sup> However, because there are potential for differences between various racial groups in trusting health care systems, as well as parenting and communication strategies, there is a need for understanding different approaches to address these cultural variations in practice.<sup>45</sup> Despite encouragement to use the HPV vaccine as a teachable moment to talk about reproductive health,<sup>48</sup> only 53% of mothers with daughters aged 9 to 15 years expressed some willingness to talk to their daughters about sex in the context of HPV vaccination.<sup>49</sup> Nonetheless, when the participant's mother was endorsed as a source of information in our study, the information was reported to be useful, and adolescents reported more positive normative beliefs about the vaccine and less concern about its safety.

Not surprisingly, other individuals, such as father, teacher, friend, and church/synagogue/mosque, were reported less frequently to be sources of information about the vaccine. Adolescents who reported their father as a source of information had lower HPV and HPV vaccine knowledge and were less likely to perceive benefits from the vaccine. This may reflect a different quality of conversation about HPV vaccines between adolescent girls and their fathers, or there may be something different in terms of family structure or dynamics (eg, father is a single parent) that was reflected in our findings. Our findings suggest that, because mothers can clearly be a valuable and influential source of information (and fathers may lack information) about the vaccine, clinicians should provide HPV and HPV vaccine education to both the adolescent and his/her parent.

Several limitations should be acknowledged with regard to this study. First, this study is cross-sectional, and therefore, the association between sources of information and knowledge and vaccine perceptions may not be causal. Additionally, all girls in this study were vaccinated; this study does not address the relationship between sources of information and knowledge or perceptions among unvaccinated adolescent women. However, research documents that women who are vaccinated, compared with unvaccinated women, score higher on HPV and vaccine knowledge questions, implying that unvaccinated women may not have researched their choice, and lacked information to make a decision in either direction.<sup>35</sup> Thus, it is important to determine which sources of information vaccinated women consider important in learning about the HPV vaccine to help develop interventions to provide accurate information and increase knowledge in unvaccinated women.

## Conclusion

In summary, this study demonstrates that sources of information about HPV vaccines, including media and individuals, are associated with greater knowledge and more positive perceptions among adolescent girls who received the first HPV vaccine dose. The findings from this study should be used to create culturally appropriate HPV vaccine interventions by disseminating medically accurate information through the most common reported sources of information. Professionals developing interventions should consider the sources of information that were associated with higher knowledge and perceptions, and utilize these avenues to increase adolescents' HPV vaccine knowledge, improve the appropriateness of their perceptions, and increase vaccine uptake. Furthermore, to maximize the impact of future vaccine

campaigns, these findings suggest the need to assess the accuracy of HPV vaccine messages and to heighten awareness of those involved in health care to provide accurate HPV vaccine messages given the associations between media and individuals as sources of information and adolescents' knowledge and perceptions about the HPV vaccine.

### Author Contributions

BLR: Contributed to interpretation; drafted manuscript; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

MLS: Contributed to interpretation; drafted manuscript; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

GDZ: Contributed to conception and design; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

LD: Contributed to acquisition, analysis, and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

TLKM: Contributed to interpretation; drafted manuscript; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

JAK: Contributed to conception and design; contributed to acquisition, analysis, and interpretation; critically revised manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

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The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr. Kahn served as the chair of a grant review committee for a grant program sponsored by the Society for Adolescent Health and Medicine, which provided funding for public health demonstration projects to improve adolescent vaccination. Funding for the grant program was provided by Merck. Dr. Kahn has also served as cochair of two clinical trials of an HPV vaccine in HIV-infected individuals; these studies were funded primarily by the National Institutes of Health, but Merck provided vaccines and immunogenicity testing. Dr. Zimet has received funding for investigator-initiated HPV-related research from Merck and from Roche Diagnostics. Dr. Shew has and is currently participating as an investigator for Merck and Co, Inc, related HPV vaccine trials. She has received salary support for her efforts.

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### References

- Petrosky E, Bocchini JA Jr, Hariri S, et al; Centers for Disease Control and Prevention (CDC). Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices. *MMWR Morb Mortal Wkly Rep.* 2015;64:300-304.
- Luxembourg A, Moreira ED Jr, Samakoses R, et al. Phase III, randomized controlled trial in girls 9-15 years old to evaluate lot consistency of a novel nine-valent human papillomavirus L1 virus-like particle vaccine. *Hum Vaccin Immunother.* 2015;11:1306-1312.
- Office of Disease Prevention and Health Promotion. Immunization and infectious diseases. <https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases>. Accessed November 3, 2017.
- de Visser R, Waites L, Parikh C, Lawrie A. The importance of social norms for uptake of catch-up human papillomavirus vaccination in young women. *Sex Health.* 2011;8:330-337.
- Ogilvie G, Anderson M, Marra F, et al. A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLoS Med.* 2010;7:e1000270.
- Fernández ME, Allen JD, Mistry R, Kahn JA. Integrating clinical, community, and policy perspectives on human papillomavirus vaccination. *Annu Rev Public Health.* 2010;31:235-252.
- Conroy K, Rosenthal SL, Zimet GD, et al. Human papillomavirus vaccine uptake, predictors of vaccination, and self-reported barriers to vaccination *J Womens Health (Larchmt).* 2009;18:1679-1686.
- Gerend MA, Lee SC, Shepherd JE. Predictors of human papillomavirus vaccination acceptability among underserved women. *Sex Transm Dis.* 2007;34:468-471.
- Boehner CW, Howe SR, Bernstein DI, Rosenthal SL. Viral sexually transmitted disease vaccine acceptability among college students. *Sex Transm Dis.* 2003;30:774-778.
- Dempsey AF, Abraham LM, Dalton V, Ruffin M. Understanding the reasons why mothers do or do not have their adolescent daughters vaccinated against human papillomavirus. *Ann Epidemiol.* 2009;19:531-538.
- Gerend MA, Weibley E, Bland H. Parental response to human papillomavirus vaccine availability: uptake and intentions. *J Adolesc Health.* 2009;45:528-531.
- Kahn JA, Ding L, Huang B, Zimet GD, Rosenthal SL, Frazier AL. Mothers' intention for their daughters and themselves to receive the human papillomavirus vaccine: a national study of nurses. *Pediatrics.* 2009;123:1439-1445.



13. Reiter PL, Brewer NT, Gottlieb SL, McRee AL, Smith JS. Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc Sci Med*. 2009;69:475-480.
14. Rogers EM. Diffusion of prevention innovations. *Addict Behav*. 2002;27:989-993.
15. Rogers EM. *Diffusion of Innovations*. 5th ed. New York, NY: Free Press; 2003.
16. Bero LA, Grilli R, Grimshaw JM, Harvey E, Oxman AD, Thomson MA. Closing the gap between research and practice: an overview of systematic reviews of interventions to promote the implementation of research findings. The Cochrane Effective Practice and Organization of Care Review Group. *BMJ*. 1998;317:465-468.
17. Thompson GN, Estabrooks CA, Degner LF. Clarifying the concepts in knowledge transfer: a literature review. *J Adv Nurs*. 2006;53:691-701.
18. Herbert NL, Gargano LM, Painter JE, et al. Understanding reasons for participating in a school-based influenza vaccination program and decision-making dynamics among adolescents and parents. *Health Educ Res*. 2013;28:663-672.
19. Wetzel C, Tissot A, Kollar LM, Hillard PA, Stone R, Kahn JA. Development of an HPV educational protocol for adolescents. *J Pediatr Adolesc Gynecol*. 2007;20:281-287.
20. Conroy K, Rosenthal SL, Zimet GD, Jin Y, Bernstein DI, Kahn JA. Human papillomavirus vaccine uptake, barriers to vaccination, and predictors of vaccination in young women. *J Adolesc Health*. 2009;44:S13.
21. Mullins TL, Zimet GD, Rosenthal SL, et al. Adolescent perceptions of risk and need for safer sexual behaviors after first human papillomavirus vaccination. *Arch Pediatr Adolesc Med*. 2012;166:82-88.
22. Hackett AJ. Risk, its perception and the media: the MMR controversy. *Community Pract*. 2008;81:22-25.
23. Marlow LA, Zimet GD, McCaffery KJ, Ostini R, Waller J. Knowledge of human papillomavirus (HPV) and HPV vaccination: an international comparison. *Vaccine*. 2013;31:763-769.
24. Hughes J, Cates JR, Liddon N, Smith JS, Gottlieb SL, Brewer NT. Disparities in how parents are learning about the human papillomavirus vaccine. *Cancer Epidemiol Biomarkers Prev*. 2009;18:363-372.
25. Verhoeven V, Baay MF, Baay PE, Lardon F, Van Royen P, Vermorken JB. Everything you always wanted to know about HPV (but could not ask your doctor). *Patient Educ Couns*. 2010;81:101-105.
26. Betsch C, Renkewitz F, Betsch T, Ulshöfer C. The influence of vaccine-critical websites on perceiving vaccination risks. *J Health Psychol*. 2010;15:446-455.
27. Nan X, Madden K. HPV vaccine information in the blogosphere: how positive and negative blogs influence vaccine-related risk perceptions, attitudes, and behavioral intentions. *Health Commun*. 2012;27:829-836.
28. Kalichman SC, Kegler C. Vaccine-related internet search activity predicts H1N1 and HPV vaccine coverage: implications for vaccine acceptance. *J Health Commun*. 2015;20:259-265.
29. Almeida CM, Tiro JA, Rodriguez MA, Diamant AL. Evaluating associations between sources of information, knowledge of the human papillomavirus, and human papillomavirus vaccine uptake for adult women in California. *Vaccine*. 2012;30:3003-3008.
30. Kelly BJ, Leader AE, Mittermaier DJ, Hornik RC, Cappella JN. The HPV vaccine and the media: how has the topic been covered and what are the effects on knowledge about the virus and cervical cancer? *Patient Educ Couns*. 2009;77:308-313.
31. Bodemer N, Müller SM, Okan Y, Garcia-Retamero R, Neumeyer-Gromen A. Do the media provide transparent health information? A cross-cultural comparison of public information about the HPV vaccine. *Vaccine*. 2012;30:3747-3756.
32. Briones R, Nan X, Madden K, Waks L. When vaccines go viral: an analysis of HPV vaccine coverage on YouTube. *Health Commun*. 2012;27:478-485.
33. Habel MA, Liddon N, Stryker JE. The HPV vaccine: a content analysis of online news stories. *J Womens Health (Larchmt)*. 2009;18:401-407.
34. Hull PC, Williams EA, Khabele D, Dean C, Bond B, Sanderson M. HPV vaccine use among African American girls: qualitative formative research using a participatory social marketing approach. *Gynecol Oncol*. 2014;132(suppl 1):S13-S20.
35. 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.
36. Holman DM, Benard V, Roland KB, Watson M, Liddon N, Stokley S. Barriers to human papillomavirus vaccination among US adolescents: a systematic review of the literature. *JAMA Pediatr*. 2014;168:76-82.
37. Allison MA, Hurley LP, Markowitz L, et al. Primary care physicians' perspective about HPV vaccine. *Pediatrics*. 2016;137:e20152488.
38. Zimet GD. Health care professionals and adolescent vaccination. A call for intervention research. *Hum Vaccin Immunother*. 2014;10:2629-2630.
39. Quinn GP, Murphy D, Malo TL, Christie J, Vadaparampil ST. A national survey about human papillomavirus vaccination: what we didn't ask, but physicians wanted us to know. *J Pediatr Adolesc Gynecol*. 2012;25:254-258.
40. Daley MF, Crane LA, Markowitz LE, et al. Human papillomavirus vaccination practices: a survey of US physicians 18 months after licensure. *Pediatrics*. 2010;126: 425-433.
41. McCave EL. Influential factors in HPV vaccination uptake among providers in four states. *J Community Health*. 2010;35:645-652.
42. Perkins RB, Clark JA. Providers' attitudes toward human papillomavirus vaccination in young men: challenges for implementation of 2011 recommendations. *Am J Mens Health*. 2012;6:320-323.
43. Vadaparampil ST, Murphy D, Rodriguez M, Malo TL, Quinn GP. Qualitative responses to a national physician survey on HPV vaccination. *Vaccine*. 2013;31:2267-2272.

44. Perkins RB, Clark JA. What affects human papillomavirus vaccination rates? A qualitative analysis of providers' perceptions. *Womens Health Issues*. 2012;22:e379-e386.
45. Hamlisch T, Clarke L, Alexander KA. Barriers to HPV immunization for African American adolescent females. *Vaccine*. 2012;30:6472-6476.
46. McRee AL, Reiter PL, Gottlieb SL, Brewer NT. Mother-daughter communication about HPV vaccine. *J Adolesc Health*. 2011;48:314-317.
47. Guilamo-Ramos V, Jaccard J, Dittus P, Bouris AM. Parental expertise, trustworthiness, and accessibility: parent-adolescent communication and adolescent risk behavior. *J Marriage Fam*. 2006;68:1229-1246.
48. Sherris J, Friedman A, Wittet S, Davies P, Steben M, Saraiya M. Chapter 25: education, training, and communication for HPV vaccines. *Vaccine*. 2006;24(suppl 3):S3/210-S18.
49. Askelson NM, Campo S, Smith S, Lowe JB, Dennis LK, Andsager J. The birds, the bees, and the HPVs: what drives mothers' intentions to use the HPV vaccination as a chance to talk about sex? *J Pediatr Health Care*. 2011;25:162-170.