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Political and News Media Factors Shaping Public Awareness of the HPV Vaccine

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A B S T R A C T

Background: In 2006, the U.S. Food and Drug Administration licensed a vaccine for the human papillomavirus (HPV) that prevents the strains of HPV that cause 70% of cervical cancers. Within months, many states introduced legislation requiring the vaccine for girls, prompting controversy and heightened political and media attention to the issue. Previous research has shown differences in HPV vaccine awareness by individual-level characteristics such as race/ethnicity, income, and education levels. We examined how individual political orientation and exposure to media coverage can also shape awareness of the vaccine.

Methods: Using data from a 2009 Internet survey of 1,216 nationally representative adult respondents linked to data on state-specific news coverage, we assessed how political orientation, media exposure, and state political context predicted HPV vaccine awareness.

Results: Younger people, women, and those with more education were significantly more likely to be aware of the vaccine. Even after controlling for these characteristics, we found that exposure to news media was associated with higher HPV vaccine awareness. Whereas liberals and conservatives were both more aware of the vaccine compared with moderates, the data are suggestive that liberals were more sensitive to news coverage.

Conclusion: These findings suggest that individual-level political identities and their interaction with the informational environment may be important factors to consider in evaluating the determinants of individuals' attitudes and behaviors related to politically charged women's health issues.

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Introduction

In 2006, the U.S. Food and Drug Administration licensed a vaccine for the human papillomavirus (HPV) that prevents the strains of HPV that cause 70% of cervical cancers. Within months, states introduced legislation requiring the vaccine for girls, prompting intense media discussion and debate over the

vaccine's merits and potential concerns (Colgrove, Abiola, & Mello, 2010; Haas et al., 2009). Politicians, health professionals, conservative groups, women's health organizations, and researchers competed to have their message heard in the news media (Fowler, Gollust, Dempsey, Lantz, & Ubel, 2012), as legislative discussions over HPV vaccine requirements, education, and insurance coverage unfolded after 2006 across more than 40 states (National Conference of State Legislatures, 2012). Political arguments over the HPV vaccine even played a role in the 2011 Republican presidential debates (Gostin, 2011). Despite its great public health value, the vaccine has not achieved uptake at recommended levels. According to the 2010 National Immunization Survey-Teen, 48.7% of 13- to 17-year old girls have received one dose of the vaccine, and 32.0% have completed the series (Dorell, Stokley, Yankey, Liang, & Markowitz, 2011). Estimates of vaccine coverage for adult women are even lower, ranging from 9% (Caskey, Lindau, & Alexander, 2009) to 18% for initiation (Dempsey, Cohn, Dalton, & Ruffin, 2011) and 1.8% (Rosenthal et al., 2011) to 10% for completion (Dempsey et al., 2011).

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Understanding the factors that contribute to these relatively low vaccination rates is an important priority for research.

When a public health issue becomes politicized, as the HPV vaccine has been, and news coverage is extensive and often focuses on conflicts and disagreements among politicians and medical experts, there may be consequences on the public's attitudes and behaviors. However, existing studies of the HPV vaccine have rarely considered individuals' political orientation or likelihood of exposure to media coverage, leading to an incomplete picture of the factors that influence public attitudes toward the vaccine. Research has demonstrated that HPV vaccine awareness is high overall, but differs across subgroups; Whites (compared with non-Hispanic Blacks and Latinos), women compared with men, and those with higher socioeconomic status have significantly higher awareness of the vaccine (Allen et al., 2010; Cui, Baldwin, Wiley, & Fielding, 2010; Gelman, Nikolajski, Schwarz, & Borrero, 2011; Hughes et al., 2009; Jain et al., 2009). No previous work has examined how awareness differs by political orientation, although the limited existing HPV vaccine-related research that has considered such factors suggests that parents who identify as liberals reported stronger intentions to vaccinate their sons (Reiter, McRee, Kadis, & Brewer, 2011) and that women or parents who reported being liberal or moderate, compared with conservative, expressed greater acceptance of the vaccine (Constantine & Jerman, 2007; Stupiansky, Rosenthal, Wiehe, & Zimet, 2010).

The news media are an important source of information about the HPV vaccine (Cates et al., 2010), with the potential to affect both awareness of and attitudes about vaccination. Research using experimental methods has shown that the way news articles frame the vaccine, such as portraying the vaccine's effectiveness (Bigman, Cappella, & Hornik, 2010), emphasizing whether the goal of the vaccine is preventing cervical cancer or other outcomes (Leader, Weiner, Kelly, Hornik, & Cappella, 2009; McRee, Reiter, Chantala, & Brewer, 2010), and highlighting the vaccine's controversial elements (Gollust, Dempsey, Lantz, Ubel, & Fowler, 2010), influences attitudes. However, limited research using observational data is available to identify the actual impact of the news media on HPV vaccine-related perceptions outside of a laboratory context. One previous study relying on self-reported survey data indicated that adults who reported more health-specific media exposure had greater gains in knowledge about the HPV vaccine over time; there was no such relationship with self-reported general news exposure (Kelly, Leader, Mittermaier, Hornik, & Cappella, 2009). In this study, we advance previous research by documenting the volume of HPV vaccine-specific local media coverage and linking it with individuals' reports of media use.

Research and theory in political science and communication are helpful to formulate general hypotheses about why political predispositions and the news media might influence awareness of a politicized women's health issue like the HPV vaccine, both independently and interactively. Two bodies of literature are highly relevant: Theories on the relationship of ideological predispositions to attitudes and theories of media effects. On the former, research demonstrates that political predispositions (e.g., how liberal or conservative an individual is) influence citizens' attitudes about a host of policy topics—from education to health care—even more than characteristics representing an individual's personal interest in that issue (Lau & Heldman, 2009). Political orientation has been shown to serve as a cognitive heuristic, helping people to form opinions on complex policy topics because they can rely on "cues" in the media

(i.e., matching their political inclinations to the political stances publicized in news coverage) rather than coming to their own original interpretations of an issue (Kam, 2005). In the case of the HPV vaccine, news stories about the HPV vaccine often featured competing messages from both liberal and conservative advocacy groups presenting their side's policy prescriptions and implications (Fowler, Gollust, Dempsey, Lantz, & Ubel, 2012); furthermore, opposition to HPV vaccine mandates was justified with ideologically based arguments, including concerns about the sexually transmitted nature of the vaccine and general resistance to governmental intrusion on parental autonomy (Colgrove, et al., 2010). Given the high volume of these ideological cues in the news media, liberals and conservatives may have been more attentive to news coverage of this issue than those with more moderate beliefs, which could translate to different opinions (Zaller, 1992), as evidenced by ideological differences in perceptions of the vaccine (Constantine & Jerman, 2007; Stupiansky et al., 2010).

The second related body of research relevant to this issue is communication theory on media effects, which has shifted over the last few decades from considering the media as a unidirectional, uniform force shaping citizens' views to acknowledging heterogeneity in the effects of media based on individuals' predispositions and considering reciprocal effects between news exposure and political attitudes (Bennett & Iyengar, 2008). Some people will resist certain media messages to which they are predisposed to disagree by not selecting those media, or, if exposed, they will resist the message by counterarguing the premise or selectively incorporating some aspects and forgetting others (Iyengar & Hahn, 2009; Lord, Ross, & Lepper, 1979; Taber & Lodge, 2006; Zaller, 1992). In the increasingly politically charged discourse surrounding women's health issues in general (and the HPV vaccine in particular), where it is relatively simple for individuals to link their political beliefs with a publicized perspective on an issue, we expect that individuals of different ideological orientations may respond to the news media differently.

In this study, we use nationally representative survey data to examine the association between demographic, political, media, and geographic variables on adults' awareness of the HPV vaccine. Based on previous research, we hypothesize that women (compared with men) and those with higher education (compared with lower education) will be more aware of the vaccine. We further hypothesize that as a result of the ideologically-oriented content that was a component of media coverage of the vaccine, conservatives and liberals will be more likely to be aware of the vaccine than moderates. We also hypothesize that, as a result of the intensity of state-specific media coverage, those who had higher exposure to media will be more aware of the vaccine, and that those who lived in a state that considered a vaccine requirement for school-age girls will be more likely to be aware of the vaccine. Finally, we hypothesize that, because of the selection and filtering processes that characterize media effects related to politically-charged issues, the influence of media exposure on awareness of the vaccine will vary by individuals' ideological orientation.

Methods

Sample

The survey was conducted using the web-enabled KnowledgePanel, a probability-based panel designed to be representative of the U.S. population. Initially, participants are

chosen by a random selection of telephone numbers and residential addresses. Persons in selected households are then invited by telephone or by mail to participate in the web-enabled KnowledgePanel. For those who agree to participate but do not already have Internet access, Knowledge Networks (now known as GfK Knowledge Networks) provides a laptop and Internet connection at no cost. The KnowledgePanel has served as the sampling frame for other published peer-reviewed studies on health topics (Barry, Brescoll, Brownell, & Schlesinger, 2009; Davis & Fant, 2005; Tarini, Singer, Clark, & Davis, 2008), including previous studies related to the HPV vaccine (Allen et al., 2010; Gowda et al., 2012; Stupiansky et al., 2010). Participants completed the web survey between June 19 and July 2, 2009. Out of 2,235 sampled cases, 1,216 completed the survey, for a completion rate of 54.4%.

Measures

Dependent variables

The dependent variable was HPV vaccine awareness, measured by yes/no responses to a single item: "Have you ever heard anything about a vaccine which prevents cervical cancer?"

Independent variables

Independent variables included gender, age, education (less than high school, high school, some college, or bachelor's degree), race (non-White versus White), household income (5 categories ranging from <\$20,000 to ≥\$125,000), household size (ranging from 1 to ≥5), living in a metropolitan statistical area versus a rural area, and being in a target group for the HPV vaccine (having a daughter aged 11–17 or being female aged 18–26). We measured political ideology using a standard measure, a 7-point scale ranging from very liberal to very conservative, which we collapsed into three categories representing liberal, moderate or middle-of-the-road, and conservative. We categorized this variable in this way because previous research has identified distinctions among these three groups' HPV vaccine perceptions (Constantine & Jerman, 2007; Stupiansky et al., 2010) and because we anticipated that conservatives' and liberals' awareness would differ from moderates', given the way the issue had been framed (Fowler et al., 2012). We constructed a variable for residence in a state that introduced HPV vaccine mandate legislation if they lived in one of the 23 states (excluding DC, because no respondents were from there) that had considered legislation to require the HPV vaccine in school-age girls between 2006 and June 2009, when the survey was fielded (National Conference of State Legislatures, 2012). All demographic variables were obtained from Knowledge Networks panel data.

Media exposure

To examine the influence of media exposure, we measured the volume of media coverage of the HPV vaccine across the 50 U.S. states from January 1, 2006 (6 months before FDA licensure) through June 1, 2009 (when the survey was fielded). In brief, using validated key word searches of newspaper databases (Proquest, Newsbank, and LexisNexis), we examined news coverage in 99 newspapers, including two newspapers (the largest circulation paper and/or the capital city paper and second-highest circulation paper) per U.S. state when available. These searches generated a count of articles in each state appearing over the time period. Full detail on the search methods is available elsewhere (Fowler et al., 2012). News coverage of the

HPV vaccine was highly variable across states, ranging from three articles over the 3.5-year time period in Hawaii to 163 articles in Texas. This variable is a proxy for the upper bound of the newspaper content to which study participants could have been exposed, but individual propensity to consume news varies. To more accurately measure plausible individual-level exposure to this content, we constructed a variable combining the state-specific count of articles with individuals' reported consumption of media (Freedman & Goldstein, 1999). Following research conventions (Tewksbury, Althaus, & Hibbing, 2011), respondents were asked: "During a typical week, how many days do you read a print or online version of a local newspaper?" and "During a typical week, how many days do you read a print or online version of a national newspaper?" Response options ranged from 0 to 7 days. We took the mean of these two items to obtain an average measure of news consumption and rescaled the variable from 0 to 1 (where 0 means no consumption and 1 means consumption of both types of newspapers every day). Finally, we multiplied this measure of news consumption by the volume of news coverage in the individuals' state of residence and log-transformed this variable to account for its skewed distribution (Stevens, 2008). The final constructed variable flexibly accounts for individuals' differential consumption of the news and differential volume of news coverage by state; thus, an individual who consumes a great deal of news but lives in a state with relatively low coverage of the issue (like Hawaii) would receive a lower exposure value than someone who reads less news but lives in a high HPV vaccine news volume state (like Texas).¹

Data Analysis

Bivariate associations between awareness and key independent variables were assessed with chi-square tests. Next, multivariate logistic regression models of awareness were estimated, first examining the contribution of sociodemographic variables and then adding in the political, geographic, and news exposure variables based on a priori expectations that these would matter above and beyond demographic differences. The analysis was set up in this way to test whether variables representing ideology, the informational environment, and the legislative history of the state of residence were associated with HPV vaccine awareness, after adjusting for the sociodemographic factors known to predict awareness in other research. Finally, recognizing that news coverage of the vaccine was politically charged, we tested whether the association between media exposure and vaccine awareness varied by individual political ideology by estimating models with interaction terms. We interpreted the interaction terms by plotting the predicted probabilities of awareness.

All analyses used STATA 12.0 and were weighted using the survey weights provided by Knowledge Networks to adjust for nonresponse and produce nationally representative estimates. Predicted probabilities were calculated using the "margins" commands in STATA, with all other characteristics estimated at their means. The research was determined to be exempt from human subjects research review by the University of Michigan Institutional Review Board, given that all data collected via the on-line survey were anonymous.

¹ When we include the three variables separately (logged state news articles, self-reported consumption, and their interaction) in the model of awareness, none are individually statistically significant due to high multicollinearity but the joint effect nears statistical significance ($F_3, 1213 = 2.59; p = .052$).

Results

Study participants were roughly evenly divided by gender, and were diverse in age, education, and household income. Thirty percent were non-White; equal proportions identified their ideological orientation as conservative (36.9%) or moderate (36.7%), and 26% reported their ideological orientation as liberal. Sixty-five percent lived in a state that had introduced legislation to require the vaccine for school-age girls by the time of the survey (Table 1).

Sixty-nine percent of respondents were aware of the vaccine (Table 2). Significantly ($p < .05$) more women (78.7%) than men (57.9%) reported awareness. Table 2 also indicates rising awareness of the vaccine with increasing educational attainment and income, and that younger and White respondents were more likely to be aware of the vaccine than older and non-White respondents. Liberals and conservatives were each more likely to be aware of the vaccine than moderates. There were no differences in vaccine awareness by living in a metro area, having a daughter in the target population, or living in a state that had introduced legislation to require the vaccine; women aged 18 to 26 were marginally more likely to be aware of the vaccine than others ($p < .10$).

In the first multivariate model (Table 3), women, those with some college or a bachelor's degree (compared with those without a high school education), and White respondents (compared with non-Whites) were all more likely to report awareness of the HPV vaccine, whereas older individuals were less likely to do so. There was no significant independent

Table 1
Characteristics of the Sample

	<i>n</i>	% (Weighted)
Gender		
Female	593	51.7
Male	598	48.3
Age (yrs)		
18–29	160	21.2
30–44	291	27.2
45–59	394	27.5
≥60	346	24.1
Education		
Less than high school	124	13.9
High school	362	31.1
Some college	345	27.8
Bachelor's degree or higher	360	27.1
Race		
Non-White	256	29.9
White	935	70.1
Household income (U.S.\$)		
<20,000	146	14.9
20,000–39,999	260	23.5
40,000–74,999	392	33.1
75,000–124,999	277	20.0
≥125,000	116	8.5
Metropolitan Statistical Area		
Non-Metro	176	16.4
Metro	1015	83.6
HPV vaccine target group		
Has daughter age 11–17	91	7.6
Female age 18–26	61	6.3
Ideology		
Liberal	313	26.4
Moderate	431	36.7
Conservative	447	36.9
Lives in state that introduced mandate legislation (2006–2009)	782	64.7

Table 2

Awareness of the HPV Vaccine, by Sociodemographic, Geographic, and Political Characteristics

	Heard of Vaccine				Pearson Chi Square
	No		Yes		
	<i>n</i>	%	<i>n</i>	%	<i>p</i>
Total	357	31.4	834	68.6	
Gender					
Male	248	42.1	350	57.9	<.001
Female	109	21.3	484	78.7	
Age (yrs)					
18–29	40	24.2	120	75.8	.001
30–44	78	28.3	213	71.7	
45–59	100	28.2	294	71.8	
≥60	139	44.6	207	55.4	
Education					
Less than high school	68	53.3	56	46.7	<.001
High school	128	39.2	234	60.8	
Some college	88	24.3	257	75.7	
Bachelor's degree or higher	73	18.4	287	81.6	
Race					
Non-White	88	37.5	168	62.5	.040
White	269	28.7	666	71.3	
Household income (U.S.\$)					
<20,000	57	40.1	89	59.9	.019
20,000–39,999	87	35.2	173	64.8	
40,000–74,999	115	31.3	277	68.7	
75,000–124,999	71	25.4	206	74.6	
≥125,000	27	19.7	89	80.3	
Metropolitan Statistical Area status					
Non-Metro	53	29.3	123	70.8	.576
Metro	304	31.8	711	68.2	
Has daughter age 11–17					
No	339	32.0	761	68.0	.218
Yes	18	23.8	73	76.2	
Female 18–26					
No	345	32.1	785	67.9	.095
Yes	12	20.5	49	79.5	
Ideology					
Liberal	77	25.0	236	75.0	.011
Moderate	160	37.9	271	62.1	
Conservative	120	29.5	327	70.6	
In state that introduced mandate legislation					
No	129	33.0	280	67.0	.484
Yes	228	30.5	554	69.6	

association of household income and awareness. Adjusting for all covariates (model 2), liberals and conservatives were each slightly more likely to be aware of the vaccine relative to moderates. In addition, individuals with greater exposure to news about the HPV vaccine were significantly more likely to be aware of the vaccine than those with less news exposure.

Figure 1 demonstrates the magnitude of the significant differences in predicted probabilities of awareness of the HPV vaccine, after setting all other characteristics to their means. The figure demonstrates striking differences in awareness by gender. Moreover, the figure also shows a gradient relationship between education and awareness, with awareness rising by 10% for each increase in education from less than high school, to high school, to some college. Although gender, age, and education produced the greatest relative differences in probability of HPV vaccine awareness, the political and media exposure factors were also important. Differences in awareness between liberals compared with moderates (8.2%), or for a shift from low media exposure (one standard deviation below the mean) to high exposure (one standard deviation above the mean; 7.7%) were greater, for instance, than the differences in awareness by race (7.1%) or between a younger and middle-aged person (6.3%).

Table 3
Sociodemographic and Political Contextual Predictors of Human Papillomavirus Vaccine Awareness

	Model 1 (Sociodemographic Predictors Only; n = 1,216)		Model 2 (Including Political Context Variables; n = 1,216)	
	OR	95% CI	OR	95% CI
Age (yrs)	0.98**	0.97–0.99	0.98**	0.97–0.99
Female (Ref = male)	3.35**	2.34–4.81	3.55**	2.45–5.12
High school (Ref = less than high school)	1.59	0.88–2.87	1.522	0.83–2.78
Some College (Ref = less than high school)	2.79**	1.49–5.21	2.67**	1.41–5.06
Bachelor's degree (Ref = less than high school)	4.95**	2.54–9.61	4.34**	2.18–8.62
White (Ref = non-White)	1.43 [†]	0.95–2.16	1.41	0.93–2.13
Income \$20,000–39,999 (Ref = <\$20,000)	1.12	0.65–1.93	1.21	0.70–2.08
Income \$40,000–74,999 (Ref = <\$20,000)	1.14	0.65–1.98	1.19	0.68–2.10
Income \$75,000–124,999 (Ref = less than \$20,000)	1.17	0.63–2.17	1.20	0.64–2.23
Income ≥\$125,000 (Ref = <\$20,000)	1.27	0.62–2.61	1.29	0.63–2.63
Has daughter age 11–17	0.94	0.44–1.99	0.94	0.44–2.00
Household size	1.13	0.97–1.31	1.12	0.97–1.30
Lives in metropolitan area	0.78	0.48–1.26	0.70	0.42–1.15
In state that introduced mandate legislation			1.14	0.80–1.64
Liberal (Ref = moderate)			1.49 [†]	0.95–2.34
Conservative (Ref = moderate)			1.53*	1.01–2.34
Media exposure (log transformed average)			1.14*	1.01–1.30

Abbreviations: Ref, reference variable; OR, odds ratio; CI, confidence interval.

** $p < .01$; * $p < .05$; [†] $p < 0.1$.

Finally, we examined whether the association between media exposure and awareness varied by political ideology. The addition of interaction terms between news exposure and the two ideology groups significantly added to the model 2 shown in Table 3 ($F_{2, 1214} = 3.18$; $p = .04$; see Appendix Table 1). Given the challenges inherent in interpreting the coefficients of interaction models estimated in nonlinear (i.e., logit) models (Karaca-Mandic, Norton, & Dowd, 2011), we plot the predicted probabilities in Figure 2. Figure 2 shows that increasing media exposure was associated with increasing awareness of the vaccine, but only for liberals. Conservatives showed no relationship between media exposure and awareness. This difference in slopes between liberals and conservatives was statistically significant (Wald test of coefficient on individual interaction term of media \times liberals relative to conservatives; $p = .013$). In sensitivity analyses (available from authors upon request), a linear probability model (estimated using linear regression) similarly showed a significant interaction effect

between media and conservative ideology, relative to liberal ($\beta = -0.07$; $p = .02$) and logit regressions estimated with news media modeled as a categorical variable demonstrated that the difference between conservatives' and liberals' awareness was most pronounced at high levels of news media exposure.

Discussion

When examining factors that predict health attitudes or behaviors, past studies of the HPV vaccine have infrequently taken the political context into account. However, health issues are often politicized in media and policy discourse, with the HPV vaccine a prime example of this growing phenomenon. Research demonstrates that the public has increasingly polarized health-related opinions (Baum, 2011; Gollust, Lantz, & Ubel, 2009; Kahan, 2010). This polarization in attitudes can translate into differential behaviors. For instance, a recent study showed that states with a greater share of Democratic voters had higher H1N1

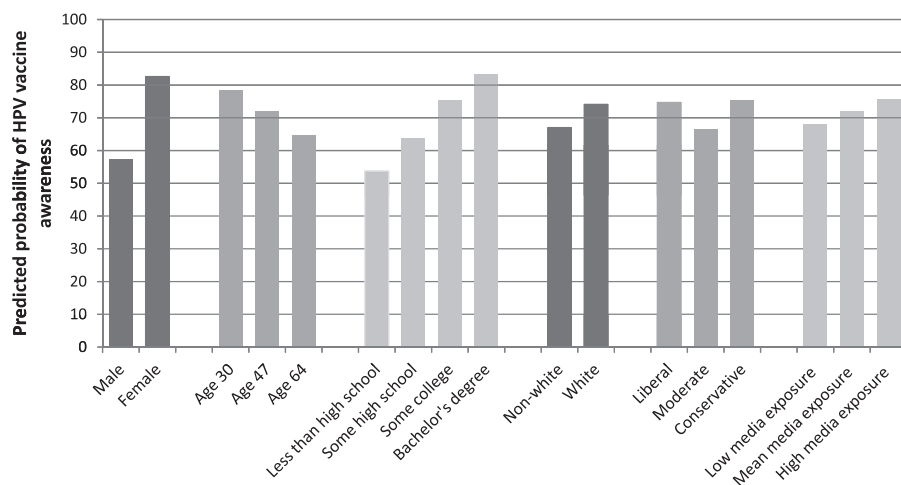


Figure 1. Predicted probability of HPV vaccine awareness by selected significant characteristics. All covariates included in Table 3, model 2, are set to their means.

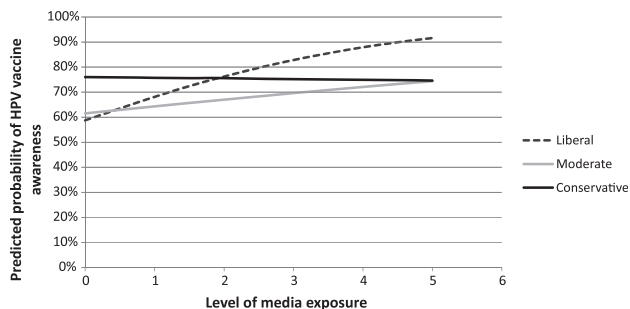


Figure 2. Interaction of news media exposure and political ideology on awareness of the HPV vaccine. All covariates included in Table 3, model 2, are set to their means. The difference between liberals and conservatives is significant ($p = .013$ of interaction term); the difference between moderates and conservatives is not significant; the difference between moderates and liberals is marginally significant ($p = .07$).

vaccination rates than those with a lower share, which the author attributes to a highly politically segmented information environment surrounding the H1N1 vaccine (Baum, 2011). As a first step to examine whether such political divergence in HPV vaccination-related outcomes may manifest, this study examined how political- and news media-related factors independently and interactively influence HPV vaccine awareness, while also examining demographic variables that have demonstrated relationships with awareness.

Consistent with other research (Gelman et al., 2011; Hughes et al., 2009; Jain et al., 2009), we found that a large majority of respondents were aware of the HPV vaccine, but that female, White, younger, and more educated respondents were significantly more likely to be aware. The educational gradient in awareness was particularly large, with a 30% difference in awareness between the most educated and the least educated, larger even than the difference between men and women. After accounting for these demographic differences, we also found tentative evidence that ideological orientation was associated with awareness of the HPV vaccine. Specifically, individuals who reported having a liberal or conservative political orientation had slightly higher awareness of the HPV vaccine compared with moderates. Although the difference was small relative to education, the magnitude of difference between liberals and moderates was similar in size as that between Whites and non-Whites. Other research has shown that HPV vaccine acceptability is higher among liberals than conservatives (Constantine & Jerman, 2007; Reiter et al., 2011; Stupiansky et al., 2010), potentially reflecting the well-publicized conservative outcry over the vaccine based on concern about its consequences and the government's role in proposing mandates (Colgrove, et al., 2010). Because parental awareness of the vaccine is one significant predictor of vaccine uptake among daughters (Laz, Rahman, & Berenson, 2012), increased outreach is needed to ensure that less-educated women and men and racial and ethnic minorities are aware of the vaccine and its merits for cancer prevention, as others have suggested (Gelman et al., 2011). Our study also suggests that future educational efforts may need to overcome the politicized context to have maximum population impact.

Our findings also show that the highly variable media environment—with some states' newspapers reporting on the issue constantly and other states' newspapers hardly discussing it—had an association with awareness of the vaccine. In general, awareness of the vaccine rose with increasing exposure to

HPV-specific news coverage in the respondents' state, but we identified some evidence suggesting that this relationship varied by political predispositions. Liberals seemed to be most sensitive to media exposure to the vaccine debates. As exposure increased, liberals were more aware of the vaccine, whereas conservatives' awareness was constant and did not vary with increasing news media exposure. Future research, particularly with larger samples and attention to mechanisms, might explore these relationships. For instance, it will be important to understand whether and how information in the media might affect people differently based on political orientation. Research on media effects indicates that ideological predispositions produce biases in selection, acceptance, or retention of news information (Bennett & Iyengar, 2008), suggesting that conservatives may avoid HPV-related news content or fail to retain it. In addition, whereas previous health communication research has documented the importance of the news media's influence on the public's health-related perceptions (Kelly et al., 2009) and health behaviors (Rutten, Augustson, Doran, Moser, & Hesse, 2009), such studies measure only self-reported consumption of news, not individual-specific exposure to the issue-specific news environment, and these studies do not account for selectivity of information. Thus, our study emphasizes the importance of constructing more specific measures of news exposure to health issues and examining whether the influence of health communication varies by political predispositions and other factors.

Our results must be interpreted in light of several limitations. First, our sample size was relatively small, with only 1,200 respondents, preventing us from making confident assertions about increasingly small subgroups by ideology and news consumption. Second, our data only allowed us to explore vaccine awareness as our outcome of interest. However, vaccine awareness is not necessarily predictive of behaviors among adults or youth (Conroy et al., 2009), so future efforts should examine how political predispositions and media exposure influence actual vaccine uptake, along with other factors shown to be related to HPV vaccine uptake, such as social norms, provider recommendations, and access to and cost of care (Conroy, et al., 2009). The only existing study of which we are aware that examined political orientation as a predictor of vaccine uptake did not identify a significant relationship between parental political identity and reported vaccine receipt in a sample of North Carolina parents (Brewer et al., 2011). However, given political differences in uptake documented for the H1N1 vaccine (Baum et al., 2011), a vaccine that was rolled out with less political discussion than the HPV vaccine, more research on this question is needed in other samples. Third, although a web-based survey poses concerns about bias for those without access, the Knowledge Networks panel is recruited to be diverse in respondents' socioeconomic status; in addition, because respondents were unaware of the study's subject before agreeing to participate, participation in the panel is unlikely to bias our results (Groves, 2006).

Fourth, we measured volume of news media to assess whether coverage, irrespective of that coverage's content, affected awareness; more sophisticated analyses might investigate the effects of news media content and tone on other measures of HPV vaccine attitudes. Fifth and related, information about the vaccine was available not only through traditional print news media (local and national), but also through TV, social media, and an extensive advertising campaign; however, we did not measure exposure to TV, social media, or advertising. Finally, our data were collected in summer 2009, when media and policy

discussions of the HPV vaccine were minimal; this was before the vaccine was licensed for boys (later in 2009) or recommended by the Advisory Committee on Immunization Practices for routine use by boys (in 2011) and before the vaccine received renewed political scrutiny in fall 2011 with the Republican primary campaign (Gostin, 2011). We can predict that political and informational factors have only become stronger influences on perceptions of the HPV vaccine given its sustained and well-publicized politicization.

Implications for Practice and/or Policy

Our findings suggest that demographic factors like socioeconomic status and gender, political predispositions, and the informational environment are all important factors to consider when considering women's—and the general public's—HPV vaccine-related attitudes. Future research should assess whether similar factors are also associated with awareness, attitudes, and behaviors related to other highly controversial and politicized women's health issues, such as breast cancer screening, abortion, and contraception. It is now well known that the news media environment is fragmented, with individuals selecting to receive their news from different sources based, in part, on their own political orientation (Iyengar & Hahn, 2009). There is no reason to believe that the news environment for health issues is any less politically fragmented than that for other social issues. Because political variables have been shown in this study and others (e.g., Baum, 2011) to predict health-relevant outcomes, health researchers could benefit from collecting these variables more routinely in their studies, and policymakers and practitioners should be attune to the importance of such political predispositions in shaping patients' and public attitudes.

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coverage of and public opinion toward controversial health policy issues, including childhood obesity, the HPV vaccine, and mammography screening.

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Appendix

Table 1
Sociodemographic and Political Contextual Predictors of Human Papillomavirus Vaccine Awareness, With Ideology–Media Interactions

	Coeff. (SE)
Age (yrs)	−0.02 (0.01)**
Female (Ref = male)	1.26 (0.19)**
High school (Ref = less than high school)	0.43 (0.30)
Some college (Ref = less than high school)	0.97 (0.32)**
Bachelor's degree (Ref = less than high school)	1.45 (0.34)**
White (Ref = non-White)	0.36 (0.21)**
Income \$20,000–39,999 (Ref = <\$20,000)	0.17 (0.28)
Income \$40,000–74,999 (Ref = <\$20,000)	0.17 (0.28)
Income \$75,000–124,999 (Ref = <\$20,000)	0.17 (0.32)
Income ≥\$125,000 (Ref = <\$20,000)	0.32 (0.37)
Has daughter age 11–17	−0.05 (0.38)
Household size	0.11 (0.08)
Lives in metropolitan area	−0.36 (0.26)
In state that introduced mandate legislation	0.11 (0.18)
Liberal (Ref = conservative)	−0.80 (0.43)†
Moderate (Ref = conservative)	−0.68 (0.36)†
Media exposure (log transformed average)	−0.01 (0.11)
Liberal * media exposure	0.42 (0.17)*
Moderate * media exposure	0.13 (0.15)
Wald test for joint significance (Liberal * media exposure; Moderate * media exposure)	$F_{(2,1214)} = 3.18, p = .042$

Abbreviations: Coeff., coefficient; Ref, reference variable; SE, standard error. Logit coefficients and standard errors are displayed.

** $p < .01$; * $p < .05$; † $p < .1$.