



Perceptions of politicization and HPV vaccine policy support

Loren Saulsberry^{a,*}, Erika Franklin Fowler^b, Rebekah H. Nagler^c, Sarah E. Gollust^d

^a Department of Public Health Sciences, The University of Chicago, Chicago, IL, USA

^b Government Department, Wesleyan University, Middletown, CT, USA

^c Hubbard School of Journalism and Mass Communication, University of Minnesota, Minneapolis, MN, USA

^d Division of Health Policy and Management, School of Public Health, University of Minnesota, Minneapolis, MN, USA



ARTICLE INFO

Article history:

Received 15 January 2019

Received in revised form 10 May 2019

Accepted 21 May 2019

Available online 8 July 2019

Keywords:

HPV vaccine

Legislation

Public health

Health policy

Politics

Cancer prevention

ABSTRACT

Background: Since its FDA approval in 2006, the Human papillomavirus (HPV) vaccine has been politically-charged, given its association with sexual health among young women and its history of controversial, and largely unsuccessful, legislative mandates. The extent to which perceived politicization is related to public support for the vaccine's use, however, is not clear. We sought to examine the relationship between public perceptions of politicization of the HPV vaccine and public support for HPV vaccine policies.

Methods: We fielded a survey from May–June 2016 using a nationally representative sample of U.S. adults (18–59 years). Among respondents aware of the HPV vaccine ($n = 290$), we predict support for HPV vaccine policies based on respondents' perceptions of three characteristics of the vaccine's portrayal in public discourse: degree of controversy, certainty of the scientific evidence supporting the vaccine's use, and frequency with which the vaccine appears in political discussion.

Results: Respondents who perceived greater certainty about the scientific evidence for the HPV vaccine were more supportive of HPV vaccine policies ($p < 0.0001$) than respondents who perceived the scientific evidence to be uncertain, after adjusting for respondents' characteristics, including demographics and partisanship.

Conclusions: Public perceptions of the HPV vaccine's politicization, particularly the portrayal of scientific evidence, are associated with receptivity to legislative mandates.

Policy implications: How the certainty of a body of evidence gets communicated to the public may influence the policy process for a critical cancer prevention intervention.

© 2019 Published by Elsevier Ltd.

1. Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States and a known cause of cancer [1,2]. The Centers for Disease Control and Prevention (CDC) estimates that more than 90% of sexually active males and over 80% of sexually active females will become infected with HPV at some point in their lives [3]. HPV can cause oropharyngeal (throat, tongue, tonsils), anal, penile, vulvar, vaginal, and cervical cancers [1,2]. However, HPV is responsible for causing most cases of cervical cancer [4], and symptoms can develop years after a sexual encounter resulting in infection [1]. Approximately 12,000 women in the U.S. will be diagnosed with cervical cancer each year,

and despite screening and treatment, over 4000 of those women will die from cervical cancer [1].

Preventing HPV infection presents a critical opportunity to reduce the risk for cervical cancer and decrease new incidences of cervical cancer. The HPV vaccine was developed as a preventive measure against HPV's transmission, and it was approved for use by the U.S. Food and Drug Administration (FDA) in 2006 [5]. As the ideal time for HPV vaccination is prior to sexual activity [5], the national Advisory Committee on Immunization Practices (ACIP) recommends routine HPV vaccination for females and males beginning at 11 or 12 years of age. They also recommend vaccination for females aged 13–26 years and males 13–21 years, who were not vaccinated previously [6–8].

U.S. vaccination policy has traditionally centered around school requirements, which have been effective tools for achieving and maintaining high coverage rates as well as decreasing the incidence of vaccine-preventable diseases (VPDs) [9–14]. Most states already require multiple vaccines prior to school attendance, such

* Corresponding author at: Department of Public Health Sciences, The University of Chicago, 5841 S. Maryland Ave., Chicago, IL 60637-1447, USA.

E-mail address: lsaulsberry@uchicago.edu (L. Saulsberry).

as Hepatitis B, Tdap (tetanus, diphtheria, and acellular pertussis), and the meningococcal conjugate [9,11,15]. As of 2017, 53% of adolescent girls and 44% of adolescent boys had received all doses of the HPV vaccine; these rates are lower than for other similar vaccines (like meningococcal vaccine) likely in part because of the exceptionally low rate of implementing state-level requirements for the HPV vaccine [9]. Since 2006, at least 25 states have enacted legislation requiring, funding, or providing education for the HPV vaccine, yet only the District of Columbia (DC) [10,11,16], Virginia (VA) [10,11,16–18], and Rhode Island (RI) [11,19], require HPV vaccination for school attendance [20,21]. The HPV vaccination laws in DC, VA, and RI vary, particularly in their allowance for parents to opt-out of having their children vaccinated [10,11,16–19].

Another possibility explaining low uptake of vaccine mandates at the state level is that the introduction of the vaccine into the legislative context in 2006–2007 was fraught with controversy [22,23]. News coverage of the early legislative debate surrounding the vaccine became increasingly controversial during this initial period (2006–2007) [24], and over the course of ten years such coverage has perpetuated the idea that the vaccine and its related policies are politically contentious [25]. We argue that at this point the HPV vaccine has been “politicized”—which we define (based on synthesis of previous work in political science [26–29]) as a strategic effort to portray the vaccine as controversial for political ends; to question the evidence behind the vaccine’s safety and efficacy, highlighting a lack of scientific consensus; and to feature the vaccine in political discourse (such as political candidates’ remarks [30]). While previous work has demonstrated that explicit political disagreement over the vaccine may lead to decreased support for HPV vaccine requirements [31], it remains unclear how other aspects of politicization (i.e., perceptions of scientific uncertainty or of controversy irrespective of political discussion) may relate to public support for policies surrounding the HPV vaccine, especially in the years since the early rush (2006–2007) to legislate vaccine requirements. In this analysis, we evaluate the extent to which politicization (as measured through three different dimensions) surrounding the HPV vaccine is associated with the public’s support for two policies that might be implemented by states and/or health care organizations to increase vaccination behavior: HPV vaccine school requirements and requiring physicians to offer the HPV vaccine to families with children 11–18 years old. Both legislative mandates and clinician-based vaccination strategies have been identified as important priorities to increase HPV vaccination [32].

2. Methods

2.1. Data

We draw on the Public Attitudes about Cancer Prevention survey, a nationally representative survey examining the public response to conflicting and controversial information about cancer, specifically focusing on mammograms and the HPV vaccine. Participants (18–59 years) were recruited by the survey firm GfK from their KnowledgePanel®, a probability-based panel of survey respondents designed to be representative of the United States [33]. The survey was fielded from May 24–June 6, 2016 with a total of 1519 respondents. A subset of respondents were randomly assigned to view the survey module about the HPV vaccine and science politicization (instead of a module about other cancer-related topics). These 406 respondents were eligible for inclusion into this study, although we limited the sample to only those respondents with at least some awareness of the HPV vaccine, as described below. Survey weights adjusting for panel and study non-response were constructed based on a range of geodemo-

graphic benchmarks (e.g., gender, age, race/ethnicity, income, etc.) [33] and were applied to produce nationally-representative estimates.

2.2. Measures

2.2.1. Dependent variables

Key dependent variables were public support for two HPV vaccine policies: (1) requiring all children in middle school get the HPV vaccine, with opt-outs allowed as determined by the state, and (2) requiring pediatricians to offer the HPV vaccine to every family with a child 11–18 years of age. These outcomes were measured as binary variables indicating whether an individual said they “strongly support” or “support” compared to any other response (“neither support nor oppose,” “oppose,” “strongly oppose,” and “refused”).

A strong precedent of legislative mandates for vaccination upon school entry exists as these laws are currently in place across the U. S. [9–14]. Three states (DC, VA, and RI) have mandatory school-entry laws in effect for the HPV vaccine [10,11,16–21]. The 2014 report of the President’s Cancer Panel identified clinician-based vaccination strategies as a major priority [32], even though similar previous efforts to encourage and train health care clinicians had only modestly improved vaccine uptake [34]. These strategies focused on developing and implementing communication programs for physicians about the HPV vaccine. Provider recommendation is a key predictor of HPV vaccination [35], and weak or low quality recommendations may contribute to under-immunization among adolescents [36]. In health care delivery settings, there are mechanisms to require vaccine administration by providers; known as “offer” or “ensure” laws, these requirements indicate that vaccination of a non-immune person is either optionally offered to patients or is mandatory except in cases of exemption or refusal [37,38]. To our knowledge, at present no state has passed an “offer” or “ensure” law to regulate HPV vaccination for eligible patients in a healthcare delivery setting. Alternatively, such a requirement for physicians to offer the vaccine could be set by health care organizations, instead of through a state law, and implemented through reminders in the electronic medical record that every eligible patient be offered the vaccine [39]. In hopes of gauging public support for an “offer” law associated with the HPV vaccine, we included a secondary policy alternative that could be implemented at the clinic level. Together, these two dependent variables would provide a greater understanding of the public appetite for HPV vaccine policy alternatives, and we predicted that politicization of the HPV vaccine would influence support of either type of policy.

2.2.2. Independent variables

Our key independent variables were respondents’ perceptions of the extent to which the HPV vaccine is politicized, as measured through three domains developed for this survey based on prior conceptualizations of politicization [30]. For all three of these survey measures, respondents were specifically instructed to answer based on how they “perceive these issues are portrayed in society and the media” as opposed to their own personal views of the HPV vaccine. The first politicization domain related to public perceptions of whether society and the media have portrayed the HPV vaccine as controversial:

*Some health and science issues seem particularly **controversial**, by which we mean that they arouse a lot of debate or disagreements, while other health and science issues are **less controversial**. Based on what you’ve seen or heard, how controversial do you think [the HPV vaccine is]?*

The second politicization domain related to public perceptions of whether society and the media have portrayed the scientific evidence supporting the vaccine's use as certain versus uncertain:

*For some issues, the science or evidence behind them is **clear or fairly certain**, while for other issues the science is **less clear and more uncertain**. Based on what you've seen or heard, how certain or uncertain do you think the scientific evidence is about the [the HPV vaccine]?*

The third politicization domain related to public perceptions of whether society and the media have portrayed the HPV vaccine as a part of political discussions:

*Some health and science issues are **part of political discussions**, by which we mean that politicians and other elected officials talk about them, while other health and science issues are **not a part of political discussions**. Based on what you've seen or heard, how much do you think [the HPV vaccine] is a part of political discussions? For this question, we ask that you think not only about the current political campaign but also other political discussions at the local, state, or national level.*

Each of these three perceived politicization variables had four response categories. The response categories for perceptions of the controversy surrounding the HPV vaccine included: "Not controversial," "A little controversial," "Very controversial," and "Not sure, I don't know." The response categories for perceptions of the certainty around the scientific evidence supporting the HPV vaccine included: "The science is not at all clear, very uncertain," "The science is not so clear, somewhat uncertain," "The science is clear, fairly certain," and "Not sure, I don't know." The response categories for perceptions of the HPV vaccine as a part of political discussions included: "The issue is rarely or never a part of political discussions," "The issue is sometimes part of political discussions," "The issue is often part of political discussions," and "Not sure, I don't know."

We also measured several individual respondent characteristics including gender (male or female), parental status (see below), age, education (less than high school, high school, some college, and Bachelor's or higher), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Other, Hispanic, and Non-Hispanic of 2 or more races), party identification (strong Republican, not strong Republican, leans Republican, undecided/independent/other, leans Democrat, not strong Democrat, and strong Democrat) and political ideology (extremely liberal, liberal, slightly liberal, moderate/middle of the road, slightly conservative, conservative, extremely conservative). The demographic variables were obtained from GfK profile data; the party identification and political ideology variables were measured on the survey. The binary parental status variable (parent or non-parent) was constructed from four survey measures indicating the presence of children of multiple age groups in the respondent's household: (1) children 0–2 years, (2) children 2–5 years, (3) children 6–12 years, (4) children 13–17 years. These four variables consisted of mutually exclusive categories describing the number of children in that specific age group in the household. Respondents indicating that at least one or more children lived in their household were designated as parents, and all other respondents were assigned to the non-parent category.

We also asked at the beginning of the module whether respondents had ever heard of the HPV vaccine. Given that for participants to judge their perceptions of the vaccine's politicization they must first be aware of the vaccine, we restricted our final sample to those with previous awareness about the HPV vaccine. Of the 406 respondents who answered the politicization measures, 293 (72%) were previously aware of the HPV vaccine. Three observations were excluded as they did not respond to the survey item

measuring political ideology, yielding a final sample of 290 respondents.

Finally, we asked respondents to indicate whether they had ever gotten at least one shot of the HPV vaccine or whether they were parents of at least one child 11–17 years old that had gotten at least one shot of the HPV vaccine. We expected these measures of personal/family experience with the HPV vaccine to be closely related to perceptions about the HPV vaccine. Sensitivity analyses confirmed our expectations that these measures and perceptions of the HPV vaccine were highly correlated. We report the proportions of our final sample that indicate some personal/family experience with the HPV vaccine.

2.3. Analyses

We first descriptively characterized respondents' support for the HPV vaccine policies and their perceptions of the three politicization dimensions. We then used unadjusted Pearson chi-square tests for independence to evaluate the relationships between the key independent variables, the covariates, and support for each HPV vaccine requirement. Finally, we estimated logistic regression models of the two policy support items on the three perceptions of politicization, adjusting for respondents' gender, parental status, age, education, race/ethnicity, party identification, and political ideology, and then estimated predicted probabilities of policy support based on these regression models. All analyses were conducted using StataMP, version 15 (StataCorp) with $p < 0.05$ indicating significance [40].

This study was determined to be exempt from human subjects review by the University of Minnesota Institutional Review Board.

3. Results

3.1. Descriptive findings

Requiring pediatricians to offer the HPV vaccine to families with children 11–18 years of age was the more popular of the two public health policies, with more than half of adults (59%) expressing support; only 1 in 3 respondents (32%) supported HPV vaccine school requirements. Of adults who had some prior knowledge of the HPV vaccine, a majority (72%) perceived portrayal of the HPV vaccine as controversial, and 32% perceived portrayal to include some uncertainty of the scientific evidence for the HPV vaccine. Fewer than 1 in 10 (7%) perceived the HPV vaccine to be frequently a part of political discussions.

Respondents reported personal/family experience with the HPV vaccine. Of those respondents who had previously heard of the HPV vaccine, 44% of females 18–36 years of age and 15% of males 18–33 years of age had received at least one shot of the HPV vaccine. The age ranges for men and women vary because the HPV vaccine was approved for women in 2006 and men in 2009 which means at the time of the survey, women up to age 36 and men up to age 33 would have been in the cohort of people for whom the HPV vaccine was available. Of those respondents who were parents with at least one child and had previously heard of the HPV vaccine, 52% reported that their child had received at least one shot of the HPV vaccine.

Bivariate analyses shown in Table 1 show that perceptions of politicization are related to support for the two policy strategies, yet the relationships varied by the domains of politicization and the policy outcomes. Reported perceptions of scientific uncertainty had the strongest association with support for either HPV policy ($p < 0.0001$), with perceptions that the science is less clear related to lower support for both policies. Relationships were also observed between perceptions of how controversial the HPV vac-

Table 1
 Characteristics of respondents reporting they strongly support/support requiring children in middle school get the HPV vaccine or requiring physicians to offer the HPV vaccine (N = 290).

Sample characteristics	Full sample		Percent support for middle school mandates		Percent support for physician mandates	
	N	(%)	(%)	p-value	(%)	p-value
<i>Perceptions of politicization</i>						
Perceptions of controversy over the HPV vaccine (%)						
Not controversial	35	13	39	0.15	59	0.004**
A little controversial	166	56	36			
Very controversial	47	16	27			
Refused/not sure, I don't know	42	15	19			
Perceptions of certainty of scientific evidence about the HPV vaccine (%)						
Science is not at all clear, very uncertain	17	7	11	<0.0001***	40	<0.0001***
Science is not so clear, somewhat uncertain	76	25	16			
Science is clear, fairly certain	132	45	53			
Refused/Not sure, I don't know	65	24	17			
Perceptions of HPV vaccine as part of political discourse (%)						
Issue rarely or never a part of the discussion	128	44	38	0.05	65	0.001***
Issue is sometimes a part of the discussion	84	28	36			
Issue is often a part of the discussion	19	7	23			
Refused/not sure, I don't know	59	21	18			
<i>Demographics</i>						
Gender (%)						
Female	158	57	30	0.15	65	0.04*
Male	132	43	36			
Parental status (%)						
Parent	112	43	32	0.62	60	0.61
Non-parent	178	57	32			
Age (%)						
18–29	79	28	35	0.47	54	0.61
30–44	85	37	33			
45–59	126	35	29			
Education (%)						
Less than high school	16	7	34	0.70	58	0.29
High school	63	24	35			
Some college	90	33	29			
Bachelor's degree or higher	121	35	34			
Race/Ethnicity (%)						
White, Non-Hispanic	212	66	29	0.27	60	0.96
Black, Non-Hispanic	18	10	28			
Other, Non-Hispanic	9	5	53			
Hispanic	46	17	40			
2 + Races, Non-Hispanic	5	3	41			
<i>Political affiliation</i>						
Party ID (%)						
Strong Republican	34	13	20	<0.0001***	42	0.001***
Not Strong Republican	42	14	37			
Leans Republican	45	15	18			
Undecided/Independent/Other	12	4	6			
Leans Democrat	67	23	37			
Not Strong Democrat	49	16	37			
Strong Democrat	41	15	48			
Ideology (%)						
Extremely conservative	9	3	0	<0.0001***	45	0.001***
Conservative	41	14	14			
Slightly conservative	32	10	33			
Moderate, middle of the road	119	44	32			
Slightly liberal	28	9	32			
Liberal	47	15	43			
Extremely liberal	14	5	80			

Source: Public Attitudes about Cancer Prevention Study.

Notes: N-values are unweighted. All % values are weighted but may not sum to 100 due to rounding. Refused/No answer responses not shown. Unadjusted Pearson chi-squared tests. *p ≤ 0.05. **p ≤ 0.01. ***p ≤ 0.001.

cine is and support for requiring physicians to offer the HPV vaccine (p < 0.01) and a sense that the HPV vaccine was more frequently a part of political discussions (p < 0.01). Respondents who felt the HPV vaccine was more frequently a part of political

discussions were less likely to support requiring the HPV vaccine for middle school (p = 0.05). Women were slightly more likely than men to support requiring physicians to offer the HPV vaccine (65–50% respectively; p < 0.05). Respondents identifying themselves as

more liberal in political ideology reported greater support for requiring the HPV vaccine for middle school ($p < 0.0001$).

3.2. Regression analyses

After adjusting for individual respondent characteristics (i.e., age, gender, parental status, education, race/ethnicity, party identification, and political ideology), only one of the three politicization domains was significantly related to policy support: public perceptions of the certainty of the scientific evidence on the HPV vaccine (Table 2). Compared to those perceiving that the “science is not at all clear, very uncertain,” respondents perceiving that the “science is clear, fairly certain” were significantly more likely to support requiring the HPV vaccine for middle school and requiring physicians to offer the HPV vaccine to families (OR = 8.53, $p \leq 0.05$ and OR = 7.39, $p \leq 0.01$ respectively). Among the individual respondent characteristics, only ideology was related to policy support, with conservative respondents less likely to support vaccine requirements than liberals.

Table 3 converts the odds ratios into more meaningful values, estimating the predicted probabilities that respondents supported the HPV vaccine policy alternatives by the three different measures of politicization, adjusting for all other characteristics shown in Table 2. Of individuals perceiving the “science is clear, fairly certain,” an estimated 55% supported HPV requirements for children in middle school in comparison to an estimated 16% supporting the policy among those perceiving the “science is not at all clear, very uncertain” ($p < 0.0001$). Of the individuals perceiving the “science is clear, fairly certain,” an estimated 82% supported requiring pediatricians to offer the HPV vaccine compared to an estimated 44% supporting the policy among respondents that perceived the “science is not at all clear, very uncertain” ($p < 0.0001$). No significant associations were observed between the other two politicization domains and support for the HPV vaccine requirements (Table 3). Fig. 1 displays the predicted probabilities for the scientific uncertainty findings in graphical form, demonstrating the strong relationship between perceptions of scientific certainty and support for the HPV vaccine policy alternatives.

Table 2
Predicted odds of HPV vaccine mandate support^a by perceptions of politicization.

	Support for middle school mandate		Support for physician mandate	
	OR	95% CI	OR	95% CI
<i>Perceptions of politicization</i>				
<i>Perceptions of controversy over the HPV vaccine</i>				
Not controversial [†]	1.00		1.00	
A little controversial	1.90	0.79, 4.56	2.35	0.97, 5.69
Very controversial	0.83	0.27, 2.56	1.15	0.38, 3.52
<i>Perceptions of certainty of scientific evidence about the HPV vaccine</i>				
Science is not at all clear, very uncertain [†]	1.00		1.00	
Science is not so clear, somewhat uncertain	1.09	0.14, 8.22	0.86	0.25, 2.94
Science is clear, fairly certain	8.53 [†]	1.13, 64.33	7.39 ^{**}	2.12, 25.74
<i>Perceptions of HPV vaccine as part of political discourse</i>				
Issue rarely or never a part of the discussion [†]	1.00		1.00	
Issue is sometimes a part of the discussion	0.68	0.32, 1.45	0.93	0.45, 1.93
Issue is often a part of the discussion	0.30	0.069, 1.34	0.35	0.09, 1.27
<i>Sociodemographic characteristics</i>				
<i>Gender</i>				
Men [†]	1.00		1.00	
Women	0.60	0.31, 1.14	2.04	1.11, 3.77
<i>Parental status</i>				
Non-parent [†]	1.00		1.00	
Parent	1.13	0.57, 2.22	1.11	0.58, 2.12
<i>Age</i>				
18–29 [†]	1.00		1.00	
30–44	1.26	0.57, 2.79	2.00	0.89, 4.50
45–59	0.74	0.31, 1.75	0.93	0.47, 1.83
<i>Education</i>				
Less than high school [†]	1.00		1.00	
High school	0.93	0.21, 4.03	0.59	0.16, 2.20
Some college	0.64	0.16, 2.45	0.48	0.13, 1.83
Bachelor's degree or higher	0.87	0.23, 3.34	0.61	0.17, 2.23
<i>Race/Ethnicity</i>				
White, Non-Hispanic [†]	1.00		1.00	
Black, Non-Hispanic	1.23	0.42, 3.61	0.97	0.26, 3.63
Other, Non-Hispanic	4.65	0.95, 22.89	0.68	0.15, 3.03
Hispanic	1.66	0.67, 4.11	0.96	0.42, 2.21
2 + Races, Non-Hispanic	2.74	0.44, 17.26	1.01	0.15, 6.49
<i>Party ID</i>				
Party ID	0.95	0.76, 1.18	0.97	0.80, 1.18
<i>Ideology</i>				
Ideology	0.63 ^{**}	0.45, 0.87	0.82	0.62, 1.09
<i>Pseudo R²</i>				
Pseudo R ²	0.2252		0.2160	
<i>N</i>				
N	290		290	

Source: Public Attitudes about Cancer Prevention Study.

Notes: ^aStrongly support/support for the specific HPV mandate. OR, odds ratio; CI, confidence interval. * $p \leq 0.05$. ** $p \leq 0.01$. *** $p \leq 0.001$. [†]Reference category.

Table 3
Predicted probabilities HPV vaccine mandate support^a by perceptions of politicization.

Politicization measure	Middle school mandate		Physician mandate	
	Strongly support/support (%)	P	Strongly support/support (%)	P
<i>How controversial do you think the [HPV vaccine is]?</i>				
Not controversial	26	0.13	47	0.09
A little controversial	35		61	
Very controversial	23		49	
Refused/not sure, I don't know	44		66	
<i>How certain or uncertain do you think the scientific evidence is about the [HPV vaccine]?</i>				
Science is not at all clear, very uncertain	16	<0.0001	44	<0.0001
Science is not so clear, somewhat uncertain	17		41	
Science is clear, fairly certain	55		82	
Refused/not sure, I don't know	14		36	
<i>How much do you think the [HPV vaccine is] a part of political discussions?</i>				
Issue rarely or never a part of the discussion	37	0.28	63	0.28
Issue is sometimes a part of the discussion	30		62	
Issue is often a part of the discussion	19		44	
Refused/not sure, I don't know	31		52	
N	290		290	

Source: Public Attitudes about Cancer Prevention Study.

Notes: ^aStrongly support/support for the specific HPV mandate. Statistical significance of $p < 0.05$ for joint χ^2 tests of the average marginal effects. Adjusted odds ratios calculated with logistic regression analysis controlling for respondent's gender, parental status, age, education, race/ethnicity, party ID, and ideology.

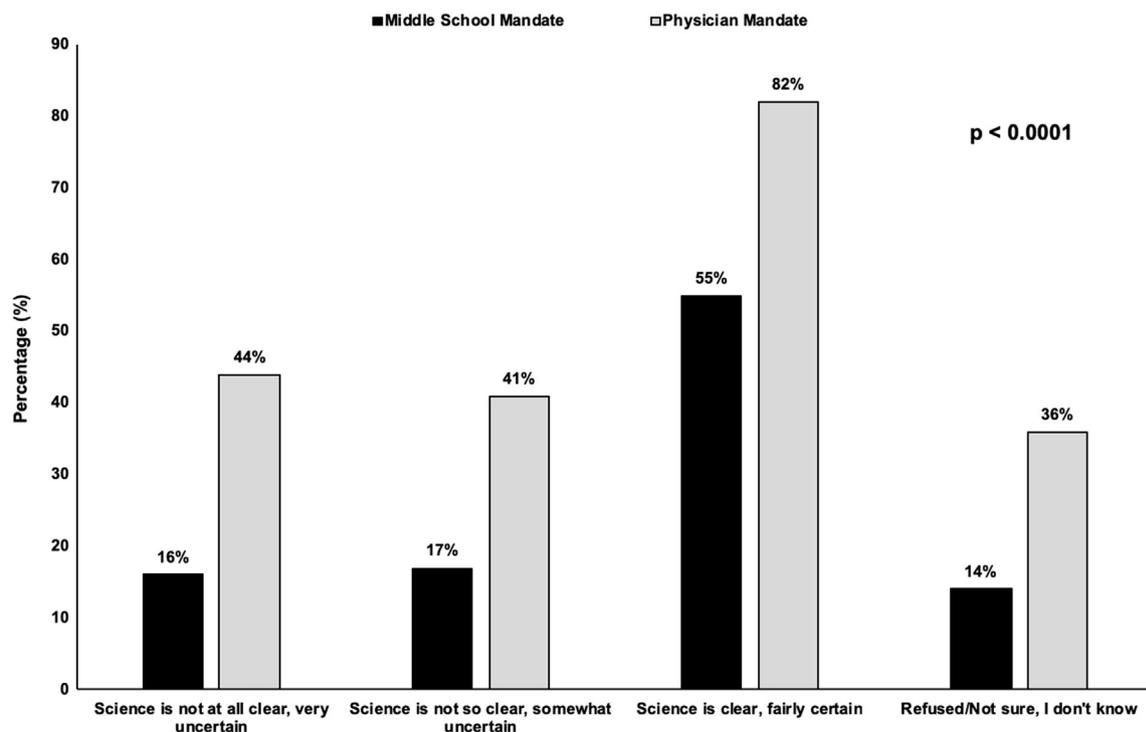


Fig. 1. Predicted HPV vaccine mandate support, by perception of certainty of the scientific evidence about the HPV vaccine.

SOURCE: Public Attitudes about Cancer Prevention Study.

NOTE(S): P-value indicates statistical significance of joint χ^2 test of differences of predicted margins. N = 290.

4. Discussion

This study reveals that perceived politicization of the HPV vaccine is associated with the public's preferences for HPV vaccine policy alternatives. Public perceptions of uncertainty about the scientific evidence for the HPV vaccine is associated with lower support for HPV vaccine mandates. Politicization is broadly defined in the literature. Political scientists Toby Bolsen and James N. Druckman describe politicization as the promotion of skepticism around scientific consensus, by strategically accentuating the uncertainty of scientific findings in pursuit of a particular agenda [27]. The pre-

sent study reinforces this concept, suggesting that perceptions of scientific uncertainty—whether produced unintentionally or intentionally as in Bolsen and Druckman's framework—are associated with lower policy support. Our findings differ somewhat from previous experimental studies showing that exposure to politicization (defined as political debate and presence of controversy) [29,31] can decrease support for HPV vaccine mandates; in the present study, perceptions of this type of politicization were not related to policy support. These results also suggest that adults perceiving the science to be certain might be more open to a range of policy options for the HPV vaccine, as they were more likely to support

both HPV vaccination requirements for school attendance and mandating that physicians offer the HPV vaccine. The study suggests that perceptions of various types of politicization could differentially impact HPV vaccine policy preferences, and it highlights the importance of delineating how specific dimensions of politicization may influence views and behaviors amid health controversies.

After over ten years of HPV vaccine use, school entry requirements remain underutilized as a tool to raise HPV vaccination uptake [41]. The observed lower public support for a school vaccination mandate in comparison to a requirement for physicians to offer the vaccine reiterates that the political will to pursue HPV vaccine school entry requirements may not be strong [33]. Furthermore, the design of school entry requirements for the HPV vaccine may impact vaccine uptake as the inclusion of opt-out provisions have been shown to increase support while simultaneously limiting their effectiveness [42]. Although there was greater public support for provider-level interventions where physicians would be required to offer the HPV vaccine, the effectiveness of this policy alternative would likely rely on equipping physicians with proper tools for communication and outreach, such as knowledge about high-priority messages for parents [39]. For example, of the multiple reasons justifying HPV vaccination, cancer prevention was the message that most strongly resonated with parents [43]. Additionally, such provider-level interventions could be designed similarly to policies instituted in the U.S. states of California and Washington, which required proof that a health care provider had counseled parents on the benefits/risks of vaccines and effectively lowered the number of vaccine exemptions [44,45].

As states have debated legislating HPV vaccination mandates, the framing of the HPV vaccine in media coverage—publicizing the political and moral views of the vaccine's opponents—may have played a significant role in shaping the public response to the HPV vaccine [24]. Issue frames reinforcing conflict over the HPV vaccine, particularly around the evidence supporting the vaccine's use, may have established a standard for news coverage and the public discourse about the health issue. A historical precedent exists in the U.S. for skepticism about vaccinations [46,47], which has resulted in considerable public scrutiny of the scientific evidence for vaccines and their value to public health. Given this context, the public may have been exposed disproportionately to negative messages emphasizing scientific uncertainty over the HPV vaccine. A recent study found that parents that heard either stories about only the harms of the HPV vaccine or stories about both the harms and benefits (preventing diseases) had lower HPV vaccination intentions [48]. A heightened predisposing concern about vaccine safety may have meant the public was more likely to seek out or recall such messages. Regardless of the mechanism of exposure, public perceptions of scientific uncertainty could have negative consequences for public support of an important public health intervention.

4.1. Limitations

The current study has several strengths, including the use of nationally representative data, but it is not without limitations. First, as the data collected were cross-sectional, no causal relationships can be determined from the analyses. Second, we only included three items to measure perceptions of politicization, one for each proposed domain. Future research should apply more nuanced or multidimensional measurement strategies. Third, we explicitly asked respondents how they perceived the issues to be constructed in public discourse, not about their own personal opinions, which might have produced different results. Our findings may have some response error for respondents who gave their own opinion in spite of our instruction. Future research comparing

respondents' perceptions of politicization in public discourse, as opposed to their own personal opinions about the vaccine, is needed. Fourth, the study sample was small (restricting to respondents previously aware of the HPV vaccine) which increased the size of confidence intervals. Future work with larger sample sizes should attempt to replicate our results. Due to the small sample size, we were also unable to assess whether the relationship between perceptions of politicization and respondents' support for the HPV vaccine policies are different by whether they themselves or their children had received the vaccine, so examining the relationship between attitudes and beliefs among those who have received the vaccine compared to those who have not is another important direction for future work.

5. Conclusions

In spite of these limitations, our results contribute evidence of the potential impact of politicization on public support for HPV vaccine policies. The political setting at the state level, especially where ideological consistencies exist between states, provides essential context to the types of potential challenges to uptake that could arise when considering legislative requirements for the HPV vaccine [49]. The extent to which the political setting at the state level undermines public confidence in scientific uncertainty may have a substantial impact on the public's enthusiasm for policy alternatives addressing this preventive public health practice.

Given the current polarized climate of U.S. politics, which highlights lack of scientific consensus on issues like the HPV vaccine, greater understanding of how multiple domains of politicization individually and collectively affect policy preferences related to the HPV vaccine is imperative. This is particularly important as more states consider enacting HPV vaccination mandates as a requirement for school attendance or as a standard of care in clinical practice. Emerging research in science communication supports our findings that understanding the consequences of communicating scientific uncertainty versus scientific consensus is an important direction for future research [50]. Overall, our findings suggest that public perceptions about how the scientific evidence supporting the HPV vaccine is portrayed in society and the media may influence the support for health policy approaches related to a form of cancer prevention critical to public health.

Author contributions

Dr. Saulsberry completed the analysis and prepared the initial draft of the manuscript. All authors contributed to the interpretation of the results, provided substantive edits to the multiple iterations of the manuscript, and have approved the final draft.

Declaration of Competing Interest

The authors declare no conflicts of interest, and Drs. Saulsberry, Fowler, Nagler, and Gollust have no financial disclosures.

Acknowledgements

This study was funded, in part, by a Research Scholar Grant from the American Cancer Society (RSG-14-166-01-CPPB) (PI: Gollust). R.H. Nagler also acknowledges support from the Building Interdisciplinary Research Careers in Women's Health Grant (K12-HD055887) from the Eunice Kennedy Shriver National Institutes of Child Health and Human Development, the Office of Research on Women's Health, and the National Institute on Aging, administered by the University of Minnesota Women's Health Research Program. The study sponsors had no role in study design;

collection, analysis, and interpretation of data; writing the report; nor the decision to submit the report for publication.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2019.05.062>.

References

- Centers for Disease Control and Prevention (CDC). Human Papillomavirus (HPV). <https://www.cdc.gov/std/hpv/stdfact-hpv.htm>. Accessed November 20, 2018.
- National Institutes of Health. U.S. National Library of Medicine. Medline plus. HPV. <https://medlineplus.gov/hpv.html>. Accessed November 20, 2018.
- National Institutes of Health. National Cancer Institute. HPV and cancer. <https://www.cancer.gov/about-cancer/causes-prevention/risk/infectious-agents/hpv-fact-sheet#r8>. Accessed November 20, 2018.
- Chesson HW, Dunne EF, Hariri S, Markowitz LE. The estimated lifetime probability of acquiring human papillomavirus in the United States. *Sex Transm Dis* 2014;41(11):660–4.
- Centers for Disease Control and Prevention (CDC). FDA licensure of bivalent human papillomavirus vaccine (HPV2, Cervarix) for use in females and updated HPV vaccination recommendations from the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2010;59:625–9.
- Markowitz LE, Dunne EF, Saraiya M, Chesson HW, Curtis CR, Gee J, et al. Centers for Disease Control and Prevention (CDC). Human papillomavirus vaccination, recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2014;63(5):1–30.
- Petrosky E, Bocchini JA, Hariri S, Chesson H, Curtis CR, Saraiya M, 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* 2015;64(11):300–4.
- Meites E, Kempe A, Markowitz LE. Centers for Disease Control and Prevention (CDC). Use of a 2-dose schedule for Human papillomavirus vaccination—updated recommendations of the Advisory Committee on Immunization Practices. *MMWR* 2016;65(49):1405–8.
- Schwartz JL, Easterling LA. State vaccination requirements for HPV and other vaccines for adolescents, 1990–2015. *JAMA* 2015;314(2):185–6.
- Perkins RB, Lin M, Wallington SF, Hanchate AD. Impact of school-entry and education mandates by states on HPV vaccination coverage: analysis of the 2009–2013 National Immunization Survey-Teen. *Human Vaccines Immunotherap* 2016;12(6):1615–22.
- Barraza L, Weidenaar K, Campos-Outcalt D, Yang YT. Human Papillomavirus and Mandatory Immunization Laws: what can we learn from early mandates? *Public Health Rep* 2016;131(5):728–31.
- Bradford WD, Mandich A. Some state vaccination laws contribute to greater exemption rates and disease outbreaks in the United States. *Health Aff (Millwood)* 2015;38:1383–90.
- Wang E, Clymer J, Davis-Hayes C, Buttenheim A. Nonmedical exemptions from school immunization requirements: a systematic review. *Am J Public Health* 2014;104:e62–84.
- Markowitz LE, Gee J, Chesson H, Stokley S. Ten years of human papillomavirus vaccination in the United States. *Acad Pediatr* 2018;18(2S):S3–S10.
- Doke K, Fitzgerald SA, Barral RL, Griffin P, Ellerbeck EF. Concomitant HPV and MenACWY vaccination among sixth and seventh graders receiving Tdap. *Vaccine* 2018;36:6819–25.
- Stewart A. Childhood Vaccine and School Entry Laws: the case of HPV vaccine. *Public Health Rep* 2008;123:801–3.
- Cuff RD, Buchanan T, Pelkofski E, et al. Rates of human papillomavirus vaccine uptake among girls five years after introduction of statewide mandate in Virginia. *Am J Obstet Gynecol* 2016;214(752):e1–6.
- Pierre-Victor D, Page TF, Trepka MJ, Stephens DP, Li T, Madhivanana P. Impact of Virginia's School-entry vaccine mandate of human papillomavirus vaccination among 13–17-year-old females. *J Women's Health* 2017;26(3):266–75.
- Thompson EL, Livingston MD, Daley EM, Zimet GD. Human papillomavirus vaccine initiation for adolescents following Rhode Island's School-Entry requirement, 2010–2016. *Am J Public Health* 2018;108(10):1421–3.
- National Conference of State Legislatures (NCSL). HPV Vaccine: State Legislation and Statutes. 6/12/2018. <http://www.ncsl.org/research/health/hpv-vaccine-state-legislation-and-statutes.aspx#>. Accessed November 20, 2018.
- Keim-Malpass J, Mitchell EM, DeGuzman PB, Stoler MH, Kennedy C. Legislative activity related to the human papillomavirus (HPV) vaccine in the United States (2006–2015): a need for evidence-based policy. *Risk Manage Healthcare Policy* 2017;10:29–32.
- Colgrove J. The ethics and politics of compulsory HPV vaccination. *N Engl J Med* 2006;355(23):2389–91.
- Abiola SE, Colgrove J, Mello MM. The politics of HPV vaccination policy formation in the United States. *J Health Polit Policy Law* 2013;38(4):645–81.
- Fowler EF, Gollust SE, Dempsey AF, Lantz PM, Ubel PA. Issue emergence, evolution of controversy, and implications for competitive framing: the case of the HPV vaccine. *Int J Press/Politics* 2012;17(2):169–89.
- Gollust SE, LoRusso SM, Nagler RH, Fowler EF. Understanding the role of the news media in HPV vaccine uptake in the United States: synthesis and commentary. *Hum Vaccin Immunother* 2016;12(6):1430–4.
- Bolsen T, Druckman JN, Cook FL. How frames can undermine support for scientific adaptations: politicization and the status-quo bias. *Public Opin Quart* 2014;78(1):1–26. <https://doi.org/10.1093/poq/nft044>.
- Bolsen T, Druckman JN. Counteracting the politicization of science. *J Commun* 2015;65(5):745–69. <https://doi.org/10.1111/jcom.12171>.
- Kahan DM. Climate-science communication and the measurement problem. *Polit Psychol* 2015;36(S1):1–43. <https://doi.org/10.1111/pops.12244>.
- Fowler EF, Gollust SE. The content and effect of politicized health controversies. *Ann Am Acad Polit Social Sci* 2015;658(1):155–71. <https://doi.org/10.1177/0002716214555505>.
- Fowler EF, Nagler RH, Gollust SE. In: Public Views on the Politicization of Health and Science: How the Public Assesses Controversy, Scientific Uncertainty, and Political Discourse for Nine Issues. Presented at the Midwest Political Science Association Annual Conference, April 2017, Chicago, IL.
- Gollust SE, Dempsey AF, Lantz PM, Ubel PA, Fowler EF. Controversy undermines support for state mandates on the human papillomavirus vaccine. *Health Aff (Millwood)* 2010;29(11):2041–6.
- Accelerating HPV Vaccine Uptake. Urgency for action to prevent cancer. A report to the President of the United States from the President's Cancer Panel. Bethesda (MD): National Cancer Institute; 2014.
- Gfk. KnowledgePanel®. [http://www.knowledgenetworks.com/ganp/docs/KnowledgePanel\(R\)-Design-Summary.pdf](http://www.knowledgenetworks.com/ganp/docs/KnowledgePanel(R)-Design-Summary.pdf). Accessed November 20, 2018.
- Daley E, Thompson E, Zimet G. Human papillomavirus vaccination and school entry requirements politically challenging. But not impossible. *JAMA Pediatr* 2018. <https://doi.org/10.1001/jamapediatrics.2018.3327>.
- Niccolai LM, North AL, Footman A, Hansen CE. Lack of school requirements and clinician recommendations for human papillomavirus vaccination. *J Publ Health Res* 2018;7(1324):29–34.
- Gilkey MB, Malo TL, Shah PD, Hall ME, Brewer NT. Quality of physician communication about human papillomavirus vaccine: findings from a national survey. *Cancer Epidemiol Biomark Prev* 2015;24(11):OF1–7.
- Lindley MC, Horlick GA, Shefer AM, Shaw FE, Gorji M. Assessing state immunization requirements for healthcare workers and patients. *Am J Prev Med* 2007;32(6):459–65.
- Centers for Disease Control and Prevention (CDC). Menu of state healthcare facility measles, mumps, and rubella (MMR) vaccination laws. <https://www.cdc.gov/php/publications/topic/menus/mmr-vaccinationlaws/index.html>.
- American Academy of Pediatrics. HPV champion toolkit. PDSA cycle focus: provider prompts. September 2015. https://www.aap.org/en-us/Documents/hpvtoolkit_providerprompts_hpv_pdsa.pdf.
- StataCorp. Stata statistical software: release 15. College Station (TX): StataCorp LLC; 2017.
- North AL, Niccolai LM. Human papillomavirus vaccination requirements in US schools: recommendations for moving forward. *AJPH* 2016;106(10):1765–70.
- Calo WA, Gilkey MB, Shah PD, Moss JL, Brewer NT. Parents' support for school-entry requirements for human papillomavirus vaccination: a national study. *Cancer Epidemiol Biomarkers* 2016;25(9):1317–25.
- Gilkey MB, Zhou M, McRee AL, Kornides ML, Bridges JFP. Parents' views on the best and worst reasons for guideline-consistent HPV vaccination. *Cancer Epidemiol Biomarkers Prev* 2018;27(7):762–7.
- Jones M, Buttenheim AM, Salmon D, Omer SB. Mandatory health care provider counseling for parents led to a decline in vaccine exemptions in California. *Health Aff (Millwood)* 2018;37(9):1494–502.
- Attwell K, Navin MC, Lopalco PL, Jestin C, Reiter S, Omer SB. Recent vaccine mandates in the United States, Europe, and Australia: a comparative study. *Vaccine* 2018;36:7377–84.
- Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. *Pediatrics* 2014;133(4):e835–42.
- Quick JD, Larson H. The vaccine-autism myth started 20 years ago. Here's why it still endures today. *Time Magazine* February 2018;28. Accessed November 20, 2018 <http://time.com/5175704/andrew-wakefield-vaccine-autism/>.
- Margolis MA, Brewer NT, Shah PD, Calo WA, Gilkey MB. Stories about HPV vaccine in social media, traditional media, and conversations. *Prev Med* 2018;118:251–6. <https://doi.org/10.1016/j.ypmed.2018.11.005>.
- Bernstein S, North A, Schwartz J, Niccolai LM. State-level voting patterns and adolescent vaccination coverage in the United States, 2014. *AJPH* 2016;106(10):1879–81.
- Dixon G, Hubner A. Neutralizing the effect of political worldviews by communicating scientific agreement: a thought-listing study. *Sci Commun* 2018;40(3):393–415.