Human Papillomavirus Vaccine Recommendations and Agreement with Mandated Human Papillomavirus Vaccination for 11-to-12-Year-Old Girls: a Statewide Survey of Texas Physicians

Jessica A. Kahn,[1] H. Paul Cooper,[2] Susan T. Vadaparampil,[3] Barbara C. Pence,[4] Armin D. Weinberg,[2] Salvatore J. LoCoco,[5] and Susan L. Rosenthal[6]

[1]Division of Adolescent Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; [2]Baylor College of Medicine, Houston, Texas; [3]Moffitt Cancer Center and University of South Florida, Tampa, Florida; [4]Texas Tech University Health Sciences Center, Lubbock, Texas; [5]University of North Texas Health Science Center and John Peter Smith Hospital, Forth Worth, Texas; and [6]Division of Adolescent and Behavioral Health, University of Texas Medical Branch at Galveston, Galveston, Texas

Abstract

Background: **The purpose of this study was to examine Texas physicians' recommendations for the quadrivalent human papillomavirus (HPV) vaccine in 11-to-12-year-old girls, intention to recommend HPV vaccines to 11-to-12-year-old boys, and attitudes about mandated HPV vaccination for 11-to-12-year-old girls.**

Materials and Methods: **We conducted a cross-sectional, web-based survey of Texas physicians who provide direct patient care in family medicine, pediatrics, obstetrics/gynecology, and internal medicine in September 2008. The three outcome variables were: HPV vaccine recommendations to 11-to-12-year-old girls, likelihood of recommending the vaccine to 11-to-12-year-old boys, and agreement with mandated vaccination of 11-to-12-year-old girls. Univariate and logistic regression analyses were used to determine practice-related and attitudinal factors associated with each outcome.**

Results: **Of the 1,122 respondents, 48.5% stated they always recommended HPV vaccines to girls, 68.4% were likely to recommend the vaccine to boys, and 41.7% agreed with mandated vaccination. In multivariate logistic regression models, variables independently associated with recommendation to 11-to-12-year-old girls included: percentage of patients with Medicaid [odds ratio (OR), 1.02; 95% confidence interval (95% CI), 1.01-1.03], academic versus nonacademic practice (OR, 2.11; 95% CI, 1.05-4.23), office procedures to maximize vaccination (OR, 1.25; 95% CI, 1.01-1.56), HPV knowledge (OR, 1.25; 95% CI, 1.04-1.49), valuing HPV vaccine information from both professional organizations (OR, 1.90; 95% CI, 1.15-3.16) and professional conferences (OR, 1.68; 95% CI, 1.10-2.57), belief in mandated HPV vaccination (OR, 5.38; 95% CI, 3.28-8.83), and barriers to vaccination (OR, 1.08; 95% CI, 1.00-1.16).**

Discussion: **Half of the physicians in this study did not follow current recommendations for universal HPV vaccination of 11-to-12-year-old girls. Factors linked to vaccine recommendations may be targeted in educational or policy interventions.** (Cancer Epidemiol Biomarkers Prev 2009;18(8):2325–32)

Introduction

The quadrivalent human papillomavirus (HPV) vaccine was licensed in June 2006, and the Advisory Committee on Immunization Practices has recommended targeting vaccination of 11-to-12-year-old girls, as well as catch-up vaccination of 13-to-26-year-old women and vaccination of 9-to-10-year-old girls at the provider's discretion (1). HPV vaccines are highly effective in preventing cervical cancer precursor lesions and have the potential to decrease rates of cervical and other HPV-related cancers (2, 3). Widespread vaccination could also decrease existing racial and ethnic disparities in cervical cancer in the United States. (4). However, the public health impact of HPV vaccines cannot be fully realized unless vaccination rates are high (5).

Despite national recommendations for universal vaccination of adolescent girls, two studies showed that HPV vaccination rates in 2007 ranged from ~6% to 25% in 11-to-18-year-old girls in the United States (6, 7). Because physician endorsement of vaccination is one of the most important predictors of vaccine acceptance (8-10), research that provides information about physician recommendations for HPV vaccines may help to inform interventions to improve those recommendations and increase uptake among adolescents. Conceptual models predicting physicians' intentions and recommendations for HPV vaccination may be useful in guiding both research and interventions. We developed one such model, informed by the Theory of Planned Behavior, the Awareness-to-Adherence Model, and the Diffusion Model (11-13). The model proposes that the key predictors of vaccine intentions and recommendations are professional characteristics, vaccine policies and procedures,

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Requests for reprints: Jessica Kahn, Division of Adolescent Medicine, MLC 4000, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229. Phone: 513-636-2970; Fax: 513-636-1129. E-mail: jessica.kahn@cchmc.org

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awareness of HPV vaccines and vaccine guidelines, communication about vaccines from trusted sources, parental factors, and vaccine cost and reimbursement (14). Information is also needed about physician attitudes toward male vaccination, given recent data indicating that the quadrivalent vaccine may be effective in preventing HPV-associated anogenital disease in boys and men, and a possible recommendation for use in boys in the future (15, 16).

Whereas physician recommendation is an important individual-level factor influencing adolescent and parental decisions about vaccination, legal mandates are an effective policy-level strategy for ensuring high vaccination rates regionally and nationally (17). Legislation on mandated HPV vaccination has been introduced in a number of U.S. states, but there has been resistance from a range of stakeholders, including physicians (18). An executive order was signed by the Texas governor in 2007 to require HPV vaccination for girls entering 6th grade in Texas, but the order was overturned by a bill introduced by the legislature. Given the controversy around vaccination mandates, it would be helpful to understand physicians' attitudes about mandated HPV vaccination to inform future policy-related efforts.

Therefore, we conducted a statewide survey of Texas primary care physicians 2 years after the quadrivalent HPV vaccine was licensed to examine: (*a*) physicians' reported recommendations for the quadrivalent HPV vaccine for 11-12-year-old girls, (*b*) intention to recommend HPV vaccines for 11-to-12-year-old boys, (*c*) attitudes about mandated HPV vaccination for 11-to-12-year-old girls in Texas, and (*d*) whether factors, such as practice characteristics, HPV knowledge, and vaccination attitudes, were associated with recommendations for vaccination in girls, intention to vaccinate boys, and agreement with mandated vaccination.

Materials and Methods

The Physician Oncology Education Program of the Texas Medical Association, in collaboration with other investigators, conducted this cross-sectional, web-based survey of a representative sample of Texas primary care physicians. The Physician Oncology Education Program has conducted statewide physician surveys for >10 y to monitor oncology education needs for Texas medical education providers. Physicians are identified from a master file of all practicing physicians in the state, obtained from the state board of medical examiners, the American Medical Association, and other sources. Eligible physicians for this study were the 12,811 Texas physicians who provided direct patient care in the following specialties: family medicine, pediatrics, obstetrics/gynecology, and internal medicine. Resident physicians were excluded. The survey was e-mailed to the 7,815 physicians in the four specialties for whom the Texas Medical Association had e-mail addresses on file (61% of all eligible physicians). The survey was first sent to physicians in September 2008, ~2 y after vaccine licensing and 1.5 y after the executive order for mandated vaccination was overturned. Physicians received four e-mailed reminders to complete the survey over the next 2 mo. All identifying information was removed from the dataset before it was sent to the first author for analysis; the Institutional Review Board of

Table 1. Texas physicians participating in survey: demographic characteristics, practice characteristics, HPV knowledge, and sources of information about HPV vaccines (*N* = 1,122)

	n (%)
Demographic characteristics	
Race	
White	722 (64.3)
Black	27 (2.4)
Hispanic	100 (8.9)
Asian/Pacific Islander	98 (8.7)
American Indian/Alaska Native	2 (0.2)
Other/missing	173 (15.4)
Physician gender	
Male	619 (55.2)
Female	503 (44.8)
Years in practice	
0-9	402 (35.8)
10-19	301 (26.9)
20-29	284 (27.0)
>30	135 (10.3)
Practice characteristics	
Practice setting	
Solo practice	305 (27.2)
Single specialty group practice	287 (25.6)
Multispecialty group practice	144 (12.8)
Academic setting	104 (9.3)
Two-physician practice	86 (7.7)
Other/missing	196 (17.4)
Specialty	
Family medicine	384 (34.3)
Pediatrics	298 (26.6)
Obstetrics/gynecology	289 (25.7)
Internal medicine	147 (13.1)
Other	4 (0.4)
Type of practice	
Nonacademic (direct patient care only)	954 (85.0)
Academic (teaching or research in addition to direct patient care)	168 (15.0)
Primary clinical practice specialty	
Primary care family medicine	348 (31.0)
Primary care pediatrics	266 (23.7)
Primary care obstetrics/gynecology	247 (22.0)
Primary care internal medicine	109 (9.7)
Subspecialty care/other	152 (13.5)
Membership in professional organization	
Texas Medical Association	1004 (89.5)
American Medical Association	270 (24.1)
Patient care	
Care for girls/women in the eligible age range for HPV vaccination	1081 (96.3)
Office procedures to improve vaccination	
Standing order policies/protocols	416 (37.1)
Patient or parent reminder/recall procedures	412 (36.7)
Flagging of charts when vaccines are due	256 (22.8)
Provider auditing/feedback systems	196 (17.5)
Knowledge about HPV	
Knowledge items (correct)	
HPV types 16 and 18 are associated with cervical cancer	840 (74.9)
HPV types 6 and 11 cause genital warts	771 (68.7)
>90% of cervical cancers are caused by HPV	593 (52.9)
Lifetime risk of genital HPV infection is ~70%-90%	245 (21.8)
Sources of information about HPV vaccines	
Valuable sources of information for decisions about HPV vaccination	
Professional organizations (newsletters, journals, listservs)	902 (80.4)
Articles in academic journals	652 (58.1)
Professional conferences or meetings	611 (54.5)
Academic lectures, grand rounds	443 (39.5)
Promotional materials from industry	417 (37.2)
Colleagues	404 (36.0)
General news media (television, magazines, radio)	230 (20.5)

Table 2. Physician recommendations for HPV vaccines to girls in the age groups for which the HPV vaccine is licensed and intention to recommend HPV vaccines to boys in the same age groups

	Age group			
	9-10 y	11-12 y	13-17 y	18-26 y
Recommend HPV vaccine to girls in each age group*	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Always	134 (17.6)	390 (48.5)	635 (64.4)	564 (57.1)
Usually	149 (19.6)	216 (26.9)	228 (23.1)	249 (25.2)
Occasionally	214 (28.2)	128 (15.9)	79 (8.0)	115 (11.6)
Never	263 (34.6)	70 (8.7)	44 (4.5)	60 (6.1)
Care for patients this age	*760 (100)*	*804 (100)*	*986 (100)*	*988 (100)*
Intend to recommend HPV vaccine to boys in each age group*	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Extremely likely	166 (21.8)	333 (42.1)	523 (60.9)	505 (59.8)
Somewhat likely	165 (21.7)	208 (26.3)	177 (20.6)	156 (18.5)
Neither likely nor unlikely	115 (15.1)	79 (10.0)	68 (7.9)	84 (9.9)
Somewhat unlikely	105 (13.8)	75 (9.5)	31 (3.6)	32 (3.8)
Extremely unlikely	210 (27.6)	96 (12.1)	60 (7.0)	68 (8.0)
Care for patients this age	*761 (100)*	*791 (100)*	*859 (100)*	*845 (100)*

*Among those physicians who care for girls/women or boys/men in each of the age groups.

the hospital determined that this secondary data analysis was exempt from formal review.

The survey was structured to assess those constructs identified in a previously published conceptual model as being important in predicting physician intention to recommend HPV vaccines (14). The survey items and scales were largely drawn from previously validated survey instruments developed by two of the authors through qualitative and quantitative methods (14, 19-21), with the exception of the items assessing beliefs about whether HPV vaccination should be mandated for 11-to-12-year-old girls in Texas. These items were developed based on expert opinion, as well as a review of the scientific literature and lay media.

The survey comprised 38 items assessing physician sociodemographic and practice characteristics, HPV knowledge, valued sources of information about HPV vaccines, educational needs related to HPV vaccines, barriers to HPV vaccination, reasons for and against mandated HPV vaccination, overall agreement with mandated HPV vaccination, frequency of HPV vaccine recommendations to girls in four age groups (9-10, 11-12, 13-17, and 18-26 y old), and intention to recommend the HPV vaccine to boys in the same four age groups. Specific items are shown in Tables 1–4.

The independent variables were as follows. Practice characteristics included whether the physician cared for women in different age groups, the number of 11-to-12-year-old female patients seen per week, patients' demographic characteristics, patients' insurance coverage, primary physician specialty, type of practice (academic work and direct patient care versus direct patient care only), practice setting, and office procedures to maximize vaccination, such as recall and reminder systems, or flagging of charts when vaccines are due (measured with the use of four items, which were summed to create a score measuring the number of procedures). Knowledge about HPV was measured with the use of four items assessing lifetime risk of HPV infection, percentage of cervical cancer caused by HPV, types associated with genital warts, and types associated with cervical cancer, which were summed to create a knowledge score. We assessed need for additional education about HPV with the use of one item, and valued sources of information in decision-making about HPV vaccines with the use of seven items. Barriers to vaccine recommendations were measured with the use of 10 yes-no items, and responses were summed to create a barriers scale. We assessed specific reasons for and against mandated HPV vaccination for 11-to-12-year-old girls in Texas with the use of 14 items with 5 response categories ranging from strongly agree to strongly disagree.

The outcome variables were measured as follows. The first outcome variable was HPV vaccine recommendation to 11-to-12-year-old girls among participants who cared for girls in this age group (responses were categorized for

Table 3. Physician-reported barriers to recommending HPV vaccines

	n (%)
Parental refusal because of concerns about vaccine safety	629 (69.2)
Inadequate insurance coverage	610 (67.1)
Parental lack of education and understanding about HPV	593 (65.2)
Parental refusal because of negative media reports about the vaccine	549 (60.4)
Parental mistrust of vaccines in general	549 (60.4)
Parental concern that their consent will imply they condone premarital sex	491 (54.0)
Parental concern that vaccination would lead to riskier sexual behaviors	422 (46.4)
Parental reluctance for clinician to discuss a STI vaccine	358 (39.4)
Parental refusal because of concerns about vaccine efficacy	208 (22.9)
Insufficient vaccine supply	67 (7.4)

NOTE: Among those (n = 909; 81.0% of participants) who reported ever having recommended an HPV vaccine.
Abbreviation: STI, sexually transmitted infection.

Table 4. Physician-reported reasons for and against mandated HPV vaccination for 11-to-12-year-old girls in Texas (*N* = 1,122)

	n (%) who strongly or somewhat agree
HPV vaccination should be mandated for 11-12-year-old girls in Texas	467 (41.7)
Reasons why HPV vaccination should be mandated	
Would be an effective strategy for ensuring widespread vaccine uptake	912 (81.3)
Would ensure that those with poor access to care are vaccinated	851 (75.9)
Vaccination policies should be guided by public health impact of vaccination, not beliefs of individual parents	749 (66.8)
Parents are always able to opt out of HPV vaccination because of religious, philosophical, other reasons	476 (42.4)
Reasons why HPV vaccination should not yet be mandated	
Patients not covered by Medicaid or VFC may not be able to pay for mandated vaccination	818 (73.0)
Public understanding of HPV and HPV vaccines is still poor	541 (48.2)
Insufficient long-term data on safety	504 (45.0)
Mandated HPV vaccination will increase opposition to mandating vaccines in general	494 (44.0)
Parents may choose to opt out of other vaccines as well	484 (43.1)
Insufficient long-term data on efficacy	457 (40.7)
Parents should have autonomy to make decisions about vaccination	360 (32.1)
Clinician experience with HPV vaccines is limited	316 (28.2)
HPV is not an infection transmitted casually in schools	287 (25.6)
Vaccination may lead to riskier sexual behaviors in adolescents	75 (6.6)

Abbreviation: VFC, Vaccines for Children Program.

analysis as always/usually versus occasionally/never). The second outcome variable was intention to recommend HPV vaccine to 11-to-12-year-old boys, if the vaccine were approved for boys in that age group and among participants who cared for boys in this age group (responses were categorized for analysis as extremely likely/somewhat likely to recommend versus neither/somewhat unlikely/extremely unlikely to recommend). The third outcome variable was overall agreement with mandated HPV vaccination, which was measured with the use of one item (responses were categorized for analysis as strongly agree/somewhat agree versus neither/somewhat disagree/strongly disagree).

Statistical analyses were conducted with the use of SPSS version 16.0. χ^2 tests, Wilcoxon rank-sum tests, and *t* tests were used to assess whether physician demographic characteristics, practice characteristics, knowledge, and attitudes were associated with each of the three outcome variables. Those variables significantly associated with each outcome ($P < 0.05$) were entered into three separate multivariate logistic regression models to determine which variables were independently associated with each outcome. Independent variables eligible for inclusion in the multivariate models were similar for each model, except for three variables that measured similar constructs to, and were highly correlated with, the outcome variables. Recommendation of the HPV vaccine for girls in other age groups was not included in the multivariate model predicting recommendation in 11-to-12-year-old girls, intention to recommend the HPV vaccine to boys in other age groups was not included in the model predicting intention to recommend to 11-to-12-year-old boys, and belief that vaccination should be mandated for 11-to-12-year-old girls was not included in the model predicting agreement with mandated vaccination.

Results

Of the 7,815 physicians who received a survey invitation message by e-mail, 1,326 (17.0%) opened both the e-mail message and the link to the online survey. The 1,122 physicians who completed the survey represented 84.6% of those who opened the link to the online survey, 14.4% of those who received an e-mailed invitation, and ~7% of all practicing Texas physicians from the targeted specialties.

Respondents were generally comparable in terms of demographic and practice characteristics with all Texas physicians in the master file from those four specialties. In a comparison of those who had an e-mail address in the master file with those who did not, those with an e-mail address were more likely to be Texas Medical Association members but did not differ in terms of medical specialty, gender, race, or ethnicity. However, those who received a survey and responded differed significantly from those who did not respond ($P < 0.05$) in terms of gender (13% of women versus 10% of men), race/ethnicity (14% of White, 9% of Hispanic, and 6% of Black physicians), practice type (15% of those in academic practice versus 10% of those in nonacademic practice), and specialty (18% of obstetricians/gynecologists, 15% of pediatricians, 11% of family physicians, and 5% of internists). Respondents were predominantly White; most were in solo or single specialty group practice, most were not

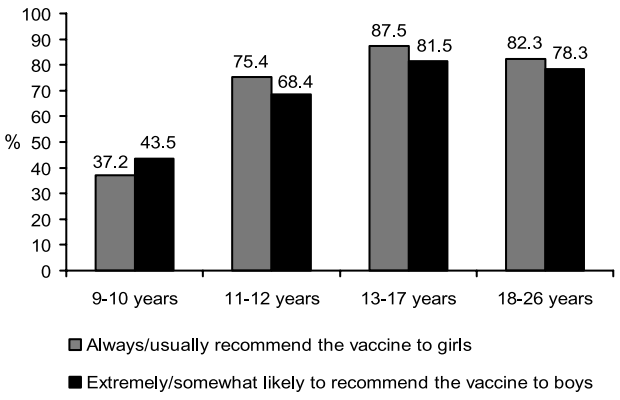

Figure 1. Physician recommendations for the quadrivalent HPV vaccine to girls and women, and intention to recommend the vaccine to boys and men, in different age groups.

Table 5. Multivariate logistic regression model results: factors associated with physicians' recommendation of HPV vaccines to 11-to-12-year-old girls, intention to recommend to 11-to-12-year-old boys, and agreement with mandated vaccination for 11-to-12-year-old girls in Texas

	Recommend to 11-to-12-year-old girls*	Intention to recommend to 11-12-year-old boys† OR (95% CI)	Agree with mandated vaccination‡
Gender (female vs male)	NA	1.59 (1.11-2.28)	NA
Subspecialty	NA	NA	NS
Percentage of patients in one's practice covered by Medicaid	1.02 (1.01-1.03)	NS	1.01 (1.00-1.01)
Percentage of Hispanic patients in one's practice	NS	1.01 (1.002-1.02)	NS
Academic vs nonacademic practice	2.11 (1.05-4.23)	NA	1.63 (1.11-2.39)
No. of procedures in one's office to maximize vaccination§	1.25 (1.01-1.56)	NA	NA
No. of 11-to-12-year-old girls seen per week in one's practice	NS	NS	NS
Knowledge about HPV‖	1.25 (1.04-1.49)	1.44 (1.24-1.68)	NA
Professional organizations a valuable source of information	1.90 (1.15-3.16)	NS	NA
Professional conferences a valuable source of information	1.68 (1.10-2.57)	NS	NA
Media a valuable source of information	NS	0.63 (0.42-0.96)	NA
Belief vaccination should be mandated for 11-to-12-year-old girls	5.38 (3.28-8.83)	3.88 (2.65-5.70)	NI
Barriers to vaccination¶	1.08 (1.00-1.16)	1.10 (1.03-1.17)	NA
Recommend to girls in other age groups (9-10, 13-17, 18-21 y)	NI	NI	NS
Intention to recommend to boys in other age groups (9-10, 13-17, 18-21 y)	NI	NI	NS

NOTE: NS indicates the variable was not significantly associated with the outcome in this multivariate model but was included in the model because it was significantly associated ($P < .05$) with the outcome in univariate analyses. NA indicates the variable was not included in this multivariate model because it was not associated with the outcome in univariate analyses. NI indicates the independent variable was not included in this multivariate model because it was a similar construct to, and highly correlated with, the outcome variable.

Abbreviations: NS, not significant; NA, not applicable; NI, not included.

*Defined as always/usually versus sometimes/never recommend the HPV vaccine to 11-to-12-year-old girls. Independent variables associated ($P < .05$) with this outcome in univariate analyses and adjusted for in this model ($n = 730$ observations) were: academic versus nonacademic practice, percentage of Hispanic patients, percentage of patients covered by Medicaid, office procedures, knowledge, media a valued source of information, professional organizations a valued source of information, professional conferences a valued source of information, agree with mandated vaccination, barriers to vaccination, recommend to girls in other age groups (9-10, 13-17, and 18-21 y of age), and intention to recommend to boys in different age groups (9-10, 13-17, and 18-21 y of age).

†Defined as extremely likely/somewhat likely versus neither likely nor unlikely/somewhat unlikely/extremely unlikely to recommend the HPV vaccine to 11-to-12-year-old boys. Independent variables associated ($P < .05$) with this outcome in univariate analyses and adjusted for in this model ($n = 556$ observations) were: gender, percentage of Hispanic patients, percentage of patients covered by Medicaid, knowledge, media a valued source of information, professional organizations a valued source of information, professional conferences a valued source of information, agree with mandated vaccination, barriers to vaccination, recommend to girls in other age groups (9-10, 13-17, and 18-21 y of age), and intention to recommend to boys in different age groups (9-10, 13-17, and 18-21 y of age).

‡Defined as strongly agree/somewhat agree versus neither agree nor disagree/somewhat disagree/strongly disagree that HPV vaccines should be mandated for 11-to-12-year-old girls in Texas. Independent variables associated ($P < .05$) with this outcome in univariate analyses and adjusted for in this model ($n = 577$ observations) were: subspecialty, academic versus nonacademic practice, number of 11-to-12-year-old girls seen per week in one's practice, percentage of Hispanic patients, percentage of patients covered by Medicaid, recommend to girls in other age groups (9-10, 13-17, and 18-21 y of age), and intention to recommend to boys in different age groups (9-10, 13-17, and 18-21 y of age).

§Range of procedures possible: 0 to 4.

‖Knowledge scale score: 0 to 4.

¶Range of barriers possible: 0 to 10.

involved in teaching or research, and most did not have office systems in place to improve immunization rates (Table 1). Knowledge about HPV was fair: the percentage of correct responses to each of the four items assessing knowledge ranged from 22% to 75%. Almost half (44%) of respondents noted that more information about HPV vaccines would be helpful to them. The most valued sources of information about HPV vaccines were professional organizations.

Most participants ($n = 909$; 81%) reported having recommended an HPV vaccine to a patient of any age. Only half of physicians who cared for 11-to-12-year-old girls reported that they always recommended the HPV vaccine to girls in that age group; the highest reported vaccination rates were for 13-to-17-year-old girls (Table 2 and Fig. 1). Physicians had frequently encountered barriers in recommending the HPV vaccine (Table 3). The mean scale score (i.e., the mean number of barriers reported out of a possible 10) was 4.0 (SD, 3.0; Cronbach's $\alpha = 0.82$). The most commonly encountered parental barriers were parental concerns about vaccine safety, lack of education and understanding about HPV, negative media reports about the vaccine, mistrust of vaccines in general, and concern that their consent for vaccination would imply that they condoned premarital sex. More than half of the participants reported that inadequate insurance coverage was a barrier to vaccination, but only 7% reported that insufficient vaccine supply was a barrier.

Most respondents intended to recommend the quadrivalent HPV vaccine to boys in the future, if approved for use in boys. Among physicians who cared for boys in each of the age groups for which intention to recommend vaccination was assessed, 68% were extremely or somewhat likely to recommend the vaccine to 11-to-12-year-olds and 82% to 13-to-17-year-olds (Table 2 and Fig. 1).

Almost half of respondents agreed or strongly agreed that HPV vaccines should be mandated for school enrollment for 11-to-12-year-old girls in Texas (Table 4). Most participants agreed that mandated vaccination would be an effective strategy to ensure widespread vaccine uptake and increase vaccination among those with poor access to care. Most participants also noted that vaccination policies should be guided by the potential public health impact of vaccination, not by the beliefs of individual patients. However, most participants were concerned that patients not covered by Medicaid or the Vaccines for Children Program may not be able to pay for mandated vaccination. Approximately half reported that HPV vaccines should not yet be mandated because public understanding of HPV and HPV vaccines is still poor, mandated HPV vaccination could increase opposition to mandating vaccines in general, and parents may use opt-out clauses to refuse other vaccines as well.

In multivariate logistic regression models, variables independently associated with reported vaccination of 11-to-12-year-old girls included higher percentage of patients covered by Medicaid in one's practice, academic versus nonacademic direct patient-care practice, higher number of office procedures to maximize vaccination rates, higher knowledge about HPV, perception that professional organizations and conferences are valuable sources of information about HPV vaccines, belief that HPV vaccination should be mandated for school enrollment, and higher number of barriers to vaccination experienced (Table 5). Variables independently associated with intention to recommend HPV vaccines to an 11-to-12-year-old boy included higher knowledge about HPV, belief that the media was a valuable source of information (inversely associated with intention), belief that vaccination should be mandated for 11-to-12-year-old girls in Texas, and female gender.

Variables independently associated with agreement that vaccination should be mandated included higher percentage of patients covered by Medicaid in one's practice and academic versus nonacademic direct patient-care practice. To better understand the reasons why those in academic versus nonacademic practices were more supportive of mandated vaccination, we examined associations between practice type and individual beliefs about mandated vaccination. Those in nonacademic practices were significantly more likely than those in academic practices to believe that it was too early to mandate vaccination because of insufficient data on long-term safety, insufficient data on long-term efficacy, limited clinician experience with HPV vaccines, the fact that HPV is not transmitted casually in schools, concern that it would increase opposition to mandating vaccines in general, and belief that parents should have the autonomy to make decisions about vaccination. In contrast, those in academic practice were significantly more likely to believe that mandated vaccination is a good idea because vaccination policies should be guided more by the potential public health impact of vaccination than by the beliefs of individual parents, and it is acceptable to mandate HPV vaccination because parents can always opt out of vaccination for religious, philosophical, or other reasons.

Discussion

Physicians' Reported Recommendations to 11-to-12-Year-Old Girls. Despite national recommendations for universal vaccination of 11-to-12-year-old girls and catch-up vaccination of all 13-to-26-year-old girls not previously vaccinated, fewer than half of Texas physicians who responded to this survey reported that they always recommended the vaccine to 11-to-12-year-old girls. Two thirds reported always vaccinating 13-to-17-year-old girls, suggesting that parents or physicians may be delaying vaccination until girls are >12 years. Given that this study was conducted 2 years after national guidelines for HPV vaccination were published (1), the findings suggest that additional efforts are needed to improve clinician awareness of and adherence to national recommendations.

The physicians who participated in this study had frequently experienced barriers to recommending HPV vaccines. More than half reported that insufficient insurance coverage for vaccination was a barrier in their practice; thus, ensuring that HPV vaccination is covered by public and private health care plans will be important to improve vaccine uptake. Physicians had commonly experienced parental barriers to HPV vaccination, and most of these had been anticipated by physicians in studies conducted before vaccine licensing (14, 20, 22, 23). This finding may be consistent with a trend toward increasing parental concern about vaccines, and especially vaccine safety, which, in turn is linked to parental decisions about vaccinating their children (24, 25). These concerns may be fueled by negative media and Internet reports related to HPV and other vaccines, which are often based on unreliable sources and which have exposed parents to an extensive amount of misinformation about vaccines (26). The findings suggest that providing clinicians with information about HPV vaccines, especially vaccine safety, and with practical strategies to educate parents and address specific parental concerns will be critical to overcoming barriers. National coalitions that are focusing on regaining the public trust in vaccines, and encouraging accurate and responsible journalism will be an important component of this effort (27).[7]

Physicians' Intention to Vaccinate 11-to-12-Year-Old Boys. Physician attitudes about immunizing boys and girls may differ in that they may anticipate specific barriers to vaccinating boys (e.g., challenges in persuading parents that boys are at risk for HPV-related disease) or question the added value of vaccinating boys. In our previous national studies of pediatricians and family physicians, conducted before vaccine licensing, intention to vaccinate was significantly higher for girls compared with boys (19, 20). In this study, 68% of physicians reported being extremely or somewhat likely to recommend the vaccine compared with the previous studies in which 59% of family physicians and 61% of pediatricians intended to recommend HPV vaccines (19, 20). Physicians may be more willing to recommend HPV vaccines to boys now than in the past because more data are available about the efficacy and safety of HPV vaccines in girls, and clinicians may be more aware of HPV-related disease in men. Nevertheless, male HPV vaccination raises unique issues. Specific educational messages for clinicians, parents, and boys will need to be developed if HPV vaccines are ultimately indicated for use in boys.

[7] http://www.nfid.org/pdf/immalliancecta.pdf

Physicians' Attitudes about Mandated Vaccination. Although physician recommendation is a key factor driving parental decisions about vaccination (8-10), mandated vaccination can be a very effective strategy for ensuring high vaccination rates regionally and decreasing disparities in vaccine uptake. For example, hepatitis B vaccination rates were similarly low when first recommended for adolescents, but mandates for vaccination of school-age children were effective in increasing rates of vaccination and narrowing disparities in vaccine coverage (28). State vaccination requirements that would ensure high uptake of HPV vaccines also have the potential to narrow existing racial, ethnic, and economic disparities in cervical cancer incidence and mortality (4). Despite the strong legislative opposition to the Texas governor's executive order in 2007 to require HPV vaccination for school entry, >40% of Texas physicians in this 2008 study supported mandated HPV vaccination. Legislation requiring HPV vaccination for school entry, education about HPV vaccines, committees or task forces about cervical cancer prevention, and/or insurance coverage for vaccination has been introduced in most U.S. states, and several states have passed such legislation.[8] Our findings related to specific physician concerns about mandated vaccination suggest that when mandated HPV vaccination is being considered in any state, several issues must be anticipated and addressed. These include ensuring coverage for the cost of vaccination for those who are uninsured, improving public education about HPV and HPV vaccines, and addressing any clinician concerns about vaccine safety and efficacy. Careful consideration should be given to the potential for a backlash against mandated vaccination generally or an increase in opt-out rates for other vaccines.

Factors Associated with Outcomes. Identification of those factors associated with recommendations for vaccination in girls and intention to vaccinate boys may have implications for future strategies to improve adherence to national vaccination recommendations. Factors associated with reported HPV vaccine recommendations for 11-to-12-year-old girls included practice characteristics, knowledge, sources of information, and attitudes. The findings provide additional support for a conceptual model we developed previously, proposing that key factors influencing vaccination intentions and recommendations included professional characteristics, vaccine policies and procedures, knowledge and awareness of HPV vaccines/vaccine guidelines, communication about vaccines from trusted sources, parental factors, and potential barriers, such as vaccine cost (14). Our findings suggest that efforts to improve clinician recommendations for HPV vaccination may be more successful if they are multilevel, and focus on improving physician awareness and knowledge, promoting the implementation of office procedures to improve vaccination rates, disseminating guidelines through trusted sources, providing guidance to address parental concerns, and ensuring adequate insurance coverage and clinician reimbursement. Factors associated with intention to recommend HPV vaccines to 11-to-12-year-old boys were similar to those associated with actual recommendations to girls, although female physician gender was also associated with intention. Female clinicians may be more supportive of male vaccination to interrupt transmission to girls or may feel more comfortable explaining this rationale to mothers.

Only two factors were associated with agreement with mandated vaccination: higher percentage of Medicaid patients and practicing in an academic versus nonacademic patient-care setting. Clinicians who care for low-income populations may be more supportive of mandated vaccination as a mechanism for ensuring widespread vaccine coverage among underserved populations. Specific beliefs about mandated vaccination differentiated those practicing in academic compared with nonacademic direct patient-care settings. Those who practiced in academic settings tended to value public health considerations in policy decisions about vaccination, whereas those in nonacademic settings tended to value parental autonomy. Those practicing in nonacademic settings were also more concerned about insufficient data on long-term safety and efficacy, and limited clinician experience with the vaccine. These findings suggest that physicians practicing in academic compared with nonacademic primary care settings may differ in terms of their ethical or philosophical beliefs about mandated vaccination (29).

Limitations. A main limitation of this study was the low response rate of 14%: response rates are typically lower in web-based compared with other survey methods (30). However, the participants represented 7% of the total population of Texas physicians in the four targeted specialties and were similar demographically to all Texas physicians in these specialties. The 14% response rate may underestimate the true response rate because it is not known how many e-mails were received by the eligible physicians; factors such as spam filters may have prevented delivery of the email invitation (31). Among those physicians who clicked on the e-mailed link to the survey and opened the survey form, the completion rate was high at 84%. Although the low overall response rate does not affect the internal validity of the findings, it may decrease the generalizability of the results to all physicians in these specialties because of selection bias due to nonresponse (32). Female physicians, White physicians, those in academic practice, obstetricians/gynecologists, and pediatricians were somewhat overrepresented among respondents. It is possible that physicians with some of these characteristics (e.g., female physicians, obstetricians/gynecologists, and pediatricians) would be more likely to recommend HPV vaccines. Thus, the findings may overestimate the proportion of Texas physicians who are recommending HPV vaccines. However, the risk of nonresponse bias is thought to be relatively low in surveys of physicians, because physicians tend to be fairly homogeneous with respect to knowledge, training, attitudes, and behaviors (33). Finally, due to space constraints, we measured only those barriers reported most commonly in previous studies of physicians and may have omitted others.

This study also has a number of strengths, including the relatively large sample size and the unique ability to examine beliefs about HPV vaccine mandates in a state where legislative efforts to mandate vaccination received widespread attention.

In conclusion, this study provides novel information about HPV vaccine recommendations in girls, intention to recommend vaccination in boys, and beliefs about

[8] http://www.ncsl.org/programs/health/HPVvaccine.htm#hpvlegis

mandated HPV vaccination among Texas physicians 2 years after vaccine licensing. The findings have implications for multilevel efforts, including physician education, procedural changes in office settings, and policy efforts, that will strengthen adolescent immunization.

Disclosure of Potential Conflicts of Interest

Dr. Jessica Kahn is a co-Principal Investigator on an NIH-funded HPV vaccine clinical trial in HIV-infected adolescents, for which Merck, Inc. is providing HPV vaccine and immunogenicity testing. She receives no personal funds (e.g., salary support or consulting) from the industry on that grant. Dr. Susan Rosenthal is a co-Principal Investigator on an investigator-initiated grant funded by Merck, and serves as a research consultant/collaborator on a Merck-sponsored research project and on a Merck advisory board.

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