

RESEARCH PAPER



## Parental knowledge gaps and barriers for children receiving human papillomavirus vaccine in the Rio Grande Valley of Texas

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### ABSTRACT

**Purpose:** Despite its availability for more than a decade, the human papillomavirus (HPV) vaccine has low uptake in Texas (49%). The objective of this study was to understand parental knowledge and attitudes about HPV and the HPV vaccine as well as child experience with the HPV vaccine among a medically underserved, economically disadvantaged population.

**Methods:** As part of a Cancer Prevention Research Institute of Texas-funded project to improve HPV vaccination rates, we surveyed parents / guardians of 4<sup>th</sup>–12<sup>th</sup> graders (ages 9–17) in the Rio Grande City Consolidated Independent School District (RGCCISD). Descriptive statistics were used to describe parents' knowledge and attitude and children's vaccine experience.

**Results:** Of the 7,055 surveys distributed, 622 (8.8%) were returned. About 84% of the respondents were female. About 57.1% of the parents / guardians had female RGCCISD students with a mean age of 11.7 ± 1.8 years. Overall, 43.9% reported receiving a healthcare provider recommendation and 32.5% had their child vaccinated. Higher percentages were reported if the respondent was female and had a female child aged ≥15 years old. Among survey respondents, 28.2% reported their child initiated the HPV vaccine and 18.8% completed the series. Barriers of uptake included work / school schedule conflicts and no healthcare provider recommendation.

**Conclusions:** There are still prominent gaps in parents' and students' complete understanding of HPV vaccination, gender preferences for vaccination, and provider recommendations. Future interventions must target men and minority populations in order to increase knowledge and awareness about HPV, the HPV vaccine, and HPV-associated cancers.

### ARTICLE HISTORY

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Human papillomavirus (HPV); HPV vaccine; vaccination; Texas; Rio Grande Valley; survey

### Introduction

The human papillomavirus (HPV) vaccine is an effective strategy for reducing the morbidity and mortality of HPV-associated diseases, including cervical, oropharyngeal, vulvar, vaginal, penile and anal cancer as well as anogenital warts.<sup>1–9</sup> There has been increasing evidence supporting the safety and effectiveness of HPV vaccination in reducing vaccine-type HPV infections at the population level.<sup>10,11</sup> The HPV vaccine provides the greatest benefit to those who receive the vaccine before they become sexually active.<sup>12,13</sup> Although routine HPV vaccination has been recommended in the United States (US) since 2006 for females and 2011 for males ages 9–26 years,<sup>14</sup> disparities in knowledge and awareness about HPV and the HPV vaccine persist, and vaccination rates remain suboptimal.<sup>15</sup> The *Healthy People 2020* goal is to have 80% HPV coverage among 13–15-year-olds.<sup>16</sup> In the US, HPV vaccine completion rates are low for girls and boys ages 13–17 (49.5% and 37.5%, respectively).<sup>17</sup> Raising rates to 80% would prevent 53,000 more cervical cancer cases over the lifetime of those ≤12 years.<sup>18,19</sup> Texas ranks 47<sup>th</sup> in terms of up-to-date HPV vaccinations out of 50 states and the District of Columbia.<sup>17</sup>

### Challenges in increasing HPV vaccine uptake

Given that the HPV vaccination is recommended for preadolescent boys and girls, research has shown that parents play a pivotal role in HPV vaccine uptake.<sup>20</sup> Given that the target age group is pre-adolescence (ages 11–12), there are different challenges compared to targeting adolescents and young adults. Compared to traditional infant vaccines, there is more scrutiny of HPV vaccines in regards to age appropriateness, sexual activity, and safety concerns.<sup>11</sup> In addition to the structural and health system issues (eg, cost, insurance coverage, delivery strategies) that may contribute to low HPV vaccine coverage, the broader context of vaccine hesitancy suggests that parents' knowledge, attitudes, and beliefs about HPV and vaccines may have a substantial influence on the uptake.<sup>11</sup>

In addition to parents, healthcare providers play a crucial role in ensuring its administration.<sup>21–28</sup> It is important for healthcare providers to bundle HPV vaccines with other required vaccines, such as tetanus-diphtheria-pertussis (Tdap) and meningococcal vaccine (MCV4, MenB).<sup>29,30</sup> They are encouraged to consistently and equally recommend HPV vaccination to parents of female and male children.<sup>31–33</sup> A recent survey of Texas healthcare providers found that 94%

self-reported giving a consistent recommendation of HPV vaccination to 9–12-year-old children of both sexes.<sup>34</sup>

### Factors associated with vaccine uptake

Factors shown to be positively associated with parents' uptake of HPV vaccines for their children include: (1) healthcare provider – physician recommendation and parents' trust in healthcare providers,<sup>20,21,25,26,33</sup> (2) mother as HPV vaccine decision-maker versus both parents,<sup>20</sup> (3) parents' vaccine beliefs, attitudes, and intentions,<sup>20,35</sup> (4) preventive healthcare utilization for child,<sup>28</sup> (5) insurance / cost – health insurance coverage of HPV vaccination,<sup>28</sup> (6) parents' HPV risk history,<sup>20</sup> (7) parents' HPV-related knowledge and awareness,<sup>28</sup> and (8) sociodemographic factors – urban versus rural location and child's age.<sup>20,21,25,26,33</sup> For those who have chosen to not vaccinate against HPV, parents cite lack of knowledge and worry about the side effects or safety of the vaccine as the primary reasons for vaccine hesitancy.<sup>20</sup> Interventions that improve parental knowledge and awareness prior to the administration of the HPV vaccine have increased uptake immediately following the encounter.<sup>24,36,37</sup> The sex of the parent may also affect the choice to vaccinate. Male parents are less likely to vaccinate their daughters.<sup>35,38</sup>

### Study background

Although HPV initiation rates have risen nationally over the last decade, Texas continues to have a 10% lower uptake than the rest of the nation and had a decrease in HPV vaccine coverage among girls ages 13–17 years old in 2016.<sup>39</sup> Since certain diseases disproportionately affect low-income, rural, and minority individuals, offering the HPV vaccine at no cost is important in medically underserved settings, such as the Rio Grande Valley (RGV).<sup>9</sup> The RGV consists of four counties bordering Mexico: Cameron, Hidalgo, Starr, and Willacy Counties. Texas counties that border Mexico have characteristics different from the state of Texas as a whole.<sup>40</sup> This region has some of the worst health and economic disparities in the nation. Residents are more likely to be Hispanic, medically underserved, less educated, and economically disadvantaged and have low health literacy. Culturally appropriate interventions and survey methods are needed to increase HPV uptake and improve efforts in engaging with this population.<sup>41–43</sup>

Compared to other parts of Texas and the rest of the US, the RGV has the highest cervical cancer incidence and mortality rates. Specifically, women living in the RGV have a 30% higher cervical cancer incidence and mortality rate than women living in other parts of Texas or the rest of the country.<sup>44,45</sup> Since Hispanics are at higher risk for HPV-associated cancers, it is imperative that HPV vaccine coverage improves in this region.<sup>46</sup> The objective of this study was to assess parental knowledge and attitudes toward the HPV vaccination as well as parent-reported HPV vaccination rates in the Rio Grande City Consolidated Independent School District (RGCCISD) in Starr County, Texas, prior to the introduction of a school-based vaccination program. We also investigated parental/guardian gender differences that might affect intent and serve as the possible reasons for not vaccinating. Introduction of the HPV vaccine in a school-

based setting provides a rare opportunity to build or strengthen school health and adolescent health.<sup>11</sup>

## Results

### Sample characteristics

A total of 7,055 surveys were distributed to 4<sup>th</sup>–12<sup>th</sup> graders. By the end of the 2017 academic year, 622 completed surveys (8.8%) were returned. Of the 622 HPV Parent Surveys collected, 84.4% of the respondents were female parents/guardians, with a mean age of 38.1 years  $\pm$  7.4 (Table 1). Most of the respondents were of Hispanic or Latino descent (83.8%), and almost half of the survey respondents were US-born (45.8%). Over half of the parent respondents had female students enrolled at RGCCISD (57.1%), with a mean age of 11.7  $\pm$  1.8 years. A majority of the survey respondents had children aged  $\leq$ 14 years old (33.3%  $\leq$ 10 years old and 60.0% ages 11–14 years old). Most of the children were in either elementary school (50.5%) or middle school (44.1%).

### Parental knowledge, awareness, and attitudes of HPV and the HPV vaccine

Table 2 provides a summary of the parent/guardian responses regarding knowledge, awareness, and attitudes of

**Table 1.** Summary of demographic characteristics of survey respondents and their children.

Respondent Demographic Characteristics	N (%)
<b>Number of Respondents</b>	n = 622
<b>Age of Respondent (years)</b>	
25–34	199 (32.0)
35–44	281 (45.2)
$\geq$ 45	102 (16.4)
Missing	40 (6.4)
Mean Age $\pm$ SD <sup>a</sup>	38.1 $\pm$ 7.4
Median Age (Q1–Q3)	37 (32–42)
<b>Gender of Respondent</b>	
Female	525 (84.4)
Male	75 (12.1)
Missing	22 (3.5)
<b>Race of Respondent</b>	
White	20 (3.2)
Hispanic or Latino	521 (83.8)
Black or African American	20 (3.2)
Native American / American Indian	30 (4.8)
Other <sup>b</sup>	3 (0.5)
Missing	28 (4.5)
<b>Place of Birth for Respondent</b>	
US-born	285 (45.8)
Foreign-born	269 (43.3)
Missing	68 (10.9)
<b>Student Demographic Characteristics</b>	
<b>Age of Child (years)</b>	
$\leq$ 10	207 (33.3)
11–14	373 (60.0)
$\geq$ 15	42 (6.8)
Mean Age $\pm$ SD <sup>a</sup>	11.7 $\pm$ 1.8
Median Age (Q1–Q3)	11 (10–13)
<b>Gender of Child</b>	
Female	355 (57.1)
Male	267 (42.9)
<b>School Type</b>	
Elementary	314 (50.5)
Middle	274 (44.1)
High school	34 (5.5)

Demographics from surveys collected between May and June 2017 for RGCCISD. <sup>a</sup>SD: standard deviation; <sup>b</sup>Other" category includes Asian and Pacific Islanders.

**Table 2.** Summary of survey results on parental knowledge, awareness, and attitudes toward HPV and the HPV vaccine by child demographics and respondent's gender.

No. of Respondents Survey Question	Total	Child's Gender			Child's Age (Years)				Respondent's Gender		
		Female	Male	p-value	≤ 10	11–14	≥ 15	p-value	Female	Male	p-value
<b>No. of Respondents</b>	622	355	267		207	373	42		525	75	
<b>Survey Question</b>											
Have you ever heard of HPV?											
Yes, n (%)	539 (86.7)	318 (89.6)	221 (82.8)	0.0224 <sup>ab</sup>	171 (82.6)	331 (89.0)	37 (90.2)	0.0395 <sup>ab</sup>	465 (88.6)	57 (76.0)	0.0098 <sup>ac</sup>
Would you like to learn more about HPV?											
Yes, n (%)	459 (73.8)	261 (73.5)	198 (74.2)	0.8559	166 (80.2)	263 (71.7)	30 (73.2)	0.0354 <sup>ab</sup>	388 (73.9)	55 (73.3)	0.4840 <sup>a</sup>
Have you heard of the HPV vaccine?											
Yes, n (%)	520 (83.6)	313 (88.2)	207 (77.5)	0.0018 <sup>c</sup>	164 (80.2)	317 (85.2)	39 (95.1)	0.0098 <sup>ac</sup>	452 (86.1)	53 (70.7)	0.0012 <sup>ac</sup>
Are you aware that the HPV vaccine can prevent certain types of cancer?											
Yes, n (%)	481 (77.3)	285 (80.3)	196 (73.4)	0.0007 <sup>c</sup>	151 (74.0)	297 (81.8)	33 (82.5)	0.1099 <sup>a</sup>	416 (79.2)	48 (64.0)	0.0525 <sup>a</sup>
What do you think about the HPV vaccine? <sup>d</sup>											
Not needed	23 (3.7)	15 (4.2)	8 (3.0)	0.4214	11 (5.3)	11 (3.0)	1 (2.4)	0.3150	19 (3.6)	3 (4.0)	0.6961 <sup>a</sup>
Does not work	2 (0.3)	0 (0.0)	2 (0.8)	0.1839 <sup>a</sup>	1 (0.5)	1 (0.3)	0 (0.0)	1.0000 <sup>a</sup>	1 (0.2)	1 (1.3)	0.2878 <sup>a</sup>
Bad side effects	34 (5.5)	16 (4.5)	18 (6.7)	0.2250	11 (5.3)	22 (5.9)	1 (2.4)	0.6320	27 (5.1)	7 (9.3)	0.2194 <sup>a</sup>
Good/important	500 (80.4)	290 (81.7)	210 (78.7)	0.3449	158 (76.3)	308 (82.6)	34 (81.0)	0.1918	428 (81.5)	55 (73.3)	0.2124 <sup>a</sup>

Results of surveys collected between May and June 2017 for RGCCISD.

<sup>a</sup>Denotes Fisher's exact test was used; otherwise, Chi-square test was used.

<sup>b</sup>Significance under 0.05.

<sup>c</sup>Significance under 0.01.

<sup>d</sup>Questions where individuals could choose all answers that apply.

HPV and the HPV vaccine. The results are stratified by child demographics (gender and age) and respondent's gender. Most of the parents reported having heard of HPV (86.7%) and the HPV vaccine (83.6%) (Table 2). A majority of respondents (77.3%) reported awareness that the HPV vaccine can prevent certain types of cancer and were interested in learning more about HPV (73.8%). Overall, 80.4% of respondents thought that the vaccine is good / important.

In the comparison of respondents with female versus male children, a higher percentage of respondents with female children than respondents with male children had heard of HPV (89.6% vs 82.8%,  $p$ -value = 0.0224) and the HPV vaccine (88.2% vs 77.5%,  $p$ -value = 0.0018) and were aware that certain types of cancers were prevented by the vaccine (80.3% vs 73.4%,  $p$ -value = 0.0007) (Table 2). When stratifying by child's age, the percentage of respondents who responded with knowledge about HPV ( $p$ -value = 0.0395, Table 2) and the HPV vaccine ( $p$ -value = 0.00981, Table 2) increased with the age of the student. Compared to female parents, a lower percentage of male parents had heard of HPV (76.0% vs 88.66%,  $p$ -value = 0.0098) and the HPV vaccine (70.7% vs 86.1%,  $p$ -value = 0.0012).

### Child's experience with the HPV vaccine

Table 3 provides a summary of the parent/guardian responses regarding their child's experience with the HPV vaccine by child's gender and age and respondent's gender. The gender for a small percentage of survey respondents were missing (3.5%,  $n$  = 22). Overall, 43.9% reported receiving a recommendation from a healthcare provider, and 32.5% reported that their child received the HPV vaccine (Table 3). Among survey respondents who vaccinated their child, 87.1% reported HPV initiation ( $n$  = 176) and 57.9% completion ( $n$  = 117). Among respondents who received recommendations for the HPV vaccine, the highest percentage of recommendations

was among respondents with children between 11 and 14 years old (52.3%) compared to those aged ≤10 and ≥15 ( $p$ -value < 0.0001) (Table 3). According to respondents who did not vaccinate their child, the two main reasons for their child not receiving the HPV vaccine were no recommendation from the child's doctor (34.8%) and their child was too young (30.4%) (Table 3). For respondents who had children aged ≤10 years old, the most common reason for not administering the HPV vaccination was their age (41.3%,  $p$ -value ≤0.0001, Table 3). Respondents with students ages 11–14 years reported work/school schedule conflicts as the primary reason for their children not receiving the HPV vaccine ( $p$ -value = 0.0113, Table 3).

### Healthcare provider recommendation

Table 4 shows a summary of the children's HPV vaccination history for parents who received a recommendation by a healthcare professional to vaccinate their child against HPV. Overall, 32.5% of respondents reported that their child had received the HPV vaccine, and 48.1% had not vaccinated their child. Almost two-thirds (63.5%) of parents who received recommendations from a healthcare provider reported vaccinating their children against HPV. Of those who did not receive healthcare provider recommendations for the HPV vaccine, 8.2% reported vaccinating their children while 73.0% reported not vaccinating their children.

### Discussion

This study examined knowledge, awareness, and attitudes towards HPV and the HPV vaccine among parents/guardians of school children (4<sup>th</sup>–12<sup>th</sup> graders) as well as parent-reported HPV vaccination rates and provider recommendations. A high proportion of respondents in this study sample had heard of HPV and the HPV vaccine and thought that the HPV vaccine

**Table 3.** Child's vaccine history and experience with the HPV vaccine by child's demographics and respondent's gender.

	Total	Child's Gender			Child's Age (Years)				Respondent's Gender <sup>e</sup>		
		Female	Male	p-value	≤ 10	11–14	≥ 15	p-value	Female	Male	p-value
<b>No. of Respondents</b>	622	355	267		207	373	42		525	75	
<i>Has a doctor or health professional (like a practitioner) ever advised you to get your child vaccinated against HPV?</i>											
Yes	273 (43.9)	165 (46.5)	108 (40.5)	0.0595 <sup>a</sup>	59 (28.5)	195 (52.3)	19 (45.2)	< .0001 <sup>a, b</sup>	242 (46.1)	24 (32.0)	0.0573 <sup>a</sup>
No	267 (42.9)	149 (42.0)	118 (44.2)		123 (59.4)	132 (35.4)	12 (28.6)		220 (41.9)	34 (45.3)	
Not Sure	78 (12.5)	37 (10.4)	41 (15.4)		25 (12.1)	43 (11.5)	10 (23.8)		60 (11.4)	16 (21.3)	
Missing	4 (0.6)	4 (1.1)	0 (0)		0 (0)	3 (0.8)	1 (2.4)		3 (0.6)	1 (1.3)	
<i>Has your child received the HPV vaccine?</i>											
Yes	202 (32.5)	117 (33.0)	85 (31.8)	0.6173 <sup>a</sup>	25 (12.1)	159 (42.6)	18 (42.9)	< .0001 <sup>b</sup>	175 (33.3)	20 (26.7)	0.3783 <sup>a</sup>
No	299 (48.1)	170 (47.9)	129 (48.3)		143 (69.1)	139 (37.3)	17 (40.5)		252 (48.0)	36 (48.0)	
Not Sure	112 (18.0)	61 (17.2)	51 (19.1)		35 (16.9)	70 (18.8)	7 (16.7)		90 (17.1)	19 (25.3)	
Missing	9 (1.5)	7 (2.0)	2 (0.8)		4 (1.9)	5 (1.3)	0 (0)		8 (1.5)	0 (0)	
<i>If yes, how many doses?<sup>d</sup></i>	202	117	85		25	159	18		175	20	
1	59 (29.2)	39 (33.3)	20 (23.8)		11 (44.0)	45 (28.3)	3 (16.7)		56 (32.0)	3 (4.0)	
2	36 (17.8)	20 (17.1)	16 (19.1)		6 (24.0)	28 (17.6)	2 (11.1)		28 (16.0)	6 (30.0)	
3	81 (40.1)	46 (39.3)	35 (41.7)		5 (20.0)	67 (42.1)	9 (50.0)		69 (39.43)	8 (40.0)	
Not Sure	25 (13.4)	12 (10.3)	13 (15.5)		3 (12.0)	18 (11.3)	4 (22.2)		21 (12.0)	3 (15.0)	
Missing	1 (0.50)	0 (0)	1 (1.2)		0 (0)	1 (0.6)	0 (0)		1 (0.6)	0 (0)	
Initiation (at least 1 dose)	176 (87.1)	105 (89.7)	71 (83.5)	0.3711 <sup>a</sup>	22 (88.0)	140 (88.1)	14 (77.8)	0.2527 <sup>a</sup>	153 (87.4)	17 (85.0)	0.2858 <sup>a</sup>
Complete (at least 2 doses)	117 (57.9)	66 (56.4)	51 (60.0)		11 (44.0)	95 (59.8)	11 (61.1)		97 (55.4)	14 (70.0)	
<b>If no, what are the main reasons your child has not received the HPV vaccine?<sup>f,g</sup></b>	299	170	129		143	139	17		252	36	
Work / School schedule conflict	19 (6.4)	11 (6.5)	8 (6.2)	0.9247	3 (2.1)	15 (10.8)	1 (5.9)	0.0113 <sup>c</sup>	17 (6.8)	2 (5.6)	1.0000 <sup>a</sup>
Not recommended by child's doctor	104 (34.8)	55 (32.4)	49 (38.0)	0.3112	44 (30.8)	52 (37.4)	8 (47.1)	0.277	87 (34.5)	16 (44.4)	0.0959
My child is not sexually active	50 (16.7)	25 (14.7)	25 (19.4)	0.2834	24 (16.8)	22 (15.8)	4 (23.5)	0.724	46 (18.3)	2 (5.6)	0.1600
Too young	91 (30.4)	59 (34.7)	32 (24.8)	0.0654	59 (41.3)	32 (23.0)	0 (0)	< .0001 <sup>b</sup>	79 (31.4)	6 (16.7)	0.0419 <sup>c</sup>
Safety concern / side effects	46 (15.4)	28 (16.5)	18 (14.0)	0.5502	18 (12.6)	26 (18.7)	2 (11.8)	0.3316	39 (15.5)	5 (13.9)	0.9373
Other	54 (18.1)	29 (17.1)	25 (19.4)	0.6054	25 (17.5)	24 (17.3)	5 (29.4)	0.4557	46 (18.3)	5 (13.9)	0.5884

Stratified group results from surveys collected between May and June 2017 for RGCCISD.

<sup>a</sup>Denotes Fisher's exact test is used. Otherwise, Chi-Square test is used.

<sup>b</sup>Denotes significance under  $\alpha = .001$ .

<sup>c</sup>Denotes Significance under  $\alpha = .05$ .

<sup>d</sup>Where n is the total number of individuals who answered YES to the question of "Has your child received the HPV vaccine?"

<sup>e</sup>Missing parent's gender found in the survey.

<sup>f</sup>Denotes questions where individuals could choose all choices that apply.

<sup>g</sup>Where n is the total number of individuals who answered NO to the question of "Has your child received the HPV vaccine?"

was good or important, which highlights the high level of public awareness and knowledge about HPV and the HPV vaccine in the RGV community. While research has shown that parents' HPV-related knowledge and awareness are positively associated with HPV vaccination rates,<sup>28</sup> HPV vaccine initiation and completion rates in RGV remain low despite seemingly high levels of awareness and knowledge about HPV and the HPV vaccine.

### Reasons for low vaccination rates

Parental vaccine beliefs, attitudes, and intentions<sup>20,35</sup> may be affecting these rates. The low HPV vaccination rates reported are reflective of the low recommendation rate by RGV healthcare providers for the HPV vaccine. Research has shown that healthcare provider/physician recommendation and parents' trust in healthcare providers is positively associated with parents' uptake of the HPV vaccine.<sup>20,21,25,26,33</sup> Survey respondents reported higher vaccination rates when they were recommended to get the HPV vaccine for their child by their healthcare provider compared to those who did not receive recommendations. Previous research has shown that parents who vaccinate their children are more likely to remember and report higher quality recommendations from providers, i.e., providers recommending HPV as high importance for patients

at ages 11–12.<sup>47</sup> However, HPV vaccination rates in this study are relatively low even among those who did receive provider recommendations.<sup>47</sup> Less than two-thirds of respondents who received a recommendation reported vaccinating their child.

Parental hesitancy towards HPV vaccine uptake has been attributed to lack of information regarding the 2- and 3-dose series, side effects, and safety of the HPV vaccine.<sup>20,22,37,48–50</sup> In addition, recommendations for HPV vaccination may be attributed to area-based factors (eg, racial / ethnic composition, area-based socioeconomic status), social context (eg, social norms of behavior, knowledge, and risk perception), physical circumstances (eg, geographic accessibility), and economic conditions (eg, time demands, work / school schedule, costs) in RGV.<sup>51</sup> Besides healthcare provider recommendations, the main reasons reported for not getting their child vaccinated are age (too young), child was not sexually active, safety concerns, and other reasons.<sup>50</sup>

### Healthcare provider recommendation

A recent study in South Carolina, a state with low HPV vaccination completion (34% for girls and 16% for boys), identified that lack of provider recommendation as a major barrier to uptake.<sup>52</sup> Similar to other studies, there were notable gender differences in



**Table 4.** Summary of HPV vaccination history by recommendation of healthcare provider.

	n (%)	Has a doctor or health professional (like a practitioner) ever advised you to get your child vaccinated against HPV?				p-value
		Yes	No	Not Sure	Missing	
<b>No. of Respondents</b>	622	273	267	78	4	
<b>Survey Question</b>						
<i>Has your child received the HPV vaccine?</i>						< .0001 <sup>ab</sup>
Yes	202 (32.5)	173 (63.4)	22 (8.2)	6 (7.7)	1 (25.0)	
No	299 (48.1)	80 (29.3)	195 (73.0)	22 (28.2)	2 (50.0)	
Not Sure	112 (18.0)	17 (6.2)	46 (17.2)	49 (62.8)	0 (0.0)	
Missing	9 (1.5)	3 (1.1)	4 (1.5)	1 (1.3)	1 (25.0)	
<i>If yes, how many doses?</i>	202	173	22	6	1	0.6674 <sup>a</sup>
1	59 (29.2)	51 (29.5)	7 (31.8)	1 (16.7)	0 (0.0)	
2	36 (17.8)	29 (16.8)	6 (27.3)	1 (16.7)	0 (0.0)	
3	81 (40.1)	72 (41.6)	5 (22.7)	3 (50.0)	1 (100.0)	
Not Sure	25 (13.4)	20 (11.6)	4 (18.2)	1 (16.7)	0 (0.0)	
Missing	1 (0.5)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	

Stratified group result from surveys collected between May and June 2017 for RGCCISD.

<sup>a</sup>Denotes Fisher's exact test is used; otherwise, chi-square test is used.

<sup>b</sup>Denotes significance under  $\alpha = .001$ .

how providers recommend the HPV vaccine.<sup>15,53,54</sup> In this study, higher percentages were reported if the respondent was female and if they had a female child aged  $\geq 15$  years old. Healthcare providers may recommend HPV vaccination less frequently to parents / guardians of male children.<sup>20</sup> While the HPV vaccine has been available for use in males since 2009 and has been recommended since 2011, the lower level of knowledge and awareness among male respondents and those with male children is reflected in the parent-reported vaccination rate. Male parents / guardians may be less likely to be educated or counseled about HPV, a sexually transmitted infection and its cancer-preventing vaccine. Although the HPV vaccine was initially heavily marketed towards women, educational interventions should target both parents of children who would benefit from this vaccine.<sup>53</sup>

The survey results suggest that HPV vaccine uptake may be less attributable to a child's gender, but rather if the healthcare provider recommended the HPV vaccine at all. The study results also suggest that the provider recommendations may be dependent on a child's age. Healthcare providers may be less likely to discuss HPV or recommend the HPV vaccine when counseling younger patients, such as a 9-year-old presenting in the pediatric clinic with an acute ailment.<sup>52</sup> However, healthcare providers are more likely to improve uptake at recommended ages of 11–12 years old if they begin the conversations earlier with parents and students. More healthcare providers are likely to advocate the importance of the vaccine at older ages. In this study, the percentage of children reported by their parents to receive the HPV vaccine increased with age from 12.1% for those aged  $\leq 10$  to 42.9% for those aged  $\geq 15$ . This gap in providing preventive care at recommended ages presents a missed opportunity for HPV education and vaccination.

### Future efforts to improve HPV vaccine uptake

Although the survey of Texas healthcare practitioners reports HPV vaccination recommendations at 94%,<sup>34</sup> this percentage is much lower in this study. There was a nearly even split on whether healthcare providers had recommended or not recommended the HPV vaccine to the study sample. Similar percentages concerning healthcare provider recommendation were seen when looking at student's gender. Less than half of

respondents with female students (46.5%) and 40.5% of respondents with male students received HPV vaccination recommendations from healthcare providers. About one-third of the respondents whose child did not receive the HPV vaccine reported that they had not received a recommendation from the child's doctor.

The efforts to improve public awareness and knowledge of HPV and HPV-related cancer are futile if providers do not provide strong recommendations for the HPV vaccine. A strategy that has improved parental approval for vaccine uptake in other studies is emphasizing how the HPV vaccine prevents HPV infection and subsequently decreases the risk of HPV-related cancers in the future.<sup>36,55,56</sup> The change in the dose schedule from 3 doses to 2 doses should help increase completion rates among preadolescents and adolescents. Future research may benefit from distinguishing between completion of 2-dose and 3-dose HPV vaccines and exploring community-level factors (e.g., racial / ethnic composition, area-based socioeconomic status), social context, economic conditions, and physical circumstances that may affect vaccination rates.

In 2016, the National HPV Vaccination Roundtable identified system-level approaches for improved uptake of the HPV vaccine as an important research gap.<sup>57</sup> Future research should identify systemic barriers that may interfere with series completion. Intervention development should focus on improving accessibility and addressing the research gaps recommended by the National HPV Vaccination Roundtable. For example, improving accessibility would likely improve completion rates. Parents in this study reported significant difficulty for vaccine series initiation and completion because of work / school schedule conflicts. This is in line with findings from the National Immunization Survey (NIS) 2008–2012 data. NIS showed that low HPV vaccine uptake (16%) was due to systemic barriers, such as lack of access to clinics during hours of operation.<sup>58</sup> More frequently reported barriers included vaccine misinformation, worry about safety, and lack of knowledge about the vaccine.

### Strengths and limitations

There are several strengths to this study. First, it is one of the few studies assessing HPV and HPV vaccine in a medically

underserved, economically disadvantaged, high-risk Hispanic population in Starr County, Texas. Specifically, this study provides current estimates of and disparities in HPV knowledge and awareness in an already disadvantaged population. This helps inform what interventions are needed and more importantly what subgroups to target to help increase vaccine uptake. Otherwise, there is a potential to increase health inequalities if there is low vaccine uptake. Second, we assessed a survey sample that includes males. This has become increasingly important as many HPV-associated cancers occur in men and the approval of the HPV vaccine for use among boys.<sup>53</sup> Next, we evaluate the role of parental gender and child's age and gender in the uptake of the HPV vaccine among school-age children. Last, this study may elucidate the barriers or reasons for not initiating or completing HPV vaccination.

The current study also had limitations. First, we did not assess actual HPV vaccination patterns. The self-reported nature of our measures may pose limitations. For example, parents' recall of HPV vaccine history and provider recommendations may be misreported. Second, we did not assess current healthcare provider awareness and recommendation practices, which could possibly explain the differences seen in the study responses. Third, low survey response rates may be attributed to the characteristics unique to the study population, i.e., lower health literacy / education, low socioeconomic status, vaccine belief / attitudes, and gender differences. The response rate was lower than expected due to other end-of-the-year activities and mandatory testing. The highest responses were from 7<sup>th</sup>- grade parents / guardians. A power analysis was conducted and confirmed that the response rate was powered to detect clinical meaningful differences. A fourth is the limited generalizability of our respondents, who were selected from a specific geographic area. The results may not be generalizable to the rest of the Texas or the US. The respondents may be more engaged because of current CPRIT efforts to improve HPV vaccine uptake. Next, the response rate was low and could lead to selection bias (undercoverage and volunteer response bias). It is possible that the low response rate reflects an underrepresentation of the problem. It might also reflect sensitivities about the general topic of HPV or lack of a baseline response incentive. The potential for bias increases if the respondents were different from nonrespondents, i.e., age, education, and socioeconomic status. Last, the current study included a small sample of male respondents, which may not be the representative of all RGCCISD male parents / guardians.

## Conclusions

The HPV vaccination coverage in RGV is low, with only 28.2% initiation ( $\geq 1$  dose) and 18.8% completion ( $\geq 2$  doses) of the HPV vaccine series. Although parents and guardians of RGCCISD students (4<sup>th</sup>–12<sup>th</sup> graders) report high awareness of HPV and the HPV vaccine, healthcare providers need to actively engage with parents to discuss HPV and the HPV vaccine. A strong body of evidence speaks to the importance of increasing the frequency and quality of

provider recommendations for HPV vaccination, especially in an economically disadvantaged, predominately Hispanic population. Given the positive influence of healthcare providers on parental decisions to the vaccine, future studies should examine various interventions and education that target underrecommended groups, men and Hispanics, to increase knowledge and awareness about HPV, the HPV vaccine, and HPV-associated cancers to promote greater HPV vaccine uptake and reduce parental hesitancy toward vaccination.

## Materials and methods

### Study overview

This study was conducted as part of the Cancer Prevention Research Institute of Texas (CPRIT)-funded study to increase HPV vaccination in the RGV. Our CPRIT-funded project includes two components: educational events in Cameron, Hidalgo, and Starr Counties and implementation of the first school-based HPV vaccination program in Texas. The HPV Parent Survey “Knowledge about the Human Papillomavirus Vaccine” (Appendix A) was developed to assess parent-reported HPV vaccination rates as well as parental knowledge and attitudes toward the HPV vaccination before strategies were implemented to increase HPV vaccination uptake in the RGCCISD. Prior to the implementation of this study, the guidelines for the dosing schedule were changed. In October 2016, the Centers for Disease Control and Prevention (CDC) updated its guidelines and reduced the recommended dosing schedule for those initiating before age 15 to 2 doses given at least 6 months apart.<sup>59,60</sup> Three doses are still recommended for those initiating on or after their 15<sup>th</sup> birthday and for people with certain immunocompromising conditions.<sup>59</sup> This affects the evaluation of vaccine completion in the population of interest in our study — changing the requirement from three doses to two doses for those initiating before age 15.

### Survey participants and collection

The target audience for the Parent Survey was parents / guardians of RGCCISD students enrolled in grades 4–12. The UTMB Institutional Review Board approved the use of the HPV Parent Survey as a knowledge assessment tool and for the collection of sensitive confidential information. Surveys were distributed to 4<sup>th</sup>–12<sup>th</sup> grade students in RGCCISD homeroom classes. Students took the surveys home to their parents or guardians for completion. The RGCCISD encompasses 15 school campuses and 159 homerooms. Collection sites monitored for late submissions of completed surveys. The survey enrollment packet was provided in English and Spanish and included an introductory cover letter, HPV Parent Survey, CDC HPV factsheet, and return envelope. Several attempts were made to get a higher response, including reaching out to parents directly and working with school officials.

## Survey questions/measures

Parents/guardians completed the survey. The exact survey questions are provided in [Appendix A](#). Demographic information was collected for both the parent/guardian (age, gender, race/ethnicity, and place of birth) and the RGCCISD student (age). Survey participants were asked to provide their knowledge and awareness about HPV and the HPV vaccine. For their child, they were asked if they received a recommendation from a healthcare provider, if their child received the HPV vaccine and number of doses, and reasons why their child has not received the vaccine. They were also asked if they had other children who already graduated high school and if they were enrolled in ImmTrac, Texas Immunization Registry.

## Statistical analysis

Descriptive statistics were used to describe parents' knowledge and attitude and children's experience. Chi-square tests were used to compare group differences. For groups with a limited count under null distribution (20% or more cells in the contingency table with an expected count less than 5), for which a Chi-square test might be misleading, a Fisher's exact test was used instead. All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC). We believe that our study was powered to detect clinical meaningful differences. We determined that our final sample size reached a power of 90% to detect at least effect size of 0.15 based on Chi-square test with 2 degrees of freedom.

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No potential conflicts of interest were disclosed.

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## Appendix A

### PARENTSURVEY: Knowledge About the Human Papillomavirus (HPV) Vaccine

Dear Parents, thank you for taking the time to participate in our survey about the Human Papillomavirus (HPV) vaccine. This survey should take less than 5 minutes to complete. All information you provide is CONFIDENTIAL and will be used to help promote education about the HPV vaccine in our community. We may contact you in the future to provide more information about our vaccination program, or to ask for your feedback. Thank you for your participation.

<b>PARENT INFORMATION:</b>		Name: _____	Address: _____	Age: _____	Sex: _____
		Phone: _____	Email address: _____	Place of Birth: _____	
<b>ETHNICITY OR RACE:</b>	<i>Please check one.</i>	<input type="checkbox"/> White	<input type="checkbox"/> Hispanic or Latino	<input type="checkbox"/> Black or African American	<input type="checkbox"/> Asian/Pacific Islander
		<input type="checkbox"/> Native American/American Indian	<input type="checkbox"/> Other		
<b>YOUR KNOWLEDGE ABOUT THE HPV VACCINE</b>					
1)	Have you ever heard of the Human Papillomavirus (HPV)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
2)	Would you like to learn more about HPV?	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
3)	Have you heard of the HPV vaccine?	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
4)	Are you aware that the HPV vaccine can prevent certain types of cancer?	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
5)	What do you think about the HPV vaccine? <i>Please check all that apply; enter comments below.</i>	<input type="checkbox"/> Not needed	<input type="checkbox"/> Does not work	<input type="checkbox"/> Has bad side effects	<input type="checkbox"/> Good/important
<i>Please enter your comments, if desired:</i>					
<b>INFORMATION ABOUT YOUR CHILD AND THE HPV VACCINE</b>					
6)	<b>Your child's Name:</b> _____	<b>Your child's Age:</b> _____	<b>Your child's Date of Birth:</b> _____		
7)	Has a doctor or health professional (like a nurse practitioner) ever advised you to get your child vaccinated against HPV?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not sure	
8)	Has your child received the HPV vaccine?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not sure	
9)	If YES, how many doses has your child received?	<input type="checkbox"/> One dose	<input type="checkbox"/> Two doses	<input type="checkbox"/> Three doses	<input type="checkbox"/> Not sure
10)	If NO, what are the main reasons your child has not received the HPV vaccine? <i>Please check all that apply; enter comments below.</i>				
		<input type="checkbox"/> Work/school schedule conflict	<input type="checkbox"/> Not recommended/mentioned by child's doctor	<input type="checkbox"/> My child is not sexually active	
		<input type="checkbox"/> Too young	<input type="checkbox"/> Safety concerns/side effects	<input type="checkbox"/> Other ( <i>please specify</i> )	
<i>Please enter your comments, if desired:</i>					
11)	Do you have any other children already graduated from high school, who have received the HPV vaccination?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not sure	
12)	Is your child enrolled in *ImmTrac? (Texas Immunization Registry)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not sure	
*ImmTrac is a no-cost service offered by the Texas Department of State Health Services (DHS), designed to promote vaccination coverage across Texas. It is a free, secure and confidential registry available to all Texans. ImmTrac safely consolidates and stores vaccination information from multiple sources in one safe, centralized system. Vaccination information in ImmTrac is provided by a variety of sources, including healthcare providers, pharmacies, public health clinics, Medicaid and the Vital Statistics Unit (VSU).					

This program is sponsored by the Cancer Prevention & Research Institute of Texas (CPRI), in collaboration with the University of Texas Medical Branch – Galveston, Texas

**PLEASE LEAVE THIS SECTION BLANK:** PARENT ID: \_\_\_\_\_/STUDENT NAME: \_\_\_\_\_/STUDENT ID: \_\_\_\_\_/SCHOOL \_\_\_\_\_  
(Rev\_02012017)

### Encuesta de Padres de familia acerca del conocimiento sobre la vacuna el Virus del Papiroma Humano (VPH)

Estimados padres, gracias por tomarse el tiempo para participar en nuestra encuesta sobre la vacuna contra el virus del Papiroma Humano (VPH). Esta encuesta solo tarda menos de 5 minutos en completarse. Esta encuesta es CONFIDENTIAL y toda la información obtenida se utilizará para ayudar a promover la educación sobre la vacuna contra el VPH en nuestra comunidad. Podríamos continuar comunicándonos con usted en el futuro para proporcionar más información sobre nuestro programa de vacunación, o para pedir su opinión. Gracias por su participación.

<b>Información acerca de los Padres:</b>		Nombre: _____	Dirección: _____	Edad: _____	Sexo: _____
		Numero de Telefono: _____	Dirección de correo electrónico: _____	Lugar de Nacimiento: _____	
<b>Etnicidad o raza:</b>	<i>Por favor marque uno.</i>	<input type="checkbox"/> Blanco	<input type="checkbox"/> Negro o Afroamericano	<input type="checkbox"/> Asia/Islas Pacifico	
		<input type="checkbox"/> Hispano o Latino	<input type="checkbox"/> Indigena/Indio Americano	<input type="checkbox"/> Otro	
<b>Su conocimiento sobre la vacuna contra el VPH</b>					
1)	¿Alguna vez ha oído hablar del virus del papiroma humano (VPH)?	<input type="checkbox"/> Si	<input type="checkbox"/> No		
2)	¿Quiere saber más sobre el VPH?	<input type="checkbox"/> Si	<input type="checkbox"/> No		
3)	¿Ha oído hablar de la vacuna contra el VPH?	<input type="checkbox"/> Si	<input type="checkbox"/> No		
4)	¿Sabe usted que la vacuna contra el VPH puede prevenir ciertos tipos de cáncer?	<input type="checkbox"/> Si	<input type="checkbox"/> No		
5)	¿Qué piensas de la vacuna contra el VPH? Por favor marque todos los que apliquen; <i>Escriba los comentarios adicionales a continuación si lo desea.</i>				
		<input type="checkbox"/> Innecesario	<input type="checkbox"/> No funciona	<input type="checkbox"/> Tiene efectos secundarios negativos	<input type="checkbox"/> Bueno/ Importante
<b>Comentarios:</b>					
<b>Información sobre su hijo y la vacuna contra el VPH</b>					
6)	Nombre de su hijo/a: _____	Fecha de nacimiento de su hijo/a: _____	Edad de su hijo/a: _____		
7)	¿Alguna vez le aconsejó un médico o profesional de la salud (como una enfermera practicante) que vacunara a su hijo contra el VPH?	<input type="checkbox"/> Si	<input type="checkbox"/> No		
8)	¿Ha recibido su hijo/a la vacuna contra el VPH?	<input type="checkbox"/> Si	<input type="checkbox"/> No	<input type="checkbox"/> No lo sé	
9)	En caso que SI, ¿cuántas dosis ha recibido su hijo/a?	<input type="checkbox"/> (1) dosis	<input type="checkbox"/> (2) dosis	<input type="checkbox"/> (3) dosis	<input type="checkbox"/> No lo sé
10)	Si NO, ¿cuáles son las principales razones por las que su hijo no ha recibido la vacuna contra el VPH? <i>Por favor marque todas las que apliquen; escriba comentarios si lo desea.</i>				
		<input type="checkbox"/> Trabajo/ horario escolar difícil	<input type="checkbox"/> No recomendado / no mencionado por el médico del niño	<input type="checkbox"/> Mi hijo/a no esta sexualmente activo	
		<input type="checkbox"/> Preocupaciones de los efectos secundarios	<input type="checkbox"/> Muy joven	<input type="checkbox"/> Otro	
<b>Comentarios:</b>					
11)	¿Tienes algún otro niño/a que ya se haya graduado de la escuela secundaria y que haya recibido la vacuna contra el VPH?	<input type="checkbox"/> Si	<input type="checkbox"/> No	<input type="checkbox"/> No lo sé	
12)	Está su hijo/a inscrito en * ImmTrac? (Texas Immunization Registry)	<input type="checkbox"/> Si	<input type="checkbox"/> No	<input type="checkbox"/> No lo sé	
* ImmTrac es un servicio sin costo ofrecido por el Departamento de Servicios de Salud del Estado de Texas (DHS), diseñado para promover la cobertura de vacunación en todo Texas. Es un registro gratuito, seguro y confidencial disponible para todos los tejanos. ImmTrac consolida y almacena de manera electrónica información de vacunas de múltiples fuentes en un sistema seguro y centralizado. La información sobre vacunación en ImmTrac es proporcionada por una variedad de fuentes, incluyendo proveedores de atención médica, farmacias, clínicas de salud pública, Medicaid y la Unidad de Estadísticas Vitales (VSU).					

Este programa es patrocinado por el Instituto de Investigación y Prevención del Cáncer de Texas (CPRI), en colaboración con la Universidad de Texas Medical Branch – Galveston, Texas

**POR FAVOR DEJE ESTA SECCIÓN EN BLANCO:**

ID DE PADRE: \_\_\_\_\_/NOMBRE DE ESTUDIANTE: \_\_\_\_\_/ID DE ESTUDIANTE: \_\_\_\_\_/ESCUELA \_\_\_\_\_

(Rev\_02032017)