













116 of Alabama and using a sample that includes students who have never heard of the vaccine. Past  
117 literature has also not explored how TPB constructs may vary based on the knowledge of the  
118 individuals. Therefore, we also examined how the TPB variables vary based on HPV knowledge.

## 119 **2. Methods**

### 120 **2.1. Participants**

121 This study was conducted from January 2019 through March 2019. It was approved by the  
122 university's Institutional Review Board. We used a cross-sectional survey design and a  
123 convenience sample for this study. The participants were college students enrolled in a rural state  
124 university in Alabama who ranged from 18 to 26 years old. The students were recruited through  
125 several means. We contacted professors, department chairs, and deans across campus, asking  
126 them to share the survey with students in their classes, or to share the survey with professors in  
127 their units. A number of professors agreed to share the survey, either in class or via email, with  
128 their students. Furthermore, the university's social media manager agreed to post links to the  
129 survey on the official university Facebook, Twitter, and Instagram accounts. Triangulations of  
130 recruitment methods has shown effectiveness in recruitment, and social media provide a rapid  
131 and cost-effective data collection method. Because students were recruited in multiple ways, it is  
132 impossible to know how many students had the opportunity to participate. For this reason, we  
133 did not attempt to calculate a response rate.

134 The students who consented to participate in the study completed an online questionnaire.  
135 A total of 292 responses were returned. Due to extensive missing data, 35 responses were  
136 excluded and the final number of usable responses was 257. The researchers did not provide any  
137 monetary compensation for participation.









206 a bachelor's degree ( $n = 112$ ). Overall, 21.9% of respondents ( $n = 56$ ) said both of their parents  
207 had a college degree, and 45.7% reported that neither parent had finished college ( $n = 117$ ).

### 208 **3.2. Group comparisons**

209 Chi-square tests showed significant associations of sex assigned at birth ( $\chi^2=5.64, p=.018$ )  
210 and race/ethnicity ( $\chi^2 =12.15, p<.01$ ) with getting vaccinated. The odds of getting at least one  
211 HPV shot were 1.98 times higher for females than for males and 3.18 times higher for Black and  
212 biracial students than for White students. There was no significant association between getting  
213 vaccinated and sexual orientation, having insurance, or parents' education.

### 214 **3.3. Knowledge and beliefs**

215 A majority of students, including those who had received at least one dose of the HPV  
216 vaccine and those who had not received any doses of vaccine, knew that HPV is contagious and  
217 that it can affect both women and men (see Table 1). However, less than 40% of each group  
218 knew how HPV is transmitted. When asked whether HPV causes cancer, most of those who had  
219 been vaccinated (61.2%) answered correctly that it does, compared to 44% of respondents who  
220 had not been vaccinated. This difference was statistically significant,  $\chi^2 = 6.292, p = .008$ .  
221 Differences in knowing that HPV causes genital warts were not statistically significant between  
222 HPV vaccinated respondents (55.1%) compared to those who had not been vaccinated (43.4%),  
223  $\chi^2 (1, N = 257) = 3.329, p = .068$ . Similarly, the difference in self-efficacy in HPV self-  
224 protection between HPV vaccinated respondents (77.6%) and those who had not been vaccinated  
225 (66.7%) did not reach statistical significance,  $\chi^2 (1, N = 257) = 3.476, p = .062$ . By contrast, a  
226 significantly higher percentage of HPV vaccinated respondents (46.9%) believed that the HPV  
227 vaccine was effective at protecting them from the virus, as compared to just 30.8% of those who  
228 had not been vaccinated,  $\chi^2 (1, N = 257) = 6.763, p = .009$ . Interestingly, fewer than half of the















364 not want them engaging in sexual activity and, thus, would not see any reason to get the vaccine.  
365 It is important to note that our study did not find any statistically significant difference in sexual  
366 activity between vaccinated and unvaccinated students. Moreover, research documented that  
367 there was no relationship between sexual initiation following HPV vaccination and risk  
368 perceptions. However, it may be that some students feel that people in their social networks  
369 would perceive getting vaccinated as a sign that they intended to engage in sexual activity and  
370 would therefore oppose vaccination. Past research has documented that parental concerns about  
371 their children's sexual risk perceptions following HPV vaccine pose a barriers to HPV  
372 vaccination [48], despite the overwhelming evidence that HPV vaccination does not lead to risky  
373 sexual behavior.

374 Our study was important in examining the influence of religion on TPB and getting  
375 vaccinated in a state with high religiosity [49]. In contrast to past studies that reported  
376 organizational religiosity and non-organizational religiosity were associated with low  
377 vaccination uptake among college-aged students [27, 33], our study indicates that the  
378 relationship of religiosity to HPV-related attitudes and behavior is complex. There was no  
379 statistically significant difference between vaccinated and unvaccinated students in how much  
380 they agreed with this general statement: "My religious beliefs are what really lies behind my  
381 whole approach to life." In contrast, students who were not vaccinated reported significantly  
382 higher agreement with the item that stated, "My religious beliefs influence decisions about my  
383 health," than the students who were vaccinated. This set of results indicates that religion may  
384 only play a critical role in the vaccination decision making, if someone sees it as having  
385 relevance to their health decisions. To our knowledge, this is a unique finding that has not been  
386 previously reported and may be worth exploring further. Perhaps, working with churches and





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Table 1

*Comparison of HPV Knowledge Between Vaccine Recipients and Non-recipients (N = 257)*

HPV Knowledge	Correct answers from those with at least one HPV vaccine shot ( <i>n</i> = 98)	Correct answers from those who have never received an HPV vaccine shot ( <i>n</i> = 159)	$\chi^2$	Sig.
Do you think human papillomavirus (HPV) is contagious? (Correct answer: Yes)	68 (69.4%)	101 (63.5%)	1.586	.452
In which gender can human papillomavirus cause health problems? (Correct answer: In both women and men)	67 (68.4%)	101 (65.5%)	.629	.428
What are modes of transmission of HPV? (Correct answers: Sexual intercourse or From mother to baby during birth)	27 (27.6%)	56 (35.2%)	1.631	.202
Can HPV cause cancer? (Correct answer: Yes)	60 (61.2%)	70 (44.0%)	6.929	.008*
Can HPV cause genital warts? (Correct answer: Yes)	54 (55.1%)	69 (43.4%)	3.329	.068

\* $\chi^2$  (1, *N* = 256) = 6.292, *p* = .008

Table 2

*Means, Standard Deviations, and Alphas for Theory of Planned Behavior Items Among Respondents Not Fully Vaccinated.*

Variable <sup>1</sup>	<i>M</i>	<i>SD</i>	Cronbach's $\alpha$
Attitude Scale	4.39	1.70	.94
I think getting HPV vaccine in the next 12 months would be very bad/very good.	4.50	1.96	
I think getting HPV vaccine in the next 12 months would be not protective at all/extremely protective.	4.68	1.95	
I think getting HPV vaccine in the next 12 months would be unnecessary/necessary.	3.79	2.10	
I think getting HPV vaccine in the next 12 months would be very unhealthy/healthy.	4.65	1.98	
I think getting HPV vaccine in the next 12 months would be disadvantageous/advantageous.	4.47	2.02	
I think getting HPV vaccine in the next 12 months would be extremely painful/painless.	4.35	1.73	
I think getting HPV vaccine in the next 12 months would be extremely harmful/extremely beneficial.	4.53	1.82	
Subjective Norms	3.21	1.98	.95
Most people who are important to me think that I should get HPV vaccine in the next 12 months (completely disagree/completely agree).	3.27	2.10	
My parent(s) or legal guardian(s) would like me to get HPV vaccine in the next 12 months (completely disagree/completely agree).	3.24	2.12	
Family members other than my parent(s) or legal guardian(s) (for example, siblings aunts, uncles, grandparents, etc.) would like me to get HPV vaccine in the next 12 months (completely disagree/completely agree).	3.15	2.01	

<sup>1</sup>All items measured on 7-point scales.

Table 2 (continued)

*Means, Standard Deviations, and Alphas for Theory of Planned Behavior Items Among Non-Vaccinated Respondents (n = 163).*

Variable <sup>1</sup>	<i>M</i>	<i>SD</i>	Cronbach's $\alpha$
Perceived Behavior Control Scale	5.29	1.54	.93
If I wanted to, I am sure I could get HPV vaccine in the next 12 months (completely disagree/completely agree).	5.79	1.69	
For me to get HPV vaccine in the next 12 months would be extremely difficult/extremely easy.	5.26	1.73	
How much control do you have to get HPV vaccine in the next 12 months (no control/complete control)?	5.52	1.70	
I am confident I can get HPV vaccine in the next 12 months, even if there is a financial cost (very unconfident/very confident).	5.01	1.84	
I am confident I can get HPV vaccine in the next 12 months even if my schedule is busy (very confident/very unconfident).	4.97	1.90	
I am confident I can find a healthcare provider (for example, clinic, health center, physician's office) where I can get HPV vaccine in the next 12 months (very unconfident/very confident).	5.42	1.72	
Behavioral Intention Scale	2.68	1.90	.98
I intend to get HPV vaccine in the next 12 months (completely disagree/completely agree).	2.62	1.88	
I will try to get HPV vaccine in the next 12 months (completely disagree/completely agree).	2.76	1.98	
I plan to get HPV vaccine in the next 12 months (completely disagree/completely agree).	2.67	1.98	

<sup>1</sup>All items measured on 7-point scales.

Table 3

*Predictors of Intention to Get HPV Vaccine*

Predictor	<i>B</i>	<i>Bootstrap S.E.</i>	<i>z</i>	95% CI	BCa CI
Constant	.14	.31	.44	[-.48, .76]	[-.47, .78]
Attitude	.29***	.07	4.19	[.15, .42]	[.16, .43]
Subjective norms	.57***	.06	8.81	[.44, .70]	[.43, .69]
Perceived behavioral control	-.08	.06	-1.37	[-.20, .04]	[-.20, .04]
Previous HPV vaccine injection	-.50	.29	-1.71	[-1.07, .07]	[-1.07, .07]
R <sup>2</sup>	.53				

*Note.* *N* = 202. CI = confidence interval. BCa = bias-corrected and accelerated.

\*\*\* *p* < .001