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Easing Human Papillomavirus Vaccine Hesitancy: A Communication Experiment With U.S. Parents

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Abstract

Introduction: The Announcement Approach using presumptive announcements increases human papillomavirus (HPV) vaccine uptake. This study seeks to understand the impact of the final Announcement Approach steps, easing parents' vaccine concerns and then encouraging them to get HPV vaccine for their children, on parents' HPV vaccine hesitancy and confidence in the vaccine's benefits.

Methods: In 2017–2018, investigators recruited an online national sample of 1,196 U.S. parents of children aged 9–17 years who had not yet completed the HPV vaccine series. Following the steps of the Announcement Approach, participants viewed brief videos of a pediatrician announcing the child was due for HPV vaccine (shown to all parents). In the 2 × 2 experiment, parents saw: (1) a video of the pediatrician attempting to ease a concern the parent had raised earlier in the survey (Ease video), (2) a video of the pediatrician encouraging the parent to get their

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child vaccinated (Encourage video), (3) both videos, or (4) neither video. Data analysis was conducted in spring 2020.

Results: Seeing the Ease video message led to lower HPV vaccine hesitancy compared with not seeing it (mean=2.71, SD=1.29 vs mean=2.97, SD=1.33; $p<0.001$). The beneficial impact of easing concerns on lower vaccine hesitancy was explained by higher confidence ($p<0.05$). By contrast, the Encourage video had no impact on HPV vaccine hesitancy or confidence.

Conclusion: Addressing parents' concerns can decrease HPV vaccine hesitancy and increase confidence. Based on these findings, the Announcement Approach retained its emphasis on announcing children are due for vaccination and easing parent concerns.

INTRODUCTION

Human papillomavirus (HPV) vaccine series completion in the U.S. was 54% among adolescents aged 13–17 years in 2019,¹ far below the *Healthy People 2020* goal of 80%.² Coverage may be even lower given the drop in childhood vaccine uptake during the coronavirus disease 2019 (COVID-19) pandemic,³ potentially undoing progress made for adolescent vaccination over the past 14 years. Additionally, the WHO identified vaccine hesitancy as a top 10 threat to global health,⁴ adding new urgency to vaccine hesitancy interventions. Vaccine hesitancy is a motivational state of being conflicted about or opposed to getting vaccinated and is a key predictor of vaccine uptake.⁵ To date, RCTs have identified that using a presumptive communication approach, wherein providers assume parents are ready to vaccinate their children, elicits higher uptake of HPV^{6–8} and other vaccines.^{9,10} However, few studies have examined the effect of subsequent vaccine communication on parents' HPV vaccine hesitancy after the presumptive statement.

The Announcement Approach is an evidence-based communication strategy shown to increase HPV vaccine uptake in primary care clinics.⁶ As of 2017, training on the approach suggested 3 steps: (1) start with a presumptive announcement stating the child is due for HPV vaccination and will receive it at the end of their health visit, (2) ease parents' questions or concerns about vaccination, and (3) encourage HPV vaccination. As of 2019, >1,700 healthcare professionals in the U.S. and England have attended Announcement Approach trainings.¹¹ The training is recognized by the National Cancer Institute as an Evidence-Based Cancer Control Program.¹² However, the trial evaluating the training isolated the benefit of the Announcement Approach's use of presumptive announcements for raising the topic of vaccination.⁶ Little is known about the effect of the Approach's later steps. Identifying active intervention components¹³ in the Announcement Approach can support changes to optimize the communication intervention so that it is easier to teach, more memorable to vaccine providers, and more likely to be used in clinical encounters. This paper reports the findings of a national experiment that evaluated the second and third steps of the Announcement Approach. The authors predicted that parents exposed to the Ease step would report lower HPV vaccine hesitancy, have higher vaccine confidence, and perceive that the physician made a stronger recommendation to get their child HPV vaccine compared with parents who were not exposed. The authors predicted a similar benefit of the Encourage step.

METHODS

Study Population

Participants were U.S. parents who were members of an existing, national online probability panel of 60,000 non-institutionalized adults maintained by GfK (now Ipsos).¹⁴ The company used address-based, probability-sampling to build a panel representative of U.S. adults.¹⁴ A core profile survey on sociodemographic characteristics allows the company to identify target populations within the panel. Eligible respondents for the survey were parents of children aged 9–17 years who either had received 0 or 1 dose of HPV vaccine. Parents with >1 eligible child answered survey items about the child with the most recent birthday. From November 2017 to January 2018, the company contacted a randomly selected sample of 2,857 parents from the panel via e-mail. Of these parents, 1,834 parents responded by visiting the website for the survey and confirmed eligibility, and 1,313 parents (72%) met eligibility criteria, provided informed consent, and completed some portion of the survey. After excluding 50 panelists who did not complete at least two thirds of the survey and 30 parents who did not provide data for key variables, the surveyed sample contained 1,233 parents. The response rate was 61%, based on American Association for Public Research Response Rate 4 (Appendix 1).¹⁵ The authors excluded 37 parents unable to properly view the video messages to arrive at a final analytic sample of 1,196 parents (Appendix 2). Survey non-responders and excluded parents did not differ from the analytic sample on key sociodemographic characteristics (all $p>0.05$). Parents were aged 43 years on average, mostly identified as non-Hispanic White (70%), and had at least some college education (73%) (Table 1). Index children were aged 13 years on average, and most had not initiated HPV vaccination (60%).

Experimental procedures

The experiment used a 2×2 between-subjects factorial design in which parents saw brief videos of a board-certified female pediatrician (KT) recommending HPV vaccination. The videos followed the steps suggested by the Announcement Approach for recommending adolescent vaccines.⁶ The scripts for all video messages are in Appendix 3. All participants first saw the Announcement video. Then, the survey software randomly assigned parents to receive an Ease video, the Encourage video, both videos, or neither videos. After viewing the videos, participants responded to several questions assessing the outcomes of interest. The survey did not evaluate these outcomes prior to participants viewing the videos in order to avoid a testing by treatment interaction.¹⁶

All participants first saw a video in which the pediatrician announced the child was due for vaccines routinely recommended at the child's age. The script for the Announce Step read:

At your child's age, children are due for vaccines against meningitis, HPV cancers, and whooping cough. We will give the vaccines that your child is due for at the end of today's visit.

Next, participants assigned to see the Ease Step video watched the pediatrician address an HPV vaccine topic. Because most parents expressed interest in >1 of the 7 potential topics, the survey software selected the topic at random, attempting to match their interests. Most

parents (92%) wanted to learn more about the topic to which they were randomly assigned. Then, software randomly assigned the parent to view 1 of 4 possible videos that addressed that topic. The authors developed these messages in the videos from a library of 267 unique messages identified in existing HPV vaccination educational materials.¹⁷ To develop these brief messages used in the videos, the authors used an iterative process that included several rounds of consultations with health communication scientists and vaccine-prescribing physicians, and then text refinements to produce brief messages accessible to people with lower educational attainment. To better understand elements of the messages that made them effective (e.g., use of the word “cancer”), a separate study used the same analytic sample as this experiment.¹⁸ Example script of one of the Ease videos read:

I hear you. You’re wondering about the diseases that the HPV vaccine can prevent. HPV infection can cause cancer in both men and women. The HPV vaccine will protect your child from many of these cancers.

Finally, participants assigned to the Encourage video watched the pediatrician advise them to get their child HPV vaccine. The video was informed by the authors’ previous research on recommendation quality^{19,20}: strongly endorsing HPV vaccine, highlighting cancer prevention, and encouraging same-day vaccination. The script for the video read:

I strongly believe in the importance of this cancer-preventing vaccine for your child. I recommend your child get the HPV vaccine today.

The University of North Carolina IRB approved the experimental protocol. A protocol was not pre-registered for this study.

Measures

This study used survey items that the authors had previously validated (P Reiter, A McRee, J Kadis, N Brewer, unpublished observations, 2010),^{19–25} adapted from other sources,^{26–29} or newly developed. A convenience sample of 16 parents of adolescents aged 9–17 years participated in cognitive testing of the survey. Thirty-one parents from the national panel participated in a pilot test of the survey to ensure proper survey functionality. The full survey instrument is available online (noelbrewer.web.unc.edu/hpv/).

After the video messages, parents answered several survey items. The survey assessed parents’ HPV vaccine hesitancy (3 items, Cronbach’s $\alpha=0.98$): (1) *I am likely to get my child [the next dose of] the HPV vaccine in the next year*, (2) *I want to get [the next dose of] the HPV vaccine for my child in the next year*, and (3) *I plan to get [the next dose of] the HPV vaccine for my child in the next year*. The 5-point response scales ranged from *strongly agree* (reverse coded as 1) to *strongly disagree* (5). The survey also assessed HPV vaccine confidence, the attitude that a vaccine is effective and safe. The item read: *Overall, the HPV vaccine will benefit my child’s health*. The 5-point response scale ranged from *strongly disagree* (1) to *strongly agree* (5). Finally, the survey assessed perceived vaccine recommendation strength: *How strongly do you think the doctor in the videos recommends the HPV vaccine for your child?* The 5-point response scale ranged from *not at all* (1) to *extremely* (5).

Other survey items assessed parents' general attitudes toward vaccines (4 items, $\alpha=0.84$) and trait reactance (3 items, $\alpha=0.61$).^{28,30} The items had 5-point response scales ranging from *strongly disagree* (coded as 1) to *strongly agree* (5). The survey company provided parent demographic characteristics including sex, age, race and ethnicity, and education. The survey asked the parent to report the index child's sex, age, and HPV vaccinations status (0 doses or 1 dose).

Statistical Analysis

The authors used 2×2 between-subjects factorial ANOVA to examine the impact of the Ease and Encourage videos (present or absent) on HPV vaccine hesitancy (Figure 1 and Table 2). The authors repeated the analyses using vaccine confidence and perceived recommendation strength as outcomes. For statistically significant interactions, the authors used the Tukey–Kramer post-hoc test for multiple comparisons, which adjusts for inflation of family-wise error, deeming studentized ranged statistics (Q) larger than a critical value of 2.77 to be statistically significant.

Exploratory analyses used 3-way ANOVA to examine potential moderators (child's HPV vaccination status, parents' general attitude toward vaccines, and parents' trait reactance) of the impact of experimental factors on vaccine hesitancy, vaccine confidence, and perceived recommendation strength. Child's HPV vaccination status had statistically significant 2-way interactions with these experimental factors in 2 instances for perceived recommendation strength, but in all other analyses no moderator had significant 2- or 3-way interactions and thus are not reported in the text (Appendix 4).

Easing parents' concerns about HPV vaccination and encouraging vaccination may improve their HPV vaccine confidence, which could then decrease their vaccine hesitancy. Thus, the authors used structural equation modeling to evaluate whether the main effect of the Ease and Encourage videos on vaccine hesitancy is mediated through vaccine confidence (Figure 2). Structural equation modeling used full information maximum likelihood estimation with bootstrapped resampling procedures.³¹ The authors assessed the statistical significance of direct and indirect (mediated) paths, reporting regression coefficients ($\hat{\beta}$) standardized on the outcomes.

The model employed 5,000 random sample draws with replacement from the existing data set to generate bias-corrected CIs.³² Both standardized and unstandardized model estimates appear in Appendix 5.

The authors used Stata version 16 for data cleaning and conducting ANOVAs and *Mplus*, version 7.4 for structural equation modeling. All statistical tests were 2-tailed with a critical $\alpha=0.05$. Bias-corrected CIs that did not contain 0 met the criteria for statistical significance. Data analysis ended in spring 2020.

RESULTS

Parents exposed to Ease video messages reported lower HPV vaccine hesitancy (mean=2.71, SD=1.29) compared with parents who were not exposed to Ease video messages

(mean=2.97, SD=1.33; $p<0.001$) (Table 2). However, the Encourage video did not affect hesitancy (mean=2.79, SD=1.33 vs mean=2.89, SD=1.30; $p=0.19$). The interaction between the Ease and Encourage factors was not statistically significant ($p=0.30$).

Parents exposed to Ease video messages reported higher confidence in the benefit of HPV vaccine (mean=3.61, SD=1.14) compared with parents who were not exposed to Ease video messages (mean=3.43, SD=1.19; $p=0.008$). Parents exposed to the Encourage video message reported similar vaccine confidence (mean=3.53, SD=1.23) compared to parents who were not exposed to the Encourage video message (mean=3.52, SD=1.10; $p=0.87$). The interaction between the Ease and Encourage factors was not statistically significant ($p=0.85$).

Parents exposed to Ease and Encourage video messages reported stronger perceived recommendation strength (both $p<0.001$), qualified by an interaction between the 2 factors ($p=0.003$). Without the Encourage video, parents viewing the Ease video perceived a stronger recommendation (mean=3.53, SD=0.97) than those who did not view the video (mean=3.10, SD=1.14; $Q=7.48$). However, in the presence of an Encourage video message, the Ease video messages did not contribute to perceived recommendation strength (mean=3.79, SD=0.94 vs mean=3.87, SD=0.93; $Q=1.41$) (Figure 1).

Parents who had higher HPV vaccine confidence after video message exposure reported lower hesitancy to get their child HPV vaccine ($\hat{\beta} = -0.740$, 95% CI= $-0.774, -0.703$) (Figure 2). The indirect effect of the Ease video on hesitancy through confidence was negative and statistically significant (pathway product= -0.057 , 95% CI= $-0.098, -0.015$). However, the indirect effect of the Encourage video on hesitancy through confidence was not statistically significant (pathway product= -0.004 , 95% CI= $-0.047, 0.038$).

DISCUSSION

Using presumptive communication methods like the Announcement Approach increases HPV vaccine series initiation.^{6,7} However, which aspects of a provider's recommendation affect parents' HPV vaccine hesitancy and confidence is less well understood. In this national experiment evaluating the communication components of the Announcement Approach, easing parents' concerns led to higher confidence and lower hesitancy to get their children HPV vaccine. However, encouraging vaccination did not appear to influence these outcomes when preceded by a presumptive announcement. The results of this experiment expand upon communication principles the authors previously recommended¹⁸ and produced a revised Announcement Approach.

First, the findings suggest that addressing questions or concerns parents raise about HPV vaccine (Ease step) is a necessary step of the Announcement Approach. Parents who received Ease video messages reported lower vaccine hesitancy compared with parents who did not receive them. Providing additional information that address HPV vaccination concerns is clearly beneficial for parents whose children have not initiated the vaccine.³³ A previous communication experiment the authors conducted also suggested that these Ease messages have a positive effect on vaccine confidence and motivation in parents who had

initiated the series for their children.¹⁸ However, further investigation is warranted to better understand and address parent hesitancy. The mediation analysis showed vaccine confidence may partially explain the relationship between the Ease video's effect on vaccine hesitancy. Behavior change theories posit that attitudes like vaccine confidence are predictors of vaccination motivation and behaviors, and influencing these attitudes could change motivation.⁵ Vaccine confidence is conceptually a broad construct that includes attitudes or beliefs that the vaccine works, is safe, and is part of a trustworthy medical system.⁵ Public health and medical authorities prioritize improving vaccine confidence,⁴ particularly as vaccine hesitant parents are more likely to be exposed to vaccine misinformation, damaging their trust in vaccines.^{34,35} Providers are trusted sources of vaccine information and can play a paramount role in improving parents' confidence in HPV vaccination for their children.

Second, the findings suggest that inclusion of the Encourage step can be left to a provider's discretion when recommending HPV vaccine to hesitant parents. The Encourage video led to higher ratings of recommendation strength but did not affect vaccine hesitancy or confidence. The Ease video alone contributed to perceptions of a strong recommendation but added little to recommendation perceptions when followed by the Encourage video. The initial announcement may adequately communicate a provider's expectations that parents should get their children vaccinated,⁵ and thus the Encourage step may not bolster influence on hesitancy and confidence. However, parents did not appear to interpret a presumptive announcement as a strong recommendation for the vaccine, something the Encourage video was able to do. Hence, the provider could use the Encourage step to signal their unambiguous endorsement of HPV vaccination. For parents who initially decline vaccination during the visit, the Encourage step may help parents remember the provider's advice and simplify future visits.

Experiment strengths included a large national sample of U.S. parents of adolescents and a factorial design. Parents evaluated messages presented by video rather than in writing, which may more closely reflect the clinical experience and bolster ecological validity.

Limitations

Limitations of this experiment include that vaccination hesitancy was as a proxy for behavior. Although motivations (e.g., intentions, hesitancy) are 1 of the strongest predictors of behavior, barriers to action and other impediments can reduce the strength of the association,³⁶ thus making it unclear what impact the Ease and Encourage Steps separately would have on HPV vaccine uptake. Additionally, interventions that increase parents' confidence in HPV vaccine and reduce hesitancy alone may not increase vaccine uptake; they could however increase uptake in combination with strong provider recommendations to get the vaccine, as other studies have shown.⁵⁻⁷ The analyses did not use survey weights to yield generalizable point estimates, but other studies have shown that experiments with convenience samples closely match those done with nationally representative samples.³⁷ Randomization should have distributed any tendency for socially desirable responding equally across experimental conditions.³⁸ The findings contribute information on the effect of communication components of the Announcement Approach on HPV vaccine confidence and hesitancy, but future studies should examine how the communication components affect

uptake. Additionally, future studies should evaluate how provider communication trainings function in subpopulations (e.g., rural) with lower HPV vaccine coverage.¹

CONCLUSIONS

The Announcement Approach gives providers an effective way to communicate about HPV vaccine that saves time during clinical encounters³⁹ and results in same-day HPV vaccination.⁶ The updated training spends more time teaching the Ease step, given its clear value. If parents raise a concern about HPV vaccine, a provider can address their concern, thereby increasing confidence and reducing hesitancy. In addition, the authors now recommend the Encourage step as an optional measure for providers to use when recommending HPV vaccine. Ongoing international dissemination of this training will benefit from these findings and help reduce HPV cancers through increased HPV vaccine uptake.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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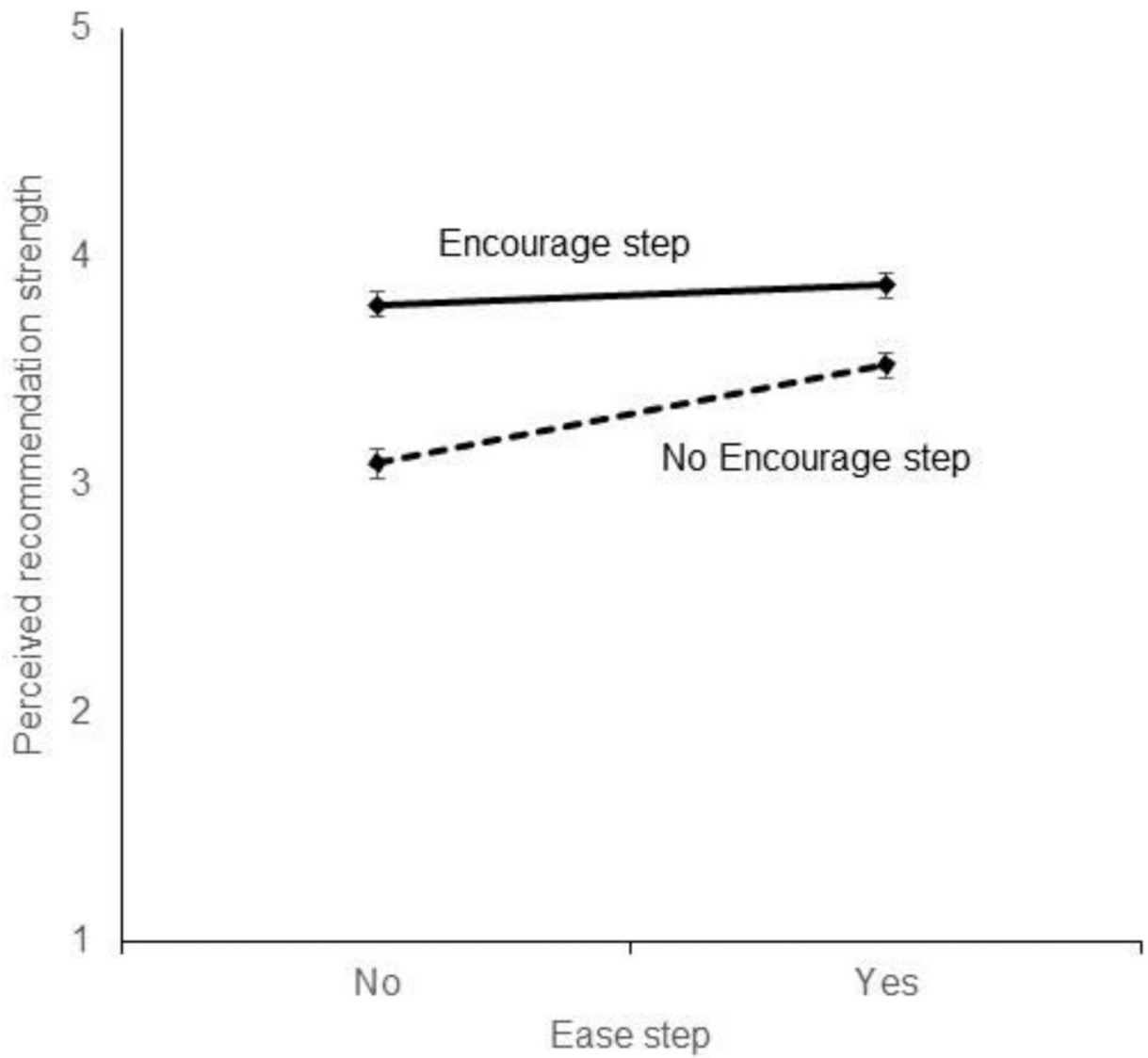


Figure 1. Interactions between Ease and Encourage factors on perceived recommendation strength.
Note: Error bars report SEs.

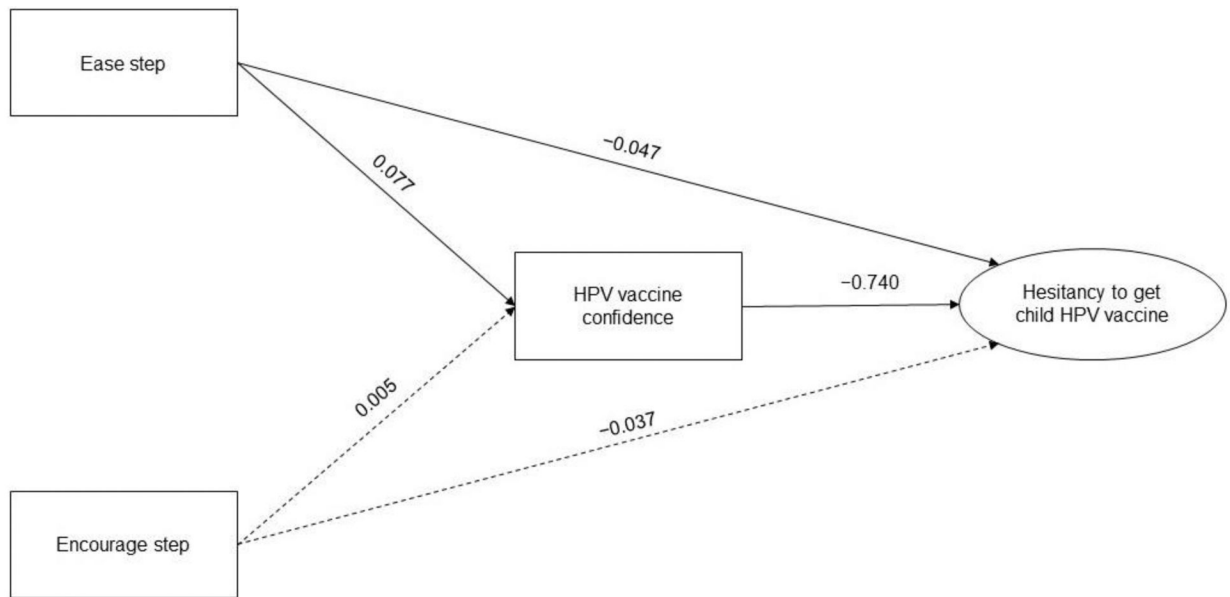


Figure 2.

Mediating effect of vaccine confidence between Announcement Approach steps and HPV vaccine hesitancy.

Note: Paths show regression coefficients ($\hat{\beta}$ s) standardized on the outcomes. Goodness of fit tests: $\chi^2=33$; RMSEA=0.062; CFI=0.996; TLI=0.990. Figure omits factor loadings, residuals, and correlations between variables to simplify presentation. Dashed pathways were not statistically significant.

HPV, human papillomavirus.

Table 1.

Parent Characteristics

Characteristics	Overall n (%) or mean (SD)	Experimental conditions			
		A video only (n=298) n (%) or mean (SD)	A + ES videos n (%) or mean (SD)	A + EN videos n (%) or mean (SD)	A + ES + EN videos n (%) or mean (SD)
<i>n</i>	1,196 (100)	298 (25)	300 (25)	301 (25)	294 (25)
Parent characteristics					
Sex					
Male	551 (46)	135 (45)	135 (45)	148 (49)	133 (45)
Female	645 (54)	163 (55)	168 (55)	153 (51)	161 (55)
Age	42.7 (8.1)	42.2 (8.4)	42.7 (7.9)	43 (8.3)	43.1 (8)
Race/ethnicity					
Non-Hispanic White	839 (70)	214 (72)	214 (70)	214 (71)	197 (67)
Non-Hispanic Black	113 (9)	32 (11)	26 (9)	29 (10)	26 (9)
Non-Hispanic multiracial/other	79 (7)	19 (6)	15 (5)	20 (7)	25 (9)
Hispanic	165 (14)	33 (11)	48 (16)	38 (13)	46 (16)
Education					
High school or less	325 (27)	89 (30)	79 (26)	81 (27)	76 (26)
Some college or more	871 (73)	209 (70)	224 (74)	220 (73)	218 (74)
Child characteristics					
Sex					
Male	622 (52)	146 (49)	169 (56)	158 (52)	149 (51)
Female	574 (48)	152 (51)	134 (44)	143 (48)	145 (49)
Age	12.5 (2.7)	12.4 (2.7)	12.5 (2.7)	12.7 (2.8)	12.4 (2.6)
HPV vaccination status					
No doses	719 (60)	223 (75)	207 (68)	220 (73)	201 (68)
Initiated series (1 dose)	477 (40)	75 (25)	96 (32)	81 (27)	93 (32)

Note: Announcement Approach steps: A=Announce; ES=Ease; EN=Encourage.

HPV, human papillomavirus.

Table 2.

Impact of Ease and Encourage Factors on HPV Vaccine Hesitancy, Confidence, and Perceived Recommendation Strength

Experimental factors	Hesitancy to get HPV vaccine n=1,195			Vaccine confidence n=1,195			Perceived recommendation strength n=1,183		
	df	F	<i>p</i>	df	F	<i>p</i>	df	F	<i>p</i>
Ease step	1	12.55	<0.001	1	7.01	0.008	1	19.66	<0.001
Encourage step	1	1.75	0.19	1	0.03	0.87	1	80.73	<0.001
Ease X Encourage	1	1.06	0.30	1	0.04	0.85	1	9.09	0.003

Note: All participants received the Announce video message.

HPV, human papillomavirus; df, degrees of freedom; F, F test statistic