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The effectiveness of a religiously framed HPV vaccination message among Christian parents of unvaccinated adolescents in the United States

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ABSTRACT

Background: The uptake of the human papillomavirus (HPV) vaccines has been controversial among religious parents due to beliefs that their children are expected to practice sexual purity and so do not need protection from a sex-related infection. Also, if at all they get infected in the future, God can protect them from sickness without a vaccine. Yet, most HPV vaccination messages are secular, lacking spiritual themes. This study compared the effectiveness of the Centers for Disease Control and Prevention (CDC) Vaccine Information Statement (VIS) on HPV with our intervention message- a scripture-embedded HPV vaccination message (using a randomized controlled trial design) on vaccination intention.

Methods: The study was conducted online. Participants were 342 Christian parents (from any denomination) of unvaccinated adolescents aged 11-17 years. The intervention message used the Cognitive Metaphor Theory to map the constructs of the Biblical story of Noah and the Ark to HPV vaccination. We framed Noah as
the parents, the flood as HPV, and the ark as the vaccination. Multiple linear regression was used to analyze the changes in vaccination intention before and after the intervention.

**Results:** Our findings showed that parents who received the scripture-embedded message reported a higher intention to vaccinate their children than those who received the CDC VIS (β= 0.31, 95% confidence interval [95%CI] = 0.11-0.52; p=0.003).

**Conclusion:** Our findings support the need for equitable messaging regarding HPV vaccination. Faith-based messaging interventions that seek to increase HPV vaccination should be framed to address religious anti-vaccination beliefs.

**KEYWORDS**
Equitable messaging; HPV; HPV vaccination; vaccine hesitancy; religiosity; messaging intervention; religious messaging; vaccine information statement
Background

Human Papillomavirus (HPV) is the foremost cause of cervical cancer, and it accounts for about 75% of vaginal cancers, 91% of anal cancers, and 70% of oropharynx cancer [1]. The HPV vaccination has been available since 2006 and is approved for ages 9–45 years and recommended at 11–12 years old [2]. There have been various HPV vaccination-specific communication strategies to promote vaccination intention. They have focused on individual (e.g. message framing to improve knowledge [3–5]); or systemic factors (e.g. reduced vaccination cost and increased vaccination sites [6–8]). Despite the persistent HPV vaccination promotion, uptake among adolescents has consistently remained sub-optimal [9,10].

One reason may be that most strategies have not addressed socio-cultural determinants – specifically religiosity [11–13]. Limited studies addressing religiosity primarily have relied on Organizational Religious Activities (ORA), utilizing religious settings to promote vaccination [14,15]. Interventions have used secular messages in religious settings to influence parents’ HPV vaccination intention [16,17]. A major challenge in these approaches is how they have omitted those who practice religiosity without possibly accessing religious venues and communities. On the contrary, faith-based messaging intervention may encounter wider reach and less variability in effective-ness among religious members who share overlapping/similar beliefs. Specifically, the messages are extracted from shared scriptural passages, themes, parables, or contents that are similarly interpreted and widely accepted [18,19]. Thus, a faith-based messaging intervention is as important as faith-based sources and settings interventions – and may be more effective. In this current study, we compared the relative effectiveness of a religiously framed HPV vaccination message to a standard, secularly framed HPV vaccination message from the Centers for Disease Control and Prevention (CDC).

This study draws from multiple theoretical frameworks: Cognitive Metaphor Theory – CMT, Elaboration Likelihood Model- ELM, and Theory of planned behavior-TPB [20–22] to conceptualize how religiously framed HPV messages may influence HPV vaccination intention through attitudinal change. Our model posits that exposing a person who practices intrinsic religious activities – IRA (i.e. their
religious belief shapes their approach to life) in addition to other domains to a religiously framed metaphorical message about HPV vaccination can influence their vaccination intention through influencing perceived message relevance, perceived message argument strength, persuasion, and attitudinal change. To implement this framework, we developed a religiously framed metaphorical message. Metaphor message framing approaches may render a complex concept in a more familiar term using relevant analogies that can be easily understood [23–25].

Study objective

Our study aimed to compare the effectiveness of a scripture-embedded HPV vaccination message with the current CDC Vaccine Information Statement on HPV vaccination intention among Christian parents. Given our theoretical postulations, we hypothesized that parents who receive a religiously framed HPV vaccination message targeting their attitude would report a higher HPV vaccination intention than parents who receive a secular message.

Methods

We conducted a blinded 2-arm randomized trial, comparing two messages – a CDC HPV message (control) and a scripture-embedded HPV message (intervention) on parental intent to receive the HPV vaccination on behalf of their children/adolescents. We collected baseline characteristics, randomized participants into one of the two message groups. After each group received their messaging, they were immediately presented with the post-messaging questions. Messages were presented in text format, having Facebook and Twitter share icons. They were identical in every way but content. Both messages fell between the Flesch-Kincaid Reading grade of 61% to 70% to enhance readability. They were also very similar in their emotionality. Results from the Linguistic Inquiry and Word Count (LIWC) showed that the positive emotional tone fell between 2.86 and 2.61 while the negative emotional tone was 0.0 for both messages.
Message development

Intervention group: message development

The intervention group received a message embedded with a religious metaphor on parent’s attitudes (Figure 1). This approach merges scientific facts and religious metaphors/references. The CMT initially guided the intervention message’s framing, entitled ‘Get your child into the Ark: HPV Vaccine.’ We selected our intervention message from religious scriptures. We chose a scriptural passage that emphasizes parents’ role in protecting their children from danger despite being close to God. To select the right story, we engaged with a Christian faith leader in our social network to generate a list of likely scriptural passages that meet these criteria. The faith leader enumerated a list of scriptural passages (e.g. how Job offered sacrifices to protect his children from harm) considered to meet the criterion. Finally, the Noah and the ark’s famous religious story was selected by the principal investigator [18,26].

The control group received an adapted version of the 2019 CDC Vaccine Information Statement (VIS) on HPV (CDC, 2019), which was only slightly altered for length (Figure 2). The CDC VIS was considered adequate control because the federal law requires that healthcare providers give a copy of the current CDC VIS to all patients before vaccination (Wang et al., 2019).

The selected story underscores the role of parents in taking personal responsibility for the safety of their children. According to this story, Noah was a God-fearing man who was close to God. He was warned by God about an imminent flood that would wipe out the earth. He was further instructed to build an ark that would protect whoever was in it from the flood. Noah built the ark and took the personal responsibility to make sure that his children/family got into the ark. Hence only his family members were protected from the flood. This story contradicts the attitude of parents who considered the HPV vaccination unnecessary for their children since God is close enough to protect their children from the harm caused by HPV. We mapped our religious story with CMT, thereby identifying HPV vaccination as the target domain while Noah’s story is the source. Specifically, Noah represents the parents of HPV vaccination-eligible children; the flood is the virus,
and the ark is the vaccination. Next, we embedded scientific information about HPV from the CDC VIS (e.g. the response efficacy of the vaccine to protect). Our conceptual framework guides this message’s framing approach. Improving the personal relevance and argument strength of the scripture-embedded HPV message among religious individuals can influence their attitude and vaccination intention.

The message was further examined for clarity, first by community members who share similar characteristics to the research participants. We independently engaged with eleven Christian parents of unvaccinated adolescents in our social networks for their feedback after presenting them with the initially developed message. Parents noted that the message should include information that readers should talk to their healthcare provider for more inquiry. Second, the message was also validated by our research team members – comprising a health communication expert, an internal medicine pediatrician, and a community health researcher. We refined the final message based on the feedback received.

**Trial procedures**

**Participants: eligibility criteria, recruitment, screening, and compensation**

We collected data using a cross-sectional online survey from September 28 to October 8, 2020. Participants were recruited through the Qualtrics Panel System (QPS; Qualtrics, Provo, Utah). Participants (using the QPS aggregator) were from diverse sources such as permission-based networks, member referrals, targeted email lists, and social media. We used the background profile information provided by registered members to randomly select potential participants who are likely to meet the study eligibility criteria. Potential participants received an email invite from Qualtrics, inviting them to take the screening questions to assess their eligibility. Detailed specifications about the study are excluded from the email to avoid selection biases.
Get your Child into the Ark: HPV Vaccine

When we hear the name Noah, we remember a man who saved his children from the great flood by bringing them into the ark for protection. Today, you can bring your children into the ark by getting them the HPV (Human Papillomavirus) vaccine.

HPVs are a group of more than 150 related viruses that cause both cancerous and non-cancerous tumors. HPV infection cannot be treated but can be prevented by a vaccine. HPV infections can cause certain types of cancers including:

- Genital cancers in men and women
- Head and neck cancer in men and women

However, the HPV vaccine prevents infection from the HPV types that cause over 90% of these cancers. HPV is spread through intimate skin-to-skin or sexual contact. HPV infections are so common that about 6 million people get infected each year.

The good news is that there is an Ark of Protection. HPV vaccine is routinely recommended for adolescents at 11 or 12 years of age to ensure they are protected before they are exposed to the virus. HPV vaccine may be given beginning at age 9. Most people older than 26 years will not benefit from HPV vaccination. The flood is the virus, the ark is the vaccine. You can get your children and teens out of the flood zone into the ark today. Still in doubt? Talk with your health care provider #ArkNotFlood #IChooseTheArk

For this study, we used a 2-step screening procedure to determine eligibility and ensure high data quality. First, participants were screened for being (i) over 18 years of age, (ii) parents or guardians of at least one child aged 11–17 years who has never been vaccinated for HPV, (iii) Christian, and (iv) residents of the United States. The QPS is configured to further enforce the eligibility screening.
criteria by activating the platform’s fraud detection settings to prevent deceit using IP addresses. Participants who passed the first screening stage proceeded to an online informed consent form, which they completed before proceeding with the survey.

As a second screening measure, we took a response validity check measure by subtracting the child’s reported age from the parents.’ Participants whose parent–child age difference showed that they were 8–14 years old at the time of
birth were excluded from the study. Finally, we embedded three instructional manipulation checks (i.e. participants were asked to skip some questions) into various survey sections to check participants’ attentiveness to the survey questions [27]. Institution Review Board (IRB) application was submitted on August 7, 2020, to the University of Illinois at Chicago IRB Board. All study activities were approved on September 11, 2020 (IRB Protocol #2020-1033).

The QPS respondents were compensated based on their preferences for different incentives such as Sky-Miles for airline rewards, retail customers’ points at their favorite retail outlet, gift cards, etc. It can be anticipated that participants are compensated with an amount worth less than $9.50.

**Randomization and blinding**

The Qualtrics survey system activated its ‘online experiment’ setting using its automatic ‘randomizer’ tool. Participants were randomly assigned (1:1) to one of the two experimental conditions without any restrictive criteria. Both the participants and the researchers were blinded to the participant’s groups. This approach eliminates selection and ascertainment biases by preventing the researcher from influencing the randomization process [28,29].

**Measures**

**Dependent Variable**

*Intention score change* was measured by subtracting the pre-intention from the post-intention scores. We measured HPV vaccination intention with a two-item measure ($\alpha = 0.90$; [30]) on a five-point Likert scale of ‘Definitely false’ to ‘Definitely true.’ Participants were asked if they (i) intended and (ii) wished to vaccinate their children against HPV in the next one year. The mean of the responses was analyzed, thereby ranging from 1 to 5.

**Sociodemographic, socioeconomic, health-related and religiosity-based covariates**

Participants reported sociodemographic characteristics such as age (parent
and child), sex (parent and child’s), race/ethnicity, and marital status (married, divorced, separated, widowed, or single). Socioeconomic status (SES) covariates included household income (<$20,000, $20,000 – <$35,000, $35,000 – <$50,000, $50,000 – <$75,000, and $75,000 or more), employment status, and education (less than high school, high school graduate, some college, college graduate or more). Health-related covariates were measured using two items that assessed HPV-related medical history and general vaccine beliefs [30]. Religiosity-based covariates included religious affiliation (Catholic, Baptist, Pentecostal, Protestant, Adventist, Jehovah’s Witness, Mormon) and three domains of religiosity- (i) organizational religiosity (2 items), (ii) non- organizational religiosity (1 item), and (iii) intrinsic religiosity (3 items) H. G. Koenig & Büssing, [31]).

Data analysis

The sample size calculation was completed with PowerUp, using the multivariate regression test procedure, assuming α = .05, power = 0.80, 50% randomization per arm, 5 covariates, an $R^2$ of 0.5, and a presumed sample size of 350 yielded a minimum detectable effect size of 0.2.

All analyses were conducted using SAS 9.4. We analyzed the randomized study condition as the primary independent variable: the CDC VIS on HPV message group compared with the scripture-embedded HPV message group. First, descriptive analysis was used to characterize the initial and final analytic sample (Figure 3). We examined the distribution of continuous variables by assessing the skewness and kurtosis. Values between $-2$ and 2 were considered to be normally distributed [32]. Next, we conducted a bivariate analysis to compare study arm differences in covariates (i.e. how the intervention and control groups differ in their distribution of the study covariates) using t-tests and chi-square tests. Significant covariates were included in the multivariate analysis.

To test the effectiveness of the scripture-embedded message on vaccination intention, we used multi- variate linear regression to test the relationship between the study arm (CDC and scripture-embedded group) and the primary outcome (intention change) while adjusting for the relevant covariates for which there were
significant study arm differences. Finally, we conducted a sensitivity analysis to test our model’s robustness to all theoretically important study covariates (sociodemographic, socioeconomics, and health-related factors).

Results

Response, participation, and retention rates

Between September 28 and October 8, 2020, we recruited 969 participants, 502 (52%) of whom were eligible. Among those eligible, 374 (75%) were randomized, and 342 (91%) were included in the final analytic sample. Of the total 160 excluded eligible participants, 110 failed the attention check questions, 20 did not complete the survey, and 30 participants failed the quality check measure by completing the survey before half the median time and reporting a parent–child age difference ≤15 years. We had a final sample of 167 participants in the CDC VIS message group (control) and 175 in the scripture-embedded message group (intervention). Figure 3 summarizes the selection, inclusion and exclusion criteria, randomization, and analytic sample.

Study sample characteristics study arm differences in covariates

Table 1 shows participant characteristics by study arm. Participants’ mean age was 41.33 ± 5.47 years for parents and 14.08 ± 2.04 years for child participants. The majority of the sample was male (54%). Most respondents had male children (66%), identified as White (87%), married (89%), had a college education or more (75%) and employed (83%). There were 221 (64%) participants with no personal belief against vaccines, and 317 (93%) had no history of HPV-related infections. Mean religiosity for organizational, non-organizational, and intrinsic religiosity were 3.09 ± 0.93, 3.46 ± 1.35, and 4.25 ± 0.78, respectively. The baseline means for intention to vaccinate a child against HPV in the next year were 2.94 ± 1.27 in the intervention group and 3.11 ± 1.37 in the control group with P = 0.25. Mean intention changes were 0.8 ± 0.98 in the intervention group and 0.49 ± 0.95 in the control group with P = 0.003. All continuous variables’ skewness ranged from −0.21 to 1.74, indicating that they were normally distributed [32]. The intervention group had fewer non-White participants than the control group (9% vs.
17%, \( P = 0.02 \)). Other study arm differences in covariates were non-significant (\( P = 0.08–0.99 \)). We included participants’ race as covariates in the models as control variables based on these findings.

**Study arm differences in outcomes**

Mean post-intention scores were 3.76 ± 1.39 in the intervention group and 3.65 ± 1.39 in the control group with \( P = 0.48 \). However, the intervention group reported a higher and statistically significant mean intention change (post – pre intention scores) than the control group (0.81 ± 0.99 vs. 0.46 ± 0.96, \( P = 0.002 \)) before adding any covariates. Table 2 shows the results of the multivariate regression models. After adjusting for race, the intervention group reported higher intention score change (post–pre vaccination intention) to vaccinate their children (\( \beta = 0.31 \), 95% confidence interval [95%CI] = 0.11–0.52; \( P = 0.003 \)). Additional analysis to test the sensitivity of our model to all study covariates showed a consistent higher vaccination intention score change among the group that received the scripture-embedded message compared to those who received the non-religious message (\( \beta = 0.33 \), 0.13–0.52; \( P = 0.001 \)).
Discussion

Religion plays a role in influencing HPV vaccination through attitudes, yet religiously framed messaging interventions promoting HPV vaccination among adolescents are rare. This is partly because of the complexity of contextualizing a secular health message within the religious framework to parents who practice religion in non-religious settings [33,34]. The complexity partly stems from the tension between science and religion. In a 2017 study by Carson and Flood, they carefully established that some Christian groups (such as Catholics) have refused
vaccination due to moral concerns but also argued that religious teachings can be used to justify why vaccination is a moral duty [35]. High levels of religiosity have mostly been associated with negative attitude toward scientific evidence [36,37]. Some parents have replaced the vaccine coping appraisal with religious coping, resulting in an anti-vaccination attitude [12,38]. Attitude has been shown to mediate the relationship between coping appraisal and vaccination [39]. Our study is one of the first to develop and test a scripture-embedded HPV vaccination message that addresses the attitude of parents who practice intrinsic religiosity and examines its impact on Christian parents’ vaccination intent using an RCT. Specifically, we targeted the attitude that it is unnecessary to take a personal responsibility of vaccinating one’s child since God is close enough to protect. Overall, there was a significant increase in HPV vaccination intention scores among parents who received the scripture-embedded HPV message compared to those who received the secular CDC message. The implication of these findings in real-world practice is that presenting religious parents with religiously framed HPV vaccination message may be more persuasive in getting them to vaccinate their children than presenting them secularly framed messages.
Our conceptual framework, drawn from the CMT, ELM, and TPB, strongly support the notion that parents who received our religious message may have perceived it to be personally relevant and have a more persuasive argument because it is rooted in a spiritual context. This persuasion can promote a positive change in the targeted attitude and an increased HPV vaccination intention. Our approach of merging scientific facts (the CDC message) and a religiously framed metaphor is very novel and may have provided a more robust argument and persuasion for HPV vaccination. This scriptural enrichment may have addressed the religion-scientific tension and appealed to participants’ rational and theological reasoning [40].

Table 1. Study sample characteristics by study arm (n = 342).

<table>
<thead>
<tr>
<th></th>
<th>Scripture-embedded message group (n=175)</th>
<th>CDC message group (n=167)</th>
<th>Overall</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent’s age</td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
<td>P-value</td>
</tr>
<tr>
<td></td>
<td>41.5 (5.24)</td>
<td>41.05 (5.69)</td>
<td>41.33 (5.47)</td>
<td>0.36</td>
</tr>
<tr>
<td>Child’s age</td>
<td>14.1 (2.02)</td>
<td>14.06 (2.08)</td>
<td>14.08 (2.04)</td>
<td>0.83</td>
</tr>
<tr>
<td>Organized religiosity</td>
<td>3.09 (0.93)</td>
<td>3.08 (0.92)</td>
<td>3.09 (0.93)</td>
<td>0.89</td>
</tr>
<tr>
<td>Non-organized religiosity</td>
<td>3.45 (1.35)</td>
<td>3.49 (1.35)</td>
<td>3.46 (1.35)</td>
<td>0.79</td>
</tr>
<tr>
<td>Intrinsic religiosity</td>
<td>4.28 (0.75)</td>
<td>4.22 (0.81)</td>
<td>4.25 (0.78)</td>
<td>0.49</td>
</tr>
<tr>
<td>Intention to vaccinate</td>
<td>2.94 (1.27)</td>
<td>3.11 (1.37)</td>
<td>3.09 (0.93)</td>
<td>0.25</td>
</tr>
<tr>
<td>Parent’s sex</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>0.66</td>
</tr>
<tr>
<td>Female</td>
<td>78 (45%)</td>
<td>79 (47%)</td>
<td>157 (46%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>97 (55%)</td>
<td>88 (53%)</td>
<td>185 (54%)</td>
<td></td>
</tr>
<tr>
<td>Child’s sex</td>
<td></td>
<td></td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>56 (32%)</td>
<td>61 (37%)</td>
<td>117 (34%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>119 (68%)</td>
<td>106 (63%)</td>
<td>225 (66%)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Married</td>
<td>0.89 (11%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>1.89 (89%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denomination</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catholic</td>
<td>0.44 (44%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Catholic</td>
<td>0.56 (56%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest education</td>
<td>0.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than college degree</td>
<td>0.21%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College degree or more</td>
<td>0.79%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $75,000</td>
<td>0.27 (27%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over $75,000</td>
<td>0.73 (73%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>0.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>0.83 (83%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed /retired/others</td>
<td>0.17%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal belief again vaccines in general (No)</td>
<td>0.62%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of HPV-related infections (No)</td>
<td>0.92%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Multivariate linear regression on HPV vaccination intention change (time 2-time 1).

<table>
<thead>
<tr>
<th>Primary analysis</th>
<th>β (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition (ref = CDC message group)</td>
<td>0.31 (0.11–0.52)</td>
<td>0.003</td>
</tr>
<tr>
<td>Parent’s age</td>
<td>–0.04</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Child’s age</td>
<td>0.02</td>
<td>0.34</td>
</tr>
<tr>
<td>Parent’s Sex (ref = Female)</td>
<td>0.35</td>
<td>0.002</td>
</tr>
</tbody>
</table>
The use of metaphor is also noteworthy. The use of scripturally framed analogy offers a unique opportunity for promoting vaccination. The use of analogy is a common occurrence in religious settings. Many of the holy books used today were written many years ago and may not have a literal response to all the current life events, such as deciding to get an HPV vaccination. Therefore, religious individuals are used to drawing inferences from the non-literal texts to determine what to do [40]. The skill of sense-making from scriptural passages, coupled with selecting an appropriate scriptural story, can be leveraged for future message framing interventions targeting vaccination attitudes among religious groups.

Additionally, many faith-based interventions have always relied on center-
based interventions to address HPV vaccination resistance. This approach is often limited in reach as it excludes members who do not participate in group religiosity. It has also varied in intervention effect because its effectiveness is based on trust in the faith leaders coordinating the intervention delivery [14–17]. However, the use of religiously framed messages drawn from a religious book that is shared across denominations can reach parents who do not attend religious settings. This is an advantage that a message-framing HPV intervention has compared to venue-based interventions.

Future public health message-framing interventions seeking to promote HPV vaccination could utilize this messaging approach among religious individuals with various message delivery modes such as text, audiovisuals, etc. Future studies should consider exploring more religious analogies that can be relevantly fitted into secular themes and test the potential mediating variables responsible for the outcome change as hypothesized in our conceptual framework. It is also important to explore how this methodology can be applied to other health conditions where religious parents are disproportionately affected, such as pap smear testing [41].

Our study has several limitations. First, our sample only included Christian parents; therefore, our findings may not be generalizable to other religious groups. However, our study is an effectiveness study and not intended to be generalized. Second, we did not measure the actual vaccination uptake among participants. Although intention has been identified as a proximal predictor of behavior [20], it does not always translate into actual behavior. More studies are needed to test the effectiveness of a religiously framed messaging intervention on actual HPV vaccination behavior. Third, participants predominantly identified as White and were distributed evenly across the study arm. We accounted for this by controlling for the race variable in the multivariate analysis. Given racial differences in vaccination hesitancy, future research should explore specific faith-based interventions that may be relevant to these populations. Nevertheless, our study findings may not be generalizable and causal inferences regarding intervention effects should be treated carefully.
Conclusion

This study demonstrated that religious parents who received a scripture-embedded HPV vaccination message addressing their attitude reported a higher first-dose HPV vaccination intention for their children than parents who received a secularly framed HPV vaccination message. Our study warrants further investigation to examine whether this approach would increase the actual HPV vaccination uptake among religious parents and across religious types.

Ethics Approval

This study has been reviewed and approved by the institutional review board (IRB) of the University of Illinois at Chicago and has been determined to be in compliance with ethical standards for research involving human subjects on September 11, 2020 (IRB Protocol #2020-1033). Informed consent was obtained from all participants before their involvement in the study.

Declaration of conflicting interests

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