2018

Strength of belief: Religious commitment, knowledge, and HPVvaccination adherence

Wendy C. Birmingham
Brigham Young University - Provo

Janelle L. B. Macintosh
Brigham Young University - Provo, janelle-macintosh@byu.edu

Allison A. Vaughn

Tyler C. Graff
Brigham Young University, tygraff@gmail.com

Received: 11 October 2018 | Revised: 18 March 2019 | Accepted: 23 March 2019

DOI: 10.1002/pon.5071

PAPER

WILEY

Strength of belief: Religious commitment, knowledge, and HPV vaccination adherence

Wendy C. Birmingham[1] | Janelle L.B. Macintosh[2] | Allison A. Vaughn[3] | Tyler C. Graff[1]

[1] Department of Psychology, Brigham Young University, Provo, Utah

[2] College of Nursing, Brigham Young University, Provo, Utah

[3] Department of Psychology, San Diego State University, San Diego, California

Correspondence
Wendy C. Birmingham, Department of Psychology, Brigham Young University, 1054 KMBL, Provo, UT.
Email: wendy_birmingham@byu.edu

Abstract

Objective: Human papillomavirus (HPV) infects millions of men and women annually and is a substantial contributing factor in many cancers including oral, penile, anal, and cervical. Vaccination can reduce risk but adherence nationwide and, particularly in highly religious states, is suboptimal. Religious principles of abstinence before marriage and total fidelity following marriage may create a belief of protection through adherence to religious guidelines. However, while one partner may remain monogamous, one cannot be assured of their partner's behavior both before and after marriage. These misconceptions may create a barrier to religious youth's adherence to vaccine recommendations.

Methods: We sampled single young adults, age 18 to 25 years, from a Christian university classified as highly religious and a university not categorized as highly religious.

Results: Highly religious young adults demonstrated low knowledge of HPV and HPV vaccination. High religious beliefs were associated with lower HPV vaccination adherence.

Conclusions: Understanding the role religious beliefs have on vaccine adherence can help in the creation of campaigns that specifically address these issues. Campaigns to increase vaccination should address misconceptions of religious youth's feelings of imperviousness to sexually transmitted diseases.

KEYWORDS

attitudes, cancer, intentions, oncology, religious beliefs

1 | BACKGROUND

Approximately 79 million Americans are currently infected with human papillomavirus (HPV), and another 14 million become newly infected each year.[1] HPV is the most commonly sexually transmitted infection (STI)[2] and is so common that without vaccination, most sexually active adults will be infected at some point in their life.[1] More than 40 types of HPV are transmitted via direct sexual contact, and about a dozen are classified as high-risk types. Low-risk types are associated with genital warts, and recurrent respiratory papillomatosis, but rarely cause cancer.[3] While the immune system often clears the infection, persistent infection with high-risk HPV types can progress to cancer or precancerous lesions of the oral cavity, oropharynx, vulva, vagina, cervix, penis, and anus.[4-6]

Women bear a disproportionate burden of oncogenic HPV infection. Approximately 13 000 cervical cancer cases are diagnosed every year, and more than 4000 women will die from cervical cancer.[7] High-risk HPV types 16, 18, 31, 33, 45, 52, and 58 are responsible for 90%

All data files will be available from the OSF database DOI 10.17605/OSF.IO/DME7Q. Open Science Foundation; Birmingham, W C, Macintosh, J L B, Vaughn, A, Graff, T C.; 2019; Strength of belief: Religious commitment, knowledge, and HPV vaccination adherence; Open Science Foundation; DOI 10.17605/OSF.IO/DME7Q

of cervical cancer worldwide.[8] While women who begin having sex at an early age or who have many partners are at greater risk for HPV infection, a woman can be infected with HPV even if she has only had one sexual partner.[9] Risk is influenced by other factors such as a high number of live childbirths[10] and long-term use of oral contraceptives.[11]

Women are not alone in carrying the burden of diseases linked to HPV. Regardless of gender, HPV has been linked to cancer in the oral cavity, head, and neck. Approximately 60% of oropharyngeal cancers are linked to HPV. Indeed, HPV is associated with as much as 87% of anal cancers in men and 40% to 50% of penile cancers. About 10% of larynx cancers are associated with HPV. Additionally, genital warts, while not life threatening, can cause burning, bleeding, pain, embarrassment, and decreased self-esteem. Approximately 90% of genital warts cases can be linked to HPV.[12]

HPV vaccination has been available to adolescent girls and women since 2006. Current guidelines from the US Advisory Committee on Immunization Practices (ACIP) recommended routine vaccination for all youth at age 11 or 12 years, but vaccinations may be given as early as age 9 years.[13] The inclusion of boys and men in the vaccination program provides additional direct and indirect benefits by lowering the incidence of disease and by further reducing the prevalence of HPV infection in the population. Vaccinating boys and men would decrease the cumulative mean number of cervical cancers and cancer deaths.[14] Studies show that the largest reduction of HPV-related diseases was accomplished by vaccinating both sexes.[14] Vaccination is very effective in preventing infection and remains the only preventive measure against most HPV-related disorders.[15]

Despite the substantial benefits of HPV vaccination, many parents still choose not to vaccinate, and uptake has been suboptimal. In 2016, the national rate for full vaccination coverage was less than half (43.4% [49.5% for females and 37.5% for males]).[16] States with large populations who identify as highly religious are far below the national average for HPV vaccination, ranking in the lowest quintile. For example, Mississippi was identified in the 2011 Gallup poll as the most religious US state with 77% of residents reporting themselves as "very religious"[17] with an up-to-date rate of 29.1% (girls at 33.9% and boys at 24.5%). In a 2017 Gallup poll,[18] most Utahans (74%) rated themselves "highly religious," yet Utah ranked 46th in the nation as up to date with vaccination, with only 30.5% of adolescents up to date on vaccination (national average 43.4%). Of those, 41.3% were girls and 20.3% were boys (national average 49.5% and 37.5%).[16,19]

1.1 | Rationale for nonadherence

Common reasons for nonadherence in children and pre-adolescents include parental lack of knowledge of both HPV and HPV vaccination, a belief that vaccination condones or promotes early sexual behavior[20] and parental beliefs that the vaccination is unnecessary, as their child is not sexually active—despite evidence that premarital sex is highly normative behavior[21] and data from 2002 showing almost all Americans have sex before marrying. Parental awareness, knowledge, and beliefs predict HPV vaccine uptake in children and adolescents.[22] Prior studies have shown church attendance and church affiliation as common reasons for nonadherence.[23] These reasons could be amplified by a strong religious commitment to the faith and the faith's requirement for abstinence before marriage and complete sexual fidelity to the spouse, thus creating the belief that vaccination against an STI is unnecessary.

Church affiliation and attendance alone may not represent strong religious beliefs that may be captured more effectively by assessing one's overarching religious commitment. Worthington et al[24] theorized that highly religiously committed people tend to assess the world through religious dimensions on the basis of personal religious beliefs, in essence, the degree to which an individual adheres to and uses in daily life their religious values, beliefs, and practices.

A 2017 Gallop poll[18] showed three-quarters of Americans identify as Christian with 37% rating themselves as highly religious. Most Christian religions place strong emphasis on sexual chastity (eg, abstinence before marriage and faithfulness after marriage). For example, Catholics teach that sex has a purpose and sexual relations outside of marriage are contrary to the purpose of sex. Mormons also place high value on sexual chastity, and participation in church ordnances often requires complete sexual chastity. Other Christian religions such as Baptist, Methodist, and Presbyterian also have similar expectations for sexual behavior. The idea that vaccination condones or promotes sexual behavior, along with a strong religious commitment to adhere to religious values of abstinence and marital fidelity may result in parental decisions not to vaccinate their children.

While parents play a key role in facilitating HPV vaccination in the early teenage years, young adults can make the decision to vaccinate after the age of 18 years. All young women and young men who have been inadequately vaccinated can receive the vaccine up to age 26 years.[25]

Young adults may share the same strong religious commitment to adhere to church doctrine, believing they are immune to HPV and other STIs because of chastity beliefs, and their assumption that their future partner believes the same. It is important to address this misconception. While one may remain monogamous because of religious beliefs, one cannot be assured of a spouse's behavior both before and/or after marriage. Individuals may not always be truthful with a soon-to-be spouse regarding their sexual history, especially if prior behavior has violated religious requirements.

While religious beliefs require faithfulness following marriage, recent studies have found that for 33% of married couples, one or both spouses have engaged in either sexual or emotional infidelity.[25] Additionally, an abstinent adult may marry a divorced individual who, through no fault of his or her own, was infected by a previous spouse. This applies to both heterosexual individuals and to men who have sex with men. The divorced spouse, while remaining true to their beliefs, can now infect the new spouse, despite both remaining abstinent before marriage and faithful after marriage. Further, while a person may believe and act upon their values to remain celibate until marriage, and monogamous following, there is no assurance that they will

not be the victim of a sexual assault in their lifetime. It would add distress if a person was diagnosed with an HPV-related cancer or even lost his or her life to cancer associated with HPV for an act that was not chosen or over which there was no control.

Because of the belief in immunity associated with abstinence, young adults with strong religious beliefs may simply not have sought out information or education about the need for HPV vaccination.

1.2 | Study aims and hypotheses

Prior studies have examined the influence of religion on vaccination acceptance via church attendance and religious affiliation but most focused on parental approval of vaccination.[23,26] Less focus has been on young adults and the influence of strong religious commitment (rather than church attendance or affiliation) on HPV vaccination decision making. The purpose of the current study is to examine awareness and knowledge of HPV and HPV vaccination, and vaccination uptake among those young adults still eligible to vaccinate, and to explore how strong religious commitment contributes to decision making. While certainly other religious groups may have expectations of chastity (eg, Islam and Judaism), for the purposes of this paper, we focus specifically on Christian young adults.

We expect (1) strong religious commitment will be associated with lower knowledge of, and greater misperceptions of, HPV and HPV vaccination. We expect (2) lower knowledge of, and greater misconceptions of, HPV and HPV vaccination will be associated with lower levels of adherence. Finally, we predict (3) strong religious commitment will be associated with lower vaccination adherence in college-aged young adults.

2 | METHOD

2.1 | Participants

Eligible participants for this study were young adults between the ages of 18 and 26 years.

2.2 | Procedure

Participants were recruited from two US universities: one classified as a highly religious Christian university and one not. Each university offered research credit hours for student participation (ie, SONA). Students who logged into the university's SONA system, were within the eligible age group, and chose our study were given a link where they were informed that moving forward indicated consent. Each then completed an online survey consisting of 45 questions that addressed general HPV/HPV vaccine knowledge, and adherence, as well as religious commitment. Participants received SONA credit and could choose to be entered into a drawing for one of 20 $50 Visa gift cards. This study was approved by the university Institutional Review Board (protocol no. E17215) and complies with all local, state, and federal ethics laws.

2.3 | Measures

A demographic questionnaire assessed age, sex, race, income, education, state of residence, marital status, insurance coverage, and occupational status (Table S1). Variables assessing knowledge and adherence were constructed from previous HPV vaccine research.[27,28] HPV knowledge was assessed through *yes/no/do not know* items such as "Do you think HPV infection among women is rare?" Adherence questions included, "How many shots were required for your series of vaccinations?" and "How many [of the required] shots have you had?"

Religious commitment was assessed using the Religious Commitment Inventory-10 (RCI-10),[24] which assesses religious beliefs with statements such as "My religious beliefs lie behind my whole approach to life." Participants responded to the 10 questions on a 1- (*not at all true of me*) to 5- (*totally true of me*) point Likert scale. The RCI-10 demonstrates high construct validity (ie, concurrent, criterion, and discriminant) and reliability (ie, 3-week and 5-month test-retest reliabilities ranging from 0.83 to 0.87; internal consistency/coefficient α's ranging from 0.87 to 0.98) as evidenced by a series of six studies comprising more than 2000 participants. In the current study, the RCI-10 demonstrated high internal consistency reliability ($\alpha = 0.96$). Scoring is a simple summation of all items, with higher scores indicating greater religious commitment. Worthington and Wade suggest the normative mean for a general sample of US adults is 26 with a standard deviation (SD) of 12. Thus, an RCI-10 score of 38 or higher would constitute a person to be highly religiously committed. As suggested, we used one SD above and below a score of 26 as our cutoffs for high, moderate, and low.

2.4 | Statistical analysis

We used SPSS to examine distributions and frequencies and to conduct linear and logistic regression analysis. For the purpose of analysis, the knowledge measure was recoded into a binary indicator where *I do not know* was coded with the incorrect answer. Religious commitment was scored with the scale-indicated cutoffs, creating religious commitment as high, moderate, or low.

3 | RESULTS

A total of 1668 young adults logged in to take the survey. Of those, 1631 young adults completed the questionnaire. Most respondents were students at the highly religious Christian university (n = 1341; 82.2%) with 17.8% (n = 290) from the non-Christian university. Most were female (n = 1104; 67.7%), with 64.5% (n = 865) of the Christian university sample female and 82.4% (n = 239) of the non-Christian university sample female. See Table S1 for demographic information.

3.1 | Religious beliefs

We examined religious commitment per the RC-10. Our analysis showed 90.8% (n = 1482) identified as Christian. This is much higher

than the national average of approximately 75%, indicating that our sample was highly Christian. Most classified as highly religiously committed (71.6%; n = 1167), while 20.7% (n = 338) were classified as moderately religiously committed. This too is higher than the national average of 37% who report they are highly religious (Gallup poll 2017) indicating that our sample was highly religious.

3.2 | Knowledge

Over one-quarter of the young adults (n = 442; 27.1%) in our study had not heard of HPV. Of those who *had* heard of HPV (n = 1189), nearly one-quarter (n = 275; 23.2%) reported no knowledge of the HPV vaccination. Of those who had heard of HPV, almost half (n = 453; 46.5%) did not know the prevalence of HPV in women; and over half (n = 661; 55.6%) did not know the prevalence of HPV in men. Almost half (n = 507; 42.6%) were unaware that HPV could cause cervical cancer, and 32.1% (n = 382) did not agree HPV vaccine could protect against cervical cancer.

3.3 | Adherence

Most participants reported not having received any shots in the HPV vaccination series (n = 1161; 71.2%). Participants provided reasons for not getting the shot and were asked to report all that applied. Of those who did not receive any shots in the series, 479 (41%) indicated they had never heard of the vaccine, and 454 (39%) did not know enough about the vaccine. Nearly one-third (n = 378; 32.5%) reported they did not vaccinate because they were not having sex yet. In addition to these answer options, participants could also express their own reasons for not vaccinating through open-ended questions. Of those that indicated they had not been vaccinated, 83 included a response providing their rational for this choice. A total of six themes emerged from these qualitative responses including currently abstinent or already married, with the expectation that the spouse would also be abstinent; not sure if ever vaccinated; vaccination was actively discouraged; plan to receive the vaccination soon; do not like shots or pain; attitude against vaccinations generally or HPV vaccination specifically. See Table S2 for representative quotes.

Of those who reported having at least one shot in the series (n = 463; 28.4%), 60 (13%) reported receiving one shot, 201 (43.4%) received two shots, and 200 (43.2%) had received all three shots in the series. Of those who received at least one shot, 80 (17.3%) reported doing so because their doctor or nurse recommended they should do so, 39 (8.4%) did so to protect themselves against cancer, and 12 (2.6%) did so to protect their partner against cancer. Fifteen (3.2%) and nine (1.9%) did so to protect themselves and their partner from genital warts, respectively. Four percent reported doing so to protect their future spouse's overall health (n = 20). To put this in perspective, 200 of the entire sample of 1631 young adults or 12.2% had completed the series.

3.4 | Religion and knowledge

Binomial logistic regression was performed to ascertain the effects of religious commitment on knowledge of HPV, HPV vaccination, and cancers associated with HPV (H1). High religious commitment was associated with lower knowledge of both HPV (χ^2 (1) = 15.67, $P < 0.001$) and HPV vaccination (χ^2 (1) = 22.28, $P < 0.001$). High religious commitment was also associated with lower knowledge of the prevalence of HPV in women (χ^2 (1) = 14.67, $P < 0.001$) and men (χ^2 (1) = 25.3, $P < 0.001$) and lower knowledge of the associations of HPV with herpes (χ^2 (1) = 4.35, $P = 0.03$), genital warts (χ^2 (1) = 3.67, $P = 0.04$), or oral cancer (χ^2 (1) = 3.07, $P < 0.08$). Conversely, high religious commitment was not associated with knowledge of the association between HPV and cervical cancer (χ^2 (1) = 3.07, $P = 0.08$), oral cancer (χ^2 (1) = 0.091, $P = 0.76$), or anal cancer (χ^2 (1) = 1.71, $P = 0.185$).

High religious commitment was not associated with knowledge of HPV vaccination protection against cervical cancer (χ^2 (1) = 2.79, $P = 0.097$), oral cancer (χ^2 (1) = 1.62, $P = 0.20$), anal cancer (χ^2 (1) = 1.03, $P = 0.32$), or genital warts (χ^2 (1) = 0.827, $P = 0.36$). Our prediction that highly religiously committed young adults with lower knowledge and greater misconceptions would exhibit lower adherence was partially supported.

3.5 | Religion, knowledge, and HPV vaccination adherence

An examination of the effect of knowledge on vaccination adherence (H2) found lack of knowledge of HPV and HPV vaccination associated with vaccination (χ^2 (1) = 138.88, $P < 0.001$; χ^2 (1) = 269.94, $P < 0.001$) such that those with less knowledge did not vaccinate. Lack of knowledge regarding HPV prevalence in women (χ^2 (1) = 62.83, $P < 0.001$), and men (χ^2 (1) = 30.41, $P < 0.001$), and lack of knowledge of the link between HPV and cervical cancer (χ^2 (1) = 62.36, $P < 0.001$) were associated with lack of vaccination. Those who lacked knowledge of HPV had 1.65 higher odds of not vaccinating than those who were more knowledgeable (OR = 1.65; 95% CI, 1.15-2.35; $P < 0.001$). Our prediction that knowledge would be associated with vaccination adherence was supported.

Vaccination adherence and religious commitment (H3) were statistically significant (χ^2 (1) = 57.59, $P < 0.001$) such that high religious commitment was associated with lack of vaccination. Those who were lower in religious commitment had 1.98 higher odds of vaccinating than those who were higher in religious commitment (OR = 1.98; 95% CI, 1.639-2.30; $P < 0.001$). High religious commitment was not associated with completion of the series (χ^2 (1) = 2.54, $P = 0.11$). Our prediction that religious beliefs would be associated with vaccination adherence was partially supported.

3.6 | Ancillary analysis

Ancillary analysis showed no association between income, parental income, and insurance status on adherence. Gender was associated

with knowledge and outcome such that women knew more about HPV and HPV vaccination and were more adherent. See Table S3 for statistical results. Church attendance was significantly associated with vaccination adherence (χ^2 (1) = 81.244, P < 0.001) such that those who attended church more often were less likely to be vaccine adherent. We conducted a hierarchical logistic regression to assess the increase in variation explained by the addition of an interaction term between church attendance and religious commitment to a main effects model. Church attendance did not moderate the effect of religious commitment on vaccination adherence (b = −0.072, SE = 0.65, P = 0.270; OR = 0.93).

4 | CONCLUSION

Knowledge of both HPV and HPV vaccination was low in our sample of highly religious young adults, with 27.1% reporting no knowledge about HPV, and of those who did, nearly one-quarter had no knowledge of vaccines. Most did not know HPV was not rare in men, and almost half did not know that HPV was not rare in women. Nearly half were unaware of the association between HPV and cervical cancer. Importantly, we found high religious commitment significantly associated with lower knowledge of HPV, HPV vaccination, the contribution of HPV to cancer, and the prevalence of HPV in both men and women in society. Vaccination adherence was low among these religious young adults, with more than 71% not receiving any shots in the series, and only 12.2% of the entire sample completing the series. This is far below the national average, demonstrating the role of religious commitment to vaccination acceptance, as high religious commitment was significantly associated with low vaccination adherence.

Barriers to vaccination include lack of knowledge about HPV and the diseases caused by HPV. Barriers also include a parental belief of the importance of children's abstinence, and a parental belief that vaccination would lead to promiscuous behavior, or that vaccinating would condone such behavior.[29,30] While parents are responsible for vaccination of children, these children can make their own choices once they reach 18 years of age, as the vaccine is recommended for women up to age 26 years, and for men until age 21 years, and up to age 26 years for men who have sex with men. However, parental decision not to vaccinate may sway young adults away from vaccination as parental attitudes are often reflected in the behavior and attitudes of their children.[31] Membership in a religious group that mandates clear and stringent rules regarding sexual behavior can also influence the behavior of young adults. If young adults view sexual abstinence as protective against STIs, they may believe that only those who choose to be sexually active prior to marriage need to consider vaccination. Indeed, young adults who perceived their relationship as monogamous believed themselves at low risk and that only those who were "promiscuous" were at high risk.[32] Our qualitative data showed young adults expressing similar beliefs: that their own abstinence and their partners' reported abstinence virtually eliminate their risk, while "sleeping around" puts one at high risk.

It is informative that high religious commitment was associated with a lack of knowledge regarding HPV. If one has a belief that they are at virtually no risk from STIs via abstinence and fidelity, there may be no incentive to seek out HPV information. There are opportunities for teens and young adults to become informed about HPV. Having grown up in a time of easy internet access, teenagers and young adults can surf the web with ease; thus, finding information related to HPV would not be challenging. The internet is the second most popular source of information, after health care providers, for information regarding HPV.[33] Private surfing permits adolescents, teens, and young adults to search for information that otherwise might not be acceptable by family and church members. Harvey et al[34] found many of the questions posed by teenagers on physician-operated websites were related to sexual health. A quick search of "human papillomavirus" on Google by the authors yielded 18 pages of results.

Young adults in our study often incorrectly identified cancers associated with HPV, and most were unaware of the prevalence of HPV in society. Of particular concern, almost half of the young adults in our study were unaware that HPV causes cervical cancer even though religious commitment was not significantly associated with this lack of awareness. It is important to point out that this lack of knowledge can be perilous. Cervical cancer remains one of the most common causes of cancer deaths in women, globally,[35] and HPV accounts for 90% of all cervical cancers. To be uninformed is to be vulnerable. Information can be found with little searching: US news organizations have consistently reported on the status and efficacy of the HPV vaccine and the link between HPV and cervical cancer.[36] With the plethora of information on the internet and in news organizations, being unaware of HPV and the contribution of HPV to cervical cancer could be assumed to be due to a conscious choice not to seek out information or to ignore information that may seem not to apply.

It is also informative, but not surprising, that women were more informed of HPV and HPV vaccination, and more likely to be adherent than young men, although both men and women showed low levels of knowledge and low adherence. Much of the information on HPV and HPV vaccination has been directed toward parents of female adolescents. Our results indicate the need to direct more information to parents emphasizing the health consequences of HPV and the benefits of vaccination for their sons as well as their daughters.

Strong religious commitment was not associated with knowledge of HPV-related oral and anal cancers, or herpes, and this is not unexpected. Most individuals, even those at increased risk (eg, men who have sex with men), are largely uninformed and unaware of the link between HPV and anal cancer[37] and oral cancers.[38,39] Thus, it may not be religious commitment that contribute to a lack of knowledge but a society-wide lack of knowledge.

Although religious commitment was associated with series initiation, it was not associated with finishing the series. In other words, overcoming the religious barrier and obtaining the first shot in the series were most important. Our findings suggest that religious commitment can contribute to whether one has sufficient knowledge of HPV and HPV vaccination and whether one chooses to seek information and receives at least one vaccine. Prior studies have

assessed religious affiliation and church attendance on vaccination acceptance,[23,26] but our study addresses a significant gap in the literature by examining how strong religious commitment in young adults who are still in the age bracket to vaccinate determines vaccination decision.

4.1 | Study limitations

It is important to address the limitations of our study. Our participants were mostly white and Christian. Other religious affiliations may view religious commitment in ways that are less associated with sexual abstinence. Most of our sample identified as either highly religious (71.6%) or moderately religious (20.7%), with only 7.7% identifying as low in religious beliefs; thus, our sample may not generalize to populations with greater levels of individuals lower in religious belief. We did not assess whether parental decisions not to vaccinate influenced these young adults' decision, which may be important for future studies to examine. Furthermore, while the majority of our sample reported an income of less than $10 000, they also reported coverage by private or employer-sponsored health insurance suggesting some level of financial dependence on their parents, putting them into a middle- or high-socioeconomic class. People from lower socioeconomic classes (ie, those without insurance) may not have the same access to HPV vaccines. Future research should aim to replicate these findings in more diverse samples with regard to race/ethnicity, religious identity, and socioeconomic status. While these are limitations, our large sample size lends strength to our findings.

4.2 | Clinical implications

Our results show that highly religiously committed Christian young adults would benefit from targeted educational campaigns that address the risks of HPV and cancer even to those who maintain their religious standards of abstinence and fidelity. Public officials seeking to increase vaccination acceptance in areas with highly religiously committed individuals need to develop ways to get these messages to people who may not be seeking information, or who might ignore information, believing it does not apply to them. A first step is to seek cooperation from influential church leaders to address the misconceptions of complete immunity.

CONFLICT OF INTEREST

All other authors report no conflict of interest.

ORCID

Wendy C. Birmingham https://orcid.org/0000-0002-8908-206X

REFERENCES

1. Meites EK, Kempe A, Markowitz LE. Use of a 2-dose schedule for human papillomavirus vaccination—updated recommendations of the advisory committee on immunization practices. *MMWR*. 2016;65(49):1405-1408. Available from: https://doi.org/10.15585/mmwr.mm6549a5
2. Satterwhite CL, Torrone E, Meites E, et al. Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2008. *Sex Transm Dis*. 2013;40(3):187-193.
3. Joura EA, Giuliano AR, Iversen OE, et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *N Engl J Med*. 2015;372(8):711-723.
4. ACS. *Cancer Facts & Figures 2016*. Atlanta: American Cancer Society; 2017.
5. Grce M, Mravak-Stipetic M. Human papillomavirus-associated diseases. *Clin Dermatol*. 2014;32(2):253-258.
6. Clifford GM, Tully S, Franceschi S. Carcinogenicity of human papillomavirus (HPV) types in HIV-positive women: a meta-analysis from HPV infection to cervical cancer. *Clin Infect Dis*. 2017;64(9):1228-1235.
7. ACS. *Cancer Facts & Figures 2016*. Atlanta: American Cancer Society; 2016.
8. National Cancer Institute NIoH. Gardasil 9 vaccine protects against additional HPV types. [Available from: https://www.cancer.gov/types/cervical/research/gardasil9-prevents-more-HPV-types.
9. CDC. Genital HPV infection—CDC Fact Sheet 2017 Accessed September 2018. Available from: https://www.cdc.gov/std/hpv/hpv-Fs-July-2017.pdf.
10. CDC. Increased use of colorectal cancer tests—United States, 2002 and 2004. *MMWR Morb Mortal Wkly Rep*. 2006;55(11):308-311.
11. La Vecchia C, Boccia S. Oral contraceptives, human papillomavirus and cervical cancer. *Eur J Cancer Prev*. 2014;23(2):110-112.
12. Giuliano AR, Tortolero-Luna G, Ferrer E, et al. Epidemiology of human papillomavirus infection in men, cancers other than cervical and benign conditions. *Vaccine*. 2008;26(Suppl 10):K17-K28.
13. CDC. HPV vaccine recommendation 2018 [Available from: https://www.cdc.gov/vaccines/vpd/hpv/hcp/recommendations.html
14. Elbasha EH, Dasbach EJ. Impact of vaccinating boys and men against HPV in the United States. *Vaccine*. 2010;28(42):6858-6867.
15. Charo RA. Politics, parents, and prophylaxis—mandating HPV vaccination in the United States. *N Engl J Med*. 2007;356(19):1905-1908.
16. Walker TY, Elam-Evans LD, Singleton JA, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2016. *MMWR Morb Mortal Wkly Rep*. 2017;66(33):874-882 pp.]. Available from: https://doi.org/10.15585/mmwr.mm6633a2.
17. Lipka M, Wormald B. How religious is your state? Pew Internet & American Life Project [Internet]. 2016 February 29, 2016. Available from: http://www.pewresearch.org/fact-tank/2016/02/29/how-religious-is-your-state/.
18. Newport F. 2017 Update on Americans and religion 2017 [Available from: https://news.gallup.com/poll/224642/2017-update-americans-religion.aspx.
19. Health UDo. Utah health status updated: sexually transmitted diseases 2017 [Available from: https://ibis.health.utah.gov/pdf/opha/publication/hsu/2017/1708_STDs.pdf.
20. Reiter PL, Katz ML, Paskett ED. Correlates of HPV vaccination among adolescent females from Appalachia and reasons why their parents do not intend to vaccinate. *Vaccine*. 2013;31(31):3121-3125.
21. Finer LB. Trends in premarital sex in the United States, 1954-2003. *Public Health Rep* (Washington, DC: 1974. 2007;122(1):73-78.
22. Nonzee NJ, Baldwin SB, Cui Y, Singhal R. Disparities in parental human papillomavirus (HPV) vaccine awareness and uptake among adolescents. *Vaccine*. 2018;36(10):1243-1247.

23. Shelton RC, Snavely AC, De Jesus M, Othus MD, Allen JD. HPV vaccine decision-making and acceptance: does religion play a role? *J Relig Health*. 2013;52(4):1120-1130.
24. Worthington EL Jr, Wade NG, Hight TL, et al. The Religious Commitment Inventory-10: development, refinement, and validation of a brief scale for research and counseling. *J Couns Psychol*. 2003;50(1):84-96.
25. Trustify. Infidelity Statistics 2017: Why, when, and how people stray 2017, February 1 [Available from: https://www.trustify.info/blog/infidelity-statistics-2017#article
26. Reynolds D. Religiosity and parental acceptance of human papillomavirus (HPV) vaccine in 9-18 year-old girls. *J Christ Nurs*. 2014;31(3):172-177.
27. Guerry SL, De Rosa CJ, Markowitz LE, et al. Human papillomavirus vaccine initiation among adolescent girls in high-risk communities. *Vaccine*. 2011;29(12):2235-2241.
28. McRee AL, Brewer NT, Reiter PL, Gottlieb SL, Smith JS. The Carolina HPV immunization attitudes and beliefs scale (CHIAS): scale development and associations with intentions to vaccinate. *Sex Transm Dis*. 2010;37(4):234-239.
29. Maness SB, Reitzel LR, Watkins KL, McNeill LH. HPV awareness, knowledge and vaccination attitudes among church-going African-American women. *Am J Health Behav*. 2016;40(6):771-778.
30. Grandahl M, Oscarsson M, Stenhammar C, Neveus T, Westerling R, Tyden T. Not the right time: why parents refuse to let their daughters have the human papillomavirus vaccination. *Acta Paediatr*. 2014;103(4):436-441.
31. Thornton A, Camburn D. The influence of the family on premarital sexual attitudes and behavior. *Demography*. 1987;24(3):323-340.
32. Hendry M, Lewis R, Clements A, Damery S, Wilkinson C. "HPV? Never heard of it!": a systematic review of girls' and parents' information needs, views and preferences about human papillomavirus vaccination. *Vaccine*. 2013;31(45):5152-5167.
33. Patel PR, Berenson AB. The internet's role in HPV vaccine education. *Hum Vaccin Immunother*. 2014;10(5):1166-1170.
34. Harvey KJ, Brown B, Crawford P, Macfarlane A, McPherson A. 'Am I normal?' Teenagers, sexual health and the internet. *Soc Sci Med*. 2007;65(4):771-781.
35. Torre LA, Siegel RL, Ward EM, Jemal A. Global cancer incidence and mortality rates and trends—an update. *Cancer Epidemiol Biomarkers Prev*. 2016;25(1):16-27.
36. Calloway C, Jorgensen CM, Saraiya M, Tsui J. A content analysis of news coverage of the HPV vaccine by U.S. newspapers, January 2002-June 2005. *J Womens Health (Larchmt)*. 2006;15(7):803-809.
37. Fenkl EA, Jones SG, Schochet E, Johnson P. HPV and anal cancer knowledge among HIV-infected and non-infected men who have sex with men. *LGBT health*. 2015;3(1):42-48.
38. McBride KR, Singh S. Predictors of adults' knowledge and awareness of HPV, HPV-associated cancers, and the HPV vaccine: implications for health education. *Health Educ Behav*. 2018;45(1):68-76.
39. Walker K, Jackson R. College students' knowledge concerning oropharyngeal cancer, human papillomavirus, and intent toward being examined. *Health Care Manag (Frederick)*. 2018;37(3):250-261.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Birmingham WC, Macintosh JLB, Vaughn AA, Graff TC. Strength of belief: Religious commitment, knowledge, and HPV vaccination adherence. *Psycho-Oncology*. 2019;28:1227–1233. https://doi.org/10.1002/pon.5071