HHS Public Access

Author manuscript

Ethn Health. Author manuscript; available in PMC 2022 August 01.

Published in final edited form as:

Ethn Health. 2021 August ; 26(6): 811–826. doi:10.1080/13557858.2018.1562052.

Diverse caregivers' HPV vaccine-related awareness and knowledge

Deanna Kepka, MPH, PhD[a,b], **Julia Bodson, BS**[a], **Djin Lai, BSN, RN**[b,c], **Ana C. Sanchez-Birkhead, WHNP-BC, APRN, PhD**[b,c,d], **France A. Davis, MA, MM**[c,e], **Doriena Lee**[c,e], **Fahina Tavake-Pasi, MS**[c,f], **Edwin Napia**[c,g], **Jeannette Villalta**[c,d], **Valentine Mukundente, BA**[c,h], **Ryan Mooney, BS**[a], **Heather Coulter, Med**[i], **Louisa A. Stark, PhD**[i,j]

[a]Cancer Control and Population Sciences, Huntsman Cancer Institute, Salt Lake City, Utah, USA

[b]College of Nursing, University of Utah, Salt Lake City, Utah, USA

[c]Community Faces of Utah, Salt Lake City, Utah, USA

[d]Hispanic Health Care Task Force, Salt Lake City, Utah, USA

[e]Calvary Baptist Church, Salt Lake City, Utah, USA

[f]National Tongan American Society, Salt Lake City, Utah, USA

[g]Urban Indian Center, Salt Lake City, Utah, USA

[h]Best of Africa, West Valley City, Utah, USA

[i]Center for Clinical and Translational Science, School of Medicine, University of Utah, Salt Lake City, Utah, USA

[j]Department of Human Genetics, School of Medicine, University of Utah, Salt Lake City, Utah, USA

Abstract

Objectives: To assess factors associated with HPV vaccine-related awareness and knowledge among caregivers of adolescents from five ethnic community groups in Utah.

Corresponding author: Deanna Kepka, MPH, PhD, Huntsman Cancer Institute, 2000 Circle of Hope, Salt Lake City, Utah 84112, USA, Phone: 801-587-4565, deanna.kepka@hci.utah.edu. **Co-author Correspondence:** Julia Bodson, BS, Huntsman Cancer Institute, 2000 Circle of Hope, Salt Lake City, Utah 84112, USA, Phone: 801-910-5125, Julia.Bodson@hci.utah.edu; Djin Lai, BSN, RN, Huntsman Cancer Institute, 2000 Circle of Hope, Salt Lake City, Utah 84112, USA, Phone: 801-213-5691, Djin.Lai@hci.utah.edu; Ana C. Sanchez-Birkhead, WHNP-BC, APRN, PhD, College of Nursing, University of Utah, 10 South 2000 East, Salt Lake City, Utah 84112, USA, Phone: 801-585-5680, Ana.Sanchez-Birkhead@nurs.utah.edu; France A. Davis, MA, MM, Calvary Baptist Church, 1090 South State Street, Salt Lake City, Utah 84111, USA, Phone: 801-355-1025, pastor@calvaryslc.com; Doriena Lee, Calvary Baptist Church, 1090 South State Street, Salt Lake City, Utah 84111, USA, Phone: 801-355-1025, doriena_lee@yahoo.com; Fahina Tavake-Pasi, National Tongan American Society, 3007S West Temple, Unit H, Salt Lake City, Utah 84115, USA, Phone: 801-915-4475, fahina@ntasutah.org; Edwin Napia, Urban Indian Center, 120 West 1300 South, Salt Lake City, Utah 84101, USA, Phone: 801-214-7662, enapia@iwic.org; Jeannette Villalta, Hispanic Health Care Task Force, 291 West 5400 South, Murray, Utah 84107, USA, Phone: 801-888-8327, smile38@live.com; Valentine Mukundente, BA, Best of Africa, 6379 Thor Way West, West Valley, Utah 84124, USA, Phone: 801-706-1227, vmukundente@yahoo.com; Ryan Mooney, BS, Huntsman Cancer Institute, 2000 Circle of Hope, Salt Lake City, Utah 84112, USA, Phone: 801-213-5691, Ryan.Mooney@hci.utah.edu; Heather Coulter, Med, Health Center for Clinical and Translational Science, University of Utah, 26 South 2000 East, HSEB 5725, Salt Lake City, Utah 84112, USA, Phone: 801-598-0018, Heather.Coulter@utah.edu; Louisa A. Stark, PhD, Health Center for Clinical and Translational Science, University of Utah, 26 South 2000 East, HSEB 5725, Salt Lake City, Utah 84112, USA, Phone: 801-585-0019, Louisa.Stark@utah.edu.

Disclosure statement: The authors declare that they have no conflicts of interest

Design: For this community-based participatory research study, we surveyed N=228 caregivers of teens aged 11–17 years from African American, African refugee, American Indian/Alaskan Native, Hispanic/Latino, and Native Hawaiian/Pacific Islander community groups in Utah about their HPV vaccine awareness and knowledge.

Results: Participants exhibited high awareness of cervical cancer (71.05%), moderate awareness of HPV (53.95%), and low awareness of the HPV vaccine (46.49%). HPV vaccine-related knowledge was mostly worse, with fewer than half the participants reporting knowing that HPV can cause cervical cancer (46.93%), that most people are infected with HPV at some point in their lives (28.95%), that HPV is asymptomatic in females (36.40%) and males (37.28%), that the HPV vaccine is recommended for adolescent females (41.67%) and males (36.40%), and that the HPV vaccine requires more than one dose (27.19%). HPV vaccine-related awareness and knowledge were significantly associated with race/ethnicity, educational attainment, income, occupation, birthplace, parents' birthplace, English usage, health insurance coverage, type of health insurance, and child having a primary care provider (all $p<0.05$). HPV vaccine-related knowledge ($p<0.05$) and awareness ($p<0.05$) of caregivers were associated with a child in the household receiving the HPV vaccine.

Conclusion: Our findings indicate a need to develop educational interventions in collaboration with diverse communities in Utah. We underscore the importance of promoting knowledge about the existence of the HPV vaccine, as well as deeper HPV vaccine-related issues (e.g., HPV risks, treatment, and recommendations).

Keywords

Papillomavirus Vaccines; Health Knowledge; Attitudes; Practice; Community-Based Participatory Research; Socioeconomic Factors; Minority Health; Patient Education

Introduction

The HPV vaccine is a safe and efficacious vaccine that prevents HPV infection from strains that are related to six HPV-related cancers (cervical, oropharyngeal, vaginal, anal, penal, and vulvar). Despite the potential for cancer prevention, five out of ten girls and six out of ten boys are not up-to-date on the human papillomavirus (HPV) vaccination series nationally (Walker et al. 2017). Coverage in Utah is even lower, with most recent estimates showing six out of ten girls and eight out of ten boys in the state are not up-to-date (Walker et al. 2017). Low awareness and limited knowledge relating to the HPV vaccine are associated with poor HPV vaccination rates (Beavis and Levinson 2016; Rahman et al. 2015; Bhatta and Phillips 2015; Bastani et al. 2011), suggesting that improving understanding surrounding the HPV vaccine may be critical for achieving national vaccination goals.

In the US, African American and Hispanic/Latino populations carry a disproportionate burden of HPV-associated cervical, vaginal, and penile cancer compared to the other racial and ethnic communities (Centers for Disease Control and Prevention 2017). Furthermore, the African immigrant population is one of the fastest growing in the US, and many come from African countries where cervical cancer is still a leading cause of death (De Vuyst et al. 2013). Cervical cancer is the most prevalent cancer among women in African countries like

Burundi and Rwanda (ICO/IARC HPV Information Centre, 2017a; 2017b), which are some of the largest African immigrant communities resettled in Utah. As such, improving the awareness and understanding of this important cancer vaccine among racial and ethnic communities is an important public health priority, and improving vaccination may contribute to lowering the burden of HPV-related cancers in these already vulnerable populations.

Due to a number of cultural and structural barriers, caregivers from minority backgrounds may be at a greater risk than non-Hispanic Whites for lacking awareness and knowledge about cervical cancer, HPV, and the HPV vaccine. Immigrant populations may face challenges due to limited English proficiency and cultural differences surrounding medical decision-making (Rew et al. 2014; Derose et al. 2009; Ngo-Metzger et al. 2003; Perreira et al. 2012). Many minority communities also face limited access to the health care system due to lack of health insurance coverage or high insurance co-pays (Artiga et al. 2016). Additionally, some groups, such as the American Indian/Alaskan Native (AI/AN) population, may experience mistrust of the health care system given their negative history with medical institutions (Duvall and Buchwald 2012). Disparities in HPV vaccine-related awareness and knowledge have been documented among African Americans (Galbraith et al. 2016; Miller et al. 2014; Hughes et al. 2009; Ford 2011), AI/AN (Duvall and Buchwald 2012; Buchwald et al. 2013), Hispanics/Latinos (Galbraith et al. 2016; Fowler et al. 2016; Bodson, Warner, and Kepka 2016; Glenn et al. 2015), Native Hawaiians/Pacific Islanders (NHPI) (Lee et al. 2015; Cui et al. 2010), and immigrant communities (Barnack-Tavlaris et al. 2016; Nguyen, Chen, and Chan 2012; Drewry, Garces-Palacio, and Scarinci 2010). Additionally, prior literature has identified that age, gender, race, household income, educational attainment, occupation, and health insurance coverage are key correlates to lower awareness and knowledge in the general population and diverse communities (Bhatta and Phillips 2015; Bodson, Warner, and Kepka 2016; McBride and Singh 2018; Blake et al. 2015; Wisk, Allchin, and Witt 2014). However, many of these studies have been conducted with adult populations, and those that examine caregiver vaccine decision-making for adolescents have been conducted in other states, which may not be as generalizable to Utah, a state with consistently low HPV vaccination completion rates despite having a high rate of completion for other adolescent vaccination (Walker et al. 2017; Kepka et al. 2016). Thus, examining the sociodemographic, acculturation, and healthcare access factors among these diverse communities in Utah may provide important finer grain insights into the racial and ethnic disparities influencing HPV and HPV vaccine knowledge and awareness, and allow for the development of appropriate and culturally specific interventions to improve HPV vaccine awareness and knowledge in this state.

Although Utah is predominantly non-Hispanic White, some of the most populous cities in the state are rapidly diversifying. Today, about 20% of current residents identify as Hispanic and/or non-White (US Census Bureau 2016). While the largest racial/ethnic minority in Utah is the Hispanic/Latino population (UDoH 2015b), Utah also has one of the largest NHPI populations, and is home to five major tribal nations (UDoH 2015b, 2015c, US Census Bureau 2016). The African American community has also grown by 75% in the 2000–2010 Census-to-Census period, paralleling the rate of growth in the Hispanic/Latino community (UDoH 2015a, 2015b). In addition, Burindi and Rwandan refugees are some of

the largest African immigrant communities resettled in Utah (International Rescue Committee, 2018), and represent some of the most vulnerable immigrant populations in the state. However, few studies have examined knowledge and awareness of the HPV vaccine in diverse communities in Utah, which is an essential first step to developing culturally-targeted interventions. The purpose of this study is to assess the factors associated with HPV vaccine-related awareness and knowledge among caregivers of adolescents from five community groups in Utah, representing African American, African refugee, AI/AN, Hispanic/Latino, and NH/PI population to lay the groundwork for future interventions.

Material and Methods

This cross-sectional exploratory community-based participatory research (CBPR) study was conducted in collaboration with the Community Faces of Utah (CFU), a partnership between five racial/ethnic community organizations (African Americans, African refugees, AIs/ANs, Hispanics/Latinos, and NHs/PIs), the Utah Department of Health, and the Collaboration and Engagement Team of the Center for Clinical and Translational Science at the University of Utah (Community Faces of Utah). The CBPR approach guided the development, implementation, analysis, and dissemination phases of this study (Israel et al. 1998). This study analyses diverse caregivers' HPV vaccine-related awareness and knowledge and is part of a larger research project evaluating findings regarding vaccine receipt (Kepka et al. 2018) and sources of HPV vaccine information (Lai et al. 2017). Data was collected between May 2014 and February 2015. All research was reviewed and approved by the University of Utah Institutional Review Board.

Survey

For this project, a 21-item survey was developed based on an internal literature review and the input of CFU community leaders. The survey assessed sociodemographic characteristics, acculturation indicators (such as birthplace and English language use), awareness and knowledge of the HPV vaccine, and adolescents' receipt of the HPV vaccine. An English version of the survey was used by the African American, AI/AN, and NH/PI community organizations, while a Spanish version of the survey was used by the Hispanic/Latino community organization. As the majority of the African refugees did not read in their native language, an English version of the survey was read aloud by community translators and completed using a color-coded schematic. With the exception of the African refugee group, all surveys were self-administered with community translators available to answer questions.

Data Collection

Community leaders employed in-person, word of mouth, and recruitment letters posted in their community organizations to purposively recruit survey participants from May 2014-February 2015. All CFU leaders received and maintained current human subjects research training and had backgrounds in community-engaged research collaborations. As this was a community-based convenience sample, we were unable to determine the response rate for this study.

Participants

A total of 228 participants completed the surveys. All participants were adult (aged 18 years or older) parents, legal guardians, or caregivers who were vaccination decision-makers for teens aged 11–17 years

Awareness and Knowledge Outcomes

To gain a broad view of participants' HPV vaccine-related awareness and knowledge, two composite outcome variables were created and are referred to as the 'awareness outcome' and the 'factual knowledge outcome'. Awareness was defined as having heard of cervical cancer, HPV, and the HPV vaccine. Knowledge was defined as knowing certain facts concerning cervical cancer, HPV, and the HPV vaccine using items derived from previously published instruments (Bodson, Warner, and Kepka 2016).

Three questions assessed participants' awareness of cervical cancer, HPV, and the HPV vaccine with an analysis producing a Cronbach alpha of 0.7922 (Table 1). The awareness outcome was created by adding the number of questions to which the participant answered in the affirmative indicating awareness. Seven questions assessed participants' knowledge relating to HPV and the HPV vaccine, including whether the participant knew that HPV can cause cervical cancer, most people have HPV at some point in their lives, a man or a woman is not able to detect HPV, there is more than one injection for the HPV vaccination series, and the HPV vaccine is recommended for adolescent girls and boys. Analysis of these questions produced a Cronbach alpha of 0.7624 (Table 1). The factual knowledge outcome was created for each participant by adding the number of questions to which the participant gave the correct answer. For all 10 HPV vaccine related awareness and knowledge questions, analysis of 212 cases (16 cases excluded) produced a Cronbach alpha of 0.8225 (Table 1).

Statistical Analysis

Frequency counts and percentages of selected characteristics were reported for the sample. In exploratory analyses of the HPV vaccine-related awareness and knowledge questions, aggregate percentages of affirmative and correct answers were calculated. For each demographic variable, mean awareness score and mean factual knowledge score were calculated, and one-way analysis of variance (ANOVA) tests were used to compare the means awareness and knowledge scores between groups of participants. The one-way ANOVA test was chosen to handle the continuous outcome variable and nominal independent variables we assessed, as the low sample size prohibited multivariable analyses (e.g., regression).

For all HPV vaccine-related awareness and knowledge questions, Fisher's tests were used to compare distributions between participants who had vaccinated any child 11–17 years old with the HPV vaccine and those who had not. To avoid overfitting, multivariable regression analysis was not conducted. For all analyses, p-values of <0.05 were considered statistically significant. All statistical analyses were performed using R- 2.15.1 (R Development Core Team, 2014).

Results

Demographic Characteristics

Demographic characteristics of participants are presented in Table 2. The majority of participants were 35–50 years old (n=148, 64.91%), female (n=162, 71.05%), married or living as married (n=174, 76.32%), and born out of the US (n=154, 67.54%). Among participants born out of the US, there was a nearly even split between those who had spent fewer than 20 years in the US and those who had spent more than 20 years in the US (n=68, 44.16% vs. n=74, 48.05%). Most participants' parents were also born out of the US (n=176, 77.19%). Despite the large proportion of participants who were immigrants, there was a fairly even distribution across English use (18.86% 'low', 31.58% 'medium', 26.75% 'high'). Most participants had health insurance (n=127, 55.70%) and a primary care provider for their child (n=158, 69.30%). Among participants who reported having health insurance, the majority had private insurance (n=82, 64.57%).

HPV Vaccine-Related Awareness and Knowledge

Aggregate percentages of affirmative and correct answers to HPV vaccine-related awareness and knowledge questions (respectively) are presented in Table 3. There was high awareness of cervical cancer among participants (n=162, 71.05%); however, there was much lower awareness of HPV and the HPV vaccine, with just over half of participants reporting that they had heard of HPV (n=123, 53.95%), and just under half reporting that they had heard of the HPV vaccine (n=106, 46.49%). HPV vaccine-related knowledge was poorer for the most part, with fewer than half reporting knowing that HPV can cause cervical cancer (n=107, 46.93%), most people have HPV at some point in their lives (n=66, 28.95%), HPV is asymptomatic in females (n=83, 36.40%) and males (n=85, 37.28%), and the HPV vaccine requires more than one dose (n=62, 27.19%). Furthermore, fewer than half of participants could identify the correct vaccine recommendation guidelines for female (n=95, 41.67%) and male (n=83, 36.40%) adolescents.

In one-way ANOVA analyses (Table 4), race/ethnicity ($p<0.0001$), educational attainment ($p<0.0001$), annual household income ($p<0.0001$), occupation ($p=0.0003$), birthplace ($p=0.0004$), parents' birthplace ($p=0.0072$), English usage ($p=0.0007$), type of health insurance p= (0.0011), and having a primary care provider for child ($p=0.0349$) were all significantly associated with the awareness outcome. Race/ethnicity ($p=0.0069$), educational attainment ($p=0.0028$), occupation ($p=0.0100$), birthplace ($p=0.0056$), parents' birthplace ($p=0.0010$), English usage ($p=0.0265$), health insurance coverage ($p=0.0014$), and having a primary care provider for child ($p=0.0123$) were all significantly associated with the factual knowledge outcome.

HPV Vaccination

In bivariate analyses (Table 5), all ten HPV vaccine-related awareness and knowledge questions were significantly associated with HPV vaccination – that is, whether any child had received at least one dose of the HPV vaccine (all $p<0.05$).

Discussion

Our study explored HPV vaccine-related awareness and knowledge connected to vaccination receipt and found that some groups of racially/ethnically diverse caregivers may be at a greater risk than others for poor awareness and knowledge about cervical cancer, HPV, and the HPV vaccine. This study is among the first to survey caregivers of adolescents from five racial/ethnic community groups in Utah (African American, African refugee, AI/AN, Hispanic/Latino, and NH/PI groups) about their HPV vaccine-related awareness and knowledge.

Awareness and Knowledge Rates

Despite a high awareness of cervical cancer, participants demonstrated a moderate awareness of HPV, and low awareness of the HPV vaccine. Although previous literature has demonstrated moderate to high HPV vaccine-related awareness among Utahn Latino caregivers and has recommended interventions that go beyond simply raising awareness of the HPV vaccine (Bodson, Warner, and Kepka 2016), our findings suggest that educational efforts that focus only on raising awareness are nevertheless necessary for other diverse populations in Utah.

Supporting prior literature (Bodson, Warner, and Kepka 2016; Davlin, Berenson, and Rahman 2015; Reimer et al. 2014), our participants also demonstrated low HPV vaccine-related knowledge, with fewer than half reporting the correct answer to questions with HPV related facts. Caregivers' lack of knowledge about the consequences, ubiquity, and asymptomatic nature of HPV may affect how they calculate their children's cancer risk, thus influencing their decision about whether to have their children vaccinated. Additionally, caregivers' uncertainty about HPV vaccination guidelines may prevent them from vaccinating their children when the vaccine will be most effective, and may also translate into non-completion of the vaccination series for those who initiate. Indeed, positive parental attitudes towards HPV vaccination has been associated with higher odds of subsequent HPV vaccination receipt in adolescents (VanWormer et al. 2017), providing support for the relationship between vaccine hesitancy and vaccine receipt. However, diverse groups with lower acculturation may have lower access to mainstream information and public awareness campaigns about the HPV vaccine (Lai et al. 2017), thus may be more vulnerable to misinformation or a lack of adequate information about the vaccine. The implications of these findings indicate need for educational efforts to explain HPV vaccine-related health issues.

Race and Acculturation Characteristics

We noted significant associations between HPV vaccine-related awareness and knowledge and, respectively, race/ethnicity, birthplace, parents' birthplace, and English usage, supporting previous literature about racial/ethnic and immigrant/native differences in HPV vaccine-related awareness and knowledge (Duvall and Buchwald 2012; Galbraith et al. 2016; Miller et al. 2014; Hughes et al. 2009; Ford 2011; Buchwald et al. 2013; Bodson, Warner, and Kepka 2016; Fowler et al. 2016; Glenn et al. 2015; Lee et al. 2015; Cui et al. 2010; Barnack-Tavlaris et al. 2016; Nguyen, Chen, and Chan 2012; Drewry, Garces-Palacio, and Scarinci 2010). These findings indicate that interventions must be cognizant of the

barriers to awareness and knowledge of the HPV vaccine faced by non-native individuals, first- and second-generation immigrants, and non-English speakers in Utah. Future studies should examine the interaction of acculturation and social determinants of health in order to identify drivers of racial/ethnic disparities of HPV vaccine awareness and knowledge in the state.

Socioeconomic Characteristics

We found that educational attainment, annual household income, and occupation were significantly associated with HPV vaccine-related awareness and knowledge. These results support previous literature documenting the same associations across many populations (Bodson, Warner, and Kepka 2016; McBride and Singh 2018; Blake et al. 2015; Wisk, Allchin, and Witt 2014). Results indicate the importance for interventions for diverse populations to be sensitive to reading level, financial resources, and time constraints. Specifically, these results suggest educational campaigns could advertise the existence of free or low-cost HPV vaccinations through community programs. However, a lack of funding for such programs may be a substantial hurdle (Cartmell et al. 2018). A recent study conducted by the American Cancer Society among federally qualified health centers in the US found that providing training and technical assistance along with financial incentives among clinics who serve underserved populations was effective at increasing HPV vaccination rates among adolescents 11–12 years of age (Fisher-Borne et al. 2018). In consideration of funding challenges, it is imperative for interventions to be developed with cost-effectiveness and sustainability in mind. Implementing low-cost educational interventions in partnership with certain workplaces, (Bowen et al. 2015; Jones, Weaver, and Friedmann 2007; McCullagh 2005) or collaborating with community leaders (Cartmell et al. 2018) may provide feasbile avenues to reach particularly vulnerable groups in the state.

Health Care Institution Factors

We observed that HPV vaccine-related awareness and knowledge were significantly related to health insurance coverage, type of health insurance, and having a primary care provider for children, supporting previous studies that outlined HPV vaccine disparities for adolescents outside the health care system (Bhatta and Phillips 2015; Blake et al. 2015; Wisk, Allchin, and Witt 2014). These results indicate a need to connect vulnerable families from diverse backgrounds to the health care system. For example, interventions could leverage patient navigation programs (Gabitova and Burke 2014; Krebs et al. 2013; Scott et al. 2013; Livaudais et al. 2010) or collaborations between local health centers and programs providing HPV vaccination to individuals with no or poor health insurance.

HPV Vaccination

Finally, we found that all HPV vaccine-related awareness and knowledge questions were significantly related to HPV vaccine receipt for adolescents. Given the cross-sectional nature of the study, we cannot determine whether caregivers who were better informed had their children vaccinated or caregivers who had their children vaccinated became better informed as a result. However, we underscore the close connection between HPV vaccine-related awareness and knowledge and HPV vaccine receipt, supporting a large body of previous literature (Beavis and Levinson 2016; Bhatta and Phillips 2015; Rahman et al. 2015; Bastani

et al. 2011). These results imply that improving HPV vaccine-related awareness and knowledge through the proposed interventions may ultimately work to improve HPV vaccine coverage among diverse families in Utah.

Limitations

The study outcomes were limited to a brief assessment of awareness and knowledge of the HPV vaccine; other methods could have been tested, such as open-ended survey questions. Additionally, the study is limited by the convenience sampling approach. Participants may have been more active in their community groups than other members of the populations. Additionally, analyses were limited to a bivariate approach, so results do not control for confounding variables and do not assess interaction effects. Finally, our findings may have limited generalizability to unrepresented racial/ethnic groups (e.g., Asians) or broader geographic areas. However, many of these communities are historically difficult to recruit into research studies, and/or speak languages that are difficult to translate, making them underrepresented in research. Thus, the inclusion of these community groups is a strength of this study.

Conclusions

To the best of our knowledge, this is the first study to assess the sociodemographic correlates of HPV vaccine-related awareness and knowledge among minority caregivers in Utah, representing African American, African refugee, AI/AN, Hispanic/Latino, and NH/PI communities. Our results indicate poor awareness and knowledge, signalling the urgent need for educational interventions tailored to these populations. We underscore the importance of efforts that promote knowledge about the existence of the HPV vaccine, as well as deeper HPV vaccine-related issues (i.e., HPV risks, treatment, and vaccine recommendations). Furthermore, we recommend that these interventions be developed specifically for, and in collaboration with, each community group, be culturally appropriate and sensitive, reflective of the needs of immigrants who may speak a language other than English, and targeted to low-income audiences who lack health insurance.

Acknowledgements:

The authors thank Guadalupe Tovar, Echo Warner, Ivoni Nash, and Maria Borrerro for assisting with the study, and the families who participated in this research. The authors also acknowledge the late Sylvia Rickard, former executive director of the Hispanic Health Care Task Force, who was a key contributor to the early phases of this study; and Grant Sunada from the University of Utah and Brenda Ralls from the Utah Department of Health for their feedback throughout the research process

Funding details: This work was supported by the Primary Children's Hospital Foundation, the National Center for Advancing Translational Sciences from the National Institutes of Health award [number KL2TR001065]. The content of this paper is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The community-engaged research support reported in this publication was supported in part by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1TR001067.

References

Artiga S, Foutz J, Cornachione E, and Garfield R. 2016. "Key Facts on Health and Heath Care by Race and Ethnicity." Kaiser Family Foundation.

Barnack-Tavlaris JL, Garcini LM, Macera CA, Brodine S, and Klonoff EA. 2016. "Human Papillomavirus Vaccination Awareness and Acceptability Among U.S.-Born and U.S. Foreign-Born Women Living in California." Health Care for Women International 37 (4):444–62. doi: 10.1080/07399332.2014.954702. [PubMed: 25203744]

Bastani R, Glenn BA, Tsui J, Chang LC, Marchand EJ, Taylor VM, and Singhal R. 2011. "Understanding suboptimal human papillomavirus vaccine uptake among ethnic minority girls." Cancer Epidemiology, Biomarkers & Prevention 20 (7):1463–72. doi: 10.1158/1055-9965.epi-11-0267.

Beavis AL, and Levinson KL. 2016. "Preventing Cervical Cancer in the United States: Barriers and Resolutions for HPV Vaccination." Frontiers in Oncology 6:19. doi: 10.3389/fonc.2016.00019. [PubMed: 26870696]

Bhatta MP, and Phillips L. 2015. "Human Papillomavirus Vaccine Awareness, Uptake, and Parental and Health Care Provider Communication among 11- to 18-Year-Old Adolescents in a Rural Appalachian Ohio County in the United States." Journal of Rural Health 31 (1):67–75. doi: 10.1111/jrh.12079.

Blake KD, Ottenbacher AJ, Finney Rutten LJ, Grady MA, Kobrin SC, Jacobson RM, and Hesse BW. 2015. "Predictors of Human Papillomavirus Awareness and Knowledge in 2013: Gaps and Opportunities for Targeted Communication Strategies." American Journal of Preventive Medicine 48 (4):402–10. doi: 10.1016/j.amepre.2014.10.024. [PubMed: 25700651]

Bodson J, Warner EL, and Kepka D. 2016. "Moderate Awareness and Limited Knowledge Relating to Cervical Cancer, HPV, and the HPV Vaccine Among Hispanics/Latinos in Utah." Health Promotion and Practice 17 (4):548–56. doi: 10.1177/1524839916640271.

Bowen DJ, Briant KJ, Harris J, Hannon P, and Buchwald D. 2015. "A Multilevel Health Promotion Intervention in Minority-Owned Workplaces." Journal of Racial and Ethnic Health Disparities 2 (4):457–64. [PubMed: 26693135]

Buchwald D, Muller C, Bell M, and Schmidt-Grimminger D. 2013. "Attitudes Toward HPV Vaccination among Rural American Indian Women and Urban White Women in the Northern Plains." Health Education & Behavior 40 (6):704–11. doi: 10.1177/1090198113477111. [PubMed: 23460671]

Cartmell KB, Young-Pierce J, McGue S, Alberg AJ, Luque JS, Zubizarreta M, and M Brandt H. 2018. "Barriers, Facilitators, and Potential Strategies for Increasing HPV Vaccination: A Statewide Assessment to Inform Action." Papillomavirus Research 5:21–31. doi: 10.1016/j.pvr.2017.11.003. [PubMed: 29248818] Centers for Disease Control and Prevention. 2017. "HPV-Associated Cancers Rates by Race and Ethnicity." https://www.cdc.gov/cancer/hpv/statistics/race.htm

Community Faces of Utah. 2017. "Community Faces of Utah." https://cfu.utah.edu/.

Cui Y, Baldwin SB, Wiley DJ, and Fielding JE. 2010. "Human Papillomavirus Vaccine among Adult Women: Disparities in Awareness and Acceptance." American Journal of Preventive Medicine 39 (6):559–63. doi: 10.1016/j.amepre.2010.08.001. [PubMed: 21084077]

Davlin SL, Berenson AB, and Rahman M. 2015. "Correlates of HPV Knowledge among Low-Income Minority Mothers with a Child 9–17 Years of Age." Journal of Pediatric Adolescent Gynecology 28 (1):19–23. [PubMed: 25444051]

Derose KP, Bahney BW, Lurie N, and Escarce JJ. 2009. "Review: Immigrants and Health Care Access, Quality, and Cost." Medical Care Research and Review 66 (4):355–408. doi: 10.1177/1077558708330425. [PubMed: 19179539]

De Vuyst H, Alemany L, Lacey C, Chibwesha CJ, Sahasrabuddhe V, Banura C, Denny L, and Parham GP. 2013. "The Burden of Human Papillomavirus Infections and Related Diseases in Sub-Saharan Africa." Vaccine 31 (Suppl 5):F32–46. doi: 10.1016/j.vaccine.2012.07.092 [PubMed: 24331746]

Drewry J, Garces-Palacio IC, and Scarinci I. 2010. "Awareness and Knowledge about Human Papillomavirus among Latina Immigrants." Ethnicity & Disease 20 (4):327–33. [PubMed: 21305817]

Duvall J, and Buchwald D. 2012. "Human Papillomavirus Vaccine Policies among American Indian tribes in Washington State." Journal of Pediatric Adolescent Gynecology 25 (2):131–5. doi: 10.1016/j.jpag.2011.11.012. [PubMed: 22260893]

Fisher-Borne M, Preiss AJ, Black M, Roberts K, and Saslow D. 2018. "Early Outcomes of a Multilevel Human Papillomavirus Vaccination Pilot Intervention in Federally Qualified Health Centers". Academic Pediatrics 18(2S):S79–S84. doi: 10.1016/j.acap.2017.11.001. [PubMed: 29502642]

Ford JL 2011. "Racial and Ethnic Disparities in Human Papillomavirus Awareness and Vaccination among Young Adult Women." Public Health Nursing 28 (6):485–93. doi: 10.1111/j.1525-1446.2011.00958.x. [PubMed: 22092458]

Fowler B, Bodson J, Warner EL, Dyer J, and Kepka D. 2016. "Poor HPV Vaccine-Related Awareness and Knowledge among Utah Latinas Overdue for Recommended Cancer Screenings." Journal of Community Health 41 (4):825–37. doi: 10.1007/s10900-016-0160-3. [PubMed: 26860277]

Gabitova Guzyal, and Burke Nancy J. 2014. "Improving Healthcare Empowerment through Breast Cancer Patient Navigation: A Mixed Methods Evaluation in a Safety-Net Setting." BMC Health Services Research 14 (1):407. [PubMed: 25234963]

Galbraith KV, Lechuga J, Jenerette CM, Moore LA, Palmer MH, and Hamilton JB. 2016. "Parental Acceptance and Uptake of the HPV Vaccine among African-Americans and Latinos in the United States: A Literature Review." Social Science & Medicine 159:116–26. doi: 10.1016/j.socscimed.2016.04.028. [PubMed: 27180256]

Glenn BA, Tsui J, Coronado GD, Fernandez ME, Savas LS, Taylor VM, and Bastani R. 2015. "Understanding HPV vaccination among Latino adolescent girls in three U.S. regions." Journal of Immigrant and Minority Health 17 (1):96–103. doi: 10.1007/s10903-014-9996-8. [PubMed: 24557745]

Hughes J, Cates JR, Liddon N, Smith JS, Gottlieb SL, and Brewer NT. 2009. "Disparities in How Parents are Learning about the Human Papillomavirus Vaccine." Cancer Epidemiology, Biomarkers & Prevention 18 (2):363–72. doi: 10.1158/1055-9965.epi-08-0418.

ICO/IARC Information Centre on HPV and Cancer. 2017a. "Burundi: Human Papillomavirus and Related Cancers, Fact Sheet 2017." http://www.hpvcentre.net/statistics/reports/BDI_FS.pdf

ICO/IARC Information Centre on HPV and Cancer. 2017b. "Rwanda: Human Paillomavirus and Related Cancers, Fact Sheet 2017." http://www.hpvcentre.net/statistics/reports/RWA_FS.pdf

International Rescue Committee. 2018. "United States: Salt Lake City, UT." https://www.rescue.org/united-states/salt-lake-city-ut.

Israel BA, Schulz AJ, Parker EA, and Becker AB. 1998. "Review of Community-Based Research: Assessing Partnership Approaches to Improve Public Health." Annual Review of Public Health 19 (1):173–202.

Jones DE, Weaver MT, and Friedmann E. 2007. "Promoting Heart Health in Women: A Workplace Intervention to Improve Knowledge and Perceptions of Susceptibility to Heart Disease." AAOHN Journal 55 (7):271–6. [PubMed: 17665824]

Kepka D, Bodson J, Lai D, Sanchez-Birkhead AC, Villalta J, Mukundente V… and Stark LA. 2018. "Factors Associated with Human Papillomavirus Vaccination Among Diverse Adolescents in a Region with Low Human Papillomavirus Vaccination Rates". Health Equity 2(1):223–232. 10.1089/heq.2018.0028 [PubMed: 30283871]

Kepka D, Spigarelli MG, Warner EL, Yoneoka Y, McConnell N, and Balch A. 2016. "Statewide Analysis of Missed Opportunities for Human Papillomavirus Vaccination Using Vaccine Registry Data." Papillomavirus Research 2:128–132. [PubMed: 27540595]

Krebs LU, Burhansstipanov L, Watanabe-Galloway S, Pingatore NL, Petereit DG, and Isham D. 2013. "Navigation as an Intervention to Eliminate Disparities in American Indian Communities." Paper presented at the Seminars in Oncology Nursing.

Lai D, Bodson J, Davis FA, Lee D, Tavake-Pasi F, Napia E, … and Kepka D. 2017. "Diverse Families' Experiences with HPV Vaccine Information Sources: A Community-Based Participatory Approach". Journal of Community Health 42(2):400–412. doi: 10.1007/s10900-016-0269-4. [PubMed: 27734247]

Lee HY, Kwon M, Vang S, DeWolfe J, Kim NK, Lee DK, and Yeung M. 2015. "Disparities in Human Papillomavirus Vaccine Literacy and Vaccine Completion Among Asian American Pacific Islander Undergraduates: Implications for Cancer Health Equity." Journal of American College Health 63 (5):316–23. doi: 10.1080/07448481.2015.1031237. [PubMed: 25836058]

Livaudais JC, Coronado GD, Espinoza N, Islas I, Ibarra G, and Thompson B. 2010. "Educating Hispanic Women about Breast Cancer Prevention: Evaluation of a Home-Based Promotora-Led Intervention." Journal of Women's Health 19 (11):2049–56.

McBride KR, and Singh S. 2018. "Predictors of Adults" Knowledge and Awareness of HPV, HPV-Associated Cancers, and the HPV Vaccine: Implications for Health Education." Health Education & Behavior 45 (1). doi: 10.1177/1090198117709318

McCullagh J 2005. "Promoting Awareness and Practice of Testicular Self-Examination." Nursing Standard 19 (51):41.

Miller MK, Wickliffe J, Jahnke S, Linebarger J, and Humiston SG. 2014. "Views on Human Papillomavirus Vaccination: A Mixed-Methods Study of Urban Youth." Journal of Community Health 39 (5):835–41. doi: 10.1007/s10900-014-9858-2. [PubMed: 24664875]

Ngo-Metzger Q, Massagli MP, Clarridge BR, Manocchia M, Davis RB, Iezzoni LI, and Phillips RS. 2003. "Linguistic and Cultural Barriers to Care." Journal of General Internal Medicine 18 (1):44–52. doi: 10.1046/j.1525-1497.2003.20205.x. [PubMed: 12534763]

Nguyen GT, Chen B, and Chan M. 2012. "Pap Testing, Awareness, and Acceptability of a Human Papillomavirus (HPV) Vaccine among Chinese American Women." Journal of Immigrant and Minority Health 14 (5):803–8. doi: 10.1007/s10903-012-9607-5. [PubMed: 22447177]

Perreira KM, Crosnoe R, Fortuny K, Pedroza J, Ulvestad K, Weiland C, Yoshikawa H, and Chaudry A. 2012. "Barriers to Immigrants' Access to Health and Human Services Programs." ASPE Issue Brief. Washington, DC: Office of the Assistant Secretary for Planning and Evaluation.

Rahman M, Laz TH, McGrath CJ, and Berenson AB. 2015. "Provider Recommendation Mediates the Relationship between Parental Human Papillomavirus (HPV) Vaccine Awareness and HPV Vaccine Initiation and Completion among 13- to 17-year-old U.S. Adolescent Children." Clinical Pediatrics 54 (4):371–5. doi: 10.1177/0009922814551135. [PubMed: 25238779]

Reimer RA, Schommer JA, Houlihan AE, and Gerrard M. 2014. "Ethnic and Gender Differences in HPV Knowledge, Awareness, and Vaccine Acceptability among White and Hispanic Men and Women." Journal of Community Health 39 (2):274–84. [PubMed: 24150246]

Rew KT, Clarke SL, Gossa W, and Savin D. 2014. "Immigrant and Refugee Health: Cross-Cultural Communication." FP Essentials 423:30–9. [PubMed: 25127538]

Scott LB, Gravely S, Sexton TR, Brzostek S, and Brown DL. 2013. "Examining the Effect of a Patient Navigation Intervention on Outpatient Cardiac Rehabilitation Awareness and Enrollment." Journal of Cardiopulmonary Rehabilitation and Prevention 33 (5):281. [PubMed: 23823904]

Utah Department of Health (UDoH). 2015a. "Blacks and African Americans in Utah." https://health.utah.gov/disparities/data/demographics/UtahAAsDemoProfile.pdf.

UDoH. 2015b. "Hispanics/Latinos in Utah." https://health.utah.gov/disparities/data/demographics/UtahLatinosDemoProfile.pdf.

UDoH, Utah Department of Health. 2015c. "Native Hawaiians and Pacific Islanders (NHPIs) in Utah." http://health.utah.gov/disparities/data/demographics/UtahPIsDemoProfile.pdf.

US Census Bureau. 2016. "[Tabular representation of papulation estimates by race for Utah and the United States]." QuickFacts.

VanWormer JJ, Bendixsen CG, Vickers ER, Stokley S, McNeil MM, , Gee J, … and McLean H. 2017. "Association between Parent Attitudes and Receipt of Human Papillomavirus Vaccine in Adolescents." BMC Public Health, 17, 766. 10.1186/s12889-017-4787-5 [PubMed: 28969653]

Walker TY, Elam-Evans LD, Singleton JA, Yankey D, Markowitz LE, Fredua B, Williams CL, Meyer SA, and Stokley S. 2017. "National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13–17 Years - United States, 2016." MMWR Morbidity & Mortality Weekly Reports 66 (33):874–82. doi: 10.15585/mmwr.mm6633a2.

Wisk LE, Allchin A, and Witt WP. 2014. "Disparities in Human Papillomavirus Vaccine Awareness Among US Parents of Preadolescents and Adolescents." Sexually Transmitted Diseases 41 (2):117–22. doi: 10.1097/OLQ.0000000000000086. [PubMed: 24413492]

Table 1.

Cronbach alpha analysis for HPV vaccine-related awareness and knowledge questions

	Awareness[1]	Knowledge[2]	Overall[3]
Cases			
Valid [n (%)]	223 (97.81)	215 (94.30)	212 (92.98)
Excluded [n (%)][4]	5 (2.19)	13 (5.70)	16 (7.02)
Total [n (%)]	228 (100.00)	228 (100.00)	228 (100.00)
Number of items	3	7	10
Cronbach alpha	0.7922	0.7624	0.8225

[1]Questions include:

- Have you heard of cervical cancer? (Possible responses: Yes, No, Don't know)
- Have you heard of human papillomavirus or HPV? HPV is not the same as HIV. (Possible responses: Yes, No, Don't know)
- Before today, have you heard of the HPV vaccine (also known as the cervical cancer vaccine or Gardasil)? (Possible responses: Yes, No, Don't know)
- 'Don't know' responses were combined with 'No' answers.

[2]Questions include:

- HPV is able to cause cervical cancer. (Possible responses: True, False, Don't know)
- Most people have HPV at some point in their lives. (Possible responses: True, False, Don't know)
- A female can tell if she has HPV. (Possible responses: True, False, Don't know)
- A male can tell if he has HPV. (Possible responses: True, False, Don't know)
- The HPV vaccine is given in one injection. (Possible responses: True, False, Don't know)
- The best time for girls to get the HPV vaccination is between 11 and 12 but girls can also benefit from getting it when they are between the ages of 9-26. (Possible responses: True, False, Don't know)
- The best time for boys to get the HPV vaccination is between 11 and 12 but boys can also benefit from getting it when they are between the ages of 9-21. (Possible responses: True, False, Don't know)
- 'Don't know' responses were combined with incorrect answers.

[3]Includes all awareness and knowledge questions (see notes 1 and 2)

[4]Cases excluded if missing response to any questions of interest.

Table 2.

Demographic characteristics of participants (N=228)

	n[1]	%[2]
Age group		
< 35 years old	42	18.42
35 - 50 years old	148	64.91
> 50 years old	35	15.35
Gender		
Male	64	28.07
Female	162	71.05
Race/ethnicity		
African American	17	7.46
African Immigrant	39	17.12
American Indian/ Alaskan Native	23	10.09
Hispanic/Latino	64	28.07
Native Hawaiian/Pacific Islander	70	30.70
Other (includes multiracial)	7	3.07
Marital status		
Married or living as married	174	76.32
Other	49	21.49
Educational attainment		
< High School	29	12.72
High School/ GED	85	37.28
AD Diploma or Certificate	52	22.81
≥ Bachelor's degree	42	18.42
Annual household income		
<$20,000	86	37.72
$20,000 - $40,000	69	30.26
> $40,000	60	26.32
Occupation[3]		
Service employee	26	11.40
Business employee	36	15.79
Building/construction employee	42	18.42
Other employment	27	11.84
Student	10	4.39
Homemaker	40	17.54
Unemployed/retired	17	7.46
Birthplace		
US	72	31.58

	n[1]	%[2]
Other	154	67.54
Years in the US[4]		
< 20 years	68	44.16
≥ 20 years	74	48.05
Parents' birthplace		
US	47	20.61
Other	176	77.19
English usage[5]		
Low (< 2.5)	43	18.86
Medium (2.5 - 4)	72	31.58
High (> 4)	61	26.75
Health insurance coverage		
Yes	127	55.703
No	94	41.23
Type of health insurance[6]		
Private	82	64.57
Public	40	31.50
Primary care provider for child		
Yes	158	69.30
No	56	24.56

[1]Missing values are not shown in this table. Missing values are as follows: Age group (3 missing, including 1 participant excluded because reported age was '4'; range: 18-74; mean: 43.09; SD: 10.19); Gender (2 missing); Race/ethnicity (8 missing); Marital status (5 missing); Educational attainment (20 missing); Annual household income (13 missing); Occupation (30 missing); Birthplace (2 missing); Years in the US (86 missing, including 74 excluded for being born in the US; range: 2-55; mean: 25.62; SD: 17.25); Parents' birthplace (5 missing); English usage (52 missing); Health insurance coverage (7 missing); Type of health insurance (106 missing, including 94 excluded for not having any health insurance); Primary care provider for child (14 missing).

[2]Percentages calculated out of 228 (total number of participants), except where otherwise noted.

[3]Occupation coded using US Standard Occupational Codes and further collapse such that 'Service' includes: community and social service occupations, protective service occupations, food preparation and serving related occupations, and personal care and service occupations; 'Business' includes: management occupations, business and financial operations occupations, architecture and engineering occupations, sales and related occupations, and office and administrative support occupations; 'Building/construction' includes: building and grounds cleaning and maintenance occupations, construction and extraction occupations, installation, maintenance, and repair occupations, production occupations, and transportation and material moving occupations; and 'Other employment' includes: legal occupations, education, training, and library occupations, arts, design, entertainment, sports, and media occupations, healthcare practitioners and technical occupations, and healthcare support occupations.

[4]Percentages calculated out of 154 (number of participants reported born out of the US).

[5]Five questions were used to create this composite score. Participants answered these questions according to a five-point scale, and responses were coded numerically (1-5). To create the composite score, the numeric values associated with the participants' responses to each of the five questions were summed and then divided by the number of questions that the participant answered. Essentially, each participant's responses to these five questions were averaged.

[6]Percentages calculated out of 127 (number of participants reported having health insurance).

Table 3.

Summary statistics for HPV vaccine-related awareness and knowledge (N=228)[1]

Awareness	**Yes**	**No/Don't know**
	n (%)[2]	**n (%)**[2]
Have you heard of cervical cancer?	162 (71.05)	66 (28.95)
Have you heard of human papillomavirus or HPV? HPV is not the same as HIV.	123 (53.95)	104 (45.61)
Before today, have you heard of the HPV vaccine (also known as the cervical cancer vaccine or Gardasil)?	106 (46.49)	118 (51.75)
Knowledge	**Correct**	**Incorrect**[3]
	n (%)[2]	**n (%)**[2]
HPV is able to cause cervical cancer.	107 (46.93)	117 (51.32)
Most people have HPV at some point in their lives.	66 (28.95)	160 (70.18)
A female can tell if she has HPV.	83 (36.40)	143 (62.72)
A male can tell if he has HPV.	85 (37.28)	136 (59.65)
The HPV vaccine is given in one injection.	62 (27.19)	163 (71.49)
The best time for girls to get the HPV vaccination is between 11 and 12 but girls can also benefit from getting it when they are between the ages of 9-26.	95 (41.67)	132 (57.89)
The best time for boys to get the HPV vaccination is between 11 and 12 but boys can also benefit from getting it when they are between the ages of 9-21.	83 (36.40)	144 (63.16)

[1]Missing values are not shown in this table. Missing values are: Heard of cervical cancer (0 missing); Heard of HPV (1 missing); Heard of HPV vaccine (4 missing); HPV causes cervical cancer (4 missing); Most people have HPV (2 missing); Female can detect HPV (2 missing); Male can detect HPV (7 missing); HPV vaccine has one dose (3 missing); Girls recommendations (1 missing); Boy recommendations (1 missing)

[2]Percentages calculated out of 228 (total number of participants).

[3]'Incorrect' includes response 'Don't know.'

Table 4.

Demographic correlates of HPV vaccine-related awareness and knowledge outcomes (N=228)[1]

	Awareness[2] *(0-3)*		Knowledge[3] *(0-7)*	
	M (SD)	**p-value[4,5]**	**M (SD)**	**p-value[4,5]**
Overall	1.73 (1.22)		2.53 (2.15)	
Age group		0.1090		0.1860
< 35 years old	1.71 (1.20)		2.14 (2.03)	
35 - 50 years old	1.82 (1.23)		2.69 (2.17)	
> 50 years old	1.31 (1.18)		2.10 (2.09)	
Gender		0.3820		0.1810
Male	1.62 (1.13)		2.22 (2.05)	
Female	1.78 (1.25)		2.65 (2.17)	
Race/ethnicity		**<0.0001**		**0.0069**
African American	2.50 (0.97)		3.41 (2.48)	
African Immigrant	1.22 (1.13)		2.59 (1.83)	
American Indian/ Alaskan Native	2.00 (1.13)		3.48 (2.50)	
Hispanic/Latino	2.03 (1.11)		2.25 (1.94)	
Native Hawaiian/Pacific Islander	1.42 (1.28)		2.04 (2.12)	
Other (includes multiracial)	2.57 (0.79)		4.14 (2.12)	
Marital status		0.2610		0.8080
Married or living as married	1.79 (1.22)		2.50 (2.13)	
Other	1.56 (1.25)		2.59 (2.20)	
Educational attainment		**<0.0001**		**0.0028**
< High School	1.00 (1.14)		1.68 (1.83)	
High School/ GED	1.49 (1.24)		2.16 (2.20)	
AD Diploma or Certificate	2.13 (1.07)		3.24 (2.03)	
≥ Bachelor's degree	2.45 (0.86)		3.00 (2.28)	
Annual household income		**<0.0001**		0.0442
<$20,000	1.24 (1.18)		2.28 (2.14)	
$20,000 - $40,000	1.88 (1.24)		2.31 (2.23)	
> $40,000	2.30 (1.01)		3.14 (2.07)	
Occupation[3]		**0.0003**		**0.0100**
Service employee	1.69 (1.09)		2.50 (2.18)	
Business employee	2.17 (1.17)		3.26 (2.31)	
Building/construction employee	1.24 (1.16)		1.64 (1.78)	
Other employment	2.15 (1.01)		2.54 (1.98)	
Student	1.80 (1.03)		3.22 (1.99)	
Homemaker	1.85 (1.27)		2.90 (2.16)	

	Awareness[2] (0-3)		Knowledge[3] (0-7)	
	M (SD)	p-value[4,5]	M (SD)	p-value[4,5]
Unemployed/retired	0.82 (1.19)		1.47 (2.17)	
Birthplace		**0.0004**		**0.0056**
US	2.15 (1.15)		3.08 (2.34)	
Other	1.53 (1.21)		2.23 (1.99)	
Years in the US[4]		0.0979		0.9470
< 20 years	1.72 (1.20)		2.23 (2.05)	
≥ 20 years	1.38 (1.21)		2.26 (1.93)	
Parents' birthplace		**0.0072**		**0.0010**
US	2.15 (1.07)		3.43 (2.42)	
Other	1.61 (1.24)		2.26 (2.00)	
English usage[5]		**0.0007**		**0.0265**
Low (< 2.5)	1.64 (1.27)		2.33 (1.99)	
Medium (2.5 - 4)	1.53 (1.24)		2.26 (2.01)	
High (> 4)	2.30 (1.05)		3.22 (2.34)	
Health insurance coverage		0.0642		**0.0014**
Yes	1.86 (1.22)		2.95 (2.19)	
No	1.55 (1.23)		1.99 (2.01)	
Type of health insurance[6]		**0.0011**		0.3870
Private	2.08 (1.14)		2.99 (2.17)	
Public	1.36 (1.25)		2.63 (2.17)	
Primary care provider for child		**0.0349**		**0.0123**
Yes	1.82 (1.22)		2.74 (2.14)	
No	1.41 (1.24)		1.89 (2.11)	

[1]Missing values for variables are not shown in this table and were excluded from analysis. See Table 2 for counts of missing values for each variable. Participants with missing responses to any question used to create the outcome variables were excluded (Awareness - 5 missing; Knowledge - 13 missing).

[2]The awareness outcome was calculated by summing the number of awareness questions to which the participant answered affirmatively. Possible scores range between 0-3 (integers only). To see the questions included in this outcome, see Table 3.

[3]The knowledge outcome was calculated by summing the number of knowledge questions to which the participant answered correctly. Possible scores range between 0-7 (integers only). To see the questions included in this outcome, see Table 3.

[4]p-values calculated using ANOVA test.

[5]Boldface indicates significance $p<0.05$.

[6]See Table 1 for explanation of variable creation.

Table 5.

The effect of HPV vaccine-related awareness and knowledge on HPV vaccine receipt for any child among caregivers of children age 11-17 years old (N=181)[1]

	Any Child Received HPV Vaccine (n=37)	No Child Received HPV Vaccine (n=144)	
	n (%)[2]	n (%)[2]	p-value[3,4]
Have you heard of cervical cancer?			**0.0003**
Yes	34 (27.42)	90 (72.58)	
No/Don't know	3 (5.26)	54 (94.74)	
Have you heard of human papillomavirus or HPV?			**<0.0001**
Yes	32 (34.41)	61 (65.59)	
No/Don't know	5 (5.75)	82 (94.25)	
Before today, have you heard of the HPV vaccine?			**<0.0001**
Yes	33 (40.74)	48 (59.26)	
No/Don't know	4 (4.08)	94 (95.92)	
HPV is able to cause cervical cancer.			**0.0255**
Correct	24 (28.57)	60 (71.43)	
Incorrect/Don't know	13 (13.98)	80 (86.02)	
Most people have HPV at some point in their lives.			**0.0153**
Correct	18 (32.73)	37 (67.27)	
Incorrect/Don't know	19 (15.32)	105 (84.68)	
A female can tell if she has HPV.			**0.0198**
Correct	20 (29.85)	47 (70.15)	
Incorrect/don't know	16 (14.29)	96 (85.71)	
A male can tell if he has HPV.			**0.0372**
Correct	20 (28.57)	50 (71.43)	
Incorrect/Don't know	16 (15.24)	89 (84.76)	
The HPV vaccine is given in one injection.			**<0.0001**
Correct	26 (50.98)	25 (49.02)	
Incorrect/don't know	9 (7.09)	118 (92.91)	
The best time for girls to get the HPV vaccination is between 11 and 12 but girls can also benefit from getting it when they are between the ages of 9-26.			**<0.0001**
Correct	28 (35.90)	50 (64.10)	
Incorrect/Don't know	8 (7.84)	94 (92.16)	
The best time for boys to get the HPV vaccination is between 11 and 12 but boys can also benefit from getting it when they are between the ages of 9-21.			**<0.0001**
Correct	26 (36.62)	45 (63.38)	
Incorrect/Don't know	11 (10.09)	98 (89.91)	

[1]Missing values are not shown in this table and were excluded from analysis. See Table 3 for counts of missing values for each question.

[2] Percentages calculated out of row totals.

[3] p-values calculated using Fisher's Exact Test for Count Data (this test chosen due to small cell sizes).

[4] Boldface indicates significance $p<0.05$.