HHS Public Access

Author manuscript

Vaccine. Author manuscript; available in PMC 2023 March 03.

Published in final edited form as:

Vaccine. 2021 June 23; 39(28): 3767–3776. doi:10.1016/j.vaccine.2021.05.029.

The impact of an educational forum intervention on East African mothers' HPV vaccine-related knowledge, attitudes, and intentions to vaccinate their adolescent children

Huong Chu[a], **Linda K. Ko**[b,c], **Anisa Ibrahim**[d,e], **Farah Bille Mohamed**[f], **John Lin**[f], **Megha Shankar**[g,1,2], **Fanaye Amsalu**[f], **Ahmed A. Ali**[e], **Barbra A. Richardson**[a,h], **Victoria M. Taylor**[c], **Rachel L. Winer**[f]

[a]Department of Global Health, University of Washington School of Public Health, 3980 15th Ave NE, Box 351620, Seattle, WA 98195, USA.

[b]Department of Health Services, University of Washington School of Public Health, 3980 15th Ave NE Box 357660, Seattle, WA 98195 USA.

[c]Division of Public Health Services, Fred Hutchinson Cancer Research Center, 1100 Fairview Ave N. M3-B232, Seattle, WA 98102 USA.

[d]Department of Pediatrics, University of Washington, Harborview Medical Center, 325 9th Ave, Seattle, WA 98104, USA.

[e]Somali Health Board, 7050 32nd AVE S. Seattle, WA 98118 USA.

[f]Department of Epidemiology, University of Washington School of Public Health, 3980 15th Ave NE, Box 351619, Seattle, WA 981195 USA.

[g]Department of Medicine, University of Washington, 1959 NE Pacific St, Box 356421, Seattle, WA 98195.

[h]Department of Biostatistics, University of Washington School of Public Health, 3980 15th Ave NE, Box 351617, Seattle, WA 98195 USA.

Abstract

Objective: HPV vaccine uptake in U.S. East African adolescents is low. We developed and evaluated a culturally-targeted interactive educational intervention for East African immigrant mothers to increase HPV-vaccine-related knowledge, attitudes, and intentions to vaccinate adolescent children.

*Correspondence to: Rachel L. Winer, PhD, Address: Department of Epidemiology, University of Washington School of Public Health, 3980, 15th Ave NE, Box 351619, Seattle, WA 98195 USA. Tel: +1 206-616-5081, Fax: +1 206-616-9788, rlw@uw.edu.

[1]**Present addresses:** VA Palo Alto Health Care System Center for Innovation to Implementation (Ci2i), 795 Willow Rd, Menlo Park, California, 94025, USA

[2]Stanford University Center for Primary Care and Outcomes Research (PCOR) and Center for Health Policy (CHP), 615 Crothers Way, Encina Commons, MC6019, Stanford, California, 94305, USA

Declaration of Interests

All authors declare no conflict of interest.

ICMJE Criteria Declaration

All authors attest they meet the ICMJE criteria for authorship

Methods: Eligible mothers had ≥1 11–17-year-old child and reported all children's HPV vaccination status as unvaccinated or unknown. The intervention was delivered via 10 dinners in the Seattle metropolitan area (8 with the Somali community, 2 with the Ethiopian community). Educational presentations and pre/post-tests on knowledge, attitudes, and intentions were conducted in the participants' native language by a co-ethnic physician. Pre/post differences in responses were evaluated with McNemar's tests and GEE models. HPV vaccination uptake 6-months post-intervention was evaluated using state immunization registry data.

Results: Of 115 participating mothers, most (84%) were Somali and <40 years of age (60%). Median years of formal education was 8 (range 0–16), and 61% reported a household income <$25,000. Knowledge of HPV/HPV-vaccines was low pre-intervention, with correct responses ranging from 4%–39% (61%–91% of responses were "not sure"); correct post-intervention responses ranged from 29%–97%. Pre-intervention, only 12% of mothers thought they had enough information to make a decision about vaccination, compared to 90% post-intervention. Pre-intervention, only 16% of mothers reported that they were somewhat or very likely to vaccinate their child, compared to 83% post-intervention. All pre/post comparisons were statistically significantly different ($p<0.0001$). Although mothers were more likely to report correct HPV-related knowledge and positive vaccine attitudes and intentions post-intervention, only two mothers' children initiated HPV vaccination within 6 months after the intervention.

Conclusions: Results illustrate that a culturally targeted educational intervention effectively increased East African mothers' HPV vaccine-related knowledge, attitudes, and intentions to vaccinate their adolescent children. Future research should identify additional intervention components that can bridge the gap between intention and behavior to facilitate HPV vaccine uptake.

Keywords

HPV vaccine; Immigrant; East African; Educational intervention; Community engagement; Mothers

---

In the U.S., routine human papillomavirus (HPV) vaccination of 11- to 12-year-old adolescents (with catch-up through age 26) is recommended to prevent infection with HPV types that cause most HPV-related cancers.[1] Nonetheless, adolescent HPV vaccine coverage lags behind the 80% Healthy People 2020 target.[2] In 2019, approximately 72% of adolescents aged 13–17 years had received ≥1 dose and 54% completed the HPV vaccine series.[2] In addition, there are substantial disparities in HPV vaccine coverage across geographic areas[3], income groups[2], and racial/ethnic groups.[4] According to a recent meta-analysis, Black, Hispanic, and Asian adolescents are more likely to initiate the HPV vaccine series compared to White adolescents, but White adolescents are more likely to complete the series.[5] However, included studies did not account for heterogeneity between racial and ethnic subgroups in HPV vaccine uptake.[5]

In 2017, there were approximately 700,000 East African immigrants from Somalia, Ethiopia, and Eritrea residing in the U.S., including 26,000 in Washington State. [6] Uptake of recommended childhood vaccines is lower in children of Somali-born parents compared with children of U.S.-born parents.[7] Few studies have evaluated HPV vaccine uptake in

U.S. East African communities, and most have focused on Somali women and girls as part of cervical cancer prevention.[8–12] Current literature suggests that HPV vaccination among this population is exceptionally low. A study in King County, Washington found that none of 55 Somali mothers and only 8 of 50 (16%) Ethiopian/Eritrean mothers reported vaccinating their children against HPV.[12] Potential barriers to HPV vaccine uptake in East African and other immigrant communities include limited awareness, knowledge[8–11], cultural beliefs, misperceptions about efficacy and safety regarding HPV vaccines[13–15], mistrust of healthcare[8,16,17] or vaccines,[18,19] and lack of strong healthcare provider recommendations.[15,20]

A few studies have evaluated educational interventions to improve adolescent HPV vaccine uptake in minority populations, with limited effectiveness.[21] Two studies with positive findings showed that community-based educational interventions for mothers and daughters increased HPV vaccine series uptake and/or completion in adolescent girls in Native American[22] and Hispanic[23] communities. Specifically, community health forum interventions with small group settings or community classes delivered by healthcare providers in the community's native language can facilitate community partnership and dialogue and reduce mistrust.[24] There is also recent work suggesting that community forum interventions are successful for increasing knowledge of and trust in HPV vaccines in African American communities, but their potential within racial and ethnic subgroups is under-explored.[25,26]

Prior qualitative research with East African immigrant mothers in King County, Washington indicated that mothers prefer to receive information on HPV vaccination in their native language and in small group community settings, and that health care providers can play strategic roles in promoting HPV vaccination.[12,20] Based on these findings, we developed an interactive educational forum intervention for East African mothers and evaluated the impact on mothers' knowledge, attitudes, and intentions to vaccinate their adolescent children against HPV.

Methods

Overview

We developed an interactive education forum that provided HPV vaccine information in a culturally appropriate context and was delivered by co-ethnic health professionals. We then assessed the impact of this intervention on mothers' knowledge, attitudes and intentions to vaccinate their children with the HPV vaccine. This project was approved by the University of Washington and Washington State Institutional Review Boards.

Interactive education forum development

We used a multi-step process to develop the intervention including review of prior formative research on barriers and facilitators to HPV vaccination in East African immigrant communities and review of focus group findings with Somali, Ethiopian, and Eritrean mothers. This information was used to inform development of the educational material. Material was reviewed by the research team and co-ethnic research assistants to ensure that

it was culturally relevant, sensitive, and audience-centric to promote behavior change among East African communities.

Step 1) Review of the formative research—We reviewed results from a 2012 study on identifying strategies for increasing adolescent immunizations in Hispanic, Somali, Ethiopian, and Eritrean communities in King County, Washington.[12] Parental surveys identified lack of recommendation from a healthcare provider as the most important barrier to HPV vaccination, and found that parents trusted vaccination recommendations from doctors more than from pharmacists or nurses. Lack of awareness and knowledge were also identified as barriers. Somali parents also noted concern about pork gelatin in vaccines. Parents also noted a preference to receive vaccine education via community classes in small group settings taught in the community's native language.

Step 2) Focus groups findings (East African mothers)—We gathered three focus groups in Somali, Amharic, and Tigrinya, each with 9–11 East African mothers of 11–17 year old children in King County, Washington. Recruitment strategies, eligibility, and data collection methods were described previously.[20] Briefly, mothers who were fluent in Somali, Amharic or Tigrinya and had ≥1 11–17-year-old child were eligible. We used purposive sampling to recruit mothers based on self-reported vaccination status of their children, with up to 3 mothers with HPV-vaccinated children in each group. The focus group moderator guide was informed by the Socio-Context Framework[27,28] (including social, cultural, and religious factors) and Andersen's Behavioral Model[29] (including predisposing, enabling and need for care factors). We captured information on socio-cultural beliefs around HPV vaccines and elicited suggestions for the education forum on content, format, and cultural relevance. Results illustrated that vaccine misperceptions, limited HPV vaccine knowledge, and worries about side effects were predisposing factors. Cultural and religious factors included perceptions that conversations with children about sex were unacceptable, and concerns among Somali women about pork gelatin in vaccines. Findings also indicated that fathers have less influence on decisions to vaccinate their children than mothers. Results also showed that a critical enabling factor included strong recommendations from a co-ethnic healthcare provider who would provide comprehensive vaccine information to parents through in-person conversations.

Step 3) Intervention development

Presentation content: The research team integrated findings from prior formative research and the focus groups to inform development of the educational presentation. Content goals were to increase knowledge of HPV-related diseases and knowledge and acceptability of HPV vaccines by addressing culture-specific barriers and misperceptions, and behavioral intentions to vaccinate children (Table 1). Feedback from community partners and stakeholders was solicited on selection of representative images and health messages that were culturally appropriate and audience-centric to promote behavior change among East African communities. Final presentations included PowerPoint slides with an accompanying transcript for the health educator. Presentations were then translated into participants' native languages and were delivered by co-ethnic health professionals.

Survey development: The survey instrument development was guided by our experience conducting surveys addressing HPV vaccine uptake in immigrant communities, as well as previous HPV vaccine research studies.[12,30–34] Representatives from the local Eritrean, Ethiopian, and Somali communities reviewed the survey instrument for cultural acceptability and commented on the appropriateness of survey items.

The survey instrument included items addressing HPV (4 items) and HPV vaccine knowledge/beliefs (6 items), barriers to HPV vaccination (1 item), and relevant social norms/influences (2 items). It also included items that captured self-efficacy for getting the HPV vaccine for their sons/daughters, communication with doctors about HPV vaccination (2 items), willingness to have their sons/daughters vaccinated against HPV (1 item), and HPV vaccination intentions (2 items). Response categories were similar to other surveys conducted among immigrants.[35]

To assess HPV-related knowledge/beliefs, mothers were asked to state whether they thought a series of statements were true or false. These statements specifically addressed perceived susceptibility to HPV, perceived severity of HPV, and perceived benefits of vaccination. Another item assessed levels of concern about side effects as a perceived barrier.

Social norms/influences were measured using two survey items. Participants indicated whether they thought the following statements were true or false: Other parents in your community do not think their children should get the HPV vaccine and doctors think it is very important that adolescents get the HPV vaccine. To examine self-efficacy, mothers were asked if they agreed or disagreed with two statements: You have enough information to make a decision about getting the HPV vaccine for your son/daughter and you know where your son/daughter can go to get the HPV vaccine.

To assess willingness, they were asked to indicate which of the following best described how they felt about getting their son/daughter the HPV vaccine (you want him/her to get the vaccine, you do not want him/her to get the vaccine, you are undecided). Intention was measured with the following item: In the next 6 months, how likely is it that your son/daughter will get the HPV vaccine (very, somewhat or not likely).

Evaluation of the interactive education forums

From October 2017 to September 2018, we recruited mothers with 11–17-year-old children to participate in a series of mother/adolescent community dinner events (8 in the Somali community and 2 in the Amharic community). The events included a communal dinner for mothers and their adolescent children, followed by delivery of the educational forum intervention. (Adolescents participated in a comic book intervention described elswhere.[36]) After the educational forums, mothers completed pre- and post-intervention evaluation surveys.

Recruitment, Screening, and Consent Process: The project coordinator, a Somali native speaker, directly recruited mothers for the Somali dinners, and worked closely with project assistants from the Ethiopian community who are fluent in Amharic to recruit mothers for participation in the Amharic dinners. We used two recruitment strategies. First,

we recruited mothers face-to-face at venues and events that serve members of the target populations (community centers, places of worship, community meetings, and health fairs). Second, community partners provided us with names and telephone numbers of mothers who might be interested in participating. Research staff called to see if the mother was interested in learning about the study and assess eligibility.

Before a participant was enrolled, a research staff member fluent in the target language administered a screening questionnaire to assess eligibility. Mothers who previously participated in the focus group discussions were not eligible. The screening questionnaire collected the participant's fluency in the target language of the dinner, and information on their 11–17-year-old children, including gender and HPV vaccination status. Because the focus of the intervention was to promote HPV vaccine uptake in unvaccinated adolescents, mothers who self-reported any HPV-vaccinated children were not eligible. The screener also asked if any of her 14–17-year-old children who were fluent in English might be interested in participating in the dinner (which included a comic book intervention targeted to 14–17-year-old adolescents). Participants were provided with the date, time, and location of the dinner. We also called or texted participants to remind or inform them of the dinner time and location approximately one week prior to the dinner and gave up to two reminder calls/texts in the week leading up to the dinner.

In most cases, consent was obtained immediately after eligibility screening. In some cases, mothers provided consent in person immediately prior to the dinner event. Informed consent was administered in the participant's native language.

Study procedures: After consent was completed, participants were asked to complete a Washington State Immunization Information System (WAIIS) HPV vaccination history release of information form for each child between the ages of 11–17 years old. WAIIS is a statewide immunization information system that covers persons of all ages in Washington State. After completion of the WAIIS form, a research staff member verbally administered a brief demographic questionnaire. This was followed with a verbally administered pre-intervention survey to collect baseline information on knowledge, attitudes, and intentions about HPV vaccines.

Dinner events started with a time for socializing and included a culturally appropriate meal for participants. After dinner, research procedures commenced, where the adolescents were led into a separate adjoining room, while the mothers participated in a 40-minute interactive session with a co-ethnic health professional. During the session, study staff were available to supervise any attending children who were <14 years of age. The health professional delivered the 20-minute educational presentation in the native language of the participants. This included a video testimonial of a mother from the community about the importance of HPV vaccination. The health professional then facilitated a 20-minute question and answer period with participants to answer questions and discuss any barriers or concerns about HPV vaccines. At the end of the session, a 3–5 minute post-intervention survey analogous to the pre-intervention survey was verbally administered to individual mothers by research staff in a private area of the venue. Mothers received $25 after completing the post-dinner questionnaire.

HPV vaccine data (including vaccination dates and number of doses) were accessed from the WAIIS for participating mothers' 11–17-year-old adolescent children in the 6-months after the educational intervention. We also used the WAIIS to retroactively identify any children who might have received HPV vaccination prior to the dinner.

Data Analysis

Descriptive statistics were utilized to summarize demographic characteristics and baseline and post-intervention knowledge, attitudes and intentions of participating mothers regarding HPV and HPV vaccines. Responses to individual survey items were then dichotomized into correct and incorrect, or positive and negative responses for pre- and post-intervention comparisons. McNemar's test was used to test whether mothers' knowledge, beliefs, and intention changed between the pre- and post-survey. We also described responses to the question "In the next 6 months, how likely is it that your son/daughter will get the HPV vaccine" stratified by gender of mothers' children (all girls versus all boys, excluding mothers with both daughters and sons). In confirmatory analyses with the count of correct answers as the outcome (separately for each construct of questions), generalized estimating equation models with a Poisson family (log link), exchangeable correlation structure, number of questions asked as offset, and clustered on individual mothers were used to assess differences in knowledge, beliefs, social norms/influence, willingness, and intention between the pre and post-intervention survey. A sensitivity analysis was conducted excluding mothers with children retroactively identified via the WAIIS to have been vaccinated prior to the intervention. These mothers were retained in the primary analysis because our primary objective was to evaluate the impact of the intervention on knowledge, attitudes and intentions in mothers who self-reported children with no or unknown prior HPV vaccination. Finally, we described the number of and proportion of mothers whose children received HPV vaccination within 6-months after the dinner.

Results

A total of 120 eligible mothers participated. Five who did not complete a pre-survey (n=3) or post-survey (n=2) were excluded. Of the remaining 115 mothers, most were <40 years of age (59.6%), married (68.4%), and Somali (84.2%) (Table 2). Most reported an annual household income <$25,000 (60.7%). Mothers reported having lived in the U.S. a median of 16 years (range 1 –25) and the median number of years of formal education was 8 (range 0–16). Almost half (49.4%) reported having an adolescent child who was born in the U.S.

At baseline, mothers' HPV knowledge was low, with correct responses ranging from 6.4%–38.5% (60.6%–80.2% of responses were "not sure'). Correct responses increased significantly post-test, with 94.5%–97.2% correctly answering that HPV is different from HIV, is spread through sexual contact, and can cause cancer. Although the percentage correctly responding that the statement, HPV is rare, is false increased from 6.4%- 34.5%, over half (65.5%) still answered this question incorrectly in the post-test. All pre/post comparisons for individual questions were statistically significantly different ($p<0.0001$) (Table 3). Overall, the percentage of mothers who correctly answered all 4 HPV knowledge

questions increased from 22.1%–80.4%, and mothers were more likely to respond correctly after the intervention (RR=3.64, 95% CI:2.89–4.60) (Table 4).

Baseline HPV vaccine knowledge/beliefs was also low, with correct responses ranging from 3.5%–14.2% (75.0%–91.1% of responses were “not sure”). Correct responses increased significantly in the post-test for all questions ($p<0.0001$) (Table 3). In the post-test, 94.7% and 88.4% correctly responded that HPV vaccines prevent some cancers, and all adolescent girls should get the HPV vaccine, respectively. Approximately two-thirds correctly answered questions about vaccine safety and whether adolescent boys need the vaccine. Correct responses to questions about pork gelatin in vaccines (46.5%) and vaccination involving more than one shot (28.6%) were lower. Although “not sure” responses decreased for all items in the post-test, incorrect “true” or “false” responses increased for some items, including vaccine safety, pork gelatin, and recommendations about vaccination in boys and number of doses. Overall, the percentage of mothers who correctly answered all 6 questions increased from 8.2%–66.2%, and the overall impact of the intervention on increasing HPV vaccine knowledge and beliefs was highly statistically significant (RR=8.10, 95%CI:5.26–12.45) (Table 4).

At baseline, 8.0% of mothers disagreed that other parents in their community do not think their children should get the HPV vaccine (with 79.6% “not sure”), compared to 32.7% post-test ($p<0.0001$). However, the percentage that agreed also increased from 12.4%–43.3% (Table 3). Furthermore, the proportion of mothers who agreed that doctors think it’s important for adolescents to get the HPV vaccine increased from 27.3%–83.6% ($p<0.0001$). Overall, mothers were more likely to choose positive responses to questions about social norms and influence after the intervention (RR=3.29, 95%CI:2.38–4.55) (Table 4).

At baseline, the majority of mothers (62.5%) responded that they were “not sure” how concerned they were about HPV vaccine side effects (Table 3). There were pre-/post-test increases in both the proportions who were not concerned (8.9%–42.9%, a 4.8-fold increase) and the proportions who were somewhat or very concerned (28.5%- 50.9%, a 1.8-fold increase). For the purpose of statistical testing, “not sure” was grouped with somewhat and very concerned in the negative response category, and the increase in positive responses was statistically significant. Mothers were 4.80 (95%CI:2.65–8.69) times more likely to choose the positive response (i.e., not concerned) related to HPV vaccine’s side effects after the intervention (Table 4).

At baseline, 11.6% of mothers thought they had enough information to make a decision about vaccinating their children, compared to 90.2% in the post-survey ($p<0.0001$) (Table 3). The percentage correctly responding that they believed they know where to get the HPV vaccine for their children also increased from 25.7%–92.4% ($p<0.0001$). Positive responses were more likely to be selected after the intervention (RR=4.80, 95%CI:3.48–6.61) (Table 4).

At baseline, only 6.3% of mothers reported that they wanted their child to get the vaccine, whereas others were undecided (27.0%) or unsure (63.1%) or did not want their child to be vaccinated (3.6%). However, after participating in the interactive education forum, the

proportion of mothers who indicated that they wanted to get their child vaccinated increased to 75.7% (Table 3). Mothers were more likely to report that they wanted their child to get vaccinated after the intervention (RR=12.00, 95%CI:5.90–24.39) (Table 4).

At baseline, 19.1% of mothers reported they were somewhat likely or very likely to talk with their child's doctor about the HPV vaccine in the next 6 months, compared to 86.4% in the post-survey ($p<0.0001$) (Table 3). When asked about the likelihood of vaccinating their children in the next 6 months, 15.6% responded somewhat likely or very likely at baseline compared to 83.5% in the post-survey ($p<0.0001$). When stratifying responses by the gender of mothers' children, positive response proportions were similar between groups: 17.5% (7/40) versus 17.1% (7/41) at baseline and 82.5% (33/40) versus 80.5% (33/41) post-survey for mothers of all girls versus all boys, respectively. Overall, mothers were more likely to report positive vaccine intentions after the intervention (RR=5.03, 95%CI:3.42–7.39) (Table 4).

Sensitivity analysis.

Using the WAIIS data, we identified 19 mothers with children who received ≥1 dose of HPV vaccine prior to the intervention. Sensitivity analyses restricting to the remaining 96 mothers yielded similar results to those conducted in the main analyses of all 115 participants (Supplemental table 1).

HPV vaccine uptake 6-months post-intervention.

Of the 96 mothers whose children had no record of prior HPV vaccination, only 2 (2%) had a child who received the HPV vaccine within 6-months after the intervention.

Discussion

To our knowledge, this is the first study to evaluate the impact of an interactive educational forum on HPV-related knowledge and perceptions in a population of East African immigrant mothers. We observed marked improvements in HPV- and HPV-vaccine-related knowledge, beliefs and attitudes after the intervention was administered. However, although the post-survey showed that 76% of mothers wanted their adolescent children to get the HPV vaccine, and that 83% thought it was likely that their child would be vaccinated within the next 6 months, we only identified 2 mothers with children who were vaccinated within 6 months post-intervention.

Findings from this study underscore a critical need to increase HPV and HPV-vaccine related knowledge among East African immigrant mothers. Seventeen percent of mothers who participated in our study were found to have children who were previously HPV vaccinated (despite reporting their children's vaccination status as unvaccinated or unknown). In addition, our baseline survey found that mothers had limited knowledge of HPV and HPV vaccines, and only a small minority of mothers intended to vaccinate their children. This low level of knowledge is consistent with the prior study conducted in the Seattle metropolitan area in 2012 that showed that Somali, Ethiopian, and Eritrean parents had low awareness of HPV and HPV vaccines.[12] Additional studies also reported low knowledge of HPV among East African mothers.[8,37,38] Our study also addressed vaccine

safety and social, cultural, and religious beliefs that impact perceptions of HPV vaccines, including concerns about pork gelatin in vaccines. At baseline, over 90% of mothers were unsure about whether the HPV vaccine does not contain pork gelatin and 75% were uncertain if the vaccine was safe. These reflect concerns expressed by East African mothers who participated in the focus groups that informed the content of the intervention.[20] These findings highlight the need for sufficient, accessible HPV vaccination information for East African mothers, as limited knowledge is a contributing factor to low adolescent HPV vaccine uptake.[24,39–41]

The interactive education forum effectively increased HPV and HPV-vaccine-related knowledge, with some variation in the magnitude of gains across items. In addition, we noted incorrect or negative responses increased for some items, highlighting opportunities for improvement. Only one-third thought the HPV vaccine is unsafe, yet half were concerned about side effects (the latter representing an increase from baseline). It is likely that increases in concern over side effects were in part due to increased knowledge of the vaccine, consistent with prior studies indicating that increased HPV vaccine education is associated with increased concerns over side-effects.[42] In addition, 34% remained unsure about whether the vaccine contains pork gelatin. Results highlight the need for education to address culture-specific misperceptions about HPV vaccines, as well as concerns such as safety that are common across populations.

Physicians and community members exert a strong influence on East African mothers' decisions to vaccinate their adolescents.[20] The intervention was effective in convincing most mothers that physicians consider adolescent HPV vaccination important, but only one-third agreed that other parents in their community think the vaccine is important. This presents a potential barrier for HPV vaccine uptake, as peer perceptions can trump physicians' recommendations.[20,43] Future interventions may consider how participants can disseminate HPV-related knowledge to other community members and how to provide more discussions around potential social influences on vaccination behavior.

The study observed low HPV vaccine uptake despite high post-intervention willingness and intention, highlighting a gap between knowledge, attitudes and intentions and subsequent behavior. This is consistent with previous educational interventions that increased HPV vaccine-related knowledge but did not show a benefit for HPV vaccine uptake.[21,44–46] The low uptake could be explained by several factors. First, the 6-month follow-up interval may have been too short, especially given that opportunities for HPV vaccination often occur through annual events like sports physicals, wellness check-ups, or school-based vaccination programs.[47,48] Second, the WAIIS can be incomplete, as some clinics inconsistently report vaccination data to the registry. Third, each mother participated in only one education session. Previous studies in young adults have shown that a single education session with limited subsequent reinforcement improves short-term intentions to vaccinate but is not robust enough to impact vaccination behavior.[49–52] Finally, additional intervention components to build on participants' willingness and intentions may be needed to further facilitate HPV vaccine uptake. The educational forum for mothers was part of a multi-level educational intervention that also targeted adolescents and health care providers. An HPV vaccine comic book was effective in increasing adolescents' HPV vaccine knowledge,

attitudes, and intentions,[36] and an online continuing education course for health providers increased self-efficacy to address common parental concerns and make strong HPV vaccine recommendations to East African families.[53] We were unable to formally evaluate synergistic effects of this multi-level intervention due to limited resources that constrained the study design (e.g., provider and mother/adolescent data were not linked). Although two-thirds of mothers brought at least one of their 14–17-year-old children to participate in the comic book intervention,[36] it does not appear that there was a synergistic effect of the mother and adolescent education interventions based on the low post-intervention HPV vaccine uptake. Previous studies have found combination interventions to be effective. For example, education followed by reminders[54,55] or referral and/or navigation support to schedule appointments for HPV vaccination[23] have been successful for increasing either HPV vaccine initiation[54,55] or completion.[23,54,55] In particular, community-clinical linkages between health care clinics and community partners could be leveraged in conjunction with education to increase HPV vaccination (e.g., providing the education intervention at provider-based venues).[56]

A primary strength of this study is that it is one of few that have examined the East African immigrant population. Another strength is that we aimed to minimize cultural biases by working with stakeholders, community members, and co-ethnic medical professionals to make the intervention more culturally relevant, sensitive, and audience-centric in order to promote behavior change among East African communities. Few prior studies have evaluated culturally-tailored interventions to increase HPV vaccine uptake in diverse populations.[50] Furthermore, this is one of a few studies that included a follow-up assessment to evaluate vaccination behavior through an immunization registry system. Finally, the intervention was informed by literature and formative research and designed to fit the preferences of community members in terms of how they would like to receive education on HPV vaccines, including active involvement from co-ethnic medical professionals to facilitate connecting with the intervention and overcoming HPV vaccine misperceptions.[20,44]

This study has several limitations. First, there are issues of generalizability, as our sample only included mothers who were willing to come to a community dinner to receive health education. Individuals who are not willing to participate in such an intervention may differ from those who are willing. Furthermore, our sample size was small and predominately Somali with only a few Amharic mothers, which limits our ability to draw generalizable conclusions and evaluate differences by community. Another limitation is that the intervention was developed partly based on information gathered from focus groups. These focus groups and their findings may not necessarily be representative of the demographics and attitudes of the underlying communities.

Conclusion

The findings of this study showed that a culturally targeted educational intervention effectively increased East African mothers' HPV-vaccine-related knowledge, attitudes, and intentions to vaccinate their adolescent children, with little observed impact on subsequent HPV vaccination. Additional research should identify additional intervention components to

bridge the gap between intention and behavior. Similar interventions could then be fitted to other priority populations with suboptimal HPV vaccine uptake.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

We are grateful to the mothers who contributed to this project and the Washington State Department of Health for providing immunization records. We also thank Dr. Yemiserach Kifle for presenting the educational intervention at the Amharic dinners; Ubah Warsame, Sahra Yonis, Nafiso Egal, Faduma Yusuf, Lidia Tadlla, Selam Getahun, Kilian Kimbel, Isabelle Celentano, and Chelsea Knight for their assistance with data collection; and M. Patricia DeHart for facilitating access to HPV vaccination records from the Washington State Immunization Information System. Portions of this research were presented at the American Public Health Association, Annual Meeting and Expo, October 2020, and the 2020 Annual Meeting of the Society of General Internal Medicine, June 2020 (virtual).

Funding

This journal article is a product of a Prevention Research Center and was supported by Cooperative Agreement Number U48DP005013-03S7 from the Centers for Disease Control and Prevention. The findings and conclusions in this journal article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

References

1. Meites E, Szilagyi PG, Chesson HW, Unger ER, Romero JR, Markowitz LE. Human Papillomavirus Vaccination for Adults: Updated Recommendations of the Advisory Committee on Immunization Practices. MMWR Morb Mortal Wkly Rep. 2019;68(32):698–702. doi:10.15585/mmwr.mm6832a3 [PubMed: 31415491]
2. Elam-Evans LD, Yankey D, Singleton JA, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13–17 Years — United States, 2019. MMWR Morb Mortal Wkly Rep. 2020;69(33):1109–1116. doi:10.15585/mmwr.mm6933a1 [PubMed: 32817598]
3. Walker TY, Elam-Evans LD, Yankey D, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13–17 Years — United States, 2017. MMWR Morb Mortal Wkly Rep. 2018;67(33):909–917. doi:10.15585/mmwr.mm6733a1 [PubMed: 30138305]
4. Jeudin P, Liveright E, del Carmen MG, Perkins RB. Race, ethnicity and income as factors for HPV vaccine acceptance and use. Hum Vaccin Immunother. 2013;9(7):1413–1420. doi:10.4161/hv.24422 [PubMed: 23571170]
5. Spencer JC, Calo WA, Brewer NT. Disparities and reverse disparities in HPV vaccination: A systematic review and meta-analysis. Prev Med (Baltim). 2019;123:197–203. doi:10.1016/j.ypmed.2019.03.037
6. Migration Policy Institute. State Demographics Data. Migration Policy Institute. doi:10.18128/D010.V8.0
7. Wolf E, Rowhani-Rahbar A, Tasslimi A, Matheson J, DeBolt C. Parental Country of Birth and Childhood Vaccination Uptake in Washington State. Pediatrics. 2016;138(1):e20154544–e20154544. doi:10.1542/peds.2015-4544 [PubMed: 27358475]
8. Salad J, Verdonk P, de Boer F, Abma TA. “A Somali girl is Muslim and does not have premarital sex. Is vaccination really necessary?” A qualitative study into the perceptions of Somali women in the Netherlands about the prevention of cervical cancer. Int J Equity Health. 2015;14(1):68. doi:10.1186/s12939-015-0198-3 [PubMed: 26293806]

9. Pruitt CN, Reese CS, Grossardt BR, Shire AM, Creedon DJ. Completion of the Human Papillomavirus Vaccination Series Lags in Somali Adolescents. J Low Genit Tract Dis. 2013;17(3):280–288. doi:10.1097/LGT.0b013e3182759a64 [PubMed: 23486073]
10. Dailey PM, Krieger JL. Communication and US-Somali Immigrant Human Papillomavirus (HPV) Vaccine Decision-Making. J Cancer Educ. 2017;32(3):516–521. doi:10.1007/s13187-015-0959-0 [PubMed: 26687173]
11. Wolff ER, Madlon-Kay DJ. Childhood Vaccine Beliefs Reported by Somali and Non-Somali Parents. J Am Board Fam Med. 2014;27(4):458–464. doi:10.3122/jabfm.2014.04.130275 [PubMed: 25002000]
12. Greenfield LS, Page LC, Kay M, Li-Vollmer M, Breuner CC, Duchin JS. Strategies for Increasing Adolescent Immunizations in Diverse Ethnic Communities. J Adolesc Heal. 2015;56(5):S47–S53. doi:10.1016/j.jadohealth.2014.10.274
13. Yeganeh N, Curtis D, Kuo A. Factors influencing HPV vaccination status in a Latino population; and parental attitudes towards vaccine mandates. Vaccine. 2010;28(25):4186–4191. doi:10.1016/j.vaccine.2010.04.010 [PubMed: 20417261]
14. Gerend MA, Weibley E, Bland H. Parental Response to Human Papillomavirus Vaccine Availability: Uptake and Intentions. J Adolesc Heal. 2009;45(5):528–531. doi:10.1016/j.jadohealth.2009.02.006
15. Rand CM, Schaffer SJ, Humiston SG, et al. Patient—Provider Communication and Human Papillomavirus Vaccine Acceptance. Clin Pediatr (Phila). 2011;50(2):106–113. doi:10.1177/0009922810379907 [PubMed: 20837607]
16. Fu LY, Zimet GD, Latkin CA, Joseph JG. Associations of trust and healthcare provider advice with HPV vaccine acceptance among African American parents. Vaccine. 2017;35(5):802–807. doi:10.1016/j.vaccine.2016.12.045 [PubMed: 28063706]
17. Sanders Thompson VL, Arnold LD, Notaro SR. African American Parents' HPV Vaccination Intent and Concerns. J Health Care Poor Underserved. 2012;23(1):290–301. doi:10.1353/hpu.2012.0007 [PubMed: 22643477]
18. Hofman R, van Empelen P, Vogel I, Raat H, van Ballegooijen M, Korfage IJ. Parental Decisional Strategies Regarding HPV Vaccination Before Media Debates: A Focus Group Study. J Health Commun. 2013;18(7):866–880. doi:10.1080/10810730.2012.757390 [PubMed: 23521231]
19. Shui I, Kennedy A, Wooten K, Schwartz B, Gust D. Factors influencing African-American mothers' concerns about immunization safety: a summary of focus group findings. J Natl Med Assoc. 2005;97(5):657–666. http://www.ncbi.nlm.nih.gov/pubmed/15926642 [PubMed: 15926642]
20. Ko LK, Taylor VM, Mohamed FB, et al. "We brought our culture here with us": A qualitative study of perceptions of HPV vaccine and vaccine uptake among East African immigrant mothers. Papillomavirus Res. 2019;7:21–25. doi:10.1016/j.pvr.2018.12.003 [PubMed: 30594650]
21. Lott BE, Okusanya BO, Anderson EJ, et al. Interventions to increase uptake of Human Papillomavirus (HPV) vaccination in minority populations: A systematic review. Prev Med Reports. 2020;19:101163. doi:10.1016/j.pmedr.2020.101163
22. Winer RL, Gonzales AA, Noonan CJ, Buchwald DS. A Cluster-Randomized Trial to Evaluate a Mother–Daughter Dyadic Educational Intervention for Increasing HPV Vaccination Coverage in American Indian Girls. J Community Health. 2016;41(2):274–281. doi:10.1007/s10900-015-0093-2 [PubMed: 26399648]
23. Parra-Medina D, Morales-Campos DY, Mojica C, Ramirez AG. Promotora Outreach, Education and Navigation Support for HPV Vaccination to Hispanic Women with Unvaccinated Daughters. J Cancer Educ. 2015;30(2):353–359. doi:10.1007/s13187-014-0680-4 [PubMed: 24898942]
24. Katz IT, Bogart LM, Fu CM, et al. Barriers to HPV immunization among blacks and latinos: a qualitative analysis of caregivers, adolescents, and providers. BMC Public Health. 2016;16(1):874. doi:10.1186/s12889-016-3529-4 [PubMed: 27558506]
25. Teteh DK, Dawkins-Moultin L, Robinson C, et al. Use of community forums to increase knowledge of HPV and cervical cancer in African American communities. J Community Health. 2019;44(3):492–499. doi:10.1007/s10900-019-00665-2 [PubMed: 30989454]

26. Rani U, Darabaner E, Seserman M, Bednarczyk RA, Shaw J. Public Education Interventions and Uptake of Human Papillomavirus Vaccine: A Systematic Review. J Public Health Manag Pract. Published online November 16, 2020. doi:10.1097/PHH.0000000000001253
27. Pasick RJ, Burke NJ, Barker JC, et al. Behavioral Theory in a Diverse Society: Like a Compass on Mars. Heal Educ Behav. 2009;36(5_suppl):11S–35S. doi:10.1177/1090198109338917
28. Burke NJ, Bird JA, Clark MA, et al. Social and Cultural Meanings of Self-Efficacy. Heal Educ Behav. 2009;36(5_suppl):111S–128S. doi:10.1177/1090198109338916
29. Andersen RM. Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? J Health Soc Behav. 1995;36(1):1–10. doi:10.2307/2137284 [PubMed: 7738325]
30. Bastani R, Glenn BA, Tsui J, et al. Understanding Suboptimal Human Papillomavirus Vaccine Uptake Among Ethnic Minority Girls. Cancer Epidemiol Biomarkers Prev. 2011;20(7):1463–1472. doi:10.1158/1055-9965.EPI-11-0267 [PubMed: 21602307]
31. Glenn B A, Tsui J D, Coronado G, et al. Understanding HPV Vaccination Among Latino Adolescent Girls in Three U.S. Regions. J Immigr Minor Heal. 2015;17(1):96–103. doi:10.1007/s10903-014-9996-8
32. McRee A-L, 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. Published online November 2009:1. doi:10.1097/OLQ.0b013e3181c37e15 [PubMed: 18724269]
33. Reiter PL, McRee A-L, Pepper JK, Gilkey MB, Galbraith KV, Brewer NT. Longitudinal predictors of human papillomavirus vaccination among a national sample of adolescent males. Am J Public Health. 2013;103(8):1419–1427. doi:10.2105/AJPH.2012.301189 [PubMed: 23763402]
34. Taylor VM, Burke N, Do H, Liu Q, Yasui Y, Bastani R. HPV Vaccination Uptake Among Cambodian Mothers. J Cancer Educ. 2012;27(1):145–148. doi:10.1007/s13187-011-0269-0 [PubMed: 21861237]
35. Lee JW, Jones PS, Mineyama Y, Zhang XE. Cultural differences in responses to a likert scale. Res Nurs Health. 2002;25(4):295–306. doi:10.1002/nur.10041 [PubMed: 12124723]
36. Shin M, Ko L, Ibrahim A, Mohamed F, Lin J, Shankar M, Ali A, Richardson B, Taylor V WR. The impact of comic book intervention on increasing East African-American adolescents' HPV vaccine-related knowledge, attitudes and intentions to receive vaccine. In: Podium Presentation at: Creating the Healthiest Nation: Preventing Violence. Conference of the American Public Health Association Annual Meeting. ; 2020.
37. Rositch AF, Gatuguta A, Choi RY, et al. Knowledge and Acceptability of Pap Smears, Self-Sampling and HPV Vaccination among Adult Women in Kenya. Medeiros R, ed. PLoS One. 2012;7(7):e40766. doi:10.1371/journal.pone.0040766 [PubMed: 22808257]
38. Netfa F, Tashani M, Booy R, King C, Rashid H, Skinner SR. Knowledge, Attitudes and Perceptions of Immigrant Parents Towards Human Papillomavirus (HPV) Vaccination: A Systematic Review. Trop Med Infect Dis. 2020;5(2):58. doi:10.3390/tropicalmed5020058 [PubMed: 32283644]
39. 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. doi:10.1016/j.vaccine.2013.04.068 [PubMed: 23664990]
40. Rodriguez SA, Mullen PD, Lopez DM, Savas LS, Fernández ME. Factors associated with adolescent HPV vaccination in the U.S.: A systematic review of reviews and multilevel framework to inform intervention development. Prev Med (Baltim). 2020;131:105968. doi:10.1016/j.ypmed.2019.105968
41. Myhre A, Xiong T, Vogel RI, Teoh D. Associations between risk-perception, self-efficacy and vaccine response-efficacy and parent/guardian decision-making regarding adolescent HPV vaccination. Papillomavirus Res. 2020;10:100204. doi:10.1016/j.pvr.2020.100204 [PubMed: 32750429]
42. Chang IJ, Huang R, He W, et al. Effect of an educational intervention on HPV knowledge and vaccine attitudes among urban employed women and female undergraduate students in China: a cross-sectional study. BMC Public Health. 2013;13(1):916. doi:10.1186/1471-2458-13-916 [PubMed: 24088392]

43. Lindsay AC, Pineda JA, Valdez MJ, Torres MI, Granberry PJ. Central American Immigrant Parents' Awareness, Acceptability, and Willingness to Vaccinate Their Adolescent Children Against Human Papillomavirus: A Pilot Cross-Sectional Study. Int J Environ Res Public Health. 2020;17(8):2869. doi:10.3390/ijerph17082869 [PubMed: 32326320]
44. Lee H, Kim M, Cooley ME, et al. Using narrative intervention for HPV vaccine behavior change among Khmer mothers and daughters: A pilot RCT to examine feasibility, acceptability, and preliminary effectiveness. Appl Nurs Res. 2018;40:51–60. doi:10.1016/j.apnr.2017.12.008 [PubMed: 29579499]
45. Chao C, Preciado M, Slezak J, Xu L. A Randomized Intervention of Reminder Letter for Human Papillomavirus Vaccine Series Completion. J Adolesc Heal. 2015;56(1):85–90. doi:10.1016/j.jadohealth.2014.08.014
46. Richman AR, Maddy L, Torres E, Goldberg EJ. A randomized intervention study to evaluate whether electronic messaging can increase human papillomavirus vaccine completion and knowledge among college students. J Am Coll Heal. 2016;64(4):269–278. doi:10.1080/07448481.2015.1117466
47. Cooper Robbins SC, Ward K, Skinner SR. School-based vaccination: A systematic review of process evaluations. Vaccine. 2011;29(52):9588–9599. doi:10.1016/j.vaccine.2011.10.033 [PubMed: 22033031]
48. Tissot AM, Zimet GD, Rosenthal SL, Bernstein DI, Wetzel C, Kahn JA. Effective Strategies for HPV Vaccine Delivery: The Views of Pediatricians. J Adolesc Heal. 2007;41(2):119–125. doi:10.1016/j.jadohealth.2007.05.007
49. Doherty K, Low KG. The Effects of a Web-Based Intervention on College Students' Knowledge of Human Papillomavirus and Attitudes toward Vaccination. Int J Sex Heal. 2008;20(4):223–232. doi:10.1080/19317610802411177
50. Fu LY, Bonhomme L-A, Cooper SC, Joseph JG, Zimet GD. Educational interventions to increase HPV vaccination acceptance: A systematic review. Vaccine. 2014;32(17):1901–1920. doi:10.1016/j.vaccine.2014.01.091 [PubMed: 24530401]
51. Patel DA, Zochowski M, Peterman S, Dempsey AF, Ernst S, Dalton VK. Human Papillomavirus Vaccine Intent and Uptake Among Female College Students. J Am Coll Heal. 2012;60(2):151–161. doi:10.1080/07448481.2011.580028
52. Gottvall M, Tydén T, Höglund AT, Larsson M. Knowledge of human papillomavirus among high school students can be increased by an educational intervention. Int J STD AIDS. 2010;21(8):558–562. doi:10.1258/ijsa.2010.010063 [PubMed: 20975088]
53. McFadden SM, Ko LK, Shankar M, et al. Development and evaluation of an online continuing education course to increase healthcare provider self-efficacy to make strong HPV vaccine recommendations to East African immigrant families. Tumour Virus Res. 2021;11:200214. doi:10.1016/j.tvr.2021.200214 [PubMed: 33647533]
54. Reiter PL, Katz ML, Bauermeister JA, Shoben AB, Paskett ED, McRee A-L. Increasing Human Papillomavirus Vaccination Among Young Gay and Bisexual Men: A Randomized Pilot Trial of the Outsmart HPV Intervention. LGBT Heal. 2018;5(5):325–329. doi:10.1089/lgbt.2018.0059
55. Cassidy B, Braxter B, Charron-Prochownik D, Schlenk EA. A Quality Improvement Initiative to Increase HPV Vaccine Rates Using an Educational and Reminder Strategy With Parents of Preteen Girls. J Pediatr Heal Care. 2014;28(2):155–164. doi:10.1016/j.pedhc.2013.01.002
56. Brandt HM, Vanderpool RC, Curry SJ, et al. A multi-site case study of community-clinical linkages for promoting HPV vaccination. Hum Vaccin Immunother. 2019;15(7–8):1599–1606. doi:10.1080/21645515.2019.1616501 [PubMed: 31158042]

Table 1:

Interactive educational presentation format/context based on the mothers' focus group findings

Domain		Focus Group Findings	Presentation format/content	Example presentation quotes
Contextual Factors	Social context	Women exert social influence on one another through shared experiences	Video testimonial from a mother from the community about the importance of vaccination	Now we're going to hear directly from a mother about why she chose to vaccinate her child against HPV.
	Cultural and religious context	Concerns about pork gelatin in the vaccines	Clarify correct information about HPV vaccine ingredients	HPV vaccine does NOT contain pork gelatin.
Predisposing factors	Knowledge of HPV	- Limited knowledge about HPV	Provide more information about HPV including how it spreads, what diseases it can cause and the difference between HPV and HIV	HPV is spread through sexual contact… That means that EVERYBODY who is or one day will be sexually active is at risk for HPV infection, including both boys and girls.
				HPV can cause serious health problems, most importantly, cancer.
		- Confusion between HPV and HIV		HPV (the one with the P) is not the same thing as HIV.
		- Limited knowledge about HPV vaccine	Provide factual information about HPV vaccine including how may doses of HPV vaccine children need to take, how effective the vaccine is	Your children…don't have to worry nearly so much about cervical cancer… because we have an extremely effective and safe vaccine.
				Children who get their first dose of HPV vaccine before age 15 only need two doses… Teens who get their first dose on their 15th birthday or after need three doses for long lasting protection.
				HPV vaccine is not only safe but it's effective.
	Perceptions of vaccines	Concerns about vaccines and associated vaccination with disease risk	Clarify that HPV vaccine is not associated with disease risk	The vaccine PROTECTS you from HPV – you CANNOT get HPV infection or cancer from the vaccine.
	Vaccine side effects	Concerns about side effects	Provide correct information about the HPV vaccine's side effects	Millions of girls and boys have gotten the HPV vaccine, and there have been no serious side effects linked to the HPV vaccine. In rare cases, people have reported serious conditions that occurred around the same time the vaccine was given, but from what we know, the HPV vaccine didn't cause these conditions.
Enabling factors	Healthcare provider responsibility	Providers need to engage parents in communicating about the vaccine	A co-ethnic doctor delivered the educational presentation	One way doctors share information about vaccines is by giving parents a written document called a "Vaccine Information Statement," or VIS for short. On the day of your child's immunization appointment, your doctor should show you a VIS for every vaccine your child is due to receive. If you need help with reading or translation, your doctor should be able to identify someone to help. It is your right to ask your doctor any questions that you have about HPV vaccine or any other vaccine, and it is your doctor's responsibility to try to answer all of your questions.
	Community resources	Women shared the need for information from healthcare providers by word of mouth		
Need for care factors	Vaccine uptake needs	Women stated that a strong recommendation from a co-ethnic provider elevated their need for vaccination	Providing information about doctors' opinion of getting the child vaccinated	Doctors agree that HPV is an extremely important vaccine for adolescents.
		Women expressed need for clear vaccine information	Providing information on community resources for finding a pediatrician,	If you have a child that is at least eleven-years-old, all you need to do is call your child's pediatrician and set up an appointment… If your child goes to school in Seattle, she may be able to get vaccinated without even going to

Domain	Focus Group Findings	Presentation format/content	Example presentation quotes
		and school-based health center locations offering HPV vaccines	the doctor! Most high schools in Seattle and a few middle schools have health centers right on campus.

Table 2.

Demographic characteristics of East African immigrant mothers (N=115 and their children)

Characteristics		Frequency[1] n	%
Mothers' demographic characteristics			
Age, years	<30	3	2.6
	30–39	65	57.0
	40–49	38	33.3
	50+	8	7.0
Ethnicity	Somali	96	84.2
	Oromo	3	2.6
	Amhara	9	7.9
	Tigre	4	3.5
	Other ethnicities	2	1.8
Country of birth	Somalia	92	80.7
	Ethiopia	19	16.7
	Eritrea	3	2.6
English fluency	Fluent or very well	19	16.7
	Well	39	34.2
	Not well	39	34.2
	Not at all	17	14.9
Religion	Christianity	18	15.9
	Islam	95	84.1
Work outside of home	Yes	60	53.1
	No	53	46.9
Marital status	Married	78	68.4
	Separated	14	12.3
	Divorced	13	11.4
	Widowed	9	7.9

Characteristics		Frequency[1]	
		n	%
Annual household income	<$25,000	68	60.7
	$25,000–50,000	32	28.6
	>$50,000	4	3.6
	Don't know	6	5.4
	Prefer not to answer	2	1.8
Years in U.S (Median, range)		16 (1–25)	
Years formal education (Median, range)		8 (0–16)	
Characteristics of mothers' 11–17 year old children			
Number of children	1	59	51.3
	2	43	37.4
	3	10	8.7
	≥4	3	2.6
Age[2]	≥1 child aged 11–13 years	29	25.2
	≥1 child aged 14–17 years	94	81.7
Gender	Male only	43	37.7
	Female only	42	36.8
	Both male and female	29	25.4
Country of birth[3]	United States	43	49.4
	Somalia	12	13.8
	Ethiopia	8	9.2
	Eritrea	1	1.1
	Other country	27	31.0

[1]Percentages are calculated based on the total of non-missing values for each characteristic. The number missing for all variables are as follows (percentages are included for variables where at least 5% were missing): age, n=1; ethnicity, n=1; country of birth, n=1; English fluency, n=1; religion, n=2; work outside of home, n=2; marital status, n=1; annual household income, n=3; years in U.S., n=23(20.0%); years formal education, n=19(16.5%); mothers' 11–17 year old children gender, n=1.

[2]Numbers add to more than the total number of mothers because some mothers had children in both age groups. Percentages are calculated using a denominator of 115 mothers.

[3]Some mothers had children who were born in different countries. 28 mothers with missing country of birth for all children were excluded. Percentages are calculated using a denominator of 87 mothers.

Table 3:

The impact of the interactive educational forum on mothers' HPV-related knowledge, attitudes, and intentions to vaccinate their adolescent children (N=115).

Constructs/Survey Questions		Pre-intervention survey[1] n (%)	Post-intervention survey[1] n (%)	McNemar's p-value[2]
HPV knowledge/beliefs				
HPV infection is different than HIV infection				
Correct	True	42 (38.5)	103 (94.5)	< 0.0001
Incorrect	False	1 (0.9)	4 (3.7)	
	Not Sure	66 (60.6)	2 (1.8)	
HPV is rare				
Correct	False	7 (6.4)	38 (34.5)	< 0.0001
Incorrect	True	22 (20.0)	61 (55.5)	
	Not sure	81 (73.6)	11 (10.0)	
HPV is spread through sexual contact				
Correct	True	29 (26.4)	106 (96.4)	< 0.0001
Incorrect	False	3 (2.7)	2 (1.8)	
	Not Sure	78 (70.9)	2 (1.8)	
HPV can cause cancer				
Correct	True	16 (15.1)	103 (97.2)	< 0.0001
Incorrect	False	5 (4.7)	1 (0.9)	
	Not Sure	85 (80.2)	2 (1.9)	
HPV vaccine knowledge/ beliefs				
HPV vaccine prevents some cancers				
Correct	True	16 (14.2)	107 (94.7)	< 0.0001
Incorrect	False	6 (5.3)	2 (1.8)	
	Not Sure	91 (80.5)	4 (3.5)	
HPV vaccine is unsafe				
Correct	False	9 (8.0)	75 (67.0)	< 0.0001
Incorrect	True	19 (17.0)	29 (25.9)	
	Not Sure	84 (75.0)	8 (7.1)	
HPV vaccine contains pork gelatin				
Correct	False	4 (3.5)	53 (46.5)	< 0.0001
Incorrect	True	7 (6.1)	22 (19.3)	
	Not Sure	103 (90.4)	39 (34.2)	
All adolescent girls should get the HPV vaccine				
Correct	True	9 (8.0)	99 (88.4)	< 0.0001
Incorrect	False	11 (9.8)	5 (4.5)	
	Not Sure	92 (82.1)	8 (7.1)	

Constructs/Survey Questions		Pre-intervention survey[1] n (%)	Post-intervention survey[1] n (%)	McNemar's p-value[2]
Adolescent boys do not need the vaccine				
Correct	False	11 (9.7)	78 (69.0)	< 0.0001
Incorrect	True	10 (8.8)	24 (21.2)	
	Not Sure	92 (81.4)	11 (9.7)	
HPV vaccination involves more than 1 shot				
Correct	True	6 (5.4)	32 (28.6)	< 0.0001
Incorrect	False	4 (3.6)	51 (45.5)	
	Not Sure	102 (91.1)	29 (25.9)	
Social norms/ influence				
Other parents in your community do not think their children should get the HPV vaccine				
Positive	False	9 (8.0)	37 (32.7)	< 0.0001
Negative	True	14 (12.4)	49 (43.4)	
	Not Sure	90 (79.6)	27 (23.9)	
Doctors think it's very important for adolescents to get the HPV vaccine				
Positive	True	30 (27.3)	92 (83.6)	< 0.0001
Negative	False	2 (1.8)	4 (3.6)	
	Not Sure	78 (70.9)	14 (12.7)	
Barriers				
When thinking about the HPV vaccine for your son and daughter, how concerned are you about side effects?				
Positive	Not concerned	10 (8.9)	48 (42.9)	< 0.0001
Negative	Somewhat Concerned	9 (8.0)	17 (15.2)	
	Very Concerned	23 (20.5)	40 (35.7)	
	Not sure	70 (62.5)	7 (6.3)	
Self-efficacy				
You have enough information to make a decision about getting your son or daughter the HPV vaccine				
Correct	Agree	13 (11.6)	101 (90.2)	< 0.0001
Incorrect	Disagree	13 (11.6)	4 (3.6)	
	Not Sure	86 (76.8)	7 (6.3)	
You know where your son/daughter can go to get the HPV vaccine				
Correct	Agree	27 (25.7)	97 (92.4)	< 0.0001
Incorrect	Disagree	6 (5.7)	3 (2.9)	
	Not Sure	72 (68.6)	5 (4.8)	
Willingness				
Which of the following best describes how you feel about getting your son/daughter the HPV vaccine?				
Positive	You want him/her to get the vaccine	7 (6.3)	84 (75.7)	< 0.0001
Negative	You do not want him/her to get the vaccine	4 (3.6)	3 (2.7)	
	You are undecided	30 (27.0)	14 (12.6)	
	Unsure	70 (63.1)	10 (9.0)	

Constructs/Survey Questions		Pre-intervention survey[1] n (%)	Post-intervention survey[1] n (%)	McNemar's p-value[2]
Intention				
In the next 6 months, is it likely that you will talk with your son's/daughter's doctor about the HPV vaccine?				
Positive	Yes, very likely	6 (5.5)	77 (70.0)	< 0.0001
	Somewhat likely	15 (13.6)	18 (16.4)	
Negative	No, not likely	9 (8.2)	6 (5.5)	
	Not sure	80 (72.7)	9 (8.2)	
In the next 6 months, how likely is it that your son/daughter will get the HPV vaccine?				
Positive	Yes, very likely	3 (2.8)	69 (63.3)	< 0.0001
	Somewhat likely	14 (12.8)	22 (20.2)	
Negative	No, not likely	3 (2.8)	4 (3.7)	
	Not sure	89 (81.7)	14 (12.8)	

[1]The data for each individual question was restricted to responses from mothers who had non-missing data on both the pre- and post-survey for each question.

[2]These p-values are based on dichotomized responses (correct/incorrect or positive/negative).

Table 4.

Generalized estimating equations (GEE) models for evaluating the impact of the interactive educational forums on mothers' knowledge, beliefs, attitudes and intention to vaccinate their children (N=115).

Constructs		% Correct answers Mean (SD)		RR (95% CI)
Items	n	Pre-survey	Post-survey	
HPV knowledge/beliefs (4Qs)	102	22.1 (2.1)	80.4 (2.0)	3.64 (2.89 – 4.60)
HPV vaccine knowledge/beliefs (6Qs)	106	8.2 (1.1)	66.2 (1.9)	8.10 (5.26 – 12.45)
Social norms/influence (2Qs)	109	17.4 (2.6)	57.3 (3.3)	3.29 (2.38 – 4.55)
Barriers (1Qs)	112	8.9 (2.7)	42.9 (4.7)	4.80 (2.65 – 8.69)
Self-efficacy (2Qs)	105	19.0 (2.7)	91.4 (1.9)	4.80 (3.48 – 6.61)
Willingness (1Qs)	111	6.3 (2.3)	75.7 (4.1)	12.00 (5.90 – 24.39)
Intention (2Qs)	106	17.0 (2.6)	85.4 (2.4)	5.03 (3.42 – 7.39)

Abbreviations: SD, Standard deviation; Qs, Questions; CI, Confidence interval.