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

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Abstract

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

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Introduction: 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.

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 vaccine intentions were conducted in the participants' native language by a co-ethnic physician. We used McNemar's test and generalized estimating equation models to evaluate pre/post differences in responses.

Results: 120 mothers participated. Most (85%) were Somali and <40 years of age (58%). 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 3%-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 vaccinating their child, 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 ($p<.0001$). Mothers were more likely to report correct HPV-related knowledge, positive vaccine attitudes and intentions 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. Similar interventions could be fit to other priority populations with suboptimal HPV vaccine uptake.

1. Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI), with an estimated 80 percent of sexually-active persons contracting the virus in their lifetimes.[1,2] While most cases of HPV are asymptomatic, the infection causes significant disease burden. In fact, in 2018 alone, 570,000 new cases of cervical cancer and 311,000 deaths were attributable to the HPV infection globally.[2] A vaccine is available to prevent infections with HPV types that contribute to the majority of cervical cancers.[3] The Centers for Disease Control and Prevention (CDC) recommend that all adolescents between 11 and 12 years be vaccinated, with routine catch-up for males and females 13 to 26 years.[4] Despite the availability of a highly effective and safe vaccine, coverage in U.S adolescents lags behind the Healthy People 2020 target of 80 percent.[5] In 2018, approximately 51.1 percent of adolescents aged 13-17 years had completed the HPV vaccine series and 68.1 percent received at least 1 dose.[5]

Increasing HPV vaccine coverage is particularly challenging because there are substantial disparities in coverage across geographic areas[6], income groups[5], and racial/ethnic groups.[7] Because the vaccination requires multiple doses, more disparities arise in terms of coverage. 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.[8] While there has been significant research on disparities between racial groups, research on racial and ethnic subgroups is lacking. There is substantial heterogeneity between racial and ethnic subgroups that make certain subgroups at higher risk for HPV infection. Additional research on HPV vaccine uptake for these populations is critical for evidence-based interventions.[7]

In 2017, there were approximately 700,000 East African immigrants from Somalia, Ethiopia, and Eritrea residing in the United States including 26,000 in Washington State.[9] However, few studies have been done on HPV vaccine uptake in U.S. East African communities, and most have focused on Somali women and girls as part of cervical cancer prevention.[10-13] The current literature suggests that HPV vaccination among this population is unacceptably low. A study in King County, Washington found that none of 55 Somali mothers and only 8 out of 50 (16 percent) Ethiopian/Eritrean mothers reported vaccinating their children for HPV.[14] Potential barriers to

HPV vaccine uptake in this population include limited awareness[9], knowledge[10-13], cultural beliefs, misperceptions about efficacy and safety regarding HPV vaccines[15-17] as well as lack of strong healthcare provider recommendations.[17,18]

Educational interventions,[19-22] specifically mother/daughter education interventions[23,24] and community interventions,[25] have been evaluated to increase awareness and knowledge for various health issues. Furthermore, research has illustrated that community health forum interventions with small group settings or community classes delivered by healthcare providers in the community's native language are productive venues to facilitate community partnership and dialogue as well as reduce mistrust[26] and increase knowledge on HPV vaccine.[27] For example, community forum interventions have been used effectively in diverse communities to improve awareness of cancer prevention in Puerto Rico[28], increase education on stroke among an ethnically diverse community in Los Angeles, California[29], and improve knowledge regarding cancer health disparities[30]. In addition, a community forum intervention was successful in increasing knowledge of HPV and cervical cancer and trust in HPV vaccines in in African American communities.[27] The effectiveness of these community forums is promising as qualitative evidence has found that African Americans agree that they have a lack of knowledge of HPV. [26] While community interventions are beginning to be used for HPV-related intervention, they remain underutilized to improve HPV-related outcomes for racial and ethnic subgroups.

Prior qualitative research with East African immigrant mothers in King County, Washington indicated a preference to receive information on HPV vaccination in small groups, and that health care providers can play strategic roles in promoting HPV vaccination.[14,18] Based on these investigations, an interactive educational forum intervention delivered by co-ethnic health professionals for East African mothers was developed to reduce barriers regarding adolescent HPV vaccination and promote intentions to vaccinate their children. This study aimed to evaluate the impact of this interactive educational forum on mothers' HPV-related knowledge, perceived ability to engage with their healthcare providers about HPV vaccines, barriers to vaccination, and intentions to vaccinate their adolescent children.

2. Methods

We developed an interactive education forum that provided HPV vaccine information in a culturally appropriate context. Delivered by healthcare providers for East African mothers residing in the Seattle Metropolitan Area, the forum sought to promote mothers' knowledge, attitudes, and intentions to increase adolescent HPV vaccination. 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 Institutional Review Board.

Interactive education forum development

We used a multi-step process to develop the interactive education forum intervention including a review of prior formative research on barriers and facilitators to HPV vaccination in East African immigrant communities and review of focus groups findings with Somali, Ethiopian, and Eritrean mothers. This information was used to inform the development of the educational material. The material was then reviewed by the research team and co-ethnic research assistants to ensure that materials were culturally relevant, sensitive, and audience-centric to promote behavior change among East African communities.

1) Review of the formative research

We reviewed results from a 2012 study on identifying strategies for increasing adolescent immunizations in various ethnic communities in King County.[14] In this study, an in-person survey to assess the knowledge, attitudes and barriers related to recommended adolescent vaccination was administered to 157 Hispanic, Somali, and Ethiopian/Eritrean parents, 45 adolescents and 30 healthcare providers. Some of the barriers to adolescent HPV immunization found in this study included lack of awareness and knowledge, and lack of recommendations from healthcare providers regarding HPV vaccination.

Parents from Somali, Ethiopian and Eritrean communities reported that lack of recommendations from their healthcare providers were the most important barrier preventing HPV vaccination. Additionally, this study also pointed out that parents recognized doctors' vaccination recommendations in their native language as a more trustworthy source compared to recommendations from pharmacists or nurses.

Additional findings of this study were that community classes in a small group setting taught in the community's native language was the most desired educational setting identified by these three ethnic groups. Furthermore, out of the healthcare providers who did not recommend the vaccine series, all of them reported that they would be more likely to strongly recommend the HPV vaccine series after completing the post-presentation survey in this study.

This study identified key features that would be important for an intervention to educate mothers on the HPV vaccine interactively. The intervention, a community forum interactive approach, would be useful as it is interactive and provides HPV vaccination information and recommendations delivered by a healthcare provider in community's native language.

2) Focus groups findings (East African mothers)

We gathered three focus groups in Somali, Amharic, and Tigrinya, each with 9 to 11 East African mothers of 11–17 year old children in King County, Washington State.[18] The primary goal of these focus groups was to gather information on socio-cultural beliefs around HPV vaccines and elicit suggestions for the education forum on the content, format, and cultural relevance. Focus group sessions were conducted in Somali, Amharic, or Tigrinya and translated into English. With the collaboration of research team members, the data was reviewed, analyzed, and the key themes and codes representative of each theme were identified by researchers.

The results illustrated that vaccine misperceptions, limited HPV vaccine knowledge, and worries about side effects were barriers to vaccinating adolescent children. Other factors for vaccination included concerns about pork gelatin in vaccines and perceptions that conversations with children about sex were unacceptable. Focus group results also showed that a critical enabling factor influencing parents' decision to vaccinate included strong recommendations from a doctor or a co-ethnic medical professional who would provide comprehensive vaccine information to parents through in-person conversations.

3) Intervention development

3.1 The content of the presentation:

The research team integrated findings from prior formative research and the mothers' focus groups to inform the 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.

Table 1: Interactive educational presentation format/context based on the mothers' focus group findings[18]

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

3.2 The survey development

The survey instrument development was guided by our experience conducting surveys addressing HPV vaccine uptake in East African and other immigrant communities, as well as previous HPV vaccine research studies.[14,31-35] 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 and HPV vaccine knowledge / beliefs, barriers to HPV vaccination, and relevant social norms / influences. It also included items that captured self-efficacy for getting the HPV vaccine for their sons / daughters, communication with doctors about HPV vaccination, willingness to have their sons / daughters vaccinated against HPV, and HPV vaccination intentions. Response categories were similar to other surveys conducted among immigrants.[36]

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 the vaccine having side effects.

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

We recruited eligible mothers who reported that none of their 11-17 year old children had received HPV vaccination 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 in a separate paper.) 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 (e.g., community centers, places of worship, community meetings, and health fairs). Second, community partners provided us with names and telephone numbers of women who might be interested in participating in the study. The project coordinator or assistant called to see if the woman was interested in learning about the study and assess eligibility. All study staff were trained on recruitment procedures, including the importance of emphasizing the voluntary nature of participation.

Before a participant was enrolled into the study, a project coordinator or a project assistant who is fluent in the target language administered a screening questionnaire to assess the participant's eligibility. 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, women who had any of their children vaccinated for HPV or did not have any children 11-17 years old 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 then 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, the coordinator/assistant administered a 5-minute demographic questionnaire (e.g., age group, ethnicity, nationality, income, and English fluency). This was followed with a 5-minute pre-intervention survey to collect baseline information on mothers' knowledge of HPV and HPV vaccines, attitudes and barriers towards vaccinating their children, and perceived ability to engage with healthcare providers 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. The health professional delivered the 20-minute educational presentation on HPV and HPV-vaccines (in the native language of the participants). The health care 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 questions was collected. The post-intervention survey was verbally administered to individual mothers by coordinators/assistants in a private corner of the event venue.

All the surveys were managed using RedCap software which is built for storing data collected from all types of forms or surveys from mobile devices. Mothers received $25 after completing the post-dinner questionnaire.

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 for paired categorical variables was used as a simple comparison, with pairs defined by pre- and post-intervention surveys for each mother, to test whether mothers' knowledge, beliefs, and intention changed between the pre and post-survey. In confirmatory analyses with the count of correct answers as the outcome (separately for each construct of questions), generalized estimating equation models (GEE) 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, belief, social norms/influence, willingness, and intention between the pre and post-intervention survey.

3. Results

A total of 120 eligible mothers participated in the interactive education forum intervention. Most women were less than 40 years of age (58.4%), married (68.6%), and Somali (81.4%) (Table 2). Most reported an annual household income less than $25,000 (61.2%), and more than half worked outside of the home (53.8%). Mothers reported having lived in the U.S. a median of 17 years (range 2 -26) and the median years of formal education was 8 (range 0-16). Less than half of mothers (38.0%) reported having an adolescent child who was born in the United States.

Table 2. Demographic characteristics of East African immigrant mothers (N=120) and their children

	Frequency[1]	
	n	%
Mothers' demographic characteristics		
Age, years		
<30	3	2.5
30-39	66	55.9
40-49	41	34.7
50+	8	6.8
Ethnicity		
Somali	100	84.7
Oromo	3	2.5
Amhara	9	7.6
Tigre	4	3.4
Other ethnicities	2	1.7
Country of birth		
Somali	96	81.4
Ethiopia	19	16.1
Eritrea	3	2.5
English fluency		
Fluent or very well	20	16.9
Well	39	33.1
Not well	41	34.7
Not at all	18	15.3
Religion		
Christianity	18	15.4
Islam	99	84.6
Work outside of home		
Yes	63	53.8
No	54	46.2
Marital status		
Married	81	68.6
Separated	14	11.9
Divorced	14	11.9

Widowed	9	7.6
Annual household income		
<$25,000	71	61.2
$25,000-50,000	32	27.6
>$50,000	4	3.4
Don't know	6	5.2
Prefer not to answer	3	2.6
Years in U.S (Median, range)	17 (2-26)	
Years formal education (Median, range)	8 (0-16)	
Characteristics of mothers' 11-17 year old children		
Number of children		
1	62	51.7
2	44	36.7
3	10	8.3
≥4	4	3.3
Age[2]		
≥1 child aged 11-13 years	30	25.0
≥1 child aged 14-17 years	98	81.7
Gender		
Male only	45	37.8
Female only	44	37.0
Both male and female	30	25.2
Country of birth[2]		
United States	44	48.4
Somalia	13	14.3
Ethiopia	8	8.8
Eritrea	1	1.1
Other country	29	31.9

[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=2; ethnicity, n=2; country of birth, n=2; English fluency, n=2; religion, n=3; work outside of homes, n=3; marital status, n=3; annual household income, n=4; years in U.S., n=27(22.5%); years formal education, n=22(18.3%).

[2] Numbers add to more than the total number of mothers because mothers could have children who were born in different countries

HPV knowledge/beliefs questions

At baseline, mothers' pre-test HPV knowledge was low, with correct responses ranging from 6.4% to 38.5% (60.6% to 80.2% of responses were "not sure'). However, pre/post comparisons for individual questions were all statistically significantly different ($p<.0001$). The percentage correctly responding that HPV is different from HIV increased from 38.5% to 94.5%. Although for the question "HPV is rare", most mothers still chose the incorrect response in the post-survey (55.5%), the percentages of mothers with correct responses for the questions "HPV is spread through sexual contact" and "HPV can cause cancer" respectively increased significantly from 26.4% and 15.1% in the pre-survey to 96.4% and 97.2% in the post-survey (Table 3). Overall, the percentage of women who correctly answered all 4 HPV knowledge questions increased from 22.1% to 80.4%, and mothers were more likely to respond correctly after the intervention (RR = 3.64, 95% CI: 2.89 - 4.60) (Table 4) (Figure 1).

HPV vaccine knowledge/beliefs questions

Pre-intervention HPV vaccine knowledge/beliefs was low, with correct responses ranging from 3.5% to 14.2%. More than 75% of mothers chose "not sure" as their response to individual questions, however, the proportion of mothers choosing this option as their response decreased significantly to 3.5% to 34.2% post-survey. Pre and post intervention comparisons were statistically significantly different for all individual HPV vaccine knowledge questions ($p<.0001$). The percentage correctly responding that HPV vaccine prevents some cancers increased significantly from 14.2% to 94.7%. Eight percent responded correctly to the question "HPV vaccine is safe" in the pre-survey compared to 97% in the post-survey. Ninety percent chose "Not sure" and only 3.5% did not believe that HPV vaccine contains pork gelatin in the pre-survey compared to 34.2% and 46.5%, respectively, in the post-survey. The percentage of mothers who believed all adolescent girls should get the HPV vaccine increased from 8.0% to 88.4%. Although most mothers still chose the incorrect response for the question "HPV vaccination involves more than 1 shot" in the post survey, the percentage with a correct response increased from 5.4% to 28.6%. Overall, mothers indicated higher knowledge and beliefs about HPV vaccination on the post-intervention survey compared to responses on the pre-intervention survey (Table 3). 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) (Figure 1).

Social norms/influence.

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 intervention (Table 3). Pre and post intervention comparisons were statistically significantly different ($p<.0001$). Furthermore, the proportion of mothers who believed that doctors think adolescent HPV vaccination is important increased from 27.3% to 83.6% ($p<0.0001$) (Table 3). 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) (Figure 1).

Barriers

At baseline, the majority of mothers (n=70; 62.5%) responded that they were "Not sure" how concerned they were about HPV vaccine side effects. In the post survey, half of the mothers who were not sure at baseline reported that they were somewhat or very concerned about side effects (n=35; 50.0%), and slightly less than half chose "Not concerned"(n=32; 42.7%) (3 remained unsure). Overall, there were pre-/post-survey increases in both the proportions who were not concerned (8.9% to 42.9%) and the proportions who were somewhat or very concerned (28.5% to 50.9%) (Table 3). For the purpose of statistical testing, "Not sure" was grouped with somewhat and very concerned in the negative response category. Overall, results showed a statistically significant difference between pre and post survey responses ($p <0.0001$), with mothers being 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 (Table 4) (Figure 1).

Self-efficacy

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. The percentage correctly responding that they believed they know where to get the HPV vaccine for their children increased from 25.7% to 92.4% ($p <0.0001$). Overall, pre and post intervention comparisons were

statistically significantly different for all individual self-efficacy questions ($p<0.0001$) (Table 3). Positive responses were more likely to be selected after the intervention (RR = 4.80, 95% CI: 3.48 – 6.61) (Table 4) (Figure 1).

Willingness

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%, while the percentage of mothers who were not sure decreased to 9.0%, 12.6% were undecided and only 2.7% did not want their child to be vaccinated (Table 3). Pre/post comparison were statistically significantly different ($p<.0001$) with mothers being 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) (Figure 1).

Intention

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. 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 (Table 3). Overall, pre/post comparisons were statistically significantly different ($p<.0001$) and mothers were more likely to report positive vaccine intentions after the intervention (RR = 5.03, 95% CI: 3.42 – 7.39) (Table 4) (Figure 1).

Table 3: The impact of the interactive educational forums on mothers' HPV-related knowledge, attitudes, and intentions to vaccinate their adolescent children (N=120).

Constructs/Survey Questions		Pre-intervention survey n (%)	Post-intervention survey n (%)	McNemar's p-value[1]
HPV knowledge/beliefs (4 questions)				
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)	29 (25.9)	
	Not Sure	84 (75)	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)	
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)	
	Are undecided	30 (27.0)	14 (12.6)	
	Unsure	70 (63.1)	10 (9.0)	
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)	< 0.0001
	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)	

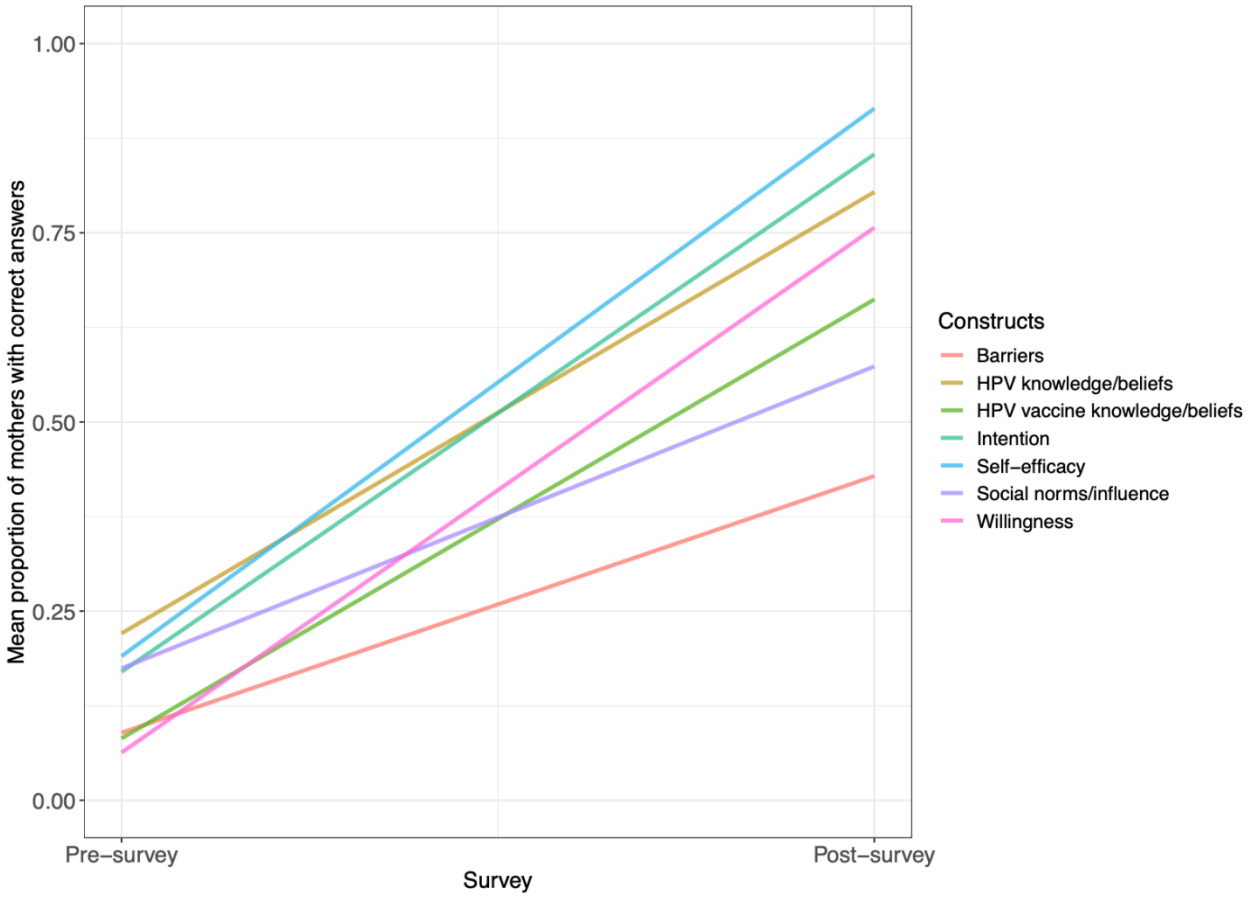
[1] These p-values are based on dichotomized responses (correct/incorrect or positive/negative).

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=120).

Constructs		% Correct answers Mean (SD)		RR (95% CI)	P-value
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)	< 0.0001
HPV vaccine knowledge/beliefs (6Qs)	106	8.2 (1.1)	66.2 (1.9)	8.10 (5.26 – 12.45)	< 0.0001
Social norms/influence (2Qs)	109	17.4 (2.6)	57.3 (3.3)	3.29 (2.38 – 4.55)	< 0.0001
Barriers (1Qs)	112	8.9 (2.7)	42.9 (4.7)	4.80 (2.65 – 8.69)	< 0.0001
Self-efficacy (2Qs)	105	19.0 (2.7)	91.4 (1.9)	4.80 (3.48 – 6.61)	< 0.0001
Willingness (1Qs)	111	6.3 (2.3)	75.7 (4.1)	12.00 (5.90 – 24.39)	< 0.0001
Intention (2Qs)	106	17.0 (2.6)	85.4 (2.4)	5.03 (3.42 – 7.39)	< 0.0001

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

Figure 1: Pre- and post- intervention changes in mothers' knowledge, beliefs, attitudes and intention to vaccinate their children (n=120)



4. 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. Our study found marked improvements across a multitude of HPV-related beliefs and attitudes after the intervention was administered. We found that correct answers to HPV and HPV-vaccine-related knowledge questions improved by 22 to 80 percentage points and levels of HPV vaccine knowledge increased by 8 to 66 percentage points. The intervention also had a significant impact on East African mothers' intentions to vaccinate their adolescent children as willingness to vaccinate increased from 19% to 76% and intentions to vaccinate in the next 6 months improved from 17% to 85%.

The findings from this study underscore a critical need to increase HPV and HPV-vaccine related knowledge among East African immigrant mothers. Our baseline survey found that these mothers had limited knowledge of HPV and HPV vaccine with only a small minority of mothers intending 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 that their adolescent children were at risk.[14] Additional studies have also persistently reported low knowledge of HPV among East African mothers.[10,37] Our study also addressed social and cultural beliefs that impact perceptions of HPV vaccines, including concerns about pork gelatin in vaccines. At baseline, over 90% of mothers did not know that the HPV vaccine does not contain pork gelatin and 75% of mothers were uncertain if the vaccine was safe. These reflect concerns that were expressed by the Somali, Ethiopian, and Eritrean mothers who participated in the focus groups that informed the content of in the intervention.[18] These findings and previous scholarship indicate that East African mothers do not have access to sufficient information regarding HPV to make decisions about vaccination.

Limited knowledge regarding HPV and HPV vaccination is a primary factor in the low number of adolescents receiving the vaccination.[5,27,38] Our study found that the interactive education forum was an effective tool for improving HPV and HPV-vaccine-related knowledge. After the intervention, over 90% of mothers agreed that HPV can cause cancer, is spread through sexual contact, and is different from HIV infection (although over 50% remained unsure about whether HPV is rare). With regards to HPV vaccine knowledge, over 75% of mothers agreed that HPV vaccines are safe, prevent cancer, and that all adolescent boys/girls should receive the vaccine. On the other hand, over 50% of mothers remained unsure about whether the vaccine contains pork gelatin. This suggests that interactive education forums among this population should emphasize addressing misperceptions of HPV vaccine knowledge in addition to broader barriers to vaccination. Previous findings from our qualitative research suggests that physicians and community members exert a strong influence on East African mothers' decisions to vaccinate their adolescents.[18] Our findings indicate that the intervention was more effective in convincing mothers that physicians consider HPV vaccines to be important than in convincing mothers that other parents in their community think the vaccine is important. This presents potential barriers for actual HPV vaccine uptake as research indicates that peer perceptions can trump physicians'

recommendations among East African mothers.[18] Future interventions may consider how participants can disseminate HPV-related knowledge to other community members and provide more discussions around potential social influences on vaccination behavior.

These findings provide further evidence of the effectiveness of interactive education forums to improve health outcomes. This study extends investigations that have found that community forums increase HPV knowledge among African Americans to racial and ethnic subgroups. Our study indicates that the education forum can increase more than knowledge as we found that these community forums can be utilized to improve a variety of HPV related outcomes such as HPV beliefs and intentions to vaccinate. The success of the intervention underscores the importance of active involvement from co-ethnic medical professionals when working with this population. Receiving support from co-ethnic medical professionals is critical for East African mothers to connect with the intervention and help overcome misperceptions of HPV vaccine.[18]

Moreover, 51% of mothers remained concerned about the side effects of the vaccine. Some of the persistent concerns after the intervention is likely due to increased knowledge regarding HPV and HPV vaccine. This is consistent with some scholarship indicating that increased education is associated with concerns over the side-effects of HPV vaccine.[39] In spite of these concerns, we still found substantial improvements in intentions and willingness to vaccinate. It is likely that these concerns do not necessarily equate to poor vaccine uptake. Previous studies have illustrated that even vaccinated individuals still have concerns over potential side-effects.[40,41] Future interactive education forums should attempt to minimize HPV vaccine concerns to make mothers more comfortable to vaccinate their adolescent.

A primary strength of this study is that it's one of a few studies 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. Finally, the intervention was informed by the formative literature and designed to fit the preferences of community members in terms of how they would like to receive education on HPV vaccines.

This study has several limitations that should be noted. 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. The individuals who are not willing to receive the intervention may differ substantially compared to those that do. 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 and derivative of the first is that the intervention was developed partly based on information gathered from focus groups. These focus groups may not necessarily be representative of the underlying communities. Therefore, the data gathered may not provide accurate predictions for those targeted. Finally, we are aware that measuring attitudes and intentions does not necessarily equate to increased vaccination uptake. Previous studies on young adults have shown that a single education session with little reinforcement at a later date improves short-term intentions to vaccinate but is not robust enough to impact vaccination behavior.[20,42-44] Thus, the study could not assess whether HPV vaccination behavior changed after the intervention.

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. Similar interventions could be fitted to other priority populations with suboptimal HPV vaccine uptake.

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