Title

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# The impact of a comic book intervention on East African-American adolescents' HPV vaccine-related knowledge, beliefs and intentions

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## Abstract

**Background:** HPV-vaccine uptake is low among East African-American (EAA) adolescents. We developed a comic book and evaluated the impact on HPV/HPV-vaccine knowledge, beliefs and vaccine-intentions.

**Methods:** The intervention was delivered to HPV-unvaccinated EAA adolescents attending educational dinners with their mothers. Adolescents aged 14–17 were sequentially assigned alternately to a pre- or post-test. Results were compared with chi-squared tests and generalized estimating equation models adjusted for age, gender, and mother's language.

**Results:** Among 136 (Pre-test=64, Post-test=72) participants (90% Somali), pre/post differences were observed for proportions of correct responses to questions on HPV (44.0% vs. 82.9%,

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RR:1.87[95%CI:1.54–2.27]), HPV-vaccine knowledge (42.8% vs. 75.4%, RR:1.74[95%CI:1.46–2.07]), comfort discussing HPV/HPV-vaccine with parents (57.8% vs. 90.3% somewhat/very comfortable, RR:1.55[95%CI:1.24–1.94]), and willingness (37.5% vs. 83.3% probably/definitely willing, RR:2.16[95%CI:1.55–3.01]) and intention (34.4% vs. 86.1% somewhat/very likely, RR:2.38[95% CI:1.69–3.37]) to get vaccinated.

**Discussion:** The intervention improved participants' HPV/HPV-vaccine knowledge, beliefs and vaccine-intentions. Similar interventions could be adapted for other racial/ethnic-minorities.

### Keywords

HPV vaccination; adolescent health promotion; immigrant; comic book; East African-American communities

## INTRODUCTION

Despite the availability of safe and effective vaccines against HPV types that cause most cervical and other HPV-related cancers, vaccine uptake in the U.S. is suboptimal [1]. Routine HPV vaccination is recommended at 11–12 years of age, with catch-up vaccination through age 26, yet only 72% of 13–17 year old adolescents had received ≥1 dose and 54% had completed the series as of 2019 [2].

Racial and ethnic minorities face barriers to HPV vaccination such as disparities in knowledge about HPV and HPV vaccines [3], parental awareness [4], and lack of provider recommendation [5]. A recent meta-analysis showed that Black, Hispanic, Asian, and other ethnic minority adolescents combined are 6.1% (95% CI: 3.3–8.8%) more likely to initiate the HPV vaccine series than their White/non-Hispanic counterparts; however, they are 8.6% (95% CI: 5.6–11.7%) less likely to complete the series [6]. Several studies indicate that adolescents whose caregivers are foreign-born are less likely to receive HPV vaccine than adolescents with U.S.-born caregivers [7–9]. HPV vaccination in East African immigrant communities is understudied, but limited data suggest very low uptake and limited vaccine awareness [10, 11].

Interventions targeted to adolescents may increase HPV vaccine uptake by addressing concern about pain [12] or limited HPV-vaccine knowledge [13], and can be adapted for specific communities. Educational interventions developed for adolescents have included video games [14], leaflets [15], and interventions delivered in school-based settings [16], such as activities, magazines and films [17], face-to-face structured information [18], and real-time teleconferencing [19]. While most improved vaccine-related knowledge and/or intentions, impacts on HPV vaccine uptake were variable or not evaluated.

Comic books are another type of educational tool and are especially relevant in adolescent health promotion because the use of visual story with text improves comprehension and retention, while engaging the reader [20, 21]. Comic books have been used successfully to improve health knowledge and behaviors in tobacco cessation and obesity prevention [22, 23]. Previously, Katz et al. developed and piloted a comic book related to HPV vaccines for adolescents in rural Appalachian communities [21]. However, no studies have developed

or evaluated the impact of an HPV vaccine comic book for East African-American (EAA) adolescents.

We developed a comic book [24] as a part of a multi-level intervention study targeted to EAA communities in Washington State involving mothers, adolescents, and healthcare providers [25, 26]. This paper describes the impact of the comic book on adolescents' knowledge of HPV/HPV vaccines, beliefs about and intention to receive HPV vaccination, as well as HPV vaccination uptake within 6-months post-intervention.

## METHODS

We developed a comic book for 14–17 year old EAA adolescents [24]. Between 2017–2018, the comic book was evaluated among adolescents who attended ethno-linguistic-specific community dinners (8 in Somali language for Somali communities and 2 in Amharic language for Ethiopian communities) with their mothers in King County, Washington. The study was approved by the University of Washington (STUDY00000785) and Washington State (2019–047) Institutional Review Boards.

### Comic Book Development

Details of the comic book development process were described previously [24]. Briefly, the comic book incorporated constructs of the Health Belief Model and Theory of Reasoned Action (including perceived susceptibility to and severity of HPV infection, vaccine benefits, cues to action [i.e., communicating with parents], self-efficacy, and barriers), and reflected input from focus groups with EAA mothers [27]. The book was written in English and graphically illustrated a story of a culturally appropriate adolescent female character who is introduced to HPV vaccine in a school health class and discusses HPV vaccines with her peers and family.

### Survey Development

The survey was informed by our research team's experience with HPV vaccine surveys and other studies on EAA and other immigrant communities [4, 10, 28–30]. Items from previous surveys were included or adapted for cultural appropriateness with feedback from EAA community representatives.

The survey included 18 simple-item response questions, designed to assess changes in seven theoretical constructs: HPV knowledge and beliefs (5 questions), HPV vaccine knowledge and beliefs (6 questions), barriers to HPV vaccination (2 questions), relevant social norms and influences (2 questions), communication with parents about vaccination (1 question), willingness to be vaccinated (1 question), and vaccination intention (1 question).

### Recruitment, Screening, and Enrollment of Study Participants

Recruitment and screening procedures were described previously [24, 26]. Briefly, recruitment targeted mothers from EAA communities who self-reported that their children were HPV-unvaccinated. Study procedures are described in Figure 1. Mothers were eligible if they spoke Somali or Amharic, had ≥111-17-year-old child, and reported none of

their children had received HPV vaccine or that they did not know their vaccination status. Mothers were invited to bring their English-speaking 14–17-year-old children to the community dinner to participate in the comic book intervention (because the comic book was specifically geared towards this age group). Written informed consent was administered in the mothers' native language. Mothers provided consent for themselves and their adolescents. Mothers were also asked to complete a Washington State Immunization Information System (WAIIS) HPV vaccination history release of information form for their children and completed a brief pre-intervention survey that included demographic information on the adolescents.

## Study Procedures

Dinners were held in centrally located community centers. Onsite prior to the start of each dinner, a list of participating adolescents was created in the order of arrival, and participants were sequentially assigned alternately to either the pre-test or the post-test. The decision to assign participants to either a pre-test or a post-test rather than having all participants complete both was made to avoid testing bias [31]. After a study-provided culturally-appropriate meal, mothers participated in an educational forum intervention with a health care provider in an adjoining room [26], and adolescents were divided into small pre-test or post-test groups of 2–4, led by the research staff. Research staff explained the study procedures and asked adolescents whether they would like to participate in the study. If the adolescent agreed, verbal assent was documented. The pre-test group completed the survey once before reviewing the comic book, and the post-test group completed the survey once after reviewing the comic book. The pre- and post-intervention surveys were identical and self-administered on paper.

Following completion of all study dinners, we received adolescents' HPV vaccine data from the WAIIS, covering 6 months of follow-up from the date of the dinner. We also used WAIIS data to identify whether any adolescents had been vaccinated before the dinner.

## Statistical Methods

Analyses were performed using R (version 3.6.1) or Stata (version 15.1). Adolescents' demographic characteristics and responses to individual survey items were summarized by pre-/post-intervention group and compared using chi-square tests. For pre/post comparisons, items were dichotomized (e.g., true/false), including questions with >2 response options (described in Table 2). In an exploratory analysis, the comparisons of pre/post responses to individual items were stratified by gender.

Each participant's proportion of correctly/positively answered questions for each construct was calculated, along with the mean and standard deviation of the proportion correctly/positively answered questions for each construct in pre-/post-intervention groups. To measure the intervention effect on each construct, generalized estimating equation (GEE) models were used to estimate relative risks (RRs) and 95% confidence intervals (CIs) [32]. Models used the count of correct answers per construct as the outcome, Poisson family (log-link), exchangeable correlation structure, and offset of the number of questions asked and were clustered on mother. Age, participant gender and mother's primary language

were included to control for potential confounding. Within each construct, adolescents who did not answer ≥1 question were excluded from GEE analysis. In an exploratory analysis, models were stratified by gender to enumerate gender-specific intervention effects, controlling for age and mother's primary language. Sensitivity analyses were run excluding adolescents identified to have been vaccinated pre-intervention. Finally, the number and proportion of adolescents who initiated HPV vaccination within 6-months post-intervention were described.

## RESULTS

Our analysis included 136 adolescents (belonging to 84 mothers). 64 adolescents were assigned to the pre-test and 72 to the post-test. Overall, about two-thirds (68.4%) were 14–15 years old and most (90.3%) were Somali. Just over half (53.7%) were female and just over half (52.4%) were born outside of the U.S. Most (90.3%) of their mothers identified as Muslim and 59.7% of their mothers reported annual household income <$25,000 (Table 1).

### HPV Knowledge and Beliefs

The proportion of correct responses across the five HPV knowledge questions ranged from 36.7%–61.3% in the pre-intervention group compared to 67.6%–93.1% in the post-intervention group (Table 2). Pre-/post-intervention comparisons were statistically significant for each question ($p<0.001$). Overall, adolescents in the post-intervention group were 1.87 (95%CI:1.54–2.27) times more likely to correctly answer questions related to HPV knowledge than adolescents in the pre-intervention group (Table 3).

### HPV Vaccine Knowledge and Beliefs

The proportion of correct responses to HPV vaccine knowledge and belief questions ranged from 26.6%–66.7% in the pre-intervention group compared to 66.2%–84.7% in the post-intervention group (Table 2). Statistically significant changes were observed for five of six questions ($p<0.001$). Overall, adolescents in the post-intervention group were 1.74 (95%CI:1.46–2.07) times more likely to correctly answer questions related to HPV vaccine knowledge ($p<0.001$, Table 3).

### Social Norms and Influences

Adolescents assigned to the post-test were more likely to assume positive social norms and influences towards receiving HPV vaccine than those in the pre-intervention group. Both items measuring positive social norm were statistically significant for change ($p<0.001$). 17.7% of the pre-intervention group disagreed with the statement "Other boys and girls would not think it is a good idea to get the HPV vaccine" compared to 52.8% of the post-intervention group. The proportion who agreed that "Doctors think it is very important that boys and girls get the HPV vaccine" increased from 54.7% to 87.5%. Overall, adolescents in the post-intervention group were 1.89 (95%CI:1.48–2.41) times more likely to positively answer questions related to social norms and influences (Table 3).

### Barriers

More adolescents in the post-intervention group (29.2%) responded “not concerned” to the question “When thinking about getting the HPV vaccine, how concerned are you about the side effects?” than in the pre-intervention group (14.1%, p=0.034, Table 2). However, there was no difference in the proportion responding “not concerned” to the question “When thinking about getting the HPV vaccine, how concerned are you about the shot being painful?” (39.1% pre-intervention vs. 40.3% post-intervention). Overall, post-test adolescents were 1.36 times more likely to be unconcerned about vaccine side effects or pain compared to pre-test adolescents; however, the result was not statistically significant (95%CI:0.93–2.01, Table 3).

### Communication

Adolescents in the post-test group were 1.55 (95%CI:1.24–1.94) times more likely to feel comfortable talking to a parent about HPV vaccines than those in the pre-test group (90.3% vs. 57.8% responding somewhat or very comfortable) (Tables 2 and 3).

### Willingness

Adolescents in the post-intervention group were 2.16 (95%CI:1.55–3.01) times more likely to respond that they were willing to receive the vaccine than those in the pre-intervention group (83.3% vs. 37.5% responding probably or definitely willing) (Tables 2 and 3).

### Intention

Adolescents in the post-intervention group were 2.38 (95%CI:1.69–3.37) times more likely than adolescents in the pre-intervention group to respond that they were somewhat or very likely receive the HPV vaccine in the next 6 months (86.1% vs. 34.4%) (Tables 2 and 3).

### Effect Modification by Gender

Pre-intervention, the proportion of correct responses to individual knowledge questions tended to be lower in males (range 18.2%–63.6%) than in females (range 32.3%–83.3%, Supplementary Material 1). In general, the magnitude of the intervention impact on constructs other than HPV vaccine knowledge and beliefs and willingness were similarly smaller for females than for males (Table 4).

### Sensitivity Analysis

We identified 15 adolescents through the WAIIS data who received the HPV vaccine prior to the intervention. Results from analyses excluding these adolescents were similar to results from the main analyses (Supplementary Material 2).

### HPV Vaccine Uptake 6-months Post-intervention

Of the 121 adolescents who were not previously vaccinated, two (2%) received the vaccine within 6-months after the intervention.

## DISCUSSION

The comic book intervention had a positive impact on EAA adolescents' HPV and HPV vaccine knowledge and beliefs, social norms around peer and healthcare provider attitudes towards the HPV vaccine, and parental communication. Adolescents surveyed after viewing the comic book were more than twice as likely to say that they were willing and likely to receive the HPV vaccine than those surveyed at baseline.

Comic books have been used to address diverse health promotion topics[21, 33–35]. They have been evaluated as interventions to decrease tobacco use among American Indian and Alaskan Native youth [33], for HIV/STD risk-reduction among South African adolescents [35], and to increase family planning among female Kenyan adolescents [34]. However, most studies have measured acceptability of comic books, but not resulting changes in knowledge or behavior [21, 33]. An exception is the Kenyan study that found that exposure to the comic book intervention was associated with delayed first sex and first pregnancy [34]. The comic book developed by Katz et al. for HPV vaccine uptake in the U.S. included similar constructs as ours but its impact on adolescents' knowledge and beliefs about HPV vaccine has not been evaluated [21]. Our study demonstrates that a culturally-adapted comic book that integrates parental feedback can improve adolescents' knowledge, beliefs and intentions to receive HPV vaccine.

Pain, distress, and/or fear about needle procedures is common among adolescents [36]. The HPV vaccine has received negative media attention about reports of high rates of pain and syncope [37]. We did not observe a positive impact on concerns about pain, perhaps because the comic book acknowledged pain as a necessary consequence of vaccination. However, adolescents surveyed after viewing the comic book were more likely to be unconcerned about side effects compared to adolescents surveyed at baseline, indicating the intervention was successful in overcoming an important barrier to vaccination.

The comic book positively impacted social norms related to peer and health care provider attitudes. Notably, only about half of the post-intervention group agreed that their peers think it is a good idea to get vaccinated, compared to 87.5% who answered that their providers would think it is very important to receive the vaccine. Very little information is available as to how adolescents' peer perception of HPV vaccine affects their own behavior. This is a significant evidence gap, as peer group acceptance becomes increasingly important in adolescence [38], with potential to influence behavioral patterns that may continue into adulthood [39]. In one study, adolescents and their caregivers in rural Alabama identified peer testimonials and recommendations as a potential facilitating strategy to increase HPV vaccine uptake [40]. More research about how adolescents' peer perceptions affect HPV-related beliefs, stigma and the decision-making process would be important for developing future interventions that specifically act on the mechanism of change to increase adolescent HPV vaccine uptake [41].

Although our study was not designed to evaluate the impact of the comic book on HPV vaccine uptake, only two adolescents were vaccinated in the 6-months post-intervention despite the positive impact on HPV vaccine intentions. There is growing evidence that

while interventions based on the Health Belief Model may positively influence vaccine intention, their effects on behavior are inconsistent and minimal [42], and that vaccine intentions are an unreliable predictor of uptake [16]. Evidence suggests that vaccine uptake involves a multi-faceted decision-making process, which requires multi-level and multi-modal interventions [16, 41]. For example, most adolescents rely on their parents or caregivers to access healthcare; therefore, parents' interest or willingness to have their children vaccinated influences whether or not adolescents receive the HPV vaccine. Netfa et al. found that while many immigrant parents had negative attitudes towards HPV vaccination because of the potential for sexual promiscuity and side effects, the majority of parents had positive attitudes after they were informed about the vaccine [43]. Lott et al. noted parental involvement is likely a facilitator to improved vaccine uptake in some minority populations, while it is a barrier in others [44]. Our findings suggest that when HPV vaccination is approached with cultural sensitivity, it is possible to enhance the level of comfort for the adolescents to have a conversation about HPV vaccines with their parents.

A strength of our study is that the comic book was developed with the EAA communities' input through a multi-methods process involving focus groups with mothers [27]. Given the heterogeneity within minority groups, it is important to design interventions and studies tailored for the unique intersectionality of the participants' racial, ethnic and cultural identities [44].

Our study had limitations. First, the quasi-experimental pre-/post-test design could have reduced the validity of the findings. We assigned participants to either a pre- or post-test to reduce testing bias, but allocation was not randomized. Furthermore, we adjusted for select demographic variables to control for confounding, but there may have been residual or unmeasured confounding. Secondly, sampling bias could have occurred, because adolescents were not recruited directly but were brought to the dinner events by their mothers. Therefore, they may have perceived their environment as vaccine-friendly, which could have influenced their intention to receive HPV vaccine. Moreover, mothers who agreed to participate in the study and their children may be different from those who did not, which may limit generalizability of the findings. Participating mothers may be more health conscious or motivated to learn about HPV vaccine than other mothers in their community. Our sample size was small, and it was not possible to look at effect differences by ethnicity because most participants identified as Somali. We found that the impact of the comic book tended to be stronger in males than in females (likely due in part to lower baseline knowledge in males than in females) but did not have sufficient power to test for effect modification. We may not have captured all adolescents vaccinated post-intervention due to possible incompleteness of the WAIIS registry, or mismatches between names of children reported by their mothers and in the registry. Lastly, because the post-test was conducted immediately after the intervention with no follow-up assessments, we were unable to assess knowledge or attitude decay that could have occurred over time.

In conclusion, a culturally targeted comic book for EAA adolescents effectively improved HPV vaccine related knowledge, beliefs, and intentions. The comic book can easily be adapted and replicated in other communities with low HPV vaccine uptake. Additional research in EAA communities on strategies that may act synergistically with adolescent

education to increase HPV vaccine uptake (such as reminders [45], referral and/or navigation support for scheduling vaccination appointments [46], or leveraging community-clinical partnerships [47]) is warranted.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Data Availability Statement

Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

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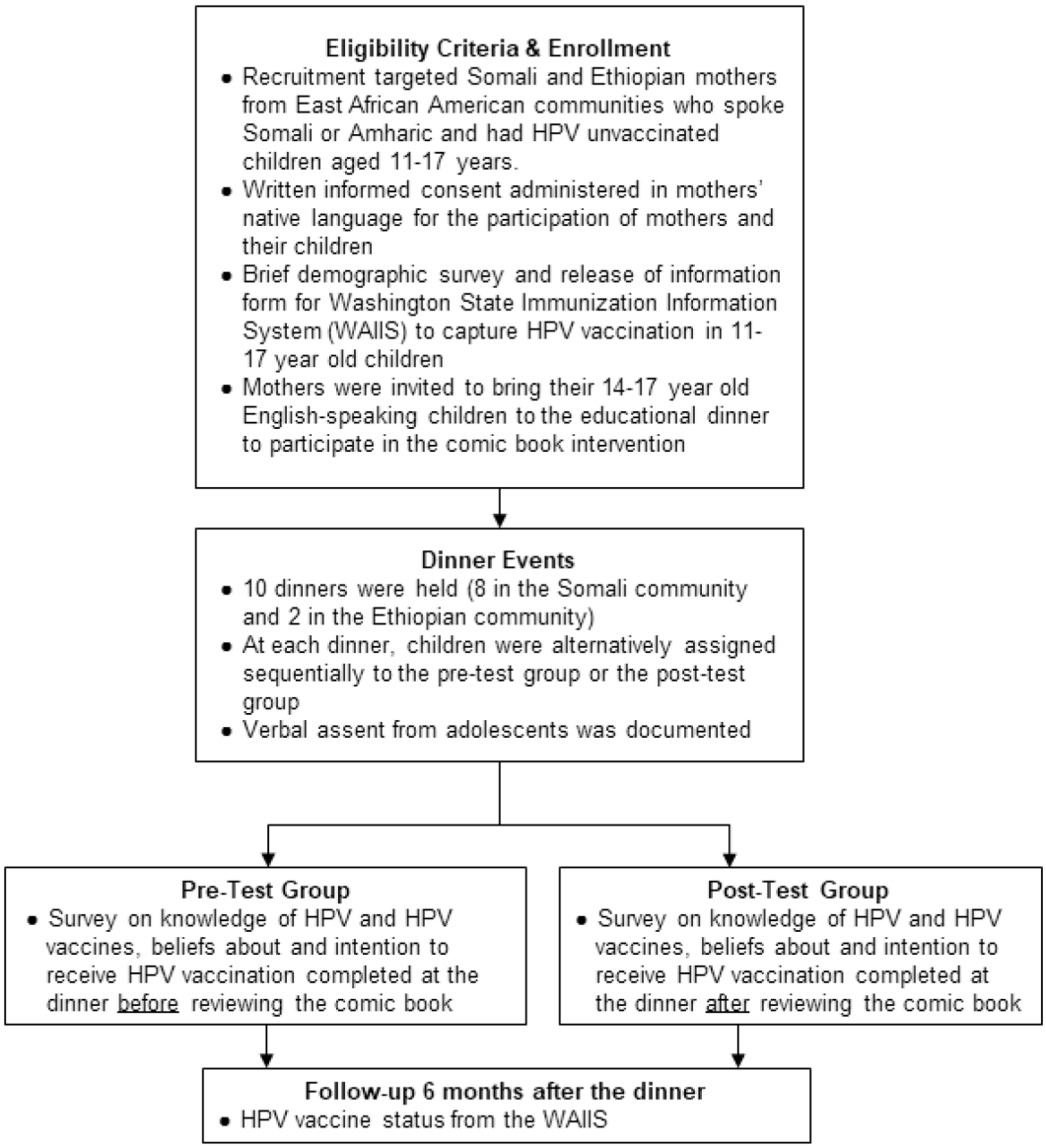


**Figure 1.**
Study Procedures Flowchart

**Table 1.**

Demographic characteristics of the adolescents (n=136)

| Characteristic | Pre-intervention survey (n=64) | Post-intervention survey (n=72) | Chi-squared p-value[c] |
|---|---|---|---|
| | n (%) | n (%) | |
| **Age (in years)** | | | 0.46 |
| 14 | 29 (45.3) | 24 (33.3) | |
| 15 | 16 (25.0) | 24 (33.3) | |
| 16 | 10 (15.6) | 15 (20.8) | |
| 17 | 9 (14.1) | 9 (12.5) | |
| **Gender** | | | 0.25 |
| Male | 33 (51.6) | 30 (41.7) | |
| Female | 31 (48.4) | 42 (58.3) | |
| **Born outside of the U.S** [a] | | | 0.03 |
| No | 22 (37.3) | 37 (56.9) | |
| Yes | 37 (62.7) | 28 (43.1) | |
| Missing | 5 | 7 | |
| **Ethnicity** [a b] | | | 0.25 |
| Somali | 58 (92.1) | 63 (88.7) | |
| Omoro | 0 (0.0) | 1 (1.4) | |
| Amhara | 2 (3.2) | 2 (2.8) | |
| Tigre | 1 (1.6) | 5 (7.0) | |
| Other | 2 (3.2) | 0 (0.0) | |
| Missing | 1 | 1 | |
| **Language** [a b] | | | 0.51 |
| Somali | 59 (92.2) | 64 (88.9) | |
| Amharic | 5 (7.8) | 8 (11.1) | |
| **Religion** [a b] | | | 0.52 |
| Christianity | 5 (7.9) | 8 (11.3) | |
| Islam | 58 (92.1) | 63 (88.7) | |
| Other | 0 (0.0) | 0 (0.0) | |
| Missing | 1 | 1 | |
| **Annual household income**[ab] | | | 0.75 |
| <$25,000 | 36 (60.0) | 41 (59.4) | |
| $25,000–50,000 | 16 (26.7) | 18 (26.1) | |
| >50,000 | 2 (3.3) | 5 (7.2) | |
| Do not know | 6 (10.0) | 5 (7.2) | |
| Missing | 4 | 3 | |

[a]Reported by the mother

[b] Mother's demographic

[c] Calculated excluding participants with missing information

**Table 2.**

The impact of the comic book on adolescents' HPV and HPV vaccine knowledge/beliefs, barriers to vaccination, social norms/influences, communication with parents about vaccination, willingness to be vaccinated, and vaccination intentions

| Constructs/Survey Questions | | Pre-intervention survey (n=64) | Post-intervention survey (n=72) | Chi-squared p-value[a] |
|---|---|---|---|---|
| **HPV knowledge/ beliefs (5 questions)** | | n (%) | n (%) | |
| **HPV infection is different than HIV infection.** | | n (%) | n (%) | |
| **Correct** | True | 38 (61.3) | 62 (87.3) | 0.001 |
| **Incorrect** | False | 3 (4.8) | 2 (2.8) | |
| | Not sure | 21 (33.9) | 7 (9.9) | |
| **HPV infection is rare.** [b] | | | | |
| **Correct** | False | 23 (37.1) | 48 (67.6) | <0.001 |
| **Incorrect** | True | 20 (32.3) | 13 (18.3) | |
| | Not sure | 19 (30.6) | 10 (14.1) | |
| **HPV is spread through sexual contact.** | | | | |
| **Correct** | True | 25 (39.7) | 62 (89.9) | <0.001 |
| **Incorrect** | False | 8 (12.7) | 2 (2.9) | |
| | Not sure | 30 (47.6) | 5 (7.2) | |
| **Most people with HPV infection know they have it.** | | | | |
| **Correct** | False | 25 (39.7) | 49 (71.0) | <0.001 |
| **Incorrect** | True | 8 (12.7) | 10 (14.5) | |
| | Not sure | 30 (47.6) | 10 (14.5) | |
| **HPV can cause cancer.** [c] | | | | |
| **Correct** | True | 22 (36.7) | 67 (93.1) | <0.001 |
| **Incorrect** | False | 9 (15.0) | 2 (2.8) | |
| | Not sure | 29 (48.3) | 3 (4.2) | |
| **HPV vaccine knowledge / beliefs (6 questions)** | | | | |
| **The HPV vaccine prevents serious health problems.** [d] | | | | |
| **Correct** | True | 42 (66.7) | 52 (72.2) | 0.484 |
| **Incorrect** | False | 11 (17.5) | 12 (16.7) | |
| | Not sure | 10 (15.9) | 8 (11.1) | |
| **The HPV vaccine is unsafe.** | | | | |
| **Correct** | False | 27 (42.9) | 53 (73.6) | <0.001 |
| **Incorrect** | True | 20 (31.7) | 9 (12.5) | |
| | Not sure | 16 (25.4) | 10 (13.9) | |
| **The HPV vaccine contains pork gelatin.** | | | | |
| **Correct** | False | 27 (42.9) | 61 (84.7) | <0.001 |
| **Incorrect** | True | 5 (7.9) | 2 (2.8) | |

| Constructs/Survey Questions | | Pre-intervention survey (n=64) | Post-intervention survey (n=72) | Chi-squared p-value[a] |
|---|---|---|---|---|
| | Not sure | 31 (49.2) | 9 (12.5) | |
| **All adolescent girls should get the HPV vaccine.** | | | | <0.001 |
| **Correct** | True | 17 (27.0) | 47 (66.2) | |
| **Incorrect** | False | 12 (19.0) | 16 (22.5) | |
| | Not sure | 34 (54.0) | 8 (11.3) | |
| **Adolescent boys do not need the HPV vaccine.** | | | | <0.001 |
| **Correct** | False | 17 (26.6) | 54 (75.0) | |
| **Incorrect** | True | 12 (18.8) | 9 (12.5) | |
| | Not sure | 35 (54.7) | 9 (12.5) | |
| **HPV vaccination involves more than one shot.** | | | | <0.001 |
| **Correct** | True | 28 (44.4) | 57 (79.2) | |
| **Incorrect** | False | 8 (12.7) | 10 (13.9) | |
| | Not sure | 27 (42.9) | 5 (6.9) | |
| **Social Norms/Influences (2 questions)** | | | | |
| **Other boys and girls would not think it is a good idea to get the HPV vaccine.** | | | | <0.001 |
| **Positive** | False | 11 (17.7) | 38 (52.8) | |
| **Negative** | True | 14 (22.6) | 22 (30.6) | |
| | Not sure | 37 (59.7) | 12 (16.7) | |
| **Doctors think it is very important that boys and girls get the HPV vaccine.** | | | | <0.001 |
| **Positive** | True | 35 (54.7) | 63 (87.5) | |
| **Negative** | False | 9 (14.1) | 5 (6.9) | |
| | Not sure | 20 (31.2) | 4 (5.6) | |
| **Barriers (2 questions)** | | | | |
| **When thinking about getting the HPV vaccine, how concerned are you about side effects?** | | | | 0.034 |
| **Positive** | Not concerned | 9 (14.1) | 21 (29.2) | |
| **Negative** | Not sure | 16 (25.0) | 8 (11.1) | |
| | Very concerned | 14 (21.9) | 19 (26.4) | |
| | Somewhat concerned | 25 (39.1) | 24 (33.3) | |
| **When thinking about getting the HPV vaccine, how concerned are you about the shot being painful?** | | | | 0.885 |
| **Positive** | Not concerned | 25 (39.1) | 29 (40.3) | |
| **Negative** | Not sure | 12 (18.8) | 6 (8.3) | |
| | Very concerned | 11 (17.2) | 16 (22.2) | |
| | Somewhat concerned | 16 (25) | 21 (29.2) | |
| **Communication (1 question)** | | | | |
| **How comfortable would you be talking with a parent about the HPV vaccine?** | | | | <0.001 |
| **Positive** | Very comfortable | 14 (21.9) | 42 (58.3) | |

| Constructs/Survey Questions | | Pre-intervention survey (n=64) | Post-intervention survey (n=72) | Chi-squared p-value[a] |
|---|---|---|---|---|
| | Somewhat comfortable | 23 (35.9) | 23 (31.9) | |
| **Negative** | Not sure | 15 (23.4) | 2 (2.8) | |
| | Not comfortable | 12 (18.8) | 5 (6.9) | |
| **Willingness (1 question)** | | | | |
| **How willing would you be to get the HPV vaccine?** | | | | |
| **Positive** | Definitely willing | 10 (15.6) | 28 (38.9) | |
| | Probably willing | 14 (21.9) | 32 (44.4) | <0.001 |
| **Negative** | Not sure | 25 (39.1) | 6 (8.3) | |
| | Not willing | 15 (23.4) | 6 (8.3) | |
| **Intention (1 question)** | | | | |
| **In the next 6 months, how likely is it that you will talk to a parent about getting the HPV vaccine?** | | | | |
| **Positive** | Very likely | 7 (10.9) | 29 (40.3) | |
| | Somewhat likely | 15 (23.4) | 33 (45.8) | <0.001 |
| **Negative** | Not sure | 29 (45.3) | 5 (6.9) | |
| | Not likely | 13 (20.3) | 5 (6.9) | |

[a]All responses were dichotomized prior to conducting the chi-squared test

[b]Perceived susceptibility measure;

[c]Perceived severity measure

[d]Perceived benefit measure

**Table 3.**

Generalized estimating equations (GEE) models for measuring the impact of the comic book on the adolescents' HPV and HPV vaccine knowledge/beliefs, barriers to HPV vaccination, relevant social norms/ influences, communication with parents about vaccination, willingness to be vaccinated, and vaccination intentions

| Construct | Mean (%) and the standard deviation of the proportion of correct/positive answers | | Unadjusted RR (95% CI) | P-value | Adjusted RR[a] (95% CI) | P-value |
|---|---|---|---|---|---|---|
| | Pre-survey | Post-survey | | | | |
| HPV knowledge / beliefs (5 questions) | 44.0 (4.1) | 82.9 (2.8) | 1.89 (1.55–2.29) | <0.001 | 1.87 (1.54–2.27) | <0.001 |
| HPV vaccine knowledge / beliefs (6 questions) | 42.8 (3.6) | 75.4 (2.7) | 1.76 (1.48–2.10) | <0.001 | 1.74 (1.46–2.07) | <0.001 |
| Social norms / influence (2 questions) | 36.3 (4.0) | 70.1 (3.9) | 1.93 (1.52–2.46) | <0.001 | 1.89 (1.48–2.41) | <0.001 |
| Barriers (2 question) | 26.6 (4.3) | 34.7 (4.3) | 1.31 (0.88–1.95) | 0.186 | 1.36 (0.93–2.01) | 0.114 |
| Communication (1 question) | 57.8 (6.2) | 90.3 (3.5) | 1.56 (1.25–1.95) | <0.001 | 1.55 (1.24–1.94) | <0.001 |
| Willingness (1 question) | 37.5 (6.1) | 83.3 (4.4) | 2.22 (1.59–3.10) | <0.001 | 2.16 (1.55–3.01) | <0.001 |
| Intention (1 question) | 34.4 (6.0) | 86.1 (4.1) | 2.51 (1.76–3.56) | <0.001 | 2.38 (1.69–3.37) | <0.001 |

[a]Adjusted for age, gender, mother's primary language

**Table 4.**

Generalized estimating equations (GEE) models for measuring the impact of the comic book on the adolescents' HPV and HPV vaccine knowledge/beliefs, barriers to HPV vaccination, relevant social norms/influences, communication with parents about vaccination, willingness to be vaccinated, and vaccination intentions stratified by gender

| Construct | Stratification by Gender | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Female | | | | Male | | | |
| | Correct/positive answers (Mean/SD) | | Unadjusted RR (95% CI) | Adjusted RR[a] (95% CI) | Correct/positive answers (Mean/SD) | | Unadjusted RR (95% CI) | Adjusted RR[a] (95% CI) |
| | Pre-intervention survey (n=31) | Post-intervention survey (n=42) | | | Pre-intervention survey (n=33) | Post-intervention survey (n=30) | | |
| **HPV knowledge / beliefs (5 questions)** | 47.6 (6.3) | 82.5 (3.6) | 1.73 (1.32–2.27) | 1.73 (1.33–2.24) | 40.6 (5.4) | 83.6 (4.6) | 2.06 (1.55–2.73) | 2.07 (1.56–2.75) |
| **HPV vaccine knowledge / beliefs (6 questions)** | 51.8 (5.7) | 76.0 (3.8) | 1.47 (1.16–1.86) | 1.48 (1.18–1.85) | 34.9 (4.1) | 74.4 (3.7) | 2.13 (1.67–2.73) | 2.13 (1.67–2.73) |
| **Social norms / influence (2 questions)** | 41.4 (6.1) | 73.8 (5.2) | 1.78 (1.30–2.45) | 1.79 (1.29–2.47) | 31.8 (5.2) | 65.0 (5.9) | 2.04 (1.42–2.95) | 2.08 (1.45–2.98) |
| **Barriers (2 question)** | 19.4 (5.5) | 26.2 (5.2) | 1.35 (0.69–2.66) | 1.30 (0.68–2.47) | 33.3 (6.4) | 46.7 (6.8) | 1.40 (0.88–2.23) | 1.40 (0.87–2.23) |
| **Communication (1 question)** | 61.3 (8.9) | 90.5 (4.6) | 1.48 (1.10–1.99) | 1.44 (1.07–1.94) | 54.5 (8.8) | 90.0 (5.6) | 1.65 (1.18–2.31) | 1.63(1.17–2.27) |
| **Willingness (1 question)** | 48.4 (9.1) | 83.3 (5.8) | 1.72 (1.17–2.55) | 1.67 (1.14–2.44) | 27.3 (7.9) | 83.3 (6.9) | 3.06 (1.70–5.48) | 3.11 (1.75–5.52) |
| **Intention (1 question)** | 45.2 (9.1) | 92.9 (4.0) | 2.06 (1.38–3.07) | 2.00 (1.35–2.95) | 24.2 (7.6) | 76.7 (7.9) | 3.16 (1.67–6.00) | 3.20 (1.69–6.04) |

[a]Adjusted for age, mother's primary language