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HPV Vaccination Decision Among Catch-up Population Through a Digital Intervention: Empowering Young Adults to Their Own Health Decision-Making

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Abstract

Human papillomavirus (HPV) is the most common sexually transmitted infection on U.S. college campuses. Although HPV vaccination is recommended through age 26, current efforts to improve vaccination rates have predominantly focused on adolescents. Consequently, vaccine uptake remains suboptimal among young adults. This represents a significant missed opportunity, as young adults face the highest risk for new HPV infections. To contextualize the factors impacting decision-making process for this vulnerable population, this study reports key themes that emerged from in-depth interviews with participants ($N = 30$) who had completed an online intervention study for HPV vaccination among college students. Twelve (40%) of the interviewees vaccinated after exposure to the intervention. Findings centered around empowerment among young adults as the facilitator to get the HPV vaccine: key themes emerged were (1) convenience is critical and empowering; (2) adulthood identity, marked by a heightened sense of autonomy, accountability, and responsibility for self/future self and others, is empowering; (3) equal access to health care and preventive resources is empowering, especially for participants with low socioeconomic status; and (4) accurate knowledge provided in the intervention destigmatized HPV vaccination to empower young adults to make informed decisions. Digital interventions with messages highlighting a newly gained autonomy, future-oriented self and social responsibility, inclusive and accurate knowledge, and providing navigation to improve access may enhance HPV vaccination among young adults.

Keywords: HPV vaccination, young adults, digital intervention, cancer prevention, cancer disparities, health decision-making

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States and the world, and it is estimated that nearly all sexually active adults will be infected with HPV at some point in their lives.¹ HPV infections, particularly with high-risk HPV strains, can cause genital warts and invasive cancers of cervix, vagina, vulva, penis, anus, and oropharynx.² Since 2006, an HPV vaccine has been available to protect against certain strains of HPV infections. The Centers for Disease

Control and Prevention (CDC) and the Advisory Committee on Immunization Practices recommend a two-dose HPV vaccination for people aged 9–12 years as routine vaccination and a three-dose schedule for the catch-up population up to 26 years old.³ However, catch-up vaccination rates remain suboptimal, missing an imperative opportunity for HPV-related cancer prevention.

Of note, young adults face elevated risks for HPV infection and may experience challenges in accessing vaccination.⁴ However, current efforts to improve HPV vaccination have been predominantly focused on adolescents.⁵ Although

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the completion of HPV vaccines is most optimal before sexual debut, participants in our study missed the opportunity to get the HPV vaccination as children, ranking them an underserved population for HPV-related cancer prevention. Young adults have the highest chance for new HPV infection: Roughly 75% of new HPV infections occur during the emerging adult developmental period⁶ due to a higher propensity to conduct risky behaviors⁷ than other age-groups. This population is also at childbearing age, so their decision to receive HPV vaccine or not may pose a public health concern if they pass the infection to the next generation.⁸ However, there are several unique opportunities to target the catch-up population in college.^{9,10} Concurrently, college students were reported to enjoy recently gained autonomy and are likely able to take charge of their own health decisions,¹⁰ providing profoundly critical opportunities for cancer prevention.

Previous literature showed that lack of knowledge of the HPV infection,^{11–17} stigma toward HPV vaccination,¹² low perceived risk,^{14,15} safety of the vaccines,^{12,13} concerns about vaccination cost,^{7,17,18} lack of health insurance,¹⁹ and worries of parental disapproval²⁰ were common factors preventing young adults from HPV vaccination. Apart from the aforementioned theoretical and practical factors, further formative research should address social, cultural, ethnic, and economic barriers¹⁴ in the decision-making of HPV vaccination among young adults, as developmentally they may vacillate between autonomy and dependence on parents.²⁰ This study aims to investigate HPV vaccination decision narratives and contextualize the factors impacting decision-making process for this population.

Currently, very few interventions have successfully increased HPV vaccination rates among young adults,²¹ and these interventions have predominantly been tested with samples comprising mostly non-Hispanic Whites. This is concerning because the current HPV coverage and cancer prevention landscape highlight a health disparity among racial/ethnic minorities. Specifically, the incidence and mortality rates of the HPV-related cancers are higher among racial/ethnic minorities.²² This inequity may be partly due to the lower HPV vaccination rates for these groups, compared with non-Hispanic White individuals.²² Although racial/ethnic minorities and those with low socioeconomic status (SES) report higher level of vaccination intention, they suffered lower vaccination rates than their White counterparts.^{23,24} This inverse relationship highlights the significance of equitable access, as this population disproportionately suffers from a lack of access to quality health care due to insurance status and low SES.^{25–27} To address this critical gap, this study investigates the narratives of HPV vaccination decision-making among racial/ethnically diverse young adults from an ongoing intervention study for college students.

Aiming to increase HPV vaccine uptake among college students in Texas, the SHIELD study^a (Student Health Initiative for Eliminating HPV Diseases) is an ongoing innovative multilevel digital intervention²⁸ based on an effective pilot study²⁹ and uses multilevel tailored narratives (video and written narratives, tailored by gender, from peers are further tailored for sexual activity status) to test the efficacy of message design and access enhancement. Participants in the

narrative groups viewed materials from the perspective of peers, a doctor, and a cancer survivor. The intervention study was launched in the spring of 2022. Participants were recruited through direct on-campus recruitment events or collaboration with community partners at four large Texas universities. The current study conducted in-depth interviews with participants ($N = 30$) who have completed the intervention study, to contextualize the facilitating mechanism for HPV vaccination uptake among young adults.

Methods

Participants

The study was approved by the institutional review board. Participants were recruited from those who completed the SHIELD study and expressed interest in participating in the post-study interview. Inclusion criteria for the intervention were (1) aged 18–26 years, (2) able to read and understand English, (3) self-reported as not received any HPV vaccines, (4) had access to a device connected to the Internet, and (5) currently enrolled in one of the participating schools with an anticipated continuous enrollment of at least 9 months.

Procedure and data analysis

The interviews were conducted over Zoom. Each interview lasted between 60 and 90 minutes. Participants gave verbal consent to audio recording and received gift cards to compensate for their time. The interviews followed a semi-structured interview guide (see Appendix A), with slight variations in questions for vaccinated and unvaccinated interviewees. Interviews were transcribed. The research team utilized an iterative process to conduct thematic analysis:³⁰ Each interview transcript was independently analyzed and coded by members of the research team. By examining, comparing, conceptualizing, and categorizing, final themes were summarized by the first author after a consensus was reached among all coders. For methodology rigor, Appendix B presents the codebook with definitions and descriptions.

Thirty individuals participated in the interview. Table 1 depicts the key characteristics of the interviewees. The mean age of the sample was 20.15 ($SD = 2.09$, range = 18–24). The majority were women ($n = 20$) and Asians ($n = 16$), and 70% of the sample were sexually inactive. Four out of the 30 interviewees had not heard of HPV before the study. At the time of the interviews, 12 participants (40%) received at least one dose of the HPV vaccine after participating in the intervention, one refused to answer, and the rest were unvaccinated.

Results

Four central themes emerged from data analysis: (1) convenience enabled by digital platform is critical; (2) adulthood identity, marked by a heightened sense of autonomy, accountability, and responsibility for self/future self and others, is empowering; (3) cost is a critical factor; and (4) knowledge destigmatizes HPV vaccination and empowers participants to make informed decisions. Table 2 demonstrates the identified themes, subthemes, and illustrative quotes.

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF INTERVIEWEES

	N = 30
Age, <i>M</i> (<i>SD</i>)	20.15 (2.09%)
Gender identity, <i>n</i> (<i>n%</i>)	
Female	20 (67%)
Male	10 (33%)
Race/Ethnicity, <i>n</i> (<i>n%</i>)	
African American/Black	3 (10%)
Asian	16 (53%)
Hispanic	4 (13%)
Native American/Alaska Native	1 (3%)
White	5 (17%)
Asian and White	1 (3%)
Sexually active (yes), <i>n</i> (<i>n%</i>)	9 (30%)
Health insurance (yes), <i>n</i> (<i>n%</i>)	26 (87%)
Vaccinated now (yes), <i>n</i> (<i>n%</i>)	12 (40%)

M, mean; *n*, number of participants; *n%*, percentage of participants; *N*, overall sample size; *SD*, standard deviation.

Theme 1: Convenience is critical

Among all 30 interviewees, we found a unified appreciation for the convenience of the online/digital delivery method of the intervention and the navigation and enhanced access to vaccination provided by the study. Students indicated they did not have time to participate in in-person interventions because of their busy, and often fragmented, schedules. For example, one interviewee noted, “If it [the study] wasn’t online, I probably would not have done it” (ID: 282). Other participants stated, “If it is a matter of calling up a receptionist then it takes extra energy from me” (ID: 629); and “On-campus clinics were very convenient” (ID: 344). Factors such as scheduling conflicts, transportation constraints, time limitations, and privacy concerns emerged as key reasons why in-person approaches may deter involvement and vaccination. Additionally, participants pointed out the privacy afforded by the flexibility of digital modality (ID: 150).

Theme 2: Adulthood identity, marked by (1) a heightened sense of autonomy and (2) accountability and responsibility for self/future self and others

Several participants identified adulthood identity as empowering and expressed a desire to embrace responsibility for their own health and the health of others. One participant asserted, “I’m an adult. It would be up to me to make the decision because I’m able to make my own decision. Their [parents] opinion will be respected, but above all, I will ask them to respect my decision and respect my individuality.” (ID: 150). Multiple interviewees, particularly male students, mentioned the need to protect others, particularly women: “I was only informed on the effects it [HPV] has on women [. . .] The biggest factor in getting vaccinated was my concern for spreading HPV to other people” (ID: 282).

Participants were also cognizant of the need to protect their *future health* and perceived the act of getting vaccinated as an *investment for the future*. An interviewee confided that she received the HPV vaccination not only to protect her own health but also “to reduce chances of chronic

HPV infection [. . .] that has consequences for childbearing” (ID: 906). Another student stated, “. . .another vaccine to prevent health complications in the future was fine with me” (ID: 76). And yet another student pointed out, “[HPV vaccination] is a good investment, because it can help prevent cancer and treatment for cancer can be very expensive” (ID: 312).

Among participants who did not get vaccinated, parental influence, especially from mother’s side, emerged as the most salient factor. For example, an interviewee, who was on her mother’s insurance, explained that her mom was against vaccines and associates HPV vaccine with sexual activity. As a result, the participant expressed concern that “mom would get upset if I got vaccinated” (ID: 402).

Theme 3: Equal access to health care and preventive resources

Equal access to health care and preventive resources is empowering, especially for students. Many interviewees (e.g., IDs 344 and 396) identified cost as an important consideration, as one stated, “cost is a big factor for me *as a student*” (ID: 349). Participants pointed out that free vaccination would be most desirable for “participants who may be [. . .] financially disadvantaged” (ID: 312). Multiple participants (e.g., IDs 629 and 344) mentioned they would not have received the vaccine if the cost was not covered by the study.

Theme 4: Knowledge destigmatized HPV vaccination

Another recurring theme is that knowledge destigmatizes HPV vaccination. A student found the information that HPV vaccine is recommended regardless of sexual activity status important for him to make decision: “It helps a lot just knowing that it [HPV prevention] is not just for people that are active” (ID: 374). Participants also consistently reported that the knowledge offered in intervention significantly enhanced their awareness of HPV infection and prevention, shedding light on the virus’s prevalence, transmission, and the protection offered by vaccination. One participant cited statistics from the intervention and noted how that influenced his vaccination decision: “80% of unvaccinated getting it in their lifetime is striking. It’s a bit scary, [. . .] the use of numbers and statistics was motivating to get vaccination” (ID: 333).

Discussion

With attention from the research community primarily focusing on adolescents for HPV vaccination,⁵ vaccine uptake remains suboptimal among young adults.^{4,9} Additionally, this population is at increased risk for HPV infection and may experience challenges in accessing HPV vaccine.⁴ The findings from this study help to contextualize the factors impacting young adults’ HPV vaccine decision-making processes and informs intervention design for this underserved population. Convenience, adulthood identity, access, and knowledge have emerged as themes that empowered young adults to get HPV vaccination.

Convenience afforded by the digital format of the intervention and the presence of HPV vaccine clinics on campus are critical to young adults’ decisions to vaccinate. This aligns with preceding literature²³ that identifies college students’ busy schedule as a barrier to vaccination. A digital intervention, such as the SHIELD study, provides the

TABLE 2. KEY THEMES AND SUBTHEMES EMERGED FROM IN-DEPTH INTERVIEWS

Theme	Subtheme	Illustrative quote	Intervention design implications
Digital intervention: Empowered to be flexible	Acknowledgment of online format	<i>If it [the study] wasn't online, I probably would not have done it. (ID: 282)</i>	A flexible hybrid approach that leverages the strengths of both online and in-person modalities
Empowered to embrace adulthood identity	A heightened sense of autonomy	<i>I'm an adult. It would be up to me to make the decision because I'm able to make my own decision. Their opinion will be respected, but above all, I will ask them to respect my decision and respect my individuality. (ID: 150)</i>	Messages with themes of a newly gained autonomy
	Accountability for future self (individual responsibility)	<i>Another vaccine to prevent health complications in the future was fine with me. (ID: 76)</i> <i>[HPV vaccination] is a good investment, because it can help prevent cancer and treatment for cancer can be very expensive. (ID: 312)</i>	Messages with themes of future-oriented self-responsibility
	Altruistic considerations (social responsibility)	<i>[his] biggest factor in getting vaccinated was my [his] concern for spreading HPV to other people. (ID: 282)</i>	Messages with themes of future-oriented social responsibility for others
Empowered to enjoy health equity	Free vaccination	<i>Cost is a big factor for me as a student. (ID: 349)</i>	Provide affordable vaccination or offer financial support
	Convenient access	<i>If it is a matter of calling up a receptionist then it takes extra energy from me. (ID: 629)</i> <i>On-campus clinics were very convenient. (ID: 344)</i>	Offer convenient access, such as clinics on campus; offer during routine check-ups/flu shot clinics
Empowered through knowledge acquisition	Accurate knowledge representation through numbers and statistics	<i>The use of numbers and statistics was motivating to get vaccination. (ID: 333)</i>	Present accurate information in scientific methods
	De-stigmatize	<i>It helps a lot just knowing that it [HPV prevention] is not just for people that are active (ID: 374)</i>	Highlight knowledge the HPV impacts both genders and could be infected through nonsexual interaction

flexibility and convenience that college students need. After the COVID-19 pandemic, the new normal would default to virtual experiences. Therefore, not offering an online format for an HPV intervention targeting busy college students may be a deal-breaker with negative implications for their vaccination decisions. Factors such as scheduling conflicts, transportation constraints, and time limitations are mentioned reasons as to why in-person approaches may deter involvement. Additionally, another student pointed out the privacy afforded by the flexibility of digital modality (ID: 150), shedding light on the stigma attached with HPV vaccination as the subject of the study.

In addition to convenience, adulthood identity is instrumental. While parental decision-making is a key driver for adolescent vaccination,³¹ findings indicated that among participants who received at least one dose of the HPV vaccine, adulthood identity, marked by a heightened sense of autonomy, accountability for future self (individual responsibility), and altruistic considerations (social responsibility), was a salient factor. As individuals transition into young adulthood, autonomy and responsibility become pivotal

facets of their health decision-making process. Separation from parents or primary caregivers, such as moving to college, facilitates the emergence of an autonomous identity.³² Participants emphasized a newfound adult identity, indicated by a sense of agency, exerted by taking control of their health through the proactive act of HPV vaccination. The assertion "I am an adult [...] I'm able to make my own decision" (ID: 150) underscores the salience of agency and independence in health decision-making as college students navigate the transition into adulthood, although self-reliance does not completely contradict with respecting parental opinions.

The other prominent subtheme in adulthood identity is the acknowledgment of accountability for future self. It is well documented that thinking about one's future would be more persuasive³³ and produce stronger anticipated regret of not taking preventive measures, such as taking the HPV vaccine.³⁴ Participants referenced the implications a HPV infection may have on their reproductive health and framed the decision to get vaccinated as long-term investment. His analogy clearly showcases the nature of strategic planning and

intentional health decision-making in HPV vaccination, emphasizing an accountability of personal health associated with the adulthood identity.

Adulthood identity also encompasses social responsibility. For male interviewees, prioritizing other people indicates a sense of duty and solidarity as a prosocial young adult, viewing HPV vaccination as a collective effort to safeguard the health of others, particularly women. On a more nuanced note, while altruistic belief (i.e., get vaccination to protect vulnerable groups) has been identified as a common facilitator for many vaccines,³⁵ including COVID-19,³⁶ this notion of protecting women underscores the enduring and prevalent gendered misperception surrounding HPV, positioning it predominantly as a female-centric health concern.³⁷ Although the altruistic belief from males may serve as a facilitating factor for HPV vaccination, the feminization of HPV³⁸ has been found to invite confusion, limit prevention, and exacerbate gender disparities.³⁸ After all, HPV and its associated health risks are present across genders, and the overidentification of HPV with females might contribute to the disproportionately low rate of male vaccination, as they may not see HPV as beneficial or necessary for their own protection.^{17,39}

Conversely, consistent with literature,⁴⁰ many *unvaccinated* participants seem to be less independent and rely more on parents, particularly their mother. For example, an interviewee (ID: 402) identified her mother's influence as the main barrier to vaccinate. Stemming from family values and religious beliefs, she holds stigma against vaccines and associates HPV with sexual activity. In addition, she was under her mother's insurance, which intensified her worry about her mother's reaction if she got vaccinated. It was not surprising she did not receive the HPV vaccination due to the twofold concern in her decision-making process. Such concerns, especially daughter's concern from mom, were also reported in Hopfer and colleagues' work,^{20,37} highlighting the importance of offering free vaccination to young adults who are on parents' insurance and have concerns about potential repercussions if their parents discovered they got vaccinated.

The catch-up population missed the first HPV vaccination window recommended by the CDC,⁷ while they were under the care of their parents, precisely due to some parents being hesitant.³¹ If parents remain unsupportive as children enter adulthood, the latter needs a strong independent identity to battle the pressure from family. While many college students struggle with finding the balance between enmeshment with parents and complete disengagement,⁴¹ dependence on parents resulted in diminished agency to take control of health decisions in the case of HPV vaccination.

Another key theme is the significance of access to HPV vaccine within college communities. Vaccinated interviewees consistently expressed a profound sense of empowerment resulting from convenient access and the removal of financial barriers to HPV vaccination. As the intervention was designed to cover all out-of-pocket costs for participants, individuals were empowered to prioritize their own decision, free of concerns about payment or insurance status.

Consistent with previous studies^{6,13,17,19} that identified cost as a key barrier to HPV vaccination, results showed that financial burden is a significant barrier among young adult populations. HPV vaccination is expensive: following a three-dose protocol costs around \$860 without insurance.⁴² In the case of young adults in our study, socioeconomic factors such as dispensable income to cover HPV cost constitute a great hurdle, supporting the inverse relationship between

SES and vaccination rates evidenced by previous study.¹⁹ Equitable access of HPV vaccination may serve as a catalyst for health decision-making, leveling the playing field for college students who otherwise face barriers to receiving preventive health services. In fact, without equitable access, disparity in HPV vaccine coverage may be exacerbated, and inequality in access may consequently translate into inequality in incidence and mortality, as shown in a recent review.²³

Another recurring theme is that accurate knowledge empowered participants to destigmatize HPV vaccination and facilitated informed health decision-making. Consistent with literature that identified lack of knowledge and awareness as a key barrier for HPV vaccination,⁷ findings support the emancipating role of knowledge acquisition. Participants consistently reported that the intervention significantly enhanced their awareness of HPV infection and prevention. The use of accurate statistics (e.g., 80% of U.S. adults would be infected with HPV at least once in lifetime) was identified as a crucial element in their decision to get vaccinated.

Knowledge on HPV was also found to disrupt stigma surrounding the vaccination. Although the pervasive stigma associating HPV with moral judgments that sexual promiscuity has been evident in the current and multiple previous studies,^{12,20} knowledge about alternative transmission (e.g., nonsexual, skin to skin) was appreciated by interviewees, particularly those currently sexually inactive. Therefore, information provided in the intervention does not only empower participants to make informed health decisions but also helps combat enduring stigma against HPV vaccination.

Limitations

Due to the inherent limitation of the qualitative methodology,⁴³ the study does not provide a representative picture of young adults but rather the perspectives of a group of self-selected and engaged interviewees. More male voices also need to be studied to address the feminization of this public health issue.³⁸

Implications and Conclusions

The strengths of the study include a focus on underserved young adults and racially diverse sample in accessing factors impacting their HPV vaccination decision. Future intervention targeting young adults may consider a flexible hybrid approach that leverages the strengths of online intervention and in-person recruitment. For content design, tailoring messages that resonate with themes of a newly gained autonomy and future-oriented self and social responsibility may enhance the effectiveness of interventions aiming at increasing HPV vaccination among young adults. This study also underscores the pivotal role of scientifically presented knowledge in promoting HPV vaccine uptake and challenging stigma. Future interventions could include data-driven presentations, utilizing epidemiological data, prevalence rates, and vaccine efficacy statistics to convey accurate information, and consequently empower individuals to make informed decisions and combat stigma fueled by discriminating myths. Additionally, due to the population's characteristics (e.g., financially draining and busy schedule), providing navigational and financial support to improve access may be the ultimate equalizer in empowering young adults in marginalized groups to enjoy health equity. Finally, the above underlined the importance of contextualizing the unique cultural

beliefs, health literacy, socioeconomic factors, and environmental or structural resources and restraints in behavioral change when working with a specific population.

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Authors' Contributions

Q.L. conceived the intervention design and secured the funding. D.C., L.D.M., S.H. and L.M.R. contributed to the intervention and protocol development. Q.L., L.D.M., Y.A.X. and D.L. were involved in developing the community operations. Y.A.X., M.B., N.N., and S.M. drafted the manuscript. Y.A.X., D.C., L.D.M., S.H., and Q.L. edited the manuscript or provided feedback on the manuscript. Y.A.X., L.D.M., M.B., and N.N. were involved in data collection. Y.A.X., M.B., N.N. and S.M. coded the data. Y.A.X. identified key information needed for submitting the manuscript for the targeted journal. All authors read and approved the final manuscript.

Note

- a. Formerly No-HPV-4-Me Study.

Author Disclosure Statement

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(Appendix follows →)

Appendix

APPENDIX A: SEMI-STRUCTURED INTERVIEW GUIDE

Introduction

Hello and welcome! Thank you for participating in No-HPV-4-ME and agreeing to share your time and thoughts with us today. My name is _____, and I'm a _____ (research coordinator) at _____ (institution). The research staff for this project is interested in knowing your thoughts and feelings about the study.

I want to be sure you understand that participating in this interview is voluntary. You may stop at any time you wish. The interview will take approximately 1.5 hours, and your time will be compensated. As was mentioned to you when you were contacted about this interview, we are audio recording this meeting. We are recording because we want to make sure that we remember everything that you say. After we review the recording and write down what you shared with us, we will delete the recording. We will not include any information about you on the written notes. The results and conclusions of this interview will be summarized for use by the research team but will not identify any individuals. Also, if you prefer not to answer any question, just let me know, and we'll skip the question.

Do you have any questions before we begin?

General Questions

- (1) What made you enroll in the study?
- (2) What was your experience like as a participant in the study?
 - a. *Probe:* What did you like most about the study?
 - b. *Probe:* What did you like the least?

Questions About the Intervention

3. You viewed some information about HPV and HPV vaccine during the study. I know it has been a while, so I am going to show it to you again (*interviewer shows CDC information, stories, or videos depending on participant's group assignment*).
 - a. (*Written narratives and CDC information only*) Please talk to me about how you read the stories/information.
 - b. (*Written narratives and CDC information only*) About what percent of the text would you say you actually read?
 - c. What do you think about the stories?
 - i. *Probe:* What do you like about the stories. What do you not like about them?
 - d. What aspects of the stories do you believe would appeal to young adults and make them want to vaccinate?
 - e. And on the flip side, what aspects of the stories might be a turn off and may not motivate a decision to vaccinate?

- f. The goal of the stories is to get college students to go and get vaccinated against HPV. What are your recommendations of ways we could improve the stories to make them more effective in achieving this goal?

4. (*For participants in the enhanced access arm*)

- a. What role, if any, did the on-campus HPV vaccine clinics play in your decision to get vaccinated?
- b. We send reminders for the dose 1, 2, and 3 clinics. (*Share an example of the reminders with participants.*) What are your thoughts about those reminders?
 - i) *Probe:* What recommendations do you have of how we could make the reminders more effective?
 - ii) *Probe:* What about the reminders made you show up for the clinics?

Questions About Barriers

5. (*All participants who did not initiate vaccination*): Can you tell me the most important factors that would influence your decision to receive the HPV vaccine?
6. (*All participants who initiated vaccination*): Can you tell me the most important factors that influenced your decision to receive the HPV vaccine?

(Instruction: First, listen to what they say. If they do not mention the points below, ask the following follow-up questions pausing after each to give participants time to respond.)

(*Participants who did not initiate vaccination*) What role would each of the following play in influencing your decision to get the HPV vaccine?

(*Participants who initiated vaccination*): What role did each of the following play?

1. Providing additional information (evidence that the vaccine is effective and safe)
2. Your personal beliefs about necessity, risks, benefits, and more of vaccine
3. Parents' approval
4. Friends' opinion
5. Health care providers' recommendation
6. Insurance coverage
7. Access/time
8. If you are under your parents' insurance, what are your thoughts about if your parents found out that you got vaccinated without telling them in advance?

Questions About Strategies

9. What other thoughts do you have about the study?

a. Probe: What do you think about:

- i) recruitment advertisements?
- ii) timing of reminders? (E-mail reminder Day 5, Day 9, and Day 13, for a total of three reminders 4 days apart. Text or call participants on day 14.)
- iii) contact/communication with the research team?
- iv) study duration/length?

v) length of the questionnaires?

vi) online format?

Closing

Those are all the questions I have. Is there anything that you believe is important to this discussion that we did not talk about?

Thank you for contributing to the study and for your time. We would like to remind you that any comments from this conversation used in any reports will be anonymous.

APPENDIX B

TABLE B.1. CODEBOOK WITH DEFINITIONS AND DESCRIPTIONS

Code label	Definition	Description	Qualifications or exclusions	Illustrative quote
Acknowledgment of online format	Expressing a preference or appreciation for the online delivery of intervention	Mentioned the convenience of doing the intervention over phone; the challenges of in-person participation, the fragmented schedule, and logistic hardships	Can be a new normative feeling created after COVID	<i>If it [the study] wasn't online, I probably would not have done it. (ID: 282)</i>
A heightened sense of autonomy	An increased feeling of independence, self-governance, and control over one's actions, decisions, and circumstances	Considering getting HPV vaccination a responsibility of themselves, having the freedom and ability to make choices aligned with their own values	Could be disregarding the opinions of parents or peers but not necessarily of both or of the medical provider	<i>I'm an adult. It would be up to me to make the decision because I'm able to make my own decision. Their opinion will be respected, but above all, I will ask them to respect my decision and respect my individuality. (ID: 150)</i>
Accountability for future self (individual responsibility)	Recognition and acceptance of one's obligations and commitments to oneself and one's future well-being	Involves taking proactive steps to ensure one's own future health through responsible behavior, that is, getting HPV vaccination in the present	Includes understanding consequences that they will impact future outcomes (i.e., cancer)	<i>[HPV vaccination] is a good investment, because it can help prevent cancer and treatment for cancer can be very expensive. (ID: 312)</i>
Altruistic considerations (social responsibility)	The ethical obligation or duty individuals must act in ways that others, beyond their own self-interest	Emphasizes the importance of considering the well-being of others and the broader community when making decisions to get HPV vaccination	Includes the misperception of HPV being gendered and that there is no direct personal benefit for HPV vaccination	<i>[his] biggest factor in getting vaccinated was my [his] concern for spreading HPV to other people. (ID: 282)</i>
Free vaccination	The provision of vaccines at no cost to individuals receiving them	All participating individuals to receive the vaccine without having to pay out-of-pocket fees despite insurance status	Includes those who previously didn't get the vaccine due to high cost	<i>Cost is a big factor for me as a student. (ID: 349)</i>
Convenient access	The ease with which individuals can obtain HPV vaccination	Vaccinations are readily available and easily reachable for intervention participants	Mentions of logistic challenges (e.g., no car to go to off-campus clinics)	<i>If it is a matter of calling up a receptionist then it takes extra energy from me. (ID: 629)</i> <i>On-campus clinics were very convenient. (ID: 344)</i> <i>The use of numbers and statistics was motivating to get vaccination. (ID: 333)</i>
Accurate knowledge through numbers and statistics	Effectively conveying information using quantitative data in a precise and understandable manner	Encompasses the use of numerical figures, statistical measures, and graphical representations to communicate knowledge about HPV, aiming to provide clarity, objectivity, and credibility to information by presenting it in a structured and verifiable format	Mentions of how persuasive accurate information and scientific report are for decision-making	
De-stigmatize HPV vaccination	To reduce or eliminate the negative social perceptions associated with receiving HPV vaccine through knowledge	Involves promoting accurate information about the safety, efficacy, and importance of the vaccine in preventing HPV-related diseases and challenging stigma and discrimination associated with HPV infection and vaccination, encouraging open communication about sexual health	Includes addressing misconceptions, myths, and fears surrounding the vaccine and the sexual nature of infection	<i>It helps a lot just knowing that it [HPV prevention] is not just for people that are active. (ID: 374)</i>

HPV, human papillomavirus.