

A Culturally Tailored AI Chatbot (K-Bot) to Promote HPV Vaccination Among Korean Americans: Development and Usability Study

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Submitted to: Asian/Pacific Island Nursing Journal
on: January 29, 2025

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A Culturally Tailored AI Chatbot (K-Bot) to Promote HPV Vaccination Among Korean Americans: Development and Usability Study

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Abstract

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection globally, associated with various cancers, including cervical and oropharyngeal cancers. Despite the availability of effective vaccines, significant disparities in HPV vaccination rates persist, particularly among racial and ethnic minorities, such as Korean Americans. Cultural stigma, language barriers, and limited access to tailored health information contribute to these disparities.

Objective: The aims of this study was to develop and evaluate the usability of K-Bot, a rule-based AI-powered chatbot designed to provide culturally sensitive, bilingual health information on HPV vaccination to Korean immigrants and Korean Americans.

Methods: The development of a culturally tailored, bilingual Korean and English AI chatbot (K-Bot) followed a structured, iterative process involving chatbot design, expert evaluation, and usability testing to address HPV vaccination disparities among Korean Americans. Eligibility criteria included: (1) individuals aged 18-45 years, (2) possession of a mobile phone or computer with internet access, (3) residence in the United States, and (4) speak in English or Korean. A online survey was conducted prior to qualitative interviews to better understand participants' demographics, HPV awareness, vaccination status, and experiences with technology (N = 21). Quantitative data were analyzed using descriptive statistics. The qualitative component involved six focus groups using semi-structured questions guided by Peter Morville's Usability Framework. Discussions explored usability, cultural relevance, and content clarity, with thematic analysis conducted across six dimensions: Desirable, Accessible, Findable, Credible, Usable, and Useful.

Results: Participants had a mean age of 23.67 years (SD = 4.66), with most being female (57.1%), second-generation (61.9%), and single (95.2%). HPV awareness was high (90.5%), vaccine knowledge was 81.8%, but only 52.4% were vaccinated. Feedback-driven refinements addressed usability challenges, including simplifying navigation and adding visual elements. Participants described K-Bot as a promising tool for promoting HPV vaccination among Korean and Korean American users,

citing its bilingual functionality and culturally tailored content as key strengths. Evidence-based information was valued, but participants recommended visuals to improve engagement and reduce cognitive load. Accessibility concerns included broken links, and participants proposed enhancements such as animations, demographic-specific resources, and interactive features to improve usability and engagement further.

Conclusions: Usability testing of K-Bot revealed its potential as a culturally tailored, bilingual tool for promoting HPV vaccination among Korean immigrants and Korean Americans. Participants valued its evidence-based information, cultural relevance, and bilingual functionality but recommended improvements such as enhanced navigation, visual elements, and interactive features to boost engagement and usability. These findings support the transformative potential of AI-driven tools in advancing health equity by addressing critical barriers to care. Further research is needed to rigorously evaluate their broader impact and optimize their design and implementation for underserved populations.

(JMIR Preprints 29/01/2025:71865)

DOI: <https://doi.org/10.2196/preprints.71865>

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Original Manuscript

A Culturally Tailored AI Chatbot (K-Bot) to Promote HPV Vaccination Among Korean Americans: Development and Usability Study

Abstract

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection globally, associated with various cancers, including cervical and oropharyngeal cancers. Despite the availability of effective vaccines, significant disparities in HPV vaccination rates persist, particularly among racial and ethnic minorities, such as Korean Americans. Cultural stigma, language barriers, and limited access to tailored health information contribute to these disparities.

Objective: This study aimed to develop and evaluate the usability of K-Bot, an AI-powered, culturally tailored, bilingual (Korean and English) chatbot designed to provide culturally sensitive health information about HPV vaccination to Korean immigrants and Korean Americans.

Methods: K-Bot was developed using CloudTuring and Google Dialogflow. Its dialogues were created using CDC evidence-based HPV information and tailored to the Korean American population based on findings from previous studies. The evaluation and refinement process for K-Bot was organized into three phases: 1) expert evaluation by a multidisciplinary panel, 2) usability testing, and 3) iterative refinement based on feedback. For usability testing, eligibility criteria included: (1) individuals aged 18-45 years, (2) possession of a mobile phone or computer with internet access, (3) residence in the United States, and (4) speak in English or Korean. An online survey collected demographics, HPV awareness, and vaccination status before six focus groups (n=21) using semi-structured questions guided by Peter Morville's Usability Framework. Quantitative data were analyzed descriptively, and thematic analysis assessed usability, cultural relevance, and content clarity across six dimensions: desirable, accessible, findable, credible, usable, and useful.

Results: Participants had a mean age of 23.7 years (SD = 4.7), with most being female (57.1%), second-generation (61.9%), and single (95.2%). HPV awareness was high (90.5%), vaccine knowledge was 81.8%, but only 52.4% were vaccinated. Feedback-driven refinements addressed usability challenges, including simplifying navigation and adding visual elements. Participants described K-Bot as a promising tool for promoting HPV vaccination among Korean and Korean American users, citing its bilingual functionality and culturally tailored content as key strengths. Evidence-based information was valued, but participants recommended visuals to improve engagement and reduce cognitive load. Accessibility concerns included broken links, and participants proposed enhancements such as animations, demographic-specific resources, and interactive features to improve usability and engagement further.

Conclusion: Usability testing of K-Bot revealed its potential as a culturally tailored, bilingual tool for promoting HPV vaccination among Korean immigrants and Korean Americans. Participants valued its evidence-based information, cultural relevance, and bilingual functionality but recommended improvements such as enhanced navigation, visual elements, and interactive features to boost engagement and usability. These findings support the potential of AI-driven tools to improve healthcare access by addressing key barriers to care. Further research is needed to evaluate their broader impact and optimize their design and implementation for individuals with diverse healthcare needs.

Keywords:

Human papillomavirus; HPV vaccination; Artificial intelligence chatbot; Korean Americans; Cultural sensitivity intervention; Usability testing

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection globally, with the highest prevalence observed among young adults [1]. Persistent HPV infections can lead to various cancers, including cervical cancer, which remains a leading cause of cancer-related deaths among women aged 20-39 years [2]. Additionally, HPV is associated with oropharyngeal cancers, which are increasingly prevalent among men and tend to develop at younger ages compared to other HPV-related cancers [3].

To combat the burden of HPV-related diseases, the U.S. Advisory Committee on Immunization Practices (ACIP) recommends routine HPV vaccination for adolescents aged 11-12, with catch-up vaccination for individuals aged 13-26 who have not completed the vaccine series [4]. Recently, the 9-valent vaccine has been approved in the U.S. for use in adults aged 27-45 years [5]. Korean Americans are at relatively high risk for HPV-related cancers, yet they exhibit significant disparities in HPV vaccination rates [6], [7]. Notably, Korean American women demonstrate particularly low intention to receive the HPV vaccine, with only 34.6% expressing willingness to obtain the vaccine in prior studies [13]. Our previous research further indicates that only 32% of participants aged 27 to 45 years had received the HPV vaccine at least once, with differences by sex (females: 35.3%; males: 12.5%) [10]. Korean Americans face several critical barriers to HPV vaccination including cultural stigma surrounding sexually transmitted infections (STIs), language barriers, and lack of culturally tailored health information. These challenges are compounded by limited knowledge and awareness of HPV and the benefits of vaccination, contributing to persistently low vaccination uptake, which contributes to lower vaccination rates [10–14]. In addition to this knowledge gap, several factors influence HPV vaccination intentions among Koreans and Korean Americans. These include parental recommendations for the HPV vaccine, perceived benefits and severity of HPV infection, a history of cervical cancer, beliefs about cervical cancer screening for daughters, experiences with sexual activity, and sociodemographic factors such as occupation, education, and income [7, 13]. To address these challenges, culturally tailored interventions are essential to improving vaccination uptake within this population. Culturally tailored interventions have been recognized as essential for improving HPV vaccination uptake, especially for communities that may encounter cultural and linguistic challenges in accessing healthcare information. For example, prior efforts have included culturally relevant health information that has demonstrated promise in increasing awareness and promoting vaccination by addressing cultural stigmas and misconceptions [8], [9], [10]. However, many of these approaches rely on traditional methods of information dissemination, which may lack the interactivity and personalization needed to address individual barriers effectively.

KakaoTalk is the most popular mobile messaging application in South Korea. It has become an integral part of daily communication and workplace interaction, offering various features beyond basic text messaging [11]. KakaoTalk has also been utilized in health research, demonstrating its potential as a platform for delivering health interventions. Studies have explored its role in supporting Korean American family caregivers [12], and promoting health interventions to Korean Americans with limited English proficiency [13], including efforts to promote HPV vaccination [14]. Additionally, KakaoTalk serves as a digital communal space for middle-aged Korean women [15], demonstrating its broad accessibility and significance across diverse Korean populations, from teenagers to older adults, both in South Korea and among Korean Americans.

Artificial intelligence (AI) chatbots have emerged as innovative tools for delivering personalized, leveraging advanced capabilities to address barriers in health communication [16]. Unlike static interventions, such as printed materials or one-size-fits-all campaigns, AI chatbots offer interactive, real-time engagement, making them particularly effective in addressing nuanced health behaviors and misconceptions [16]. The effectiveness of chatbot-based interventions in promoting behavior change is

well-supported in the literature. For instance, multiple studies reported high levels of engagement, usability, and satisfaction with chatbot interventions targeting adolescents and adults [16], [18], [19]. Recent studies have explored innovative approaches to promote HPV vaccination, particularly among adolescents and young adults. Digital health interventions, including chatbots, have shown promise in improving knowledge and vaccination intentions [20], [21], [22]. Particularly, a study conducted in South Korea developed an eHealth communication intervention using a KakaoTalk chatbot, which showed promising usability scores among experts and adolescent girls [Kim, et al., 2024].

While existing studies demonstrate the potential of chatbots to influence health behaviors through interactive and personalized engagement, there remains a significant gap in culturally tailored chatbot interventions specifically designed for HPV prevention and cancer risk reduction. Despite the growing evidence base, no studies have focused on developing a chatbot that addresses the unique cultural and linguistic barriers faced by specific populations, such as Korean immigrants and Korean Americans.

To address these gaps, we developed K-Bot, an AI chatbot designed to deliver culturally tailored, bilingual (English and Korean) health information, specifically targeting Korean immigrants and Korean Americans—groups with unique cultural and linguistic barriers to HPV vaccination [13]. This study aimed to develop and evaluate the usability of K-Bot to assess how easily and effectively a tool can be used as a culturally sensitive, AI-powered chatbot providing real-time health information on HPV vaccination.

Methods

The development and usability evaluation of K-Bot followed a structured, iterative process comprising three phases: chatbot development, expert evaluation, and usability testing. Evaluations were conducted with both a multidisciplinary expert panel and user groups to ensure the chatbot's clinical relevance, cultural sensitivity, and practical usability.

Ethics Approval

All study procedures approved by the Institutional Review Board (IRB) at the University of Cincinnati (IRB Protocol # [2022-0347]). All study procedures were conducted by institutional guidelines and ethical standards for research involving human participants. Informed consent was obtained from all participants prior to their participation.

Chatbot Development

The development of the K-Bot chatbot was based on a structured and systematic process leveraging both advanced technology platforms and cultural tailoring to address HPV vaccination disparities among Korean Americans.

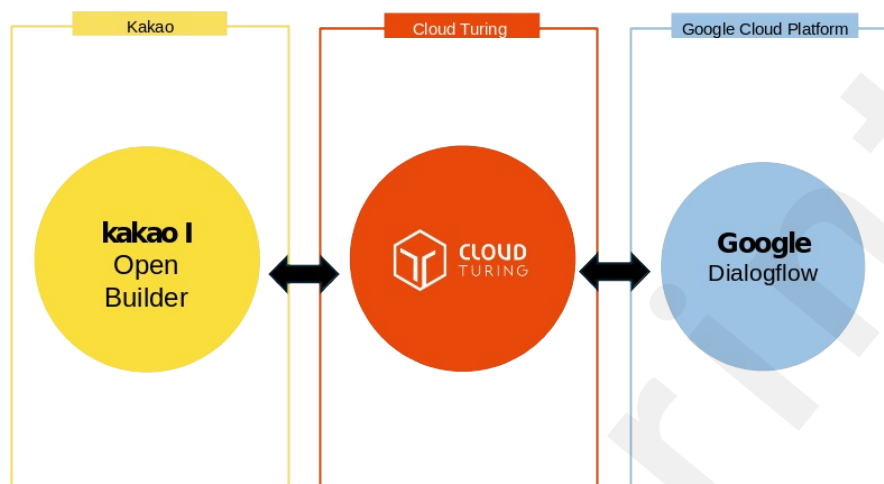
Platform Selection and Chatbot Design

K-Bot's development required a multidisciplinary team, including AI developers from South Korea who were integral to the implementation of the AI chatbot and its deployment on relevant platforms. The team also included experienced health researchers in designing and evaluating chatbots from South Korea, two healthcare professionals based in the United States, and two Korean community representatives, who provide insights to ensure cultural relevance. This diverse team brought together expertise in AI, healthcare, and cultural adaptation to ensure the chatbot's relevance and effectiveness across both Korean and Korean American populations.

The chatbot was built using CloudTuring [23], a platform offering AI-driven solutions for advanced

natural language understanding, and Google Dialogflow [24], a widely used conversational AI framework that enables natural language processing (NLP), intent recognition, and context-aware responses. The chatbot was integrated with the existing management system, allowing for continuous updates and improvement through the Kakao Chatbot Manager and Cloud Turing platforms (Figure 1).

Figure 1. K-Bot architecture and integration with the existing management system



These tools facilitated bilingual interactions in English and Korean, supporting accurate communication and seamless user engagement. Deployment was carried out on the KakaoTalk messaging app (Figure 2), which is widely used by Koreans for communication [25], and a Wix-based website, requiring secure hosting and compliance with privacy standards. The development process spanned 5 months, with iterative refinements made based on expert and user feedback.

Figure 2. K-Bot interface within the KakaoTalk app



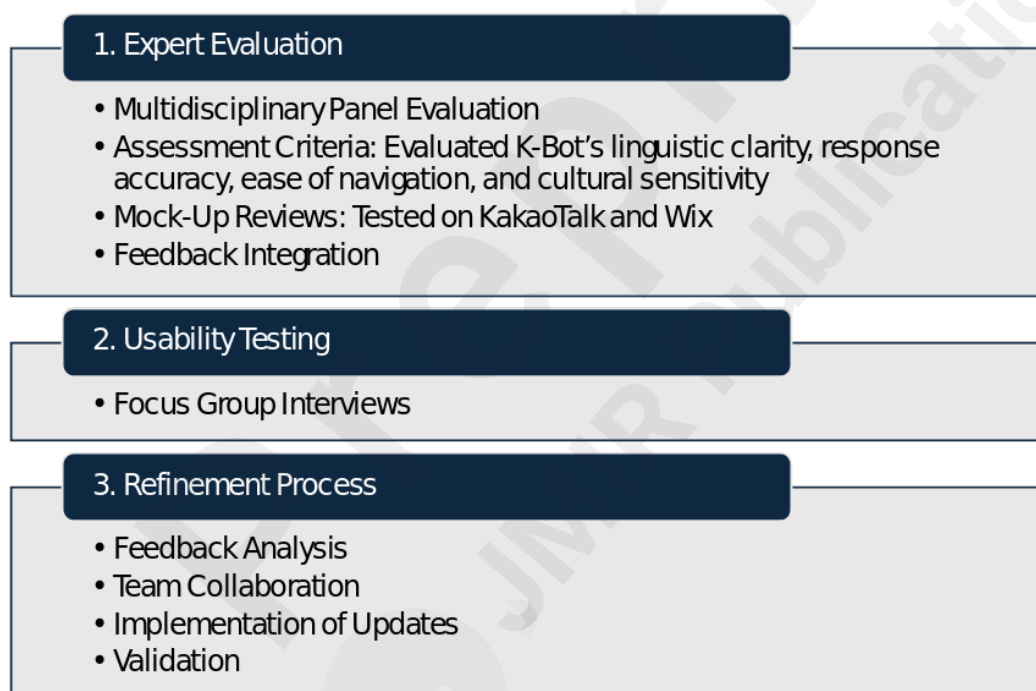
The chatbot's dialogues were designed based on evidence-based guidelines from the Centers for Disease Control and Prevention (CDC) and tailored to the Korean American population using findings from previous studies [14], [26], [27].

The chatbot was structured using a hierarchical organization of major, medium, and minor classifications, which guided the users toward their desired information. Each interaction was categorized under major topics (e.g., HPV vaccine), followed by medium-level subcategories (e.g., vaccine safety and side effects), and further segmented into minor classifications (e.g., detailed explanations of side effects). This modular structure ensured logical navigation and efficient access to information, which is critical for users seeking health-related information.

Structured Evaluation and Refinement Process

The evaluation and refinement of K-Bot followed three distinct phases: 1) expert evaluation, 2) usability testing, and 3) refinement process (Figure 3).

Figure 3. Evaluation and refinement process of K-Bot



1. Expert Evaluation

A multidisciplinary panel conducted a comprehensive evaluation of K-Bot, leveraging expertise in healthcare, cultural studies, AI, and community engagement. The panel included a clinician specializing in HPV prevention, researchers with extensive knowledge of Korean culture and its influence on health behaviors, an AI specialist experienced in chatbot development, and students in health-related fields representing Korean community perspectives. This diverse composition enabled a holistic assessment, ensuring the chatbot's clinical relevance, cultural sensitivity, technical functionality, and alignment with community needs.

The evaluation process systematically assessed K-Bot's responses, navigation, and cultural

appropriateness using predefined criteria. These criteria included linguistic clarity, response accuracy, ease of navigation, and the cultural framing of sensitive topics such as HPV vaccination. The usability evaluation framework incorporated principles from the ISO 9241-11 standards, emphasizing efficiency, effectiveness, and user satisfaction to ensure comprehensive assessment [28]. The chatbot's response design followed a structured methodology that incorporated synonyms, key phrases, and importance ratings on a scale of 1 to 5, with 5 indicating the highest priority for delivering critical information. Experts rated responses based on their relevance, clarity, and alignment with the cultural and informational needs of the target audience, ensuring the chatbot provided accurate and contextually appropriate replies.

The research team conducted mock-up reviews to evaluate the chatbot before usability testing. One review used the English version, and the other used the Korean version of the chatbot. Additionally, the team tested the chatbot on two different platforms: KakaoTalk and Wix. These sessions focused on identifying areas for improvement, such as simplifying technical terms, integrating culturally relevant idioms, and enhancing navigation flow to optimize the user experience before moving forward with usability testing involving participants.

Iterative improvements based on research team's feedback were incorporated into the chatbot's design, prioritizing culturally sensitive topics and user-relevant queries. Linguistic clarity was enhanced by simplifying technical terms and integrating culturally relevant idioms to increase accessibility. These revisions were discussed and validated during research team meetings, confirming improvements in usability, cultural sensitivity, and alignment with the needs of Korean immigrants and Korean American users.

2. Usability Testing

Recruitment and Eligibility

Participants were recruited using a combination of the researchers' networks, a community-engaged approach, and social media platforms guided by the previous successful recruitment [6]. Recruitment efforts were centered around the research theme, "Let's Talk about HPV," which was designed to engage participants and emphasize the importance of learning about HPV and its vaccine. Potential participants who expressed interest in the study were contacted within one week by research personnel to confirm their eligibility. Eligibility criteria included: (1) individuals aged 18-45 years, (2) possession of a mobile phone or computer with internet access, (3) residence in the United States, and (4) fluency in English or Korean. Upon confirming eligibility, research personnel scheduled an interview and provided participants with a password-protected Zoom link via email.

Usability Testing Procedures

Usability testing was conducted between May and June 2022, involving 21 Korean American participants who were divided into six focus groups, with each group consisting of 2 to 5 individuals. The variation in group size allowed to accommodate participants' availability and facilitate in-depth discussions. Data saturation was monitored by the facilitators throughout the sessions. Each focus group session lasted approximately 60–90 minutes. Only audio recordings were used for data analysis, ensuring that participants' identities remained confidential. Participants were encouraged to use pseudonyms instead of real names to promote anonymity. The primary objective of this study was to gather feedback on the K-Bot rather than to explore participants' awareness and attitudes toward HPV prevention. Therefore, the sensitive nature of HPV-related questions was minimal. Participants were informed about the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time without consequence.

Each usability testing session followed a structured protocol to ensure consistency and comprehensive data collection, outlined below.

- 1) **Introduction:** Participants were introduced to the study, its objectives, and the importance of their feedback in improving the chatbot's functionality and cultural relevance. The project's development history, including initial focus on Korean college women and subsequent expansion to a broader age range, including both men and women, was explained.
- 2) **Consent and Survey:** After reviewing the study information sheet and agreeing to participate, participants were provided with an online survey. This survey collected information on their sociodemographic characteristics, awareness of HPV, the HPV vaccine, and their vaccination status.
- 3) **Pre-Interaction Discussion:** Prior to interacting with K-Bot, participants were asked questions regarding their familiarity with HPV related topics and any previous experience with chatbots. Specifically, we discussed if they had heard of HPV or its vaccine, and if they believe they had received adequate information about the topic.
- 4) **Chatbot Interaction:** After completing the survey, participants received a link via email to interact with K-Bot. They were reminded that the chatbot was available in both English and Korean languages. At this stage of development, the K-bot experience consisted of two parts: a 32 Q&A style survey followed by the interactive chatbot. Participants were encouraged to document any errors, navigation challenges, or suggestions for improvement during their interaction. Additionally, K-Bot provided links to external resources, such as CDC PDFs, to test its interoperability and ensure seamless access to supplementary health information.
- 5) **Post-Interaction Feedback:** We asked participants questions guided by Peter Morville's honeycomb model [27] (Table 1): participants were asked about usability, ease of navigation, adequacy of information, reliability of chatbot responses, and integration with external resources. Participants also provided suggestions for improvement. After the interview, participants received a \$20 Amazon gift card as compensation for their time and input.

Table 1. Semi-structured interview questions with Peter Morville's usability framework.

Usability Dimension	Definition	Corresponding Interview Questions
Usable	Ensures the system is easy to use and navigate.	- How was your experience with the K-Bot? Did you find it was easy? - Were the buttons and navigation clear and easy to understand?
Useful	Determines whether the system provides valuable and relevant content.	Was there enough information provided by the chatbot?
Credible	Evaluates the reliability and trustworthiness of the system's responses.	Were the responses from the chatbot reliable?
Findable	Assesses the ease of accessing information within the system.	Was it interoperable with external sources? Were the PDFs for the CDC resource pages loading and adequate?
Desirable	Examines the appeal and attractiveness of the system design.	What did you think about the overall design of the chatbot? Did you find the chatbot visually appealing and engaging?
Accessible	Ensures the system is available and usable for a diverse	Was there any information you wish was included in the chatbot?

	audience.	
General Feedback	Captures any additional participant input for further refinement.	• Any additional comments?

Data Collection and Analysis

An online survey that takes 5-10 minutes was conducted prior to qualitative interviews to gather insights into participants' demographics (e.g. age, sex, cultural identification, generational status, educational attainment, marital status, employment status, and annual household income), HPV awareness, and vaccination status. Quantitative data were analyzed using descriptive statistics using SPSS 28 (IBM Corp, 2021). All focus group sessions were recorded using Zoom, and audio recordings were captured via Audacity [29] as a backup. Transcriptions were manually prepared and saved in Excel, with anonymized participant IDs to maintain confidentiality. We monitored the duration of participants' interactions with K-bot, which typically lasted about 10-15 minutes. All data were stored securely on password-protected drives.

Thematic Analysis Approach: Qualitative data were manually analyzed using a systematic thematic analysis to identify recurring patterns in feedback. The analysis followed Braun and Clarke's six-phase framework: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report [30]. Transcripts were independently coded guided by two researchers using Peter Morville's Usability Framework, covering aspects such as usefulness, usability, findability, credibility, accessibility, desirability, and value. Coding discrepancies were resolved through discussion to ensure a systematic approach.

3. Refinement Process

The refinement process was structured to systematically integrate insights from usability testing into iterative improvements to the chatbot's design and functionality. Feedback collected during usability sessions was reviewed and categorized into thematic areas, including navigation, content clarity, and technical performance.

- 1) **Feedback Analysis:** All participant suggestions, navigation issues, and identified gaps were documented and categorized. For example, repeated difficulties with navigating back to previous sections were flagged as high-priority issues.
- 2) **Team Collaboration:** Key findings were shared with the chatbot development team during the research team meetings. Actionable items were prioritized based on their potential impact on user experience and alignment with study objectives.
- 3) **Implementation of Updates:** Adjustments were implemented through CloudTuring. Navigation was improved by adding clearer button labels and a dedicated "help" section to guide users. Content was expanded to include additional HPV-related information that participants indicated as missing. Machine learning algorithms were updated to improve response accuracy and ensure that the chatbot delivered contextually relevant answers.
- 4) **Validation:** Updates were tested internally by the research team to ensure that changes effectively addressed the identified issues, contributing to the dependability and confirmability of the intervention's iterative development.

Results

Quantitative Findings

Sociocultural Demographic Characteristics

As presented in Table 2, participants had a mean age of 23.67 years (SD = 4.66). The majority were female (12 out of 21; 57.1%), second-generation (13 out of 21; 61.9%), and single (20 out of 21; 95.2%).

Table 2. Demographic characteristics of focus group participants (N = 21).

Characteristic	Mean (SD)	
Age (range: 18-37)	23.67 (4.66)	
	Frequency (n)	Percentage (%)
Sex		
Female	12	57.1
Male	9	42.9
Cultural Identification		
Completely or more Korean than American	6	28.5
Equally Korean and American	9	42.9
More American than Korean	6	28.6
Generational Status		
First generation (Born outside of U.S.)	8	38.1
Second generation (Born in U.S.)	13	61.9
Education Attainment		
High school degree or equivalent	6	28.6
Some college, no degree	3	14.3
Bachelor's degree	9	42.9
Master's degree	3	14.3
Single (never married)	20	95.2
Marital Status		
Single (never married)	20	95.2
Married, or in a domestic partnership	1	4.8
Current Employment Status		
Full time (40 or more hours)	9	42.9
Part time (up to 39 hours)	2	9.5
Student	10	47.6
Annual Household Income		
Less than \$50,000	8	38.1
\$50,000 to \$99,999	8	38.1
\$100,000 or more	5	23.8

Awareness of the HPV and HPV Vaccination

As presented in Table 3, most participants had heard of HPV (19 out of 21; 90.5%) and the HPV vaccine (18 out of 21; 81.8%). Half (11 out of 21; 52.4%) had received the HPV vaccine, with 63.6% (7 out of 11) completing all three doses.

Table 3. HPV awareness and vaccination status of focus group participants by sex (N = 21).

Characteristic	Female (n=12)		Male (n=9)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Heard of HPV before this study				
Yes	11	91.7	8	88.9
No	1	8.3	1	11.1
Heard of HPV vaccine or Gardasil before this study				
Yes	11	91.7	7	77.8
No	1	8.3	2	22.2
Received the HPV vaccine				
Yes	7	58.3	4	44.4
No	0	0.0	3	33.3
I don't know	5	41.7	2	22.2
Number of HPV vaccine doses received (n = 11)				
One dose	0	0.0	1	25.0
Two doses	2	28.6	1	25.0
Three doses	5	71.4	2	50.0

Qualitative Findings and Refinement

Based on the pre-interaction discussion and post-interaction feedback, participants highlighted the importance of K-Bot's bilingual functionality, expressing appreciation for its ability to deliver information in both English and Korean. Many found the information on HPV and the HPV vaccine to be helpful, with some sharing that they learned new details they were previously unaware of. Some participants who had complete middle and high school in Korea had never heard of HPV and its vaccine. Some participants also shared they came in with the preconception that the vaccine was primarily for women's health. However, after interacting with the chatbot, one female participant stated, "I feel like I would want my spouse, or partner, to have it." One male participant mentioned that he thought he would not be affected by HPV, but the interactions with K-Bot "put it into perspective that maybe I'm also prone to it." This positive change in sentiment toward the HPV vaccine was shared by other male participants in the focus groups.

The usability of the K-Bot intervention was evaluated through focus group interviews guided by Peter Morville's Usability Model. Feedback from participants provided valuable insights into their interaction with the chatbot and informed specific refinements to enhance its effectiveness (Table 3). Key refinements were implemented based on usability testing to address the needs of Korean immigrants and Korean American users and optimize the intervention for promoting HPV vaccination.

1) Usable

Focus group participants found that the Q&A format at the beginning of the interaction was time-consuming as some "stopped reading the info after answering the question" and found it "cumbersome".

The Q&A section was removed and consolidated into the interactive portion. On the other hand, participants found the chatbot's button-based Q&A format simple and intuitive with one participant mentioning it was like a "very guided Q&A session." Several requested more detailed information on complex topics such as stress and HPV. To address this, expandable sections were introduced into the interactive K-Bot, allowing users to delve deeper into specific topics while maintaining the simplicity of the button-based structure.

2) Useful

External links to resources were valued for their credibility, but broken links were noted as a barrier to usability. All external links were repaired, and additional resources, including directories of healthcare providers, were added to ensure comprehensive support. Tailored resources were also developed to meet the needs of specific demographics, particularly first-generation Korean Americans. For instance, one participant voiced that "it would be helpful if you add the term [for HPV] that is used more generally in Korea" since they may not recognize the term human papilloma virus or HPV.

3) Credible

The credibility of the chatbot was bolstered by its evidence-based content and integration with trusted sources like the CDC. However, participants emphasized the importance of culturally relevant information tailored to Korean Americans, especially for those more familiar with Korean resources. Automatic PDF downloads were replaced with direct links to reputable sources as participants did not like "surprise downloads crowding the phone". This change ensured easier access while maintaining trust, especially with concerns about the possibility of users not "trusting the information on the K-Bot." Additionally, culturally sensitive content and terms were refined to resonate with the target demographic.

4) Findable

Participants appreciated the structured menus but reported difficulties navigating the menu items at the medium and minor classifications. For instance, one participant remarked, "I kept forgetting what I read versus what I didn't read because there were so many subcategories." To resolve this, the final menu options were simplified through consolidation of similar topics, and a search function was added to help users quickly locate relevant information. Visual cues, such as highlighted buttons and GIFs, were also incorporated to guide users more effectively through the content.

5) Desirable

To increase desirability, participants suggested incorporating visual elements to improve engagement and support users with varying health literacy. In response, GIFs and images were added to the chatbot interface. One participant commented, "The menu items were clear but could use more explanations for people who aren't familiar with medical terms." Additional descriptions were added to clarify technical terms, and a "back" button was introduced to enable users to revisit previously accessed information, enhancing overall navigation.

6) Accessible

While participants found the chatbot intuitive, some noted challenges with language switching and navigation at the end of interactions. For example, one participant shared, "It wasn't immediately clear how to switch languages at the beginning." To address this, clearer instructions for language switching were integrated during onboarding, and the navigation flow was streamlined to ensure smooth transitions, particularly during extended interactions. Button formats were also standardized for greater usability.

Table 4. Findings from semi-structured interviews and refinements.

Usability Dimension	Findings	How Findings Were Addressed
---------------------	----------	-----------------------------

n		
Usable	The button-based navigation was intuitive.	Enabled participants to revisit previously accessed information
	Participants suggested adding a "back" button.	Language switching instructions were made clearer and added as part of the onboarding.
	Some users were confused by the language selection.	
Useful	Participants valued information about HPV transmission and vaccination.	Animated GIFs were integrated to complement text-heavy content.
	External links (e.g., CDC fact sheets) were credible and useful.	External links were checked, repaired, and updated.
	Suggestions included using visuals to reduce cognitive load.	Resources were tailored to specific demographics, especially first-generation Korean Americans.
Credible	Evidence-based content and links to trusted sources enhanced credibility.	Automatic PDF downloads were replaced with direct links to trusted sources, such as the CDC.
	Feedback emphasized culturally sensitive language and early trust-building.	Culturally relevant terms and tailored content for Korean Americans were refined.
		An introductory message established credibility and outlined the chatbot's purpose.
Findable	Menus were structured and effective but sometimes overwhelming.	The final menu options were simplified, and a search function was added to help users quickly locate relevant information.
	A simplified navigation structure was recommended.	Visual cues, such as highlighted buttons and GIFs, were incorporated to improve findability and guide users effectively.
Desirable	Clear icons and buttons were appreciated.	Visual elements, including GIFs and images, were introduced to engage users.
	Suggestions for animations and introduction videos to enhance engagement.	Animations and a 2-minute introduction video were included to enhance user appeal.
Accessible	Bilingual support in English and Korean was well-received.	An email address for the bilingual researcher was added to allow participants to report any issues with broken links or accessibility.
	Broken links hindered accessibility; regular updates were suggested.	
General Feedback	Suggestions for demographic-specific content, clearer instructions, and interactive features were provided.	Demographic-specific resources and culturally sensitive information were added. A brief instruction page and visual cues were included to guide users through the chatbot.
	Misconceptions of HPV vaccine being unnecessary for men were corrected. Participants realized the importance of vaccinating at a young age.	The culturally tailored K-Bot fostered a more open and informed dialogue, centered around increasing awareness and understanding of HPV.

Discussion

This study examines the development and usability evaluation of K-Bot, an AI chatbot created to provide bilingual, culturally sensitive health information about HPV vaccination for Korean immigrants and Korean Americans. The study assessed the chatbot's usability in delivering accurate health information and identified both strengths and areas for refinement, contributing to the optimization of chatbot-based health intervention aimed at promoting behavior change and informing the development of more targeted

and effective strategies in future implementation trials.

Principal Findings

This study found that while participants exhibited high awareness of HPV and its vaccine, actual vaccine uptake remained low, particularly among male participants. Participants reported that K-Bot addressed this disparity by providing inclusive education, which is critical for promoting vaccine uptake among all individuals. Participants identified K-Bot's bilingual functionality and culturally tailored content as significant strengths, with the dual language option allowing access to health information in both English and Korean. This finding highlights the necessity of linguistic inclusivity in digital health tools to engage diverse populations effectively. However, the usability evaluation revealed areas for improvement, including navigation complexity, challenges with language selection, and limited visual engagement. Although this study incorporated GIFs and images to improve visual engagement and support users with varying levels of health literacy, these enhancements alone may be insufficient to address the broader and more nuanced challenges faced by diverse user populations. Addressing these limitations through iterative design refinements and leveraging emerging technologies, such as multimodal conversational systems, could further optimize K-Bot's usability and impact on health behavior change.

Comparison to Prior Work

The findings of this study align with existing literature indicating that HPV vaccination is often perceived as primarily relevant to women, particularly within the Korean community [14], [26], [31]. Previous research has shown that cultural perceptions and public health messaging in Korea have historically targeted females, contributing to persistent disparities in vaccination rates by sex [32]. This misconception can be traced back to Korea's initial HPV vaccination program, which launched in 2016, focusing exclusively on adolescent girls before expanding to include boys in 2024 [33]. This focus on vaccinating only specific groups likely influenced public attitudes among Koreans and Korean Americans, as immigrant health behaviors are often shaped by practices from their country of origin [14], [26]. This exclusion of boys may have perpetuated misconceptions in Korean American communities, furthering barriers to vaccine uptake, particularly where familial and community norms strongly influence health decisions, [34]. Similar findings in previous studies suggest that these culturally ingrained beliefs can create significant barriers to HPV vaccination among males, necessitating targeted educational intervention [14]. Addressing these challenges requires inclusive education tailored to Korean Americans, which highlights the importance of HPV vaccination for all individuals in preventing disease and reducing transmission. Participants shared that the chatbot helped correct the belief that HPV vaccination is exclusively for women, a misconception that has been widely documented in the literature as a significant barrier to male vaccination [35]. Culturally tailored digital interventions, such as K-Bot, have the potential to play a critical role in addressing these challenges.

K-Bot's culturally tailored approach aligns with a growing body of research advocating for the use of culturally sensitive design elements. Studies have shown that culturally sensitive design elements—such as language adaptability, empathy, and humor—to enhance user trust, engagement, and the overall efficacy of digital health intervention [36]. By integrating culturally sensitive design, K-bot exemplifies the potential of AI-driven technologies to mitigate health care disparities by improving access to accurate, culturally relevant health information. The study also adds to the emerging evidence on the existing literature focusing on culturally tailored digital interventions in mitigating barriers to HPV vaccination. While the domain of culturally adapted chatbots remains underexplored, this study reinforces the critical need for such interventions to address cultural stigmas and misconceptions surrounding HPV. Existing literature highlights the critical need for culturally sensitive interventions, especially given the deeply rooted cultural stigmas and misconceptions surrounding STIs in many Asian American communities [37], [38]. These stigmas often act as significant deterrents, discouraging open discussions about HPV vaccination, particularly among Asian immigrant populations where cultural norms may further limit

access to accurate health information [38]. By directly addressing these cultural and linguistic barriers, K-Bot represents an important advancement in leveraging AI-driven tools to deliver tailored health information and promote equitable access to preventative care.

Strengths and Limitations

This study's strengths lie in its rigorous, iterative design process, combining expert evaluation with participatory user feedback to optimize K-Bot's functionality. Integrating user feedback into iterative refinements follows best practices in participatory design for digital health interventions [37], emphasizing the importance of collaborative frameworks in enhancing usability and user satisfaction.

This study has several limitations that should be considered when interpreting the findings. First, the limited small sample size reduces the generalizability of the results, as the insights gained may not fully represent the broader population. Second, while K-Bot's culturally tailored design was well-received by this specific group, its applicability to other Asian American subgroups or culturally diverse. Population remains uncertain. Lastly, the study primarily relied on self-reported data, introducing potential biases, such as social desirability and recall bias, which may affect the accuracy of the findings.

Future Research Directions

The findings underscore K-Bot's potential as both a standalone intervention and an integrated tool within healthcare systems to address HPV vaccination disparities. Future research should focus on evaluating its feasibility and efficacy through rigorous trials, with particular attention to its scalability across diverse healthcare settings. Longitudinal studies are essential to assess K-Bot's sustained impact on vaccination uptake and behavior change. Expanding K-Bot to other Asian American subgroups would enhance its adaptability and engagement, addressing the heterogeneity within these populations. K-Bot's reliance on NLP, while effective in delivering structured and evidence-based information, presents limitations in managing open-ended queries. K-Bot was developed prior to the emergence of generative AI technologies like ChatGPT. Recent literature examining the application of ChatGPT in nursing education, practice, and research highlights several advantages of generative AI [39]. These capabilities suggest significant potential for enhancing K-Bot's functionality by enabling more dynamic, context-sensitive, and user-centered interactions. However, as noted in the literature, ethical considerations—such as minimizing misinformation and ensuring cultural sensitivity—must be prioritized to safeguard the intervention's credibility and trustworthiness [39]. While K-Bot's reliance on NLP ensures accurate, evidence-based responses, its limited ability to manage open-ended queries highlights a need for integrating advanced AI technologies to better meet user needs. Additionally, usability feedback from this study may differ among various age groups, with younger users potentially being more tech-savvy than older adults. Future iteration of K-Bot could explore tailoring its interface and functionality to accommodate different subgroups, such as adolescents and parents to enhance user engagement and satisfaction.

Conclusions

In conclusion, K-Bot exemplifies an innovative, culturally sensitive approach to addressing HPV vaccination disparities in Korean Americans. By delivering personalized, bilingual health information, K-Bot has successfully demonstrated its potential to overcome barriers related to language, stigma, and misinformation. While the study's findings are encouraging, they are based on a smaller sample size, and further research is needed to validate these results across a broader and more diverse population. Refinement of the chatbot's usability and potential customization for different age groups and cultural contexts could enhance its effectiveness. The positive reception of K-Bot suggests it could be a scalable tool for public health interventions. Exploring the application of AI-driven chatbots in other populations remains a promising avenue for addressing health inequities and promoting equitable healthcare access.

Acknowledgements

We thank Dreamyoungs for their contributions to the development of the intervention. We also extend our gratitude to our research participants for their invaluable feedback during the usability testing phase.

Funding Statement

This work was funded by the University of Cincinnati's Office of the Vice President for Research and supported by the NIH/NINR K23 grant [K23NR02034].

Data Availability

Data is presented in the main manuscript.

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this manuscript.

Abbreviations

Advisory Committee on Immunization Practices (ACIP), Artificial intelligence (AI), Centers for Disease Control and Prevention (CDC), Human papillomavirus (HPV), National Health and Nutrition Examination Survey (NHANES), Natural language processing (NLP)

REFERENCES

1. Kombe AJ, Kombe et al. Epidemiology and Burden of Human Papillomavirus and Related Diseases, Molecular Pathogenesis, and Vaccine Evaluation. *Front Public Health*. 2021;8:552028. doi: 10.3389/fpubh.2020.552028.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. *CA A Cancer J Clinicians*. 2018;68(1):7-30. doi: 10.3322/caac.21442.
3. Liao CI, Francoeur AA, Kapp DS, Caesar MAP, Huh WK, Chan JK. Trends in Human Papillomavirus–Associated Cancers, Demographic Characteristics, and Vaccinations in the US, 2001-2017. *JAMA Netw Open*. 2022;5(3):e222530. doi: 10.1001/jamanetworkopen.2022.2530.
4. Meites E, Szilagyi PG, Chesson HW, Unger ER, Romero JR, Markowitz LE. Human Papillomavirus Vaccination for Adults: Updated Recommendations of the Advisory Committee on Immunization Practices. *MMWR Morb Mortal Wkly Rep*. 2019;68(32):698-702. doi: 10.15585/mmwr.mm6832a3.
5. US Food and Drug Administration. FDA approves expanded use of Gardasil 9 to include individuals 27 through 45 years old. FDA. 2018. Available: <https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm622715.htm>.
6. Kim M, et al. A Storytelling Intervention in a Mobile, Web-Based Platform: A Pilot Randomized Controlled Trial to Evaluate the Preliminary Effectiveness to Promote Human Papillomavirus Vaccination in Korean American College Women. *Health Educ Behav*. 2020;47(2):258-263. doi: 10.1177/1090198119894589.
7. Jo S, Han SY, Walters CA. Factors Associated with the HPV Vaccination among Korean Americans and Koreans: A Systematic Review. *IJERPH*. 2021;19(1):51. doi: 10.3390/ijerph19010051.
8. Rani U, Darabaner E, Seserman M, Bednarczyk RA, Shaw J. Public Education Interventions and Uptake of Human Papillomavirus Vaccine: A Systematic Review. *Journal of Public Health Management & Practice*. 2022;28(1):E307-E315. doi: 10.1097/PHH.0000000000001253.
9. Zhang X, Tang L. Cultural adaptation in HPV vaccine intervention among racial and ethnic minority population: a systematic literature review. *Health Education Research*. 2022;36(5):479-493. doi: 10.1093/her/cyab034.
10. Niccolai LM, Hansen CE. Practice- and Community-Based Interventions to Increase Human Papillomavirus Vaccine Coverage: A Systematic Review. *JAMA Pediatr*. 2015;169(7):686. doi: 10.1001/jamapediatrics.2015.0310.
11. Tinmaz H, Lee JH. General and instructional perceptions of South Korean messenger: ‘KakaoTalk’. *IJLC*. 2020;12(2):143. doi: 10.1504/IJLC.2020.106715.
12. Lee K, Seo C, Shuffler J, Miyawaki C, Grill J, Shin H. Examining Physical and Social Environments of Korean American Family Caregivers of Persons Living with Dementia. *Innov Aging*. 2021;17(5 Suppl 1):908. doi: 10.1093/geroni/igab046.2954.
13. Hong YA, Yee S, Bagchi P, Juon H, Kim SC, Le D. Social media-based intervention to promote HBV screening and liver cancer prevention among Korean Americans: Results of a pilot study. *DIGITAL HEALTH*. 2022;8:205520762210762. doi: 10.1177/20552076221076257.
14. Kim M, Güler A, Kim D, Lee RC. A qualitative study of ethnic Korean women and men’s experiences of HPV and HPV vaccination in the United States. *Ethnicity & Health*. 2024;29(2):179-198. doi: 10.1080/13557858.2023.2279933.
15. Moon JY. The Digital Wash Place: Mobile Messaging Apps as New Communal Spaces for Korean ‘Smart Ajummas’. In: Cabañes JVA, Uy-Tioco CS, editors. *Mobile Media and Social Intimacies in Asia*. Dordrecht: Springer Netherlands; 2020. p. 63-76. doi: 10.1007/978-94-024-1790-6_5.

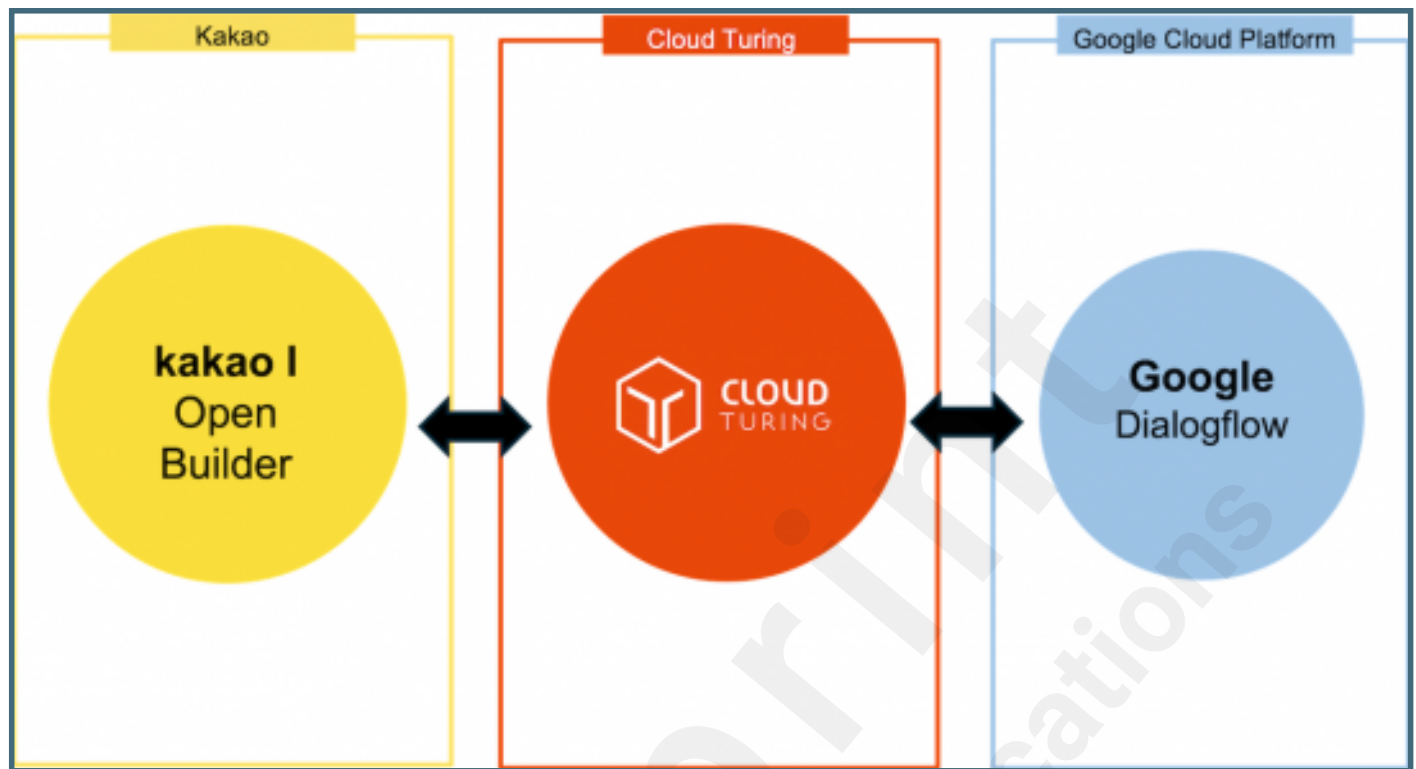
16. Aggarwal A, Tam CC, Wu D, Li X, Qiao S. Artificial Intelligence–Based Chatbots for Promoting Health Behavioral Changes: Systematic Review. *J Med Internet Res*. 2023;25:e40789. doi: 10.2196/40789.
17. Adamopoulou E, Moussiades L. An Overview of Chatbot Technology. In: Maglogiannis I, Iliadis L, Pimenidis E, editors. *Artificial Intelligence Applications and Innovations*. Cham: Springer International Publishing; 2020. p. 373-383. doi: 10.1007/978-3-030-49186-4_31.
18. Gabrielli S, Rizzi S, Carbone S, Donisi V. A Chatbot-Based Coaching Intervention for Adolescents to Promote Life Skills: Pilot Study. *JMIR Hum Factors*. 2020;7(1):e16762. doi: 10.2196/16762.
19. Piao M, Kim J, Ryu H, Lee H. Development and Usability Evaluation of a Healthy Lifestyle Coaching Chatbot Using a Habit Formation Model. *Healthc Inform Res*. 2020;26(4):255-264. doi: 10.4258/hir.2020.26.4.255.
20. Choi J, Tamí-Maury I, Cuccaro P, Kim S, Markham C. Digital Health Interventions to Improve Adolescent HPV Vaccination: A Systematic Review. *Vaccines*. 2023;11(2):249. doi: 10.3390/vaccines11020249.
21. Kim Y, Lee H, Park J, Kim YC, Kim DH, Lee YM. eHealth Communication Intervention to Promote Human Papillomavirus Vaccination Among Middle-School Girls: Development and Usability Study. *JMIR Form Res*. 2024;8:e59087. doi: 10.2196/59087.
22. Tao C, et al. VaxBot-HPV: A GPT-based Chatbot for Answering HPV Vaccine-related Questions. 2024. doi: 10.21203/rs.3.rs-4876692/v1.
23. CloudTuring. CloudTuring: AI-driven natural language understanding solutions. Available: <https://www.cloudturing.com>.
24. Google Cloud. Google Cloud Platform. Available: <https://cloud.google.com>.
25. Kakao Developers. KakaoTalk Open API Documentation. Available: <https://developers.kakao.com>.
26. Kim M. Barriers to HPV Vaccination Among Korean Men in the United States. *CJON*. 2022;26(3):324-327. doi: 10.1188/22.CJON.324-327.
27. Kim M, Lee H, Kiang P, Kim D. Human Papillomavirus: A Qualitative Study of Korean American Female College Students' Attitudes Toward Vaccination. *CJON*. 2017;21(5):E239-E247. doi: 10.1188/17.CJON.E239-E247.
28. ISO. ISO 9241-11 Ergonomics of human-system interaction Part 11: Usability: Definitions and concepts. 2018.
29. Audacity. Available: <https://www.audacityteam.org>.
30. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006;3(2):77-101. doi: 10.1191/1478088706qp063oa.
31. Kim M, et al. HPV Vaccination and Korean American College Women: Cultural Factors, Knowledge, and Attitudes in Cervical Cancer Prevention. *J Community Health*. 2019;44(4):646-655. doi: 10.1007/s10900-019-00634-9.
32. Kim J, Jung M. Associations between media use and health information-seeking behavior on vaccinations in South Korea. *BMC Public Health*. 2017;17(1):700. doi: 10.1186/s12889-017-4721-x.
33. Korea Disease Control and Prevention Agency. Vaccination information. National Immunization Program. [Online]. Available: <https://nip.kdca.go.kr/irhp/infm/goVcntInfo.do?menuCd=132&menuLv=1>
34. S J Hong, "Gendered cultural identities: the influences of family and privacy boundaries, subjective norms, and stigma beliefs on family health history communication," *Health Commun*; 2018; 33(8): 927-938. doi: 10.1080/10410236.2017.1322480.
35. K E Dibble, J L Maksut, E J Siembida, M Hutchison, and K M Bellizzi, "A systematic literature

- review of HPV vaccination barriers among adolescent and young adult males," *J Adolesc Young Adult Oncol*; 2019; 8(5): 495-511. doi: 10.1089/jayao.2019.0004.
36. C Zhai and S Wibowo, "A systematic review on cross-culture, humor and empathy dimensions in conversational chatbots: the case of second language acquisition," *Heliyon*; 2022; 8(12): e12056. doi: 10.1016/j.heliyon.2022.e12056.
37. B Kim and T Aronowitz, "Invisible minority: HIV prevention health policy for the Asian American population," *Policy Polit Nurs Pract*; 2019; 20(1): 41-49. doi: 10.1177/1527154419828843.
38. S Sen, H D Nguyen, S Y Kim, and J Aguilar, "HIV knowledge, risk behavior, stigma, and their impact on HIV testing among Asian American and Pacific Islanders: a review of literature," *Soc Work Public Health*; 2017; 32(1): 11-29. doi: 10.1080/19371918.2016.1173612.
39. Y Zhou et al, "Using ChatGPT in nursing: scoping review of current opinions," *JMIR Med Educ*; 2024; 10: e54297. doi: 10.2196/54297.

Supplementary Files

Figures

K-Bot architecture and integration with the existing management system.



K-Bot interface within the KakaoTalk app.



Evaluation and refinement process of K-Bot.

1. Expert Evaluation
• Multidisciplinary Panel Evaluation • Assessment Criteria: Evaluated K-Bot's linguistic clarity, response accuracy, ease of navigation, and cultural sensitivity • Mock-Up Reviews: Tested on KakaoTalk and Wix • Feedback Integration
2. Usability Testing
• Focus Group Interviews
3. Refinement Process
• Feedback Analysis • Team Collaboration • Implementation of Updates • Validation