



Digital HPV education to increase vaccine uptake among low income women

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ABSTRACT

Objective: The objective of this formative study was to gather women's perspectives in the design and communication modalities of a health kiosk set within a Planned Parenthood setting to promote patient education about the Human papillomavirus (HPV) and to motivate uptake of the HPV vaccine.

Methods: Twenty-four women aged 18-35 participated in in-depth one-on-one interviews at a Planned Parenthood health center, which were analyzed in code-associated categories using NVivo11 Pro.

Results: Most women showed receptivity to using an on-site health kiosk, as well as QR codes linked to text messages, to receive HPV-related health information outside of the clinic setting and reminders. Participants provided suggestions for kiosk design and communication modalities.

Conclusions: Among low-income women we interviewed at Planned Parenthood, increasing HPV vaccination rates necessitates engaging digital health tools which incorporate both the preferences and needs of vulnerable populations.

Innovation: Designing a point-of-service health kiosk that 1) draws on user preferences early in the design phase, 2) integrates multiple communication technologies, and 3) disseminates culturally grounded HPV vaccination decisions narratives that are tailored to vaccination awareness level is a promising approach in reducing barriers to HPV vaccine education and vaccine uptake among low-income women at safety-net clinics.

1. Introduction

The objective of this formative study was to gather women perspectives in the design and communication modalities of a health kiosk set within a Planned Parenthood setting to promote patient education about the Human papillomavirus (HPV) and to motivate uptake of the HPV vaccine. Specifically, the aims of this study were to elicit input about the: (1) receptivity to the potential use of a health kiosk for HPV prevention information in a Planned Parenthood waiting room, (2) receptivity to QR code and vaccine reminder text messages, and (3) design for kiosk engagement in disseminating HPV risk and vaccine information.

The Human Papillomavirus (HPV) is the most common sexually transmitted infection in the United States with more than 40 HPV types infecting the genital areas of women, including the anus, vulva, vagina, and cervix [1]. There are “non-oncogenic (wart-causing)” HPV types and “oncogenic

(cancer-causing)” types of which 13 cause cervical cancer due to the infection's capacity to linger within the body turning normal cells cancerous [1]. Although cervical cancer is the fourth most common cancer and cause of death among females [2], it is preventable through regular Papanicolaou (PAP) screening, timely treatment, and vaccination against high-risk HPV types linked to cervical cancer [3,4]. The recommended HPV vaccination occurs through a three-dose schedule for people who obtain their first dose on or after age 15 (0, 1–2, 6-month schedule) [5]. Unfortunately, disparities in vaccination rates are prevalent [6]. HPV is significantly correlated with socioeconomic status across racial/ethnic disparities [7,8]. Low HPV vaccination rates are linked with lower socioeconomic status and reduced health seeking behavior, both of which exacerbate limited awareness and knowledge of the risks are associated with HPV [1]. Moreover, health providers recommending the HPV vaccine are less prevalent among lower income groups [9]. Thus, the reproductive care needs of low-income

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women are not being met through traditional means of in-person care [10,11].

Digital health is a supplemental resource to traditional medical care, and can be optimized to reduce reproductive health disparities via improvements in health services, patient-practitioner engagement, and increased accessibility to information on HPV risks and vaccination [12,13]. Research demonstrates that low-income women's use of digital health tools for reproductive health show promising outcomes, such as risk reduction and use of the ehealth information to engage with health providers in-person [13]. A 2022 scoping review of the implementation of kiosks between 2009 and 2020, notes that emergency department, primary care, and specialty clinic settings have integrated freestanding digital tools like kiosks (see image 1) to facilitate screening and patient registration, and disseminate health information on multiple conditions [14]. Kiosks offer privacy, relative anonymity, and are preferred by patients to disclose intimate details during health screenings [14] Providing health information through kiosks increases knowledge about sexually transmitted or non-sexually acquired infections [14,15].

Kiosks have shown effectiveness in increasing HIV testing and aiding decisions to obtain the HPV vaccination [14,15] and are recommended for users in clinical settings especially if information is vetted and tailored to address usability preferences [14]. Compared to traditional pamphlets, low-income women are more likely to access and use culturally tailored, multimodal digital health information that allows them to self-register, enables connection with others, and allows them to access information to make medical decisions [13,16]. Low health and digital literacy, lack of resources, and resistance from health system administrators present barriers to the adoption of kiosks [14]. While previous research has supported the usefulness of digital health tools, the resources discussed do not take into account digital tools within safety-net centers, which are often physically situated in communities that are underserved and under-resourced and deliver place-based prevention information to alleviate to some degree preventive health barriers [17].

2. Methods

This study was approved by the Tanglewood Research Institutional Review Board (#0001467) that provide IRB services to REAL Prevention [18], the recipient of the grant that funded this research. Twenty-four semi-structured in-depth interviews were conducted at a Planned Parenthood community center in the Northwest suburbs of Philadelphia. The study's eligibility requirements were as follows: (1) women aged 18 years old and older and (2) women who knew their HPV vaccination status, whether fully, partially, or un-vaccinated. Women who were fully or partially vaccinated against HPV were regarded as vaccinated participants. Eligible participants were purposively sampled from a Planned Parenthood health center's waiting room to participate in a one-time, on-site, and in-person interview. Interviews were conducted in a private office onsite to maintain participants' confidentiality. Informed consent was obtained after entering the private office onsite and prior to the interview. The interviews lasted 30-60 minutes. Sociodemographic information was collected with a brief survey prior to the interview. The participants' personal information was not disclosed to site administrators or physicians.

Two interview guides (i.e., vaccinated and unvaccinated) were developed using Narrative Engagement Theory (NET) as it enlists stories of the intended audience for the goal of developing and adapting preventative measures for HPV [19]. The interview questions guided the participants to think back and tell their story about obtaining or not obtaining an HPV vaccination, including what led them to vaccinate or what barriers hindered vaccination and which conversations and messages about HPV and vaccination were meaningful about their decision-making [19]. Both interview guides contained the same interview schedule that probed about kiosk use and design, including if they would use a kiosk, what HPV information would look like, and how to make the kiosk useful to women. To prompt discussion during the interview, women were shown one image of a QR code and one photograph of an actual health kiosk (see image 1) already

made by the kiosk company with which we were collaborating (a women's wellness health kiosk). All interview questions were open-ended. Participants received twenty-dollar cash cards for their participation in the interview.

The interviews were deidentified, audio-recorded, transcribed verbatim, and entered into NVivo11 Pro. Four researchers (E.J.F., S.H., M.L.H., and J.R.W.) first read all transcripts, immersing themselves in the data (i.e., becoming familiar with the content of the data and what was being talked about). Subsequently, for data analysis, two researchers (E.J.F. and S.H.) engaged in the coding and interpretation process. An iterative approach involved first inductively coding data with descriptive codes (primary level data analysis) to describe what women shared (i.e., the who, what, where, when, and how) [19]. Coders then deductively categorized and organized data according to major themes (i.e., kiosk receptiveness, messaging for kiosk, kiosk engagement, familiarity with QR codes, receipt of text messages) for designing the kiosk and how to engage women visiting Planned Parenthood (e.g., safety net center setting).

3. Results

Interviews were conducted with a total of 24 women of varying races, who access Planned Parenthood services, with an age range of 18 to 34 years old. Among participants, 16 (73%) were Black, 2 (9%) were Latina, 2 (9%) were White, and 2 (9%) identified as mixed race. The median participant age was 22.4 years old. The HPV vaccination status of the participants at the time of the interview were as followed: 15 (68%) had received at least one dose in the three-dose series among whom 11 had completed the entire three-dose series, and 7 (32%) were unvaccinated. All except one woman reported using a smartphone.

Kiosk Receptivity. More than half of the participants, vaccinated and unvaccinated, were receptive to approaching a kiosk while in the waiting room. The analysis revealed that they were strongly receptive and did not require any prompts to approach the kiosk. Less than half of the women were partially receptive and discussed only approaching the kiosk under certain conditions. Lastly, some expressed no interest in approaching the kiosk.

Reasons for strong receptivity to the kiosk included perceptions that it was a part of the check-in process, alleviating boredom in the waiting room, its ability to get information easily and quickly, general feelings of curiosity, and an interest in obtaining health information. Women also discussed a preference for technology when accessing health information. For instance participants remarked:

*"I am a sexually active person, so I would like information about everything."
"I think it's better than paper or pamphlets. It's more interesting to me."*

Women who were partially receptive discussed approaching the kiosk if it was noticeable and visually appealing, there was enough waiting time to explore its contents, or participants were directed by either signage or the front desk to use it: In discussing support for the kiosk, one participant noted its role in creating awareness about HPV. Participants remarked:

*"I'm glad for the machine [kiosk]. Most people don't know about HPV. If the doctor don't talk about it, you don't know it."
"If a representative at the front desk said, 'hey, I would like for you to use that kiosk. Do you mind?' that would be tempting to walk up and use it."*

Reasons for a lack of receptivity included not wanting to get up once seated and potentially feeling tired while waiting. A lack of privacy and comfort were also discussed as potential barriers: A fear of breaking waiting room etiquette was echoed as a point of concern by women who were not strongly receptive. By contrast, the kiosk could potentially offer more confidentiality in the waiting room. The women shared:

"Me personally, if I heard it talking after a long day of work, I don't think I would walk over."

"[I]f it's in a waiting room ... other people are watching, looking at you... I wouldn't feel comfortable while I'm up there."

"Maybe I would, but I might feel embarrassed ... Everyone who comes in just sits down."

"I know some people are embarrassed when they sign papers [at the check in] like when somebody comes in and requests STD testing, they shield their papers. I think a kiosk would be a little bit more confidential. You don't have to worry about shielding your paper from everyone."

Receptivity to QR Code and Text Messaging. Participants were also asked about their receptivity to using kiosk features such as scanning QR codes with their smartphones to receive vaccination reminder text messages and additional HPV vaccine information. When asked, more than half of the women were familiar with a QR code. Participants were familiar with QR codes by observing family members using them or by personally using them in non-medical settings such as restaurant chains, stores, or their workplace. Among those unfamiliar with a QR code, women still recommended it as beneficial feature.

When asked if participants would scan their phones to receive text messages, the majority were receptive. Among the vaccinated group, all the participants who were vaccinated were receptive. More than a half of the unvaccinated women were receptive. Reasons for receptivity included personally feeling forgetful, easy access to information, and an interest in health. When asked if she would scan her phone, one woman replied: Despite not having a smartphone, another receptive woman highlighted the role of trust and credibility in her decision: Participants also discussed a preference for text messages and its benefits. For example, participants stated:

"Definitely, but that's because like I said, I really care about my health."

"I would trust it because it's a doctor's office. Otherwise, I wouldn't."

"If you have a text message come to your phone, you will actually look at it."

Reasons for a lack of receptivity included a fear of receiving an excessive amount of text messages and a concern over receiving non-relevant information. When asked if they thought other women would scan their phones, receptive participants generally said yes, but commented on potential barriers such as not having a smartphone, a fear of being charged to receive texts, and a lack of familiarity with QR codes. Privacy concerns, such as others seeing sensitive information in the text message, were also discussed. A younger participant specifically mentioned a fear of parents seeing text messages from Planned Parenthood as a barrier.

Design for Kiosk Engagement. Participants provided suggestions for improving the kiosk's appearance. Many women recommended that the kiosk display pictures or a colorful exterior to make it visually appealing. Participants also discussed signage that prompted empowerment and curiosity. Examples given were *"be proactive"* and *"take control of your health"* in addition to questions such as *"Did you know?"* When asked if she would approach the kiosk if the sign advertised only general health information, one participant responded:

"Yeah I probably wouldn't use it if it said that."

Many women recommended HPV-specific signage to attract attention. One participant suggested signage that addressed HPV risk factors such as asymptomatic male partners. While some participants discussed being in favor of advertising incentives such as free food, coupons, and clothing for interacting with the kiosk, others were opposed to the idea. In particular, one participant stated:

"Then people would just go on for free stuff and not really pay attention to what it really is."

Participants presented various suggestions for the physical placement of the kiosk in the waiting room and its navigation design. Women recommended placement near the check-in desk or isolated in a remote corner of the room. To reduce possible embarrassment and improve discretion

while operating the kiosk, participants recommended solutions such as privacy curtains. To improve comfort, many participants also suggested adding a chair. Women recommended strategies for navigating the kiosk such as a touch screen, an easy-to-use interface, and language presented in a simple and clear manner. None of the women discussed a language preference.

Suggestions for the Kiosk Videos. When asked about the type of people who should be displayed in the videos, participants recommended:

"Regular people," "Whoever gets this more," or "Younger people that never got it before sayin' why they want to get it [the vaccination]."

Participants discussed the benefits of showcasing decision narratives or stories:

"[S]tories are very important. It gives you something more relatable."

To increase relatability to decision narratives, one woman stated:

"Maybe you can have different ages that we can relate to. A younger girl or 25 and grown lady."

Participants also suggested showing short videos:

"...A one-minute video seems long. If I come in and were watching a video and they called me, I would be like forget this video and I would walk away."

To improve privacy, many participants recommended subtitles or headphones while watching the videos. Lastly, some participants requested an option of scanning a QR code to watch the HPV narrative videos directly on their smartphone instead of at the kiosk.

During the interviews, women were asked for feedback on the type of health-related content to be displayed at the kiosk. Participants requested general health, women's health, and HPV-specific content. Many women discussed the lack of awareness about HPV among individuals in their community and as a result, recommended information about HPV and the vaccine:

"Really just more detail about what HPV is about, what it [the vaccine] protects against, how to prevent it, or if you didn't get the shot, what would be the results down the line."

Women also suggested interactive features such as games or quizzes to testing current HPV knowledge and scores to motivate others to continue learning about HPV. Lastly, one participant highlighted the need to be transparent about who is curating the information presented at the kiosk (e.g., Planned Parenthood).

4. Discussion and conclusion

4.1. Discussion

The study revealed high receptivity among low-income women who utilize Planned Parenthood services to using a kiosk to deliver HPV-related health information as well high receptivity to using QR codes to deliver vaccine text message reminders on smartphones and additional information via a website link [13]. This is encouraging especially given that 100% of unvaccinated women participants were receptive to the health kiosk. Unvaccinated women are the primary target audience for any future Planned Parenthood intervention using the multi-communication channel health kiosk [19,20]. Overall, the participants supported research evaluating various dimensions relevant to kiosk design and information delivery, including "provided services, location deployment, benefits/effectiveness, challenges and notable design and construction points [21].

Kiosk design should be cognizant of placement within a safety-net health center, to address privacy and embarrassment concerns that were expressed by some women in the context of waiting room norms [21].

Women offered strategies for overcoming the potential embarrassment or shyness of using or standing at a kiosk in a waiting room by suggesting (a) having check-in staff direct women to the kiosk and thereby normalizing its use, (b) having disposable earbuds available to ensure privacy when women listen to videos and navigate the menu at the kiosk, and, (c) that for some women, the kiosk actually provided more privacy by delivering reproductive health information contained within the kiosk using a privacy screen (i.e., from the kiosk) rather than women having to shield their paperwork at the front desk because of concerns that someone might see how they completed their forms.

Kiosk signage should widely appeal to various women such as sexually active and non-sexually active women as well as women from different cultural and socioeconomic backgrounds [21]. Sexually active women expressed wanting a health kiosk that informs them of the latest updates on reproductive health and found a digitally delivered kiosk more interesting than print brochures. The kiosk also plays an important prevention role in raising awareness about the importance and availability of HPV vaccination (and prompts women to ask their gynecologist about it) especially when physicians do not necessarily routinely recommend HPV vaccination to young adult women [9].

Women's input on kiosk content suggested incorporating user engagement preferences and stories that are relatable, authentic, and representative of the population [22]. Content design should also be cognizant of varying levels of HPV vaccine awareness and education among women and offer tailored messaging that speaks to the varying levels of HPV vaccine knowledge (whether women had ever heard of it or knew anything about it). Embedded as part of the kiosk menu and navigation design the research team came up with a slide bar that women could interact with to indicate their level of awareness of HPV vaccination and depending on how women responded would be directed to different vaccine decision story types.

To reach women with prevention information beyond the health center visit, women were asked about their familiarity and comfort using QR codes [22]. While more common now, the use of QR codes in health context was just emerging at the time of the study [23]. Women expressed familiarity with QR codes through food kiosks at gas stations or coffee shops like Dunkin Donuts and this non-health context was translated into making "health kiosks" more familiar and relatable in the health center setting to increase access for women. A resurgence of QR codes has been developing with QR readers automatically installed on Smartphones. Additionally, the coronavirus pandemic has changed how receptive subgroups are to using QR codes with additional measures being taken to ensure touchless transactions for health or other visit types [24]. QR codes are increasingly used in daily life not only for food transactions and parking as women shared, but also for accessing additional information whether information at outdoor parks or museums [25–27]. Embedding QR codes as part of a health kiosk is optimal for reaching underserved communities beyond the health setting with a link to additional health information.

While this study provided critical insights regarding the design of a kiosk to communicating HPV education to ultimately increase HPV vaccine uptake among low-income women at Planned Parenthood, there were several limitations. Participants did not disclose their socioeconomic status. It was inferred due to their use of Planned Parenthood services. Hence, generalizability to low-income populations may be limited. Moreover, the participants were ethnically diverse and as such it is difficult to ascertain if one individual ethnic culture is important to represent in the overall kiosk design. This formative research study was conducted at one Planned Parenthood. Caution is recommended in assuming these findings extend across Planned Parenthood sites and those sites' ethnically diverse low-income women. Although formative research, the purpose of the study was to uncover relevant considerations for optimally designing the health kiosk to be engaging and useful for women seeking care at Planned Parenthood health centers [28]. Valuable insight was identified from this research to better serve low-income women at Planned Parenthood health centers (e.g., integrate kiosk usage with routine check-in procedures, privacy considerations, QR code and other engagement strategies). Future studies

will assess the health kiosk using the system usability scale, simulating participant interaction [29].

4.2. Conclusion

This study highlights an example of how underserved, low-income populations visiting safety net health centers such as Planned Parenthood in the U.S. can be engaged in efforts that use digital health tools. It also should be noted that the women's comments map directly onto the constructs identified by Narrative Engagement Theory (NET) [19]. Using NET and community-based participatory efforts contribute to reducing health disparities by increasing accessibility to preventive women's health through technology with their input. Working with Planned Parenthood and integrating women's perspectives into the health kiosk design addresses health disparities by including the target audience's preferences and perspectives early on in the kiosk development process [21,30]. Inclusion of these women's preferences is more likely to result in favorable reception to using such a health kiosk and telling peer women in their network about it.

4.3. Innovation

This digital HPV education intervention is innovative in its integration of technologies, collaborative design, and use of narratives to reach high-risk yet underserved low socioeconomic status and minority women. Innovation is grounded in the concept to design a point-of-care health kiosk with embedded digital features, such as a QR code and text messaging that allows for reaching women outside of the clinic setting with more information. Involving targeted users in the early design phase is innovative, affording insights into usability preferences (e.g., kiosk placement, using QR codes) and message design features (e.g., relatability). The use of NET to develop culturally grounded vaccine decision stories that are tailored to the user's level of awareness of the HPV vaccination is an innovative messaging strategy [19]. Digital interventions are particularly innovative in their scalability to reach to diverse populations of women. Incorporating these elements into the design of a health kiosk is a promising approach in reducing barriers to HPV vaccine education and increasing vaccine uptake among low-income women at safety-net clinics.

Conflict of interest disclosure

There are no conflicts of interests to disclosure for any of the authors on this manuscript except the principal investigators Hecht and Hoper who were awarded an NIH SBIR to develop a women's health promotion /vaccine health kiosk.

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References

- [1] Centers for Disease Control and Prevention. HPV and Cancer. https://www.cdc.gov/cancer/hpv/basic_info/index.htm; 2022. [accessed 18 September 2022].
- [2] Poniewierza P, Panek G. Cervical Cancer prophylaxis: State-of-the-art and perspectives. *Healthcare*. 2022;10:1325. <https://doi.org/10.3390/healthcare10071325>.
- [3] Ssentongo P, McCall-Hosenfeld JS, Calo WA, Moss J, Lengerich EJ, Chinchilli VM, et al. Association of human papillomavirus vaccination with cervical cancer screening: A systematic review and meta-analysis. *Medicine*. 2022;101:e29329. <https://doi.org/10.1097/MD.00000000000029329>.
- [4] Swid MA, Monaco SE. Should screening for cervical cancer go to primary human papillomavirus testing and eliminate cytology? *Mod Pathol*. 2022;7:1–7. <https://doi.org/10.1038/s41379-022-01052-4>.

- [5] Centers for Disease Control and Prevention. HPV Vaccine Schedule and Dosing. <https://www.cdc.gov/hpv/hcp/schedules-recommendations.html>; 2019. [accessed 5 October 2021].
- [6] Hirth J. Disparities in HPV vaccination rates and HPV prevalence in the United States: a review of the literature. *Hum Vaccin Immunother.* 2019;15:146–55. <https://doi.org/10.1080/21645515.2018.1512453>.
- [7] Chidambaram S, Mazul A, Chang SH, Zevallos J. 113 Identifying barriers to HPV Vaccination in the US Veteran population. *J Clin Transl Sci.* 2022;6:4–5. <https://doi.org/10.1017/cts.2022.33>.
- [8] Kops NL, Horvath JDC, Bessel M, Souza FMA, Benzaken AS, Pereira GFM, et al. The impact of socioeconomic status on HPV infection among young Brazilians in a nationwide multicenter study. *Prev Med Rep.* 2021;21:101301. <https://doi.org/10.1016/j.pmedr.2020.101301>.
- [9] Kong WY, Bustamante G, Pallotto IK, Margolis MA, Carlson R, McRee AL, et al. Disparities in Healthcare Providers' Recommendation of HPV Vaccination for U.S. Adolescents: A Systematic Review. *Cancer Epidemiol Biomark Prev.* 2021;30:1981–92. <https://doi.org/10.1158/1055-9965.epi-21-0733>.
- [10] Lindsay AC, Greaney ML, Rabello LM, Kim YY, Wallington SF. Brazilian Immigrant Parents' Awareness of HPV and the HPV Vaccine and Interest in Participating in Future HPV-Related Cancer Prevention Study: an Exploratory Cross-Sectional Study Conducted in the USA. *J Racial Ethn Health Disparities.* 2020;7:829–37. <https://doi.org/10.1007/s40615-020-00704-y>.
- [11] Becker D, Tsui AO. Reproductive health service preferences and perceptions of quality among low-income women: racial, ethnic and language group differences. *Perspect Sex Reprod Health.* 2008;40:202–11. <https://doi.org/10.1363/4020208>.
- [12] Steinhubl SR, Muse ED, Topol EJ. The emerging field of mobile health. *Sci Transl Med.* 2015;7:283rv3. <https://doi.org/10.1126/scitranslmed.aaa3487>.
- [13] Arsenijevic J, Tummers L, Bosma N. Adherence to Electronic Health Tools Among Vulnerable Groups: Systematic Literature Review and Meta-Analysis. *J Med Internet Res.* 2020;22:e11613. <https://doi.org/10.2196/11613>.
- [14] Maramba ID, Jones R, Austin D, Edwards K, Meinert E, Chatterjee A. The Role of Health Kiosks: Scoping Review. *JMIR Med Inform.* 2022;10:e26511. <https://doi.org/10.2196/26511>.
- [15] Hsieh YH, Gauvey-Kern M, Peterson S, Woodfield A, Deruggiero K, Gaydos CA, et al. An emergency department registration kiosk can increase HIV screening in high risk patients. *J Telemed Telecare.* 2014;20:454–9. <https://doi.org/10.1177/1357633X14555637>.
- [16] Liu P, Astudillo K, Velez D, Kelley L, Cobbs-Lomax D, Spatz ES. Use of mobile health applications in low-income populations: A prospective study of facilitators and barriers. *Circ Cardiovasc Qual Outcome.* 2020;13:e007031. <https://doi.org/10.1161/circoutcomes.120.007031>.
- [17] Tsui J, Singhal R, Rodriguez HP, Gee GC, Glenn BA, Bastani R. Proximity to safety-net clinics and HPV vaccine uptake among low-income, ethnic minority girls. *Vaccine.* 2013;31:2028–34. <https://doi.org/10.1016/j.vaccine.2013.02.046>.
- [18] Tanglewood Research Institutional Review Board IRB. Feasibility of a kiosk smartphone intervention to increase HPV vaccination; 2019.
- [19] Miller-Day M, Hecht ML. Narrative means to preventative ends: a narrative engagement framework for designing prevention interventions. *Health Commun.* 2013;28:657–70. <https://doi.org/10.1080/10410236.2012.762861>.
- [20] Giorgio MM, Kantor LM, Levine DS, Arons W. Using chat and text technologies to answer sexual and reproductive health questions: Planned Parenthood pilot study. *J Med Internet Res.* 2013;15:e203. <https://doi.org/10.2196/jmir.2619>.
- [21] Letafat-Nejad M, Ebrahimi P, Maleki M, Aryankhesal A. Utilization of integrated health kiosks: A systematic review. *Med J Islam Repub Iran.* 2020;34:114. <https://doi.org/10.34171/mjiri.34.114>.
- [22] Card JJ, Kuhn T, Solomon J, Benner TA, Wingood GM, DiClemente RJ. Translating an effective group-based HIV prevention program to a program delivered primarily by a computer: methods and outcomes. *AIDS Educ Prev.* 2011;23:159–74. <https://doi.org/10.1521/aeap.2011.23.2.159>.
- [23] Kossey J, Berger A, Brown V. Connecting to educational resources online with QR codes. *FDLA J.* 2015;2:1.
- [24] Faggiano A, Carugo S. Can the implementation of electronic surveys with quick response (QR) codes be useful in the COVID-19 era? *Int J Epidemiol.* 2020;49:1732–3. <https://doi.org/10.1093/ije/dyaa170>.
- [25] Mobile Payments Today. The Resurgence of QR Codes. <https://www.mobilepaymentstoday.com/blogs/the-resurgence-of-qr-codes/>; 2020. [accessed 5 October 2021].
- [26] Jaramillo J, Jaramillo C, editors. *Seattle Stairway Walks: An up and down guide to city neighborhoods.* Seattle: The Mountaineers Books; 2012.
- [27] Decker J, editor. *Engagement and Access: Innovative Approaches for Museums.* Boulder: Rowman & Littlefield; 2015.
- [28] Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods.* 2006;18:59–82.
- [29] Vlachogianni P, Tselios N. Perceived usability evaluation of educational technology using the System Usability Scale (SUS): A systematic review. *J Res Technol Educ.* 2022;54:392–409. <https://doi.org/10.1080/15391523.2020.1867938>.
- [30] van Bruinessen IR, van Weel-Baumgarten EM, Snippe HW, Gouw H, Zijlstra JM, van Dulmen S. Active patient participation in the development of an online intervention. *JMIR Res Protoc.* 2014;3:e59. <https://doi.org/10.2196/resprot.3695>.