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A qualitative study on ASHA workers' perspective on HPV self-sampling in Sikkim India

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Cervical cancer is a major public health concern in India, hampered by limitations in traditional screening methods and healthcare infrastructure. This study aimed to evaluate the feasibility and challenges of implementing Human Papillomavirus self-sampling (HPV) self-sampling, conducted by ASHA workers (Accredited Social-Health Activists) in Sikkim, India, using the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework. In-depth interviews were conducted between February and May 2023 with ASHA workers involved in HPV self-sampling implementation within Sikkim. The data was analysed using qualitative methods and tagged under relevant RE-AIM categories. Twenty ASHA workers participated in the study. Facilitators included participant autonomy, positive community attitudes, and logistical advantages of home-based testing. ASHA workers' efforts in health education, counselling, and community engagement were crucial. Successful implementation was supported by adequate training, community trust, and mobile technology for result transmission. Barriers included poor health literacy, logistical challenges for ASHA workers, and inadequate incentives. The study highlights the importance of tailored screening procedures, community engagement, and programmatic support in enhancing acceptance of HPV self-sampling. Addressing barriers requires multifaceted interventions at individual, community, and systemic levels.

Keywords Cervical cancer, Cervical cancer screening, Implementation, HPV self-sampling, Qualitative research, HPV self-sampling in population-based cancer screening

GLOBOCAN is a project of the International Agency for Research on Cancer (IARC) that provides estimates of the incidence, mortality, and prevalence of major cancers globally, including cervical cancer. The recent GLOBOCAN 2022 again highlighted cervical cancer as a major public health problem for women. An estimated 0.66 million new Incidences and 0.34 million mortalities were reported globally in year 2022¹. The association between Human Papillomavirus (HPV) infection and cervical cancer is well-established². Acknowledging the HPV infection as the primary cause, and in response to the WHO's call in 2018 for cervical cancer elimination by the end of this century, many developed nations recommend HPV testing as a primary screening test, along with the self-sampling option^{3,4}. This has resulted in undeniably lower cervical cancer incidence in developed nations compared to developing and less developed nations. Particularly in India, a developing nation, cervical cancer ranks second most commonly diagnosed cancer among women¹. It has reported 0.127 million incidences and 0.079 million mortalities in the year 2022¹. The Ministry of Health and Family Welfare (MoHFW), India, established a policy for a cervical cancer control program, which has been in force since 2016⁵. The program recommends screening women aged 30–65 years using the Visual Inspection with Acetic Acid (VIA) test once in 5-year intervals. However, the VIA test grapples with numerous challenges concerning acceptability among beneficiaries and the capacity building of healthcare providers^{6,7}.

Underscoring the significance of self-sampling for HPV-DNA testing as a promising screening approach, we conducted a pilot study in collaboration with the State Government of Sikkim, a north-eastern Indian state with a significant tribal population, to implement an HPV screening self-sampling strategy in one of its districts. This

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study aimed to assess the feasibility and challenges of rolling out self-sampling by women in the community as part of the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD). In the Indian healthcare system, health workers known as Accredited Social Health Activists (ASHAs) play a vital role in implementing public health programs and serve as the primary link between the system and the community for effective policy implementation⁸. In our study, ASHAs were the main facilitators, ranging from delivering HPV sampling kits to women's doorsteps to transporting samples to the central laboratory at the District Hospital. Since HPV self-sampling is a new approach in the Indian system, ASHA workers' experiences can shed light on its acceptability, feasibility, and effectiveness in this specific context. Understanding their experiences is crucial for improving training needs and support for the effective implementation and uptake of HPV self-sampling screening methods in India and other resource-limited settings.

In the process of evaluating the HPV self-sampling implementation in Sikkim using the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework, we conducted a qualitative study^{9,10}.

In line with the RE-AIM framework, our study aimed to:

- Evaluate reach by determining how HPV self-sampling could be extended to a broader population of women through the community-based ASHA model.
- Assess effectiveness by exploring ASHA workers' perspectives on the acceptability and practicality of self-sampling.
- Understand adoption by identifying the facilitators and barriers ASHA workers encountered in motivating women to participate.
- Evaluate implementation by identifying challenges faced during sample collection and transportation, as well as gaps in training and support.
- Inform potential maintenance by identifying the training and support needs necessary for long-term sustainability and effective scale-up of the self-sampling strategy.

Methods

The detailed methodology of the HPV self-sampling strategy is mentioned in our previous publication¹¹. Briefly, in a pilot study, the intervention involved training ASHA workers to deliver HPV self-sampling kits to women at their homes, motivate participation, collect the samples, and transport them to a central laboratory for HPV-DNA testing. The qualitative study among ASHA workers is a part of the pilot study. The present manuscript primarily focuses on the perspectives of ASHA workers. However, the details about community women's acceptability and feasibility for HPV-DNA testing are given in brief in the results section for the reader's benefit.

Study setting

This qualitative study was conducted in the Gangtok District of Sikkim, a north-eastern state of India with a significant tribal population. The HPV self-sampling implementation was part of a pilot project under the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD), in collaboration with the State Government of Sikkim. The ASHAs played a critical role in implementing this intervention, from delivering HPV self-sampling kits to transporting the collected samples to the central laboratory.

Theoretical perspective

This study employed the RE-AIM framework to evaluate the implementation of an HPV self-sampling strategy for cervical cancer screening in Sikkim, India. The RE-AIM framework is designed to assess public health interventions across five key dimensions—Reach, Effectiveness, Adoption, Implementation, and Maintenance. Each dimension was specifically considered in this study as follows:

- **Reach:** This dimension evaluated how well the HPV self-sampling intervention reached women in geographically remote, resource-limited tribal communities. Specifically, we assessed how ASHA workers engaged the target population and addressed the barriers to participation.
- **Effectiveness:** We examined the potential impact of self-sampling on the target population, focusing on ASHA workers' perspectives regarding the acceptability and feasibility of HPV self-sampling in meeting women's screening needs.
- **Adoption:** This dimension looked at the willingness and ability of ASHA workers and community members to adopt the HPV self-sampling method. Barriers and facilitators encountered by ASHA workers in motivating women to participate were investigated.
- **Implementation:** We focused on how well the intervention was delivered by ASHA workers, identifying any logistical challenges in the distribution and collection of self-sampling kits, as well as evaluating the adequacy of their training and support.
- **Maintenance:** Although this pilot study did not collect long-term data, we explored ASHA workers' perspectives on the sustainability of HPV self-sampling in the community, considering what resources and support would be needed to maintain the program over time.

Participants and recruitment

Participants were selected from ASHA workers actively engaged in the HPV self-sampling implementation program in the Gangtok District. The recruitment process was facilitated by program supervisors and community health authorities during regular ASHA meetings. A total of 32 ASHA workers expressed interest, and 25 agreed to participate.

Inclusion Criteria: ASHA workers currently engaged in the HPV self-sampling program in Gangtok District.

Exclusion Criteria: ASHA workers who declined to participate or did not meet the inclusion criteria.

Finally, 20 ASHA workers participated, ensuring representation across various geographic and community settings. Demographic data, such as age, gender, education, and years of employment, were collected.

Sample size and data saturation

Data saturation was employed as the guiding principle for determining sample size. Saturation was achieved when interviews yielded no new themes or insights, ensuring a comprehensive understanding of ASHA workers' experiences. The final sample size of 20 participants was deemed sufficient for in-depth thematic exploration.

Data collection

Data were collected between February and May 2023 through in-depth interviews using a semi-structured, open-ended interview guide. The guide was developed based on the RE-AIM framework and aimed to elicit insights from ASHA workers regarding the facilitators, barriers, and perceptions of HPV self-sampling implementation.

Interview Guide Development: A pilot test was conducted with five ASHA workers to refine the interview guide (Supplement 1), and the guide was translated into Nepali by a language expert to ensure cultural relevance in Sikkim^{9,10,12}. After receiving feedback from research experts, the guide was further refined and translated into Nepali by a language expert to ensure cultural relevance in Sikkim. The final version of the guide is included as Supplement 2.

Interview Procedure: Interviews lasted between 40 and 60 min and were conducted by a trained female Nepali speaker to foster open communication. Interviews were audio-recorded, and detailed field notes were taken to capture non-verbal cues and contextual observations. No repeat interviews were conducted unless necessary for clarification.

The study was conducted with prior approval from the Institutional Ethics Committee. All the methods were performed in accordance with the Institutional guidelines. Before each interview, a detailed verbal explanation of the study's purpose, procedures, risks, and benefits was provided in the regional language (Nepali). Participants provided verbal consent, which was audio-recorded. They were assured of confidentiality and their right to withdraw from the study at any time. No monetary compensation was provided; however, travel expenses were covered to minimize participation barriers.

Data analysis

Interviews were anonymized, transcribed, and translated into English. For interviews conducted in Nepali, back translation was performed to ensure accuracy. Data were securely stored in password-protected files with redundant backups for data protection.

- **Analysis Approach:** An inductive-deductive approach was employed. Thematic analysis was guided by predefined RE-AIM categories (Reach, Effectiveness, Adoption, Implementation, and Maintenance), but emerging themes from the interviews were also explored.
- **Coding:** Two researchers and two independent qualitative experts coded the data. Discrepancies in coding were resolved through discussions to reach a consensus. The qualitative data were managed using Taguette software (Version 1.4.1), which facilitated systematic organization and exploration of the findings¹³.
- **Reporting Guidelines:** The study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines, which include a 32-item checklist for enhancing the methodological rigor and transparency of qualitative studies.

Results

Among women who participated in HPV-DNA testing by self-sample collection technique with the support of ASHA workers, more than 99% of women said they were neither scared nor embarrassed to collect the samples by self-collection method. Ninety -nine percent of women did not experience any difficulty in collecting their sample. They were confident in performing self-sample collection and had no discomfort or bleeding while performing self-sample collection. The majority of women preferred self-sample collection for their future screening.

A total of 20 in-depth interviews were conducted among ASHA workers of Gangtok District in Sikkim, Assam between February and May 2023. The demographic profile of ASHA workers revealed a mean age of 39.4 years (SD = 6.9), with the majority possessing educational qualifications up to the 12th grade. Notably, half of the participants were stationed in rural locales within the study area, with a median tenure of 6 years as ASHA workers. Throughout the study, facilitating factors and barriers for self-screening were determined.

Facilitating factors among women under 'Reach' component of RE-AIM

Under the 'Reach' component, facilitating factors for women to participate in the self-sampling program included broader themes such as offering autonomy to participants to take up testing, highlighting the positive aspects of women and their families, and removing logistical constraints for women to undergo testing. Women in the community felt empowered to undergo this testing as it provided them the opportunity to undergo tests at their homes, thereby maintaining their privacy. One of the ASHAs recalled the experience of women in the community, stating, *"It's at women's home so they don't have to go to the hospital and do not have to show their private parts to doctors and nurses."* Participants also acknowledged that home-based testing provided them with a time window to self-administer the test at their convenience, which ensured better compliance for taking up this testing in the community. ASHAs also revealed that women participated enthusiastically in the home-based sampling program as it avoided travel-related costs that would be incurred if women were to get tested in hospitals (Table 1; Fig. 1).

Themes	Subthemes	Supporting quotes
Offering autonomy to women to undergo testing	Women feeling positive to undergo home-based testing	"I feel the women of my village is happy as they don't have to go to hospital as we provide care at their home and if we tell them to go hospital, they won't do the test so we are also happy and Government have done right thing by providing this kit"
	Maintaining privacy of women	"It's at women's home so they don't have to go to hospital and do not have to show their private part to doctor and nurses."
	Choosing appropriate time for self-administering test as per women's convenience	"Some women who are menstruating also gets interested and take the sample kits and do the test after menstruation"
Positive aspects of women and her family	Education serving as a medium for women to understand about testing	"Out of 10 women, 2 does not want to do the test but still many agrees to do the sample collection these days most of the women are literate to understand easily"
	Better family support	"As such no resistance faced from family members"
Avoiding logistical constraints	No need to travel to a facility, thereby avoiding travel costs	"It is done even at home without going hospital so its very good for the women. Many women got benefited and found their infection." "and they don't have to pay taxi fare."

Table 1. Participant-level facilitators for home-based HPV screening programme at community level in Sikkim under 'Reach' of RE-AIM framework.

Facilitators at the level of ASHA under 'Reach' of RE-AIM

To ensure good participation by women in the self-sampling program, ASHAs made significant efforts that were focused on launching an effective health education campaign, providing counselling at various levels in the community to reinforce testing, and implementing multi-pronged motivational strategies to encourage women to comply with self-testing. ASHAs conducted health education sessions using videos and pamphlets to increase awareness among women and their families about the importance of self-sampling for screening HPV infection. In addition, ASHAs counselled women at the family level and in community-led women's groups during Village Health and Nutrition Days to emphasize the benefits of testing for HPV infection. Along with promoting the advantages of screening, ASHAs motivated women by instilling trust in the health systems that provided a continuum of care for women who tested positive for HPV infection. ASHAs also stressed the importance of peer learning, explaining that women who had already undergone testing and benefited from it could serve as examples to encourage others to get tested. ASHAs quoted, "Those who do not accept or are not willing to give the sample, we give an example of someone who has already collected and benefitted, then they do the test" (Table 2; Fig. 1).

Programmatic-level facilitators under the 'Implementation'/adoption' of the RE-AIM framework

The successful implementation of the screening program in the community was made possible by providing adequate training to ASHAs by the state health department on explaining sample collection methods to women and adhering to the principles of Good Clinical Practice to maintain confidentiality of test results within the community. ASHAs highlighted the favourable characteristics of the self-sampling kits, such as safety and their availability at no cost, which supported the integration of this testing approach into the state health system and its smooth implementation at the ground level without major obstacles. ASHAs mentioned in their interviews that their close involvement at the grassroots level fostered a strong community bond, which contributed to a better acceptance and uptake of this new test.

During interviews, ASHAs emphasized the importance of inter-sectoral collaboration as a key factor for the successful implementation of new programs in the community, as per the quote "Coordinating with councilor/s panchayat, youth leaders. Informing self-help groups and.

Other present local Samaj, NGOs and community participation will increase the sample collection and make the program successful." They mentioned the need for coordination with councillors, panchayats, youth leaders, self-help groups, NGOs, and engaging the community to increase sample collection and ensure the program's success. Additionally, the use of mobile technology for transmitting test results from the central laboratory to women, followed by mobile-based counselling by ASHAs for those who tested positive for HPV, played a crucial role in the successful rollout of the program in the community (Table 2; Fig. 1).

Barriers for self-screening for HPV programs at various levels as per 'Reach' and 'Implementation' of RE-AIM framework

The study also identified barriers to the implementation of the self-sampling program at two crucial levels: First, women in the community and healthcare workers, specifically ASHA workers. ASHAs noted that women with low health literacy often did not recognize the importance of screening for HPV infection as a precursor to cervical cancer screening. This lack of awareness made it challenging for ASHAs to convince them to undergo testing. Additionally, refusals from family members hindered women's participation in self-testing. Despite extensive health education efforts in the community about the benefits and safety of the testing, women expressed concerns about the effectiveness of detecting HPV infection and feared the testing process, especially the potential discomfort or pain while inserting the brush for sampling. ASHAs mentioned that women were particularly scared of the brush included in the testing kits, fearing it might cause them harm (Table 3; Fig. 1).

Second, barriers also existed at the healthcare worker level, where ASHAs had to invest significant time and effort in visiting women at their homes to counsel them for testing. Transportation of the samples collected to the central laboratory was highlighted as a significant challenge by ASHAs as per this quote, "Getting HPV kits

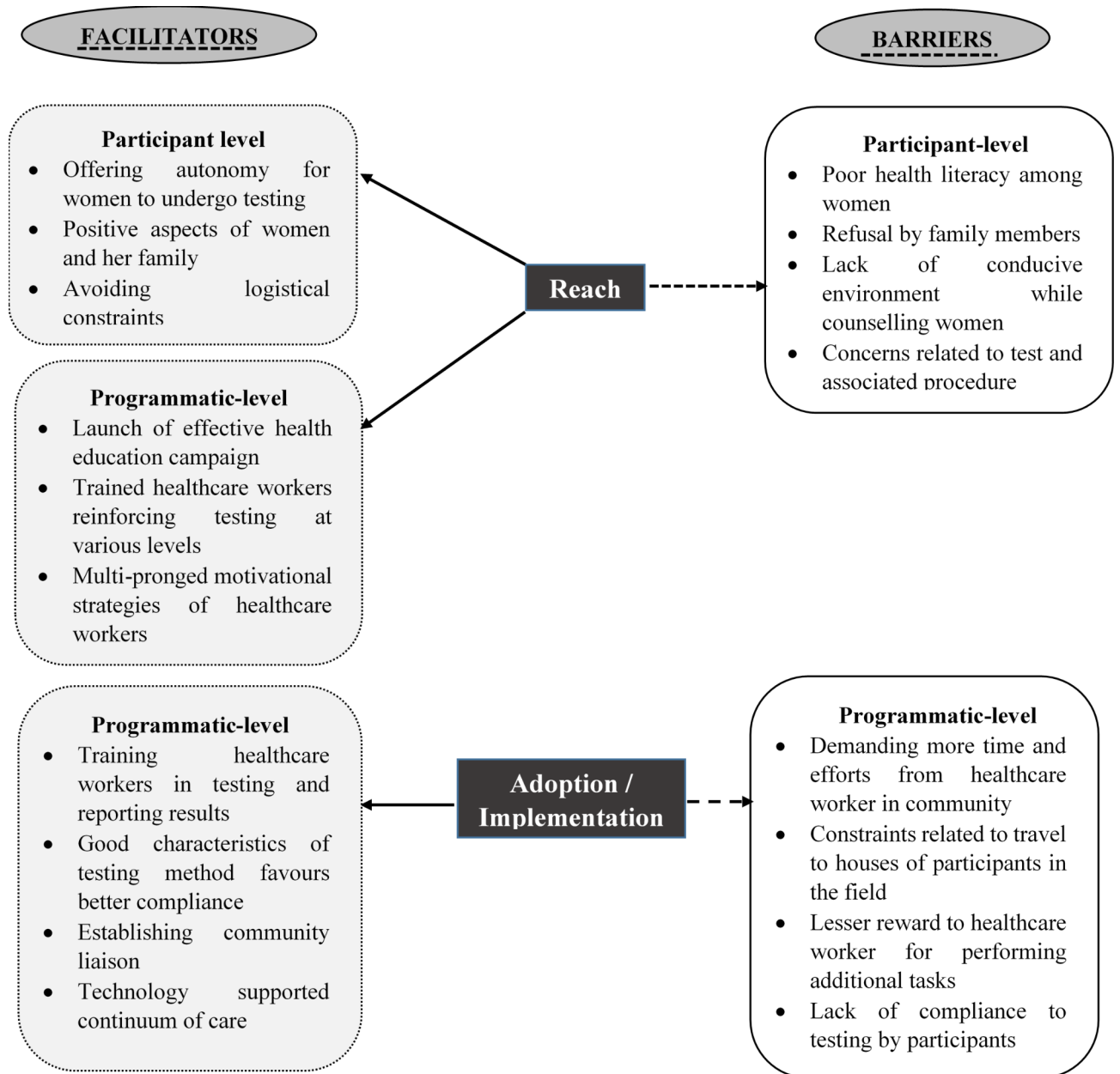


Fig. 1. Factors influencing home-based HPV screening programme at community level in Sikkim put under RE-AIM framework.

from health facilities and taking back to the health facilities after collection are tedious job for us". They mentioned that retrieving the HPV kits from health facilities and returning the collected samples was a cumbersome task. ASHAs faced logistical hurdles, such as traveling to remote areas and incurring taxi expenses during sample transportation. Since this additional task required ASHAs to go beyond their regular job responsibilities in the community, the issue of inadequate honorarium was cited as a major limitation. ASHAs emphasized their financial instability due to working on an honorarium basis, mentioning the high taxi expenses incurred during sample collection (Table 3; Fig. 1).

Discussion

To the best of our knowledge, this is the first qualitative exploration of ASHA (health) worker experiences in implementing HPV self-sampling for cervical cancer screening in India, shedding light on various facets influencing the adoption and challenges of this innovative approach. The study unravelled three overarching themes at three different levels. While this study provides valuable insights into the experiences of ASHA workers in India, it is essential to situate these findings within the context of existing literature from other countries that have implemented similar HPV self-sampling initiatives¹⁴.

Facilitator	Themes	Subthemes	Supporting quotes	
Healthcare worker level facilitators under 'Reach' of RE-AIM framework	Launch of effective health education campaign	Increased community awareness among family members / neighbours about free home-based testing services	"While explaining if other family members are present and if female are present that all gather to listen about it this I witnessed while I was explaining a women in shop everyone in and around gathered to listen about it"	
		Video- and pamphlet-based health education	"Through videos, pamphlets and awareness talk we can spread this information. They themselves understand and seek help from us".	
	Trained healthcare workers reinforce testing through counselling at various levels	Better compliance following a pre-test counselling by healthcare worker	"Women at first did not do the test but with lot of explanation they understood the benefits and started to come forward for self-sample collection by themselves"	
		Perceived benefits in early identification of HPV testing	"Women are very grateful for the HPV testing as it is helping women to protect them from getting dangerous disease"	
		Counselling at group of women during observed health days of a village	"We ASHA when we go to the village in program like VHND (Village Health and Nutrition day) where we meet women of different age group and its easier for us to aware them about HPV testing and provide counselling for the sample collection".	
		Counselling at family level	"With husband women feels more comfortable..."	
	Multi-pronged motivational strategies of healthcare worker	Motivating women through trust building mechanisms about health systems	"Only one women was HPV positive she was called for VIA got her treatment and asked to follow up after 1 year."	
		Motivating women by describing advantages of screening	"This test is very necessary to do because many women do not come forward and visit gynaecologist even if they are facing different problems like discharge, pain etc..."	
		Motivating women through highlighting essential components of programme	"It is a nice initiative step as earlier it used to be called PAP Test and as of now self-sampling is taken where the kit is provided by the health centre and along with that a guidance is available too making the patient comfortable and sense of assurance is inculcated within patients."	
		Motivating women through peer learning approach	"Those who do not accept or willing to give the sample, we give an example who has already collected and got benefited than they do the test."	
	Programmatic-level facilitators under 'Implementation' / 'Adoption' of RE-AIM framework	Providing adequate training to healthcare workers in the aspects of testing and reporting results	Training healthcare worker about conduct of the test	"As per our training we have been provided with HPV collection kits which have tube and brush. We tell women to put the brush inside her vagina till it gets resistance and either rotate clock wise or anti-clock wise, take it out and put it inside the tube and cover the tube"
			Healthcare workers maintained confidentiality about test results	"Reporting was easy as it informed from the lab itself so I did not face any difficulties. Also, I kept the privacy of patients who come positive."
Good characteristics of testing method favours better compliance		Free availability of testing kits*	"If they want it is a help for each women as this is a golden chance for all the women. It is freely available by the state government initiatives"	
		Safety of the testing kit*	"It is absolutely safe as they collect sample easily after explanation"	
Establishing community liaison		Better compliance due to self-administration of screening tests	"Once explained properly women mostly do the test" "In my area the women ask for more sample kits so I have kept one camp in coming week"	
		Maintaining good rapport with community	"We work in the grassroots level and have built a good interpersonal relationship so they opens up and ventilate their worries and issues which helps us to address the issues easily."	
		Inter-sectoral involvement at community level to maximise screening uptake	"Coordinating with councillors/panchayat, youth leaders. Informing self-help group and other present local samaj, NGO and community participation will increase the sample collection and make the program successful."	
Technology supported continuum of care		Electronic communication of results from Urban primary health centre / central laboratory facilitated easier transmission of results to participants	"Women who have done the test are informed through phone calls and messages from the main centre (HPV lab) and we also get the list of people who are positives so we also counsel them for further treatment procedure."	
		Mobile-based counselling by healthcare worker to women tested positive for HPV infection	".....we also get the list of people who are positives so we also counsel them for further treatment procedure and advise them to not panic as it can be treated since it is detected early".	

Table 2. Healthcare worker level and programmatic-level facilitators for home-based HPV screening programme at community level in Sikkim under 'Reach', 'implementation' / 'Adoption' category of RE-AIM framework.

Theme 1, highlights the pivotal elements fostering acceptance of HPV-DNA testing at the participant level, including aligning sample collection with women's convenience and ensuring privacy. The findings underscore the significance of tailoring screening procedures to accommodate cultural and logistical considerations, thereby enhancing community engagement. Moreover, the commendable efforts of ASHA workers in bolstering awareness and providing continuous support throughout the screening process played a crucial role. Consistent with our observations, previous studies have documented the widespread acceptance of self-sample collection among women, both in home screening and facility-based screening contexts¹⁵⁻¹⁸. Our study is the first in the country to incorporate screening within the NP-NCD program with the state government of Sikkim as the implementer, providing insights into real-time implementation challenges and facilitators in cervical cancer screening with HPV-DNA testing using the self-sample collection. Our findings have highlighted several factors influencing the acceptance of self-sample collection and HPV-DNA testing. At the participant level, the organization of sample collection according to the woman's convenience, ensuring her privacy, and the family's support to undergo screening are potential factors that enhanced acceptance of self-sample collection at the participant level.

At the ASHA worker level, their knowledge of cervical cancer, HPV infection, and its association with cervical cancer, the importance of screening, and the benefits of self-sample collection for HPV testing significantly

Barriers	Themes	Subthemes	Supporting quotes
Participant-level barriers under 'Reach' of RE-AIM framework	Poor health literacy among women	Lack of awareness about cervical cancer and associated stigma regarding genital conditions	"I feel most of them are not conscious about their health"
		Lack of perceiving cervical cancer as an important health condition to get screened	"Older women like above 60 years are not willing to do the test easily as they say that we don't have any problems related to it and we don't sleep with husband also its been long we are not active sexually"
	Refusal by family members	Refusal by husband to let their wife undergo testing	"...But some husbands say it's not necessary we have never heard of this test and I don't want my wife to undergo this test"
	Lack of conducive environment while women were offered counselling	Shy among women while listening about self-sampling	"To say about reaction of women while explaining about HPV self-sampling, I found many feel shy at first and some gets scared..."
		Presence of men around while counselling is offered	"But men are present on the spot, I myself feel uncomfortable to talk about HPV self-sampling"
	Concerns related to test and associated procedure	Doubt about test effectiveness in detecting HPV infection	"Women doubt on effectiveness of the test as it is done at home. Some says we will go to doctors directly."
		Getting anxious with test procedure and test results	"First of all they are scared after seeing the brush which is present in the kits, they think it may hurt them" "Most of the women used to refuse due to fear and anxiety of the test and its report"
		Fear of getting infected in women while providing sample for test	"Women hesitate to give the samples stating while giving samples they might get infected"
	Programmatic-level barriers under 'Implementation' of RE-AIM framework	Demanding more time and efforts from healthcare worker in the community	Need for multiple home visits
Increased workload to healthcare workers			"Getting HPV kits from health facilities and taking back to the health facilities after collection is tedious job for us"
Time consuming for healthcare workers			"The biggest problem for me in this HPV sample collection is to fill the forms - it takes a lot of time and some questions are very difficult for us to questions, because it matters about privacy of women and some do not tend to answer those"
Constraints related to travel to houses of participants in the field		Logistic challenges related to travel	"After collection of sample from village have to take it to UPHC. The main difficulties we face is taxi fare for travelling as I have to go to UPHC from distance of 1-2 hours and very limited taxi from my locality as it is in remote area"
		Hard-to-reach terrains	"To go house to house visit personally is very difficult due to difficult terrain."
Lesser reward to healthcare worker for performing additional tasks		Lesser monetary support for healthcare workers to perform this additional responsibility	"We are financially not stable as we work with honorarium based. During Sample collection we spend lot of money in taxi fare as..."
Lack of compliance to testing by the participants		Lack of motivation from participants and poor compliance of testing methods by women	"...but even after lot of explanation some of them do not give their sample properly and they spoil the HPV kits and have to provide another sample kits"

Table 3. Participant-level and programmatic-level barriers for home-based HPV screening programme at community level in Sikkim under 'Reach', 'Implementation' category of RE-AIM framework.

influence acceptance rates. Previous studies have emphasized the importance of relevant training and refresher courses for ASHA workers^{19–21}. In our study, we empowered ASHA workers with theoretical knowledge of cervical cancer screening and dissemination skills using IEC pamphlets and videos¹¹. Recent advancements like E-health and m-health are a few innovations that discuss the role of technological upheaval in providing consistent messages and the impact that creates enhanced community engagement and awareness^{22–24}. At the program level, the facilitation of free HPV-DNA tests and established safety assurances underscore the pivotal role of policy interventions in shaping health-seeking behaviors¹¹. Furthermore, we trained ASHA workers to counsel women on HPV infection, testing, self-sample collection, and cervical cancer prevention. They followed a "do not overshare and scare" strategy while being empathetic and avoiding judgmental words or tones regarding family/sexual life. They were trained to focus on facts, avoid using the word "cancer" during screening explanations, and utilize IEC videos/pamphlets. Additionally, they clarified doubts, shared experiences, and referred women to PHCs for triaging tests and management, reassuring them that HPV positivity doesn't necessarily mean cancer¹¹. For women who tested positive, ASHA workers offered facilitated referral to PHCs for triaging tests and further management. These findings emphasize the importance of addressing structural barriers and leveraging programmatic support to optimize screening uptake. The ASHA workers' counselling skills in motivating women to take up screening using the self-sample collection and the availability of assured support by ASHA workers for the triaging visit in case of screen-test positivity are other key drivers in promoting the self-sample collection. Researchers have tried different training methods to improve the ASHA workers' knowledge, skill sets, and communication skills, which help them perform better in national health-related programs^{24–26}. The implementation of HPV self-sampling programs relies heavily on community health workers, who serve as vital links between healthcare systems and underserved populations. This is evident in various studies that highlight the effectiveness of such workers in enhancing screening rates^{14,27}. The Jujuy Demonstration Project's implementation process, as evaluated by Arrossi et al., further illustrates the necessity of adapting strategies to local contexts, which resonates with our findings on the need for tailored approaches in Sikkim to enhance the effectiveness of HPV self-sampling²⁸.

Theme 2, underscores the instrumental role played by ASHA workers in the successful implementation of HPV-DNA testing. Their multifaceted contributions, ranging from disseminating information at individual and community levels to fostering community liaisons, are instrumental in bridging the gap between healthcare services and marginalized communities. Similar studies in Argentina highlight the pivotal role of community health workers (CHWs) in the adoption and implementation of HPV self-collection, demonstrating their effectiveness in promoting awareness and facilitating access to screening services^{29,30}. Our study underscores the importance of tailored dissemination strategies and community engagement initiatives in fostering trust and acceptance of screening programs by training the ASHA workers with the confidence and empowerment needed to sensitize the community about HPV-DNA testing using self-sample collection. They gained a better understanding of the burden of cervical cancer in India and the importance of screening to prevent loss of life. They also learned about the benefit of screening with HPV-DNA testing and the availability of the test through the government program for the first time in the country. This information helped them realize the potential of their role in the screening program. Furthermore, the state government of Sikkim has been vaccinating eligible girls with the HPV vaccine since 2016 as part of routine immunization³¹. ASHA workers have motivated and counselled parents to vaccinate their girl children in the vaccination program. The HPV vaccination movement has helped ASHA workers understand HPV infection and the prevention of girls from acquiring cervical cancer. They also used the example of the HPV vaccination to explain HPV-DNA testing to women, which helped women relate to the concept. Moreover, the motivational factors highlighted by ASHA workers, including painless sample collection and the availability of free testing and treatment, resonate with previous literature emphasizing the importance of addressing perceived barriers to screening uptake. A mixed-methods study in a middle-income country found that women showed a strong preference for self-collection due to its convenience and perceived privacy, further supporting our findings³². The continuum of care provided by ASHA workers, including facilitating referrals and follow-up care, further underscores their integral role in promoting holistic healthcare services.

Theme 3, at last, highlights the multifaceted barriers encountered in the implementation of HPV-DNA testing. From the participants' perspective, pervasive misconceptions, lack of awareness, fear of being diagnosed with cancer, and societal stigmas surrounding cervical cancer screening pose significant challenges. Addressing these barriers requires multifaceted interventions aimed at dispelling myths and fostering a supportive socio-cultural environment conducive to screening uptake. Similarly, ASHA workers followed the "Do not over share and scare" strategy for counselling women from rural areas of Sikkim who expressed concerns about the difficulties of home-based sample collection due to the vast area they cover. ASHA workers proposed creating awareness about HPV testing during home visits and sharing IEC videos with women on their WhatsApp numbers. Later, they invited women to attend scheduled NCD screening camps in the village at regular intervals, where women could undergo screening for other NCDs and provide self-collected samples for HPV testing. ASHA workers face logistical and systemic barriers. Additionally, ASHA workers faced difficulties due to the lack of public transport in Sikkim, relying on affordable private transportation and hired taxis, which were exorbitantly expensive. Inadequate monetary support impedes the seamless execution of screening programs^{21,33–36}. Consistent with our findings, also reported that stigma and misinformation pose significant barriers to the uptake of self-sampling in various cultural contexts, further emphasizing the need for targeted education and awareness campaigns³⁷. Addressing these barriers necessitates a concerted effort from policymakers and healthcare stakeholders to bolster infrastructure and support systems at the grassroots level.

Strengths and limitations of the study

This pioneering study in India integrates HPV-DNA testing into the National Program for preventing Non-Communicable Diseases (NCDs) by leveraging the existing healthcare system and ASHA workers. The study provides valuable insights into facilitators and barriers to implementing HPV-DNA testing in real-world settings. However, it has limitations, including being confined to a specific geographical area, which may limit generalizability to other regions and populations. Additionally, the qualitative nature of the study precludes establishing causal relationships between identified factors and screening uptake. In our study, we acknowledge that the measurement of effectiveness was primarily qualitative, focusing on ASHA workers' perspectives rather than quantitative outcomes. While qualitative insights are valuable for understanding the context and acceptability of HPV self-sampling, they do not provide the same rigorous assessment of effectiveness as quantitative methodologies, such as those employed in the study by Arrossi et al., which demonstrated the impact of self-collection on screening uptake³⁸.

Conclusion

In conclusion, the findings of this study underscore the complex interplay of facilitators and barriers influencing the implementation of HPV-DNA testing by ASHA workers in Sikkim, India. Moving forward, targeted interventions aimed at addressing structural barriers, enhancing community engagement, and bolstering support systems are imperative to optimize the effectiveness and reach of cervical cancer screening programs in resource-constrained settings.

Data availability

The datasets used and/or analysed during the current study is available from the corresponding author on reasonable request.

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Author contributions

Authors Kavitha Dhanasekaran and Roopa Hariprasad, with credentials in MD Gynecology and MPH, have been working as cervical cancer prevention researchers for fifteen years. Priyanka Ravi is a Public Health Dentist currently pursuing a PhD in health behavior and health promotion with a research focus on cancer prevention. Harki Tamang served as the study coordinator. All researchers involved in data collection were female. Manikandan Srinivasan is a public health researcher. All researchers participated in manuscript writing, and Kavitha Dhanasekaran, Roopa Hariprasad, Manikandan Srinivasan, Sangeeta Pradhan, and Arpana Sharma were also involved in data analysis.

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Declarations

Ethics approval and consent to participate

This study was approved and monitored by the NICPR Institutional Ethics Committee(NICPR IEC)(Study No: NICPR/IEC/2019/008). Trial registration was completed under CTRI/2020/11/029419. All the consents were taken from the participants.

Consent for publication

All authors have read and approved the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

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