

Beyond Preference: Understanding Acceptability of Urine-Based HPV Screening in Rural Eswatini

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Abstract

Background

Acceptability is a critical factor in access to healthcare and shaping individuals' engagement with preventive services and interventions. However, it is often reduced to individual willingness or intention to participate. This study explores the acceptability of urine-based cervical cancer screening in a rural healthcare setting in Eswatini, focusing on both women's and healthcare providers' perspectives.

Methods

A mixed-methods approach was used, including semi-structured interviews with women, focus group discussions with health workers, teachers and outreach staff, and a survey among women and girls attending a rural clinic. This approach offered a nuanced understanding of how cultural norms, individual attitudes, and structural barriers shaped perceptions of HPV screening.

Results

There was very high acceptability of urine-based screening, with women consistently valuing its privacy, simplicity and non-invasiveness. At the same time stigma, misinformation, and local understandings of cervical cancer screening shaped behaviours, potentially limiting demand or fuelling fears. These factors did not necessarily prevent initial acceptance but may influence long-term adherence and community uptake. Healthcare providers play a pivotal role in building trust and encouraging participation through their engagement and sense of ownership.

Conclusion

Urine-based HPV screening was highly acceptable and perceived as a feasible alternative to conventional more invasive methods in this rural Eswatini setting. Understanding social and systemic factors is crucial for developing culturally responsive and sustainable screening programs that reduce barriers and support equitable long-term participation in cervical cancer screening.

1. Introduction

The global burden of cervical cancer reflects stark inequalities in access to preventive care, with the highest mortality rates found in low-income and rural areas (Mantula et al., 2024; WHO, 2021). In sub-Saharan Africa, cervical cancer remains one of the leading causes of cancer-related death among women, despite being largely preventable through early detection and treatment (Sung et al., 2021; Arage et al., 2025). Eswatini has one of the highest cervical cancer burdens globally, with an age-standardized incidence rate of 37.6 and mortality rate of 26.9 per 100,000 women per year (2022), approximately three times the global average (Sung et al., 2026; Bruni et al., 2023).

The prevalence of high-risk HPV (hr-HPV) among women of reproductive age in Eswatini has been estimated at around 46%, with substantially higher levels observed among women living with HIV (Bruni et al., 2023). Recent screening data from rural Eswatini reported high hr-HPV positivity, particularly among younger women and those living with HIV, while population-based analyses highlight poor cervical cancer survival outcomes, reinforcing the need to strengthen early detection and treatment pathways (Msibi et al., 2026).

HIV-positive women are approximately six times more likely to develop cervical cancer compared with their HIV-negative counterparts (WHO, 2023). Despite national guidelines¹ and WHO-aligned screening and vaccination strategies (WHO, 2024), uptake remains limited in rural Eswatini, where structural, infrastructural, sociocultural, and economic barriers continue to restrict access to prevention services (Bruni et al., 2023; Ministry of Health of Eswatini, 2023; Khumalo et al., 2023).

In this context, acceptability has emerged as a key determinant of access, shaped not only by individual preferences but also by the social meanings, taboos, and experiences surrounding reproductive health.

Drawing on a mixed-methods study conducted in 2024 at a rural clinic in eastern Eswatini, this paper explores the acceptability of urine-based HPV screening and examines how women's preferences are shaped by broader social and structural factors.

Although acceptability is increasingly recognised as essential for the success health interventions, it lacks a universally accepted definition and standardised measures. A recent framework by Casale et al. (2023) analyses acceptability among African youth through nine dimensions extending the TFA - Theoretical Framework of Acceptability (Sekhon et al., 2017) by incorporating additional aspects like perceived positive/negative effects, relevance, and social acceptability. Unlike earlier models, it highlights that acceptability is dynamic, shaped by personal experience and community norms, and influences engagement both directly and through intention.

Building on this literature, we distinguish the acceptability of a screening method from participation in screening, and the acceptability of a prevention tool from understanding of the disease itself. Rather than reflecting simple adherence to medical recommendations, acceptability encompasses interconnected levels of engagement. Existing studies largely conceptualize acceptability as an individual preference. We argue instead that it is a socially negotiated process shaped by emotions, moral norms, trust in the healthcare system, and structural constraints. Differences in health literacy and motivation may also generate divergent perceptions of acceptability between users and health professionals (Dillip et al., 2012).

Against this theoretical background, we examine the case of Eswatini by analysing the barriers, facilitators, and mechanisms shaping engagement with screening at both the individual and community levels. Attention is given to the perspectives of women, adolescent girls, and community stakeholders, whose experiences provide insight into the social dynamics and attitudes that influence screening participation. Narratives and personal accounts are essential for understanding how individuals make

sense of medical interventions and healthcare experiences (Palla et al., 2024). Exploring lived experiences therefore allows us to move beyond the biomedical discourse on illness and examine local understandings of risk, disease, and prevention. As Panter-Brick (2014) argues, epidemiological constructions of risk often differ substantially from how risk is experienced and interpreted in everyday life. Likewise, idioms of fatalism may shape decision-making around cancer prevention and contribute to reluctance to participate in screening in resource-constrained settings (Drew and Schoenberg, 2011). Within this interplay between risk perception, cultural meanings, and representations of prevention, qualitative and ethnographic methods provide a valuable approach into local beliefs and practices shaping engagement with cervical cancer screening (Chávez et al., 2001).

This perspective extends current approaches by viewing screening not simply as an individual decision but as a process embedded in social relationships and health system structures.

2. Research context and methods

2.1 Study setting and background

The study was carried out in 2024 in the Lubombo region of Eastern Eswatini, a rural and underserved area characterized by limited access to health services and high levels of poverty (UNFPA, 2023). Data were collected at St. Philip's Mission, managed by the Missionary Sisters of the Sacred Heart of Jesus. The clinic currently provides primary healthcare services - including outpatient care, maternal and child health, HIV and TB management, psychosocial support, early childhood and youth education, and community outreach. Each year, it serves approximately 15,000 people, including more than 4,500 adolescent girls and women.

This research was embedded within a broader international collaborative initiative between the ANONIMIZED UNIVERSITY, Italy, the Cabrini Ministries Eswatini and Missionary Sisters of the Sacred Heart of Jesus, in partnership with the ANONIMIZED MINISTRY, and with the support of Cabrini Health Australia. Within this framework, the study was designed to evaluate the feasibility, cost-effectiveness, and acceptability of urine-based HPV testing as a non-invasive screening approach tailored to low-resource settings with a high burden of HIV (UNAIDS, 2024).

2.2 Study design and objectives

This study employed a mixed-methods design, combining ten semi-structured interviews with women accessing the clinic, three focus group discussions with key community informants, including healthcare providers, educators, and family services workers and a structured survey administered to 198 clinic clients. Combining qualitative and quantitative methods allowed us to explore women's screening preferences alongside social and structural factors shaping them

The interviews, discussions and survey explored perceptions of urine-based cervical cancer screening within the broader context of barriers to reproductive healthcare. Specific objectives included: (1) explore

women's preferences and attitudes toward different screening modalities; (2) identify contextual barriers and facilitators to screening uptake, by examining how social norms, power relations, and gendered expectations affect access to reproductive health services; and (3) understand the acceptability of the pilot screening intervention among clinic staff and community stakeholders.

2.3 Sampling and recruitment

Different sampling strategies were employed to reflect the different roles and experiences of participants. Women and adolescent girls aged 12 to 49 were recruited opportunistically while attending the clinic for routine care, allowing the study to explore both anticipated and experienced acceptability, as some participants had already undergone screening in their life, while others had not. The survey included a visual guide illustrating three different screening modalities: the invasive clinician-collected Pap smears and VIA and a non-invasive urine-based testing, to support participants' understanding of each option. This was followed by a ranking exercise, where respondents were asked to order their preferences. Visual aids were used to facilitate comprehension among participants with different levels of health literacy, following approaches adopted in similar studies (Kohler et al., 2019).

While vaginal self-sampling² for HPV testing is widely discussed in the literature as an acceptable and promising approach (Kamath & Withers, 2022, Oketch et al., 2019, Olumodeji et al., 2024), it was not included in the ranking exercise in this study because it was not available at the clinic during the study period. Including it hypothetically may have introduced confusion or unrealistic expectations among participants.

A purposive sample of key informants, such as healthcare workers, teachers, and outreach staff, was recruited based on their involvement in community health and service delivery. Sampling continued until thematic sufficiency was reached³.

2.4 Data collection and analysis

Data collection combined multiple methods to capture the complexity of perspectives. Semi-structured interviews with women attending the clinic, and three focus group discussions with clinic staff, educators and outreach workers explored perceptions, barriers, and facilitators related to cervical cancer screening. To partially address the limitations of clinic-based recruitment, participatory tools and techniques were embedded within interviews and focus group discussions. This approach also provided insight into the experiences of women who may not routinely access healthcare services, offering a broader understanding of barriers to screening.

In parallel, a survey was administered to 198 women by a trained nurse, using visual aids to enhance comprehension across different literacy levels. A cultural mediator fluent in SiSwati and English supported interviews and focus groups to facilitate communication and ensure cultural sensitivity. All sessions were audio-recorded with participants' consent and subsequently transcribed verbatim.

Qualitative data were analysed through thematic analysis (Naeem et al., 2023). The codebook was developed inductively from interview and focus group transcripts, allowing themes to emerge from participants' accounts without predefined categories. Coding was conducted manually by assigning concise codes to segments of transcripts capturing their core meanings, which were then grouped into broader thematic categories to identify recurring patterns across the data. Analytic decisions were discussed collaboratively within the research team to enhance interpretive coherence and methodological rigor.

Survey data were collected using a REDCap software and a descriptive analysis was performed to identify the characteristics of the 198 women. Descriptive statistics were calculated based on the available data. The number of observations varied across variables because of missing responses, occasional data entry errors, limited familiarity with questionnaires, and intermittent internet connectivity affecting REDCap in this rural setting. For qualitative variables, absolute and percentage frequencies were reported, while for quantitative ones, the median and interquartile range were presented. Statistical analyses were performed using Stata version 17.0 (StataCorp, College Station, TX, USA).

3. Results

Results are presented across four themes that emerged from the qualitative analysis and are complemented by survey findings where relevant. Together, they illustrate the individual, social, and structural factors shaping perceptions of urine-based HPV screening in this setting.

3.1 Comfort as a gateway: understanding and trust in urine-based screening

The majority of interviewees preferred urine-based testing over traditional clinician-collected cervical samples (pap-smear and VIA) describing it as simpler, less invasive and more private.

Survey findings mirrored the qualitative data, with 99% of respondents preferring urine collection to more invasive alternatives. However, this sense of ease and relief was tempered by uncertainty: with a few participants expressing concerns about the reliability of a less invasive method. As one woman expressed, *"I think they (VIA) may help me, maybe they can find another...maybe any signs of sickness I may have"* (SSI 4). Both women and community stakeholders described community health volunteers and local healthcare workers as key sources of information and reassurance. Their ability to communicate using familiar language and culturally meaningful examples was perceived as facilitating understanding of the screening programme and addressing concerns about the new testing method.

3.2 Seen, judged, avoided: the moral and social meanings of screening

Acceptability was shaped not only by the characteristics of the screening method itself, but also by the social meanings attached to cervical cancer prevention. Participants' accounts showed that decisions

about screening were negotiated within everyday relationships, moral expectations, and community norms, where concerns about reputation and social judgment often outweighed purely biomedical considerations.

For many participants, screening was not just a health check; it carried implications for one's sexual behaviour and reputation. *"It is supposed you're sleeping around. Or that you had sexual intercourse at a young age. So, some people are afraid to be tested"* (FGD Healthcare staff).

In small rural communities, where relationships between clinic staff and patients often extend beyond the clinic walls, simply being seen accessing screening could feel exposed. *"Some are scared that other people would gossip, gossip, talk things about. After being diagnosed, some...they commit suicide"* (SSI 6). One young woman noted: *"She just fears...that she will find someone from the community and that might judge her"* (SSI 8).

For some, screening involves navigating cultural or religious teachings that emphasize modesty, chastity, or spiritual forms of healing. *"It's a taboo for women to open their legs...we are told to close your legs and keep your private parts private"* (FGD Healthcare).

Others described traditional or religious practices as alternative pathways to health, sometimes replacing biomedical services. *"She believes she has to pray to be ok. Even if she's pregnant, she doesn't go to antenatal care"* (FGD Family Services); *"Prevention isn't really Catholic"* (FGD Healthcare staff).

Many women also described other ways of health practices that felt more aligned with their beliefs or lifestyles, including herbal detoxes, vaginal steaming, or products marketed to "clean the womb." One participant shared: *"She drinks green tea, she jogs, she goes to the gym...she says, 'I'm good, I don't need those kinds of services'"* (FGD Family Services). Confidentiality also mattered deeply, especially for women under 25. The fear that private health information might reach boyfriends, relatives or the broader community discouraged many from visiting the clinic. *"They fear the clinic might contact their boyfriend, or even his wife...they fear this obvious chain"* (FGD Family Services). When healthcare providers belong to the same community as their patients, concerns about privacy and moral judgment may discourage women from seeking care.

3.3 The hidden weight of participation: fear, doubt, and the everyday costs of prevention

Participants described a range of practical barriers that shaped women's participation in screening beyond perceptions of the test itself. Financial costs, transport, time, childcare responsibilities often played determined whether screening was realistically accessible. As one participant explained, *"You can like the test, but if you have no way to reach the clinic, it's the same as not having the test"* (SSI 4). Another noted: *"They cannot afford the transport or the treatment, so they just stay at home"* (FGD Healthcare Staff). Structural weaknesses within the health system further discouraged participation.

Several participants spoke of arriving at clinics only to be referred elsewhere, an option not feasible for most. *"She goes to the clinic, and after that, the nurses will just prescribe and tell her to go to a pharmacy to buy the medication"* (SSI 7). Others echoed this, adding that *"Not all of the clinics I go to have the medication for the STI that I want to treat"* (FGD Healthcare Staff).

Experiences within healthcare settings could be just as influential as physical or financial barriers. While the study clinic was often described as welcoming, women reported less positive experiences elsewhere. *"There are nurses who are harsh to clients. They just tell you to do the cancer screening without any explanation or kindness"* (SSI 9). Others described struggling to open up: *"When you visit a facility and find a person who's moody, it's hard to open up to that person"* (SSI 2).

Emotional barriers were equally prominent. Fear of diagnosis, anticipated stigma, and uncertainty often outweighed the perceived benefits of early detection. *"After your diagnosis...it's like you're gonna be judged...you have that fear that you're gonna die"* (SSI 9), while another participant asked, *"For now, I'm still healthy...So, what's the point?"* (FGD Family Services).

Several participants also expressed greater fear of HPV than HIV, reflecting the relative unfamiliarity of HPV and persistent confusion between the two infections: *"We are really, really scared of cervical cancer compared to HIV...with HIV, we are used to it. But HPV...it's still a new thing"* (FGD Healthcare staff).

3.4 More than painless: trust, truth, and system responsiveness

Although urine-based screening was widely perceived as easy and painless, participants' confidence often extended beyond the test itself to the healthcare system responsible for delivering follow-up care. Many viewed screening as an opportunity for early detection. *"The most helpful or useful is when you screen early, because you can treat early"* (SSI10). However, this perceived benefit was deeply influenced by the environment of the study facility, where respectful staff interactions and clear communication strengthened confidence in the test *"They're welcoming and even the type, I think the way they get [people] really pulls"* (SSI 1). When nurses were perceived as attentive and capable, trust followed: *"Nurses are qualified and if there is a problem, they will transfer her to another facility"* (SSI 2), while counselling was considered essential to making women feel comfortable (SSI 9). Past experiences with speculum-based screening, also shaped women's views. Misinformation, fear, and memories of pain remained common *"They told her about the speculum that they'll insert"* (SSI 5), one participant recalled. Another added, *"Most women... they are scared of the specula"* (SSI10).

Participants also questioned whether the health system could provide appropriate follow-up after a positive result. As one healthcare worker explained: *"I'm supposed to - there's something that I give - is supposed to go to do a LEEP? Who's gonna do me a LEEP? We don't have enough doctors here, so I will stay on that pendant knowing that I have growing something in my cervix, but there's no one who's gonna help me on that. That is very painful"* (FGD Healthcare Staff).

3.5 Screening preferences and everyday constraints: insights from the survey

Alongside the qualitative findings, the survey provided complementary information on women's screening preferences, access to healthcare and knowledge of cervical cancer prevention. A total of 198 women and adolescent girls (15–49 years; median age 30.5 years, IQR 23–38, see Table 1) completed the survey between October 2024 and May 2025.

Table 1 – Socio-demographic characteristics of the sample

Characteristic	N (%)
Age group (years)	
15-19	25 (12.63)
20-24	32 (16.16)
25-29	33 (16.67)
30-34	35 (17.68)
35-39	31 (15.66)
40-44	27 (13.64)
45-49	15 (7.58)
Education level	
None	14 (7.07)
Lower primary	14 (7.07)
Higher primary	20 (10.10)
Secondary	59 (29.80)
High school	79 (39.90)
Tertiary	12 (6.06)
Marital status	
Single / not married	117 (59.09)
Married (monogamous)	77 (38.89)
Married (polygamous)	2 (1.01)
Previously married	2 (1.01)
Previous pregnancy	
Yes	163 (82.32)
No	30 (15.15)
Missing	5 (2.53)
Median number of pregnancies (IQR)	2 (1.0-3.0)
Known HIV status	
Positive	61 (30.81)

Negative	123 (62.12)
Missing	14 (7.07)

Table 2 - Survey findings related to urine-based HPV screening

Variable	N (%)
Preferred screening method	
Urine HPV test (first choice)	196 (99.0)
VIA (first choice)	2 (1.0)
Pap smear (first choice)	0 (0.0)
Type of cervical cancer screening	
New screening	110 (55.56)
Out-of-schedule re-screening	47 (23.74)
Re-screening	35 (17.68)
Post-treatment follow-up	1 (0.51)
Missing	5 (2.53)
Access to the clinic	
Shared taxi	77 (38.89)
Bus	53 (26.77)
Foot	39 (19.70)
Car	29 (14.65)
Source of first cervical cancer information	
Today at the clinic	160 (80.81)
Community outreach activities	7 (3.54)
Community outreach + clinic	19 (9.60)
Other sources (School-radio-home)	7 (3.54)
Missing	5 (2.53)

Nearly all respondents (99%, see Table 2) preferred urine-based HPV testing over Pap smear and VIA. However, open-ended responses suggested that this preference reflected more than comfort alone.

While 37,1% of women who provided an open-ended response described the urine test as *easy, fast, not fearful, comfortable, does not compromise privacy or painless*, a smaller group (5.7%) emphasised that convenience was important only if the test was perceived as accurate, indicating that trust in the method remained essential. Only respondents (2.3%) stated that, given the availability of an alternative approach, they would prefer not to repeat screening tests they had previously undergone.

The responses also highlighted the influence of structural barriers. Most participants were unemployed (73.1%), and shared taxis (39.0%) and buses (26.8%) were the most common means of transportation to the clinic, suggesting that travel costs may represent an additional obstacle in settings of economic insecurity. Nearly all women (99.0%) attended the clinic alone, suggesting a recurrent pattern of solitary health-seeking journeys. Furthermore, the limited availability of Pap smears in facilities accessible to rural populations was perceived as a structural constraint, underscoring how urine-based testing could increase uptake in underserved communities. Health information was acquired predominantly at healthcare facilities. Among the 193 respondents, 160 (82.9%) reported first learning about cervical cancer during their clinic visit, whereas community outreach played only a secondary role, highlighting missed opportunities for earlier health education. This pattern was consistent across all age groups, including adolescents aged 15–19 years, 72.0% of whom first learned about cervical cancer during their clinic visit (Fig. 1B).

First-time screening was the most common reason for attendance overall (55.6%), followed by out-of-schedule re-screening (23.7%) and routine re-screening (17.7%), whereas post-treatment follow-up was uncommon (0.5%). As expected, all participants aged 15–19 years were undergoing screening for the first time, as this age group falls below the eligibility threshold of the national programme. Among older age groups, first-time screening became less frequent, while out-of-schedule re-screening increased with age (Fig. 1A).

Among respondents reporting their HIV status, 61 of 184 (33.2%) were living with HIV, and most were receiving antiretroviral therapy. Approximately 82% of participants with complete information first learned about cervical cancer at the clinic, with similar proportions among HIV-positive and HIV-negative women. Screening attendance patterns differed between the two groups: first-time screening predominated among HIV-negative participants, whereas HIV-positive women were more evenly distributed between first-time screening and out-of-schedule re-screening.

Overall, valid urine HPV test results were obtained for 194 participants (98%), of whom 60 (30.9%) tested positive.

4. Discussion

Our findings suggest that the acceptability of urine-based HPV screening cannot be reduced to women's preference for a less invasive test. While urine collection was overwhelmingly preferred, participants' accounts indicate that acceptability was shaped not only by the characteristics of the screening method itself, but also by trust in healthcare professionals, social and cultural norms, structural barriers, and

confidence in the health system. Consistent with previous studies, urine-based screening was widely perceived as easier, more comfortable and less invasive (Kaoma et al., 2023). However, this preference did not automatically translate into confidence in the test. Several participants questioned whether a simpler procedure could be equally reliable, suggesting that comfort alone does not necessarily translate into trust. Instead, confidence was fostered through clear communication and trusted relationships with healthcare professionals and community health workers, who helped translate biomedical information into familiar and meaningful language. These results align with previous evidence highlighting the important role of intermediaries in raising awareness and supporting informed decision-making, particularly when they share language and experiences with the communities they serve (Choi et al., 2020; Kapambwe et al., 2013; Bansil et al., 2014). Participants suggested that invasiveness is not only physical. Privacy, dignity, and fear of judgment by healthcare providers or community members also shaped women's experiences of screening.

This broader understanding of invasiveness helps explain why decisions about screening were closely intertwined with the social meanings attached to sexuality, morality, and reproductive health. Similar patterns have been reported in other settings, where cervical cancer screening is associated with stigma and assumptions about sexual transgression, making it difficult for women to seek care without risking moral judgement or gossip (Wood et al., 1997; Dillip et al., 2012; Ginjupalli et al., 2022). These dynamics reflect broader sociocultural norms surrounding purity, modesty, and appropriate female behaviour, which continue to shape both perceptions of and engagement with preventive healthcare (Henderson et al., 2022). In closely connected rural communities, concerns about confidentiality further reinforced these dynamics. When relationships between healthcare providers and patients extended beyond the clinic, simply attending screening could expose women to unwanted attention or speculation. Similar concerns have been described in Mozambique and South Africa, where breaches of confidentiality discouraged women from accessing services (Audet et al., 2012; Wood et al., 1997). In this context, avoidance of screening often reflected the potential social consequences of seeking reproductive healthcare rather than limited awareness (Wood et al., 1997; Audet et al., 2012; Ginjupalli et al., 2022; Khumalo et al., 2023).

Beliefs about health, illness, and prevention influenced screening decisions. As described in South Africa, cervical cancer screening carries symbolic meanings related to cleanliness, morality, and sexual respectability (Wood et al., 1997). Likewise, spiritual beliefs sometimes privileged prayer or divine protection over biomedical prevention, reinforcing hesitation towards screening (Audet et al., 2012; Henderson et al., 2022). Traditional practices, including herbal remedies, vaginal steaming, and products promoted to “clean the womb”, reflected alternative understandings of health and prevention (Wood et al., 1997; Khumalo et al., 2023). Rather than dismissing these practices as misconceptions, these data suggest that biomedical messages are less likely to resonate when they fail to engage with locally embedded concepts of health and wellbeing (Wood et al., 1997; Khumalo et al., 2023). Women's participation was also shaped by financial costs, transport, time, highlighting the everyday trade-offs required to seek preventive care (White et al., 2012; Khumalo et al., 2023; Adewumi et al., 2019). Interestingly, distance itself could become a strategy for preserving privacy, with some women

deliberately travelling to more distant clinics to avoid recognition by local healthcare workers (Malambo et al., 2021). Structural barriers, including referral difficulties, medication stock-outs, long waiting times, and unclear procedures, further undermined confidence in the health system, reinforcing perceptions of healthcare services as unreliable (Bansil et al., 2014; Audet et al., 2012; Mantula et al., 2024; Khumalo et al., 2023).

The quality of healthcare interactions also emerged as an important component of acceptability. Women valued respectful communication, empathy, and feeling listened to, while poor communication and judgemental attitudes discouraged future engagement (Audet et al., 2012; Drew and Schoenberg, 2011; Choi et al., 2020; Ginjupalli et al., 2022). Emotional barriers, including fear of diagnosis, anticipated stigma, and uncertainty, often outweighed the perceived benefits of early detection, echoing evidence from Zambia, Kenya, and Eswatini (White et al., 2012; Ginjupalli et al., 2022; Khumalo et al., 2023; Adewumi et al., 2019). Improving participation requires not only a less invasive method, but also trusted communication, culturally appropriate information, and the active engagement of health workers, in encouraging informed participation in screening programmes (Choi et al., 2020; Kapambwe et al., 2013; Bansil et al., 2014). In a study conducted in Northwest Ethiopia, HIV-positive women who had received information about cervical cancer from health professionals were significantly more likely to have undergone screening (Nega et al., 2018), highlighting the value of targeted education.

Likewise, women in Botswana viewed self-sampling as more convenient but often preferred clinician-based screening because of greater trust in providers and lower confidence in self-collection (Kohler et al., 2019)⁴. Interestingly, our findings suggest that knowledge alone did not significantly shape preferences: trust and perceived self-efficacy are equally important.

The quantitative data reinforce this interpretation. Across both groups, approximately 80% of participants reported first learning about cervical cancer during their clinic visit, highlighting screening encounters as important opportunities for health education. A similar pattern was observed among women living with HIV, despite their more frequent contact with healthcare services, suggesting that opportunities to strengthen cervical cancer education across existing care pathways remain underused. Confidence extended beyond the urine-based test itself to the broader screening pathway. Although participants consistently described urine collection as easy, painless, and acceptable, they also questioned whether the health system would be able to provide timely diagnosis, appropriate referral, and effective treatment. Respectful interactions with healthcare professionals strengthened this confidence, whereas previous negative experiences, misinformation, and uncertainty on follow-up care reduced participation (Audet et al., 2012; Kapambwe et al., 2013; Bansil et al., 2014; Choi et al., 2020; Khumalo et al., 2023).

Overall, our findings reinforce that the successful implementation of urine-based HPV screening depends on more than the introduction of a non-invasive technology. Reducing physical discomfort can improve access. However, technology alone is unlikely to sustain participation. Transparent communication, culturally responsive education, referral pathways, and responsive health services

remain essential. Rather than representing an intrinsic property of the screening test, acceptability emerges as a dynamic and context-dependent process shaped by the interaction between technology, healthcare systems, and the social realities in which screening takes place.

5. Limitations and directions for future research

This study has several limitations. First, it reflects acceptability within a single rural, mission-based clinic and may not capture the perspectives of women who consistently avoid screening because of fear, stigma, distance, or other structural barriers. Second, participants were not followed beyond the initial screening, leaving unanswered questions about adherence, continuity of care, and the longer-term impact of urine-based screening on health behaviours and outcomes. Although participatory methods allowed exploration of barriers beyond clinic attendees, women who completely disengage from healthcare services may remain underrepresented.

Third, the mission-based setting, the presence of trusted local staff, and the involvement of an external researcher may have encouraged social desirability responses.

Future research should include women who remain outside screening programmes and adopt longitudinal designs to examine continuity of care and long-term engagement. Further studies should also investigate how health literacy, gender norms, trust in healthcare providers, women's confidence in the screening pathway, and male involvement influence screening uptake and sustained participation (Oketch et al., 2019; Kohler et al., 2019; Nega et al., 2018; Maseko et al., 2024). Finally, research should move beyond acceptability as a static endpoint to examine how community engagement, political commitment, and health system readiness shape the long-term implementation and sustainability of urine-based HPV screening and cervical cancer prevention programmes.

6. Conclusions

This study shows that urine-based HPV screening was highly acceptable among women in rural Eswatini, with nearly all participants preferring it over clinician-collected methods. However, acceptability cannot be understood solely in terms of preference for a less invasive test. Rather, it emerged as a relational and context-dependent process shaped by confidence in healthcare professionals, social and cultural norms, structural barriers, and confidence in the broader healthcare system.

Our findings show that the acceptability of a screening technology should be distinguished from participation in screening programmes. Although urine-based screening was perceived as convenient and acceptable, engagement was influenced by wider social, relational, and health system factors. Acceptability emerged from the interaction between women, communities, healthcare providers, and the health system. It was not an intrinsic property of the screening technology. By foregrounding women lived experiences, this study demonstrates how qualitative research can complement epidemiological evidence by revealing the social and cultural processes that shape engagement with cervical cancer prevention. Expanding urine-based HPV screening requires more than a new diagnostic tool. Long-term

participation will depend on culturally appropriate communication, trusted healthcare providers, and reliable referral pathways.

These findings support the integration of urine-based HPV screening into cervical cancer prevention strategies in Eswatini and similar low-resource rural settings, while highlighting the importance of addressing the social and structural conditions that influence women's engagement with preventive care. Ultimately, a broader understanding of acceptability, beyond simple preference, may support the development of screening programmes that are effective, equitable, context responsive and sustainable.

Declarations

Ethical Approval Statement

This study was conducted in full compliance with ethical standards for research involving human participants. Ethical approval was obtained from the Eswatini Health & Human Research Review Board (EHRRB) - reference number EHRRB102/2021 and Ethics Committee of the University of Milan reference number 79/22 and was conducted in accordance with the Declaration of Helsinki. Written and verbal informed consent was obtained from all participants prior to data collection, with additional consent from guardians for minors. Participants were informed of their right to withdraw at any time without consequence. Data were anonymized and confidentiality was ensured throughout the research process. All data were de-identified prior to analysis, and no identifying information appears in the publication. Data were securely stored in password-protected files accessible only to the research team.

Consent for publication

Not applicable

Data availability statement

The data generated and analysed during this study are not publicly available due to ethical and privacy considerations.

The dataset contains sensitive information related to participants' health, sexual and reproductive behaviours, and personal experiences, which could pose risks to participant confidentiality if openly shared. This restriction was explicitly stated in the informed consent form, where participants were informed that their data would be used for research purposes and handled confidentially. Access to the data may be considered upon reasonable request to the corresponding author, subject to ethical approval and appropriate safeguards to protect participants' privacy.

Competing Interest

The authors declare that they have no financial, personal, or professional interests that could be perceived as influencing the work reported in this manuscript. No conflicts of interest, including financial

relationships, consultancies, institutional affiliations, or personal beliefs, have affected the objectivity, interpretation, or presentation of the data and results. This statement applies to all authors listed on the manuscript.

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Authors' contributions

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All authors read and approve the manuscript.

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Footnotes

1. For detailed information, see *Eswatini Cervical Cancer Elimination Acceleration Plan 2025–2030* (2023) provided by the Ministry of Health, Eswatini.
2. Although urine-based HPV testing is a form of self-sampling, in much of the literature the term "self-sampling" typically refers to the process by which women collect their own specimen using a swab, without clinician assistance (Oketch et al.,2019). In this study, we included urine testing as a self-collected but non-invasive method already piloted at the clinic. While it shares the characteristic of

being non-invasive with urine-based testing, self-sampling usually involves insertion and may still be perceived as physically or culturally uncomfortable by some participants.

- 3. Recruitment was supported by trusted local health female healthcare staff who helped introduce the study, answer questions, and facilitate culturally appropriate engagement. Participation was entirely voluntary and based on informed consent. For those under 18, assent was obtained in addition to legal guardian consent.
- 4. This study refers to self-collection using vaginal swabs, not urine samples. While both are considered self-sampling methods, the two differ in terms of technique, required guidance, and potential for sample quality concerns (Kohler et al., 2019).

Figures

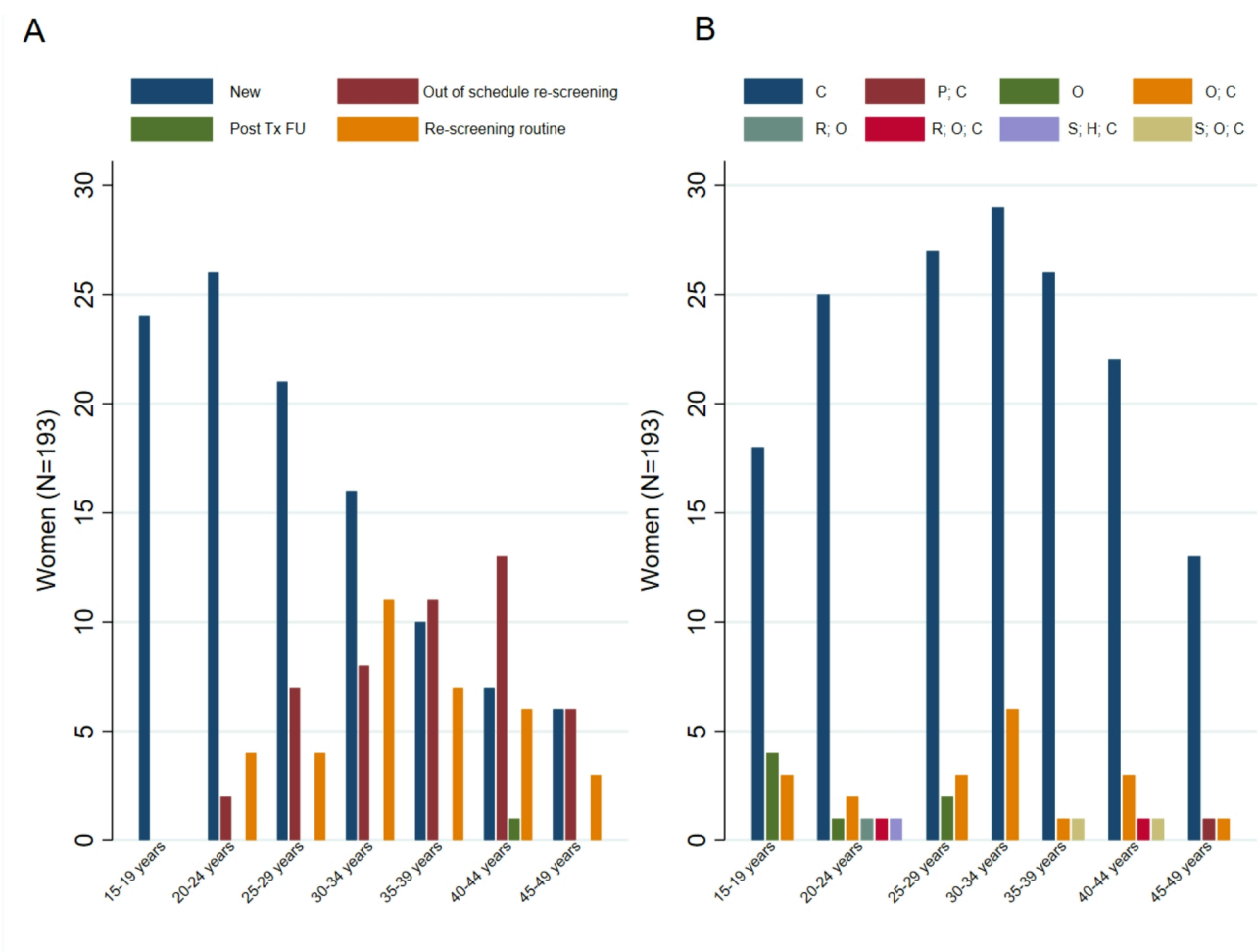


Figure 1

Figure 1A e 1B - Access to cervical cancer screening (A) and (B) Source of first cervical cancer information, by age group (N=193). In B: C=Today at the clinic; R= Listening to radio health education; O=Community outreach activities; P= Personal experience; S= Learned at school; H= Learned at home.