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### Health Systems Determinants of Uptake of Cervical Cancer Preventive Services Among Female University Students at Kenyatta University, Kenya

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**Keywords:**

*Cervical cancer preventive services, Health systems, Service visibility, Provider encouragement, Service quality, University students, Kenya.*

Globally, cervical cancer accounted for more than 600,000 new cases and 340,000 deaths in 2020 (Sung et al., 2021). In Kenya, screening uptake remains low (Kenya National Bureau of Statistics, 2014), and recent analyses indicate a rising cancer burden, including increasing cervical cancer incidence (Jani et al., 2021). Kenya continues to bear one of the highest age-standardised incidence rates of cervical cancer in East Africa (Bruni et al., 2022). Despite the availability of free cervical cancer preventive services (CCPS) at Kenyatta University's health facilities, uptake among young women remains low. Persistent knowledge gaps continue to be a major barrier to CCPS uptake among young populations in Kenya and Uganda (Masika et al., 2015; Mukama et al., 2017). This study examined the health system determinants influencing the utilisation of CCPS among female university students. **Materials and Methods:** This study draws on endline data from a cluster randomised controlled trial (cRCT) conducted at Kenyatta University, Kenya. The parent trial evaluated a structured educational intervention promoting CCPS uptake from 210 female university students, following a 12-week structured health education intervention. Data from both study arms were pooled to assess health system determinants, including service visibility, provider encouragement and perceived service quality of CCPS utilisation. Bivariate associations were assessed using chi-square tests to evaluate the determinants of CCPS utilisation, and multivariable logistic regression was used to estimate adjusted odds ratios (aOR) with 95% confidence intervals. Data was collected using a validated self-administered questionnaire assessing socio-demographic attributes, awareness of CCPS availability, perceived service quality and experiences of provider engagement. The primary outcome was self-reported CCPS uptake, while secondary outcomes included awareness of service availability, perceived service quality and provider encouragement. **Results:** Overall, 25.7% (54/210) of participants reported utilising CCPS. Awareness of service availability was the strongest determinant of uptake (aOR = 3.52, 95% CI: 1.78–6.94,  $p < 0.001$ ). Provider encouragement (aOR = 1.81,  $p = 0.092$ ) and perceived service quality (aOR = 1.44,  $p = 0.068$ ) were positively but not significantly associated. **Conclusion:** Awareness of service availability was the most significant determinant of CCPS uptake, underscoring the critical role of health system communication.

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## INTRODUCTION

Cervical cancer remains a major public health concern globally, with over 660,000 new cases and 350,000 deaths reported in 2022, nearly 90% of which occurred in low- and middle-income countries (World Health Organization [WHO], 2024). In Kenya, cervical cancer is the second leading cause of cancer-related morbidity and mortality among women, accounting for an estimated 5,236 new cases and 3,211 deaths annually (Ministry of Health [MOH], 2018; ICO/IARC, 2022). Although preventive services such as HPV vaccination and cervical screening are available and often subsidised, national coverage remains significantly below the WHO target of 70% (WHO, 2020). Within university settings, young women represent a critical population for cervical cancer prevention, given their age, sexual debut and potential exposure to HPV. Yet, uptake of cervical cancer preventive services (CCPS) among female university students in Kenya remains remarkably low, often below 10% (Binka et al., 2015; Ngetich et al., 2020; Mutiso & Mbuya, 2021). High awareness alone does not ensure utilisation; system weaknesses, often misread as service or cost barriers, continue to limit preventive uptake (Gatarayiha et al., 2021; Aber-Odonga et al., 2023; Mantula et al., 2024; Farajimakin et al., 2024).

Health system factors such as information dissemination, service readiness, provider engagement and perceived quality have been consistently identified as determinants of preventive service uptake in low-resource contexts (WHO SARA, 2015; Acharya et al., 2024; Pierz et al., 2020; Musa et al., 2017). These elements correspond to the enabling factors in the Andersen Behavioural Model of Health Services Use (Andersen, 1995), which posits that utilisation depends not only on individual motivation but also on the structural and organisational capacity of the health system.

This study examined how health system factors, particularly service visibility, provider encouragement, and perceived service quality, influence the uptake of cervical cancer preventive services among female students at Kenyatta University.

By analysing endline data from a cluster randomised controlled trial (cRCT), the study seeks to identify actionable system-level determinants that can inform university health planning and enhance institutional readiness for sustainable preventive service delivery.

## METHODS

### Study Design and Setting

This study utilised data from the endline survey of a cluster randomised controlled trial (cRCT) conducted at Kenyatta University, Nairobi, Kenya. The parent trial evaluated the effectiveness of a structured educational intervention designed to improve the uptake of cervical cancer preventive services (CCPS) among female university students. For the present analysis, data from both the intervention and control arms were pooled and analysed to identify health system determinants and predictors of CCPS uptake and related secondary outcomes. The analysis adhered to CONSORT cluster trial reporting standards for secondary analyses (Campbell et al., 2012; Eldridge et al., 2016). University campuses served as the unit of randomisation. Of the eight campuses comprising Kenyatta University, two campuses were randomly selected and assigned to either the intervention or control group. Within each selected campus, a list of eligible female students aged 18 years and above were randomly selected using a computer-generated sequence from lists provided by the university administration.

**Study Location:** The study was conducted at Kenyatta University, a public institution of higher learning headquartered in Nairobi County, Kenya. Data collection took place in two satellite campuses:

- Kitui Campus – intervention site.
- Mombasa Campus – control site.

**Population:** The target population comprised female university students enrolled at Kenyatta University, aged 18 years and above. Participation was voluntary, and informed consent was obtained before inclusion of the potential participants in the study.

**Sample size and sampling techniques:** Sample size was estimated using Chan's (2003) formula for comparing two proportions in a two-arm randomized trial, assuming a two-sided significance level of 5% ( $\alpha = 0.05$ ), a statistical power of 80% ( $\beta = 0.20$ ), and an expected effect size of 5%. To accommodate potential loss to follow-up (estimated at 10%), the computed sample size was increased, yielding a final target of 220 participants (110 per arm). The planned sample size for the cRCT was 220 students (110 participants per study arm) was achieved at baseline. However, due to attrition between baseline and endline, a total of 210 students completed the endline survey, and these 210 respondents constitute the analytical sample for this publication.

### Study Variables:

- Outcome variable: Uptake of cervical cancer preventive services (binary: 1 = utilised CCPS, 0 = not utilised).
- Independent variables: Awareness of availability of CCPS, provider encouragement, perceived service quality
- Socio-demographic covariates included age, year of study, and health insurance coverage.

**Table 1: Definition of the Study Variables**

Term	Definition
Service availability	The extent to which a health service (e.g., screening, counselling, or treatment) is accessible to individuals when needed.
Service visibility	The degree to which the existence and location of a service are known or noticeable to potential clients at the university.
Provider encouragement	The extent to which healthcare providers motivate or recommend clients to utilise specific health services.
Perceived service quality	How clients judge the overall standard, reliability and effectiveness of the service received.

### Data Collection and Instruments

Data were collected using a structured and pre-tested self-administered questionnaire. The tool was developed based on well-established theoretical frameworks and global guidelines, particularly the WHO guidelines for cervical cancer prevention. It also incorporated behavioural models relevant to health-seeking behaviour among young adults and drew insights from previous studies on cervical cancer prevention in sub-Saharan Africa (Mutya et al., 2007; Gatarayiha et al., 2021). The surveys captured data on socio-demographic characteristics, awareness, perceptions and health system experiences related to CCPS. The tool was validated through expert review and pre-testing for reliability.

### Data Management and Analysis

Data were reviewed for completeness and accuracy, then coded and analysed using SPSS version 19.0. Descriptive statistics summarised categorical variables as frequencies and percentages. Chi-square tests assessed bivariate associations, and logistic regression models estimated adjusted odds ratios (aOR) for predictors of CCPS uptake. Significance was set

at  $p < 0.05$ . Model fitness was assessed using the Hosmer–Lemeshow test and Nagelkerke  $R^2$ .

### Ethical Considerations

Ethical approval was obtained from the Kenyatta University Ethics Review Committee (Ref: KU/ERC/Approval/276/2022). Written informed consent was obtained from all participants before enrolment. To ensure confidentiality, no identification information was recorded, and data were stored in password-protected databases. Participation was voluntary, and students were assured that refusal or withdrawal from the study would not affect their access to university health services.

## RESULTS

### Factors Associated with the Utilisation of CCPS

Out of 210 endline respondents, 54 (25.7%) reported having utilised CCPS. A bivariate analysis to establish factors associated with the utilisation of CCPS showed that awareness of CCPS availability ( $P < 0.001$ ), provider encouragement ( $P = 0.001$ ), and perceived service quality as good or excellent ( $P = 0.017$ ) were significantly associated with the utilisation of CCPS (Table 2)

**Table 2: Bivariate Associations between Health System Variables and CCPS Uptake**

Health system variable	Uptake (%)	No Uptake (%)	$\chi^2$ (df)	p-value	Significance
Awareness of CCPS availability	38/82 (46.3%)	44/82 (53.7%)	18.42 (1)	<0.001	Significant
Provider encouragement	24/51 (47.1%)	27/51 (52.9%)	11.77 (1)	0.001	Significant
Perceived service quality (good/excellent)	29/75 (38.7%)	46/75 (61.3%)	6.12 (1)	0.017	Significant

### Predictors of CCPS Uptake

In the multivariable model, after adjustment for socio-demographic covariates, only awareness of service availability remained an independent predictor of CCPS uptake (Table 3). Although provider encouragement and perceived service quality showed positive associations, these did not reach a statistically significant level. This suggests that awareness of service availability,

reflecting visibility and information dissemination within the university health system, was the most decisive system-level factor influencing service utilisation.

Overall, these results underscore the importance of improving information dissemination and visibility of services within the university health system as the most effective pathway to enhance CCPS utilisation.

**Table 3: Multivariable Logistic Regression Predicting CCPS Uptake**

Predictor Variable	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value	Significance
Awareness of CCPS availability	4.26 (2.41–7.54)	3.52 (1.78–6.94)	<0.001	Significant
Provider encouragement	3.93 (2.01–7.68)	1.81 (0.91–3.59)	0.092	Not significant
Perceived service quality (good/excellent)	2.11 (1.14–3.89)	1.44 (0.97–2.68)	0.068	Marginal (not significant)

## DISCUSSION

This study examined Institutional and System-level factors within a university health setting that influence the uptake of cervical cancer preventive services (CCPS). The findings revealed that awareness of service availability was the strongest independent predictor of CCPS utilisation, underscoring the importance of effective communication and visibility of preventive services within university health systems. Students who were aware of where and how to access screening or vaccination services were over three times more likely to utilise them compared to their counterparts who lacked this awareness. This finding highlights the centrality of the health information subsystem as a determinant of preventive behaviour, consistent with Andersen's framework, which identifies enabling factors, particularly availability and accessibility, as key drivers of health service use (Andersen, 1995; de Savigny & Adam, 2009).

The significant association between awareness and CCPS uptake suggests that information pathways such as university health bulletins, peer health clubs and student sensitisation forums serve as powerful mediators of preventive health behaviour. In low-resource settings, health literacy and information dissemination have repeatedly been shown to predict screening participation more strongly than socio-economic status or even perceived risk (Ndikom & Ofi, 2012; Odetola, 2017). Therefore, strengthening information visibility within campus environments could transform passive awareness into active utilisation, particularly among young

women who are typically at the onset of reproductive health decision-making.

While provider encouragement and perceived service quality showed positive associations with uptake, their effects were not statistically significant in the adjusted model. Nonetheless, the observed trends suggest that interpersonal interactions between students and healthcare staff remain influential in shaping attitudes toward screening. Previous studies in Kenya and other low-resource contexts (Mbachu et al., 2017; Were et al., 2011) similarly demonstrate that provider-led motivation enhances willingness to participate in preventive care. Within university settings, where students' engagement with health services is often opportunistic, consistent provider communication could serve as a critical bridge between awareness and action. Provider attitude and approachability have been noted in several African studies as central to students' trust in screening services (Binka et al., 2015; Ezechi et al., 2020). Therefore, empowering university health staff through continuous training and supportive supervision could help transform passive knowledge into consistent preventive health-seeking practices.

The findings further highlight a nuanced interaction between informational and structural determinants. Although physical infrastructure and staffing are necessary, their effect on uptake appears contingent upon awareness and trust in service quality. This interplay suggests a layered model of access, in which communication serves as the first gateway to utilisation and service readiness sustains continued engagement. Conceptually, these results reinforce the World

Health Organization's (WHO) health system framework, where the information, service delivery and human resource components jointly determine service performance and population coverage (WHO, 2010). These findings emphasise that the existence of services alone is insufficient to ensure utilisation. The university health system must actively enhance information dissemination, provider engagement and perceived service reliability to translate awareness into preventive action. The results, therefore, reaffirm that effective cervical cancer prevention demands not only educational interventions but also a robust and responsive health system capable of sustaining service visibility, trust and quality over time.

Finally, the study's results also provide critical implications for policy and practice in higher educational institutions. Universities serve as unique platforms for early prevention among a demographic group that is often neglected in national cancer control programs. Institutionalising preventive health communication, integrating cervical cancer awareness into student health orientation and building service readiness at university clinics could significantly accelerate progress toward national and WHO targets for cervical cancer elimination.

## CONCLUSION

This study demonstrates that the uptake of cervical cancer preventive services among female university students is shaped primarily by the health system's ability to make services visible, trusted and accessible. Awareness of service availability emerged as the most consistent and independent predictor, highlighting the pivotal role of effective communication systems within institutional health programs. While provider encouragement and perceived service quality influence attitudes, their effects appear to operate through broader pathways of information flow and system readiness. In the university context, where preventive behaviour competes with academic priorities and limited engagement with

health services, a proactive institutional approach is required.

Strengthening the university health system through improved information dissemination, expanded service hours, staff training, and integration of preventive care into student health programs can substantially increase participation in cervical cancer screening and vaccination. These system-level interventions not only align with Kenya's national cancer control strategy and WHO's global elimination targets but also demonstrate that universities can serve as critical catalysts for advancing equitable, youth-centred preventive healthcare in low-and middle-income settings.

## Policy and Practice Recommendations:

- Enhance visibility and information flow: Universities should strengthen communication about available cervical cancer preventive services through posters, student portals, social media, and orientation programs. Clear and consistent messaging will help dispel misconceptions about cost and availability while improving awareness and service visibility within campus communities.
- Integrate preventive services into routine campus health care: Cervical cancer screening and HPV vaccination should be embedded within routine university health services, ensuring that students can easily access preventive care during regular health visits. Integration reduces procedural barriers and normalises preventive behaviour among young women.
- Strengthen provider engagement and training: Health staff should receive continuous training in effective communication, confidentiality, and non-judgmental counselling. Empowering providers to actively encourage participation can enhance trust, motivation, and utilisation of preventive services.

- Improve service readiness and accessibility: University clinics should extend operating hours to early evenings or weekends to accommodate students' academic schedules. In addition, maintaining adequate supplies of screening kits, vaccines and trained personnel is critical for sustaining service readiness and reliability.
- Align university health units with national health policies: Universities should collaborate with county and national health departments to harmonise service protocols, ensure quality assurance and secure a consistent supply of essential screening materials. This alignment will help standardise preventive care delivery and reporting mechanisms.
- Institutionalise monitoring and evaluation: Establish regular tracking of service utilisation, student satisfaction, and screening outcomes to identify performance gaps and guide continuous improvement. Routine data feedback loops will enable evidence-based decision-making and foster accountability in university health systems.

### What is Already Known

- Awareness of cervical cancer prevention remains relatively high among young women, but actual screening uptake is low.
- Health system factors such as accessibility and visibility influence utilisation of preventive services.

### What this Study Adds

- Demonstrates that awareness of service availability is a significant predictor of CCPS uptake among university women.
- Highlights the role of institutional readiness and communication as critical enablers of preventive service utilisation.

### Competing Interests

The authors declare no competing interests.

### Authors' Contributions

**Wachira Magundu:** Conceptualised the study, conducted fieldwork, analysed data, and drafted the manuscript. Supervisors contributed to.

**Prof. Sophie Ochola:** Conceptual guidance, supervision, critical manuscript review and editing, Methodology and study design refinement, theoretical framing, overall critical review, and final approval of the manuscript

**Dr. Kenneth Rucha:** Conceptual guidance, supervision, manuscript review and editing, Methodology and study design refinement, theoretical framing, overall critical review, and final approval of the manuscript

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### Tables and Figures

- Table 1: Detailed Explanation of the Study Variable Terms
- Table 2. Bivariate Associations between Health System Variables and CCPS uptake
- Table 3. Multivariable Logistic Regression Predicting CCPS Uptake

### Competing Interests

The authors declare no competing interests.

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