

BMJ Open Factors associated with cervical cancer screening among women of reproductive age in Moshi municipality, Kilimanjaro, Tanzania: a cross-sectional study

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ABSTRACT

Objective Screening for cervical cancer has been a globally advocated preventive strategy to reduce cervical cancer morbidity and mortality. This study aimed to describe the prevalence and barriers of cervical cancer screening, and to determine factors associated with cervical cancer screening among women of reproductive age in Moshi municipality, northern Tanzania.

Design We conducted a cross-sectional study between August and September 2020.

Setting Moshi municipality, Kilimanjaro, Tanzania.

Participants Women of ages 15–49 years who live in Moshi municipality.

Results A total of 300 women participated in the study and 22.7% had ever been screened for cervical cancer. Women below the age of 30 years had 87% lower odds of screening for cervical cancer compared with those aged 30 years and above (OR 0.13; 95% CI 0.04, 0.43). Women who had never heard about cervical cancer had 94% (OR 0.06; 95% CI 0.01, 0.51) lower odds of screening compared with those who ever heard about the disease. In comparison to married women, those who identified as single had 71% lower odds of screening for cervical cancer (OR 0.29; 95% CI 0.10, 0.73). Women without formal education or with only primary-level education had 72% lower odds of screening for cervical cancer compared with those with college or university education (OR 0.28; 95% CI 0.08, 0.98). A lack of awareness on where to screen and a lack of comprehensive knowledge about cervical cancer were reported as screening barriers among those who had never been tested.

Conclusion Only one in five women have ever been screened for cervical cancer, despite the majority having heard about the disease. Overall knowledge of cervical cancer was low, with many women unaware of its causes, risk factors and preventive measures. Key barriers to screening included a lack of awareness and insufficient medical advice. Factors significantly associated with lower odds of screening were being under age of 30 years, not having heard about cervical cancer, having no formal or only primary education and being single. There is an urgent need for community-based interventions to increase awareness and education about cervical cancer

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This was a community-based study with a random sampling; it ensures representativeness among women of reproductive age in Moshi municipality.
- ⇒ Data collection occurred during working hours, potentially under-representing women in formal employment.
- ⇒ The questionnaire was available in both English and Swahili, aiding effective communication.
- ⇒ Using systematic sampling ensured fair representation of the household within the selected wards.
- ⇒ Face-to-face interviews employed in this study may have introduced social desirability bias in responses.

and to improve access to screening services, especially for younger, less educated and single women.

BACKGROUND

Cervical cancer is caused by the virus known as human papillomavirus (HPV).¹ High-risk HPV types 16 and 18 are the most causative agents in more than 75% of cases.² The risk factors for cervical cancer include being sexually active at a young age, having multiple sexual partners and smoking.^{2–4} The negative effects and mortality due to cervical cancer can be reduced through primary and secondary interventions. HPV vaccination and screening for precancerous lesions are two of the preventive methods recommended by the WHO.⁵

Cervical cancer is the fourth most common cancer (6.9% of all cancers) in female carcinoma after breast, colorectal carcinoma and lung cancer worldwide.^{6,7} In spite of interventions, global estimates of the cervical cancer rate and mortality rate are high, with more than 570 000 new cases diagnosed each year and more than 250 000 women dying from

cervical cancer worldwide. More than 85% of newly diagnosed women and more than 90% of deaths from cervical cancer are from low-income countries in sub-Saharan Africa (SSA) and Asia, where vaccination and screening programmes have low coverage.¹⁷⁸ In SSA, it is the second most common and the most frequent cause of female cancer in women found in the age range of 15–44 years.⁹

The mortality rate from cervical cancer is higher in SSA, with 78% of new cases diagnosed with cervical cancer dying each year.¹⁰ This is because women who are newly diagnosed present with the late stage of the disease where curative treatment is no longer possible, and only palliative care is possible.¹ East Africa has the highest incidence and mortality rate of cervical cancer in the world, with an estimated age-standardised incidence rate of 42.7 new cases per 100 000 women.^{11 12} Low uptake of cervical cancer screening was reported in other studies conducted in East Africa, ranging from 6% to 25%.^{13–15} Similar to other East African countries, cervical cancer is the leading cause of cancer and cancer-related death among Tanzanian women; each year, more than 7300 Tanzanian women are diagnosed with cervical cancer, and more than half of these women die as they are diagnosed at a late stage of the disease.¹¹

To enhance the prevention and control of cervical cancer, the Tanzanian Ministry of Health and Social Welfare launched screening using visual inspection with acetic acid and same visit management with cryotherapy at over 300 sites nationally in 2011.¹⁶ The type of screening strategy used in Tanzania is opportunistic screening, where the invitations to screen for cervical cancer depend on the individual's decision or on encounters with healthcare providers who will inform and encourage women to screen.¹⁷ The policy targets screening women aged 30–50 years, with revisit after 5 years for negative cases. The 2020 target was to reach the coverage of 40% of the target population. By the end of 2019, there were 650 screening sites in the country, but the coverage of cervical cancer screening was low, at 11%.¹⁶ Given the high burden of cervical cancer and the low coverage of screening programmes in these regions, it is crucial to understand the proportion of women undergoing screening, the factors associated with screening behaviour and the barriers preventing screening uptake. Therefore, this study aimed to determine the prevalence of cervical cancer screening, describe the barriers reported by women regarding screening uptake and determine factors associated with cervical cancer screening in Moshi municipality.

METHODS

Study design and setting

The study was a community-based, cross-sectional study that was conducted in August and September 2020 at Moshi municipality in the Kilimanjaro region. The region is situated in northern Tanzania and is subdivided into

seven districts, namely Moshi urban, Moshi rural, Rombo, Mwanga, Same, Hai and Siha. The main economic activities are food and cash crop production, commercial activities, tourism and forestry.

Moshi municipality covers an area of approximately 59 km² and is the smallest municipality in Tanzania by area. According to the 2018 estimates, Moshi municipality has a total population of 225 225 people, 52.2% of whom are females. The municipality is administratively divided into 21 wards. In Moshi municipality, there are four cervical cancer screening and treatment centres which are at Kilimanjaro Christian Medical Centre (zonal), Mawenzi Hospital (regional), St Joseph Hospital (District Designated Hospital (DDH)) and Umati. To extend coverage, the four centres conduct outreach services for cervical cancer screening.

Study population, sampling and sample size

This study involved women of reproductive age (15–49 years) from selected wards in Moshi municipality who were willing to participate. A multistage sampling technique was used. In the first stage, five wards were randomly selected from 21 wards in Moshi municipality: Longuo, Rau, Soweto, Mawenzi and Majengo.

In the second stage, two streets were randomly selected from each of the chosen wards, resulting in a total of 10 streets. The third stage involved a systematic sampling, where the estimated number of households in the street, as provided by the hamlet chairperson, was used to obtain an interval for selecting households. If the selected household had no eligible participants, the next household in the sequence was considered. Furthermore, if a household had two or more women who met the inclusion criteria, a ballot method was used to select one participant per household.

We estimated the sample size using a formula $\frac{Z^2 P(1-P)}{d}$ with the following assumptions:

Z is the statistic corresponding to the level of confidence (we expect to report our findings with 95% CI).

P is the prevalence of cervical cancer screening and d is the precision or margin of error.

At 95% CI, $Z=1.96$.

The prevalence of cervical screening previously reported in another study from Tanzania was 14.3%.¹⁸

$n=1.96^2 \times 0.143 (1-0.143) / (0.05 \times 0.05)$.

$n=189$.

Considering 15% non-response rate, $n=189 / (1-0.15)$.

The estimated minimum sample required for this study was 222. However, a total of 300 participants were recruited to enhance the study's precision and to ensure adequate representation of our sample.

Data collection tools, methods and procedures

The data collection tool was the questionnaire that included questions in both English and Swahili languages. It was developed specifically for this study based on a thorough literature review to ensure comprehensive coverage of cervical cancer knowledge and screening practices. The

tool included both closed and open-ended questions and was administered in an electronic format using KoboCollect. To enhance the questionnaire's validity and cultural relevance, it was reviewed by public health experts and piloted with a small sample of women outside the study sample. Feedback from this pilot test was used to refine the questions for clarity and appropriateness before the main data collection. The tool was divided into five sections covering sociodemographic information, knowledge about cervical cancer and cervical cancer screening practices.

Face-to-face interviews were conducted to collect the required information by filling out the questionnaire. Interviewers were trained and instructed to observe and follow a standardised protocol to minimise interviewer bias. After the interviews, women were given a brief health education about cervical cancer and the importance of cervical cancer screening.

The data collection process included obtaining ethical approval from the ethical committee at the university. Additionally, permission to conduct the study was obtained from the district medical officer (DMO). The DMO gave written permission which requested the ward leaders to assist us in carrying out the research. We first visited the ward leaders to introduce ourselves and establish rapport between the researchers and local government leaders of each area before meeting the participants.

The ward leaders introduced the researchers to the hamlet leaders, who then introduced the researchers to the households. At the households, researchers were properly introduced and the aim of the study was explained. There were some who agreed to participate in the study and others wanted us to come back at a different time.

On the day of data collection written informed consent was obtained from every individual who met the inclusion criteria and agreed to participate.

Study variables

In this study, the dependent variable was whether a woman had ever screened for cervical cancer, which was a binary outcome coded as 'yes' for those who had ever been screened and 'no' otherwise.

The independent variables of this study included sociodemographic and reproductive health characteristics. Sociodemographic characteristics included age in years (recategorised as <30 years and 30 and above), education level (never attended school/primary-level education, secondary-level education and higher level education—above secondary level), marital status (single and married), occupation (employed and unemployed) and residence or address (urban or rural). Reproductive health characteristics included parity which was recategorised as 'no child' and 'one or more children', whether they had ever heard about cervical cancer (yes or no), knowledge about cervical cancer (regarding causes, symptoms, signs, prevention methods and place where screening can be performed), cervical cancer screening history (ever screened, frequency, place of

screening, diagnosis, management), health facility visit in the past year (if yes, whether heard about cervical cancer screening, or had been counselled on cervical cancer screening) and barriers to cervical cancer screening.

Data analysis

Data were analysed using Stata software V.17. All the statistical significance decisions throughout the analysis were made at 5% level. The study's initial analysis involved descriptive statistics, encompassing frequencies and percentages for categorical variables, as well as summary statistics like mean and SD for continuous variables, to provide an overview and general understanding of the background characteristics of the study participants.

To determine the factors associated with ever being screened for cervical cancer, both univariable and multivariable logistic regression analyses were employed. The analysis proceeded in two steps: first, a univariable logistic regression was used to determine how each independent variable was associated with the outcome. Second, independent variables with a *p* value <0.25, as recommended by Hosmer and Lemeshow,¹⁹ were purposively included in the multivariable logistic regression model. Diagnostic tests were performed for the fitted multivariable logistic model, including an assessment of multicollinearity using the generalised variance inflation factor with a cut-off of 10, and no variables were found to be correlated. Consequently, all variables were included in the adjusted model.

Patient and public involvement

Patients and the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

Background characteristics of the study participants

A total of 300 women participated in the study. The mean age of the study participants was 32.7±8.6 years. A total of 290 (96.7%) lived in urban areas, and 10 (3.3%) lived in rural areas. Regarding marital status, 184 (61.3%) were married, 116 (38.7%) identified themselves as single. A total of 153 (51%) had either only primary school education or no formal education, 101 (33.7%) had secondary education and 46 (15.3%) had attained higher than secondary education. Additionally, 241 (80.3%) were either employed or self-employed. Regarding parity, 234 (78%) of women had one or more children. Table 1 summarises these demographic findings.

Proportion of women ever screened for cervical cancer

More than three-quarters of the 300 participants, 249 (83%) had heard about cervical cancer. Of the 300 women, 68 (22.7%) reported having ever been screened for cervical cancer. Among 68 women who had ever been screened, 55 reported having been screened once, and 13 had been screened two or more times. See table 2.

Knowledge of cervical cancer and cervical cancer screening

In this study, knowledge of cervical cancer was assessed in terms of awareness, causes, risk factors, warning signs

Table 1 Demographic characteristics of the participants (n=300)

Variable	Frequency	Percentage
Age (years)		
Less than 30	119	39.7
30 and above	181	60.3
Marital status		
Single	116	38.7
Married	184	61.3
Residence		
Urban	290	96.7
Rural	10	3.3
Education level		
Primary/no education	153	51.0
Secondary	101	33.7
Higher than secondary	46	15.3
Occupation		
Unemployed	59	19.7
Employed	241	80.3
Parity		
One child	66	22.0
One or more children	234	78.0

and preventive measures against cervical cancer. The majority of the participants ever heard of cervical cancer were 249 (83%). However, when specific questions were asked to assess knowledge of cervical cancer, 246 (82%) did not know the cause of cervical cancer, 27 (9%) mentioned HPV infection as the viral infection linked to cervical cancer and 172 (57.3%) never heard about the HPV vaccine. Furthermore, 198 (66%) did not know any warning signs and nearly half the number of the participants (47%) mentioned regular medical check-up as a preventive measure against cervical cancer. Other parameters for knowledge assessment are summarised in [table 2](#).

Reasons for not screening for cervical cancer

Women who had never screened (n=232) were asked about the reasons or barriers to why they had never screened. Lack of awareness or knowledge of cervical cancer and its importance (65%) and insufficient medical advice (29%) were two of the most common reasons given for not testing for cervical cancer ([figure 1](#)).

Factors associated with ever being screened for cervical cancer

In crude analysis, being under age of 30 years, never having heard about cervical cancer, having no children (parity), single-marriage status, having no education or only primary-level education, being unemployed and never having being tested for HIV were negatively associated with ever being screened for cervical cancer ([table 3](#)).

Table 2 Awareness and knowledge of cervical cancer and cervical cancer screening among women in Moshi (n=300)

Variable	Frequency	Percentage
Ever heard about cervical cancer		
Yes	249	83.0
No	51	17.0
Ever screened for cervical cancer		
Yes	68	22.7
No	232	77.3
Cervical cancer screening frequency		
0	232	77.3
1	55	18.3
>1	13	4.3
Ever tested HIV		
Yes	266	88.7
No	34	11.3
Ever heard about HPV vaccine		
Yes	128	42.7
No	172	57.3
Knowledge on cause of cervical cancer (yes)		
HPV virus	27	9.0
Inherited	9	3.0
Punishment from God	3	1.0
Others	15	5.0
Don't know	246	82.0
Knowledge on risk factors for cancer of the cervix (yes)		
HPV infection	29	9.7
Use of contraceptives	55	18.3
Early sexual debut	32	10.7
Many sexual partners	69	23.0
I don't know	160	53.3
Warning signs of cervical cancer (yes)		
Abnormal vaginal bleeding	61	20.3
Discomfort during sex	21	7.0
Heavy and long periods	46	15.3
Weight loss	7	2.3
Lower back pain	31	10.3
I don't know	198	66.0
Preventive measures (yes)		
Regular medical check-up	140	47.0
HPV vaccine	24	8.0
Delay sexual debut	10	3.0
Condom use	10	3.0
Avoid multiple sexual partners	48	16.0
I don't know	66	22.0

HPV, human papillomavirus.

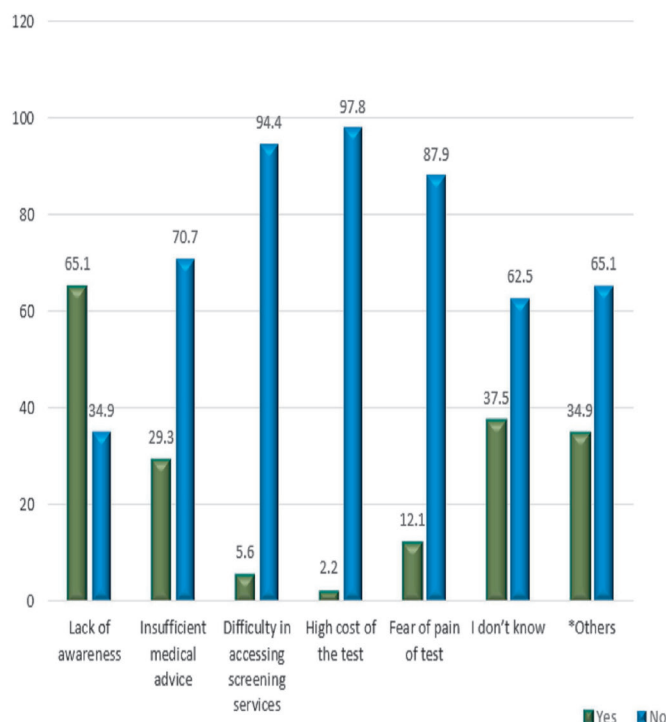


Figure 1 Barriers to cervical cancer screening among women in Moshi (n=300). *Poor health-seeking behaviours, no obvious symptoms, time wastage in the hospital.

After adjusting for other factors, young age (<30 years), never having heard about cervical cancer, having no education or only primary-level education and being single remained significantly negatively associated with ever being screened for cervical cancer. Women below the age of 30 years had 87% lower odds of being screened for cervical cancer compared with those aged 30 years and above (OR 0.13; 95% CI 0.04, 0.43). Women who never heard about cervical cancer had 94% (OR 0.06; 95% CI 0.01, 0.51) lower odds of screening compared with those who had heard about the disease. Compared with married women, women who identified themselves as single had 71% lower odds of screening for cervical cancer (OR 0.29; 95% CI 0.10, 0.73). Women with no formal education or only a primary-level education had 72% lower odds of screening for cervical cancer compared with those with education beyond the secondary level such as college or university education (OR 0.28; 95% CI 0.08, 0.98). See [table 3](#).

DISCUSSION

This study aimed to explore the awareness of cervical cancer screening, knowledge and barriers to screening and factors associated with screening for cervical cancer. Approximately one in five women (22.7%) had been tested (screened) for cervical cancer at least once in their lifetime. This finding is comparable to the average screening coverage in other developing countries.²⁰ On the other hand, it is to some extent lower than the global coverage of those who were ever screened for cervical

cancer (36%) in 2019, even though this coverage might have been influenced by high screening coverage in high- and upper middle-income countries.²¹ Among those who had been screened, the majority (80.9%) were screened only once. The low proportion of subsequent screening can be explained by the average age of participants, 32.7 years, as it is also recommended to start cervical cancer screening from the age of 25 years.²²

Despite the low screening rate, most women (83%) had heard about cervical cancer. This proportion is higher than the 66.7% reported in a study conducted between 2017 and 2019 in the same region.²³ However, in a previous study, 81.4% of women who attended the cancer prevention camp had ever heard about cancer in general.²³ The slight proportional increment might have been due to the public health interventions that are being implemented in the region. Even though having heard about cervical cancer (or cancer in general) is not an absolute measure of individuals' knowledge level, these findings are suboptimal as we strive towards universal screening coverage. When we asked about the cause and risks of cervical cancer and cervical cancer screening, we found that 82% of women did not know the cause of cervical cancer and only 9% knew that cervical cancer is highly associated with HPV infection. Previous studies reported that majority had poor knowledge about HPV and HPV vaccine.^{23–25} Other authors even described lack of awareness and ignorance about symptoms and risk factors for cervical cancer as the main contributors to low screening rates in Uganda and Zanzibar.^{9 26} The lack of knowledge on HPV and HPV vaccines in both current and previous studies raises concerns about the strategies used in interventions targeting cervical cancer, specifically screening programmes for adults and vaccination programmes for young adolescents. The design of such a programme needs coordination that forms a continuum of care that enables young adolescents to foresee the significance of cervical cancer screening during adulthood.^{27 28} Regular evaluation of programme success is mandatory and qualitative studies could be useful to understand women's perspectives on barriers to cervical cancer screening.²⁹

Furthermore, majority of women in our study mentioned lack of knowledge and insufficient medical advice as the main barriers for cervical cancer screening. The findings were consistent with other studies done in Elmina Southern Ghana, Uganda and Magu District Hospital in Tanzania.^{9 18 30} Contrary to our study, other barriers such as poor support from family and long distance to the screening sites were reported by the majority of respondents.^{9 30} Thus, the major component to be improved in cervical cancer programmes should be the provision of proper knowledge about cervical cancer, including the cause (with emphasis on HPV), risk factors, preventive measures, signs and symptoms of cancer and mode of treatment, because most studies have concluded that the community level of awareness about cervical cancer is high, but the level of screening for cervical cancer remains low.



Table 3 Factors associated with ever screening for cervical cancer among women in Moshi (n=300)

Variable	Ever screened (%)	cOR (95% CI)	P value	aOR (95% CI)	P value
Age					
Less than 30	4.2	0.08 (0.03, 0.21)	<0.001*	0.13 (0.04, 0.43)	0.001*
30 and above	34.8	Ref			
Residence					
Urban	96.7	0.67 (0.17, 2.68)	0.575		
Rural	3.3	Ref			
Occupation					
Unemployed	19.7	0.20 (0.07, 0.58)	0.003*	0.35 (0.11, 1.15)	0.084
Employed	80.3	Ref			
Marital status					
Single	33.7	0.11 (0.04, 0.26)	<0.001*	0.29 (0.10, 0.73)	0.014*
Married	2.4	Ref			
Parity					
No children	78.0	0.08 (0.02, 0.33)	0.001*	0.89 (0.12, 6.70)	0.906
One or more children	22.0	Ref			
Education level					
Primary or no education	51.0	1.97 (0.82, 4.76)	0.131	0.28 (0.08, 0.98)	0.046*
Secondary education	33.7	1.46 (0.57, 3.73)	0.427	0.39 (0.11, 0.143)	0.156
Higher education	15.3	Ref			
Ever heard about cervical cancer					
No	2.0	0.05 (0.01, 0.40)	0.004*	0.06 (0.01, 0.51)	0.010*
Yes	26.9	Ref			
Ever tested for HIV					
No	11.3	0.09 (0.01, 0.67)	0.019*	0.85 (0.09, 8.32)	0.886
Yes	88.7	Ref			

*Significant p value at less than 5%.
aOR, adjusted OR; cOR, crude OR.

Additionally, our study determined that age (<30 years), being single, ever heard about cervical cancer and no formal education or primary-level education were significantly associated with lower odds of screening for cervical cancer. Nearly 35% of women aged 30 years and above were screened for cervical cancer, whereas only 4.2% of those younger than 30 years were screened for cervical cancer. A small proportion of screening observed in younger women could be attributable to the age criteria recommended in the screening guidelines,³¹ which perhaps accounts for the lower odds of screening observed in the younger women (<30 years) in this study. Such findings were reflected by other studies although they reported it with reference to older age group having higher odds of screening for cervical cancer compared with younger women.^{32 33} In addition to age criteria in cervical cancer screening guidelines, younger women probably have less encounters with healthcare personnel, do consider themselves healthy and have lower risk of

developing cervical cancer; therefore, less motivated to screen for cervical cancer.

The proportion of single women who had ever been screened was 2.4%, whereas 33.6% of married women had ever been screened. The odds of screening were 71% lower among single women than their married counterparts. Similar findings were reported in a study conducted in Ethiopia.³⁴ We postulate that married women are likely to seek health services such as antenatal services and thus are more likely to have received health education regarding cervical cancer and cervical cancer screening.

Moreover, women who never heard about cervical cancer had lower odds of screening for cervical cancer compared with those who previously heard about the disease. Other authors reported higher odds of cervical cancer screening in those who ever heard about cervical cancer compared with those who never heard about it.^{15 35} This further highlights proper knowledge as a key tool to invest in as we improve strategies used to combat

cervical cancer through screening and early identification of cases.

Our study also revealed that women with lower level of education (primary) or no formal education at all had lower odds of screening for cervical cancer compared with those who attained high educational qualification (college/university). The finding is consistent with findings from other articles about cervical cancer screening in Kenya^{33 36} and Ethiopia.³⁷ Individuals with low or no formal education are often bound to sociocultural constraints and unemployment, that they hardly afford costs for transport even though the screening itself is provided for free. Most of them are likely to be disadvantaged in comprehending reproductive educational content. Circumstances that come with no or low education might have contributed to lower odds of screening for cervical cancer.

Strengths and limitations of the study

This was a community-based study that employed random sampling to select the women. The results can represent the level of screening, knowledge and barriers for other women of reproductive age in Moshi municipality. Additionally, the study questionnaire was available in both English and Swahili, ensuring effective communication with the participants. However, the study has some limitations. Most of the interviewed women were self-employed and housewives. We probably missed those on formal employment or those working far from their houses as the time for data collection was during working hours. This group might have been under-represented in this study. Second, the interview method we used allows respondents to report what they thought the researchers wanted to hear (social desirability bias) and led to an overestimation of other findings; for example, the proportion of ever hearing about cervical cancer is unmatched to the proportion of overall knowledge on cervical cancer. However, we encouraged participants to provide honest responses, assuring them of anonymity by using numbers instead of names, and we guaranteed the confidentiality of the information shared. The use of both random and systematic sampling procedures reduced bias and hence fair representation of the general population. Therefore, the findings of our study are transferable and applicable to the external population with similar sociocultural and economic status.

CONCLUSION

Only about one in five women had ever been screened for cervical cancer, despite the majority having heard about the disease. Overall knowledge of cervical cancer was low, with many women unaware of its causes, risk factors and preventive measures. Key barriers to screening included a lack of awareness and insufficient medical advice. Factors significantly associated with lower odds of screening were being under age of 30 years, not having heard about cervical cancer, having no formal or only primary

education and being single. We recommend that reproductive health education on cervical cancer, HPV and HPV vaccines must be programmed in a continued and sustainable manner. Cervical cancer services and HPV vaccines in key areas, such as healthcare centres (especially reproductive health units) and schools, and other outreach services should operate continuously with close monitoring of indicators of screening coverage. In these key areas, women attending for various reasons, especially the younger, single and less educated women, should be actively informed about cervical cancer and importance of screening to improve care seeking and uptake of screening. Avenues to offer awareness could be extended by involving influential people from faith-based groups and women's socioeconomic groups.

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Contributors JJH analysed the data, interpreted the results and wrote the manuscript. RD, WEZ, YZK, SA and RM equally contributed to proposal writing, data collection and interpretation of results. SEM offered guidance in refining initial idea, study design, interpretation of results and manuscript development. Given the roles played, JJH acts as a guarantor of this research and he is fully responsible for the integrity of this research.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the Kilimanjaro Christian Medical University College Research Ethics and Review Committee (approval number: UG 030/2020). Permission to conduct the study at selected wards was sought from the district medical officer of Moshi Municipal Council. Written informed consent was sought from each participant who agreed to participate. For participants aged ≤18 years, parents or caretakers were involved in consent acquisition process, and for those who agreed parents/caretakers signed on behalf. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available in a public, open access repository. Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information. The dataset used in this research article is available for sharing if needed and can be accessed on the open science framework repository. The identifier provided in reference³⁸ will navigate users to the respective file.

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