RESEARCH ARTICLE

Editorial Process: Submission:08/07/2025 Acceptance:06/14/2026 Published:06/18/2026

Awareness of Cervical Cancer, Willingness, and Barriers to Cervical Cancer Screening among Women in Madurai: A Cross-Sectional Study in South India

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Abstract

Objectives: This study aims to investigate rural women's knowledge and attitudes towards cervical cancer, their willingness to participate in cervical cancer screening, and the perceived obstacles to screening. **Methodology:** A community-based cross-sectional study was conducted in Madurai district, Tamil Nadu, India, from February to July 2024, involving 350 women aged 25 to 65 years. Utilizing multistage random sampling, the study employed face-to-face interviews with a semi-structured questionnaire focused on knowledge and attitudes towards cervical cancer, as well as barriers to screening services. Data were analyzed using R programming (version 4.4.3). **Results:** Participants had a mean age of 33.83 ± 7.56 years, with 29.1% being illiterate. Only 15.7% had undergone cervical cancer screening. Approximately 68.3% and 66.8% expressed willingness to undergo cervical cancer screening if it were free or recommended by a doctor, respectively. Major barriers to screening included fear of falling sick after screening (65.1%), lack of awareness (64.3%), and the belief that screening is unnecessary at their age (64%). Women aged 35–44 years (3.21 ± 0.49, p = 0.05, β = -0.542), those who were non-working (3.14 ± 0.50, p = 0.02, β = -0.739), illiterate (3.21 ± 0.57, p = 0.04, β = -1.093), of lower socioeconomic class (3.09 ± 0.52, p = 0.05, β = -0.883), and those who had never undergone cervical cancer screening (3.07 ± 0.52, p = 0.02, β = -0.677) had significantly lower mean knowledge scores. **Conclusion:** The research highlights significant gaps in awareness and screening among rural women in Madurai, despite a positive attitude towards screening. Low participation rates stem from educational and socioeconomic barriers. The study's regional focus may limit broader applicability, and social desirability bias may be a concern due to the use of interviewer-administered questionnaires. Enhancing the Makkalai Thedi Maruthuvam program in Tamil Nadu with targeted education and community involvement could boost awareness and screening rates.

Keywords: Cervical Cancer- Screening- Awareness- Willingness- Barriers

Asian Pac J Cancer Prev, **27 (6)**, 2053-2060

Introduction

Cervical cancer remains a significant public health challenge in India, particularly affecting women in rural areas [1]. With an alarming incidence rate of 18.3%, the disease is projected to translate to nearly 124,000 new diagnoses and over 77,000 deaths annually [2].

The majority of invasive cervical cancer cases are associated with persistent Human papillomavirus (HPV) infections, accounting for 87.8% to 96.67% of cases [3]. Approximately 5% of women are expected to experience HPV infection in their lifetime, with the risk significantly increased for women living with HIV, who are six times more likely to develop cervical cancer [4]. Behavioral, biological, and socioeconomic factors influence cervical cancer risk. Early sexual activity, multiple partners, and a weakened immune system heighten HPV exposure risk. Smoking further damages cervical cells and immune function [5]. Hormonal factors, such as long-term contraceptive use and multiple pregnancies, also increase susceptibility. Additionally, lower socioeconomic status limits access to essential healthcare services like Pap smears and HPV vaccinations [6].

The national prevalence of cervical cancer screening in India is alarmingly low at 1.97%, with state-level disparities [7]. This underscores a significant healthcare access and awareness gap, particularly for women aged 30-49, who are at higher risk. The World Health Organization (WHO) recommends screening every 5-10 years starting at age 30, with specific guidelines for women living with HIV, including at least two high-performance HPV tests at ages 35 and 45 [4]. The current low screening

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rates highlight the urgent need for enhanced outreach and education, as effective use of HPV tests and Pap smears is vital for early detection and reducing cervical cancer morbidity and mortality [8].

The proactive approach to cancer control in Tamil Nadu (the state in which the current study is conducted), as detailed in its state policy, seeks to substantially decrease cancer incidence, morbidity, and mortality by 2030, in accordance with the Sustainable Development Goals. The Makkalai Thedi Maruthuvam scheme has effectively enabled screenings for oral, breast, and cervical cancers, achieving a screening rate of 11.06% for cervical cancer among women [9].

Studies in India reveal a significant lack of knowledge about cervical cancer among women, with only 40.22% showing adequate understanding [10]. In Chennai, Tamilrasi et al. found that 66.8% of participants had no awareness of cervical cancer, and only 9% had good knowledge [11]. In Karnataka, Ramaiah et al. reported that 64% were unaware of cervical cancer and its symptoms, with only 9.5% having been screened [12]. Similarly, Chandrika et al. found that only one third of the population in Pondicherry was aware of cervical cancer and its screening facilities [13]. The systematic review by Farajimakin et al. identified barriers to accessing cancer screening services, including economic constraints, cultural and religious factors, fear and embarrassment, and distrust in healthcare systems. These barriers, combined with significant social and economic inequalities, contribute to increased cervical cancer incidence rates [14]. Sub-Saharan Africa faces significant challenges in screening coverage, mostly due to lack of information, fear of diagnosis, cultural stigma, and insufficient healthcare infrastructure (Mengesha et al., Ethiopia). Similar challenges are evident in China and Southeast Asia, where misunderstandings regarding symptoms and a low perception of risk impede screening initiatives, even with enhanced service availability (Wang et al., China). The findings reveal that obstacles to health screening in low- and middle-income countries (LMICs) are prevalent, which points to the importance of customized interventions [15,16]. The findings highlight the urgent need for targeted educational initiatives to improve awareness and knowledge about cervical cancer and its prevention.

Despite state-level cervical cancer screening programs in Tamil Nadu, there is insufficient district-specific data on women's knowledge, willingness, and barriers to screening in rural areas like Madurai. Limited regional studies reveal a concerning lack of awareness and low participation in cervical cancer preventive services among women, highlighting the need for targeted research and interventions in these communities [17].

This study investigates women's knowledge and attitudes regarding cervical cancer, as well as the perceived barriers to accessing screening services. Understanding these factors is crucial for creating effective interventions to increase screening uptake and enhance early detection rates, ultimately improving health outcomes for women.

Materials and Methods

Study design

A community based cross-sectional study was conducted in rural areas of the Madurai district from February 2024 to July 2024.

Study setting and population

The study population consisted of women aged 25-65 years residing in rural areas of Madurai district.

Sample size

The sample size was determined using the formula $n = Z^2 P (1-P) / d^2$.

The estimated sample size was 345, rounded up to 350 participants, derived from an overall knowledge rate of 34% regarding cervical cancer among women, as reported by Chandrika et al. [13], with a confidence interval of 95% and 5% absolute precision.

Sampling technique

Villages were selected using multistage random sampling. The Madurai district comprises thirteen taluks. Villages within each taluk were enumerated, and one village was randomly selected from each taluk using a computer-generated random number. The required sample size from each village was determined using probability proportional to size. Subsequently, systematic random sampling was employed by selecting every 5th household after a randomly chosen starting point until the required sample size was achieved. One woman per household was enrolled, with a lottery method employed to select the participant in cases where multiple women resided in the household.

Inclusion and exclusion criteria

Inclusion criteria include women aged 25-65, regardless of marital status, who were willing to participate in the study. Women aged under 25 and above 65, previously diagnosed or currently receiving treatment for cancer, and women who underwent a hysterectomy were excluded from the study.

Data collection

The data was gathered subsequent to acquiring written informed consent from the study participants. For women who didn't read well, the consent form was read out loud in their native language, and thumb impressions were obtained in the presence of a witness. Participants were guaranteed total anonymity and confidentiality, with no personal identifiers gathered and data utilized exclusively for study objectives.

The methodology employed a face-to-face interview format utilizing a semi-structured questionnaire that captured essential socio-demographic information, menstrual and obstetric history, oral contraceptive use, and previous sexually transmitted diseases. A significant aspect of the study involved assessing participants' knowledge, willingness regarding cervical cancer, as well as identifying barriers to utilizing available screening

services. The knowledge section was structured into four domains: general awareness about cervical cancer, knowledge of risk factors, signs and symptoms, and prevention. For both the knowledge and willingness domains, responses were rated on a five-point Likert scale, with lower scores (1) indicating strong disagreement and higher scores indicating strong agreement (5). For assessing the barrier's domain, the responses were recorded as Yes/No under the subcategories of individual level barriers, health system related barriers, and cost & time constraints. The questionnaire was designed based on extant studies about cervical cancer awareness and screening, evaluated by faculty for content validity, and underwent pilot testing before data collection, exhibiting strong reliability with Cronbach's alpha values more than 0.86.

Data analysis

Data were systematically collected and entered into Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) and all analyses were performed using R Software (Version 4.4.3; R foundation for statistical computing, Vienna, Austria). Sociodemographic and reproductive characteristics of the study participants were summarized using frequencies and percentages. As the study included participants from rural areas of Madurai, Modified B G prasad's socioeconomic scale was used to classify the study participants based on their per capita income. The mean scores were computed for each domain, and association between mean knowledge and willingness was assessed using Pearson correlation analysis. Barriers to screening were presented as frequencies and percentages. To identify sociodemographic predictors of lower knowledge levels regarding cervical cancer and its screening services, a multi-nomial regression analysis was used.

Ethical consideration

The study was approved by the Institutional Ethics Committee of Velammal Medical College Hospital & Research Institute (IEC No: VMCIEC/059/2024).

Results

Sociodemographic and reproductive details of the study participants

The study included 350 participants with an average age of 33.83 years. Most were aged 25-34 (31.4%) and 55-65 (26.6%), predominantly married (93.1%) and Hindu (86.8%). Education levels varied: 29.1% were illiterate, and 50.6% had completed schooling. The largest socioeconomic group was Upper Middle Class (38.8%), followed by Middle Class (19.4%) (Table 1). Most participants (75.7%) experienced menarche before age 15, with an average onset at 13.39 years. About 32.6% had reached menopause, averaging 48.33 years. Contraceptive use was reported by 34.9%, with 7.7% having undergone sterilization. Approximately 4.3% of participants reported a family history of cancer, and only 15.7% have undergone cervical cancer screening. Additionally, 9.1% reported a history of STDs.

Knowledge and willingness towards cervical cancer screening

Around half of the participants (50.6%) were familiar with the term "cervical cancer." Around 38.8% believed that cervical cancer is always fatal. Regarding awareness of risk factors, 51.8% correctly identified tobacco use as a risk factor (median score: 4 [IQR: 3–4]), and awareness of early age at first sexual intercourse as a risk was comparatively low (26%). Moderate levels of understanding were observed for other key risk factors: infections (38%), multiple sexual partners (43.5%), and sexually transmitted diseases (41.1%), all with median scores of 3 (IQR: 3–4).

Knowledge of symptoms was low. Only 30% associated strong vaginal odor with cervical cancer, and even fewer identified pain during menstruation (18.1%), bleeding after intercourse (28.6%), or postmenopausal bleeding (25.1%) as potential warning signs. In prevention, 37.8% agreed that cervical cancer risk can be reduced (median: 3 [IQR: 3–4]), only 40.3% were aware of screening tests (median: 4 [IQR: 3–4]), and 34% recognized the Pap smear specifically as a tool for early detection. Furthermore, only 31.5% endorsed regular Pap smear testing, again with a median score of 3 (IQR: 3–4), pointing to a limited

Table 1. Sociodemographic Details of the Study Participants

Sociodemographic characteristics	Categories	Frequency (n = 350)	Percentage (%)
Age	25 – 34	110	31.4
	35 – 44	72	20.6
	45 – 54	75	21.4
	55 – 65	93	26.6
Marital status	Married	326	93.1
	Unmarried	10	2.9
	Widowed	14	4
Religion	Hindu	304	86.8
	Christian	30	8.6
	Muslim	16	4.6
Working Status	Yes	191	54.6
	No	159	45.4
Education	Illiterate	102	29.1
	Schooling	177	50.6
	Diploma	37	10.6
	Graduate	19	5.4
	Professional	15	4.3
Socioeconomic status	Upper	65	18.6
	Upper Middle	136	38.8
	Middle	68	19.4
	Lower Middle	57	16.3
	Lower	24	6.9
Smoking	Yes	3	0.9
	No	347	99.1
Tobacco	Yes	6	1.7
	No	344	98.3

Table 2. Domain Wise Knowledge and Willingness Scores Regarding Cervical Cancer

Questions	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Median (IQR)
General Knowledge						
Aware of cervical cancer	7 (2)	42 (12)	124 (35.4)	154 (44)	23 (6.6)	4 (3-4)
Cervical cancer is fatal	8 (2.3)	23 (6.6)	183 (52.3)	118 (33.7)	18 (5.1)	3 (3-4)
Knowledge of risk factors						
It can be caused by an Infection	5 (1.4)	32 (9.1)	180 (51.5)	113 (32.3)	20 (5.7)	3 (3-4)
Early age of first intercourse	10 (2.9)	53 (15.1)	196 (56)	81 (23.1)	10 (2.9)	3 (3-4)
Multiple sexual partners	8 (2.3)	27 (7.7)	163 (46.6)	136 (38.8)	16 (4.6)	3 (3-4)
Sexually Transmitted Diseases	8 (2.3)	29 (8.3)	169 (48.3)	119 (34)	25 (7.1)	3 (3-4)
Tobacco/smoking	4 (1.1)	19 (5.5)	146 (41.7)	145 (41.5)	36 (10.3)	4 (3-4)
Knowledge of signs and symptoms						
A strong, unpleasant vaginal odour	5 (1.4)	39 (11.1)	201 (57.5)	75 (21.4)	30 (8.6)	3 (3-4)
Experiencing pain during menstruation	26 (7.4)	83 (23.7)	178 (50.8)	60 (17.2)	3 (0.9)	3 (3-4)
Bleeding after sexual intercourse	7 (2)	54 (15.4)	189 (54)	77 (22)	23 (6.6)	3 (3-4)
Post-menopausal bleeding	15 (4.3)	66 (18.9)	181 (51.7)	70 (20)	18 (5.1)	3 (3-3.25)
Knowledge towards prevention						
Cervical cancer is preventable	4 (1.1)	20 (5.7)	194 (55.4)	102 (29.2)	30 (8.6)	3 (3-4)
It can be detected earlier by screening tests	11 (3.1)	28 (8)	170 (48.6)	112 (32)	29 (8.3)	4 (3-4)
A Pap smear is a screening tool for cancer cervix	7 (2)	36 (10.3)	188 (53.7)	98 (28)	21 (6)	3 (3-4)
The Pap smear test should be done frequently	5 (1.4)	34 (9.7)	201 (57.4)	87 (24.9)	23 (6.6)	3 (3-4)
Question	Definitely would not	Probably would not	Not sure	Probably would	Definitely would	Median (IQR)
Willingness for Cervical Cancer Screening						
Willing to undergo screening if doctor advises	5 (1.4)	22 (6.3)	89 (25.5)	193 (55.1)	41 (11.7)	4 (3-4)
Willing to undergo screening if provided free of cost	6 (1.7)	19 (5.4	86 (24.6)	196 (56)	43 (12.3)	4 (3-4)
Willing to advise my family to undergo screening test	5 (1.4)	18 (5.1)	121 (34.6)	171 (48.9)	35 (10)	4 (3-4)
Willing to vaccinate the child for HPV	5 (1.4)	16 (4.6)	127 (36.2)	172 (49.2)	30 (8.6)	4 (3-4)

understanding of screening frequency and importance.

The willingness of participants to engage in cervical cancer screening and preventive measures reflected a generally positive attitude, as evidenced by a consistent median score of 4 (IQR: 3–4) across all assessed domains. A significant proportion of study participants (56.0% &

Table 3. Regression Analysis of Socio-Demographic Factors and Cervical Cancer Knowledge

S. No	Variable	Categories	Mean ± SD	β	Std. Error	Wald	p value
1	Age	25 – 34	3.36 ± 0.53		Reference		
		35 – 44	3.21 ± 0.49	-0.542	0.298	3.301	0.05
		45 – 54	3.31 ± 0.45	-0.176	0.294	0.359	0.54
		55 – 65	3.20 ± 0.56	-0.592	0.28	4.483	0.03
2	Marital status	Married	3.28 ± 0.54		Reference		
		Unmarried	3.06 ± 0.57	-0.74	0.55	1.809	0.17
		Widowed	3.34 ± 0.76	0.243	0.529	0.211	0.64
3	Religion	Hindu	3.28 ± 0.54		Reference		
		Christian	3.28 ± 0.32	0.016	0.369	0.002	0.91
		Muslim	3.13 ± 0.40	-0.513	0.494	1.078	0.29
4	Working Status	Yes	3.32 ± 0.54		Reference		
		No	3.14 ± 0.50	-0.739	0.331	4.972	0.02
5	Education	Professional	3.51 ± 0.58		Reference		
		Illiterate	3.21 ± 0.57	-1.093	0.532	4.224	0.04
		Schooling	3.25 ± 0.45	-0.943	0.515	3.354	0.05
		Diploma	3.41 ± 0.51	-0.336	0.581	0.334	0.56
		Graduate	3.35 ± 0.70	-0.583	0.664	0.771	0.38
6	Socioeconomic status	Upper	3.34 ± 0.46		Reference		
		Upper middle	3.27 ± 0.51	-0.242	0.299	0.657	0.42
		Middle	3.38 ± 0.56	0.201	0.342	0.344	0.55
		Lower middle	3.16 ± 0.52	-0.64	0.358	3.486	0.05
		Lower	3.09 ± 0.52	-0.883	0.452	3.814	0.05
7	Family history of cancer	Yes	3.40 ± 0.21		Reference		
		No	3.27 ± 0.53	-0.483	0.508	0.904	0.34
8	Previous history of cervical screening	Yes	3.29 ± 0.48		Reference		
		No	3.07 ± 0.52	-0.677	0.291	5.429	0.02
9	History of sexually transmitted diseases	Yes	3.42 ± 0.57		Reference		
		No	3.25 ± 0.51	0.443	0.576	3.781	0.03

55.1%) agreed that they would probably undergo cervical cancer screening if it were offered for free of cost and if advised by a doctor, respectively. With an additional 12.3% and 11.7% strongly agreeing to do the same.

Nearly half of respondents (48.9%) said they probably would recommend cervical cancer screening to their families and 10 % stated they definitely would. However, 34.6% were neutral. Around 49.2% would vaccinate their child for HPV, while 36.2% were not sure, possibly indicating a need for greater awareness and confidence regarding HPV vaccine safety and efficacy (Table 2).

The Pearson correlation analysis reveals a moderate to strong positive correlation ($r = 0.587$, $p = 0.001$) between knowledge and attitude towards cervical cancer screening services, indicating that higher knowledge levels lead to more favorable attitudes.

Barriers towards cervical cancer screening

Figure 1 outlines perceived barriers to cervical cancer screening among women, categorized into three domains: individual factors, health system-related barriers and cost & time constraints. Major individual-level barriers included fear of falling sick after screening (65.1%), lack of awareness (64.3%), and the belief that screening is unnecessary or ineffective at their age (64%). Additionally, 50.3% of women thought being healthy negated the need for screening, highlighting misconceptions and psychological barriers. Lack of family support was observed in 48.9% of the study participants.

Health system concerns were noted, with nearly half (46%) believing hospitals lacked the infrastructure for screening services, and only 37.4% aware of nearby health centres offering screening. While 55.1% felt healthcare providers were adequately trained, 57.4% had concerns about the confidentiality of screening procedures. Cost was seen as a barrier by 42.9% of respondents, and 39.1% cited time constraints.

Regression analysis

The multivariable regression analysis assessed the impact of sociodemographic variables on cervical cancer knowledge, revealing significant associations across various domains. In comparison to the reference group knowledge of 25-34 years (mean = 3.36 ± 0.53), women aged 35-44 years (3.21 ± 0.49, $p = 0.05$,$\beta = -0.542$), and 55-65 years (3.20 ± 0.56, $p = 0.03$, $\beta = -0.592$) had a significantly lower mean score. Working women had a mean score of 3.32 ± 0.54, significantly higher than

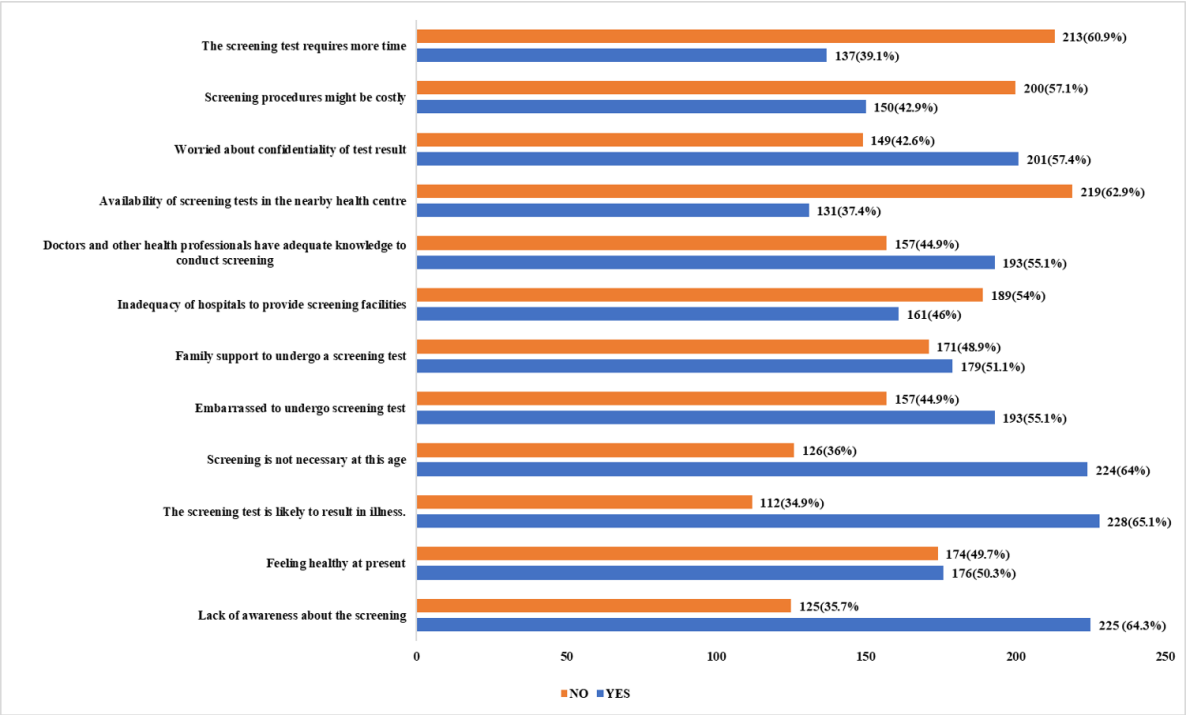

Figure 1. Perceived Barriers to Cervical Cancer Screening among Rural Women (n=350)

non-working women at 3.14 ± 0.50 (p = 0.02, β = -0.739), indicating workplace exposure enhances health literacy.

Women with professional education scored the highest at 3.51 ± 0.58, while illiterate women scored 3.21 ± 0.57 (β = -1.093, p = 0.04). Those with only school-level education had a mean of 3.25 ± 0.45 (β = -0.943, p = 0.05), emphasizing the importance of formal education in health literacy.

Women from the lower socioeconomic class had a mean score of 3.09 ± 0.52, and lower middle-class individuals had a mean score of 3.16 ± 0.52, significantly lower than those in the upper class (3.34 ± 0.46; p = 0.05). Women who had never undergone cervical cancer screening had a mean score of 3.07 ± 0.52 (β = -0.677, p = 0.02), while those with screening experience had a mean score of 3.29 ± 0.48. Women with a history of STDs had higher knowledge (mean = 3.42 ± 0.57) than those without such a history (mean = 3.25 ± 0.51, p = 0.03, β = 0.443) (Table 3).

Discussion

The study assessed awareness, willingness, and barriers to cervical cancer screening among women in rural areas of Madurai district. The results revealed a median knowledge and awareness score of 3, indicating an overall moderate level of understanding among participants. A gap in recognizing early warning signs was noted. Mengesha et al. reported a mean knowledge score of 3.21 ± 3.88, with only 19.87% of women showing good knowledge [15]. Wang L et al. found a mean knowledge of 12.55 ± 6.23 on a 26-point scale, with factors like younger age and higher education positively associated with knowledge [16]. In contrast, Masood S et al. found that 77.5% were aware of cervical cancer, with a mean score of 7.7 ± 4.4 for signs and symptoms, and 75.58% understanding HPV risk [18]. The study reveals a significant gap in awareness concerning postmenopausal bleeding as a symptom, HPV as a risk factor, and the preventability and early detection of cervical cancer. The differences in the knowledge level may be attributed to different geographical locations, cultural practices, and access to educational resources. This study highlights a significant knowledge gap in the Indian rural context, influenced by cultural and health system barriers.

In the current study, the willingness to undergo cervical cancer screening showed an encouraging trend, with a median score of 4 (3-4) on all assessed domains. More than half of the respondents showed willingness to undergo screening if advised by a doctor (66.8%) or offered free of cost (68.3%). In comparison, Yadhav et al. found that 55.7% strongly agreed and 35.1% agreed to undergo screening if it were free and non-harmful, which is a higher proportion than in our study [19]. Khanna et al. [20] reported that 68.6% strongly agreed and 17.7% agreed to undergo screening if offered free of cost. However, a minor proportion remained neutral or hesitant, indicating doubts or lack of clarity regarding screening procedures. Around 58.9% of participants agreed to recommend screening to family members, while 34.6% remained neutral. This indicates that personal willingness may be high, but proactive familial advocacy is suboptimal in the Madurai rural population, potentially due to cultural reticence or lack of confidence in discussing reproductive health.

In our study on HPV vaccination, only 57.8% were willing to vaccinate their child, with a significant 36.2% neutral responses indicating hesitancy. In Narayana G et al.'s study, only 31.3% supported HPV vaccination, while 56.3% disagreed or strongly disagreed, highlighting a larger information gap or vaccine

hesitancy [21]. This underscores the need for HPV-specific education, especially in rural India. Regarding screening discomfort, 55.1% of our participants agreed that embarrassment is a barrier, similar to the findings reported by Yadhav et al.'s 57.7% and Narayana et al.'s 46.2% [19,21]. Cultural modesty and gender norms likely contribute to these discomforts, necessitating gender-sensitive communication and female healthcare provider availability.

The study reveals that over half of participants face significant barriers to cervical cancer screening, mainly driven by psychological fears, misconceptions about the necessity of screening, and the absence of symptoms, highlighting the need for improved education and support. Devarapalli et al. [22] identified barriers including lack of knowledge and awareness, psychological, structural, sociocultural, and religious barriers. Farajimakin O et al. noted common barriers such as lack of knowledge, economic constraints, access issues, cultural and religious factors, fear and embarrassment, and distrust in healthcare systems [14]. Chandrika et al. found that fear of disease and absence of symptoms were significant barriers [13], while Mafiana J et al. highlighted fear of stigma and lack of spousal support [23]. All these findings are in synchrony with our present study findings such as lack of awareness, neglect, fear of getting diagnosed, lack of adequate screening facilities available and lack of familial support were the major barriers for non-utilization of screening services. Addressing these issues is essential to increase screening service utilization and reduce cervical cancer incidence and mortality rates.

In our study, lower levels of cervical cancer knowledge were significantly linked to older age, unemployment, lower educational attainment, lower socioeconomic status, lack of previous screening, and absence of sexually transmitted disease history. Women aged 55–65 and 35–44 years showed significantly lower knowledge compared to those aged 25–34 years. Taneja et al. reported that younger women have greater exposure to health education and digital information sources, enhancing awareness levels [10]. Educational status also strongly influenced knowledge, with women having professional education scoring the highest and illiterate women the lowest, consistent with Chandrika et al.'s findings on the role of formal education in improving cervical cancer literacy [13]. Additionally, the positive association between employment and knowledge aligns with Devarapalli et al., who noted that employed women are more likely to access workplace health interventions and media campaigns [22].

The link between prior screening experience and higher knowledge supports the idea that health system interventions, such as counseling during screening, effectively build awareness. These findings emphasize the need to target older, less educated, and socioeconomically disadvantaged women in future health education campaigns. Women with no previous screening history exhibited significantly higher odds of barriers, corroborating Bhatla et al.'s emphasis on the critical need for early screening to detect precancerous changes [24].

The report underscores a paradox between persons' readiness to attend cervical cancer screening and the considerable obstacles they encounter. To gain a deeper understanding of the cultural and psychosocial variables that contribute to these barriers, additional qualitative study is necessary, concentrating on the attitudes and perceptions that impede access to screening despite stated intentions.

The findings indicate a lack of awareness and screening rates, highlighting a potential to improve Tamil Nadu's Makkalai Thedi Maruthuvam (MTM) program. Incorporating targeted health education and counseling on cervical cancer during community outreach has the potential to enhance awareness and increase screening uptake. Leveraging frontline health workers for information dissemination and referrals has the potential to enhance early detection and reinforce state-led cancer prevention initiatives.

Limitations

This study has few limitations. The geographic focus on rural areas of Madurai district may restrict the generalizability of findings to urban populations with differing sociodemographic profiles. The use of self-reported data on screening history, contraceptive use, and reproductive health introduces potential recall bias. As data were collected through interviewer-administered questionnaires, there is a possibility of social desirability bias, which may have influenced participants' responses. Despite employing a pre-validated questionnaire, certain deep-rooted cultural beliefs, stigmas, and familial influences may not have been fully captured. Additionally, the cross-sectional design limits causal inference. While the study offers valuable quantitative insights into barriers to cervical cancer screening, lack of qualitative methods limits exploration of deep cultural factors.

In conclusion, the study reveals significant gaps in cervical cancer awareness and screening among rural women in Madurai district, despite a moderately positive attitude towards screening. The low screening uptake of only 15.7% highlights a disconnect between intent and action, exacerbated by limited knowledge and various psychosocial and systemic barriers. Key factors such as lower educational levels, older age, and lower socioeconomic status contribute to this knowledge deficit. The findings emphasize the urgent need for targeted interventions that enhance health education, improve access to screening services, and engage the community to address fears and misinformation. By focusing on these determinants and fostering trust in healthcare, it is possible to bridge the gap between knowledge, attitude, and practice, ultimately reducing cervical cancer morbidity and mortality in rural populations. Based on our results, the study underscores the need for policy-level strengthening of community-based cervical cancer screening through primary healthcare systems, particularly in rural settings.

Author Contribution Statement

All authors contributed equally in this study.

Acknowledgements

This research was funded by the MedEngage Academic Research and Innovation Grant of Metropolis Healthcare Limited under its Corporate Social Responsibility initiative. The authors gratefully acknowledge their support.

Conflict of interest

None.

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