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Assessing Knowledge, Attitudes, and Perceptions of Personalized Risk-Stratified Cervical Cancer Screening among Indian Women Using The COM-B Framework: A Mixed-Methods Study

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Abstract

Cervical cancer is one of the leading causes of cancer mortality among Indian women, despite being largely preventable through vaccination and screening. Awareness and uptake of screening methods such as Pap smear, visual inspection under acetic acid, and HPV testing remain low due to limited knowledge, access, and social barriers. This study was conducted to assess knowledge, opportunity, and motivation related to cervical cancer screening among women, and to explore barriers and facilitators influencing uptake of, and willingness to participate in, a risk-stratified screening programme. A mixed-methods study was conducted among 430 women aged 18–60 years. Quantitative data were collected using a validated questionnaire assessing knowledge, attitudes, and perceptions related to cervical cancer screening. Qualitative data were obtained through in-depth interviews and focus group discussions to identify barriers and facilitators to risk-stratified screening. Quantitative data were analysed using descriptive statistics, and qualitative data were analysed thematically. Findings from both components were mapped to the Capability, Opportunity, Motivation–Behaviour (COM-B) framework. Mean age of participants was 36.8 ± 10.2 years; 78.4% were married and 62.3% lived in urban areas. Only 39.5% could identify major risk factors, and 22.3% had ever undergone cervical screening. Participants demonstrated limited awareness of cervical cancer risk factors, HPV testing, and risk-stratified screening, with fear, stigma, cost, privacy concerns, and health-system constraints emerging as key barriers. Willingness to participate increased when screening was free of charge, ensured privacy, and was endorsed by a physician or government programme. Despite high acceptability of cervical cancer screening under supportive conditions, gaps in knowledge and structural constraints limit participation. Programmes that combine risk-stratified screening with physician recommendation, assured privacy, and no-cost access may substantially improve uptake in similar populations.

Key Message

Cervical cancer screening uptake is shaped by capability, opportunity, and motivation, highlighting the value of the COM-B framework in understanding behavioural gaps.

Low awareness, emotional barriers, and structural constraints interact to limit screening, reinforcing the need for COM-B–guided, multi-level interventions.

Physician advice, affordability, and privacy improve screening willingness, showing how COM-B can guide targeted strategies to enhance uptake.

Introduction

Cervical cancer remains a major public health concern globally and continues to impose a substantial burden in low- and middle-income countries (LMICs) [1]. In India, it is the second most common cancer among women and a leading cause of cancer-related mortality [2]. Recent estimates indicate that India reports more than 120,000 new cervical cancer cases annually and nearly 80,000 deaths each year, accounting for a significant proportion of the global burden [3]. Despite being largely preventable through vaccination and early detection, many women in India are still diagnosed at advanced stages of the disease, leading to poorer treatment outcomes and higher mortality. Screening methods such as Pap smear cytology, visual inspection with acetic acid (VIA), and human papillomavirus (HPV) testing enable the identification of precancerous lesions before

they progress to invasive cancer [4]. Countries that have implemented organised screening programmes have observed substantial reductions in cervical cancer burden [5]. However, in India, screening coverage remains extremely limited. National-level analyses indicate that only about 2% of women aged 30–49 years have ever undergone cervical cancer screening [6].

Several studies conducted in India have consistently reported low awareness regarding cervical cancer risk factors, screening methods, and the role of HPV infection [7–9]. Women often lack knowledge about the availability of screening services, the recommended age for screening, and the importance of undergoing screening even in the absence of symptoms [10, 11]. Social and cultural barriers, limited access to screening facilities, and inadequate healthcare infrastructure also play an important role in restricting participation in screening programmes [12].

In recent years, there has been growing interest in personalised risk-stratified screening strategies to cervical cancer prevention [13]. Traditional screening programmes generally apply uniform screening intervals to all eligible women regardless of individual risk. In contrast, personalised screening approaches incorporate individual risk factors such as HPV status, age, and previous screening results to determine appropriate screening intervals and follow-up strategies. This has the potential to optimise resource use, reduce unnecessary testing, and improve the effectiveness of screening programmes, particularly in resource-limited settings [14, 15].

However, evidence regarding the feasibility, acceptability, and behavioural determinants of personalised risk-stratified screening strategies in the Indian context remains limited. The Capability, Opportunity, Motivation–Behaviour (COM-B) model conceptualises behaviour as the result of interactions between capability, opportunity, and motivation, offering a structured way to identify barriers and facilitators influencing health-related behaviours[16]. Applying this framework can help identify behavioural determinants that may affect women's willingness to participate in cervical cancer screening and adopt personalised screening approaches.

Therefore, the present study aimed to assess the capability, opportunity, and motivation influencing the adoption of personalised risk-stratified cervical cancer screening among Indian women. The secondary objectives were to measure women's knowledge of cervical cancer risk factors and screening methods, assess their confidence in accessing screening services, explore social and cultural influences affecting screening behaviour, and identify key behavioural domains associated with screening uptake and intention. By integrating quantitative and qualitative findings within the COM-B framework, this study seeks to provide an understanding of the behavioural factors shaping cervical cancer screening participation in India.

Materials and Methods

Study design

A mixed-methods study was conducted in and around Hyderabad to explore behavioural determinants influencing the adoption of personalised risk-stratified cervical cancer screening among women. The study combined quantitative and qualitative approaches to obtain a comprehensive understanding of knowledge, perceptions, and contextual factors related to cervical cancer screening behaviour.

The quantitative component consisted of a cross-sectional survey assessing women's knowledge, attitudes, barriers, and intentions regarding cervical cancer screening. The qualitative component involved in-depth interviews (IDIs) and focus group discussions (FGDs) aimed at exploring women's experiences, beliefs, and social influences related to screening participation and personalised screening approaches.

Findings from both components were subsequently interpreted using the COM-B framework, which provides a structured approach to identifying behavioural determinants associated with health-related actions.

Study setting and participants

The study was conducted among women aged 18 to 60 years residing in in and around Hyderabad, India. Women within the eligible age group who were willing to participate and able to provide informed consent were included in the study. Women who had previously been diagnosed with cervical cancer or who were unable to participate due to severe illness were excluded from the study. Participation was voluntary, and all eligible participants were provided with information about the purpose and procedures of the study prior to enrolment.

A total of 430 women participated in the quantitative survey. A subset of participants from this group voluntarily participated in the qualitative component, which consisted of IDIs and FGDs aimed at exploring experiences and perceptions related to cervical cancer screening in greater detail.

Recruitment

Participants were recruited using a community-based approach. Women attending community outreach programmes and healthcare facilities were informed about the study and invited to participate. Recruitment was conducted over a predefined study period until the target sample size was reached.

Women who expressed interest in participating were provided with detailed information about the study and asked to provide written informed consent. For the qualitative component, participants were purposively selected to ensure variation in age, educational background, and prior screening experience. Recruitment for qualitative interviews and discussions continued until sufficient diversity of perspectives was obtained.

Data collection

Quantitative data collection

Quantitative data were collected using a structured questionnaire designed to assess knowledge, attitudes, and perceptions related to cervical cancer and screening practices. The questionnaire included sections on socio-demographic characteristics, awareness of cervical cancer risk factors, knowledge of available screening methods, perceived accessibility of screening services, and intentions to participate in screening.

The questionnaire (supplementary file) was developed based on existing literature and previously validated instruments used in cervical cancer screening research[17, 18]. Questions were adapted to ensure cultural relevance and clarity for the study population. Prior to the main study, the questionnaire was reviewed for comprehensibility and clarity.

Participants completed the questionnaire in a face-to-face setting with assistance from trained researchers when necessary. Responses were recorded anonymously to ensure confidentiality.

Qualitative data collection

Qualitative data were collected through IDIs and FGDs with selected participants from the study population. A semi-structured interview guide was developed to explore participants' perceptions, beliefs, and experiences related to cervical cancer screening.

Topics included awareness of cervical cancer and screening methods, perceptions of personalised screening approaches, barriers and facilitators to screening participation, social influences, and emotional responses associated with screening decisions. Open-ended questions were used to encourage participants to share their perspectives in their own words. All IDIs and FGDs were conducted by trained researchers experienced in qualitative data collection. Interviews were conducted in a private setting to ensure participant comfort and confidentiality. With participants' consent, discussions were audio-recorded and later transcribed verbatim for analysis.

Data analysis

Quantitative analysis

Quantitative data obtained from the questionnaire were entered into IBM SPSS Statistics (Version 29.0; IBM Corp., 2022). Descriptive statistics were used to summarise socio-demographic characteristics and responses related to knowledge, attitudes, and perceptions of cervical cancer screening.

Frequencies and percentages were calculated for categorical variables, while continuous variables were summarised using appropriate descriptive measures.

Qualitative analysis

Qualitative data obtained from IDIs and FGDs were transcribed verbatim and analysed using thematic analysis. The analysis involved multiple stages, including familiarisation with the data, identification of meaningful text segments, coding of relevant concepts, and grouping of similar codes into broader themes.

An iterative approach was used during the coding process, allowing new categories to be derived from the data while also considering themes informed by the research objectives. The coding process was conducted independently by members of the research team, and differences in interpretation were discussed until consensus was reached.

Themes identified through the analysis reflected key barriers and facilitators influencing women's participation in cervical cancer screening, as well as perceptions related to personalised risk-stratified screening approaches.

Data synthesis and theoretical framework

The COM-B model was used as a theoretical framework to organise and interpret the study findings. This model comprises of three components: capability, opportunity, and motivation, each of which is further divided into two subcomponents and collectively influences behaviour [19].

The model was applied to analyse and understand behavioural factors associated with participation in personalised risk-stratified cervical cancer screening and to identify both internal and external mechanisms influencing screening behaviour. Understanding these behavioural determinants is important for the development of effective interventions aimed at improving screening uptake. Within the COM-B framework, behaviour is considered to occur when individuals possess sufficient capability, have the opportunity to perform the behaviour, and are motivated to act [19].

The advantages of applying the COM-B framework include its strong theoretical basis and its widespread use in behavioural and implementation research. The framework provides a clear and structured approach for identifying key barriers and facilitators influencing health-related behaviours. The model also offers a comprehensive perspective by considering both individual-level factors and broader environmental influences, as well as deliberate decision-making processes and emotional responses. Although other behavioural frameworks, such as the Theoretical Domains Framework, were considered, the COM-B model was selected because of its conceptual clarity and practical applicability in identifying behavioural determinants relevant to screening participation.

Results

Participant characteristics

A total of 430 women aged 18–60 years participated in the quantitative survey. The mean age of participants was 36·8 years. Most of the participants were married (62·33%). Slightly more than half of the participants resided in urban areas (54·65%), with the remainder living in rural settings (45·35%). Educational attainment was predominantly secondary or higher secondary (83·72%). Nearly half of the participants were employed (47·21%), followed by homemakers (21·63%). Most participants belonged to the middle socioeconomic category (83·02%). More than half of the participants reported having one or two children (53·95%). Health insurance coverage was reported by 252 participants (58·60%). With respect to HPV vaccination status, 39% reported no vaccination, while almost 46% had received at least one dose (Table 1).

Table 1
Socio-Demographic Characteristics (N = 430)

Variables	Category	N (%)
Age (years)		36.80 ± 10.21
Marital status	Married	268 (62.33)
	Unmarried	100 (23.26)
	Widowed	20 (4.65)
	Divorced/Separated	42 (9.77)
Place of residence	Urban	235 (54.65)
	Rural	195 (45.35)
Education level	No formal education	8 (1.86)
	Primary	43 (10.00)
	Secondary	164 (38.14)
	Higher secondary	196 (45.58)
	Graduate and above	20 (4.65)
Occupation	Homemaker	93 (21.63)
	Employed	203 (47.21)
	Self-employed	78 (18.14)
	Unemployed	56 (13.02)
Socioeconomic status	Low	58 (13.49)
	Middle	357 (83.02)
	High	15 (3.49)
Parity	Nulliparous	159 (36.98)
	1–2 children	232 (53.95)
	≥ 3 children	39 (9.07)
Health insurance	Yes	252 (58.60)
	No	178 (41.40)
Vaccinated against HPV	No	168 (39.07)
	1 dose	197 (45.81)
	2 doses	30 (6.98)
	3 doses	35 (8.14)

HPV: Human Papilloma Virus

Knowledge of cervical cancer and screening practices

As outlined in Table 2, overall awareness regarding cervical cancer and its prevention was limited. Only 36% of the participants were aware that cervical cancer is preventable. Awareness of HPV as a causal factor was reported by 125 participants (29·07%), and 133 (30·93%) correctly identified at least one major risk factor. Awareness of cervical cancer screening methods was reported by only 165 participants.

Table 2
Knowledge and screening practices related to cervical cancer (N = 430)

Variable	N (%)
Awareness that cervical cancer is preventable	156 (36.28)
Awareness of HPV as a cause of cervical cancer	125 (29.07)
Correct identification of ≥ 1 cervical cancer risk factor	133 (30.93)
Awareness of cervical cancer screening methods	165 (38.37)
Awareness of Pap smear	142 (33.02)
Awareness of VIA	118 (27.44)
Awareness of HPV testing	129 (30.00)
Knowledge that screening is recommended even without symptoms	56 (13.02)
Awareness of government screening services	166 (38.60)
Awareness of HPV vaccination	255 (59.30)
VIA: Visual Inspection under Acetic Acid; HPV: Human Papilloma Virus	

COM-B Findings

Qualitative data from 48 participants who participated in IDIs and FGDs were analysed thematically and mapped to the COM-B framework (Table 3).

Psychological Capability

Limited knowledge and understanding of cervical cancer screening and personalised screening approaches were identified as key barriers. Most participants reported little prior awareness of risk-stratified screening and difficulty distinguishing it from routine screening practices. Misinterpretation of screening recommendations was common, particularly the assumption that screening was only necessary in the presence of symptoms or that a “low-risk” result indicated no future risk of cancer.

“[….] Honestly, I thought screening is only needed if there are symptoms. If everything feels normal, then why go for the test?” (Participant 12).

“[….] If the report says low risk, I would think that means there is no chance of getting cancer later.” (Participant 7).

Participants also reported uncertainty regarding follow-up after receiving screening results and confusion between screening tests and treatment procedures. Low confidence in interpreting screening recommendations

led many participants to rely on healthcare providers for guidance.

"[….] I don't really understand these tests. If the doctor explains it properly, then I can decide whether to do it." (Participant 19).

"Sometimes we hear about Pap smear or HPV, but it is not clear what exactly each test is for. [….]" (Participant 10).

Physical Capability

Misconceptions regarding the physical aspects of screening procedures were frequently reported. Participants described fears related to pain, bleeding, or potential harm associated with pelvic examinations, which discouraged participation in screening.

"I have heard that the test can be painful, so I avoid going for it. [….]" (Participant 5).

"[….] Some women say there can be bleeding after the test, so I am scared." (Participant 13).

Concerns about discomfort were also linked to the conditions of screening facilities. Government facility-based screening was sometimes described as crowded or uncomfortable. However, a small number of participants perceived personalised screening positively, as it could potentially reduce unnecessary examinations.

"[….] In government hospitals there is too much crowd and not enough comfort during examination." (Participant 23).

"[….] If the test shows that I don't need to repeat it often, then it would be easier for me." (Participant 31).

Social Opportunity

Social and cultural norms strongly influenced screening behaviour. Participants frequently reported limited discussion of cervical cancer and gynaecological health within families or communities. Social norms related to modesty often discouraged open discussion of these issues.

"In our families these issues are not talked about openly. [….]" (Participant 2).

"[….] Women feel shy discussing these problems even with close relatives." (Participant 9).

Stigma associated with HPV infection and concerns about confidentiality further influenced screening decisions. Participants described reluctance to disclose HPV-related information and emphasised the importance of family support in enabling attendance at screening appointments.

"If someone hears that you have HPV, people start making assumptions. [….]" (Participant 24).

"My husband encouraged me to go for the test, otherwise I might not have done it. [….]" (Participant 17).

Physical Opportunity

Health-system factors also influenced screening participation. Participants frequently reported long waiting times and the need for multiple visits at government facilities. Limited awareness that screening could be conducted during routine visits at primary health centres further reduced opportunities for screening.

“[….] In government hospitals you have to wait for many hours, and sometimes you have to come again the next day.” (Participant 26).

“I have no idea that these tests can be done at nearby health centres. [….]” (Participant 11).

Conversely, willingness to undergo screening increased when services were free of cost, accessible, and integrated with routine healthcare services. Participants also emphasised the importance of privacy and the availability of female healthcare providers during screening.

“If the test is free and available nearby, I would definitely do it. [….]” (Participant 4).

“[….] If there is a separate room and a female doctor, I will feel more comfortable.” (Participant 14).

Reflective Motivation

Participants expressed both supportive and cautious attitudes toward personalised screening. Some recognised the potential benefits of risk-based screening, including reduced frequency of testing and more efficient use of healthcare services. Screening was also perceived as more acceptable when recommended by healthcare providers or implemented through government programmes.

“If doctors explain our risk and guide us properly, then this kind of screening can be useful.” (Participant 33).

“If the government recommends it, then people will trust the programme more.” (Participant 18).

However, several participants preferred uniform screening intervals because they perceived more frequent testing as safer. Concerns were also expressed that extended screening intervals might delay detection of cancer.

“If everyone does the test regularly, it feels safer.” (Participant 15).

“If the gap between tests becomes too long, there is a fear that something might be missed.” (Participant 28).

Automatic Motivation

Emotional responses played an important role in shaping screening behaviour. Fear and anxiety related to cancer diagnosis were frequently reported and often discouraged participation in screening.

“I feel scared to do the test because what if the result shows cancer? [….]” (Participant 6).

“If cancer is found, my uterus will have to be removed. [….]” (Participant 10).

HPV-positive results were also perceived as emotionally distressing and potentially damaging to social relationships. At the same time, some participants described reassurance when screening was conducted through organised government programmes, and a few participants perceived personalised screening as empowering.

“If I test positive, it will create tension in the family. [….]” (Participant 24).

“When the government provides the test, it feels safer and more reliable. [….]” (Participant 18).

Table 3
Barriers and facilitators to cervical cancer screening and risk-stratified screening mapped to the COM-B framework (N = 48)

COM-B Component	Knowledge	Attitude	Perception
Psychological Capability	Lack of prior awareness of personalized, risk-stratified cervical cancer screening (N = 42) Difficulty distinguishing routine screening from risk-based screening approaches (N = 42) Uncertainty regarding follow-up processes after receiving risk-stratified results (N = 41) Limited understanding that Pap smear or VIA screening is recommended even in the absence of symptoms (N = 40) Interpretation of “low risk” as implying no future cancer risk (N = 40) Limited awareness of HPV vaccination as a preventive strategy for cervical cancer (N = 39) Confusion between screening tests and treatment procedures (N = 31) Limited understanding of HPV as a causal factor in cervical cancer (N = 30) Limited awareness that cervical cancer screening is offered under government programs (N = 28)	Low confidence in personal understanding of screening recommendations (N = 39) Unwillingness to visit healthcare facilities (N = 17) Dependence on healthcare providers for interpretation of risk-based screening information (N = 8)	Risk perceived to be low among women within marriage (N = 36) Personal cervical cancer risk perceived as either lower than expected (N = 27) Risk categorisation viewed as challenging to understand without professional explanation (N = 8) Cervical cancer perceived as an unavoidable disease rather than preventable through screening (N = 4)
Physical Capability	Misconceptions regarding pain, bleeding, or harm associated with screening methods (N = 37) Limited awareness of the level of invasiveness associated with different cervical cancer	Physical discomfort during screening influencing willingness to undergo repeated testing (N = 39)	Government facility–based screening perceived as physically uncomfortable or poorly resourced (N = 32) Screening procedures perceived as physically demanding over time (N = 28)

COM-B Component	Knowledge	Attitude	Perception
	screening methods (N = 25)		Personalized screening viewed as a means to reduce unnecessary physical examinations (N = 17)
Social Opportunity	Limited discussion of cervical cancer screening within families or communities (N = 37) Exposure to misinformation through family members or peers (N = 31) Information about cervical cancer screening obtained from health care workers / healthcare providers (N = 23) Limited clarity regarding the role of ASHAs in counselling, referral, and follow-up for cervical cancer screening (N = 10)	Hesitation to disclose gynaecological issues due to social norms around modesty (N = 47) Reluctance to discuss HPV status or screening decisions within social circles (N = 40) Preference for advice from frontline health workers over doctors for screening decisions (N = 31) Reluctance to undergo screening due to lack of privacy or female healthcare providers (N = 15) Lack of trust in clinician recommendations related to low screening frequency (N = 2)	Family support perceived as necessary to attend screening appointments (N = 43) HPV positivity perceived as socially stigmatizing (N = 33) Social support regarded as important for following screening recommendations (N = 10) Concerns about confidentiality when discussing screening or HPV status with local health workers from the same community (N = 10) Screening perceived as more acceptable when endorsed by a physician rather than offered as a general programme (N = 5)
Physical Opportunity	Limited awareness that screening can be done at primary health centres during routine visits (N = 16)	Greater willingness to participate in screening when services are provided at no cost (N = 47) Positive attitudes towards opportunistic screening when offered during other services (N = 39) Concern about long waiting times and multiple visits at government facilities (N = 37) Concerns about the nearest health facility's ability to manage individualized screening schedules (N = 24) Preference for screening facilities that ensure privacy, including availability of female providers and separate examination spaces (N = 13)	Personalized screening perceived as convenient when incorporated into routine care (N = 29) Concern about missed follow-up under longer screening intervals (N = 18)

COM-B Component	Knowledge	Attitude	Perception
Reflective Motivation	Awareness that early detection through screening can prevent advanced cervical cancer (N = 21) Limited understanding of the long interval between HPV infection and cancer development (N = 17) Awareness that personalized screening may help reduce unnecessary testing (N = 10)	Willingness to accept risk-based screening (N = 40) Preference for uniform screening intervals despite understanding the rationale for personalization (N = 37) Preference for treatment-focused care over preventive screening (N = 37) Acceptance of screening when recommended as part of a government program (N = 31)	Scepticism regarding the quality of screening provided at public facilities (N = 34) Government-led screening perceived as trustworthy by participants (N = 23) Concern that extended screening intervals could delay cancer detection (N = 3)
Automatic Motivation		Cervical cancer screening commonly associated with fear or anxiety (N = 42) Fear associated with cancer diagnosis discouraging participation in screening (N = 41) Anxiety driving a preference for more frequent screening irrespective of assessed risk (N = 20) Reassurance from being screened under a government program increasing participation (N = 8)	HPV-positive results perceived as emotionally distressing (N = 35) Screening perceived as threatening due to fear of surgery, hysterectomy, or infertility (N = 30) HPV vaccination perceived with suspicion due to concerns about safety or fertility (N = 23) Risk stratification perceived as empowering (N = 4)

N indicates the number of participants whose responses reflected the theme during qualitative interviews or focus group discussions; values are provided to indicate relative prominence of themes and do not represent prevalence estimates.

Discussion

The present mixed-methods study examined behavioural determinants influencing the adoption of personalised risk-stratified cervical cancer screening among Indian women using the COM-B framework. Overall, the findings suggest that although many women expressed willingness to undergo screening when supportive conditions were present, several behavioural and structural barriers continue to limit participation. Physician recommendation, benefits of early detection, availability of free screening services, and assurance of privacy were identified as important facilitators. In contrast, limited awareness regarding cervical cancer risk factors and screening modalities, fear of diagnosis, embarrassment associated with pelvic examinations, and financial barriers were commonly reported barriers. These findings indicate that screening behaviour is shaped by capability, opportunity, and motivational factors rather than by knowledge alone.

The sociodemographic characteristics of participants in the present study are consistent with those reported in previous studies examining cervical cancer awareness among Indian women. The mean age of participants was 36 years, corresponding to the age group typically targeted in cervical cancer prevention programmes. Similar demographic distributions have been reported by Begam et al [20]. The predominance of married women in the present study is also consistent with findings reported by Shin et al., who noted that married women tend to be overrepresented in reproductive health research due to greater interaction with healthcare services [21]. However, previous studies have suggested that such contact with healthcare systems does not necessarily translate into improved awareness of cervical cancer prevention strategies [22, 23]. Educational attainment among participants in the present study was relatively high, with most women having completed secondary or higher secondary education. While higher educational levels are typically associated with improved health literacy [24], the knowledge gaps regarding cervical cancer prevention indicates that general education may not adequately address specific gaps in reproductive health awareness.

The present study also identified a lack in awareness regarding cervical cancer risk factors and screening methods. Awareness of HPV infection as the primary etiological agent of cervical cancer was limited. Similar findings have been reported across several studies conducted in India and other LMICs. Sivasubramanian et al. reported that knowledge regarding HPV infection and its association with cervical cancer was extremely low among Indian women [25]. Shrestha et al. observed that although some women had heard of cervical cancer, awareness of screening procedures such as Pap smear and HPV testing remained inadequate [26]. These findings are consistent with conclusions from a systematic review and meta-analysis by Hassine et al., which reported persistently low awareness of cervical cancer risk factors and screening methods across many low-resource settings [27]. Limited awareness of HPV infection may contribute to poor acceptance of HPV-based screening and vaccination programmes.

Screening uptake observed in the present study was low, which aligns with findings from national surveys and regional studies conducted in India. Singh et al. highlighted the substantial burden of cervical cancer in India and emphasised that screening coverage remains extremely limited despite the availability of effective screening technologies [28]. Analysis of national survey data by Subramanian et al. further demonstrated that only a small proportion of eligible women in India have ever undergone cervical cancer screening [29]. These findings are consistent with those of Petersen et al., whose systematic review examining barriers to cervical cancer screening in LMICs identified low awareness, limited access to services, and sociocultural barriers as major determinants of screening utilisation [30].

Applying the COM-B framework provided insights into behavioural determinants influencing screening participation. Within the capability domain, psychological capability was primarily affected by limited knowledge and understanding of cervical cancer prevention. Participants frequently expressed uncertainty regarding the purpose of screening, eligibility criteria, and available screening methods. Similar findings have been reported by Fernandez et al., who emphasized that inadequate health literacy significantly limits participation in preventive health programmes [31]. Improving knowledge through targeted health education therefore remains a key strategy for increasing screening uptake.

Opportunity-related factors also played an important role in shaping screening behaviour. Physician recommendation was as one of the strongest facilitators reported by participants in the present study. This finding is consistent with that of Topuridze et al., who demonstrated that healthcare provider endorsement is

one of the strongest predictors of cervical cancer screening participation [32]. Similarly, Rana et al. observed that women who received advice from healthcare professionals were significantly more likely to undergo cervical cancer screening [33]. Clinical consultations therefore represent an important opportunity for healthcare providers to promote preventive screening and address patient concerns regarding screening procedures.

Structural barriers related to healthcare accessibility were also highlighted in the present study. Participants frequently reported concerns regarding cost, time constraints, and privacy during screening procedures. Similar barriers have been documented in several previous studies conducted in low-resource settings. Gurayah et al. demonstrated that logistical barriers such as travel distance, service availability, and financial constraints significantly influence screening participation [34]. Sivaram et al. further emphasised that organised screening programmes and accessible services are critical for improving screening coverage at the population level [35].

Motivational factors were also important determinants of screening behaviour. Reflective motivation was influenced by participants' perceptions regarding the benefits of early detection and their trust in medical advice. Women who believed that screening could prevent serious illness were more likely to express willingness to participate. Similar findings have been reported by Topuridze et al. and Lamichhane et al., who identified perceived benefits and healthcare provider recommendation as key predictors of screening uptake [32, 36]. Automatic motivation was shaped by emotional responses such as fear of cancer diagnosis and embarrassment related to pelvic examinations. Emotional barriers have been widely reported in qualitative studies examining cervical cancer screening behaviour. For example, Bae et al. found that stigma, fear, and embarrassment frequently discourage women from undergoing cervical cancer screening in conservative cultural contexts [37].

Support from healthcare professionals and family members were also identified as important facilitators of screening behaviour in the present study. Similar findings have been reported by Documet et al., whose findings highlighted the important role of social support in influencing participation in cancer screening programmes [38]. These findings suggest that cervical cancer prevention programmes may benefit from involving family members and community networks in awareness and education initiatives.

The findings of the present study have several implications for cervical cancer prevention programmes. Interventions aimed at improving screening uptake should address not only knowledge deficits but also emotional and structural barriers. Strengthening physician-led counselling during routine healthcare encounters, expanding access to affordable screening services, and ensuring privacy during examinations may help increase participation in screening programmes. Personalised risk-stratified screening approaches may improve acceptability by modifying screening recommendations to individual risk profiles, as suggested by Perkins et al., who highlighted the potential benefits of risk-based screening strategies for improving screening efficiency and resource utilisation [39].

The present study has several strengths. The mixed-methods design allowed integration of quantitative findings with qualitative findings, providing a more comprehensive understanding of behavioural determinants influencing screening uptake. The application of the COM-B framework enabled a structured analysis of behavioural influences affecting preventive health behaviour. However, several limitations should also be considered. The study was conducted within a specific geographic setting, which may limit the generalisability of findings to other regions, particularly rural populations where healthcare access may be more limited. Self-reported screening behaviour may be subject to recall bias or social desirability bias.

In conclusion, the present study highlights behavioural and structural barriers influencing cervical cancer screening participation among Indian women. Although many participants expressed willingness to undergo screening under favourable conditions, limited awareness, emotional concerns, and health-system constraints continue to restrict uptake. Addressing these barriers through targeted health education, physician-led counselling, and improved accessibility of screening services may substantially improve participation in cervical cancer prevention programmes. Integrating behavioural insights into screening programme design may therefore play an important role in reducing the burden of cervical cancer in India.

Abbreviations

COM-B: Capability, Opportunity, Motivation–Behaviour

FGD: Focus Group Discussion

HPV: Human Papillomavirus

IDI: In-Depth Interview

LMICs: Low- and Middle-Income Countries

NFHS-5: National Family Health Survey, Fifth Round

SPSS: Statistical Package for the Social Sciences

VIA: Visual Inspection with Acetic Acid

Declarations

Ethics approval and consent to participate

The study received ethical approval from the Apollo Institute of Medical Sciences and Research, Hyderabad (Approval No. EC/NEW/INST/1527/2025/12/001). The research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and its subsequent amendments.

Participation in the study was entirely voluntary, and written informed consent was obtained from all participants prior to data collection. Participants were informed about the objectives of the study, the procedures involved, and their right to withdraw from the study at any stage without any adverse consequences.

Confidentiality and anonymity of participants were strictly maintained throughout the research process. All data were securely stored, accessible only to the research team, and used solely for research purposes.

Consent for publication

Not applicable

Availability of data and materials

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

Competing Interests

Not applicable

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Authors' contributions

KGM: Conceptualisation, methodology, data curation, formal analysis,

investigation, validation, writing – original draft.

SP, KGM, AR: Conceptualisation, methodology, data curation, formal analysis

KRP: Investigation, validation, writing – review and editing.

NRP: Conceptualisation, methodology, funding acquisition

NP: Project administration, supervision, writing – review and editing.

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Not applicable

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