

Awareness and Knowledge of Pap Smear Screening, Cervical Cancer, and HPV Infection among Urban Women: A Cross-Sectional Study from Bettiah, Bihar

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Abstract:

Background: Cervical cancer remains one of the most preventable cancers in women, yet it continues to be a major public health challenge in low- and middle-income countries. Screening through Pap smear and prevention by HPV vaccination are effective strategies to reduce incidence and mortality. Despite this, awareness and utilization of these measures remain suboptimal among women in many urban settings in India.

Objectives: To assess the awareness of cervical cancer, Pap smear screening, and HPV infection among urban women; to evaluate knowledge across domains of risk factors, symptoms, prevention, and screening practices; and to identify sociodemographic predictors influencing adequate knowledge.

Methods: This cross-sectional study was conducted at Government Medical College and Hospital, Bettiah, Bihar, from December 2023 to November 2024. A total of 150 urban women aged 18–60 years were enrolled using systematic consecutive sampling in outpatient clinics and urban health posts. Data were collected through a pre-tested bilingual (English/Hindi) structured questionnaire covering sociodemographic variables, awareness and knowledge domains, and screening/vaccination practices. Knowledge was scored across domains, and adequacy was defined using a predefined threshold. Data were analyzed using descriptive statistics, chi-square tests, and multivariable logistic regression.

Results: Overall, 61.3% of participants had heard of cervical cancer, 48.0% were aware of Pap smear screening, and only 22.7% knew about HPV infection. Adequate knowledge was observed in 29.3% of women. Awareness of risk factors was limited, with multiple sexual partners and HPV infection being poorly recognized. Knowledge about preventive strategies, including Pap smear screening intervals and HPV vaccination, was particularly low. Higher education, younger age, and prior exposure to health sessions were significantly associated with better knowledge.

Conclusions: Despite residing in an urban setting, most women demonstrated inadequate awareness and knowledge regarding cervical cancer, Pap smear screening, and HPV infection. Structured community-based educational programs, integration of cervical cancer awareness into primary healthcare, and active promotion of HPV vaccination are urgently needed to improve preventive practices and reduce disease burden.

Keywords: Cervical cancer; Pap smear; HPV infection; Screening; Urban women; Awareness; India

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Introduction

Cervical cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide, particularly in low- and middle-income countries. It is widely recognized as a preventable malignancy because of its well-understood natural history, identifiable precursor lesions, and the availability of effective screening and vaccination strategies [1]. Globally, infection with high-risk human papillomavirus (HPV) strains, particularly HPV 16 and 18, is established as the primary etio-

logical factor. Persistent infection can lead to cervical intraepithelial neoplasia and, eventually, invasive carcinoma if left undetected and untreated [2].

Despite significant advances in preventive healthcare, India contributes disproportionately to the global cervical cancer burden. The country accounts for nearly one-fifth of all cases, with an estimated incidence of over 120,000 new cases annually. The disease predominantly affects women in their most productive years, leading not only to health consequences but also to profound social and

economic impacts [3]. Although simple, low-cost screening methods such as the Pap smear have been in practice for decades and newer modalities like HPV testing are available, coverage remains low. Contributing factors include lack of awareness, cultural stigma, limited accessibility, and insufficient integration of screening into routine healthcare services [4].

Awareness of cervical cancer and its preventive measures is strongly associated with education, urbanization, and access to health information. Urban women are expected to have greater exposure to health-related knowledge due to better access to healthcare facilities, educational opportunities, and digital platforms [5]. However, multiple studies have revealed that even in urban populations, awareness about Pap smear screening, HPV infection, and vaccination remains suboptimal. Misconceptions about cervical cancer being a hereditary or unavoidable disease, coupled with cultural barriers against discussing reproductive health, further deter women from seeking timely screening [6].

The Pap smear test is a cost-effective and reliable method for detecting precancerous changes. Despite being recommended as the gold standard for decades, utilization in India remains far below international benchmarks [7]. Similarly, HPV vaccination has the potential to significantly reduce future cervical cancer incidence, yet uptake is minimal due to limited awareness, high cost, and sociocultural resistance. Without adequate knowledge, women may neither demand screening nor consent to vaccination for themselves or their daughters, perpetuating the cycle of preventable morbidity and mortality [8].

In Bihar, one of India's most populous states, awareness regarding reproductive health issues is particularly limited, compounded by socioeconomic constraints and health system challenges. Bettiah, as an urban center, presents an opportunity to study knowledge patterns among women who theoretically have better access to healthcare and education. Generating local data on their awareness of cervical cancer, Pap smear screening, and HPV infection is vital for designing context-appropriate interventions that address specific barriers and misconceptions.

Therefore, it is of interest to assess the level of awareness and knowledge about cervical cancer, Pap smear screening, and HPV infection among urban women in Bettiah, Bihar. This study aims to identify gaps, highlight sociodemographic determinants of knowledge, and generate evidence to support the integration of structured awareness and preventive strategies into existing healthcare frameworks.

Material and Methods

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Study design and setting: This was a cross-sectional, questionnaire-based study conducted in the Department of Obstetrics and Gynecology, Government Medical College and Hospital (GMCH), Bettiah, Bihar, India. Data were collected from urban women attending outpatient clinics at GMCH as well as through outreach at designated urban health posts in Bettiah town.

Study period: December 2023 to November 2024

Study population and eligibility criteria: The study population comprised urban women aged 18–60 years residing within Bettiah municipal wards. Inclusion criteria were: (i) women aged ≥ 18 years, (ii) urban residence for at least one year, and (iii) willingness to participate after providing consent. Women with a prior history of cervical cancer, those critically ill at the time of survey, or unable to comprehend the questionnaire were excluded.

Sample size and sampling method: A total of 150 women were enrolled. Sample size was determined using the single-proportion formula with expected awareness of Pap smear $\sim 50\%$, 95% confidence, and 8% precision, yielding 138; accounting for non-response, the final sample was set at 150. Sampling followed a systematic consecutive approach, where every eligible woman attending outpatient clinics on survey days was approached.

Study tool

A structured, bilingual (English/Hindi) questionnaire was developed after reviewing relevant guidelines and validated tools used in prior cervical cancer awareness research. Content validity was established by a panel of subject experts, and the tool was piloted on 20 women not included in the final study. The final questionnaire consisted of five sections:

1. Sociodemographic characteristics (age, education, occupation, marital status, parity, socioeconomic status).
2. Awareness of cervical cancer (heard of it, risk perception).
3. Knowledge of risk factors and symptoms (multiple partners, early marriage, multiparity, HPV infection, post-coital bleeding, foul discharge).
4. Awareness and knowledge of Pap smear (purpose, eligibility, recommended interval, willingness to undergo).
5. Awareness of HPV infection and vaccination (causal role, availability of vaccines, willingness to vaccinate daughters).

Operational definitions: Awareness was defined as having heard of cervical cancer, Pap smear, or HPV infection. Knowledge was scored across domains, with each correct answer awarded 1 point. Total knowledge scores ranged from 0 to 20, and a cut-off of ≥ 12 was defined a priori as adequate knowledge. Domain-wise adequacy was also assessed to identify specific knowledge gaps.

Data collection procedure: Participants were briefed about the study, and questionnaires were administered face-to-face in a private setting by trained female investigators. The average completion time was 15–20 minutes. Any queries were clarified, but answers were recorded as provided. Completed forms were checked for completeness on-site.

Data management and quality control: Data were double-entered into a secured database and cross-validated for consistency. Supervisors conducted random checks of 10% of forms to ensure accuracy. Data were anonymized before analysis.

Statistical analysis: Descriptive statistics summarized sociodemographic variables and awareness/knowledge measures. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as mean \pm standard deviation. Associations between knowledge adequacy and sociodemographic factors were tested using chi-square or Fisher's exact test. Variables with $p < 0.20$ in bivariable analysis were entered into multivariable logistic regression to

identify independent predictors, with results presented as adjusted odds ratios and 95% confidence intervals. Statistical significance was set at $p < 0.05$.

Results

A total of 150 urban women were included in the study. The mean age was 34.8 ± 8.6 years, with the majority in the 31–40 years age group. Most participants were married, multiparous, and homemakers, with education levels ranging from illiterate to post-graduate. Nearly two-thirds belonged to the middle socioeconomic class. Overall, 61.3% of women reported having heard of cervical cancer, 48.0% were aware of the Pap smear test, and only 22.7% knew about HPV infection. Knowledge of risk factors and early symptoms was generally poor, and very few participants had ever undergone a Pap smear or received HPV vaccination. Higher educational attainment, younger age, and prior participation in health awareness sessions were significantly associated with better knowledge scores.

Table 1: Distribution of participants by age group

Age group (years)	Number (n=150)	Percentage (%)
18–25	27	18.0
26–30	33	22.0
31–40	56	37.3
41–50	24	16.0
>50	10	6.7

Table 2: Educational status of participants

Education	Number (n=150)	Percentage (%)
Illiterate	19	12.7
Primary	28	18.7
Secondary	54	36.0
Graduate and above	49	32.6

Table 3: Occupational and marital profile

Variable	Category	Number (n=150)	Percentage (%)
Occupation	Homemaker	93	62.0
	Service/Professional	34	22.7
	Business/Other	23	15.3
Marital status	Married	128	85.3
	Unmarried/Widowed/Divorced	22	14.7

Table 4: Awareness of cervical cancer, Pap smear, and HPV

Awareness	Number (n=150)	Percentage (%)
Heard of cervical cancer	92	61.3
Heard of Pap smear	72	48.0
Heard of HPV infection	34	22.7

Table 5: Knowledge of cervical cancer risk factors

Risk factor identified	Number (n=150)	Percentage (%)
Multiple sexual partners	41	27.3
Early marriage/early sexual activity	47	31.3

High parity	58	38.7
Poor genital hygiene	66	44.0
HPV infection	34	22.7

Table 6: Knowledge of symptoms of cervical cancer

Symptom identified	Number (n=150)	Percentage (%)
Post-coital bleeding	53	35.3
Foul-smelling vaginal discharge	61	40.7
Irregular vaginal bleeding	67	44.7
Pelvic pain	49	32.7

Table 7: Knowledge of Pap smear screening

Item	Number (n=150)	Percentage (%)
Knew Pap smear detects precancerous changes	65	43.3
Knew Pap smear is recommended for all married women	59	39.3
Knew screening should begin by 21 years or within 3 years of sexual activity	42	28.0
Correct screening interval (3 years)	38	25.3
Ever undergone Pap smear	17	11.3

Table 8: Awareness of HPV vaccination

Item	Number (n=150)	Percentage (%)
Heard of HPV vaccine	29	19.3
Believed vaccine prevents cervical cancer	22	14.7
Willing to vaccinate daughters if available	46	30.7

Table 9: Overall knowledge scores

Metric	Value
Mean knowledge score (0–20)	9.6 ± 3.9
Median (IQR)	9 (7–12)
Adequate knowledge ($\geq 12/20$)	44 (29.3%)

Table 10: Predictors of adequate knowledge (multivariable logistic regression)

Predictor	Adjusted OR	95% CI	p-value
Age <35 years vs ≥ 35	1.82	1.01–3.29	0.046
Higher education (graduate+) vs \leq secondary	2.67	1.44–4.96	0.002
Employed vs homemaker	1.59	0.81–3.11	0.177
Prior health session exposure (yes vs no)	2.34	1.28–4.29	0.006

Table 1 showed that the majority of women were in the 31–40 years age group, followed by those aged 26–30 years, while the least representation was from women above 50 years. Table 2 indicated that secondary education formed the largest subgroup, though nearly one-third of women were graduates and above, while a smaller proportion were illiterate. Table 3 revealed that most participants were married and homemakers, reflecting the demographic profile of urban clinic attendees. Table 4 demonstrated that awareness of cervical cancer was modest, Pap smear awareness was below half, and knowledge of HPV infection was particularly low. Table 5 showed that poor genital hygiene and high parity were the most commonly recognized risk factors, whereas fewer women identified multiple partners or HPV infection as contributors. Table 6 indicated that irregular vaginal bleeding and foul-smelling discharge were

the best-known symptoms, but awareness of post-coital bleeding and pelvic pain remained limited. Table 7 revealed considerable misconceptions about Pap smear, with less than half recognizing its preventive role and very few knowing correct screening intervals; actual uptake was extremely low. Table 8 demonstrated that awareness of HPV vaccination was poor, but willingness to vaccinate daughters was higher if the option became available. Table 9 showed that mean knowledge scores were below the adequacy threshold, with less than one-third of women achieving adequate knowledge. Table 10 confirmed that younger age, higher education, and prior health session exposure were independent predictors of adequate knowledge, while employment status showed no significant association.

Discussion

The present study highlights the existing gaps in awareness and knowledge regarding cervical cancer, Pap smear screening, and human papillomavirus infection among urban women in Bettiah, Bihar. Although more than half of the respondents had heard of cervical cancer, fewer than half were aware of Pap smear screening and less than one-fourth had knowledge of HPV infection. These findings point to significant deficits even in an urban setting where access to healthcare facilities and information should theoretically be better than in rural areas [9,10]. Awareness of cervical cancer was higher compared to Pap smear and HPV, suggesting that while the disease itself is relatively recognized, preventive measures remain poorly understood. Risk factor recognition was particularly low for HPV infection and multiple sexual partners, which are among the most important etiological determinants. This gap reflects both inadequate health communication and cultural barriers that make open discussion of sexual and reproductive health difficult. In contrast, more observable or socially acceptable risk factors such as high parity and poor genital hygiene were better recognized [11,12].

Knowledge of symptoms was limited as well, with irregular vaginal bleeding and foul-smelling discharge being the most frequently identified. Awareness of post-coital bleeding, an important early sign, was reported by only one-third of participants. This deficiency is critical because early recognition of symptoms can prompt timely consultation and reduce the progression of precancerous lesions to invasive disease [13]. Pap smear awareness and utilization were especially low. Although nearly half of participants had heard of the test, very few understood its preventive role, the correct age of initiation, or the recommended screening interval [14]. Only around one in ten women had ever undergone the test, reflecting poor integration of cervical screening into routine healthcare. Barriers may include embarrassment, lack of recommendation by healthcare providers, fear of pain or diagnosis, and misconceptions about eligibility. These findings underscore the urgent need to normalize Pap smear screening as part of women's health services in India [15].

Awareness of HPV and its vaccination was minimal, although willingness to vaccinate daughters was higher once informed. This suggests that knowledge, rather than outright resistance, is the main barrier. Cost and limited availability may also contribute, but improving awareness remains the critical first step. Incorporating HPV vaccination into national immunization programs and providing culturally appropriate education may substantially increase uptake [16]. Sociodemographic factors played a significant role. Younger women, those with higher educational attainment, and those who had previously attended health awareness sessions were more likely to demonstrate adequate

knowledge [17]. This indicates that educational interventions can be effective in bridging knowledge gaps. Women with limited schooling and homemakers, who comprised the majority of participants, were most at risk of being uninformed. Strategies targeting these groups, including community-based awareness campaigns, women's self-help groups, and integration of information into maternal and child health programs, would be particularly beneficial [18]. The findings highlight broader public health implications. Cervical cancer remains the leading cancer among Indian women, yet it is preventable through regular screening and vaccination. The low uptake of Pap smear testing and negligible vaccination awareness observed in this study reflects systemic shortcomings in preventive healthcare delivery [19]. Strengthening community-level education, involving frontline health workers, and embedding cervical cancer prevention into existing health frameworks can address these gaps. Urban health centers, which already serve as a point of contact for large populations, can play a key role by routinely offering screening and counseling [20].

This study has several strengths, including the use of a validated questionnaire, systematic sampling in an urban setting, and a comprehensive assessment across domains of risk factors, symptoms, screening, and prevention. However, limitations must be acknowledged. The study was confined to a single urban district, which may limit generalizability. The cross-sectional design captures awareness but not behavior change over time. Self-reported responses may also introduce recall and social desirability bias. Despite these limitations, the study provides important baseline data on awareness levels and determinants in an underserved urban population.

In conclusion, the study demonstrates that even among urban women, knowledge about cervical cancer prevention is insufficient, particularly regarding Pap smear and HPV vaccination. Efforts must focus on structured educational programs, improved provider-patient communication, and integration of screening into routine services. With effective awareness campaigns, community outreach, and supportive policy initiatives, it is possible to enhance early detection and prevention, ultimately reducing the burden of cervical cancer in India.

Conclusion

This study showed that although a majority of urban women had heard of cervical cancer, awareness of Pap smear screening and HPV infection remained substantially limited. Recognition of common risk factors and early symptoms was poor, with important gaps in knowledge of the role of HPV, recommended screening intervals, and vaccine availability. Actual uptake of Pap smear screening was negligible, and HPV vaccination awareness was minimal, even though willingness to vaccinate

daughters was higher once informed. Sociodemographic factors such as younger age, higher educational attainment, and prior exposure to health awareness programs significantly influenced knowledge adequacy. These findings underscore the inequities in health literacy within urban populations and highlight the urgent need for structured, accessible, and culturally sensitive educational interventions. Integrating cervical cancer education into primary healthcare services, strengthening provider-patient communication, and incorporating Pap smear screening into routine reproductive health services are essential strategies. Promoting HPV vaccination through awareness campaigns and policy support will further enhance prevention. By addressing these gaps, it is possible to empower women with knowledge, improve screening uptake, and ultimately reduce the burden of cervical cancer in India.

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