# **Barriers to Cervical Cancer Screening in India: Insights from National Family Health Survey-5 Data**

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# Abstract

Background: Cervical cancer, one of the commonest malignancies, can be prevented and cured through early diagnosis. Screening plays an important role in its control strategy, and India has dedicated strategies to its implementation. However, screening uptake is low in India. We examined how sociocultural and financial factors affect Indian women's cervical cancer-screening uptake behaviour. Methods: Cervical cancer screening-uptake and relevant social, cultural, and financial data obtained from round-5 of the National Family Health Survey (NFHS) were used for analysis. We examined 399,039 eligible records to survey cervical cancer screening conduct and assessed the impact of sociocultural barriers on such conduct using logistic regression. Descriptive statistics were used to describe background data. Results: Most participants, aged 30-34 years, were uneducated, homemakers with bank accounts; mobile phone usage was limited, particularly in rural areas. One-third possessed health insurance, and approximately 10% had pre-diagnosed comorbidities. Only 2% underwent cervical cancer screening. Screening uptake was higher among older, educated, employed individuals with bank accounts, phone access, and media exposure. Mothers with more children and perceived constraints against healthcare seeking had lower uptake rates. Tobacco use, insurance, wealth, and media access had contrasting effects in rural and urban settings. Conclusion: Sociocultural and monetary factors have an unmistakable influence on cervical cancer screening uptake. Thus, aside from the continuous strengthening of the health system, our findings call for targeted mediations against misguided judgments and taboos alongside financial and social empowerment for better outcomes in India's cancer-screening policy.

Keywords: Women- Prevention- determinants- National Family Health Survey- India

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# Introduction

Cancer is the fifth most common cause of mortality in India, with over 100,000 new cancer patients recorded annually [1]. Cervical and breast cancers are the commonest in Indian women [2]. Though the 7<sup>th</sup> most common cancer worldwide, cervical cancer is the second most common in Indian women. Such a huge load of cases lead to large medical and non-medical expenses and losses in productivity [1,3].

However, cervical cancer is generally preventable, and, even treatable [4]. The best control strategy for cervical cancer is through vaccination and systematic screening along with necessary treatment and follow-up [5]. Screening programs in developed countries have greatly reduced mortality among cervical cancer patients, where the prevalence of uptake of cervical cancer screening among women aged 30-49 years often exceed 75%. In Australia, Canada and the Western European countries this figure crosses the 90% mark [6]. India's first national screening program was launched in 2016 with the aim to screen people against three commonest cancers including cervical cancer [7]. However, screening coverage for cervical cancer stays low in India (less than 2%) like other developing countries [8, 9] where socio-cultural influences on people's cancer-related health practices are more evident. The average uptake of cervical cancer screening in South-east Asia comes around 8% [6]. Limited knowledge about cancer and screening programs, fear of stigma and side effects often hinder the widespread adoption of cancer screening [10, 11].

This study utilized data from the National Family Health Survey Round-5 (NFHS-5) to explore how sociocultural and financial factors affected cervical cancer screening uptake among women from urban and rural India. Existing evidence dealing with the uptake of cancer screening services has mostly been led in clinical settings. The NFHS-5 dataset provides nationally representative, large-scale population data, allowing for a comprehensive assessment of sociocultural and economic determinants influencing cervical cancer screening uptake across diverse urban and rural settings in India. Unlike clinical

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studies, which focus on healthcare-seeking populations, NFHS-5 enables the identification of systemic barriers at the community level, offering policy-relevant insights to enhance screening programs nationwide. This study using national data could provide valuable, updated insights on cancer prevention, guiding policy changes in India.

The aim of the study was to analyse the impact of sociocultural and economic factors on the uptake of cervical cancer screening among eligible urban and rural Indian women.

# **Materials and Methods**

#### The NFHS and its methodology

The NFHS surveys are cross-sectional in design. NFHS-5 (2019-2021) covered all Indian states and union territories to produce nationally representative statistics [9]. Each district was divided into urban and rural zones, which were then subdivided into six substrata of comparable size, depending on a variety of factors. A sample of villages (rural regions) or Census Enumeration Blocks (urban areas) were chosen as Primary Sampling Units (PSUs) within each sampling stratum. PSUs with 300 or more households were each divided into segments of 100–150 households. In the second stage, a newly generated list was used to identify 22 houses per cluster (PSU or its segment) using systematic random selection. In 30,198 of the 30,456 (PSUs), the fieldwork was finished [9] (Figure 1).

#### Sample size

The NFHS-5 included 724115 women aged 15-49 years.[9] The analysis included women aged 30 or older who were eligible for cancer screening according to Indian guidelines [6, 7]. Entries with inadequate information were excluded. A total of 399039 entries were found to be eligible.

#### Questionnaire and variables

We used data gathered using the NFHS woman questionnaire [9]. Independent variables included age (in



Figure 1. Sampling Strategy of NFHS-5 [41]

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years), educational status, wealth status, marital status, number of children, religion, caste/tribe, presence of comorbidities, current work status, possession of bank account(s), automobiles, properties, and access to mobile phones, the Internet, newspapers, radio, and television. Possession of health insurance, recent healthcare contact, and socioeconomic problems related to health careseeking were also taken as independent variables [9].

Outcome variable was assessed using the question that asked "Have you ever undergone a screening test for cervical cancer?" [12] and the variable was defined as:

• takers of cervical cancer screening: The individuals who went through self-reported cervical cancer screening

# Data entry and Statistical analysis

SPSS (version 16.0; SPSS Inc., Chicago, IL, USA) was used for analysis. Adjusted associations between sociocultural and economic variables and cancer screening uptake were estimated using logistic regression after applying necessary weights. Multivariable regression was used to further examine the significance (p<0.05) of the independent factors that significantly predicted screening uptake behaviour in univariate logistic regression (p<0.1). Adjusted odds ratios (AOR) and 95% confidence intervals (CI) are presented.

#### Ethical Considerations

The International Institute of Population Sciences (IIPS) Mumbai's Institutional Review Board approved the survey procedures and questions used by the NFHS. The NFHS approach was also examined by the Centers for Disease Control and Prevention (CDC) in the United States. Additional ethical approval was not required because this study employed readily accessible anonymised data from NFHS (which has already received ethical approval as stated earlier).

# Results

Table 1 shows, of all 399,039 valid entries, women aged between 30-34 years constituted the largest proportion among respondents (27.8%). While 44.5% of the rural respondents were uneducated, the proportion was much lesser among urbanites (19.6%). Of all participants, a higher proportion of rural women were employed (33.5%) compared to urban areas (28.2%); television was the most commonly accessed media, across both areas. Internet-usage was more commonly noted among urban women.

Hypertension was the most common co-morbidity among those who had at least one known disease. Any form of tobacco or alcohol use was reported more commonly by rural Indian women. About a-third had some form of health insurance. (Table 2) Of all rural participants, 17.2% were found to have been screened for Human Immunodeficiency Virus (HIV) infection; 1.8% had undergone cervical cancer screening. The number was 34.7% and 2.4% respectively in urban areas.

A negative perception of healthcare facilities was a common deterrent against institution-based healthcare seeking, like non-availability of drugs or service providers.

Variables		Rural (n=269,009)	Urban (n=130,030)	Total (n=399,039)
		No. (%)	No. (%)	No. (%)
Age (completed years)	30-34	74,265 (27.6)	36,831 (28.3)	111,096 (27.8)
	35-39	72,345 (26.9)	35,806 (27.5)	108,151 (27.1)
	40-44	59,524 (22.1)	29,868 (23.0)	89,392 (22.4)
	45-49	62,875 (23.4)	27,526 (21.2)	90,401 (22.7)
Education	None	119,806 (44.5)	25,527 (19.6)	145,333 (36.4)
	Primary	46,120 (17.1)	15,241 (11.7)	61,361 (15.4)
	Secondary	89,764 (33.4)	61,707 (47.5)	151,471 (38.0)
	Higher	13,319 (5.0)	27,555 (21.2)	40,874 (10.2)
Religion	Hinduism	230,497 (85.7)	104,392 (80.3)	334,889 (83.9)
	Islam	23,226 (8.6)	18,155 (14.0)	41,381 (10.4)
	Christian	6,147 (2.3)	3,375 (2.6)	9,522 (2.4)
	Others	9,139 (3.4)	4,108 (3.2)	13,247 (3.3)
Caste	SC	62,730 (23.3)	23,437 (18.0)	86,167 (21.6)
	ST	31,801 (11.8)	5,317 (4.1)	37,118 (9.3)
	OBC	121,882 (45.3)	60,966 (46.9)	182,848 (45.8)
	Others	52,596 (19.6)	40,310 (31.0)	92,906 (23.3)
Wealth status	Poorest	47,884 (17.8)	24,651 (19.0)	72,535 (18.2)
	Poorer	50,200 (18.7)	24,499 (18.8)	74,699 (18.7)
	Middle	53,170 (19.8)	25,379 (19.5)	78,549 (19.8)
	Richer	58,074 (21.6)	27,063 (20.8)	85,137 (21.3)
	Richest	59,680 (22.2)	28,438 (21.9)	88,118 (22.0)
Family owns motorized two-wheeler		135,257 (50.3)	82,979 (63.8)	218,236 (54.7)
Family owns motorized four-wheeler		14,370 (5.3)	19,564 (15.0)	33,934 (8.5)
No. of children	None	7,415 (2.8)	4,933 (3.8)	12,348 (3.1)
	1	24,094 (9.0)	22,339 (17.2)	46,433 (11.6)
	2	98,904 (36.8)	59,443 (45.7)	158,347 (39.7)
	3 or more	138,596 (51.4)	43,315 (33.3)	181,911 (45.6)
Has Bank Account		216,508 (80.5)	108,557 (83.5)	325,065 (81.5)
Presently employed		90,075 (33.5)	36,634 (28.2)	126,709 (31.8)
Part of health care decision making		46,694 (17.4)	18,914 (14.5)	65,608 (16.4)
Owns House in her name (singly/jointly)		133,185 (49.5)	54,252 (41.7)	187,437 (47.0)
Owns Land in her name (singly/jointly)		104,102 (38.7)	32,223 (24.8)	136,325 (34.2)
Uses Internet		36,039 (13.4)	53,512 (41.2)	89,551 (22.4)
Uses mobile		119,225 (44.3)	91,839 (70.6)	211,064 (52.9)
Access to Media	Newspaper	48,345 (18.0)	58,896 (45.3)	107,241 (26.9)
	Radio	25,164 (9.4)	19,833 (15.3)	44,997 (11.3)
	TV	174,872 (65.0)	114,173 (87.8)	289,045 (72.4)

Table 1. Socio-Cultural and Financial Characteristics of the Respondents

Distance, transport-issues and difficulties in getting necessary permissions from the household were important barriers, encountered more frequently by rural women. (Table 2).

Table 3 reveals that there are significant sociocultural and economic determinants influencing cervical cancer screening uptake among urban and rural Indian women. Older women had higher odds of undergoing screening in both urban and rural areas (p < 0.001) and education level positively influenced screening uptake in both settings, with secondary education showing the strongest effect (p < 0.001). Christian women had significantly higher odds of screening compared to Hindus (p < 0.001), while rural Muslims had a lower chance (p=0.002).

Wealth status showed opposite effects in urban and rural areas - in urban areas, wealthier women were less likely to be screened compared to the poorest, while in rural areas, the middle, richer, and richest groups had higher odds of screening (p < 0.01). Employed women were more likely to undergo screening in both (p < 0.001), so were bank account holders and vehicle owners. Mobile phone users had higher screening uptake in both urban (p < 0.001) and rural areas (p = 0.001). Radio and newspaper access had contrasting effects in rural and urban areas

Table 2. Health Status and Care-Seeking Benaviour of the Respondents (n=209,009	Table 2. Heal	th Status and	Care-Seeking	Behaviour of t	he Respondents	(n=269,009)
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Co-morbidities Absent Present	* Diabetes Heart disease	233,222 (86.7%) 6,121 (2.3) 2,801 (1.0)	26,470 (20.4) 5,335 (4.1)
Present	* Diabetes Heart disease	6,121 (2.3) 2,801 (1.0)	5,335 (4.1)
	Heart disease	2.801 (1.0)	
		_,)	1,048 (0.8)
	Hypertension	18,503 (6.9)	10,359 (8.0)
	Kidney disease	2,166 (0.8)	1,094 (0.8)
	Respiratory disease	5,883 (2.2)	2,609 (2.0)
	Thyroid disease	7,978 (3.0)	8,218 (6.3)
	Cancer	342 (0.1)	152 (0.1)
Healthcare contact in preceding 3 mont	hs		
Visited	Health Facility	66,646 (24.8)	39,076 (30.1)
Health Insurance Present		99,190 (36.9)	40,382 (31.1)
Issues with care-seeking * Alone		139,295 (51.8)	45,095 (34.7)
Distanc	e	169,388 (63.0)	52,651 (40.5)
Money		143,821 (53.5)	48,509 (37.3)
No drug	<u>3</u> 5	183,785 (68.3)	70,055 (53.9)
No fem	ale staff	171,394 (63.7)	62,680 (48.2)
No prov	vider	185,051 (68.8)	69,903 (53.8)
Permiss	ion	92,377 (34.3)	30,853 (23.5)
Transpo	rt	165,452 (61.5)	47,652 (36.6)
Tobacco user		19,662 (7.3)	5,129 (3.9)
Alcohol user		4,164 (1.5)	689 (0.5)

(p<0.001) Health Insurance was a deterrent in urban women (p < 0.001) but significantly increased screening in rural women (p < 0.001) and HIV screening history was strongly associated with cervical cancer screening in both groups (p < 0.001). Women actively involved in health decisions had significantly lower screening uptake (p < 0.001).

## Discussion

In 2018, almost 90% of related deaths occurred in low- and middle-income countries, where the burden of cervical cancer is the highest, due to limited access to public health services. The prognosis of cervical cancer is highly favoured by early diagnosis through screening [4]: Cervical cancer incidence and mortality dropped by over 50% in the United States [13]. In developed countries, cervical cancer screening strategies have been successful, achieving a coverage level of 80% [8]. Cervical examination rate in India was 20.7% in 2015-16 [14]. However, NFHS-5 shows that, less than 2% of the women had been screened for cervical cancer, most of whom being opportunistic or symptomatic. While this decline could be the result of the COVID-19 pandemic-associated travel restrictions, even the previous 20%-mark is significantly low, despite persistent and committed efforts to encourage cancer screening uptake [9]. This study, based on NFHS-5 data, examines the sociocultural and economic factors affecting Indian women's cancer screening behaviour to assess the current challenges and propose solutions.

To combat related barriers, it is crucial to empower women by increasing their educational and financial independence, reducing their reliance on men. The study's promising findings in this regard are indicated by most women having their own bank account and a-third pursuing financially fulfilling careers, even though they primarily manage household responsibilities. As a sign of social advancement, close to 50% of the women owned a home, and a comparable percentage had a motor vehicle. However, a high rate of illiteracy was prevalent in specially in rural areas, which often results in inadequate knowledge about health problems, as well as the services that can be obtained for medical care.

Regression analysis of our data showed better education, being employed, having bank account(s), and owning automobiles to significantly predict a favourable chance of getting screened for cervical cancers. Our results are consistent with a WHO's International Agency for Research on Cancer (IARC) report [11]. An Indian study similarly emphasised the facilitative impact of education on screening uptake. Negative consequences of inadequate knowledge and insufficient understanding of preventive measures on such adoption were discussed [15]. In line with ours, multiple studies have found that knowledge and age favourably influence screening uptake. Other research has identified higher knowledge and age to predict screening uptake positively, concordant with our findings [15, 16].

Most respondents had more than two children despite official advice. More pregnancies are typically caused by

Table 3. Social,	Cultural, a	and Financial	Predictors	of Cervical	Screening	Uptake	Behaviour	by	Multivariable
Regression Analy	sis.* [Refe	rence category	(Ref) indic	ated inside ro	ound bracke	ets]			

			Urban			Rural			
		AOR	95% C.I.		Р	AOR	95% C.I.		Р
			Low	Up			Low	Up	
Age		1.043	1.036	1.05	0	1.031	1.026	1.036	0
Education (Ref: No education)									
	Primary	1.17	1.005	1.361	0.043	1.195	1.097	1.301	0
	Secondary	1.466	1.286	1.671	0	1.227	1.136	1.326	0
	Higher	1.237	1.043	1.467	0.015	1.154	0.994	13.4	0.06
Religion (Ref: Hinduism)									
	Islam	1.099	0.977	1.236	0.117	0.825	0.731	0.932	0.002
	Christianity	1.54	1.294	1.834	0	1.766	1.516	2.057	0
	Others	1.014	0.809	1.269	0.906	1.101	1.02	1.188	0.014
Caste (Ref: Unreserved/ General)	)								
	Scheduled Caste	1.821	1.598	2.075	0	1.063	0.972	1.162	0.179
	Scheduled Tribe	1.11	0.866	1.423	0.411	0.491	0.424	0.569	0
	Other Backward Classes	2.643	2.388	2.925	0	1.149	1.065	1.24	0
Wealth Index (Ref: Poorest)									
	Poorer	0.638	0.566	0.719	0	0.954	0.835	1.09	0.488
	Middle	0.305	0.264	0.353	0	1.612	1.425	1.823	0
	Richer	0.408	0.354	0.469	0	1.456	1.279	1.656	0
	Richest	0.565	0.488	0.653	0	1.234	1.072	1.421	0.003
No. of children (Ref: None)		0.751	0.722	0.781	0	0.884	0.862	0.907	0
Employed (Ref: Unemployed)		1.809	1.674	1.954	0	1.229	1.158	1.305	0
Bank Account Holder (Ref: Non-holder)		1.205	10.75	1.35	0.001	1.322	1.218	1.436	0
Owns Two or Four-Wheeler (Ref: Others)		2.049	1.855	2.262	0	1.285	1.2	1.376	0
Owns Property (Ref: Others)		0.977	0.907	1.052	0.542	1.333	1.259	1.413	0
Mobile phone user (Ref: Non use	r)	1.513	1.366	1.675	0	1.119	1.049	1.194	0.001
Access to Internet (Ref: No acces	ss)	1.038	0.949	1.136	0.417	1.058	0.967	1.157	0.219
Access to Newspaper (Ref: Non-	access)	1.161	1.062	1.269	0.001	0.834	0.769	0.905	0
Access to Radio (Ref: Non-access)		0.706	0.634	0.787	0	1.585	1.462	1.72	0
Access to TV (Ref: Non-access)		1.025	0.905	1.161	0.699	1.128	1.045	1.219	0.002
Alcohol user (Ref: Non-user)		1.043	0.789	1.381	0.766	1.271	1.199	1.348	0
Tobacco user (Ref: Non-user)		1.26	1.038	1.531	0.02	0.572	0.486	0.672	0
Co-morbidities (Ref: who had no co-morbidity)		1.404	1.269	1.554	0	1.029	0.963	1.1	0.42
Health insured (Ref: Non-insured)		0.741	0.683	0.804	0	1.297	1.223	1.376	0
Screened for HIV (Ref: Not Screened)		1.746	1.617	1.887	0	2.052	1.924	2.189	0
Take part in Health Decision (Ref: Others)		0.542	0.495	0.592	0	0.69	0.645	0.739	0
Constraints towards care-seeking present (Ref: who had no such constraint)		0.92	0.847	1	0.05	1.221	1.122	1.329	0

early marriage and indicate towards social norms that are biased against the interests of women [17]. Programs like "Beti Bachao Beti Padhao" under the aegis of women empowerment projects like "Mission Shakti" and incentive programs like "Kanyashree," which are intended to ensure protection, promote education, and increase the active involvement of girls in the community, can therefore positively influence cancer prevention initiatives [18, 19].

Caste and religion often promote biased healthcare preferences, such as selecting a preferred gender for healthcare providers or favouring specific treatment methods [20]. Religion also has an impact on resilience and coping mechanisms, which are crucial in defining healthcare-seeking behaviours. An one-size-fits-all approach isn't appropriate for policy issues affecting diverse populations, like India's complex socio-religious landscape, especially for sensitive topics like cancerscreening [21]. Therefore, to ensure acceptability, it is crucial for any mass-scale screening strategy to take into account religious needs. Previous research emphasizes upon the importance of considering social and religious obligations of the target population in cancer prevention

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initiatives [22, 23]. South Asian families often delegate decision-making responsibilities to males. To achieve successful outcomes, it is therefore essential to consider and incorporate their perspectives. By doing so, disparities can be eliminated, and equitable healthcare services can be ensured [24–27].

The importance of media as health communication tools is widely known, and public health has seen an increase in the use of mass media [15]. Television and radio were found to be more effective in promoting users' screening behaviour in rural areas, indicating their potential as reliable health awareness platforms; however, radio predicted negatively in case of urbanites, a finding that demands critical thinking. More so, because, India will be soon introducing indigenously made vaccines in its immunization schedule and media could prove beneficial in generating awareness [28]. No mobile use predicted unfavourable cancer screening uptake behaviour– less than 50% of rural women were found to be using mobile telephones. A far lower proportion accessed the Internet.

Individuals with comorbidities and those who have undergone HIV screening are more likely to receive cancer screening due to increased interaction with the healthcare system and health consciousness. While rural tobaccousers are less likely to be screened, the opposite was true in urban areas. Tobacco users are often found guilty of unhealthy health-related behaviours such as delaying care-seeking [29, 30], but the scenario noted among urbanites could be a result of exposure to frequent health campaigns organised by local bodies and corporations. One-third of our participants were protected by health insurance. We found that, insured rural women had a greater probability of getting screened. Insurance status increases the chances for medical check-up, including screening uptake for non-communicable disorders [31]. However, insured women residing in urban areas tended to get screened less compared to the uninsured. This can be the result of complacency with guaranteed medical care at any time. Perceived hurdles in care-seeking due to distance and transport-related issues was less frequently encountered in urban areas. Added to these factors, because of their financial means and insurance coverage, which can offset associated expenses, both the insured and wealthy in urban areas may have better access to healthcare services, including cancer care [32]. As a result, they might avoid taking up usual screening services as well [33]. Furthermore, not every insurance plan pay for the implications and expenses of cancer screening. Many plans exclude cancer-related costs entirely or in part [34, 35]. Consequently, even though multiple studies have demonstrated that insurance holders are more likely to use cancer screening programs, this may not be the case every time. Therefore, existing government-aided health insurance schemes like the 'Pradhan Mantri Jan Arogya Yojana' (PM-JAY) and 'Swasthya Sathi' assume central role along with other players offering contributionbased insurance schemes [19, 36]. Such schemes have successfully contributed towards reducing the out-ofpocket expenditure in India.

Women from both India and overseas have been found to resist screening due to concerns about outcomes,

accompanying embarrassment, and cultural taboos [16]. IARC identifies other factors such as insufficient family support, limited access to healthcare, and cultural traits as potential barriers to optimal cancer care-seeking behaviour [11]. Our analysis reveals that any perceived constraint against healthcare seeking hinder screening uptake. Interestingly, women who make their own health decisions were less likely to undergo cancer screening. This might be the outcome of the existing social scenario in which women tend to prioritize giving over taking, putting others' needs before their own.

Getting a community to endorse screening is always a challenge. In rural areas, where healthcare infrastructure is limited and awareness is low, interventions should focus on strengthening community-based health worker networks such as ASHAs (Accredited Social Health Activists) and Anganwadi Workers. Their reputation can be used to construct social consensus and related awareness campaigns, as well as to overcome societal barriers against screening. Expanding their role to include door-to-door HPV testing can significantly improve uptake. Additionally, government-led transport assistance programs for women traveling to healthcare facilities should be implemented. Traditional village gatherings, religious meetings, and self-help groups can be leveraged as platforms for health promotion campaigns, helping to dispel misconceptions about screening and increase local acceptance. It is also essential to involve community leaders and family men in reconstructing concepts. The integration of point-of-care HPV DNA testing kits in rural health centres, backed by conditional cash transfers to incentivize participation, could further boost screening uptake.

Improving accessibility and quality of healthcare is crucial as it is found to impact the care-seeking behaviour of potential beneficiaries. In urban settings, barriers to screening often stem from lack of time, perceived low risk, and complacency due to insurance coverage. To counteract this, workplace-based screening programs should be promoted in corporate offices, factories, and educational institutions to ensure ease of access for working women. Integration of cervical screening within routine gynaecological check-ups in both public and private healthcare settings should be mandated. Additionally, digital health interventions such as Artificial Intelligence-based risk assessment tools and mobile app-based reminders should be implemented to improve adherence. Leveraging influencers, celebrities, and social media campaigns can also play a crucial role in changing attitudes toward preventive healthcare. Also, India's readiness for cervical cancer screening with its present healthcare system has critical flaws due to lack of infrastructure and a shortage of trained staff [37]. Other practical challenges include overworked, unmotivated staff and insufficient, disorganized services at designated centres [38]. A positive development in this respect is the political resolve to build community health facilities [39].

A successful public health programme requires effective stakeholder coordination, reliable data management, and a robust monitoring system. Additionally, motivated and adequately trained human resources are crucial for implementation [38]. Therefore, it is crucial to hire, sensitise and regularly train the staff involved in cancer screening [40].

As NFHS data is based on self-reported information, the possibility of social desirability and recall biases are present. Additionally, the study's conclusions were drawn from cross-sectional data, making causation undeterminable. Furthermore, the impact of the COVID-19 pandemic and related restrictions on screening uptake could not be assessed. Data on cancer-screening-related awareness was lacking, therefore could not be analysed.

As our analysis is based on large and nationally representative data, its findings can be generalised. This research offers in-depth understanding of cervical cancer screening adoption and its understudied influencers, which might aid policymakers in creating impactful interventions. The research analysed a wide range of sociodemographic factors to comprehensively investigate the factors influencing cervical cancer screening uptake. The study applied logistic regression to remove confounding variables and improve the validity of the findings.

This study highlights the importance of adopting a multidimensional approach that incorporates community participation and systemic improvements to enhance screening rates and minimise disparities. Priority should be given to longitudinal studies that establish the causal relationship between sociocultural and economic factors. To gain a deeper understanding of the influence of social, cultural, and financial factors on screening uptake, it is crucial to collect relevant qualitative data. Additionally, leveraging the power of media and grassroot level health workers to raise awareness and dispel misconceptions should be explored.

A multifaceted approach is needed to address the various factors that influence healthcare-seeking behaviour, including sociocultural and economic determinants, which often work together to affect screening uptake. By adopting a holistic perspective, we can better understand the dynamic nature of cervical cancer screening uptake and formulate comprehensive strategies to address the complexity of these determinants. While strategies aimed at boosting cervical cancer screening rates should focus on the female population asa-whole, it is also crucial to overcome the barriers brought on by social and cultural factors in specific scenarios, in addition to strengthening cancer screening strategies in the nation and building the capacity of the Indian healthcare system for the efficient implementation of such programs. Although some actions have already been taken, others are required. A key next step is to increase the number of trained healthcare workers, particularly in rural areas, through targeted capacity-building initiatives. A critical policy intervention would be the mandatory integration of HPV screening into routine gynaecological check-ups at all public and private healthcare facilities. Additionally, insurance regulators should consider subsidizing screening costs or making it completely free under available health insurance schemes even from the private players, particularly for economically disadvantaged women. The PM-JAY already has similar provisions. Leveraging telemedicine platforms and mobile health (mHealth) applications can facilitate remote consultations and at-home self-sampling HPV tests. The long-term objective of a healthy and cancer-free society can only be achieved by ensuring sociocultural uplift and financial independence for Indian women. Achieving this vision requires a legal and policy framework that not only mandates regular screening but also enforces workplace policies that allow women to take paid leave for preventive health check-ups.

## **Author Contribution Statement**

Conceptualization: SG; Data curation: SG, AD; Formal analysis: SG, AD, SK; Investigation: SG, AD, SK; Methodology: SG, SSG; Project Administration: SG, SK; Software: SK; Resources: SG, AD, SK, SSG; Supervision: SSG; Visualization: SG, SK; Writing original draft: SG, AD; Writing review and editing: SK, SSG

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#### Ethics approval and consent to participate

The International Institute of Population Sciences (IIPS) Mumbai's Institutional Review Board approved the survey procedures and questions used by the NFHS. The approval ID has not been quoted in the NFHS-5 report and therefore cannot be stated. The NFHS approach was also examined by the Centers for Disease Control and Prevention (CDC) in the United States. Additional ethical approval was not required because this study employed readily accessible anonymised data from NFHS (which has already received ethical approval as stated earlier).

#### Data availability statement

Data is available from the website of the DHS programme (https://dhsprogram.com/data/).

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#### Conflicts of Interest

The authors have no relevant financial or non-financial interests to disclose.

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