

A STUDY ON AI-DRIVEN DIGITAL CYTOLOGY ADOPTION IN CERVICAL CANCER SCREENING IN TIER-1 INDIAN CITIES: GYNAECOLOGISTS' PERSPECTIVES



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Introduction

Cervical cancer is preventable and treatable if caught early – WHO

Cervical cancer develops in a woman's cervix (the entrance to the uterus from the vagina) -WHO

HPV Infection



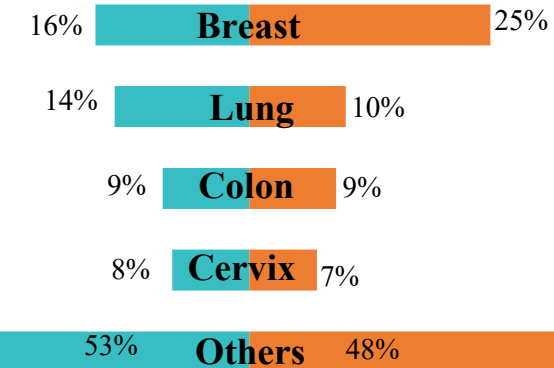
- Long term use of **oral contraceptive**,
 - **Multiple** full-term pregnancies,
 - Becoming sexually active at **young age**
 - **Poor** menstrual hygiene
 - **Family history** of cancer
- Risk factors*

CERVICAL CANCER

- Post - coital vaginal bleeding
- Post-menopausal bleeding
- Intermenstrual bleeding
- Foul smelling vaginal discharge
- Pain in the Pelvic region

Cervical cancer ranks as the fourth leading cause of cancer incidence and mortality among women globally

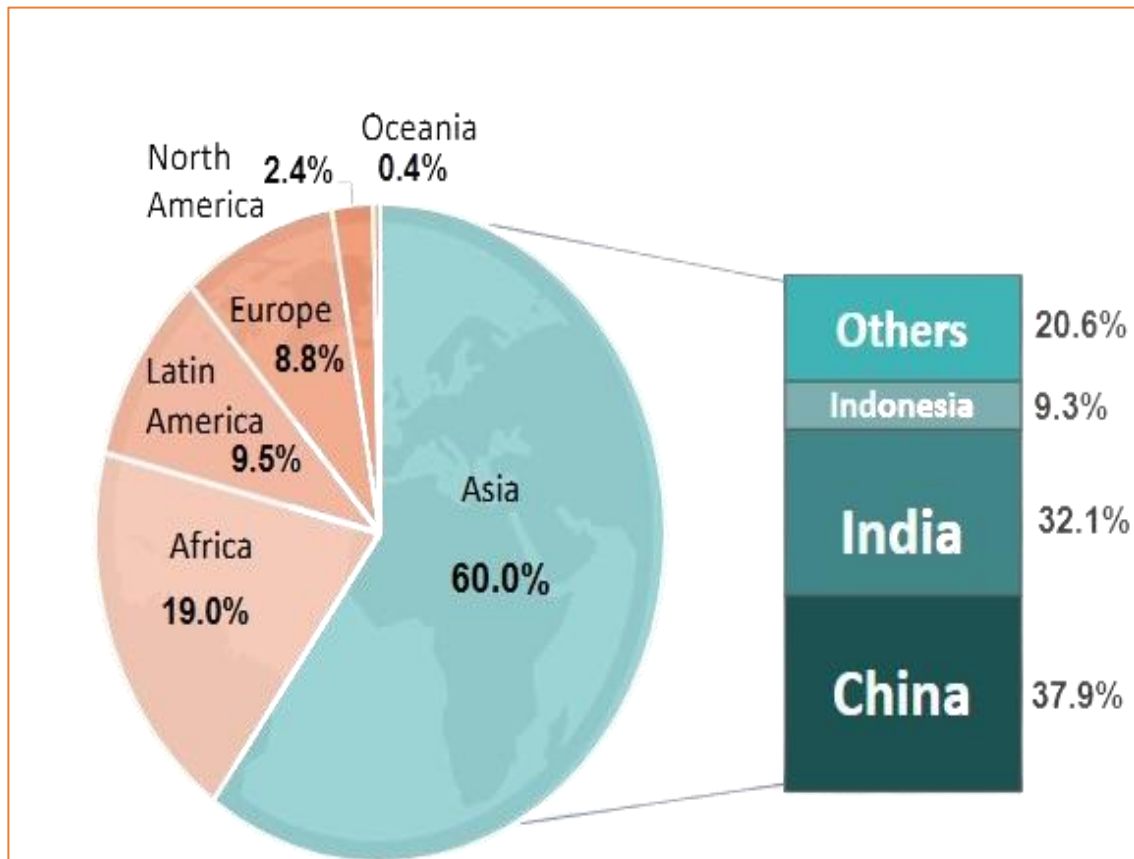
Mortality Incidence



WHO states vaccination as primary and screening as secondary most effective preventive measures for CC

Vaccinations	Screening Methods
Gardasil (<i>Present in India since 2008</i>)	HPV DNA Testing
Cervarix	PAP Smear Cytology
Cervavac (<i>First domestically produced vaccine</i>)	VIA

“One woman dies of cervical cancer every two minutes...Each one is a tragedy, and we can prevent it” – WHO



Asia accounts for 60% of global cancer incidence, with India alone contributing one-third to this regional burden

Cervical cancer is the second most common cancer in females; India contributes one – fifth to global burden

511.4 Mn
Women aged
+15 years

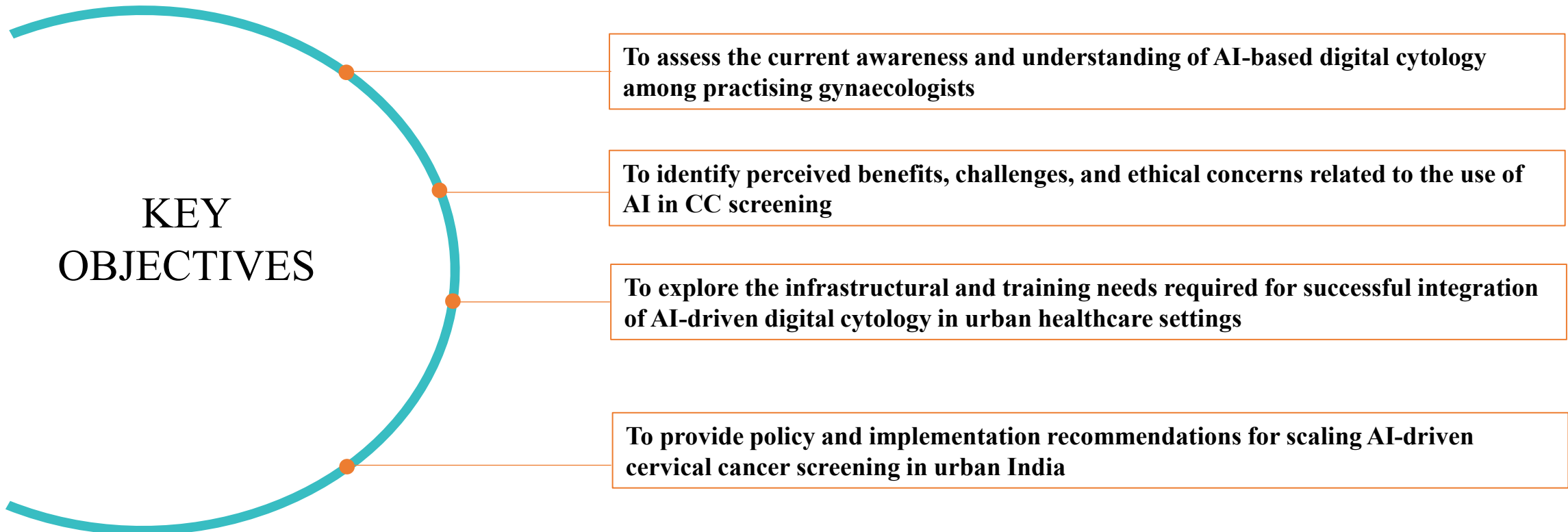
Screening rate
1.9% India
0.2% Gujarat

2.5%
Cumulative risk of
getting CC
1.4%
Cumulative risk of
dying CC

45 – 55 years
Peak age of incidence
of Cervical Cancer

Research Questions

1. What is the level of awareness among gynaecologists in Tier-1 Indian cities regarding AI-driven digital cytology?
2. What is the market potential and willingness of adoption for AI-enabled cervical cancer screening in Tier-1 Cities?
3. What infrastructural and training support is required for effective integration of AI-driven cytology in urban healthcare settings?
4. What policy and implementation strategies can enable the scalable adoption of AI-based screening in urban India?



Review of Literature

Introducing AI in cervical cancer screening in rural setting of Uganda and Bangladesh and India: experiences of implementation and lessons learned (Jogchum Beltman et al., 2024)

- › AI tools in CC screening are most effective when they are built around clearly defined clinical objectives
- › The study underscores the need for aligning AI outputs with real world clinical risk to ensure meaningful patient management, particularly in low resource settings

Artificial intelligence strengthens cervical cancer screening – present and future (Tong Wu et al., 2024)

- › AI demonstrated superior sensitivity and specificity in detecting low-grade and high-grade cervical lesions compared to conventional methods
- › The study concluded that AI, when used either as a standalone or in combination with traditional screening tools, offers the most efficient and accurate strategy for CC screening

Enhancing cervical cancer cytology screening via innovation (Yuki Kurita et al., 2024)

- › The AI system significantly reduced the initial screening time to approximately 10 seconds per case, enhancing overall workflow efficiency
- › The AI effectively prioritized abnormal cytology cases using anomaly scores, helping ensure that higher risk cases received timely attention

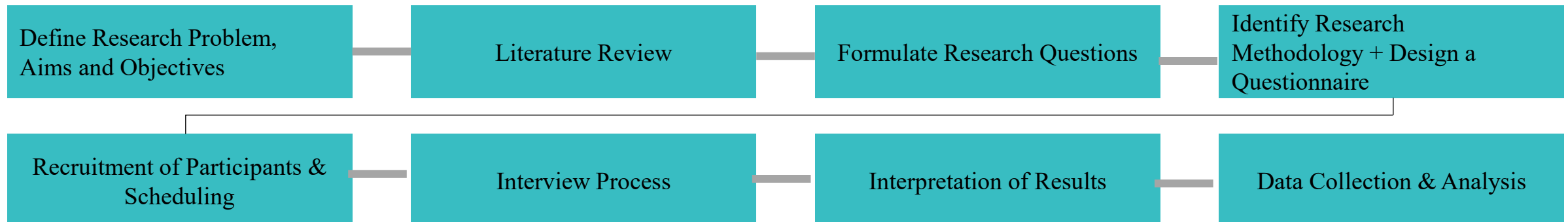
Applying Artificial Intelligence to Gynaecologic Oncology: A Review (David P. Mysona et al., 2021)

- › Machine learning models have been utilized to predict patient responses to treatments, aiding in personalized therapy planning and improving prognostic assessments
- › The implementation of AI in pathology has led to more efficient analysis of histopathological slides, reducing the workload on pathologists and expediting diagnosis

Methodology

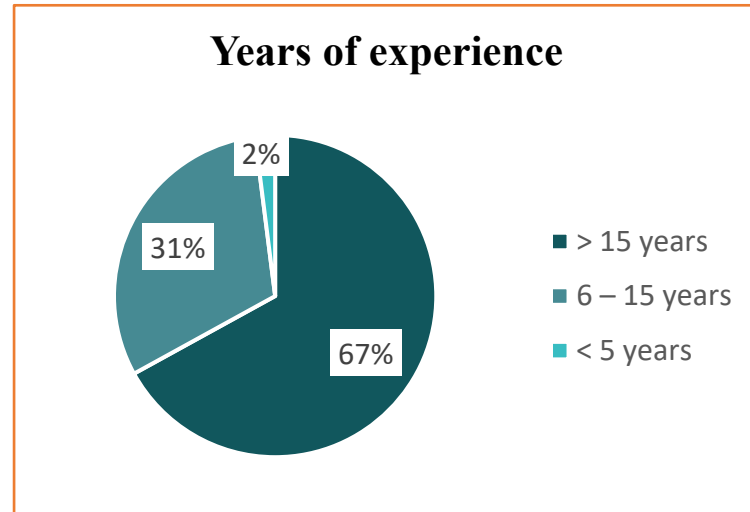
Study design: Descriptive cross-sectional design
Study setting: The study was conducted in Tier-1 Indian cities like Mumbai, Pune, Hyderabad, Ahmedabad, Delhi, Gurgaon, Noida
Study population: The target population comprises of practicing gynaecologists in private clinics, hospitals, fertility centers, and diagnostic centres
Sampling technique: Purposive sampling method was used
Sampling size: The final sample compromised 61 gynaecologists practicing in Tier-1 Indian cities. This number was determined based on the feasibility of conducting qualitative interviews within a limited time frame of seven days
Study instruments: A structured questionnaire is the primary tool for data collection
Data management & analysis: Data was collected using structured questionnaires from gynaecologists and analyzed in Microsoft Excel with graphical representation.

Research Procedure:

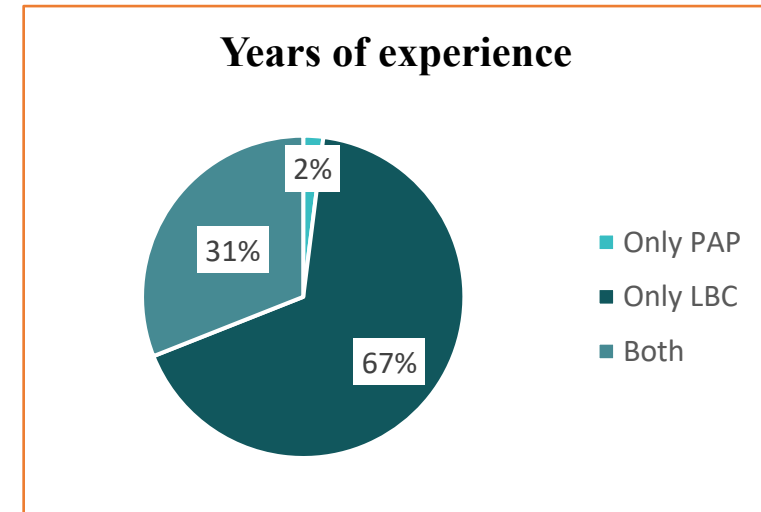


Result and Discussion

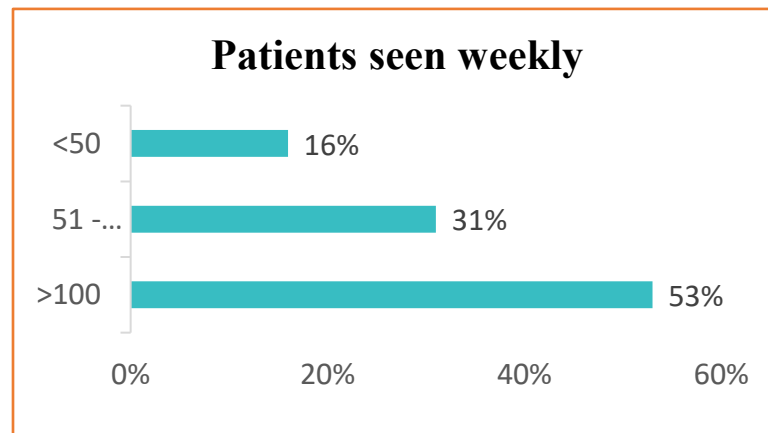
Demographic profile of respondents (n = 61)



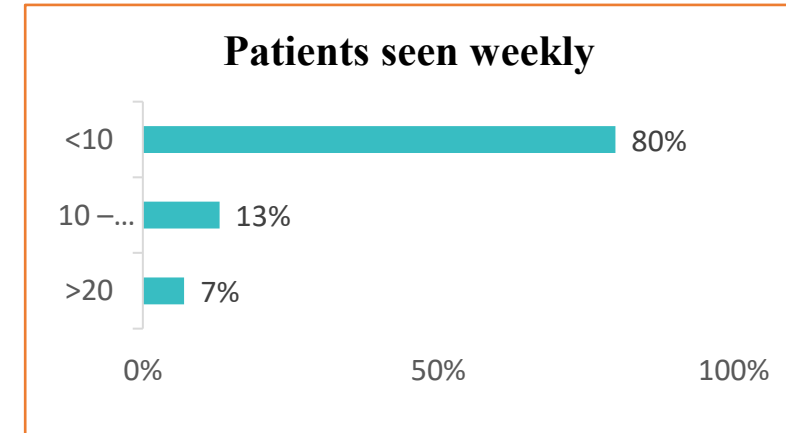
Two-third of the gynaecologists had over 15 years of clinical experience, indicating a majority are highly experienced professionals



Two-third of gynaecologists reported using Liquid-Based Cytology (LBC) as their primary screening method



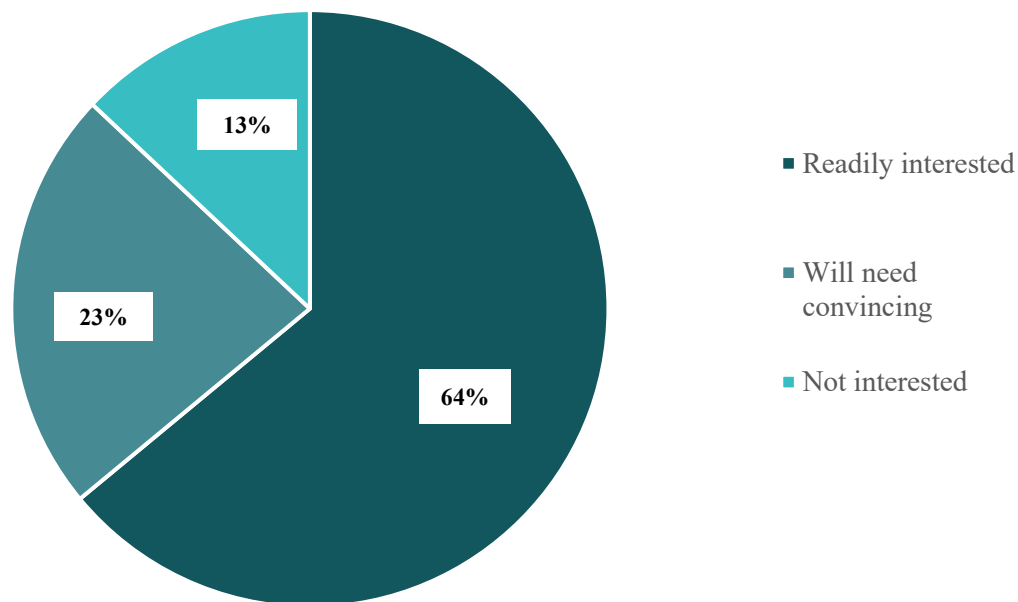
Almost half of the gynaecologists reported seeing more than 100 patients per week, indicating a very high patient throughput



Majority of gynaecologists performed fewer than 10 screenings per week

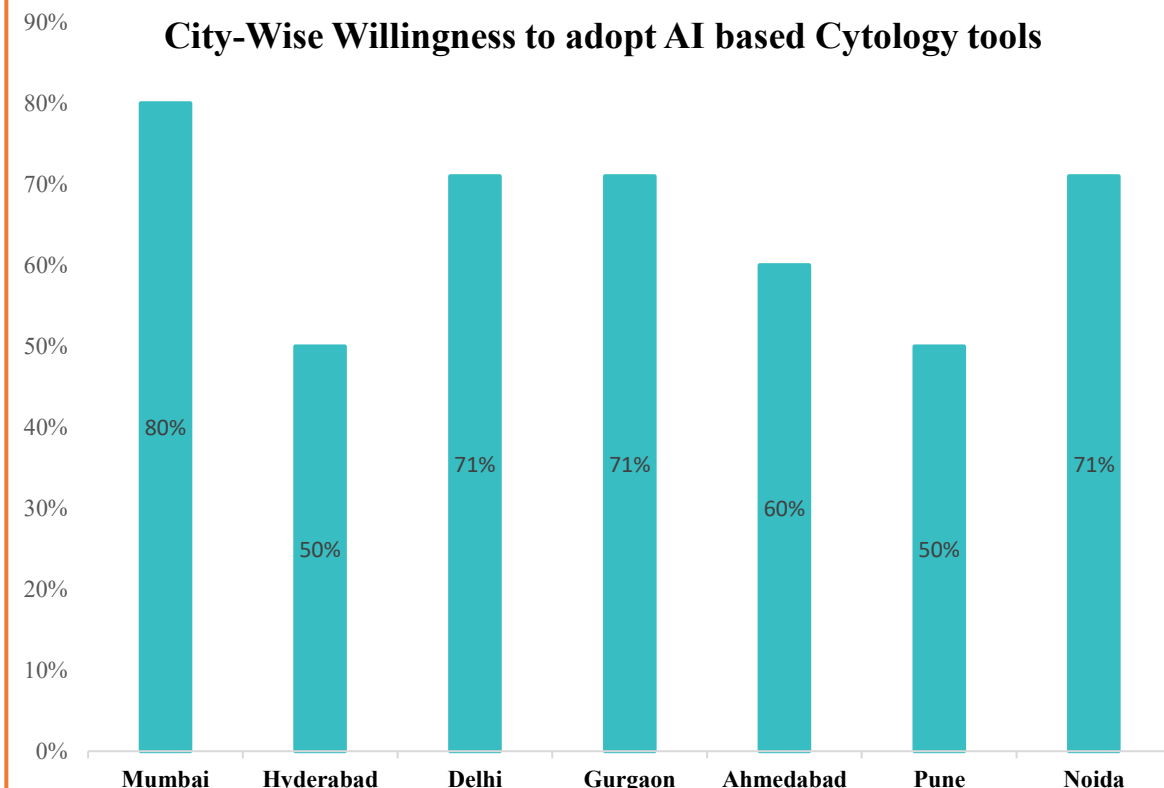
Willingness to adopt AI-based cytology tools

Willingness to adopt AI based Cytology tools



- › Nearly two-thirds (64%) of respondents expressed immediate readiness to integrate AI-driven digital cytology into their practice
- › 23% of respondents will need convincing
- › 13% who remain hesitant, indicate that targeted educational initiatives, cost-benefit clarity, and clinical efficacy evidence are critical to accelerating adoption

City-Wise Willingness to adopt AI based Cytology tools

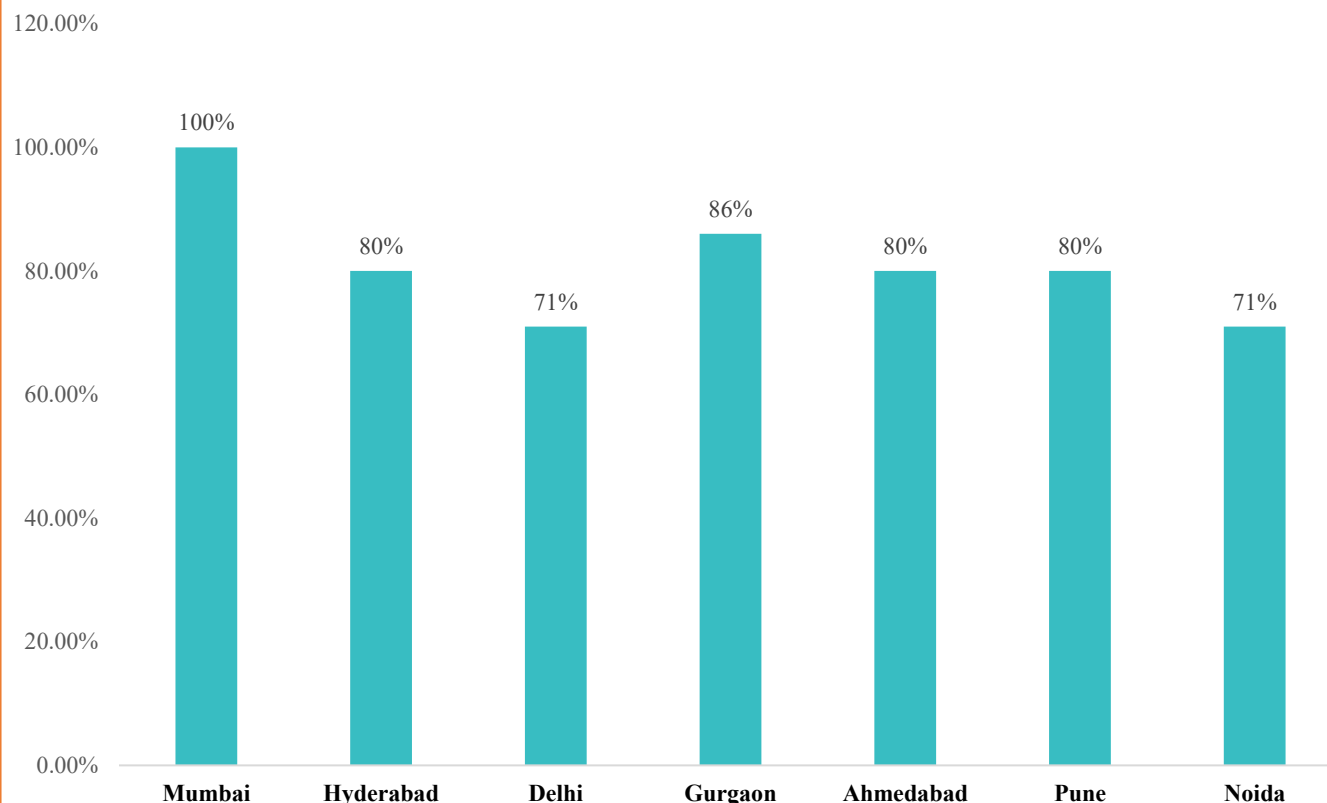


- › Cities like Mumbai, Delhi NCR, and Ahmedabad reflects a generally favourable environment for innovation in CC screening
- › Cities with higher reluctance, such as Hyderabad and Pune, may benefit from localized pilot programs, peer-led workshops, and exposure to success stories from early adopters in comparable settings

Perceived role in driving screening uptake

Gynaecologists believe they play an influential role in encouraging cervical cancer screening among their patients

City-wise perceived role in driving screening uptake



- › **Mumbai stands out with 100% of respondents expressing confidence, reflecting strong leadership and a proactive stance toward screening advocacy**
- › Delhi and Noida show moderately lower confidence levels (~71%), suggesting variability in perceived influence among regions
- › These differences imply that urban, high-volume centres like Mumbai may be more receptive to initiatives targeting gynaecologists as key change agents
- › There is a need for supportive interventions such as awareness campaigns or institutional incentives in cities like Delhi and Noida to boost clinician engagement in screening advocacy

Barriers to Adoption

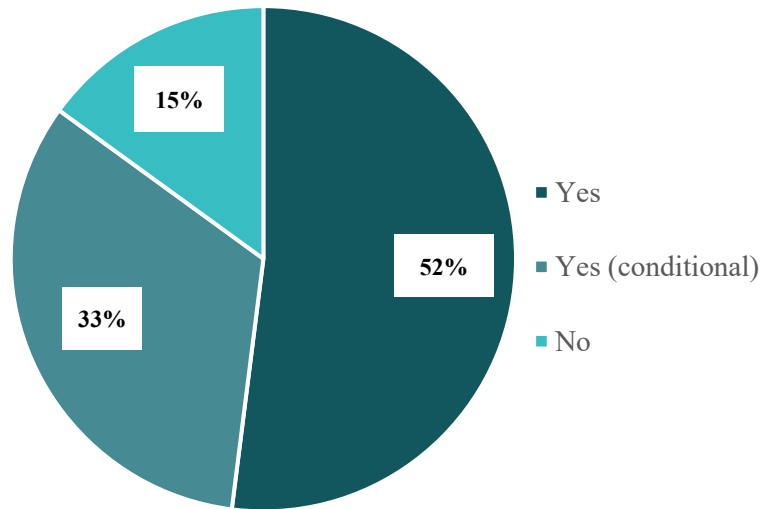
Barrier	Key Points
1. Lack of awareness	• Most cited barrier • Women unaware of Pap / LBC • Many women don't know about screening
2. Cost & financial barriers	• High cost deters participation • They don't want to spend money
3. Fear and anxiety	• Fear of diagnosis and procedure • Scared of speculum exam
4. Discomfort & embarrassment	• Cultural shyness and discomfort • Not comfortable for check-up
5. Stigma & social norms	• Cancer stigma • Women lack autonomy • Need consent from home
6. Misconceptions	• Beliefs like “no family history = no need” • Think checking means surgery
7. Technical barriers	• Procedure seen as complex • Technicality of collecting sample

- › **Lack of awareness** is the most frequently cited barrier, with many women unaware of screening methods or the importance of early detection
- › **Cost and financial constraints** prevent many patients from accessing screening services
- › **Fear and anxiety** related to cancer diagnosis or medical procedures discourage participation
- › **Discomfort and embarrassment**, especially around intimate exams, affect women's willingness to get screened
- › **Stigma and cultural norms** limit decision-making power, particularly for women needing family consent
- › **Misconceptions** about screening being unnecessary without symptoms or family history are common
- › **Technical and logistical barriers**, such as perceived complexity of the procedure, further reduce uptake

Perceptions on Pricing Structure

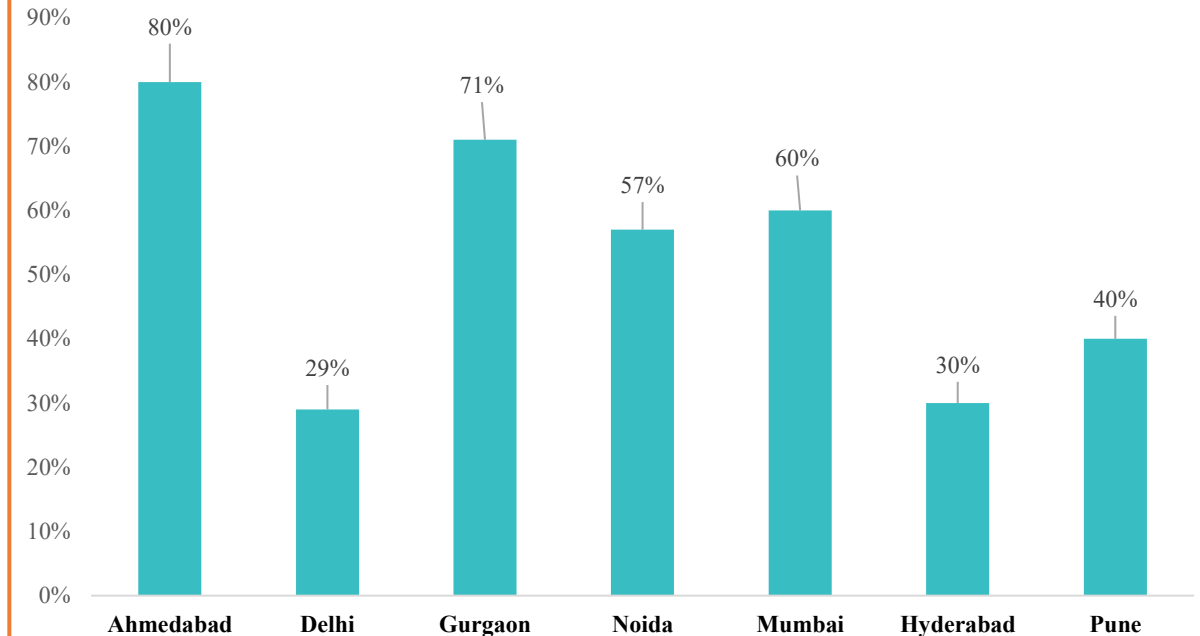
Respondents were presented with the model of buying LBC tests at Rs. 2000 and offering them at Rs. 2500 to patients

Perceptions on Pricing structure



- **52% of gynaecologists showed a positive inclination to adopt the proposed pricing structure for AI-based cytology tools**
- 33% expressed conditional acceptance while 15% rejected the pricing model altogether due to concerns about insufficient ROI

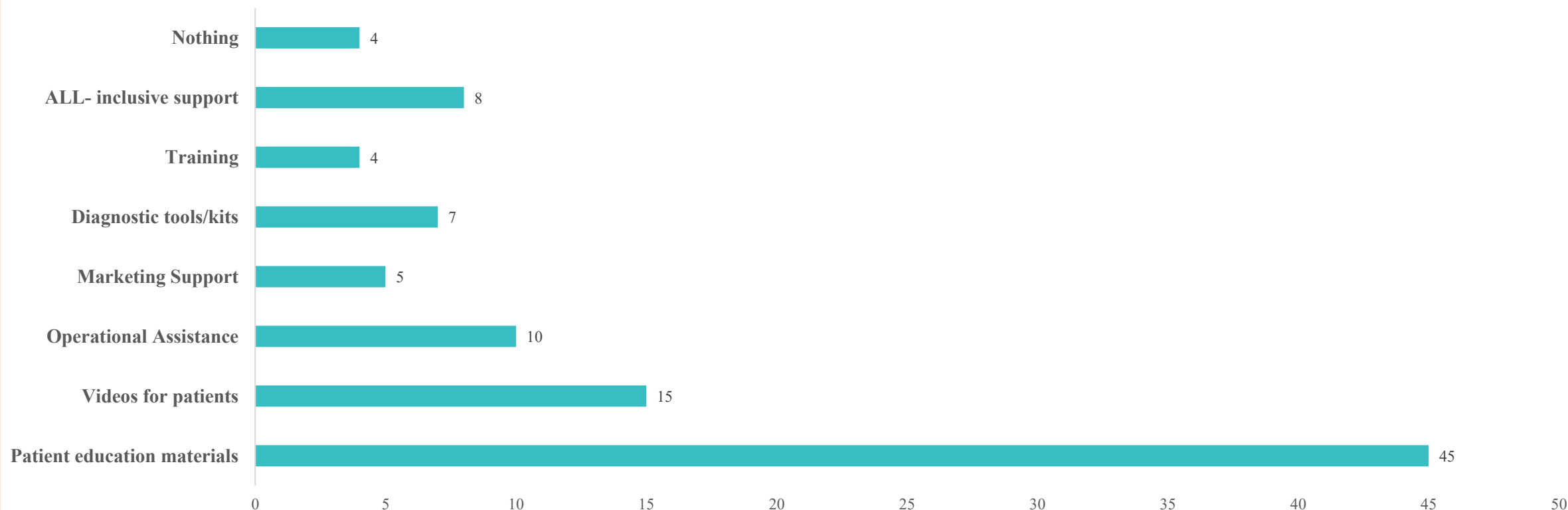
City-wise perceptions of gynaecologists on adopting AI-based cytology at a proposed pricing model



- **Ahmedabad exhibited the highest positive response rate, with 80% of respondents expressing readiness to adopt AI-based screening**
- Mumbai, Noida and Pune demonstrated moderate willingness, while cities like Delhi and Hyderabad reflected a more cautious approach

Expectations from diagnostic partners

Type of support expected for successful partnership (Total<61 due to multiple responses)



- **Patient education materials are the most requested support**
- Videos for patients and operational assistance are next in demand
- Other categories like diagnostic tools, marketing, and training are also mentioned but less frequently

Discussion

Results	Observation	Underlying Reason
Positive attitude	Majority of gynecologists are open to adopting AI tools	Perceived benefits like speed, accuracy, and efficiency
Regional variations	Higher acceptance in Mumbai & Delhi; lower in Pune, Hyderabad	Institutional readiness and operational capacity differ across cities
Practice-implementation gap	Many willing gynecologists still screen <10 patients/week	Patient hesitation, low awareness, and lack of institutional push
Demand for patient education	Strong call for materials like videos, brochures	Patients need to understand benefits to feel comfortable with AI tech
Institutional resistance	Few doctors resist AI adoption	Existing pathology setups, rigid administrative protocols
Urban vs LMIC focus	Urban doctors prioritize efficiency, ROI	LMIC studies that focus on basic access and diagnostic accuracy
Need for contextual strategy	One-size-fits-all won't work	Adoption success depends on region, institution, and practitioner readiness

Conclusion

Cervical cancer remains a major public health challenge in India due to low screening uptake

Study focused on gynaecologists in Tier-1 cities and their perceptions of AI-based cytology tools

- Gynaecologists in urban Cities like Mumbai show strong openness towards AI-driven cytology tools
- Key motivations for adoption include improved accuracy, faster reporting and reduced human error
- Some resistance remains, mainly due to existing system comfort, cost concerns, and lack of institutional readiness
- Most clinicians recognize their influential role in driving awareness and screening uptake
- AI offers a powerful opportunity to enhance screening outreach and efficiency within existing clinical workflows

Implications for Practice and Policy

- Successful AI integration requires a holistic, multi-stakeholder approach
- Continuous awareness and hands-on training are essential to build confidence in AI tools
- Pricing models must balance patient affordability with clinical sustainability
- Diagnostic partners should offer comprehensive support – educational materials, training, and operational assistance
- Strategic deployment of AI can transform cervical screening from reactive care to proactive prevention

Recommendations



Policy-level recommendations

- Incorporate AI into National screening programs
- Implement subsidy/ reimbursement schemes to support adoption
- Develop AI-specific regulatory frameworks



Clinical practice recommendations

- Conduct training & onboarding for lab technicians and physicians
- Promote peer-to-peer advocacy
- Integrate AI seamlessly into existing lab systems



Vendor-side recommendations

- Offer comprehensive support bundles
- Adopt flexible pricing: trial models, discounts
- Use evidence-backed marketing with data, case studies, and real-world outcomes



Patient-centric recommendations

- Launch urban awareness campaigns
- Simplify the screening experience
- Involve ASHAs and ANMs in community outreach and screening facilitation



Future research recommendations

- Expand studies to Tier-2 and rural areas for broader applicability
- Conduct long-term assessments of cost-effectiveness
- Include patient experience surveys

THANK YOU