

Synopsis

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Title: AI-driven digital cytology adoption in cervical cancer screening: A study of Gynaecologists' perspectives in Tier-1 Indian cities

1. Introduction

As per the Global Observatory Report of 2022, Cervical cancer is the 4th most commonly diagnosed cancer and the 4th leading cause of cancer death among women¹, but in India, it is the second most common cancer among females² posing a significant public health challenge (Bray et al., 2022). Cervical cancer typically develops early in a woman's life, often during their most active and productive years. This cancer is most common between the ages of 30 and 34, and again peaking between the ages of 55 and 65 (Kaarthigeyan, 2012)³. High-risk HPV infections are the primary cause of cervical cancer, with HPV types 16 and 18 responsible for 80% of cases in India (Sankaranarayanan et al., 2019)⁴.

Despite the availability of effective screening methods such as HPV DNA testing, Pap smear, and Visual Inspection with Acetic Acid (VIA), the uptake remains low, with 1.9 percent in India and particularly in Gujarat where only 0.2% of women have ever been screened (NFHS-5, 2021)⁵. Cervical cancer, often transmitted through sexual activity, faces cultural stigma in India and the issue is compounded by the country's limited resources for testing, and shortage of skilled healthcare personnel (Think Global ,2023)⁶. The rise of cervical cancer as a significant health concern in India, with over 100,000 new cases each year. Current screening methods (Pap smear, HPV testing) and their limitations in terms of accessibility, affordability, and accuracy. Introduction of AI in cervical cancer screening as an emerging solution that promises to address these challenges.

2. Research Gap

Research in the field of cervical cancer has predominantly focused on clinical aspects such as disease pathology, screening efficacy, and epidemiological trends. However, there is comparatively less attention on the behavioural and technological adoption factors, especially concerning newer tools like AI-driven digital cytology. While several

global studies highlight the clinical accuracy of AI in diagnostic imaging and cytology, there is a scarcity of research investigating healthcare providers' readiness and perceptions regarding such technologies in the Indian context.

Specific to India, existing studies emphasize traditional screening methods such as Pap smears and HPV testing but do not adequately explore the integration of AI-enhanced tools in routine gynaecological practice. Despite tools available in the market, there is no comprehensive understanding of gynaecologist's attitudes, perceived barriers (like cost, trust, training), and willingness to adopt such innovations.

This study aims to fill this critical gap by examining the perspectives of gynaecologists in Tier-1 cities, thereby providing context-specific insights that can support the development of adoption strategies, training models, and health tech implementation policies.

3. Rationale

This study is important as it will provide extensive insights into the perceptions, readiness, and concerns of gynaecologists—the key decision-makers in cervical cancer screening—regarding the adoption of AI-based digital cytology tools in Tier-1 Indian cities. With India's high cervical cancer burden and emerging AI technologies in diagnostics, understanding the real-world sentiments of practicing gynaecologists is essential for effective implementation.

Identifying the factors that influence adoption, such as clinical trust in AI, patient acceptability, cost dynamics, and regulatory influence will help stakeholders like healthcare companies, policy planners, and medical institutions to design targeted strategies. The study's findings will therefore be instrumental in shaping future directions for tech-enabled preventive healthcare in India.

4. Research Question

Primary Research Question:

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?

Secondary Research Questions:

1. What are the barriers to adoption of AI-enabled cervical cancer screening among gynaecologists in India?
2. How do factors such as turnaround time (TAT), accuracy, and cost influence the decision-making process of healthcare professionals?
3. What factors influence the willingness of gynaecologists to partner with AI-based diagnostic platforms?

5. Objectives

1. To assess the current awareness and understanding of AI-based digital cytology among practising gynaecologists
2. To identify perceived benefits, challenges, and ethical concerns related to the use of AI in cervical cancer screening
3. To explore the infrastructural and training needs required for successful integration of AI-driven digital cytology in urban healthcare settings
4. To provide policy and implementation recommendations for scaling AI-driven cervical cancer screening in urban India

6. Hypothesis

1. Hypothesis 1: AI-based cervical cancer screening will have a high adoption potential in metropolitan cities
2. Hypothesis 2: Factors such as the quality of diagnosis, cost-effectiveness, willingness of the doctor and AI's ability to reduce human error will have a more significant impact on adoption than TAT alone

7. Methodology

Study design:

- Descriptive cross-sectional study using interviews and surveys to collect data from gynaecologists in India

Setting:

- Research will be conducted in Tier 1 cities i.e. Mumbai, Pune, Hyderabad, Bangalore, Delhi NCR and Ahmedabad

Sampling technique:

- Purposive and snowball sampling for maximum practitioner diversity

Sample size:

- Sample size calculated through the formula $n = \{Z^2 * P (1 - P)\} / d^2$
- Around 63 samples will be selected by taking $Z_{95\%} = 1.96$, P as 0.5, and $d = 0.05$

Inclusion criteria:

- Gynaecologists practicing in Tier 1 cities
- Gynaecologists with atleast 5 years of experience

Exclusion criteria:

- Gynaecologists who are not involved in cervical cancer screening
- Clinics that do not have access to diagnostic technologies

Data Collection procedure:

- Data will be collected using a structured pre-designed questionnaire through an online survey with gynaecologists.
- Data will be collected regarding their experiences with existing screening methods and attitudes towards AI-based solutions

Data Analysis Plan:

- Data will be analysed using SPSS software
- Summarize demographic information as well as levels of knowledge, attitude and practice using Descriptive statistics
- Chi-square tests will be used to examine associations between demographic variables and knowledge levels attitude and practice
- Logistic regression will identify predictors of positive attitudes towards screening and vaccination

8. Operational definitions

- **Cervical Cancer:** A malignant tumour of the cervix, often caused by persistent HPV infection

- **LBC (Liquid-Based Cytology):** A method of preparing cervical cells in liquid for clearer, more accurate examination
- **Pap Smear:** A screening procedure used to identify precancerous or cancerous cells on the cervix
- **AI-enabled cervical cancer screening:** Screening techniques powered by AI algorithms to detect cervical abnormalities.
- **TAT (Turnaround Time):** The time taken from sample collection to diagnosis

9. Ethical considerations

- Participation is completely voluntary, and participants are free to withdraw at any time from the study
- Measures will be taken to safeguard the privacy and confidentiality of participants personal information

10. Implications

- **For Healthcare Providers:** Insights into factors that could accelerate the adoption of AI-driven cervical cancer screening solutions, leading to improved patient outcomes
- **For the Industry:** Helps companies to better understand the market dynamics and barriers to adoption in the Indian market, enabling more effective marketing strategies

11. References

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4. Sankaranarayanan, Rengaswamy et al. The Lancet Oncology, Volume 20, Issue 11, e637 -e644
5. https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf
6. <https://www.thinkglobalhealth.org/article/easing-cervical-cancer-disease-burden-india>

Questionnaire for Primary data collection

Sr No.	Questions
	Ask at Reception
1.	What are the consulting fees for patients?
2.	How many years of experience does the doctor have?
3.	How long has the doctor been running this centre?
	Ask from Doctor
	Cervical Cancer Screening numbers
4.	Total number of patients seen per day / week / month
5.	What is the volume of cervical cancer screenings performed per week?
6.	What methods are used for cervical cancer screening?
7.	Reason for using this particular method for screening.
8.	What are the costs of these cervical cancer screening methods?
	Cervical cancer and PAP Smear
9.	How does doctor collect the sample for CC screening?
10.	How many PAP smears are performed per week?
11.	Does the doctor perform HPV co-testing as well along with PAP or only PAP?
12.	Primary reason for screening (from patient's perspective)?
13.	Major volume of patients for CC screening is from which age group?
14.	What is the doctor's opinion on cervical cancer screening (adequate/not)?
15.	Are there any barriers or patient hindrances for cervical cancer screening?
16.	In general, how frequently does the doctor recommend CC screening (Once in ____ Years)
17.	What role do you think gynaecologists can play a role in increasing cervical cancer screening rates?
18.	According to them, what steps can be taken to increase enrolments for CC Screening?
19.	Would the doctor be interested in championing / advocating for CC Screening?
20.	Does the doctor think that being an active promoter of CC screening would benefit his profile and overall reputation?

	Advanced LBC Technique
21.	Is the doctor aware of advanced LBC techniques?
22.	Has the doctor used advanced LBC techniques?
23.	According to the doctor, what are the advantages and disadvantages of LBC compared to traditional PAP smear methods?
	Company
24.	If the doctor starts cervical screening regularly, how many PAP smears will he be able to do daily?
25.	Would you prefer to partner with a company that is a market leader in cervical cancer screening, which does US FDA-approved cervical screening using AI-based reporting for thin prep smears and US FDA approved mRNA-based HPV testing?
26.	How likely are you to move away from your preferred lab to a highly specialized cervical cancer screening centre?
27.	Would you be okay partnering under the company's terms and conditions and receiving electronic payments?
28.	How comfortable would you be adopting a pricing structure where you purchase cervical screening tests at Rs 2000 and offer them to your patients at Rs 2500?
29.	Do you think your patients will perceive the value of advanced cervical screening technology at this price point?
30.	What types of support (e.g., patient education materials, diagnostic tools, operational assistance) would you expect from the company to make this partnership successful?
31.	Key Reason if the doctor refuses for the partnership