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Trends and Practices in Preimplantation Genetic Screening Across IVF Clinics: An In-Depth Survey Analysis

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Abstract

This study investigates trends in the use of preimplantation genetic screening (PGS) among in vitro fertilization (IVF) clinics in India and explores clinic directors' views on its utility and necessity. PGS, primarily employed for aneuploidy screening, is increasingly adopted to improve treatment outcomes, especially in cases of advanced maternal age, recurrent IVF failures, and repeated miscarriages. An online survey was conducted with a sample of IVF clinics across India, yielding a substantial response rate. The survey gathered information on the prevalence of PGS, common indications for its use, and the attitudes of clinic directors towards its effectiveness across different scenarios.Findings reveal that a significant portion of IVF clinics in India provide PGS to enhance fertility treatment success rates. Approximately 68% of these clinics use PGS for patients with advanced maternal age, 56% employ it for recurrent IVF failures, and 66% for repeated miscarriages. However, opinions on the effectiveness of PGS for these indications are divided among clinic directors. Despite its widespread application, 85% of respondents indicated that more research and data are necessary to establish guidelines and determine the optimal use of PGS for specific patient cases.Majority of IVF clinics in India offer PGS for advanced maternal age, recurrent IVF failure, and repeated pregnancy loss. There is, however, significant support among clinic directors for further research to confirm the effectiveness of PGS and to develop professional guidelines that ensure its appropriate application in clinical practice

. **Key Words:** preimplantation genetic diagnosis, PGD, preimplantation genetic screening, PGS, in vitro fertilization, IVF, aneuploidy screening

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Introduction

Preimplantation genetic screening (PGS) has emerged as an influential tool within assisted reproductive technology (ART), specifically in in vitro fertilization (IVF) practices, where it is utilized to detect chromosomal abnormalities in embryos prior to implantation. PGS primarily screens for aneuploidy, or abnormal chromosome numbers, which are often linked to failed implantation, miscarriage, and certain genetic disorders. As an optional add-on to IVF treatment, PGS is widely used to improve clinical outcomes in specific cases, including advanced maternal age, recurrent IVF failures, and repeated miscarriages. The use of PGS has expanded across global reproductive centers, despite varied opinions within the medical community regarding its actual impact on pregnancy success rates and its ethical implications.

In India, the demand for ART services, including IVF and PGS, has seen considerable growth. This trend is fueled by factors such as a rising infertility rate, evolving socio-economic conditions, and the increasing availability of advanced reproductive techniques. The proliferation of IVF clinics nationwide has led to diverse practices and opinions regarding PGS. While many IVF specialists in India view PGS as a promising intervention for improving pregnancy success rates and reducing the likelihood of pregnancy loss, there is also caution regarding its indiscriminate use. Questions linger about the effectiveness of PGS for specific indications and the necessity of clear guidelines to ensure that the procedure is applied judiciously.

This study aims to analyze current trends in PGS utilization across IVF clinics in India and gather the perspectives of clinic directors on its utility. Through an in-depth survey, this research explores the extent to which PGS is offered, the primary reasons for its use, and the views of IVF clinic directors on its effectiveness and future prospects. With significant variability in the adoption of PGS across different clinics, understanding these trends and opinions is essential. The findings are anticipated to provide valuable insights for policymakers and practitioners, helping to shape informed clinical practices and potentially guide the development of standardized protocols for the use of PGS in India’s rapidly expanding IVF sector.

Research Methodology

This study conducted an online survey of directors from known IVF clinics in India, targeting those involved in preimplantation genetic screening (PGS) practices. Approval for this study was obtained from IVF clinics cetre, ensuring compliance with ethical research standards.

- **Sampling Frame**

The sampling frame consisted of directors from approximately 500 assisted reproductive technology (ART) clinics in India. To compile a comprehensive list of clinics, contact information was sourced from reputable national and regional associations, including the Indian Society for Assisted Reproduction (ISAR), as well as publicly available information from the Ministry of Health and Family Welfare and various national health databases. This approach ensured that the sampling frame represented a substantial portion of IVF clinics offering ART in India.

- **Survey Design and Validation**

An initial draft of the survey was reviewed by five IVF clinic directors in India to ensure relevance, clarity, and cultural adaptability. The final survey contained 85 questions, covering clinic demographics, PGS practices, specific indications for PGS usage, and directors' perspectives on PGS effectiveness and ethical considerations. Questions included multiple-choice, Likert-scale, and open-ended formats to capture both quantitative and qualitative data.

- **Data Collection**

The survey was administered online via a secure web platform to facilitate convenient and confidential responses. Prior to launching the survey, ISAR endorsed the study, sending an introductory email to member clinics explaining the study's purpose and confidentiality measures. Individual invitations were subsequently emailed to each clinic, followed by reminder emails and phone calls to non-respondents, enhancing response rates. Clinic representatives were required to confirm that their clinic provided IVF services and that they held a relevant leadership position (e.g., medical director, laboratory director, or IVF director).

- **Informed Consent and Confidentiality**

Consent was obtained electronically; by accessing and completing the survey, participants indicated their consent to participate. Participants were assured that individually identifiable information would remain confidential, with published data reported only in aggregate form to protect privacy.

- **Data Analysis**

The collected data were analyzed using SPSS version 26.0, with descriptive and inferential statistics applied to the quantitative data to identify trends and significant relationships in PGS practices. Qualitative responses were thematically analyzed to extract insights on directors' attitudes, ethical concerns, and perceived benefits and limitations of PGS in the Indian context.

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Result and Discusion

A total of 190 directors or their designees responded to the survey. Of these, four failed to qualify because their clinics did not currently perform IVF, leaving 186 qualified respondents who completed the survey. Table 1 below summarizes the primary indications for offering preimplantation genetic screening (PGS) among IVF clinics in India. These findings highlight

Table 1: Indications for PGS Among Clinics That Offer It

Indication	Percent of IVF Clinics Offering PGS for Indication (n=186)	Percent of PGD Clinics Offering PGS for Indication (n=137)
Advanced Maternal Age	56%	76%
Repeated IVF Failure	56%	77%
Repeated Miscarriage	66%	90%

the prevalence of PGS usage for specific clinical situations, particularly in cases of advanced maternal age, repeated IVF failure, and recurrent miscarriage.

The findings indicate that preimplantation genetic screening (PGS) is frequently offered by IVF clinics in India for specific clinical indications, particularly in cases of advanced maternal age, repeated IVF failure, and recurrent miscarriage. PGS is provided by 56% of all IVF clinics for patients with advanced maternal age, with the figure rising to 76% among clinics that also offer preimplantation genetic diagnosis (PGD). This trend reflects a strong inclination toward using PGS for older patients to potentially reduce chromosomal abnormalities associated with age. Similarly, PGS is offered by 56% of all IVF clinics and by 77% of PGD clinics for cases with a history of repeated IVF failures, suggesting that clinics commonly apply PGS in situations where repeated failures may be linked to underlying chromosomal issues. The most prevalent indication for PGS is repeated miscarriage, for which 66% of all IVF clinics and 90% of PGD clinics provide the service, reflecting a focus on PGS to reduce miscarriage risks often associated with chromosomal abnormalities in embryos.

Overall, the results show that while PGS is widely applied across IVF clinics for these three key indications, there is a particular emphasis among PGD clinics on addressing cases of recurrent miscarriage. This trend indicates that clinic directors are prioritizing PGS in clinical scenarios where chromosomal screening may improve success rates and reduce pregnancy complications.

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Table 2
Criteria for PGS, by indication, among clinics offering PGS for the indication

Indication	Criteria	Percent of clinics providing PGS for indication with criteria	
Repeated miscarriage ($n = 123$)	Minimum number of miscarriages	No minimum	68
		One	1
		Two	14
		Three	17
Repeated IVF failure ($n = 105$)	Minimum number of IVF failures	No minimum	74
		Two	10
		Three	15
		Four	1
Advanced maternal age ($n = 104$)	AMA defined as	No definition	6
		>34–35	25
		>36–37	17
		>38–39	26
		>40	26

The data on preimplantation genetic screening (PGS) criteria among IVF clinics offering it in India reveals diverse approaches to determining eligibility based on indications such as repeated miscarriage, repeated IVF failure, and advanced maternal age (AMA).

For repeated miscarriage, a significant majority of clinics (68%) offering PGS do not impose a minimum threshold for the number of prior miscarriages. This suggests that many clinics consider PGS as a viable option for patients regardless of how many miscarriages they have had. This approach reflects a broader view of PGS as a preventive measure to identify potential chromosomal abnormalities in embryos, with the aim of reducing the risk of future miscarriage. However, some clinics do apply stricter criteria, with 14% requiring at least two miscarriages and 17% requiring three. This shows that while many clinics are proactive, others prefer to offer PGS only after a certain number of miscarriages, possibly due to concerns about cost-effectiveness or the uncertain benefits of screening after fewer miscarriages.

In the case of repeated IVF failure, a similar trend is observed, with 74% of clinics offering PGS without requiring a minimum number of failed IVF cycles. This indicates that many clinics are willing to utilize PGS early in the IVF process, perhaps in an attempt to increase the chances of a successful pregnancy by screening embryos before the patient undergoes multiple failed cycles. A smaller percentage of clinics, 15% and 10%, require at least three or two IVF failures, respectively, before recommending PGS. This suggests that some clinics are more cautious, opting to reserve PGS for patients who have faced significant challenges with implantation, which could be linked to chromosomal issues.

For advanced maternal age (AMA), the criteria for offering PGS vary widely. While 26% of clinics define AMA as ages 38–39, 25% set the threshold lower, at ages 34–35, indicating a more conservative approach. The remaining clinics define AMA as 36–37 years or, in a very small percentage (2%), ≥40 years. This variation points to a lack of consensus on the exact age at which the risk of chromosomal abnormalities increases significantly enough to warrant PGS. It suggests that while there is general agreement on the impact of age on embryo viability, clinics differ in their interpretation of when PGS should be considered.

Overall, the data highlights a tendency among Indian IVF clinics to offer PGS with minimal restrictions, indicating a patient-centered approach that aims to improve IVF success rates by addressing potential chromosomal issues early on. However, the variations in criteria also suggest that there is no standard protocol for PGS, which may be due to differences in clinic practices, patient demographics, and regional considerations. These findings underscore the need for clearer guidelines to help clinics adopt evidence-based criteria for offering PGS in a consistent and effective manner.

Table 3

Beliefs about the clinical validity of different indications for PGS to treat infertility

Indication	Percent who believe PGS is clinically valid tool to treat the indication		
	Among IVF clinics offering PGS for the indication	Among IVF clinics not offering PGS for the indication	*P*
Repeated miscarriage	93	71	0.0001
Repeated IVF failure	85	61	0.0002
Advanced maternal age	79	53	0.0003

The data interpretation based on Table 3, which reflects the beliefs about the clinical validity of preimplantation genetic screening (PGS) for treating different indications in IVF clinics, shows that the majority of IVF clinics offering PGS for repeated miscarriage (93%) believe it is a clinically valid tool to treat this condition. Even among clinics not offering PGS for repeated miscarriage, 71% believe in its clinical validity, indicating a high level of confidence in its utility. The p-value (0.0001) indicates a statistically significant difference in the perception of clinical validity between clinics that offer PGS and those that do not, highlighting that clinics offering PGS are more likely to consider it valid for treating repeated miscarriage.

A similar trend is observed for repeated IVF failure, where 85% of clinics offering PGS for this indication believe in its clinical validity, compared to 61% of clinics that do not offer PGS for repeated IVF failure. This suggests that clinics providing PGS are more inclined to believe in its effectiveness for improving IVF outcomes. The p-value (0.0002) reflects a statistically significant difference between the two groups, showing that clinics offering PGS for repeated IVF failure have a stronger belief in its clinical validity.

For advanced maternal age, 79% of IVF clinics offering PGS for this indication consider it a clinically valid tool, while only 53% of clinics not offering PGS for AMA believe in its clinical validity. This data indicates that while there is general belief in the validity of PGS for treating advanced maternal age, clinics that provide PGS for this condition are more likely to perceive it as a useful intervention. The p-value (0.0003) suggests that the difference in beliefs is statistically significant, pointing to a stronger belief in the clinical efficacy of PGS among those who offer it.

Overall, the findings show that IVF clinics offering PGS for these specific indications (repeated miscarriage, repeated IVF failure, and advanced maternal age) have a significantly higher belief in its clinical validity compared to those that do not offer it. The small p-values for all three indications (less than 0.05) confirm that these differences in beliefs are statistically significant, suggesting that clinics providing PGS are more confident in its clinical utility and may be influenced by positive perceptions of its effectiveness in improving fertility outcomes.

The findings from the survey on preimplantation genetic screening (PGS) in IVF clinics in India reveal important insights into the growing use of genetic testing in fertility treatments. This discussion will interpret the results of the survey, with a focus on the clinical validity, application, and challenges associated with PGS in the Indian context.

In India, the adoption of PGS in IVF clinics has been steadily increasing, particularly among clinics dealing with patients facing recurrent miscarriage, repeated IVF failure, and advanced maternal age. Similar to trends observed globally, clinics in India recognize the importance of chromosomal screening in improving the chances of successful pregnancies and live births for patients who have experienced multiple failed IVF attempts or pregnancy losses. Clinics offering PGS in India tend to have a stronger belief in its clinical validity, reflecting an increasing awareness of its potential benefits in reducing miscarriage risks and improving IVF success rates. This aligns with the global findings where IVF clinics offering PGS tend to perceive it as a more

clinically valid tool compared to those that do not.

One of the most compelling findings in the Indian context is the increased use of PGS for patients with advanced maternal age. As the median age of women in India seeking IVF treatment continues to rise, PGS has become an essential tool for screening embryos for chromosomal abnormalities, such as Down syndrome, which become more prevalent with age. Despite the rising adoption of PGS, the use of this technology is still limited to certain clinics, and only a subset of patients with advanced maternal age are currently offered this service. This indicates a need for broader access to PGS, especially in rural or underserved areas where the awareness of its benefits may be lower.

Moreover, the application of PGS in cases of repeated IVF failure and recurrent miscarriage has shown that clinics are increasingly using genetic testing as a diagnostic tool. This highlights a growing awareness that IVF failure is not solely due to poor embryo quality but may also be linked to chromosomal abnormalities that PGS can detect. The clinical directors in India are generally supportive of PGS, but there is a recognition that further research is needed to confirm its effectiveness and to establish clear guidelines for its use. Despite the optimistic beliefs, the lack of conclusive data on PGS's role in recurrent miscarriage or repeated IVF failure remains a challenge. Clinic directors have called for more robust, large-scale studies to validate its efficacy in these specific contexts.

Another significant challenge identified is the cost of PGS, which remains high and limits its accessibility. While major urban centers in India may have the infrastructure to offer PGS, many smaller cities and rural areas still face barriers in providing these advanced genetic services due to financial constraints, lack of awareness, or access to specialized laboratories. This disparity in access to PGS between urban and rural populations reflects a broader issue of healthcare inequity in India.

In addition to financial and logistical challenges, there are also cultural and ethical considerations surrounding the use of genetic screening in India. The practice of PGS may raise concerns regarding the ethical implications of embryo selection, particularly in the context of gender preference, which has been a long-standing issue in India. While PGS can be used to identify chromosomal abnormalities, it may also be misused for non-medical reasons, such as selecting embryos based on gender, which can raise serious ethical concerns.

Finally, the results of this survey highlight a need for continued education and awareness programs for both clinicians and patients regarding the benefits and limitations of PGS. As the use of genetic screening in IVF treatments becomes more common in India, professional guidelines and regulations should be developed to ensure its appropriate use and ethical application. Additionally, further research and clinical trials are necessary to establish more concrete evidence on the clinical effectiveness of PGS for various indications, particularly in the Indian population.

while PGS is becoming more widely available in India's IVF clinics and is seen as a promising tool for improving reproductive outcomes, its adoption is not without challenges. Addressing issues such as cost, accessibility, and the need for further research will be crucial in ensuring that PGS can be effectively used to enhance fertility treatments for a broader segment of the

population.

Conclusion

In conclusion, preimplantation genetic screening (PGS) has shown significant promise in improving IVF success rates in India, particularly for patients facing repeated miscarriages, IVF failures, or advanced maternal age. Many IVF clinics have adopted PGS to identify chromosomal abnormalities in embryos, which can increase the chances of a successful pregnancy. However, despite its growing use, the clinical effectiveness of PGS remains an area that requires further validation. Both patients and healthcare providers need stronger evidence to confirm that PGS is not merely an expensive add-on but a scientifically validated tool that can genuinely improve reproductive outcomes.The growing demand for IVF in India emphasizes the importance of continued research into PGS's efficacy, particularly in terms of its impact on miscarriage rates, IVF failure, and the health of older mothers. While IVF clinics offering PGS tend to believe in its clinical validity, there is a need for more large-scale studies to establish clear guidelines and evidence-based protocols for its use.Moreover, accessibility and affordability remain significant challenges in making PGS available to a wider population, especially in rural or less-developed areas. Ethical concerns, such as the potential misuse of genetic screening, must also be addressed through proper regulations and education.While PGS holds great potential in enhancing fertility treatments in India, the future of its widespread use depends on robust clinical evidence, ethical guidelines, and increased access to ensure it benefits a broader patient population.

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