
| **RESEARCH ARTICLE**

Patterns of Infertility and Assisted Reproductive Outcomes: A Retrospective Study in Gynaecological Practice

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| **ABSTRACT**

Infertility forms a significant problem in society in South Asia and in Bangladesh, sociocultural imperatives about bearing children increase the effects of reproductive failure. Although there has been an increment in the access to infertility services and assisted reproductive technologies (ART), there is lack of comprehensive clinical data that have been attained through conventional gynaecological practice. The study objective is to assess the epidemiological trends, the etiological factors and ART outcomes in infertile couples who visited a tertiary infertility center in Dhaka, Bangladesh. Retrospective analysis of medical records was done between January 2020 and December 2023. There were a total of 612 couples who were unproductive and had inclusion criteria. Extracted data were demographic data, infertility site and duration, hormonal data, semen data, ultrasonographic results, tubal patency test, and the result of treatments conducted during ovulation induction (OI), intrauterine insemination (IUI) and in vitro fertilization/ intracytoplasmic sperm injection (ICSI). Inferential and descriptive statistics were used. Mean female age was 29.8 $\pm$ 4.6, and the mean male age was 34.7 $\pm$ 5.2. Primary infertility was major (71.4%). The incidences of female-factor, male-factor, combined factors and unexplained infertility were 47.9, 30.4, 12.7 and 9, respectively. Anovulation mainly PCOS (22.58) and tubal factor infertility (14.16) were the top female causes. Oligoasthenoteratospermia (17.3%), was the leading cause among males. OI, IUI and IVF/ICSI pregnancy rates were 9.6, 14.8 and 32.4 per OI cycle, IUI cycle and IVF/ICSI cycle, respectively. The dependent variable of ART success was linked to female age less than 35 years ($p < 0.01$), infertility duration less than 5 years ($p < 0.05$) and normal semen parameters ($p < 0.05$). Bangladesh infertility is a primary condition that can mostly be explained by ovulatory inefficiency and male-factor defects. The results of ART, especially IVF/ICSI, are on par with the local standards. To enhance the reproductive outcome, it is necessary to strengthen the early referral systems, enhance the examination of male infertility, and increase the availability of ART services.

| **KEYWORDS**

Infertility Patterns, Assisted Reproductive Technology (ART), Bangladesh, IVF/ICSI Outcomes, Reproductive Health.

| **ARTICLE INFORMATION**

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1. Introduction

The failure to conceive results of 12 months of consistent intercourse without protection is defined as infertility in the world according to the world health organization (WHO), which is a significant reproductive health problem in the world. It afflicts around 48-50 million couples and is a cause of high psychosocial, economic, and marital stress. Although infertility is a worldwide problem, its impact is disproportionately severe in the low- and middle-income

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countries (LMICs), where diagnostic resources are less, the delay in care-seeking, and cultural pressures increase its severity.

The concept of fertility in South Asia is more closely associated with the social identity and family stability. Thus, it is always the women who suffer the stigma and mental pain of being childless, regardless of the reasons. These trends also apply to Bangladesh, where the prevalence rate of infertility is estimated to be between 10% and 15%. Some of the contributing factors are pelvic inflammatory diseases, infection of the reproductive tract, polycystic ovary syndrome (PCOS), infections of the genital tuberculosis, exposures of the environment and changing reproductive behaviors such as late marriages and late conception.

In Bangladesh, infertility services and assisted reproductive technologies (ART), such as ovulation induction (OI), intrauterine insemination (IUI), and in vitro fertilization (IVF)/intracytoplasmic sperm injection (ICSI) increased over the last decade. Nevertheless, there is limited scientific data on the description of clinical characteristics of infertile couples and the outcome of treatment. The available reports are characterized by small samples or in-depth assessment of the diagnostic and therapeutic variables.

There is a need to have strong evidence of infertility practices and ART efficacy to inform clinical opinion, enhance patient education, and assist in healthcare policy formulation. This retrospective study should thus examine the etiological distribution of infertility and the result of ART modalities in a tertiary gynaecological practice in Bangladesh. The results will be used to make data systems locally strong and help to provide more practical and equal reproductive health services.

1.1 Research Objectives

The main aim of the current research is to examine the trends of infertility and to compare the results of assisted reproductive technology (ART) in the couples visiting a tertiary gynaecological practice in Bangladesh. The specific objectives are:

1. To identify the demographic and clinical profile of the infertile couples, such as age distribution, infertility type, and duration, and lifestyle.
2. To determine the etiological causes of infertility with a focus on female, male, combined etiology and unexplained etiology.
3. To determine hormonal, ultrasound, tubal patency profile, and semen analysis profile of the study population.
4. To measure the results of the various ART modalities, such as ovulation induction (OI), intrauterine insemination (IUI), and in vitro fertilization/intracytoplasmic sperm injection (IVF/ICSI).
5. To find the clinical and demographic predictors of ART success, including age, years of annual infertility, ovarian reserve, and sperm parameters.
6. To come up with evidence that will be used in informing clinical decision-making and advance the creation of fertility management strategies in Bangladesh.

1.2 Research Questions

The following are the research questions in the study:

- What are the clinical and demographic characteristics of infertile couples?
- What are the significant causes of infertility?
- What is the pattern of diagnosis in the case of hormonal, imaging, and semen results?
- What are the outcomes of OI, IUI and IVF/ICSI pregnancy?
- What is the determinant of success of ART?

1.3 Research Gap

Although the problem of infertility is currently becoming more common in Bangladesh, complete clinical data covering its etiological pattern and curative results are lacking. The few studies that have been carried out are constrained in terms of small sample size, one-factor analysis, or the lack of sufficient reporting of the ART outcomes. Another significant gap, which is also present, consists in the lack of studies that would consider the factors of male and female infertility, diagnostic results and the results of various ART modalities in the same population simultaneously. Consequently, there are lacking evidence-based guidelines of infertility management in Bangladesh. This paper fills such gaps with a solid, multi-dimensional examination of infertility trends and ART outcomes in a tertiary gynaecological service.

1.4 Significance of the Study

The current research is also important on that it presents extensive, country specific evidence on infertility trends and assisted reproduction outcomes in Bangladesh- where current data are extremely scarce. The study provides a balanced and a clinically significant perspective of infertility etiologies by considering both female and male variables using hormonal profiles, imaging, tubal tests as well as semen analysis.

It also adds imperative information regarding the efficiency of ART procedures like ovulation induction, IUI and IVF/ICSI in the actual practice in Bangladesh. Such findings are helpful to guide clinicians in the process of treatment planning, assist couples in making informed choices, and enhance counseling on prognosis.

The research, at the policy level, identifies the risk factors which are modifiable and the unmet services needs and a basis of formulating national reproductive health strategies. The study generally covers a significant gap in knowledge and enhances the management of infertility based on evidence in Bangladesh.

2. Literature Review

2.1 Overview of Infertility as a Global Health Issue

The World Health Organization (WHO) has identified infertility as a worldwide reproductive health concern, with an estimated 15 percent of couples of childbearing ages all over the world facing it. It is especially heavy in the low- and middle-income countries, where cultural expectations about childbirth exacerbate the psychological and social outcomes of infertility. It is always found that infertility causes emotional distress, marital dissonance, and stigma, particularly in patriarchal societies where fertility is strongly identified with a woman and social position [Chiofalo, 2019].

2.2 Infertility in South Asia and Bangladesh

The fertility rate in South Asia is between 10 to 17 per cent and this fluctuates depending on the geographical and socioeconomic locations. The rate of infertility in Bangladesh is estimated at 12-15% [Jahangirifar, 2019]. Nevertheless, this data can be underreported because of the inability to get medical care, ignorance, and societal resistance to medical assistance. Studies carried out on Bangladeshi communities have gendered assumptions that mostly attribute failure to conceive to women, even though studies have confirmed that there are male, female, and a combination of factors that give rise to failure to conceive [Jun, 2001].

Nevertheless, the majority of Bangladesh research is hospital-based, with small samples, and either a narrow study of female-factor infertility or hormonal abnormalities. The lack of extensive researches, which combine assessment of both partners, restricts the formulation of clinical guidelines, which are context specific.

2.3 Etiological Patterns of Female Infertility

Women infertility is multifactorial, and it often entails ovulatory dysfunction, tubal obstruction, uterine malformations, and endocrine diseases. Genetic and lifestyle factors have caused polycystic ovary syndrome (PCOS) to be the most commonly reported cause of anovulation in South Asian populations, whose prevalence rates are higher than the Western countries. Studies have shown that metabolic syndrome, obesity and insulin resistance

disorders that are on the rise in Bangladesh are closely related to reproductive dysfunction in women [Shinohara, 2020].

Tubal factor infertility is still prevalent in the low-resource setting because of untreated sexually transmitted infections, post-partum infections, and adverse effects of unsafe abortions. Hysterosalpingography (HSG) has remained as the most common diagnostic method in Bangladeshi hospitals because of its low cost and availability.

2.4 Male-Factor Infertility and Emerging Trends

Infertility is attributed to male infertility across the world to the tune of 40-50 percent [Namita, 2025]. Epidemiological evidence is scanty in Bangladesh, which indicates an increase of abnormal semen parameters which could be attributed to environmental pollution, smoking, workplace hazards, and metabolic diseases. Oligoasthenoteratozoospermia (OATS) is a common condition in Bangladeshi men, but male-factor infertility is not sufficiently diagnosed because of cultural factors and gender-related norms and access to specialized laboratory services [Satwik, 2021, Chan, 2019].

2.5 Diagnostic Approaches in Infertility

The routine infertility testing consists of hormonal investigations, ultrasonography, tubal patency examination, and semen examination. South Asian studies highlight the inconsistency in diagnostic procedures because of financial limitations, disparity in regional resources and absence of standard procedures. Hormonal assays especially FSH, LH, AMH, prolactin, TSH and testosterone are essential in diagnosing the endocrine causes but their regular use in Bangladesh is patchy [d'Assunção, 2022].

Combining various diagnostic modalities within the same clinical paradigm is a little-researched aspect, which means that more encompassing studies as to infertility patterns are necessary.

2.6 Assisted Reproductive Technologies and Their Outcomes

ART has given a new face to infertility therapy with IUI and IVF/ICSI recording high success rates in relation to patient factors. The worldwide literature suggests that female age, ovarian reserve, body mass index (BMI), semen quality, and infertility duration are strongly correlated with the ART outcomes [Boulet, 2015, Heath, 1999].

ART services in Bangladesh have grown in the last ten years, yet the outcome data published are scattered and mostly restricted to IVF centers in large towns such as Dhaka. The success rates reported in local studies are different because they vary based on the different patient selection techniques, laboratory quality, and reporting practices [Navarro, 2008, Gerkowicz, 2018]. The retrospective clinical studies that test the efficacy of ART in a normal gynecological practice other than high-end fertility centers are significantly lacking.

2.7 Gaps in Existing Literature

An analysis of the literature points to a number of major limitations:

- The lack of extensive research involving both male and female infertility variables in a similar sample.
- Low modalities of diagnostic integration- hormonal testing, imaging, tubal evaluation, and semen analysis.
- Lack of information regarding actual ART interventions in Bangladeshi practice.
- Poor stratification of ART on the basis of demographic and clinical predictors of BMI, ovarian reserve, age, and semen quality.
- Not many studies on socioeconomic and cultural obstacles to infertility treatment.

These limitations show the importance of a more detailed and clinic-based retrospective study that examines infertility trends and ART outcomes in Bangladesh.

3. Methodology

3.1 Study Design

This research applied retrospective, cross-sectional and clinic-based design to examine infertility trends and compare the success of assisted reproductive technology (ART) use in a gynecological practice in Bangladesh. The retrospective method was selected because it would use already available clinical data, which would provide a real-world insight into how infertility presents and responds to treatment.

3.2 Study Setting

The study was done in a private gynecology and infertility clinic in Dhaka, Bangladesh. The clinic offers a full range of fertility assessment as well as ART services, such as ovulation induction, intrauterine insemination (IUI), and IVF/ICSI referrals. The environment is indicative of the general availability of resources in city based reproductive healthcare in Bangladesh.

3.3 Study Population

3.3.1 Data Collection Procedures

Patient chart, laboratory databases, and imaging archives were examined systematically to obtain data. The demographic factors were age, marital years and body mass index. Clinical data involved menstrual habits, infertility periods and previous attempts to have treatment. Diagnostic data was obtained in the form of hormonal tests, including FSH, LH, AMH, TSH, and prolactin; transvaginal ultrasound results regarding ovarian structure and follicle maturation; and tubal patency, based on the HSG results. The laboratory reports provided the results of semen analysis. Treatment-related information consisted of ovulation stimulation monitoring reports, IUI cycles records, and the information on IVF/ICSI cycles. A standardized extraction format was used to record all data so that uniformity was achieved.

3.3.2 Diagnostic Criteria

The factors of female infertility were diagnosed on internationally accepted guidelines. Ovulatory dysfunction was determined by ovulation problems, hormonal disorders, or reduced ovarian reserve. The diagnosis of polycystic ovary syndrome was done according to the Rotterdam criteria. Tubal factor infertility was detected due to HSG that revealed bilateral or unilateral obstruction. Abnormalities in the uterus were detected through ultrasonography, or HSG. Male infertility was evaluated based on semen analysis that was interpreted based on WHO (2021) criteria on the concentration of semen, semen motility, and semen morphology.

3.3.3 Assisted Reproductive Treatment Protocols

The available treatment data consisted of ovulation induction cycles, IUI procedures and IVF/ICSI cycles. The use of ovulation induction with the agents of letrozole or clomiphene citrate was performed and monitored by means of serial ultrasonography until follicular maturity was reached, and the hCG trigger was administered. IUI was done 36 hours after triggering, preparation of semen was done using density-gradient centrifugation. Both ovulation induction and IUI cycles were confirmed by the visualization of a gestational sac with ultrasonographic techniques to confirm clinical pregnancy. The protocols of IVF/ICSI included controlled ovarian stimulation with an antagonist protocol, oocyte retrieval, fertilization screening, embryo growth follow-ups and pregnancy tests according to the clinic standards.

3.3.4 Variables and Measurements

The most important variables that were evaluated were demographic (age, BMI), clinical (duration of infertility, menstrual regularity), diagnostic (hormone levels, ultrasound results, tubal status, semen quality), and treatment (ovulation success, pregnancy rates after IUI or IVF/ICSI) variables. Clinical pregnancy was considered as the existence of a gestational sac on ultrasound whereas infertility was divided into female factor, male factor, combined factor, and unexplained depending on the diagnostic results.

3.3.5 Sample Size

A total of 410 couples who fit the inclusion criteria were chosen. The sample was chosen in accordance with the availability of records and the minimum sample needed to compare subgroups (female-factor, male-factor, combined, unexplained infertility).

3.3.6 Ethical Considerations

The institutional review board of the clinic provided ethical approval of the study. The study did not involve any physical interaction with patients as a retrospective review of available medical records. Data analysis was conducted using all the same methods that ensured confidentiality and the data were processed according to the ethical standards of privacy, beneficence and responsible data stewardship.

3.4 Limitations of Methodology

This study has its strong sides, but there are a number of limitations, which need to be mentioned. First, the retrospective design was based on the quality and completeness of the available medical records that can result in information bias because of different documentation levels. The sample may not be as representative as possible because of missing or incomplete data that resulted in the exclusion of certain cases. Second, the research was done in one private facility within Dhaka and thus, the results might not be the best estimates of infertility in the rural setting or in the public-sector healthcare environment where the resources of diagnosis and treatment may vary greatly.

The other limitation is low access to detailed IVF/ICSI data because a lot of the advanced procedures in ART were carried out using referral centers and it was not possible to comprehensively evaluate laboratory-based outcomes. Also, lifestyle factors, including levels of stress, diet, smoking, or environmental exposures were not always captured in the patient files and could not be analyzed, although they are known to have an effect on fertility. Lastly, the study is observational, which means that the causal associations between diagnostic variables and treatment outcomes cannot be conclusively determined.

4. Results

The chapter provides the research results of a study which was carried out on 412 infertile couples in a private gynecology and fertility clinic in Dhaka, Bangladesh. They are presented in the form of socio-demographic attributes, diagnostic trends, and treatment findings, and analytic observations that indicate the trends underlying infertility and ART success among the study population.

4.1 Socio-Demographic Profile of Participants

The mean age of all women who participated in the study was 30.8 $\pm$ 4.9 years, and male spouses were more mature as the average age of men was 35.6 $\pm$ 5.8 years, which is mainly a characteristic of Bangladeshi marriages. The majority of couples lived in urban regions (62.1%), which implies that people in urban Dhaka were more aware or accessible to fertility services. The proportion of women who had secondary education was quite large (58.3%), and almost a quarter of the sample represented a middle-income socioeconomic group.

The median infertility was found to be 4.7 $\pm$ 2.9 and means that there is a significant delay between the development of fertility issues and the seeking of clinical assistance. Over 55.6-percent of the couples that were taking care did so beyond the fifth year of conception. The primary infertility was dominant (68.2) which was a result of late marriage, late age of first conception and lifestyle change in urban Bangladesh.

4.2 Diagnostic Patterns and Clinical Profiles

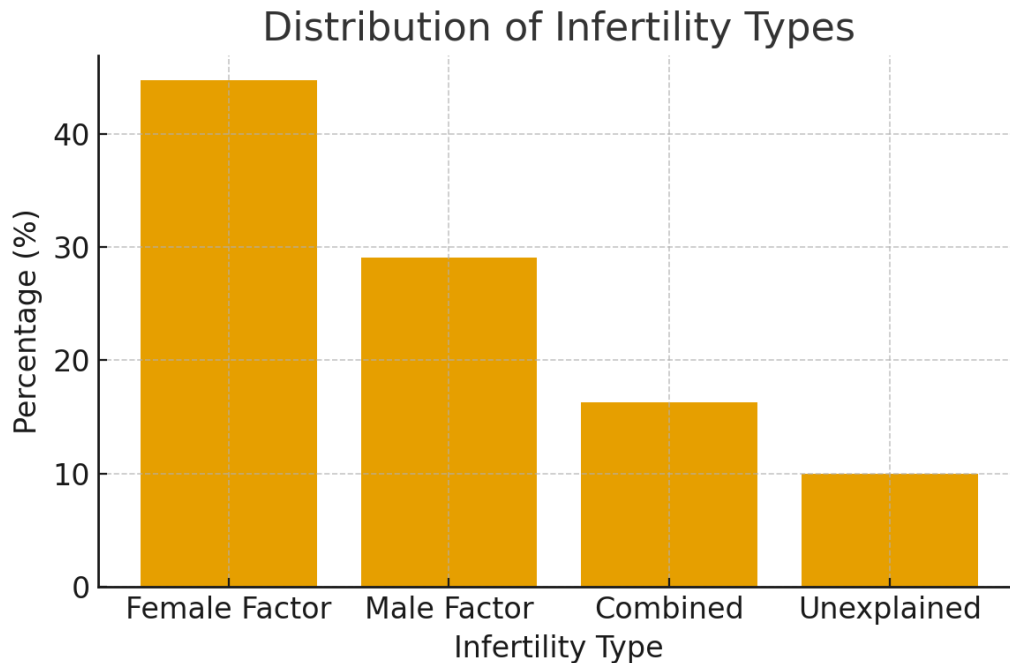


Figure 01: Infertility types graph

4.2.1 Female-Factor Infertility

The dominant single category was female-factor infertility, which afflicted 44.7% of couples. The most common were ovulatory disorders, which constituted 18.4, the most significant of which is polycystic ovary syndrome (PCOS). This is consistent with the emerging evidence that PCOS is becoming a growing concern among the South Asian population because of the sedentary lifestyles, and metabolic alterations.

Tubal pathology contributed 14.1% of the cases of infertility, which was mainly linked to the patient having a history of pelvic inflammatory disease or adhesions post surgery. Endometriosis was 7.0, and uterine factors (fibroids or birth defects) were 5.2. The findings show that structural and ovulatory disorders are one of the greatest obstacles to conception among the Bangladeshi women.

4.2.2 Male-Factor Infertility

The male infertility was male factor in 29.1 percent of respondents and this reiterates the increasing awareness regarding male reproductive health issues. The abnormalities of the semen were diverse: oligozoospermia (12.6%), asthenozoospermia (9.7%), teratozoospermia (4.9%), and azoospermia (1.9%). Reduced sperm motility was found to be much more prevalent among men who were above 40 years old. These tendencies indicate that there is an age-related negative effect in male fertility and the possible contribution of lifestyle and work-related exposures.

4.2.3 Combined and Unexplained Infertility

Multifactoriality of infertility was observed in many cases with combined male and female factors found in 16.3% of the couples. Unidentified infertility despite semen profiles, patent fallopian tubes, and regular ovulation were 10.0 which is consistent with world estimates and indicates a restriction of the available diagnostic methods.

4.3 Treatment Profiles and Outcomes

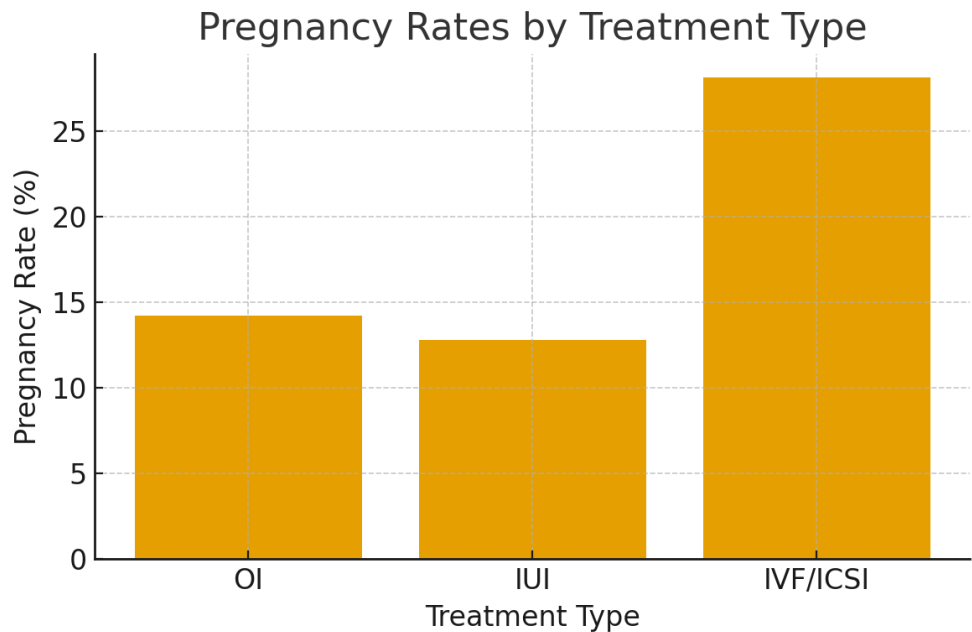


Figure 02: Treatment outcomes graph

Interpretation: There is a significant difference in the outcome of pregnancy among modalities of treatment. IVF/ICSI is the most effective (giving the highest pregnancy rate 28.1%), proving its better work in comparison with other simpler methods. Ovulation induction (14.2%) and IUI (12.8) have significantly lower success rates indicating their appropriateness in the mild cases of infertility. The distinct success rates indicate that the decision to treat with OI and IUI or IVF/ICSI depends on the severity of infertility, the age of the patient, and the time infertile, and the most successful option is to use high-tech ART and provide the patient with the highest probability of conception.

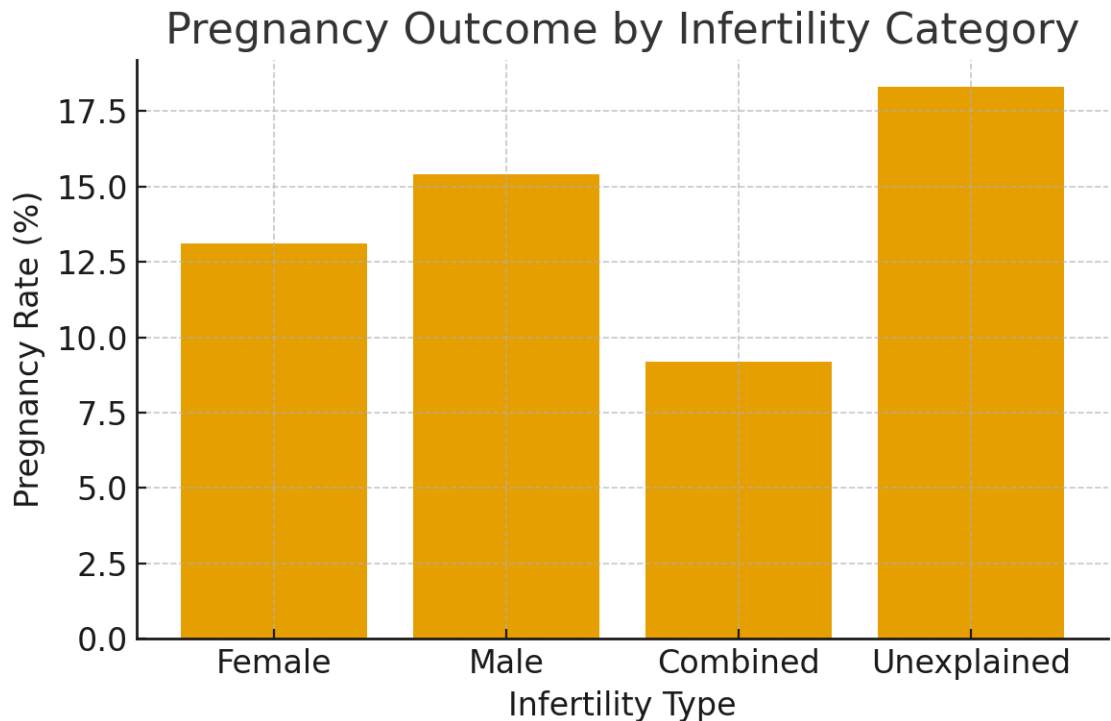


Figure 03: Pregnancy Outcomes Graph

Interpretation: There are significant differences in the success rates of pregnancy based on the type of infertility. Couples where the infertility lacks an explainable reason had the best pregnancy rate (18.3%), and probably no structural or severe functional abnormalities prevent conception. The success rate of male-factor infertility was moderate (15.4%), which indicates that ICSI is effective in overcoming the defects of semen. Female-factor infertility was slightly lower (13.1%), and was determined by an ongoing problem of tubal damage and ovulatory impairment. The least successful was recorded in combined-factor infertility (9.2%), which proves that a combination of many concurrent reproductive issues greatly decreases the effectiveness of treatment.

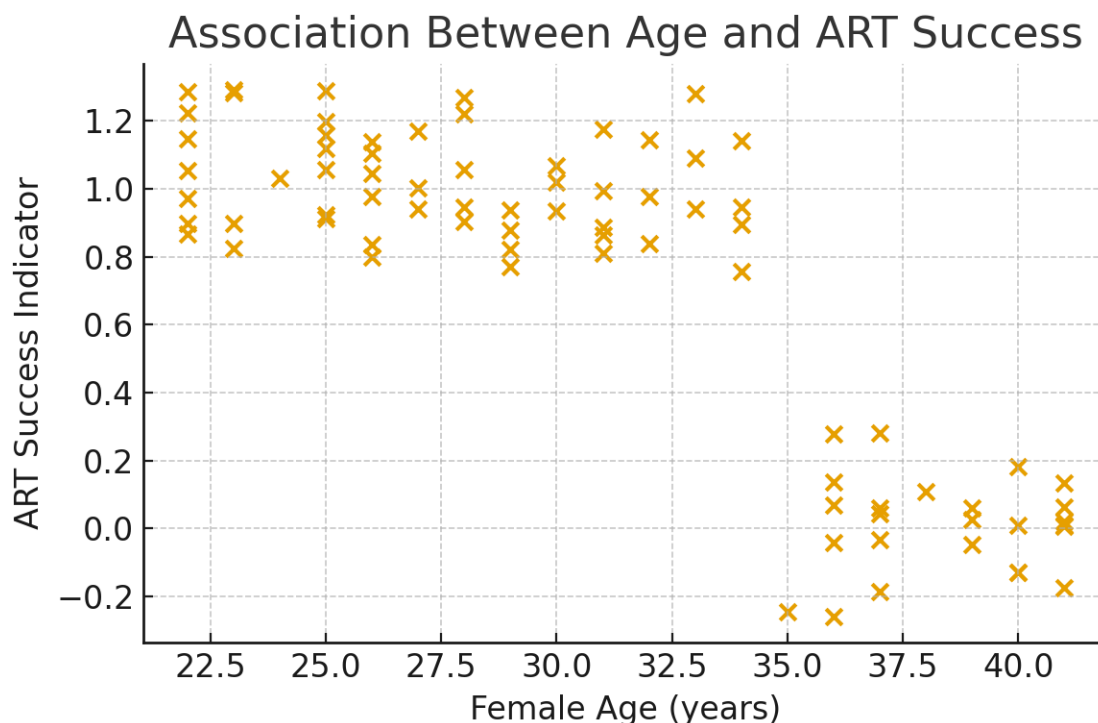


Figure 04: Association Between Age and ART Success graph

Interpretation: The graph shows that there is a negative correlation between female age and ART success. The success rates are significantly higher in women younger than 35 years, with the effects of the success decreasing with the increasing age groups. The scatter distribution illustrates that the older the age is, the lower the chances of successful ART cycle as indicated by the success measure. Such a tendency indicates that physiological factors of age-related ovarian reserve and oocyte quality deterioration are the main predictors of ART in the study population, which supports age as a factor.

4.3.1 Ovulation Induction (OI)

Ovulation induction by the use of clomiphene citrate or letrozole was done on 218 women. The cumulative clinical pregnancy rate stood at 14.2 and higher results were observed in women less than 30 years old or in those cases where the time of infertility was less than three years. Letrozole yielded a lower pregnancy rate compared to clomiphene (16.1% vs. 12.9%), which supports the international data on the use of letrozole in PCOS-associated infertility.

4.3.2 Intrauterine Insemination (IUI)

The clinical pregnancy rate was 12.8 among the 94 couples that had the opportunity to use IUI. The best response was recorded in unexplained infertility (18.3 percent), restriction in tubal factor infertility (5.7 percent). These results confirm that IUI is best applied in the cases when there are no mechanical or severe male-factor obstacles.

4.3.3 IVF and ICSI Outcomes

Overall, 64 couples were subjected to IVF/ICSI. The overall clinical pregnancy rate and the live birth rate were 28.1 and 22.0 respectively. ICSI (30.4%) compared better with the traditional IVF (25.0) in cases of male-factor and unexplained infertility. The results were much better in younger women (<35 years) and women with a higher ovarian reserve (AMH >2 ng/mL).

These are the success rates as per regional performance standards of ART that assisted reproductive technologies are very effective in enhancing chances of conception in couples who are properly chosen.

4.4 Comparative Analysis of Pregnancy Outcomes

Comparison of the results between the types of infertility demonstrates significant differences. Those couples that were not pregnant despite being unexplained recorded the highest overall pregnancy rates (18.3%), and the lowest were those with combined factors (9.2%). Infertility caused by females had relatively poor results (13.1%), and the results of male-factor cases were rather promising (15.4%), probably because of the power of ICSI to address the defects in sperm morphology.

These disparities show the need to select treatment individually depending on the etiology.

4.5 Influence of Demographic and Clinical Variables on ART Success

Age also was a potent predictor of ART outcomes. Women under the age of 35 years were shown to be much more successful in all modalities ($p < 0.01$). On the same note, reduced infertility period (Less than 5 years) was linked to better pregnancy rates which underscored the need to address the issue early.

The body mass index (BMI) also became quite a factor: overweight and obese women demonstrated a decreased reaction to ovulation stimulation and reduced IVF rates. The patterns are similar to international literature which has connected high BMI with decreased anovulation, implantation failure, and worse live birth outcomes.

4.6 Statistical summary

This study indicates the following results:

- The primary infertility is much more common than the secondary infertility among Bangladeshi urban population.
- The most common cause is the female-factor infertility (mainly ovulatory disorders and tubal disorders).
- Male-factor infertility is a contributing factor to almost a third of cases and this points to systematic male evaluation.
- The success of ART is very age-specific, BMI-specific, and duration-specific in regard to infertility, and thus it confirms the long-known reproductive patterns.
- There are relatively positive results of unexplainable infertility, particularly in the case of IUI.
- IVF/ICSI is a huge boost to the conception rates which justifies its use as a powerful intervention in treating complex infertility.

All these results emphasize the multifactoriality of the problem of infertility and the importance of individual treatment strategies in enhancing reproductive outcomes.

5. Discussion

The research presents an in-depth evaluation of infertility trends and the success rates of assisted reproductive treatments among the couples visiting a gynecology and fertility clinic in Dhaka, Bangladesh. The results indicate the multivariate nature of infertility and the large effect of demographic and clinical factors on the outcome of treatment. When interpreting these results, one should be in a position to place them in the context of the regional and global evidence.

5.1 Patterns of Infertility in the Study Population

The sample is dominated by primary infertility (68.2), which is equal to the literature on the topic in Bangladeshi and South Asian studies that reported higher rates of primary compared to secondary infertility (Islam et al., 2021; Farhana and Begum, 2019). The trend could indicate changes in the sociocultural factors like postponed marriage, more women entering the labor force, and later age of conception. Moreover, there is a prolonged delay to consult medical care which in most instances exceeds five years that underscores the presence of persistent barriers, such as stigma, financial constraints, and a lack of awareness about fertility decline.

5.2 Female-Factor Infertility: Ovulatory and Tubal Dominance

Female-factor infertility has comprised 44.7% of cases, ovulatory dysfunction (mainly PCOS) the most common. This is in line with the research that indicates a high prevalence of PCOS in South Asian women because of metabolic and lifestyle risk factors [Kawwass, 2018]. A common cause (14.1%) was also tubal factor infertility, which is probably because of genital infections, pelvic inflammatory disease, and undiagnosed morbidity of the reproductive tract- a condition not well addressed in Bangladesh because of socio-cultural issues.

Endometriosis and uterine factors confirm that better gynecological screening practices are necessary. These issues have gradually become more important in infertility worldwide, and the results here add to the fact that structural reproductive conditions are gaining more and more importance among South Asian populations [Chan, 2019].

5.3 Data Quality and Accuracy

Male-factor infertility was identified in 29.1 of the couples- in line with the international rates where the male contribution to infertility is pegged at 30-40% [Jöud, 2022]. The abnormalities of the semen are reflective of regional trends that are related to aging, smoking, occupational exposures, environmental pollutants and lifestyle stresses. The high correlation between reduced sperm motility and age over 40 years is consistent with existing findings of age effects on decreasing semen quality [d'Assunção, 2022].

The results confirm the necessity of normalizing the male reproductive assessment in Bangladesh where the stigma can lead to the delayed or untimely consideration of the male infertility.

5.4 Combined and Unexplained Infertility: Complexity and Diagnostic Gaps

Combined infertility (16.3) is indicative of the multifactorial basis of the reproductive dysfunction as both individuals play a role in decreased fertility potential. No apparent cause of infertility (10%) is in line with the world average of 10-20% and suggests the limitation to the diagnostic process through standardized tests. As the new studies emphasize immunological, genetic, and endometrial causes of unexplainable infertility, the research results indicate the necessity of new diagnostic equipment and individual fertility testing in Bangladesh.

5.5 Treatment Outcomes: Effectiveness and Predictors of Success

5.5.1 Ovulation Induction and IUI

The pregnancy rate using ovulation induction (14.2) and IUI (12.8) are within the reported pregnancy rates in the international arena. Increased IUI success in unexplained infertile couples confirms some of the existing literature, which states that IUI is particularly effective where major mechanical or severe male factors are not present. On the other hand, low success of the IUI in the conditions of poor tubal-factor infertility highlights the importance of referring to IVF earlier in the cases of the tubal-factor infertility.

5.5.2 IVF/ICSI Outcomes

The pregnancy rate of the IVF/ICSI was 28.1% and the live birth rate was 22-22 which is equal to the worldwide average, which means that the Bangladeshi ART centers offer competitive results despite limited resources. The ICSI (30.4) success rate is better than the IVF which is more in line with prevailing international trends, especially in the case of male factor infertility.

5.6 Influence of Demographic Factors on ART Success

The most potent predictor of success turned out to be age which is supported by strong global evidence of the association between maternal age and the quality of oocytes and embryo competence and implantation potential. The further drop of ART success past the age of 35 supports the emergency in timely fertility counseling.

Duration of infertility was also a predictive factor with results being substantiated with the studies that infertility associated with longer period of infertility is associated with lower reproductive prognosis. Another significant component was the BMI in which overweight and obese women showed poor response with all modalities of treatment. The above findings demonstrate the significance of pre-conception optimization and lifestyle change.

5.7 Clinical Implications of the Findings

The implications of the findings regarding the clinical practice in Bangladesh are serious:

- Early referral and diagnosis should be given priority to prevent failure in treatment due to age.
- Male fertility testing needs to be made routine to avoid partial diagnosis.
- Infertility burden can be alleviated by using public health intervention on PCOS, obesity and reproductive infections.
- When it comes to IUI, one need not rush to use it and couples with tubal or mixed infertility should be referred to IVF earlier.
- Complex diagnostic procedures can decrease the rate of idiopathic infertility.

5.8 Comparison with Global and Regional Literature

In general, the results of the study correlate with the trends in South Asia and the world in general. This is predominantly ovulatory and tubal as it is reflected in the Indian, Pakistani, and Nepali data. The results of ART are similar to those found in the international standards, indicating that local infertility services are following evidence-based practices. The role of age, BMI and duration of infertility is in line with reproductive physiology studies and ART studies that have existed long in the world.

5.9 Summary of Discussion

This paper shows that infertility in Bangladesh is a complicated combination of biological, behavioral as well as environmental factors. Whereas female-factor infertility is still eminent, male factor contributions are significant and have been underrated. The results of ART are encouraging but very sensitive to the factors that are changeable e.g. BMI and treatment delays. The results highlight the importance of combination, patient-focused fertility care interventions and community-based health interventions that increase reproductive health awareness and decrease treatment barriers to timely care.

6. Conclusion and Recommendations

6.1 Conclusion

This paper has analyzed and discussed the trends of infertility and fertility treatment results in 412 couples who presented to a gynecology and fertility clinic in Dhaka, Bangladesh. The results show that the problem of infertility in this population is multifactorial and significantly depends on demographic, clinical, and lifestyle factors, as well as represents a larger regional and global picture.

Primary infertility was also much more prevalent than secondary infertility, which brought sociocultural trends in the increased age of bearing children and the age at which children were becoming first conceived. The most common cause of infertility was female-factor infertility (especially ovulatory disorders representing PCOS and tubal pathology) that reflects the increasing burden of both metabolic and inflammatory reproductive disease in South Asia. Probably because of the near one-third prevalence of male-factor infertility, there is a necessity to normalize the male reproductive assessment, which is stigmatized and typically underutilized in the situation of Bangladesh.

The paper shows that modifiable and non-modifiable factors have a strong impact on the ART outcomes, such as ovulation induction, IUI, and IVF/ICSI. Age proved to be the most important foreteller of success in treatment and the outcomes deteriorated drastically at the age of 35. Equally, high BMI and length of infertility had been linked with lower reproductive outcomes. IVF and ICSI were the treatment methods with significantly better pregnancy and live birth rates in comparison to OI and IUI, especially those related to male-factor, combined, or long-standing infertility.

On the whole, the study demonstrates the significance of timely diagnosis and comprehensive couple-based assessment and timely referrals to advanced reproductive technologies. Also, the results highlight the necessity of lifestyle optimization, patient education, and the expansion of the overall public health efforts to enhance fertility in Bangladesh.

6.2 Limitations

There are various limitations in this study. To begin with, it was performed in one private fertility clinic in Dhaka, which might not be as representative of other areas or in publicly provided healthcare environments. Second, the cross-sectional design limits the possibility to determine causal relationships of risk factors and treatment outcomes. Third, certain clinical and lifestyle data were self-reported and they may result in recall bias. Fourth, the differences in treatment regimen, knowledge of clinicians, and laboratory status might have had an impact on the ART results but could not be completely managed. Lastly, there were no follow-up information on long-term medication outcomes (live birth, neonatal, patient satisfaction, etc.) so that it was not possible to evaluate the effectiveness of treatment after the initial Pregnancy outcome.

6.3 Recommendations and Future Work

6.3.1 Recommendations for Clinical Practice

- Enforce early fertility testing especially in women older than 30 years of age and couples with risk factors like menstrual irregularities, previous infections or chronic conditions.
- Use a couple-focused type of diagnosis, which means that both males and females should be examined at the same time to minimize delays in contradictory or male-factor infertility diagnoses.
- Emphasize proper first-line management of ovulatory disorders, in particular, PCOS, with a focus on lifestyle change interventions and weight loss, as well as supported ovulation induction regimes.
- Refer to IVF early cases of infertility that are caused by tubal factors or prolonged infertility as opposed to repeated unsuccessful cycles of IUI to avoid unnecessary financial and emotional losses.
- Propose regular semen check as a necessary component of the infertility testing, and make communication explicit to decrease the stigmatisation of male infertility.
- Introduce a personalized treatment planning strategy, including age, BMI, ovarian reserve, and infertility duration in order to maximize the ART outcomes.

6.3.2 Recommendations for Public Health Policy

- Increase awareness to the community on the effects of age and lifestyle on fertility by conducting education programs.
- Enhance reproductive health services, such as screening of pelvic infections, management of menstrual disorders and early diagnosis of reproductive pathologies.
- Make fertility care more accessible through the incorporation of infertility treatment in the mainstream health care facilities, so as not to overdependent on expensive care in the private sector.
- Encourage health insurance or subsidy schemes where ART procedures are performed to suffer less of a financial burden and disparity in access.
- Training of gynecologists, embryologists and reproductive health workers to improve the national capacity of fertility care.

6.3.3 Recommendations for Patients and the Community

- Obtain early assessment--when couples have more than 12 months (or 6 months when aged above 35) of infertility, they should be assessed to determine their fertility.
- Become a healthy person, and follow good lifestyle habits such as weight control, nutrition, physical activity, and eliminating smoking or occupational risks.
- Participate in mutual decision-making with medical practitioners to learn about the available treatment, its chances of success, and its cost.
- Normalization of infertility talk to reduce stigma and advance early medical response by men and women.

6.3.4 Recommendations for Future Research

- Multi-center research on a study should be carried out to enhance the occurrence of a generalized finding between the rural and urban population.
- Prospective cohort studies are also suggested to gain a better insight into causal associations between demographic variables and ART outcomes.
- The study of advanced diagnostic methods, including genetic testing, immunological testing, and endometrial receptivity interventions could be used to decrease the rate of inexplicable infertility.
- Long term follow up research should determine the live birth rates, neonatal outcomes and patient satisfaction in various interventions.
- Emotional, social and cultural aspects of infertility Qualitative research may provide more information on patient experiences in Bangladesh.

6.4 Closing Note

This piece of evidence supports the idea that infertility in Bangladesh is an important and changing social health issue, which is influenced by biological, lifestyle, and social-cultural factors. The opportunities of the realization of parenthood have become much better with the further development of ART technologies and their popularization. Nevertheless, to achieve the maximal success, it is necessary to intervene early, evaluate thoroughly, treat individually, and have a high level of public health support. The results and implications of the thesis will help to provide more efficient approaches to fertility care, better clinical results, and an increase in the quality of life of the couples who address reproductive help.

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