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Clinical and Neonatal Outcomes of in Vitro Fertilization in a Tertiary Centre in Yenagoa, Nigeria

Porbeni-Fumudoh B. Offiong[1]; Florence A. Koroye[2]; Markson W. Sam[3]; Agbo John[1]; Joshua K. Stephen[1]; Atemie Gordon[1]; Warisuo S. Ariwelo[1]; Amadi-Oyioma M. Chigesilem[1]; Onisoubuana John-Bennibor[1]; & Clifford A. Timiebi[1]

[1]Department of Obstetrics and Gynaecology, Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria. [2]General Internal Medicine, Princesses Royal Hospital Telford, United Kingdom. [3]Department of Paediatrics, Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria.

Corresponding Author: atemieg@yahoo.com

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Abstract

Infertility is a significant reproductive health issue worldwide, with a disproportionate burden in low- and middle-income countries. In vitro fertilization (IVF) has emerged as an effective treatment option; however, its success rates and neonatal outcomes vary widely depending on patient characteristics, clinical expertise, and resource availability. In Nigeria, there is limited local data evaluating both clinical and neonatal outcomes of IVF, particularly in tertiary health institutions. This study aimed to evaluate the clinical and neonatal outcomes of IVF at a tertiary centre in Yenagoa, Nigeria, and to assess the relationship between selected sociodemographic and clinical factors and treatment success. A retrospective descriptive study was conducted involving 70 IVF cycles performed between January 2022 and December 2025. Data were obtained from patient records and included age, marital status, educational level, parity, type and duration of infertility, and IVF outcomes. The primary outcomes assessed were clinical pregnancy rate, term pregnancy rate, and neonatal output. Secondary outcomes included conversion rate from clinical pregnancy to term delivery and annual variations in success rates.

Statistical analysis was performed using chi-square testing, with statistical significance set at $p<0.05$. The overall clinical pregnancy rate was 30.0% (21/70), while the term pregnancy rate was 20.0% (14/70). Among those who achieved clinical pregnancy, 66.7% progressed to term delivery. Annual IVF outcomes showed variability, with higher success rates recorded in 2022 and 2025 compared to other years. Sociodemographic and clinical variables, including age, parity, educational status, and duration or type of infertility, did not demonstrate a statistically significant association with IVF success ($p>0.05$). Neonatal outcomes revealed a relatively high number of babies per pregnancy, suggesting a notable occurrence of multiple gestations. The IVF outcomes observed in this study are comparable to internationally reported ranges but demonstrate variability across different years.

Keywords: In Vitro Fertilization, Infertility, Clinical Outcomes, Neonatal Outcomes, Nigeria, Assisted Reproductive Technology.

Introduction

Infertility is a major public health concern affecting millions of couples worldwide, with significant medical, psychological, and social consequences. Globally, it is estimated that about 10–15% of couples of reproductive age experience infertility, with a higher burden in low- and middle-income countries, particularly in sub-Saharan Africa (Mascarenhas et al., 2018; Inhorn & Patrizio, 2020). In many African societies, including Nigeria, infertility is associated with stigma, marital instability, and emotional distress, often disproportionately affecting women (Zegers-Hochschild et al., 2019; De Geyter, 2020). In the Niger Delta region, tubal factor infertility remains a major indication for IVF and is frequently associated with pelvic inflammatory disease, sexually transmitted infections, unsafe abortion practices, and complications of poorly managed obstetric conditions. Chronic pelvic infections continue to contribute significantly to infertility among women in the region. In addition, environmental pollution and industrial activities within oil-producing communities have been suggested as possible contributors to reproductive health disturbances, although available evidence is still evolving. These regional characteristics may influence both infertility patterns and IVF outcomes among patients receiving treatment in Yenagoa and other centres within the Niger Delta (Mascarenhas et al., 2018; Inhorn & Patrizio, 2020).

The advent of assisted reproductive technologies (ART) has revolutionized the management of infertility. In vitro fertilization (IVF), in particular, has become a cornerstone in the treatment of various infertility conditions, including tubal disease, male factor infertility, ovulatory dysfunction, and unexplained infertility (Chambers et al., 2021; Ombelet, 2018; Botha et al., 2022). Since its introduction, IVF has evolved significantly, with improvements in ovarian stimulation protocols, embryo culture

techniques, and cryopreservation methods contributing to enhanced success rates (Okonofua et al., 2019; Maheshwari et al., 2018; CDC, 2022).

Despite these advances, IVF outcomes vary widely across regions. In high-income countries, clinical pregnancy rates per cycle typically range from 25% to 40%, influenced by factors such as maternal age, embryo quality, and treatment protocols (ESHRE, 2023; Franasiak et al., 2019). However, in low-resource settings, outcomes are often less predictable due to limitations in infrastructure, cost barriers, and variability in technical expertise (Luke et al., 2020; Smith et al., 2021; McLernon et al., 2019). In Nigeria, although IVF services are increasingly available, access remains limited and outcome data are still relatively scarce (Gleicher et al., 2020; Qin et al., 2021).

Maternal age is widely recognized as a key determinant of IVF success. Advancing age is associated with declining ovarian reserve and reduced oocyte quality, leading to lower fertilization, implantation, and pregnancy rates (Sunkara et al., 2018; Chambers & Ledger, 2020). Other factors such as duration and type of infertility, parity, and underlying medical conditions may also influence outcomes, although their effects are less consistent across studies (Calhaz-Jorge et al., 2021; Kupka et al., 2019).

While clinical pregnancy rate is commonly used as an indicator of IVF success, the ultimate goal of treatment is the achievement of a live birth. Therefore, term pregnancy and neonatal outcomes provide more meaningful measures of success from both clinical and patient perspectives (Fauser, 2019; Pandey et al., 2018). However, pregnancies resulting from IVF are associated with higher risks of complications, particularly due to multiple gestations, which increase the likelihood of preterm delivery, low birth weight, and neonatal morbidity (Pinborg et al., 2020; Nyboe Andersen et al., 2022).

The transfer of multiple embryos has historically been employed to improve pregnancy rates, but this practice has contributed to an increased incidence of multiple pregnancies (Ishihara et al., 2021; Adamson et al., 2018). As a result, there is a growing emphasis on optimizing embryo transfer strategies, including elective single embryo transfer, to balance success rates with maternal and neonatal safety (Dyer et al., 2020; Gerris, 2019).

In addition to traditional outcome measures, there is increasing interest in evaluating IVF performance indicators such as the conversion rate from clinical pregnancy to term delivery and the number of babies per pregnancy (Legro et al., 2020; Berntsen et al., 2021). These indicators provide a more comprehensive assessment of treatment effectiveness and can guide improvements in clinical practice. However, such data are often limited in resource-constrained settings due to smaller sample sizes and challenges in data collection (World Health Organization [WHO], 2023).

Although assisted reproductive technology services are becoming increasingly available in Nigeria, most published reports are derived from private fertility centres located in large urban settings. Evidence from public tertiary healthcare institutions remains limited, especially in the South-South region of the country. Outcomes obtained in public institutions may differ from those reported by private fertility clinics because of variations in funding, laboratory

capacity, availability of medications, patient burden, and treatment standardization. Public hospitals also frequently manage more complicated infertility cases and patients with delayed presentation due to financial constraints. Consequently, data from public tertiary IVF centres are important for understanding the realities of ART practice in resource-constrained environments and for guiding policy decisions aimed at improving access to fertility care in Nigeria (Okonofua et al., 2019; Gleicher et al., 2020; Dyer et al., 2020).

Given the limited availability of comprehensive local data, there is a need to evaluate both clinical and neonatal outcomes of IVF in Nigerian settings. This study aims to assess the outcomes of IVF at a tertiary centre in Yenagoa, Nigeria, and to determine the relationship between selected sociodemographic and clinical factors and treatment success. The findings will contribute to the existing body of knowledge and may inform strategies to improve ART services in similar settings.

MATERIALS AND METHODS

This study was a retrospective descriptive analysis conducted at the Department of Obstetrics and Gynaecology, Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria. The centre is a tertiary referral facility that provides assisted reproductive technology (ART) services to patients within the state and surrounding regions. The study reviewed all in vitro fertilization (IVF) cycles carried out over a three-year period from January 2022 to December 2025.

The study population comprised women who underwent IVF during the study period. All completed IVF cycles with adequate documentation were included, while cycles with incomplete records, missing outcome data, or those cancelled prior to oocyte retrieval or embryo transfer were excluded. Each IVF cycle was treated as an independent unit of analysis, including cases where a patient underwent more than one cycle.

Data were collected retrospectively from patient case notes, IVF registers, and embryology records using a structured data extraction form. Information obtained included sociodemographic characteristics such as age, marital status, and educational level, as well as clinical variables including parity, type of infertility (primary or secondary), and duration of infertility. Outcome variables included clinical pregnancy, term pregnancy, and neonatal outcome.

Controlled ovarian stimulation was carried out using individualized treatment protocols based on patient age, ovarian reserve, previous response to treatment, and clinician preference. Both gonadotropin-releasing hormone (GnRH) agonist and antagonist protocols were utilized where indicated. Follicular monitoring was performed using serial transvaginal ultrasonography with hormonal assessment where necessary. Final oocyte maturation was triggered after adequate follicular development, followed by transvaginal ultrasound-guided oocyte retrieval.

Fertilization was achieved using either conventional IVF or intracytoplasmic sperm injection (ICSI) depending on semen quality and clinical indication. Embryo transfer was performed either at the cleavage stage (day 3) or blastocyst stage (day 5), depending on embryo

development and laboratory assessment. Between one and three embryos were transferred per cycle according to embryo quality, maternal age, and previous IVF history. Progesterone-based luteal phase support was routinely administered following embryo transfer.

Clinical pregnancy was defined according to the International Committee for Monitoring Assisted Reproductive Technology (ICMART) criteria as ultrasonographic evidence of at least one intrauterine gestational sac with or without fetal cardiac activity (Adamson et al., 2018). Term pregnancy was defined as delivery occurring at or beyond 37 completed weeks of gestation.

The primary outcome measures were clinical pregnancy rate, defined as ultrasound confirmation of a gestational sac, and term pregnancy rate, defined as delivery at or beyond 37 completed weeks of gestation. Neonatal outcome, defined as the total number of babies delivered, was also assessed. Secondary outcome measures included the conversion rate from clinical pregnancy to term delivery and annual variations in IVF success rates. Babies per pregnancy were calculated as an indirect indicator of multiple gestations.

Data were analyzed using appropriate statistical software. Categorical variables were summarized as frequencies and percentages. The association between sociodemographic and clinical variables and IVF outcomes was assessed using the chi-square (χ^2) test. A p-value of less than 0.05 was considered statistically significant. Confidence intervals for key outcome measures were estimated using standard binomial methods.

Ethical approval for the study was obtained from the Research and Ethics Committee of the Federal Medical Centre, Yenagoa. As the study was retrospective and based on existing records, the requirement for individual informed consent was waived. Confidentiality of patient information was maintained throughout the study.

RESULTS

The overall clinical pregnancy rate was 30.0% (21/70), while the term pregnancy rate was 20.0% (14/70). Among those who achieved clinical pregnancy, 66.7% progressed to term delivery. Annual IVF outcomes showed variability, with higher success rates recorded in 2022 and 2025 compared to other years. Sociodemographic and clinical variables, including age, parity, educational status, and duration or type of infertility, did not demonstrate a statistically significant association with IVF success ($p>0.05$). Neonatal outcomes revealed a relatively high number of babies per pregnancy, suggesting a notable occurrence of multiple gestations.

Table 1: Sociodemographic and Clinical Characteristics by IVF Outcome

Variable	Positive n (%)	Negative n (%)	Total	χ^2	Df	p-value
<35 years	10 (47.6)	14 (28.6)	24			
≥35 years	11 (52.4)	35 (71.4)	46	2.44	1	0.118
Married	20 (95.2)	46 (93.9)	66			
Others	1 (4.8)	3 (6.1)	4	0.05	1	0.823
≤Secondary	6 (28.6)	18 (36.7)	24			
Tertiary	15 (71.4)	31 (63.3)	46	0.43	1	0.512

Variable	Positive n (%)	Negative n (%)	Total	χ^2	Df	p-value
Nulliparous	13 (61.9)	35 (71.4)	48			
≥1	8 (38.1)	14 (28.6)	22	0.56	1	0.452
Primary infertility	10 (47.6)	32 (65.3)	42			
Secondary infertility	11 (52.4)	17 (34.7)	28	1.94	1	0.163
<5 years	10 (47.6)	14 (28.6)	24			
≥5 years	11 (52.4)	35 (71.4)	46	2.44	1	0.118

Footnote: χ^2 =Chi-square test; df = degrees of freedom; $p<0.05$ considered significant.

No sociodemographic variable showed a statistically significant association with IVF outcome ($p>0.05$).

Table 2: Annual IVF Procedure Outcomes

Year	Total Cycles	Positive	Negative	Term Pregnancies	Ongoing	Total Babies
2022	15	6	9	4	–	8
2023	19	4	15	3	–	4
2024	15	3	12	2	–	6
2025	21	8	13	5	1	8

Footnote: Term pregnancies refer to pregnancies carried to delivery.

IVF outcomes varied across the years, with highest performance observed in 2022 and 2025.

Table 3: IVF Success Rates by Year

Year	Clinical Pregnancy Rate (%)	Term Rate (%)	Live Birth Output
2022	40.0	26.7	8
2023	21.1	15.8	4
2024	20.0	13.3	6
2025	38.1	23.8	8

Footnote: Rates calculated per total IVF cycles per year.

Clinical pregnancy and term rates fluctuated across years without a consistent trend.

Table 4: Derived IVF Performance Indicators

Year	Conversion to Term (%)	Babies per Pregnancy
2022	66.7	2.0
2023	75.0	1.33
2024	66.7	3.0
2025	62.5	1.6

Footnote: Conversion to term = term pregnancies/positive cases.

High babies per pregnancy suggests a notable rate of multiple gestations.

Table 5: Overall IVF Outcomes with Confidence Intervals

Outcome	Value	95% Confidence Interval
Clinical Pregnancy Rate	30.0% (21/70)	19.3 – 40.7
Term Pregnancy Rate	20.0% (14/70)	10.6 – 29.4
Conversion to Term	66.7% (14/21)	46.6 – 86.8

Footnote: Confidence intervals estimated using standard binomial methods.

Overall IVF success rates fall within expected clinical ranges, though confidence intervals are wide due to sample size.

Detailed neonatal outcome parameters such as birth weight, gestational age at delivery, neonatal intensive care unit admission, congenital abnormalities, neonatal morbidity, and neonatal mortality were not consistently documented in all patient records and therefore could not be comprehensively analyzed. However, the available data demonstrated a relatively elevated babies-per-pregnancy ratio, suggesting an appreciable occurrence of multiple gestations among IVF pregnancies.

DISCUSSION

This study evaluated the clinical and neonatal outcomes of in vitro fertilization (IVF) at a tertiary centre in Yenagoa, Nigeria. The overall clinical pregnancy rate of 30.0% and term pregnancy rate of 20.0% observed in this study fall within the range reported in the literature, particularly in settings with similar resource constraints (Mascarenhas et al., 2018; Inhorn & Patrizio, 2020; Zegers-Hochschild et al., 2019). Although outcomes in high-income countries may be slightly higher, the results from this centre demonstrate that acceptable success rates can be achieved in low- and middle-income settings with appropriate clinical practice (Chambers et al., 2021).

The clinical pregnancy rate recorded in this study is comparable to global averages, which typically range between 25% and 40% per cycle depending on patient characteristics and treatment protocols (Ombelet, 2018; Botha et al., 2022). However, the term pregnancy rate of 20.0% is relatively lower, reflecting the well-recognized gap between conception and live birth outcomes in IVF practice (Okonofua et al., 2019). This disparity may be attributed to early pregnancy losses, which are known to occur more frequently in assisted reproductive cycles, particularly among older women (Maheshwari et al., 2018; CDC, 2022).

In this study, no statistically significant association was found between sociodemographic or clinical variables and IVF success. Although women aged 35 years and above had lower success rates, this did not reach statistical significance. This finding contrasts with extensive evidence identifying maternal age as a key determinant of IVF outcome, with declining success rates observed with increasing age due to diminished ovarian reserve and oocyte quality (Franasiak et al., 2019; Luke et al., 2020). The lack of statistical significance in this study may be explained by the relatively small sample size, which limits the power to detect such associations.

Similarly, other variables such as parity, type of infertility, and duration of infertility were not significantly associated with IVF outcomes. While some studies have suggested that primary infertility and shorter duration of infertility may be associated with better outcomes, findings across studies remain inconsistent (Smith et al., 2021; McLernon et al., 2019). The absence of significant associations in this study further underscores the need for larger, multicentre studies to better elucidate predictors of IVF success in this population.

The annual variation in IVF outcomes observed in this study, with better performance in 2022 and 2025, may reflect differences in clinical practice, laboratory conditions, or patient selection over time. Such variability has been reported in other studies and may be influenced by factors such as embryology laboratory quality, clinician experience, and protocol optimization (Qin et al., 2021). The improvement noted in later years may suggest a gradual refinement of techniques and increased institutional experience.

The conversion rate from clinical pregnancy to term delivery was 66.7%, indicating that approximately two-thirds of pregnancies progressed to delivery. This is consistent with findings from previous studies, which report conversion rates ranging from 60% to 80% (Chambers & Ledger, 2020). While this suggests reasonable pregnancy sustainability once implantation is achieved, the relatively wide confidence interval highlights the variability inherent in small sample sizes.

An important observation in this study is the relatively high number of babies per pregnancy, suggesting a notable rate of multiple gestations. This finding is consistent with the practice of transferring multiple embryos to enhance pregnancy rates, particularly in settings where patients may have limited access to repeated IVF cycles (Kupka et al., 2019). However, multiple gestations are associated with increased risks of adverse maternal and neonatal outcomes, including preterm birth, low birth weight, and neonatal morbidity (Pandey et al., 2018). Current best practices advocate for more conservative embryo transfer strategies, such as elective single embryo transfer, to reduce these risks while maintaining acceptable success rates (Pinborg et al., 2020; Nyboe Andersen et al., 2022).

Neonatal outcomes in the present study were mainly assessed using live birth output and babies per pregnancy because detailed neonatal records were incomplete in some cases. Nevertheless, the relatively high babies-per-pregnancy ratio observed suggests a considerable occurrence of multiple gestations. Multiple pregnancies resulting from IVF have consistently been associated with increased risks of prematurity, low birth weight, neonatal morbidity, and perinatal complications (Pandey et al., 2018; Berntsen et al., 2021). This finding highlights the importance of adopting safer embryo transfer strategies, including elective single embryo transfer where feasible, in order to improve neonatal outcomes while maintaining acceptable pregnancy rates (Sunkara et al., 2018; Gerris, 2019).

Overall, the findings of this study highlight both the potential and the challenges of IVF practice in a resource-limited setting. While success rates are comparable to global averages, variability in outcomes and the risk of multiple gestations remain important considerations.

Strengthening laboratory infrastructure, standardizing clinical protocols, and promoting evidence-based practices are critical steps toward improving outcomes (Dyer et al., 2020).
This study provides valuable insight into IVF outcomes in a tertiary centre in Nigeria and contributes to the limited body of literature from the region. It underscores the need for continued research, particularly large-scale, multicentre studies, to better understand the determinants of IVF success and improve reproductive health outcomes in sub-Saharan Africa.

LIMITATIONS

This study was limited by its retrospective design and relatively small sample size, which may have reduced the ability to detect statistically significant associations between some clinical variables and IVF outcomes. Furthermore, several neonatal outcome variables, including birth weight, gestational age distribution, neonatal intensive care admission, congenital abnormalities, and neonatal mortality, were incompletely documented in patient records and could not be fully evaluated. Despite these limitations, the study provides important baseline data on IVF outcomes from a public tertiary institution in the Niger Delta region of Nigeria.

CONCLUSION

IVF outcomes were comparable to international standards, demonstrating effective service delivery. Variability in success rates highlights the need for improved standardization of clinical protocols. Optimizing embryo transfer practices and strengthening infrastructure will enhance overall outcomes.

RECOMMENDATIONS

There is a need to standardize IVF protocols to improve consistency in outcomes across treatment cycles. Adoption of safer embryo transfer strategies, including limiting the number of embryos transferred, is recommended to reduce multiple gestations. Continuous training of clinical and embryology staff should be prioritized to enhance technical expertise. Investment in laboratory infrastructure will further improve success rates. Strengthening data management and record-keeping systems is essential for quality improvement and research. Larger multicentre studies are encouraged to generate more robust and generalizable findings. Policymakers should also support expanded access to affordable ART services in Nigeria.

AUTHOR CONTRIBUTIONS

Idea/Concept: Porbeni-Fumudoh B. Offiong, Florence A Koroye, Markson W Sam, Agbo John; Design: Porbeni-Fumudoh B. Offiong, Florence A Koroye, Joshua k. Stephen, Atemie Gordon; Control/Supervision: Agbo John, Joshua k. Stephen, Markson W Sam, Atemie Gordon, Warisuo S. Ariwelo; Data Collection and/or Processing: Warisuo S. Ariwelo, Amadi-Oyioma M Chigesilem, Onisoubuana John-Bennibor, Clifford A Timiebi; Analysis and/or Interpretation: Florence A Koroye, Amadi-Oyioma M Chigesilem, Onisoubuana John-Bennibor, Clifford A Timiebi; Literature Review: Porbeni-Fumudoh B. Offiong, Florence A

Koroye, Markson W Sam, Agbo John, Warisuo S. Ariwelo; Writing the Article: Atemie Gordon, Joshua k. Stephen, Amadi-Oyioma M Chigesilem, Onisoubuana John-Bennibor, Clifford A Timiebi; Critical Review: Porbeni-Fumudoh B. Offiong, Florence A Koroye, Markson W Sam, Agbo John, Joshua k. Stephen, Atemie Gordon, Warisuo S. Ariwelo, Amadi-Oyioma M Chigesilem, Onisoubuana John-Bennibor, Clifford A Timiebi.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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ETHICAL APPROVAL

Ethical approval was obtained from the ethical committee of the Federal Medical Centre, Yenagoa, Bayelsa State.

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