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Risk-related Behaviours and Prevalence of Acquired Female Reproductive Tract Factor Infertility among Childbearing Age Women in a Tertiary Hospital in Nigeria: An Analytical Cross-sectional Study

[1]Eugene Maduabuchukwu Ikeanyi, [2]Daprim Samuel Ogaji, [3]Elvis Somadina Ikeanyi

[1]Department of Obstetrics and Gynecology, Niger Delta University, Bayelsa, Nigeria
[2]Department of Preventive and Social Medicine, University of Port Harcourt, Choba, Nigeria
[3]Department of Obstetrics and Gynecology, University of Benin Teaching Hospital, Benin City, Nigeria

Corresponding author: Eugene Maduabuchukwu Ikeanyi, Department of Obstetrics and Gynecology, Niger Delta University, Wilberforce Island P.M.B.071, Bayelsa State, Nigeria.eugeneikeanyi@ndu.edu.ng:+23408033528344

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ABSTRACT

Background: Acquired female reproductive tract factor infertility is often associated with modifiable lifestyle, infection-related, preventable, and predominant in low-resource settings. This study identified risk-related behaviors, determined prevalence, and assess associated factors among childbearing-age gynecologic clinic attendees

Methods: An analytical cross-sectional study among 204 randomly selected reproductive-age women attending a tertiary hospital gynecological clinic over six months. Outcomes were prevalence and risk-related behaviors of acquired female reproductive tract factor infertility. Data were collected using a pre-tested semi-structured instrument. Descriptive statistics, Fisher's exact tests, Student's t-test, and binary logistic regression, with significance set at $p < 0.05$ was done.

Results: Acquired reproductive tract factor infertility affected 42/74 (56.8%) of infertile participants. Significant predictors were non-use of contraception (aOR=2.62, 95% CI: 1.29-5.30, $p = 0.0073$), unprotected sex without condom use (aOR=2.83, 95% CI: 1.23-6.67, $p = 0.0071$), prior pelvic or abdominal surgery (aOR=3.14, 95%CI: 1.37-7.24, $p = 0.0073$), unmarried status (aOR=0.31, 95%CI:0.13-0.73, p = 0.0075), history of pelvic inflammatory disease (aOR=2.25, 95% CI: 1.05-4.81, $p = 0.0366$), and chronic lower abdominal pain (aOR= 1.32, 95% CI: 1.14-1.56, $p = 0.0034$). Infertile women more avoided contraception (OR= 2.22, 95%CI: 1.24-3.97, $p = 0.0085$), engaged in unprotected sex (OR=2.06, 95% CI: 1.10-3.85, $p = 0.0238$), and used non-professional care for sexually transmitted infections (OR=2.66, 95%CI: 1.24-5.74, $p = 0.0155$) and pelvic inflammatory disease (OR=2.95, 95%CI: 1.15-7.60, p = 0.0271).

Conclusion: Acquired reproductive tract factor infertility was prevalent. Risk-related behaviors were common particularly among the infertile subgroup requiring lifestyle modification and improved health-seeking behavior to reduce incidence.

Keywords: Behaviour, childbearing-age, factor, infertility, prevalence, reproductive tract, risk-related

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INTRODUCTION

Infertility remains a major reason for gynecological consultations in Nigeria, accounting for 14.8% to 38.8% of outpatient visits. [1-2] A third of women in the infertility belt of Africa, including parts of sub-Saharan Africa, may remain childless at the end of their reproductive years.[2]

Among the leading causes of female infertility are acquired female reproductive tract disorders, mostly sequelae of pelvic infections. Reproductive tract factor infertility, particularly utero-tubal infertility, is the most common cause of infertility in Nigeria, including this setting, where a substantial proportion of infertility cases have been attributed to tubal factors.[3-5]

This refers to infertility caused by factors such as pelvic infections, endometriosis, uterine fibroids, and endometrial polyps.[6-7] Studies conducted in Africa, including Nigeria found that acquired female reproductive tract factor infertility (ARTFI) was accounted for by 54.9-67.2% tubal and 5.4-36.6% uterine pathology of cases of female infertility.[3,8-9] The contributory role of chlamydia in ARTFI is supported by research findings.[2] The pathology includes fallopian tube blockage or distortion, intrauterine adhesions or distortion, abnormalities of the pelvic peritoneum, and other uterine cavity pathologies.[8,10-12] These result from untreated or poorly managed reproductive tract infections (RTIs) and contribute to a large proportion of female infertility in the region.

Sexually transmitted infections (STIs), a major contributor to genital tract infections, often presenting sub clinically, are highly prevalent in sub-Saharan Africa [13], and Nigeria ranks among the countries with the highest prevalence of both STIs and reproductive tract factor infertility.[14] The critical role of STIs and other RTIs in the aetiology of infertility was supported by the significant isolation of Neisseria gonorrhea pathogens from the endocervices and chlamydia trachomatis antibodies in the serum samples of infertile Nigerian women.[2]

Chlamydia trachomatis, Neisseria gonorrhea and trichomonas vaginalis infections are among the leading curable STIs.[15] The global prevalence estimates of STIs for 2012 among women aged 15-49 were 4.2%, 0.8%, and 0.5% for chlamydia, gonorrhea, and trichomoniasis respectively.[15] Epidemiologically, risk factors for pelvic inflammatory disease (PID) strongly reflect those of STIs and consequent tubal damage and tubal factor infertility (TFI).[16]

Given the significant role of ARTFI and paucity of data on it in Nigeria, this study was designed to investigate its contribution to reproductive health outcomes. Additionally, to reduce the scourge of ARTFI, a comprehensive data on its risk-related behaviors of people is crucial. This study was therefore undertaken to measure the prevalence and investigate the risk factors of this disorder.

MATERIALS AND METHODS

***Study Setting*:** This was conducted at Niger Delta University Teaching Hospital, Bayelsa State in South-south region of Nigeria.

Study Design: This was an analytical cross-sectional study.

Study Population: Reproductive age women; aged 15-49 years attending gynecological clinic at the study center within the study period.

Eligibility criteria: All consenting women of reproductive age attending the gynecology clinic at the study center within the study period who met the following conditions were included in the study: Women aged 15–49 years presenting at the general gynecology clinic for infertility evaluation or management or other gynecological complaints (such as menstrual disorders, pelvic pain, or infections etc.) and potentially at risk of reproductive tract factor infertility.

Women who declined or withheld consent to participate in the study after provision of appropriate information and counseling, those with intersex conditions or ambiguous genitalia**,** pregnant women and those who have undergone total hysterectomy were excluded

Data collection and collation: a combination of self-reported surveys, medical records, clinical evaluation and laboratory investigations as appropriate were employed to collect data on risk-related behaviors and the prevalence of ARTFI during the period of the study. Radiological investigations such as hysterosalpingography and pelvic ultrasonography were requested when clinically indicated, following standard gynecological practice. Properly filled-out request forms were submitted to the Radiology Department at the study center, and imaging results were retrieved, reviewed, and systematically documented. The interpretation of findings was standardized to ensure diagnostic consistency and to reduce observer variation. Where indicated, hormonal assays (luteinizing hormone (LH), follicle-stimulating hormone (FSH), prolactin, progesterone, thyroid-stimulating hormone (TSH),

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testosterone, and estrogen) were performed to complement clinical and imaging findings. Semen analysis was also recommended for partners, as appropriate, in accordance with WHO guidelines. The data were fed into a prepared EPI INFO spreadsheet.

Sample Size Determination: The sample size for this study was determined using the Cochran formula [17] for estimating sample size in cross-sectional studies, based on the known ARTFI prevalence of 13.5%.[10] The formula is as expressed;

$n=z^2pq/d^2= z^2*p*(1-p)$ ^$d^2=1.96^2$ x 0.135 x $0.865/0.05^2=180$

Plus 10% for attrition=198

Where

n = minimum required sample size

p = estimated prevalence of the relevant variable (here, the proportion of women with reproductive tract factor infertility)

q = 1 − p

Z = standard normal deviate corresponding to the desired confidence level (for 95% confidence, Z = 1.96 that is Z= the Z statistic for 95% confidence level (value for selected alpha level α=0.05 which is 1.96)

d = margin of allowable error or desired precision (typically set at 0.05 for a 5% error margin)

***Study Instrumen*t**: With the aid of a pre-tested, semi-structured questionnaire; internal consistency of grouped items measuring risk-related behaviors was evaluated using Cronbach's alpha coefficient. Values of 0.70 or above was interpreted as evidence of satisfactory internal consistency. A satisfactory content validity was from expert assessment.

Study Variables: The study instrument included sections on sociodemographic characteristics, obstetrics and gynaecological history, and risk-related behaviors. The social classification was based on Olusanya et al.[18]

Sampling Methodology: Data were collected from consenting, eligible attendees recruited using a systematic random sampling technique. The sampling frame (N) consisted of the average number of gynecological clinic attendees (list of the target population; 15-49 years) recorded over the preceding three months prior to data collection, as obtained from clinic register. This was 288 attendees. From this, the sampling interval (k) was determined by dividing the estimated total number of eligible clinic attendees within data collection period by the calculated sample size (n) using this formula k=N/n =288/198≈2. The first participant was selected using simple random sampling—by drawing lots among the first few eligible women on the clinic attendance list after which every *k-th* (alternate) woman was systematically selected until the required sample size was achieved.

Whenever an eligible woman declined participation or did not meet the inclusion criteria at the time of selection, the next consecutive eligible attendee was enrolled in her place to maintain the sampling sequence. Data collection was continued daily during the clinic sessions until the targeted number of participants was recruited using random sampling technique, standardized data collection with validated questionnaire, well defined eligibility criteria and sufficient sample size were employed to minimize potential bias.

Data Analysis: The outcome measures were the proportion of participants who had acquired reproductive tract factor infertility and the proportions involved in risk-related behaviors. Univariate, bivariate, and multivariable analyses for the statistical associations of the categorical variables were done using Fisher's exact test, while the student's t test for comparison of the means of the quantitative variables. The odds ratio was calculated with the aid of a 2 by 2 contingency table to measure the strength of the association between the independent and dependent variables. Multiple logistic regression analysis, as appropriate, was used to identify the significant predictor variables and exclude or control the effects of the confounders. An a priori causal selection approach was employed in the regression analyses. Incompletely filled questionnaires were excluded from analysis. The statistical significance was set at $p<.05$ or 95% confidence interval exclusion of nullity of one.

Ethics: The study was supported by ethical approval with reference number NDUTH/REC/0154/2025 from the Research and Ethical Committee of the study center. Informed verbal consent was obtained from each participant following counselling. Confidentiality of data, anonymity of the participants and their rights to participate or decline were clearly explained at the beginning of the questionnaire.

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RESULTS

A total of 694 women attended the gynaecological clinics during the study period. Thirteen (1.9%) were below 15 years, 62 (8.9%) were above 49 years, while 619 (89.2%) were within the reproductive age group (15–49 years). Of these, 135 presented with infertility, giving a prevalence of 21.8%. Two hundred and seven eligible participants were randomly selected; three questionnaires were excluded due to improper completion, leaving 204 (98.6%) for analysis. Among them, 74 presented with fertility problems, and 42 (56.8%) were confirmed to have tubal, uterine, or cervical tract damage, resulting in an ARTFI prevalence of 42/74 (56.8%).

Table 1: Sociodemographic Profile of Participants N=204

Characteristics	Variables	Frequency	%
Age group (years)	<35	125	61.3
	≥35	79	38.7
Marital status	Single	70	34.3
	First marriage	110	53.9
	Remarried	11	5.4
	Separated/divorced/widowed	3	1.5
	Co-habiting	10	4.9
Marriage Arrangement	Monogamous	112	90.3
	Polygamous	12	9.7
Education	≤Secondary	77	37.7
	≥Tertiary	127	62.3
Employment	Government employed	61	29.9
	Private Organization	16	7.8
	Self-employed	76	37.3
	Students	26	12.7
	Unemployed	25	12.3
Religion	Christianity	199	97.5
	Others	5	2.5
Parity	0	117	57.4
	≥1	87	42.6
Tribe	Ijaw	148	72.5
	Others	56	27.5
Socioeconomic class	Upper	64	31.4
	Middle	69	33.8
	Lower	71	34.8
Type of Participants	Fertile	130	63.7
	Infertile	74	36.3

Table 1. Shows the sociodemographic characteristics of the participants. The mean age of participants was 32.2±8.1 years, highest age bracket 25-29 years (26%) and modal age 27 years. Most (53.9%) of the participants were in their first marriage, about two fifths (34.3%) single and never married while about one in twenty were at least in their second marriage. The vast majority 90.3% of the married participants were in monogamous marriage arrangement while 9.7% were in polygamous arrangement. About three in every five (62.3%) had tertiary level of education. Approximately a third each was of upper, middle and lower social class respectively. About two-fifths (37.3%) of the participants were on self-employment, close to 3 in 10 (29.9%) in government employment while 12.7% and 12.3% were students and unemployed respectively. Most (97.5%) of them were Christians and of Ijaw ethnicity (72.5%). Again most (57.4%) of them were nulliparous. The majority (63.7%) of the participants had no fertility problems while 36.3%presented at the clinic for infertility.

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Table 2: Risk-Related Behaviors by the Infertile and Fertile Subsets of Participants N=204

Risk- related Behaviors	Frequency N=204(%)	Infertile Participants: n=74(%)	Fertile Participants n=130(%)	OR (95% CI)	*p*-value
Non-Contraceptive use	93(45.6)	43(58.1%)	50(38.5%)	2.22 (1.24-3.97)	0.0085
Non male condom use (Unprotected sexual intercourse)	133(65.2%)	55(74.3)	76(58.5)	2.06 (1.10-3.85)	0.0238
Previous pelvic/abdominal Surgical	48(23.5)	20(27.0)	28(21.5)	1.35 (0.70-2.62)	0.3943
First consultation of non-healthcare personnel	26(12.7)	9(12.2)	17(13.1)	0.92 (0.39-2.18)	1.0000
Cigarette smoking	4(2.0)	3(4.1)	1(0.8)	5.45 (0.56-53.41)	0.1367
Alcohol intake	73(35.8)	26(35.1)	47(36.2)	0.96 (0.53-1.74)	1.0000
≥2 lifetime sex partners	109(53.4)	45(60.8)	64(49.2)	1.60 (0.90-2.86)	0.1442
Mean lifetime sex partners		2.5±1.9, range=1-10	2.2±1.8,R=0-10		0.2634
Previous Home delivery/Non-hospital/unskilled attendance at childbirth	34(16.7)	7(9.5)	27(20.8)	0.40 (0.16-0.97)	0.0497
Previous Traditional birth attendance at delivery	29(14.2)	6(8.1)	23(17.7)	0.41 (0.16-1.06)	0.0638
≥1 induced abortion	79(38.7)	31(41.9	48(36.9	1.23 (0.69-2.21)	0.5504
Non-doctor/hospital induced abortion	40(19.6)	18(24.3)	22(16.9)	1.58 (0.78-3.18)	0.2053
Previous PID	61(29.9)	28(37.8)	33(25.4)	1.79 (0.97-3.31)	0.0799
Secondary amenorrhea	68(33.3)	29(39.2)	39(30.0)	1.50 (0.83-2.74)	0.2168
Previous STIs	80(39.2)	36(48.6)	44(33.8)	1.85 (1.03-3.32)	0.0521
Non hospital/physician treatment of PID	20(9.8)	12(16.3)	8(6.2)	2.95 (1.15-7.60)	0.0271
Non-hospital/non-physician treatment of STIs	32(15.7)	18(24.3)	14(10.8)	2.66 (1.24-5.74)	0.0155
Treatment Lower abdominal pains	87(42.6)	35(47.3)	52(40.0)	1.35 (0.76-2.39	0.3772

Table 2 shows the risk-related behaviors by the type of participants; infertile or fertile subsets. Overall, about 46% of the participants have never utilized contraception. More than a double of the infertile subset relative to the fertile subset had never used any form of contraception previously. The observed difference was statistically significant (OR= 2.22, 95% CI: 1.24-3.97, p=0.0085). Similarly, the infertile participants were more than twice less likely to use male condom protection during sexual intercourse relative to their fertile counterparts and the observed difference was also statistically significant (OR=2.06, 95% CI: 1.10-3.85, p=0.0238). Overall prevalence of alcohol use in this data was 35.8% while the infertile subset was 35.1% and fertile subset 36.2% but no statistical significance between the subsets. Only 2% of the participants smoked cigarette with infertile subset 5.5 times more than the fertile counterparts. The observed difference was not statistically significant. Though the infertile participants were 35% more likely to have previously undergone pelvic or abdominal surgical operation but they were statistically comparable with their fertile counterparts (OR=1.35, 95%CI: 0.70-2.62, *p*=0.3943). The participants were not different in their choice of consultation of non-health professionals at their initial seek of health assistance for fertility concerns. Over a half (53.4%) of the participants indulged in multiple sexual partnership habit and infertile subset was 60% more than the fertile counterparts in this habit. Nonetheless, they were statistically comparable (OR=1.60, 95%CI: 0.90-2.86, p=0.1442). Similarly, close to 39% of the participants have previously had at least an induced abortion among them were about 42% of the infertile subset compared with 37% of the fertile subset. However, the observed difference was not statistically significant (OR=1.23,95%CI: 0.69-2.21, *p*= 0.5504).Though the infertile and fertile participants were statistically comparable, but the infertile subset were 60% more likely to have had their pregnancies terminated by non-health professionals (OR=1.58, 95%CI: 0.78-3, 18, *p*=0.2053).Close to a fifth of the participants in each of the two arms respectively have had at least one of their deliveries at their homes or at traditional birth attendant homes (16.7% vs. 14.2%). The infertile participants were 60% less likely to have their births at home or traditional birth attendant homes respectively. However, while unlike the TBA home, the observed differences in home deliveries were statistically significant (OR=0.40, 95%CI: 0.16-0.97, *p*=0.0497). Of the 39.2% of the participants

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that previously had sexually transmitted infections, the infertile subset was about twice as involved as the fertile counterparts. The observed difference was not quite statistically significant (OR=1.85, 95%CI; 1.03-3.32, *p*= 0. 0.0521). Similarly close to as many as double the proportion of the infertile participants suffered pelvic inflammatory disease in the past as the fertile counterparts. Again, the observed difference was not statistically significant (OR=1.79, 0.97-3.31, *p*=0.0799). Though the rate of PID and STIs in the participants were not statistically significant, nonetheless the infertile subset was statistically significant, thrice (OR=2.95, 95%CI: 1.15-7.60, *p*= 0.0271) and about the same rate (OR=2.66, 95%CI: 1.24-5.74, *p*= 0.02) more likely to seek care with non-health professionals when they suffered from PID and STIs respectively

Table 3: Bivariable and Multiple Logistic Regression Analyses for Factors Associated with Acquired Female Reproductive Tract Factor Infertility among the Participants N=204

Variable/Characteristic	Bivariable Analyses		Multiple Logistic Regression Analyses	
	Crude Odd Ratio(95%CI)	*P*-value	Adjusted Odd Ratio(95%CI)	*P*-value
Age group >35 /≤34	2.74 (1.37-5.49)	0.0044	3.01 (1.40-6.5)	0.0053•
Parity 0/≥1	1.64 (0.80-3.35)	0.2204	3.40 (1.5-7.72)	0.0041•
ARTFI unawareness/aware	1.58(0.80-3.16)	0.2264	1.40 (0.71-2.78)	0.3344
Tertiary education(Yes/No)	1.27(0.62-2.60)	0.5935	1.44 (0.62-3.37)	0.3980
Non-Contraception practices	3.42(1.65-7.06)	0.0008	2.62 (1.29-5.30)	0.0073•
Non male condom use Unprotected sexual intercourse)yes/no	3.44(1.44--8.21)	0.0037	2.83 (1.23-6.67)	0.0071•
Unsafe abortion practices	1.08(0.45-2.57)	0.8254	1.66 (0.65-4.23)	0.2844
Skilled attendance at childbirth	0.95(0.42--2.18)	1.0000	0.87 (0.37-2.02)	0.7431
Previous pelvic/abdominopelvic surgery	2.50(1.20-5.21)	0.0232	3.14 (1.37-7.24)	0.0073•
Previous STI (yes/no)	2.23(1.12-4.44)	0.0324	1.75 (0.88-3.46)	0.1121
Multiple sexual partners(Yes/No)	1.37(0.69-2.72)	0.3916	1.21 (0.61-2.40)	0.5912
Unmarried/Married	0.35(0.16-0.78)	0.0080	0.31 (0.13-0.73)	0.0075•
Marriage arrangement: polygamous/monogamous	0.91 (0.23-3.59)	1.000	1.18 (0.27-5.06)	0.8254
Previous PID(yes/no)	2.08(1.03-4.20)	0.0577	2.25 (1.05-4.81)	0.0366•
Student/Employed	0.15(0.46-0.72)	0.0231	0.12 (0.02-0.92)	0.0443•
Unemployed/employed	0.81(0.41-1.61)	0.5994	0.41 (0.12-1.46)	0.1672
Upper/lower Social class	1.12(0.54-2.31)	0.8522	1.82 (0.77-4.28)	0.1681
Cigarette smoking	1.29(0.13-12.76)	1.0000	1.35 (0.13-14.60)	0.8026
Alcohol intake	1.13(0.56-2.29)	0.7217	1.37 (0.66-2.86)	0.3995
Treatment lower of abdominal pain	2.34(1.19-4.63)	0.0159	1.32 (1.14-1.56)	0.0034•

•Statistical significance (p<.05)

Table 3 shows the factors that were associated with acquired female reproductive tract factor infertility among the participants. Participants 35 years or older were about thrice more likely to suffer reproductive tract factor infertility than those younger and the observed difference was statistically significant (aOR=3.01, 95%CI:1.40-6.5, p=0.0053).Similarly, the nulliparous participants were 3.4 times more likely to have ARTFI compared to the parous ones with at least one previous childbirth, the observed difference was equally statistically significant (aOR=3.40 (1.5-7.720,p=0.004] The participants who were not aware of acquired reproductive tract factor infertility were 40% more prone to suffer ARFTI compared with those who were aware. However, the observed difference was not statistically significant (aOR=1.40, 95%CI: 0.71-2.78, p=0.3344). The participants with tertiary level of

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education compared with those with less education had 44% more odds to suffer ARTFI though the observed difference was also not statistically significant (aOR=1.44, (95%CI: 0.62-3.37, p= 0.3980). Compared with the employed participants, the students were 88% less likely to suffer acquired reproductive tract factor infertility and the observed difference was statistically significant (aOR=0.12, 95%CI: 0.02-0.92, p=0.0443). Similarly, the unemployed participants have 60% less likelihood of suffering ARTFI relative to the employed counterparts. However, unlike the case of the students, there was no strong evidence to conclude that compared with employment, unemployment impacts ARTFI risks as the observed difference was not statistically significant (aOR=0.41, 95%CI: 0.12-1.46, p= 0. 0.1672)

There was close to triple adjusted odds of developing ARTFI among the participants who did not practice contraception compared with those who did practice. The observed difference was statistically significant (aOR=2.62, 95%CI: 1.29-5.30, p=0.0073). Those participants who did not protect their sexual acts with the male condom were about thrice more likely to suffer acquired reproductive tract factor infertility when compared with those who did and likewise, the observed difference was statistically significant (aOR=2.83, 95%CI: 1.23-6.67, p=0. 0.0071). Unsafe abortion practices have some odds and statistically insignificant association with ARTFI in this data (aOR=1.66, 95%CI: 0.65-4.23, p=0.2844). Similarly, skilled attendance at childbirth was not significantly associated with ARTFI. However the participants that were delivered by skilled attendants were 13% slightly less at risk of ARTFI though this was not statistically significant (aOR=0.87, 95%CI: 0.37-2.02, p=0.7431).The participants who had previously undergone pelvic or abdominal surgeries were more than thrice more likely to suffer acquired reproductive tract factor infertility compared with those who did not and the observed difference was statistically significant (aOR=3.14, 95% CI:1.37-7.24, p=0.0073) Participants who previously had sexually transmitted infections had 75% odds of ARTFI compared with those who had not though the observed difference was not statistically significant (aOR=1.75, 95%CI: 0.88-3.46, p=0.1121). Indulgence in multiple sex partnership had 21% adjusted odds of increased risk of ARTFI but the observed difference was not statistically significant (aOR=1.21, 95%CI: 0.61-2.40, p=0.5912). Unmarried status have 70% reduced likelihood of having acquired reproductive tract factor infertility compared with the married counterparts and the observed difference was statistically significant (aOR=0.31, 95%CI: 0.13-0.73, p=0.0075). Having previously suffered pelvic inflammatory disease had more than double the odds of developing ARTFI among the participants when related to those who did not suffer the disorder. The observed difference was statistically significant (aOR=2.25, 95%CI: 1.05-4.81, p=0.0366).Compared with the lower socioeconomic class participants, the upper class counterparts were 82% more likely to suffer ARTFI but the observed difference was not statistically significant (aOR=1.82, 95%CI: 0.77-4.28, p= 0.1681). Participants who indulged in cigarette smoking had 35% more odds of developing ARTFI compared with those who did not smoke but the observed difference was not statistically significant (aOR=1.35, 95%CI: 0.13-14.60, p= 0.8026). Those who took alcohol had marginal odd of risk of ARTFI. Again the observed difference was statistically comparable (aOR=1.37, 95%CI: 0.66-2.86, p=0.3995). The participants who frequently or recurrently had treatment of lower abdominal pain were 32% more likely to suffer ARTFI and the observed difference was statistically significant (aOR=1.32, 95%CI: 1.14-1.56, p=0.0034)

DISCUSSION

Prevalence of ARTFI and Profile of Participants

This study investigated the risk-related behaviors and prevalence of acquired reproductive tract factor infertility among reproductive age women attending gynaecological clinic in a tertiary hospital. The prevalence of ARTFI was 56.8% comparable to another report, [9] higher than the report by other workers[19-21] but lower than these other findings.[3, 8, 22] Supporting evidence showed that tubal factor infertility is prevalent in Nigeria.[3-5,9]

The mean age of the participants was 32 years comparable to many reports within and outside Nigeria,[10, 20, 22-23] but in contrast with some other findings.[9,24-25] Infertility varies with age and the occurrence increases with age.[11] Most participants were married (59.3%) and had tertiary education (62.3%) unlike the Douala, Cameroon study where secondary education predominated.[23] About two-fifths were self-employed and one-third government-employed contrasting with another African report where government employment dominated and self-employment was the least.[23] The majority (79.9%) were

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either nulliparous (57%) or of low parity (22.5%) similar to Abiodun et al.[22]

Contraceptive Behavior

There was a strong evidence that infertile participants were more than twice less likely to have ever used contraception or protected intercourse with condoms compared with fertile women. Poor contraceptive use increases unplanned pregnancies and in restrictive settings like Nigeria, promotes unsafe abortion and long-term reproductive tract damage. Low or inconsistent condom use also increases the risk of STIs including PID, identified as major contributors to ARTFI.[2] These findings underscore the need to expand contraceptive education and services through media and health facilities to improve both awareness and uptake. Fear of infertility remains a barrier in some settings.[11],[26] Evidence confirmed that non-contraceptive users had over two and a half times higher odds of ARTFI than contraceptive users. This was consistent with earlier report that infertile women were less likely to have ever or currently used contraception.[27] Non-use of contraceptives was overall, among the infertile participants and fertile ones respectively lower than figures from South-West Nigeria.[27] Low uptake may reflect premarital fertility concerns and current infertility status.[6,27] Evidence confirms that contraceptive use regardless of type or duration does not impair fertility after discontinuation.[2,27-28] This underscores its protective role against unplanned pregnancy, unsafe abortion and sepsis. Condom use was similar to Nigeria Demographic and Health Survey (NDHS) data.[29] Condom users had a lower risk of ARTFI, an independent protective effect consistent with previous reports.[23] Given its dual role; contraception and STI protection, promotion of condom use to reduce preventable ARTFI is essential. Integrating infertility-prevention messages into routine sexual and reproductive health services becomes crucial in low-resource settings.

Surgical Factors

Prior pelvic/abdominal surgery was a strong predictor of ARTFI, consistent with Egbe et al.[23] Surgeries such as appendectomy, salpingectomy, myomectomy, ovarian cystectomy and cesarean delivery increase pelvic adhesion formation, especially with repeated operations. Such surgeries have been implicated in reproductive tract damage and infertility.[23] Infertile participants had higher rates of pelvic and abdominal surgeries; comparable to a report from northern Nigeria and Cameron.[23,24] This may reflect increased prevalence of underlying pelvic pathologies like uterine fibroids, adenomyosis, endometriosis and pelvic adhesions pre or post diagnosis of infertility.

Sexual Partner Factors: Infertile participants were also more likely to have multiple sex partners higher than report by Dogbanya et al.[24] weakly reflecting in their twice incidence of STIs and PID. STIs and infertility remain associated with premarital sex, multiple partners and commercial sex.[2] Having more than three lifetime sex partners predicts infertility.[2]

Age and Parity Factors

Strong evidence confirmed that female age 35 years or older was a threefold independent predictor of ARTFI consistent with other reports.[2, 23,30] Female fertility decline peaks after 35 years when early life risky exposure such as STIs and unsafe abortion begin to manifest. Ikeanyi et al. reported that most women with complicated illegal abortions were young, single, nulliparous and had at least one prior unsafe abortion under Nigerian restrictive abortion laws.[31] Poor health-seeking and age-related conditions such as fibroids and adenomyosis are also more prevalent.

Lower parity among participants with ARTFI was consistent with previous reports.[2] Infertility reduces parity depending on when reproductive tract damage occurs. Damage before childbearing results in nulliparity while damage afterwards ends in low parity underscoring the need for early STIs and unsafe abortions prevention.

Chronic Pelvic Pain

Frequent lower abdominal pain strongly predicted underlying ARTFI consistent with other reports.[2, 23] Chronic or recurrent lower abdominal pain may indicate chronic PID, pelvic endometriosis or degenerating fibroids implicated in tubal infertility.[23]

Educational Status

Although weak evidence, tertiary-educated participants had higher odds of ARTFI contrasting another report.[2] Higher education is expected to improve health through awareness and service utilization yet it may increase exposure to urban lifestyle risks like multiple sex partners, unplanned pregnancies and unsafe abortions. This suggests that education alone is not protective if awareness does not translate into ARTFI-preventive behaviors. Further research is needed to clarify infertility–education dynamics and targeted interventions must include both uneducated and educated women emphasizing behavior-change.

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Employment Status

Students were less likely to have ARTFI than employed women likely due to younger age, lower sexual activity, unmarried status and better access to health information which reduces exposure to STIs and unsafe abortion risks. Unemployed participants also had lower odds of ARTFI, though weakly supported. Employment usually improves healthcare access but may also increase stress, delay childbearing and elevate risky exposures. Egbe et al. identified self-employment as a risk factor for tubal infertility.[23] Employed women may be more exposed to urban environments and exercise greater autonomy in sexual and reproductive decisions including pregnancy delay or termination. These patterns highlight the links between socioeconomic status, employment and reproductive health.

Impact of Unsafe Abortion

Unsafe abortion showed only a marginal weak association with ARTFI, despite its known reproductive morbidity. A South-South Nigeria study found most women with abortion complications to be single, nulliparous, poorly educated, presented with post-abortion sepsis and only a fifth had ever used contraception under restrictive laws.[31] Low contraceptive use drives unintended pregnancies and unsafe abortions increasing infection and tubal damage.[2] Skilled birth attendance was also poorly associated with ARTFI, though a modest protective. Despite conflicting evidence, strengthening reproductive health systems remains essential, as high secondary infertility in sub-Saharan Africa results from unsafe abortion and poor maternity care.[32]

Sexually Transmitted Infections: STI/PID

Sexually transmitted infection prevalence was lower than in northern Nigeria.[24] Prior STIs increased ARTFI odds though insignificant. Gonorrhea and other pathogens were more common in secondary infertility, with ascending infection causing tubal blockage.[2] Evidence consistently attributes reproductive tract damage to STIs and PID.[2, 23-24, 33.] Lack of strong evidence may reflect under-reporting and delayed treatment. Multiple sexual partners increased ARTFI risk, similar to STI-related infertility patterns.[2,23 29] Prior PID more than doubled ARTFI odds, a strong, supportive association consistent with earlier reports.[2,23] PID causes tubal scarring, adhesions, and occlusion.[2,24,33] Okonofua identified STIs and post-abortion/puerperal infections as major causes of tubal destruction.[2] Lower STI and infertility rates in high-income settings reflect better treatment, screening, safe abortion and maternity care.[2] Evidently, infertile women relied far more on non-health professionals for STI/PID care, consistent with an earlier report.[2] This increased inadequacy of treatment, chronicity and reproductive tract damage.

Marital Status Factors: Unmarried participants had a reduced likelihood of ARTFI. Other studies associated housewives with tubal infertility and found impaired fecundity among married, older and higher-income women.[23,34] Upper-class women had higher but non-significant odds of ARTFI, indicating socio-economic complexities. Women in polygamous marriage though weakly supported showed higher risk of ARTFI.

Cigarette Smoking and Alcohol Intake

Smokers had higher odds of ARTFI, with weak evidence.[30] Smoking prevalence was similar to Dogbanya et al.[24] but contrasted the reports from Okafor et al.[27] Alcohol consumption was higher than Western and Northern Nigeria reports.[24,27] Alcohol users had an insignificantly higher ARTFI risk. Alcohol may indirectly increase reproductive morbidity.[30]

Dysmenorrhea Impact: Dysmenorrhea was more common among infertile women, in agreement with Egbe et al.[32] and Dogbanya et al.[24] While primary dysmenorrhea is mostly innocuous, secondary dysmenorrhea is often associated with underlying PID, endometriosis, adnexal masses, adenomyosis and fibroids which reduce fertility.[35-36]

Limitations and Strengths: Self-reporting of one's behavior is known to be fraught with under-reporting bias, more so for sensitive information on sexual and reproductive experiences. A hospital-based data may not be as generalizable to the larger population as multicenter data. Nonetheless, this study was supported by a scientifically estimated sample size that improves the power of the study and prospective data largely known to be more complete. Additionally, an analytical cross-sectional design can address some of the concerns, such as how, when, and why unlike a descriptive cross-sectional design. However, it can only identify an association but lacks the ability to establish the temporality (direction) of the relationships between exposure and outcome or infer causality.

Implications and Recommendations

With 56.8% of infertility caused by acquired reproductive tract factors, it suggests that most cases are largely preventable, highlighting ongoing failures in preventive sexual and reproductive health, early detection, treatment, and health-seeking behaviors.

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The Strong associations with non-uptake of contraception, unprotected sex, and reliance on non-professional treatment for STIs/PID show that ARTFI is closely attributable to unsafe sexual practices and delayed or inappropriate care. This confirms infertility as a *downstream consequence* of poor STI prevention and management.

Using non-professional treatment for STIs and PID highlights barriers to accessing quality care, such as cost, stigma, low sexual and reproductive health literacy, and weak engagement with primary healthcare.

These gaps lead to ongoing pelvic inflammation, damage to the reproductive tract, and later infertility.

The strong association with previous pelvic/abdominal surgeries suggests possible iatrogenic contributors such as post-operative adhesions, late presentation of gynecological conditions, or inadequate peri-operative care.

The association with chronic lower abdominal pain may indicate missed opportunities for early diagnosis and treatment of PID, endometriosis, or adhesions before irreversible reproductive damage and infertility. These call for a shift from awareness-only to behavior-change interventions**,** focusing on consistent condom use for dual function: contraception and STI prevention. Additionally, to integrate infertility prevention counseling into existing family planning, STI, and adolescent/youth (sexual and reproductive health) SRH programs. Furthermore, the need to improve youth access- and unmarried-friendly SRH services, address myths and misconceptions surrounding contraception and condom using culturally sensitive counseling.

Clinically, to ensure appropriate indications, meticulous surgical techniques, and post-operative follow-up to minimize adhesion-related infertility. Promote early treatment of gynecological conditions to reduce the need for invasive surgeries.

Policy wise, infertility prevention should be integrated into national reproductive health policies, especially within STI and family planning frameworks and expand health insurance coverage for STI/PID treatment to reduce reliance on non-professional care

While further longitudinal studies can establish risk-behaviors and infertility causal pathways, investigate effectiveness of behavior-change and early-intervention strategies, community-based studies can help capture women who do not access healthcare.

This study is the first in this setting to investigate and generate data on the prevalence of acquired female reproductive tract damage-related infertility. Previous studies in the area focused primarily on tubal factor infertility. In contrast, this study uniquely provides a comprehensive assessment by examining the combined contributions of damage to various segments of the female reproductive tract; the vagina, cervix, uterus and fallopian tubes to acquired female reproductive tract factor infertility. This broader approach expands the existing knowledge and understanding of the burden and determinants of reproductive tract damage-related infertility in the population.

CONCLUSION

Acquired female reproductive tract factor infertility despites being preventable, is still prevalent in Nigeria with high rates of risky exposures among the target female population. Organized reproductive and sexual health education and services, coupled with adequate female empowerment, will curtail reproductive tract damage.

Declarations

Authors' contribution: The authors have participated in various stages of the study as follows;

Author IEM: Conceptualized, designed, searched Literature, acquired and analysed data, prepared manuscript.

Author ODS: Defined intellectual content, edited, and reviewed the manuscript.

Author IES: Searched Literature, statistical analysis

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