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Male and female factors associated with infertility among couples attending an assisted reproductive technologies clinic in Harare, Zimbabwe

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Abstract

Characterising causes of infertility is crucial to inform interventions that maximise chances of conception. In this descriptive cross-sectional study, we analysed records of 276 couples who visited an ART centre in Harare to determine the proportions of male and female factor infertility. We summarised categorical variables using percentages and determined associations between male and/or female causes of infertility and exploratory variables using the chi-square test. Around 67% of men had abnormal spermiograms; the commonest were oligoasthenozoospermia (28%) and teratozoospermia (24%). Around 65% of women had female factor infertility. The odds of female infertility were higher among women who reported irregular menstrual cycles (OR=2.26, 95% CI: 1.14-4.47). Overall, 111/267 (42%) of couples had both female and male factor infertility. We observed high proportions of male and female factor infertility. Timely access to fertility assessments is likely to maximise ART and pregnancy outcomes. This will require policy interventions to remove financial barriers to accessing ART services. (*Afr J Reprod Health* 2026; 30 [19]: 17-27).

Keywords: In vitro-fertilisation; male infertility; spermatozoa; sterility; urogenital infection; sub-fertility.

Résumé

L'identification des causes d'infertilité est essentielle pour orienter les interventions visant à maximiser les chances de conception. Dans cette étude transversale descriptive, nous avons analysé les dossiers de 276 couples ayant consulté un centre d'assistance médicale à la procréation (AMP) à Harare afin de déterminer la proportion d'infertilités d'origine masculine et féminine. Les variables qualitatives ont été résumées sous forme de pourcentages, et les associations entre les causes d'infertilité (masculines et/ou féminines) et les variables étudiées ont été évaluées à l'aide du test du chi carré. Environ 67 % des hommes présentaient un spermogramme anormal ; les anomalies les plus fréquentes étaient l'oligo-asthénozoospermie (28 %) et la tératozoospermie (24 %). Environ 65 % des femmes présentaient une infertilité d'origine féminine. La probabilité d'infertilité féminine était plus élevée chez les femmes signalant des cycles menstruels irréguliers (OR = 2,26 ; IC à 95 % : 1,14-4,47). Au total, 111 couples sur 267 (42 %) présentaient une infertilité mixte (à la fois masculine et féminine). Nous avons observé des proportions élevées d'infertilité d'origine masculine et féminine. Un accès rapide aux bilans de fertilité est susceptible d'optimiser les résultats de l'AMP et les chances de grossesse. Cela nécessitera des interventions politiques visant à lever les obstacles financiers à l'accès aux services d'AMP. (*Afr J Reprod Health* 2026; 30 [19]:28-40).

Mots-clés: Fécondation in vitro ; infertilité masculine ; spermatozoïdes ; stérilité ; infection urogénitale ; subfertilité

Introduction

Globally, around 16% of individuals experience infertility at some point in their lifetime.¹ Infertility is failure to achieve pregnancy during a period of one year of regular unprotected sexual intercourse.¹ The right to health encompasses the right to decide

whether to have children, the number of children and how children should be spaced. Infertility therefore, impacts negatively on this fundamental right.²

The causes of infertility are multi-factorial and in some cases are unknown. A meta-analysis of African studies reported that both males and

females are affected in around 20% of infertility cases, while around 10% of cases of infertility are unexplained.³ Studies have shown that fertility declines after the age of 30 years, especially among women.^{4,5} Hence, the risk of infertility invariably increases when people attempt to bear children at advanced reproductive years. This is common among people who first pursue education or professional careers before they turn their focus to childbearing.⁶ At an individual level, causes of infertility fall within two broad categories: male and female factors. Male factors include oligospermia (low sperm count), asthenozoospermia (impaired sperm motility), teratozoospermia (abnormalities in sperm morphology), asthenoteratozoospermia (combination of reduced motility and abnormal morphology) and oligoasthenoteratozoospermia (combination of all sperm abnormalities).

Female factor infertility is usually associated with ovulatory disorders, tubal disease and uterine anomalies.³ In Africa, infertility is commonly associated with spiritual and socio-cultural factors.⁷⁻⁹ A focus on biomedical factors, commonly applied by Western medicine, narrows the scope of investigating infertility in African tradition. Witchcraft and punishment from either God or angry ancestors are considered some of the determinants of male infertility in African culture.¹⁰

The psychosocial and economic impacts of infertility on couples cannot be over-emphasised. While infertility among men is associated with stigma, unstable marriages, frustrations and pain,¹¹ women bear most of the burden of infertility in patriarchal societies. Women are usually investigated for childlessness, blamed for childless marriages and may be divorced by husbands who fail to bear childless marriages.^{7,8,12} For this reason, women often experience sorrow, self-blame, social exclusion, loss of social worth and ridicule for failure to bear children.^{8,13} Men are usually not keen to get tested for virility due to either hesitancy or ignorance about male factor infertility.⁸ Cultural methods have been in place to diagnose male infertility at infancy, puberty and after marriage.^{11,14} Often there is secrecy around male infertility, including health seeking.¹⁵

The stigma associated with cultural and traditional views often result in broken marriages, strained relations and gender-based violence, making assisted reproductive technology (ART) a critical solution.¹⁰

Assisted reproductive technology is a proven method for addressing infertility. Women view ART as a gateway to overcoming the shame of childlessness.¹³ Owing to its privacy and capability to ensure couple get offsprings in those failing through natural methods, interventions such as in-vitro fertilisation (IVF) can preserve fertility for those who want to have children at a later stage through gamete cryopreservation and maximises chances of having children in those with identified male or female factor infertility.¹⁵ Over the years, improved education has catalysed cultural acceptance of ART. Moreover, the media has enhanced cultural acceptance of ART through framing positive impacts of ART such as highlighting success stories of ART and community appreciation of ART.⁹

Despite its promising results, ART remains unavailable, inaccessible and unaffordable in most low and middle-income countries.¹⁶ ART services are not only uneven across countries, creating geographical barriers, but also expensive. ART services cost between USD 9,000 and USD 15,000 in the USA and between USD 3,500 and USD 5,000 in Zimbabwe.^{17,18} To cushion households, some states in the United States of America imposed mandates for IVF insurance.^{19,20} Zimbabwe has few ART centres, which are not equitably distributed and are inaccessible to people in most underserved areas.⁹ ART services are exclusively provided in the private sector in two clinics available in two major cities.¹⁶ There is limited awareness regarding insurance options for IVF and few health insurance policies cover fertility treatments in Zimbabwe. Consequently, fertility treatments are covered by out of pocket costs, which can consume at least 20% of a household's annual income.²¹ This pushes households into poverty and financial catastrophes.² As a result, some people may cope by undergoing partial workups, foregoing expensive tests e.g. hysterosalpingography (HSG) and semen analysis. This reduces chances of ascertaining definitive causes of their infertility. The co-existence of traditional and cultural methods with ART cannot be ignored in Zimbabwe.¹¹ High cost of ART may force couples to seek fertility services from faith healers and traditional practitioners. This delays health seeking at ART centres and minimises chances of conception.

A Harare-based ART centre started screening for male and female factors among people

who present with primary and secondary infertility in the year 2020. We aimed to determine the proportion of male and female infertility and describe the workup package that is offered by the ART facility. Among couples who accessed ART services during the period 2021-2023, we sought to describe their i) sociodemographic and clinical characteristics, ii) the proportion who had male and female factor infertility and associated factors.

Methods

Study design

This was a descriptive cross-sectional study.

General setting

Zimbabwe is a landlocked country in southern Africa with a population of 15.1 million in 2022.²² She has borders with Mozambique to the east, South Africa to the South, Botswana to the west and Zambia to the north. In 2019, approximately 40% of Zimbabwe's population was living below the poverty line of less than USD 2.15 per day.²³ Out of pocket (OOP) costs were around 25% of overall health expenditure around 2015.²⁴

The total fertility rate in Zimbabwe declined from 4.3 children per woman in 1994 to 3.9 children in 2024.²⁵ Contraceptive use among women is around 53%, indicating progress in family planning but also highlighting unmet needs.²⁵ Around 30% of Zimbabweans have access to some form of health insurance, mainly employer-sponsored schemes or private insurance. Uninsured households face high OOP costs for healthcare.

Screening for infertility and management of STIs at an ART centre in Harare

This study was based on secondary data obtained at an ART centre in Harare, the capital of Zimbabwe. The following sociodemographic and clinical data are documented for all clients, usually couples: age, sex, alcohol use and smoking status. A minimum fertility workup package exists for both sexes based on their historical information. For men, the package includes semen analysis, screenings for HIV, hepatitis B virus, hepatitis C virus and chlamydia IgM/IgG antibodies. Men provide fresh semen specimens after observing sexual abstinence

for at least two days (maximum of 7 days).²⁶ The semen is analysed within 30 minutes of collection. Sperm counts are conducted using the improved Neubauer chamber (Shanghai Qijing Biochemical Instrument Co., Ltd.). Additional semen analysis involve measuring: i) volume, motility, pH, progressive motility, concentration and spermogram results e.g. normozoospermia, oligospermia, asthenozoospermia, teratozoospermia, cryptozoospermia, asthenoteratozoospermia. HIV testing was introduced to the men's workup package at a much later stage after the ART centre became operational.

Screening tests for women

Sociodemographic and clinical data, including age, sex, smoking and alcohol use status are collected during history taking and are based on self-reports. Women provide data on histories of menstrual cramps, miscarriages and menstrual cycle. They also undergo physical examinations of the pelvis, biochemical tests, imaging tests and screenings for STIs.

Around 5-10mL of venous blood samples are collected in anticoagulant free tubes. The sera is used to perform immunological and biochemical assays such as chlamydia IgM and IgG antibodies, HIV, hepatitis B and C, rapid plasma reagin for syphilis and anti-Mullerian (AMH) hormone to ascertain ovarian reserve or a woman's egg count. Women who test positive for STIs are started on treatment as per national guidelines. Women with a positive Chlamydia result, an almost confirmatory test for tubal blockage, are offered hysterosalpingogram (HSG) or laparoscopy examinations to ascertain reproductive system disorders in their fallopian tubes and uteri. Women who report irregular cycles submit blood samples for biochemical tests e.g. follicle stimulating hormone, luteinising hormone, prolactin and thyroid stimulating hormone. The sociodemographic, clinical and laboratory data are recorded in paper-based medical records and are linked by unique laboratory numbers. Normally, records for couples are kept in a single file.

Sample size calculation and sampling

Sample size was calculated using the Slovin's formula based on the total population of 882 men

and women pairs who accessed ART services during the period 2021-2023. The following assumptions were made: a power of 80% and a margin of error of 0.05. The final sample size was 276 men: women pairs. We consecutively sampled all records for men: women pairs until the sample size was reached.

Data variables, sources of data and data collection

The following variables were collected. For objective (i) *Sociodemographic and clinical characteristics of clients*: age, sex, smoking status, alcohol use status, HIV status and chlamydia IgM/IgG antibody results, HCV results and for women (cycle history, history of miscarriages, menstrual cramps).

Objective (ii): *workup package at the ART centre*: Data were abstracted from medical records at the ART centre. Objective (iii): *Male and female factor infertility and associated factors*. Data variables for men are semen analysis results (sperm volume, pH, motility, concentration, morphology). Data variables for women include age of >45 years, AMH result, HSG and ultra-sound scan results. Individual level data were abstracted by the study biostatistician from paper-based medical records using a structured proforma developed in MS Excel.

Analysis and statistics

Data were cleaned in MS Excel and were exported to Stata v 13.0 (StataCorp, College Station, TX, USA) for further cleaning and analysis. Categorical variables were summarised using numbers and proportions. Continuous variables e.g. volume of semen were first assessed for normality. Skewed data were summarised using medians and interquartile ranges as appropriate. The key outcome variables included the presence of male and/or female factor infertility (Yes/No). Male factor infertility (MFI) was based on: i) abnormal spermograms plus normal sperm volume and/or progressive motility or concentration. Normal semen parameters were based on WHO's 2021 criteria of pH $\geq$ 7.2, sperm concentration $>16 \times 10^6$ /mL, volume >1.4 mL, total motility $>42\%$, progressive motility $>30\%$ and total sperm count $>39 \times 10^6$ /mL.²⁶ Female factor infertility was

derived from abnormalities on HSG and ultra-sound scan results, AMH levels (<0.1 ng/mL) and age (>45 years). Any abnormality on HSG (complete/partial blocked tubes, hydrosalpinges) and/or ultra-sound scan (fibroids, cysts) and an age of >45 years were indicative of female factor infertility (FFI). The variables male factor infertility (MFI) and FFI were used to create a variable for couples who had both male and female factor infertility. The association between male or female factor infertility and sociodemographic and clinical variables was assessed using the Chi square test. Results were presented as odds ratios. A *P-value* of <0.05 was considered statistically significant.

Ethics

Ethics approval for this study was obtained from the Medical Research Council of Zimbabwe (MRCZ/E/380). Permission to access data from the ART centre was obtained from the management at the ART centre.

Results

Of the 276 men who were enrolled in the study, their median age was 39 years (IQR: 35-44), the majority aged 31-40 years (Table 1). HIV status was available for 139 men, of whom six (4%) tested positive. Approximately 21% of the men had chlamydia IgM antibodies and 25% had chlamydia IgG antibodies, indicating current and past infection respectively.

Table 1: Characteristics of men who were enrolled in the study, N=276

Characteristic		Number (%) [*]
Age category (n=264)	≤ 30	14 (5)
	31-40	139 (53)
	41-50	92 (35)
	>50	19 (7)
Smoker (n=134)	Yes	17 (13)
Alcohol use (n=135)	Yes	68 (50)
HIV status (n=139)	Positive	6 (4)
HBV status (n=242)	Positive	7 (3)
Chlamydia IgM (n=253)	Positive	52 (21)
Chlamydia IgG (n=253)	Positive	63 (25)
Any chlamydia infection (n=253)	Yes	95 (38)

HBV=Hepatitis B virus; IgG=immunoglobulin G; IgM=immunoglobulin M; ^{*}Percentages are column percentages calculated from those with data for each parameter.

Table 2: Characteristics of women who were enrolled in the study, N=276.

Characteristic	Number (%)*
Age categories (n=271)	
≤30	55 (20)
31-40	155 (57)
41-50	56 (51)
>50	5 (2)
Smoker (n=142)	Yes 4 (3)
Alcohol intake (n=139)	Yes 45 (32)
HIV (n=236)	Positive 10 (4)
HBV (n=132)	Positive 3 (2)
Chlamydia IgM (n=141)	Positive 14 (10)
Chlamydia IgG (n=141)	Positive 49 (35)
Any chlamydia infection (n=141)	Yes 56 (40)
Cycle history (n=186)	Regular 125 (67)
	Irregular 61 (33)
Menstrual cramps (n=183)	Yes 115 (63)
Type of infertility (196)	Primary 155 (79)
	Secondary 41 (21)
HSG results (n=77)	Normal 31 (40)
	Abnormal 46 (60)
Abnormal HSG results	• Both tubes blocked 20 (43)¥ • Partial tube blockage 15 (33) • Hydrosalpinges 22 (48) • Fimbrial adhesions 5 (11)
Scan results (n=276)	Normal 120 (43)
	Abnormal 156 (57)
Abnormal scan results	• Fibroid uterus 71 (46) • Polycystic ovarian syndrome 30 (19) • Cysts 21 (13) • Fluid in Pouch of Douglas 17 (11) • Adenomyosis 12 (8) • Endometriosis 5 (3) • Enlarged ovaries 4 (3) • Follicles 3 (2) • Others§ 10 (6)

HBV=Hepatitis B virus; IgG=immunoglobulin G; IgM=immunoglobulin M; *Column percentages calculated from those with available data for each parameter; ¥=Some women had multiple abnormalities and percentages exceed 100%. §=Others include polyps=2, atrophic uterus=2, hypoplastic uterus=1; Left enlarged ovary=1, OHSS=1, Thick endometrium=1, Thin endometrium=1 and tubular structure=1.

Table 3: Spermogram results, N=265

Morphology	Number (%)*
Normozoospermic	88 (33)
Abnormal	177 (67)
• Oligoasthenozoospermic	49 (28)
• Teratozoospermic	42 (24)
• Azoospermic	25 (14)
• Oligoteratoasthenozoospermic	24 (14)
• Oligoteratozoospermic	16 (9)
• Teratoasthenozoospermic	14 (8)
• Oligozoospermic	6 (3)
• Asthenoteratonecrozoospermia	1 (<1)

IQR=Interquartile range; *=Column percentages

The median (IQR) age of the 276 women enrolled in the study was 36 years (IQR: 31-40). A total of 210 (77%) women were aged 40 years and below (Table 2). HIV status was available for 236 women, of whom 10 (4%) tested positive. One in 10 women had chlamydia IgM antibodies while 40% had evidence of current or past chlamydia infection. Around 33% of women reported irregular menstrual cycles and 67% reported menstrual cramps. Of the 77 women who had HSG results, 46 (60%) had abnormal results. Twenty (26%) had bilateral tubal blockages on HSG. The majority of HSG abnormalities were complete or partial tubal blockages (76%), followed by hydrosalpinges

Table 4: Factors associated with infertility among men

Characteristic		Total	Male infertility		cOR (95% CI)	p-value
			Yes	(%)§		
Age category		265	177	(67)		
	≤30	13	10	(77)	1.63 (0.43-6.22)	0.47
	31-40	134	90	(67)	Ref	
	41-50	90	59	(66)	0.93 (0.53-1.64)	0.80
	>50	19	11	(58)	0.67 (0.25-1.79)	0.42
Smoker (n=130)	Yes	17	14	(82)	2.76 (0.75-10.7)	0.11
	No	113	71	(63)	Ref	
Alcohol use	Yes	66	44	(67)	1.17 (0.57-2.40)	0.67
	No	65	41	(63)	Ref	
Any chlamydia (n=246)	Yes	91	65	(71)	1.34 (0.76-2.35)	0.31
	No	155	101	(65)	Ref	
HIV status (n=119)	Positive	6	6	(100)	-	-
	Negative	130	79	(61)	Ref	

cOR=Crude odds ratio; CI=Confidence interval; §=Row percentages

Table 5: Factors associated with infertility among women

Characteristic		Total	Female infertility		cOR (95% CI)	p-value
			Yes (%)§			
Age category		276	178 (65)			
	≤30	55	30 (55)		0.55 (0.30-1.04)	0.06
	31-40	155	106 (68)		Ref	
	41-50	56	37 (66)		0.90 (0.47-1.72)	0.75
	>50	5	5 (100)		-	-
Smoker (n=142)	Yes	4	3 (75)		1.70 (0.17-16.83)	0.64
	No	138	88 (64)		Ref	
Alcohol use (n=139)	Yes	45	30 (67)		1.13 (0.54-2.40)	0.74
	No	94	60 (64)		Ref	
Cramps (n=183)	Yes	115	77 (67)		1.33 (0.72-2.49)	0.36
	No	68	41 (60)		Ref	
Any chlamydia infection, (n=141)	Yes	56	37 (66)		0.77 (0.37-1.59)	0.47
	No	85	61 (72)		Ref	
Cycle history, (n=186)	Irregular	61	46 (75)		2.26 (1.14-4.47)	0.02
	Regular	125	72 (58)		Ref	
HIV status, n=216	Positive	10	6 (60)		0.85 (0.23-3.12)	0.81
	Negative	226	144 (64)		Ref	

cOR=Crude odds ratio; CI=Confidence interval; §=Row percentages

(48%). All the 276 women had ultrasound scan results and 156 (57%) of them had at least one scan abnormality. The proportions of fibroid uteri and polycystic ovarian syndromes (PCOS) were 71

(26%) and 30 (11%), respectively. Among the abnormal USS scans, fibroid uteri and PCOS accounted for 46% and 19% of scan abnormalities, respectively.

Semen parameters

Overall, 269 men had semen analysis results since seven men did not submit semen specimens. Records for four men were excluded from the analytic dataset since they did not have spermogram results. Of the 265 who were part of the analytic dataset, 177 (67%) had abnormal spermograms. The commonest abnormalities include oligoasthenozoospermia (28%), teratozoospermia (24%), azoospermia (14%) and oligoteratoasthenozoospermia (14%).

Around 1 in 5 men had low semen volumes. The mean (SD) sperm volume was 2.74 millilitres (1.65) and it decreased with age. By contrast, sperm concentration increased with age. Almost 40% of the men had abnormal sperm motilities and abnormal progressive motilities.

Biochemical parameters in women

The median (IQR) of AMH was 2.12ng/ml (0.84-4.74). A quarter of the women had safe or normal levels of AMH, while around a third (31%) had reduced/negligible levels. The factors associated with male infertility are shown in Table 4. None of the exposure variables was associated with male factor infertility.

The factors associated with female factor infertility are shown in Table 5. Overall, 178 (65%) (95%CI: 59-70%) had female factor infertility. The odds of female infertility were 2.26 times higher in women who had histories of irregular cycles, odds ratio (OR=2.26, (95%CI: 1.14-4.47)).

Proportion of couples who had both male and female factors contributing to infertility

Among the 267 male: female pairs who had results, 111 couples 42% (95%CI: 36-48%) were found to have male and female factors contributing to infertility.

Discussion

We observed high proportions (42% overall) of male and female factor infertility and chlamydia

infection (past and present) of at least 38% among couples who sought ART services. Among women, we observed high proportions of primary infertility (79%), abnormal HSGs (60%) and ultrasound scans (57%), and irregular menstrual cycles (33%).

A systematic review reported that in Africa, infertility was more than two times higher in women (54%) than in men (22%).³ There has been variations in proportions of male infertility in Africa with high (around 25%) proportions reported in Ethiopia and Nigeria, while low proportions of around 5% were reported in Senegal.⁵ Some of the studies conducted in Zimbabwe and Nigeria reported very high proportions of male infertility, ranging from 63% to 70%, respectively.^{27,28} Both results are comparable to our findings and show that male infertility is three times the pooled prevalence recorded in Africa. High proportions of male infertility have been reported among Zimbabwean men since the early 1980s, and were associated with abnormal spermograms, bacterial and parasitic infections, and abnormalities such as varicocele and cryptorchidism.²⁹ In North Africa, data from Libya, Tunisia and Algeria showed that sperm quality decline with age, highlighting the multifactorial nature of male infertility.³⁰ These findings show that male factor infertility indeed contributes to childlessness in marriages and challenge traditional norms where society blames women for infertility. Of note, we observed a high proportion of couples who had both male and female factor infertility in Zimbabwe.

Sexually transmitted infections are associated with male and female infertility. In a previous study, up to 78% of Zimbabwean men seeking care at fertility clinics reported a history of STIs.¹² High proportions of chlamydia infection among couples seeking ART services were reported in several settings, a finding confirmed in this study. Acute and chronic bacterial infections account for 15-20% of reversible infertility in men due to either impaired sperm concentration or lowered progressive motility.^{31,32} In Nigeria, up to 38% of positive bacterial cultures were reported among men who had oligospermia.²⁸ Although female sex workers are known to have high-risk profiles for STIs such as chlamydia, we observed higher proportions of chlamydia than proportions reported among Zimbabwean female sex workers.³³ Out of desperation to conceive, people may engage in unprotected sexual relations with partners outside

marriage.³⁴ Culturally, families may preserve childless marriages by hiring a man's young brother or nephew to sire children without his knowledge.¹⁴ This exposes couples to STIs including HIV infection. Of note, the proportion of HIV was lower than the prevalence of 10.5% among the general population.³⁵ The reasons for this could be two-fold. Firstly, the availability of HIV prophylaxis e.g. pre- and post-exposure prophylaxis (PrEP/PEP) confers protection against HIV and not the other STIs. In the USA, HIV pre-exposure prophylaxis (PrEP) users were less likely to use condoms and were more likely to engage in multiple sexual relations as compared to non-PrEP users.³⁶ Use of PrEP/PEP may lower the risk perception of HIV infection in sexual relations in which condoms are not used (arguably most of the sexual relations among people whose intention is to conceive). By contrast, lack of knowledge or willingness to use either doxycycline pre-exposure (doxy-PrEP) or doxycycline post exposure prophylaxis (doxy-PEP) for STIs may explain the high proportion of chlamydia (and not HIV infection) as reported in other settings.^{37,38} Secondly, the risk of HIV transmission among people living with HIV (PLHIV) who attain viral load suppression (<1000 viral copies/mL) is low. Around 90% of Zimbabwean PLHIV attained viral load suppression.³⁹

While a previous study in Africa reported similar proportions of primary and secondary infertility, studies in Zimbabwe show higher proportions of primary infertility compared to secondary infertility.³ Around 2019, primary infertility was reported among two-thirds of women seeking ART services in Zimbabwe.²⁷ We observed an even higher proportion of primary infertility of up to 79% among women — an unexpected finding given the high proportion of chlamydia infection. Possible reasons could be, i) women may be engaging in risky sexual behaviour at a young age, predisposing themselves to STIs e.g. *Chlamydia*, a risk factor for tubal blockage and ii) the high proportion of irregular menstrual cycles. Irregular menstrual cycles, especially during teenage years are associated with polycystic ovarian syndrome which leads to poor ovulation, a risk factor for infertility, a finding confirmed by this study.⁴⁰ In Saudi Arabia, primary infertility was associated with irregular menstrual cycles while secondary infertility was associated with older age.⁴ Around 2021, the proportion of women seeking fertility

treatment who reported irregular menstrual cycles was 20%.⁴¹ The proportion of primary infertility has increased in our setting and future studies ought to investigate this finding and possibly explore the associated factors.

We observed high proportions of abnormalities on HSG and USS of around 60%, confirming findings by an earlier study.²⁷ The percentage of women who had bilateral tubal blockages was slightly higher in our study than in a previous study.²⁷ Tubal occlusions indicate reduced capacity of women to conceive.

Our study has notable strengths. Firstly, we utilised routine data. Hence, our findings reflect what happens within a real-world setting. Secondly, we minimised selection bias by consecutively recruiting records for couples.

However, our study has some limitations. Firstly, we potentially under-reported female factor infertility because access to HSG scan, a definitive diagnostic test for tubal blockage, was low as reported in previous studies.^{27,42} Secondly, use of routine data made it difficult to get data on other STIs, behavioural factors (e.g. smoking and alcohol use), dietary factors (e.g. intake of sugary foods and caffeine) and imaging tests (HSG and USS). Substance use, e.g. smoking and alcohol use are associated with infertility.⁵ Secondary data also made it impossible to capture data on environmental and occupational exposures that are associated with infertility. For example, male infertility may be attributed to parasitic infections e.g. bilharzia,²⁹ and occupational exposure to wireless fidelity (wi-fi). Medium to high exposure to wi-fi of 2-5 hours laptop use per day was associated with low semen volume and increased time to conception among Jamaican men.⁴³ Exposure to wi-fi and electronic gadgets increases both duration and intensity of exposure to radio waves, leading to abnormal sperm parameters such as low sperm count.³⁰ In Ghana, high intake of caffeine was associated with impaired sperm morphology while intake of sugary foods was associated with decreased sperm motility.³⁰

Thirdly, herpes simplex virus type 2 (HSV-2) and human papillomavirus (HPV) induced male infertility have been reported in some studies. These viral infections are associated with abnormal sperm counts and morphology.^{44,45} Importantly, HSV-2 is a biomarker for risky sexual behaviour such as unprotected sexual intercourse and multiple partners. However, it is currently not part of the

workup package at the ART centre and its association with the abnormal spermiograms observed in this study is unknown. Lastly, our study was conducted in an urban setting. Hence, the results cannot be generalised to the rest of the country.

Despite the limitations, we have recommendations for practice. Since more than 40% of couples had male and female factor infertility, there is need to raise awareness about benefits of screening couples, including STIs to maximise fertility outcomes. Increasing the number of STIs in the workup package will certainly increase the cost of ART but it is a worthy sacrifice considering the social benefits of successful ART and pregnancy outcomes.

Given the association of viral (HSV 2 and HPV) and bacterial (*Chlamydia*, *Mycoplasma hominis* and *Ureaplasma spp*) infections with male infertility, inclusion of additional STIs to the workup package is crucial.³¹ *Chlamydia* and *Ureaplasma urealyticum* are prevalent in young men and women, while *Chlamydia* and *Mycoplasma hominis* are prevalent in men.³² A blanket inclusion of additional STIs to the diagnostic workup package will certainly increase costs and disadvantage those with low risk profiles for these STIs. A customised workup package, taking into account one's risk profile for STIs, may be applied to triage clients for STI testing even if they are asymptomatic for STIs. High prevalence of *Chlamydia*, *Ureaplasma spp*, and *Mycoplasma hominis* have been reported in asymptomatic men.³² The starting point is getting accurate history of clients to ascertain their risk profiles for STIs in a manner that ensures privacy and reduces social desirability bias.⁴⁶ Lastly, given the association between infertility and irregular menstrual cycles, menstrual history needs to be documented during fertility assessments to inform interventions in women who report irregular cycles.

Future studies should apply longitudinal designs to collect data prospectively on sociodemographic, environmental, occupational and clinical factors (including endometriosis and polycystic ovary syndrome) and their associations with infertility. Studies may also investigate fertility care seeking patterns, socio-economic and psychosocial impacts of infertility on couples before and during health seeking for ART.

In conclusion, we observed high proportions of male and female factor infertility. Timely access to comprehensive, integrated fertility treatments and counselling services for couples is likely to maximise ART and overall pregnancy outcomes. This will require policy interventions aimed at reducing and/or eliminating both geographical and financial barriers to accessing ART services in Zimbabwe.

Conflict of interests

All the authors declare no competing interests.

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Data availability

Data can be accessed from the corresponding author upon request.

Author contributions

T.M; T.Makurumure; T.B.C; S.F; C.T; and Y.W.C.M conceptualised the study. T.M; T.Makurumure; S.F and M.M reviewed the protocol. Y.W.C.M and T.Makurumure curated the data. T.B.C; CT; Y.W.C.M analysed the data. T.B.C; CT and Y.W.C.M wrote the initial draft manuscript. T.M; T.Makurumure; S.F and M.M critically reviewed the manuscript for intellectual content. T.M; S.F and M.M contributed to project administration and supervision. All authors read and approved the final version of the manuscript.

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