

# Prevalence, associated factors and psychosocial consequences of infertility among women of childbearing age in Guinea: Case of a cross-sectional study with an analytical aim carried out in the five municipalities of Conakry city in 2021

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## Research Article

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# Abstract

**Introduction:** This study aimed to determine the prevalence of infertility among women of childbearing age, to identify its explanatory factors and to assess its psychosocial consequences among victims.

**Methods:** This was a 6-month cross-sectional study from 18 June to 18 November 2021 involving 4,910 women of childbearing age (15-49 years) in the five municipalities of Conakry. Medians were used to summarise quantitative variables, and proportions were used to summarise categorical variables. Multivariate logistic regression was used to investigate factors associated with infertility ( $p$ -value  $\leq 0.05$ ). GHQ-28 questionnaire items were used to assess the psychosocial impact of infertility in female victims.

**Results:** The overall prevalence of infertility was 17.8% (5.40% primary and 12.4% secondary infertility). Risk factors associated with infertility were non-education (AOR: 6.146; CI: [4.961 - 7.614]), sexually transmitted infections (AOR: 2.461; CI: [1.997 - 3.033]), (AOR: 3.141; CI: [2.291 - 4.307]), salpingitis (AOR: 4.766; AOR: [3.165 - 7.177]), ovarian cystectomies (AOR: 3.286; CI: [2.008 - 5.376]), uterine myomas (AOR: 3.141; CI: [2.291 - 4.307]) and induced abortions (AOR: 3.372; CI: [2.556 - 4.448]). Social stress, feelings of spousal rejection, anxiety, insomnia, somatic injury, depression and psychosocial dysfunction were the main psychosocial consequences of infertility in the women who experienced it.

**Conclusion:** This study showed the importance of the problem of infertility among women of childbearing age in Conakry. It also helped to understand the need to set up and/or strengthen prevention and care interventions (medical and psychosocial) for victims of infertility. Another study taking into account the clinical and Para clinical explorations of women and men improved the understanding of the phenomenon of infertility in Guinea.

## Introduction

Fertility is a key component of reproductive health and is recognised as a global public health issue by the World Health Organisation (WHO) (1). Infertility is the inability to achieve a pregnancy after 12 months of regular unprotected sex (2).

There are two forms of infertility, one called primary, corresponding to the total absence of previous clinical pregnancy, and the other called secondary, characterised by the onset of infertility after pregnancy has been achieved without treatment (3).

One of the main reasons why marriage was instituted is for procreation. Thus, the joy of every marriage is that couples have their own children. But the problem of infertility has inhibited this joy and has been described as a major reproductive health problem for women and a common reason for visiting a gynaecologist (4).

Worldwide, the lifetime prevalence of infertility ranges from 8 to 12% (5). Infertility has a negative impact on an entire family and on the reproductive health of developing countries (6). The 2010 WHO estimates showed that 48.5 million people suffer from infertility with a ratio of one in seven in Western countries and one in four in developing countries (5, 7).

In the United States of America, a national survey study on family growth showed a prevalence of infertility and impaired fertility of 6.4% and 11.0% respectively (8). In Canada, 2012 estimates showed a prevalence of infertility ranging from 11.5–15.7%. (9). A study in Germany in 2012 showed that 8.91% of German women suffer from infertility (10).

Africa bears the greatest burden of infertility, with prevalence as high as 32% in some ethnic groups (4). Infertility is spreading like wildfire across West, East and Central Africa (11). In some countries in these regions, the majority of women may remain childless for the rest of their reproductive lives (12). For example, a systematic review with meta-analysis reported the overall prevalence of primary infertility in Africa as 49.91% and secondary infertility as 49.79%. (13). A 2018 study in Morocco showed a prevalence of primary infertility among couples at 77.2% and secondary infertility at 22.8% (14). In Rwanda, in Kigali, a 2011 study found a female prevalence of infertility of 73%. (15).

There are several causes of infertility, including ovulatory disorders, anatomical, endocrine, genetic, functional or immunological abnormalities of the reproductive system, chronic diseases, sexual conditions incompatible with coitus, abnormal sperm function and sexual conditions incompatible with the ability to deposit sperm in the vagina (3). To these factors can be added the level of education, gynaecological (menstrual) disorders, repeated surgical operations (16). Sexually transmitted diseases, tuberculosis, obesity, smoking, semen-related urological disorders, alcohol consumption, ovulatory and menstrual disorders, sexual intercourse initiated during adolescence, spontaneous or induced abortions, pelvic inflammatory disease have also been identified by some studies as risk factors associated with infertility in couples (7, 14, 15, 17).

The experience of infertility has a negative effect on affected individuals and well-being through the manifestation of frustration, anxiety and depression. It places a high economic burden on couples, which can lead to intimate partner violence, isolation and divorce (18). In addition, it can lead to lack of concentration, anxiety and decreased sexual satisfaction (19). Available studies have revealed that infertile women suffer psychological and social consequences in Africa compared to their men (20).

Thus, a better understanding of the extent of infertility and the factors that explain it would help to better define prevention and care interventions for victims. In Guinea, at the current state of knowledge, no rigorous study has been conducted on the epidemiology of infertility. Hence the interest of the present study, whose objective is to estimate the prevalence of infertility (primary and secondary), to analyse the factors that influence it and to evaluate the psychosocial consequences for women victims in the five communes of the city of Conakry, Guinea.

# Methods

## Type and setting of study

This was a cross-sectional study with an analytical focus for a period of 6 months (18 June to 18 November 2021) conducted among women of childbearing age (15 to 49 years) in the Conakry city in 2021.

The Conakry city is the capital of the Republic of Guinea. It is the country's largest demographic agglomeration with nearly 2,039,725 inhabitants in 2021(21). Overall, the total fertility rate in Guinea is 4.8 children per woman. The socio-economic situation in Guinea is marked by persistent poverty. According to recent statistics from the "Institut National de la Statistique (INS)", the national poverty rate is 43.7%, meaning that 43.7% of the Guinean population lives below the poverty line. A large proportion of this population lives in vulnerable areas, notably in urban slums and in rural areas (21). In addition to the high maternal mortality rate and low health service coverage, the country is facing the emergence and re-emergence of epidemic diseases, including Ebola (2014 - 2016, and again in 2021), Marburg Haemorrhagic Fever in 2021, etc. (22).

In Guinea, the management of infertility consists mainly of clinical and Para clinical investigations to ensure that it is infertility and to identify the cause; then follows the treatment of the causes. In the event of failure to treat, a referral is made to a higher level health structure (23). To our knowledge, apart from these practitioners' recommendations, no national protocol and no formal national strategy for the prevention and management (medical and psychosocial) of infertility exist in Guinea.

## Study population

Women meeting the following criteria were included in the study: i). aged 15-49 years; ii). living in a couple (married or cohabiting) for 12 months or more; iii). having, at some point, regular unprotected sex with a desire for pregnancy for at least a period of 12 months; and iv). residing locally in one of the five communes of the city of Conakry for at least 3 months prior to data collection. The exclusion criteria for participants were: i). single women of reproductive age; ii). women of reproductive age who had not given informed consent for participation in the study.

## Sampling and data collection

The sample size was calculated by the SCHWARTZ formula ( $n = \frac{[ZeZ\alpha]^2 \times pq}{i^2}$ ); where n= sample size, e = cluster effect equal to 2.3; p = expected prevalence of infertility, estimated at 50% (chosen because there is no previous reference study in Guinea), q = 1-p, Z $\alpha$  = the standard deviation constant, equal to 1.96 corresponding to the 5% risk of error and i = desired precision of the estimate, set at 5%. The non-response or wrong answer rate was set at 10%. Thus the number of women to be interviewed in each of the five communes was 972.

A three-stage cluster sample was used to select targets in each of the five municipalities of Conakry city. The first stage consisted of the selection of sectors. From the list of sectors, a random selection of 30 sectors was made per municipality. An automatic random number generator (Open Epi) was used to select the survey sectors. The second stage was the selection of households. Thus, starting from a crossroads in the centre of each sector, the interviewers turned a pen and threw it in the air. The direction was indicated by the tip of the pen. Following this direction, they proceeded to select the households. The first household on the right was the first to be visited. When there were no interviewees, the one on the opposite side was selected. Then the interviewers proceeded in a stepwise fashion until they had enough people to interview in each cluster. The number of households per cluster was obtained by dividing the sample size by the number of clusters. The third stage was the selection of women in households. In the households, the women to be interviewed were selected according to the eligibility criteria. If there were no eligible women in the household, the interviewers continued to the next household in the direction indicated by the pen. The survey was conducted when informed consent was obtained. If the woman refused to participate in the survey, the interviewers clearly emphasized the purpose and importance of the study. If she persisted, the interviewers moved on to the next household. If the area was crossed before the expected number of women to be interviewed was reached, the interviewers returned to the center of the municipality and repeated the same technique in the opposite direction until the desired number of women was reached.

Data were collected through the administration of a semi-structured questionnaire. Data collection was carried out by final-year medical students at the Gamal Abdel Nasser University in Conakry. These students were trained for three days on the objectives of the research, unfamiliar medical terminology, and the administration of the questionnaire in French and in the main local languages of the country (Fulani, Malinke, Soussou, Kissi, Kpèlè and Toma). The questionnaire was deployed in the Kobo collect v1.14.0 application to facilitate its administration.

## **Study's variables**

### **a) Prevalence variables and factors associated with infertility**

- **Dependent variable**

The dependent variable in this study was infertility, both in its primary and secondary forms and in its general form. In this study, infertility was defined as the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sex (24,25).

Primary infertility was defined as a woman who had never been diagnosed with a clinical pregnancy and who met the criteria for classification of infertility; whereas secondary infertility was defined as a woman unable to establish a clinical pregnancy who had already been diagnosed with a clinical pregnancy (26).

The question about the experience of infertility was asked of all participants included in this study. The question was: "Have you ever had a time, lasting 12 months or more, when you and your partner tried to

get pregnant, but it didn't happen? We considered a participant to be infertile when she answered "yes" to this question (27).

To classify women with infertility into primary and secondary infertility, we asked the following question: "Have you ever had a pregnancy that was completed and/or resulted in a live birth? We considered a woman to have primary infertility if she answered "No" to this question; and women who answered "Yes" to this question were considered to have secondary infertility.

- **Independent variables**

The independent or explanatory variables of infertility were composed of socio-demographic characteristics (age, education level, religion, ethnicity, marital status, social conditions, occupation, lifestyle, etc.); and clinical characteristics (gynaecological history, medical history, surgical history, etc.).

### **b) Variables related to the psychosocial consequences of infertility**

The variables related to the psychosocial consequences of infertility were made up of variables defined in the General Health Questionnaire - 28 (GHQ-28), which includes 28 items (28). The GHQ-28 is a standard questionnaire that is used as a tool to assess psychological well-being. It was chosen as the primary endpoint based on the results of a comparable trial and because it was evaluated as an appropriate tool to capture emotional stress. The GHQ-28 asks participants to indicate the state of their general health in recent weeks, using behavioural items with a 4-point scale indicating the following frequencies of experience: "not at all", "no more than usual", "rather more than usual" and "much more than usual".

## **Analysis of the data**

### **a) Analysis of prevalence and factors associated with infertility**

In the descriptive analysis, all quantitative variables were expressed as medians with interquartile ranges and as means with their standard deviations. Categorical variables such as type of infertility and etiological factors were expressed as percentages.

Univariate and multivariate analyses were performed to investigate associations between infertility and explanatory variables. In the univariate analysis, the crude odd ratio was used as a measure of association with 95% confidence intervals and p-value. Covariates for multivariate logistic regression were selected if the p-value was less than or equal to 0.20 in univariate. The adjusted odd ratio was calculated to identify non-confounding associations between infertility and explanatory variables. We adjusted simultaneously for several variables in the models. The associations observed in this study were not due to confounding by any of the other variables in the models. A p-value <0.05 was considered statistically significant.

### **b) Analysis of the psychosocial consequences of infertility**

A descriptive analysis was carried out using the GHQ-28 to study the psychosocial consequences of infertility among the victims. To assess the general health of the victims, we used the original scoring system, the Likert scale 0, 1, 2, 3. The minimum score for version 28 is 0 and the maximum is 84. Higher GHQ-28 scores indicate higher levels of distress. Goldberg suggests that participants with total scores of 23 or less should be classified as non-psychiatric; whereas participants with scores > 24 can be classified as psychiatric; but this score is not an absolute cut-off. It is recommended that each researcher derive a cut-off score based on the average of their respective sample (28). The assessment of psychological impact (psychological damage) in infertility victims was also carried out. A woman was considered psychologically impaired when she had at least one of the following problems: anxiety, depression, somatisation, social dysfunction. This was established through interpretation according to "The Hospital Anxiety and Depression Scale (HADS)", where a score  $\leq 7$  means there is no impairment; a score of 8-10 reflects doubtful symptomatology and a score of  $10 \leq$  reflects definite symptomatology (29).

### **Ethical considerations**

The study had no risk of adverse effects as it was non-interventional. However, before the launch of this study, the research protocol was presented for validation and approval to the scientific committee of the public health chair of the Faculty of Health Sciences and Technique of the Gamal Abdel Nasser University of Conakry. The study protocol was registered at the University of Conakry under number 638/B/DC/FSTS/VDR/UGANC/RECT. Oral and written informed consent was obtained from each participant before the questionnaire was administered. In order to preserve confidentiality, the data collected was made anonymous. It was only accessible to the investigators.

## **Results**

### **Characteristics of the sample**

A total of 4,910 women of reproductive age (15–49 years) were interviewed about infertility in the five municipalities of Conakry city in 2021. The median observed age of these women was 28 (24–33) years. The majority of these women were educated (64.7%), married (75.5%) and employed (70.9%). The median age at first sexual intercourse for these women was 18 (16–20) years. Women who consumed alcohol (11.1%) and smoked tobacco (8.1%) were few among the women interviewed (Table 1).

Table 1

Sociodemographic characteristics of the 4910 women of childbearing age interviewed about infertility in the five municipalities of Conakry city, September – November 2021, Guinea

<b>Variables</b>	<b>Categories</b>	<b>Effective</b>	<b>Percentage (%)</b>
<b>Commune of survey</b>	Kalum	958	19.5
	Dixinn	1011	20.6
	Ratoma	991	20.2
	Matam	977	19.9
	Matoto	973	19.8
<b>Respondent's religion</b>	Christianity	775	15.8
	Muslim	3927	80.0
	Traditional religion/without religions	208	4.2
<b>Respondent's ethnicity</b>	Fulani	1685	34.3
	Malinke	1032	21.0
	Soussou	1702	34.7
	Forest	491	10.0
<b>Respondent's age</b>	Median (IQI)	28 (24–33)	
	< 25 years old	1396	28.4
	25–34 years old	2508	51.1
	≥ 35 years old	1006	20.5
<b>Profession/occupation of respondent</b>	Employed	3479	70.9
	Unemployed	1431	29.1
<b>Respondent's level of education</b>	Schooled	3175	64.7
	Unschoolled	1735	35.3
<b>Respondent's marital status</b>	Bride	3709	75.5
	Concubine	1201	24.5
<b>Age at respondent's first sexual intercourse</b>	Median (IQI)	18 (16–20)	
	< 15 years	353	7.2



<b>Variables</b>	<b>Categories</b>	<b>Effective</b>	<b>Percentage (%)</b>
	15–24 years old	4334	88.3
	≥ 25 years old	223	4.5
<b>Spouse's age</b>	Median (IQR)	33 (26–43)	
	< 25 years old	903	18.4
	25–34 years old	1814	36.9
	≥ 35 years old	2193	44.7
<b>Profession/occupation of respondent's spouse</b>	Employee	3738	76.1
	Unemployed	1172	23.9
<b>Level of education of the respondent's spouse</b>	Schooled	3613	73.6
	Unschooling	1297	26.4
<b>Tobacco consumption</b>	Never smoked	4111	83.7
	current smoker	400	8.1
	Former Smoker	399	8.1
<b>Alcohol consumption</b>	Never drank	3919	79.8
	Current drinker	547	11.1
	former drinker	444	9.0

It should also be noted that 32.4% of the women surveyed had a history of sexually transmitted infections. Women who had undergone surgery represented 11.7% of the study sample. The percentages of women with a history of uterine myomas, salpingitis (PID), ovarian cystectomies were 11.1%, 4.6% and 3.3% respectively. About 76% of the women had had at least one pregnancy. Of these, 5.4% had already had an induced abortion and 8.0% a spontaneous or involuntary abortion (Table 2).

Table 2

Medical, surgical and gynaeco-obstetric history of 4910 women of childbearing age interviewed about infertility in the five municipalities of Conakry city, September-November 2021, Guinea

Variables	Categories	Effective	Percentage (%)
History of diabetes	No	4632	94.3
	Yes	278	5.7
History of high blood pressure	No	4218	85.9
	Yes	692	14.1
History of sexually transmitted infections	No	3319	67.6
	Yes	1591	32.4
History of surgery	No	4334	88.3
	Yes	576	11.7
History of uterine myomas	No	4366	88.9
	Yes	544	11.1
History of salpingitis	No	4683	95.4
	Yes	227	4.6
History of ovarian cystectomies	No	4749	96.7
	Yes	161	3.3
Ectopic pregnancy (n = 3737)	No	3569	72.7
	Yes	168	3.4
Type of abortion (n = 3737)	No abortion	3080	62.7
	Deliberate	266	5.4
	Involuntary	391	8.0

### Prevalence of infertility

The prevalence of infertility among women of childbearing age in the five communes of Conakry was 17.8%. Taking into account the types of infertility, this study shows that 5.40% of the women interviewed suffered from primary infertility and 12.4% of them suffered from secondary infertility (Fig. 1).

### Factors associated with infertility

The study showed that the respondent's level of education, history of sexually transmitted infections, gynaecological and surgical history (uterine myomas, surgical interventions, salpingitis and ovarian cystectomies) and induced abortions were associated with infertility among women of childbearing age in the five communes of Conakry. Thus, the probability of being infertile increased six fold among women with no education compared to women with other levels of education (AOR: 6.14; CI: [4.96–7.61]). Sexually transmitted infections increased the probability of female infertility by 2-fold (AOR: 2.46; CI: [1.99–3.03]). Women with a history of uterine myomas were 3 times more likely to be infertile (AOR: 3.14; CI: [2.29–4.30]), while those with a history of PID were 5 times more likely to be infertile (AOR: 4.76; AOR: [3.16–7.17]). Women with a history of ovarian cystectomy were 3 times more likely to be infertile (AOR: 3.28; CI: [2.00–5.37]), those who had an induced abortion were also 3 times more likely to be affected by infertility (AOR: 3.37; CI: [2.55–4.44]) (Table 3).

Table 3

Multivariate analysis of factors associated with infertility among 4910 women of childbearing age interviewed about infertility in the five municipalities of Conakry city, September-November 2021, Guinea

Variables	Categories	Effective	Prevalence of infertility (%)	OR adjusted	95% CI	P-value
<b>Commune of survey</b>	Kalum	958	17.0	Ref.	-	-
	Dixinn	1011	12.5	1.025	[0.694–1.514]	0.901
	Ratoma	991	28.9	1,295	[0.853–1.966]	0.224
	Matam	977	18.7	0.420	[0.290–0.610]	< 0.001
	Matoto	973	11.7	0.658	[0.443–0.977]	0.038
<b>Respondent's ethnicity</b>	Fulani	1685	18.5	Ref.	-	-
	Malinke	1032	17.5	1,867	[1.340–2.602]	< 0.001
	Soussou	1702	14.9	2,142	[1,500–3,059]	< 0.001
	Forest	491	25.9	3,055	[2.181–4.278]	< 0.001
<b>Respondent's level of education</b>	Schooled	3175	8.8	Ref.	-	-
	Unschoolled	1735	34.2	6,146	[4.961–7.614]	< 0.001
<b>Level of education of the respondent's spouse</b>	Schooled	1297	15.6	Ref.	-	-
	Unschoolled	3613	18.5	2,207	[1.712–2.846]	< 0.001
<b>History of diabetes</b>	No	4632	17.8	Ref.	-	-
	Yes	278	17.6	0.630	[0.400–0.992]	0.046
<b>History of sexually transmitted infections</b>	No	3319	13.3	Ref.	-	-
	Yes	1591	27.1	2,461	[1.997–3.033]	< 0.001
<b>Background of surgical interventions</b>	No	4334	17.8	Ref.	-	-
	Yes	576	17.5	0.523	[0.382–0.714]	< 0.001

Variables	Categories	Effective	Prevalence of infertility (%)	OR adjusted	95% CI	P-value
History of uterine myomas	No	4366	15.9	Ref.		
	Yes	544	32.7	3,141	[2.291–4.307]	< 0.001
History of salpingitis	No	4683	16.1	Ref.		
	Yes	227	52.0	4,766	[3.165–7.177]	< 0.001
History of ovarian cystectomies	No	4749	16.9	Ref.	-	-
	Yes	161	44.1	3,286	[2.008–5.376]	< 0.001
alcohol consumption	Never drank	3919	17.6	Ref.		
	Current Drinker	547	17.9	1,413	[0.999–1.997]	0.051
	Former drinker	444	18.7	1,849	[1.164–2.936]	0.009
Type of abortions undergone (n = 3737)	No abortion	3080	13.9	Ref.	-	-
	Deliberate	266	45.9	3,372	[2.556–4.448]	< 0.001
	Involuntary	391	34.0	0.618	[0.419–0.911]	0.015

### Psychosocial consequences of infertility

Social stress (44.5%) and feelings of rejection by a partner (36.5%) were the most common psychosocial consequences for the infertile women in this study (Fig. 2). According to the items of the GHQ-28 (General Health Question – 28) assessment questionnaire, psychosocial consequences such as somatic impairment, anxiety and insomnia, severe depression, and psychosocial dysfunction were the psychological symptomatology's encountered in infertile women with frequencies of 12%, 22%, 7.5%, and 11.2% respectively (Table 4).

Table 4

Psychosocial impact of infertility (*interpretation of GHQ-28 domains according to HADS criteria*) among 872 women of childbearing age who were victims of infertility interviewed in five municipalities of Conakry city, September-November 2021, Guinea (n = 872)

Psychosocial Impact Assessment Domains (GHQ-28)	Mean $\pm$ SD	Level of psychosocial impairment			Total not (%)
		Absence of achievement not (%)	Symptomatology questionable not (%)	Symptomatology certain not (%)	
Somatic impairment	4.67 $\pm$ 3.35	685 (78.6)	79 (9.1)	108 (12.4)	872 (100)
Anxiety and insomnia	5.49 $\pm$ 4.01	564 (64.7)	116 (13.3)	192 (22.0)	872 (100)
Severe depression	3.37 $\pm$ 3.63	677 (77.6)	130 (14.9)	65 (7.5)	872 (100)
Psychosocial dysfunction	6.67 $\pm$ 2.38	630 (72.2)	144 (16.5)	98 (11.2)	872 (100)
<i>GHQ-28 score according to HADS criterion (Absence: <math>\geq 7</math>; Doubtful symptomatology: 8–10; Definite symptomatology: <math>\leq 10</math>)</i>					

The classification of psychosocial impact according to Goldberg's interpretation shows that 34.6% of women with infertility had a psychosocial impairment (Table 5).

Table 5

Psychosocial impact of infertility (*interpretation of GHQ-28 Goldberg domains*) among 872 women of childbearing age who were victims of infertility interviewed in five communes of the city of Conakry, September-November 2021, Guinea (n = 872)

GHQ-28 score according to Goldberg's interpretation	Effective	Percentage (%)
No Psychological impairment (Score GHQ-28 $\leq 23$ )	570	65.4
Psychological impairment (GHQ-28 score $\geq 24$ )	302	34.6
Average score	20.23 $\pm$ 10.83	

## Discussion

Infertility is a real health problem and has a negative effect on the psychological well-being of the victims through the manifestation of frustration, anxiety and depression. It represents a high economic burden for couples, especially in sub-Saharan Africa. It can lead to intimate partner violence, isolation and divorce. This phenomenon of infertility is poorly documented in the Guinean context. The objective of this study was to estimate the prevalence of infertility among women of childbearing age in the five

municipalities of Conakry city. It also consisted of identifying the factors associated with infertility and describing its psychosocial consequences for the women affected. Thus, we conducted a cross-sectional study with an analytical focus on 4,910 women of childbearing age in the five municipalities of Conakry city in 2021.

This study shows that the prevalence of infertility among women of childbearing age in the city of Conakry was 17.8%. The prevalence of primary infertility was 5.4% and that of secondary infertility was 12.4%. A study by Dia and al. in 2017 in Ivory Coast reported an infertility prevalence of 13.1%. (30). Another study by Eric and al. in Burkina Faso in 2016 showed a prevalence of 10.4%, with 6.8% for primary infertility and 3.6% for secondary infertility in 2016 (31). The predominance of secondary infertility in our study can be explained by the high exposure of women of childbearing age in resource-limited countries (such as Guinea) to risk factors for infertility. These factors include sexually transmitted infections, unsafe induced abortion practices, etc. (7, 14).

Reproduction is very often the prerogative of the socio-economic level of the couple or the individual with the desire to procreate (32). Our sample was predominantly composed of women with low levels of education, and this was associated with infertility. Women with no education were 6 times more likely to be infertile. In China, in 2018, people with low education were 3.4 times more likely to be infertile than those without (33). These results are evidence that women with higher levels of education have easier access to curative care and a generally healthier and higher quality lifestyle (34).

Also, the likelihood of infertility related to sexually transmitted infections has been shown to increase with repeated new infections, and in most cases there are multiple re-infections within 12 months of treatment (35). In our study, we found that women with sexually transmitted infections were twice as likely to be infertile as those without. In Africa, pelvic inflammatory disease accounts for 39.38% of the factors that would explain infertility (36). The promiscuity, low economic and social level of the population could be at the origin of this association. The presence of uterine myomas in women is in most cases an obstacle to fertility (37). In this study, women with a history of uterine myomas were 3 times more likely to be infertile.

The practice of cystectomy affects ovarian reserve by causing a significant decrease in the level of Antimüllerian Hormone (AMH) in cases of endometriomas, teratomas and other benign cysts (38). In this study, we found that women with a history of cystectomy were 3 times more likely to experience infertility. These data corroborate with the literature which reports a high risk of infertility in case of cystectomy (38).

Furthermore, it should be noted that studies conducted by Polis and al. in Malawi in 2015 reported that the rate of induced abortion was 38‰ among women of reproductive age. The same study had shown that unplanned pregnancies accounted for 53% of pregnancies; and 30% of these pregnancies ended in abortion (39). In Ivory Coast the percentage of induced abortions in 2020 was 27‰ among women of childbearing age (40). These high rates of induced abortion show how common this practice is among women of childbearing age. It becomes appropriate to assess the risks to fertility in this population. In our

study, for example, we found that women of childbearing age with a history of induced abortion were three times more likely to be infertile. In Switzerland, a study by Carlsson and al. showed that women with a history of induced abortion had an increase in the frequency of complications from 4.2% in 2008 to 8.2% in 2015 (RR = 1.49, CI95% = 1.04–2.15) (41). In Guinea, the low economic level and promiscuity give way to risky sexual practices. Sex work has become common practice and gives rise to multiple unwanted pregnancies which inevitably lead to clandestine and repeated abortions. To this should be added the low contraceptive coverage, especially among young girls, who are most often exposed to unwanted pregnancies. The 2018 Guinea Demographic and Health Survey showed a modern contraceptive coverage of 11% among teenagers aged 15 to 24 years (42).

The stigmatization of infertile women in our society often provokes the involvement of the in-laws, increasing, by their presence, the psychological and social pressure of the woman; thus explaining the various disorders within the couples, as Ndikumana reports in her study carried out in Burundi in 2020 (20). Women with infertility were mostly stressed and rejected both at work and in society. This was also the case for Nana and al. in 2011, who found in their study that stress (83.7%) and depression (35%) were common among infertile women (43). Our results also corroborate with the findings of Lakatos and al. in Hungary in 2017 who reported that depression and anxiety were found in 44.8% and 39.6% of infertile women respectively (45). Childbirth is very important for a couple, especially in the first year of a relationship. Its absence in a couple causes unparalleled concern, as well as social pressure that can lead to divorce (44). In the light of these results, we can see how wide-ranging the treatment of this phenomenon is, including the psychological aspect.

The assessment of the general state through the GHQ-28 questionnaire allowed us to have an overview of the psychological impact of infertility in women experiencing infertility. It was found that infertility had a negative effect on the psychological state of 34.6% of the women. The average found ( $20.23 \pm 10.83$ ) revealed the deterioration of their general state. Moridi and al. found the same in their study conducted in 2019 in Iran with a mean of  $28.6 \pm 13.0$  (46).

It should also be noted that the sensitivity of the subject of infertility makes it predisposed to psychological problems, because the longer it takes to obtain a child, the more infertile women feel abandoned, anxious, depressed and finally sink into an unparalleled despair, as Donkor and al. reported in Ghana in 2017 (47). In our society, women are already being singled out for infertility, putting pressure on the man to subjugate the woman, so that her areas of exercise, authority and dignity are being trampled on. They become the object of all kinds of ridicule, mockery and contempt by society, by the in-laws, by co-wives and sometimes by the spouse (20). Psychological support for these women to accept their condition would be very beneficial for effective management.

Our study provides information on present data only, a rigorous follow-up over a longer period of time would give ample information on risk factors and the nature of infertility. Data on infertility, associated factors and psychosocial consequences were obtained using a pre-designed questionnaire, thus presenting subjective, non-diagnostic results. It should be noted that it would be possible for a woman



said to be infertile after 12 months to achieve a pregnancy beyond 12 months. Clinical and para clinical examinations, as well as certain medications that may induce infertility, were not explored during our study. Essentially, our study aimed to analyse the phenomenon of infertility and to assess its psycho-social impact on women victims; this did not allow us to compare or reconcile psycho-social items between infertile and fertile women. It is important to note that procreation is the result of copulation, so it would be more judicious to undertake a similar survey among men and to associate clinical and para clinical examinations with it. As the majority of the population was of average level, communication during the survey proved more difficult. Notwithstanding all these limitations, the population-based prevalence assessment approach can be considered reliable and valid; and can also be extrapolated to the Conakry population, given the size and randomness of our sample. Several factors as well as the psychological impact of this disease could be identified from this study, allowing the establishment of preventive measures and management of this phenomenon.

## Conclusion

This study has enabled us to understand that infertility is a health and social problem in Guinea. Its prevalence remains high among women of childbearing age in the city of Conakry. Socio-economic factors (education level, employment, etc.), history of sexually transmitted infections, gynaecological and surgical history and induced abortions were the factors independently associated with female infertility. This study also showed that women with infertility experienced social stress, rejection by their spouses, marital conflict and conflict with in-laws. The psychology of its victims was also affected with signs of somatic damage, anxiety, insomnia, severe depression and psychosocial dysfunction to varying degrees. This study constitutes an important basis for a national study that takes into account the performance of complementary examinations on the people to be interviewed. It gives the public authorities the means to develop and implement prevention and care interventions (medical and psychosocial) for victims of infertility in Guinea. Preventing unwanted pregnancies by improving contraceptive coverage, especially among young people, could be one of the key interventions for reducing secondary infertility in Guinea.

## Abbreviations

**PID**, Pelvic Inflammatory Disease; **WHO**, World Health Organization; **AOR**, Adjusted Odd Ratio; **GHQ-28**, General Health Questionnaire; **INS**, Institut National de la Statistique; **HADS**, Hospital Anxiety and Depression Scale; **AMH**, Antimüllerian Hormone, **PID**, Pelvic Inflammatory Disease.

## Declarations

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### Authors' contributions

Authors	Contributions
Niouma Nestor Leno	Design of the study, data analysis, writing of the first manuscript, finalisation of the submitted manuscript
Kadio Jean-Jacques Olivier Kadio	Supervision of data collection, data processing and analysis, review of the first manuscript
Zézé Charles Romuald Bley	Data collection and cleaning, literature review, writing the introduction
Djaky Armande Olivia Ehora	Data collection and cleaning, literature review
Adoum Aganaye	Data collection and cleaning, literature review
Alioune Camara	Review of the designation of the study, review of the manuscript
Alexandre Delamou	Review and validation of study design, review and validation of manuscript

### Competing interests

The authors stated that there is no competing interest.

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The design and implementation phases of the study were not funded. The data collection has been done by medical students supervised by the public health chair of the Faculty of Health Sciences and Techniques of the Gamal Abdel Nasser University of Conakry as part of their end-of-cycle thesis.

### Data availability

The database used to analyze the data for this study contains individual and anonymous information from women of reproductive age interviewed in the five communes of Conakry. Permission to conduct the study and disseminate its results was obtained from communal authorities, neighbourhood chiefs and sector chiefs. However, the data used in the study are not publicly available. Anyone interested in

obtaining these data for scientific purposes can request them from the authors of this work at the following address : [nnleno81@gmail.com](mailto:nnleno81@gmail.com).

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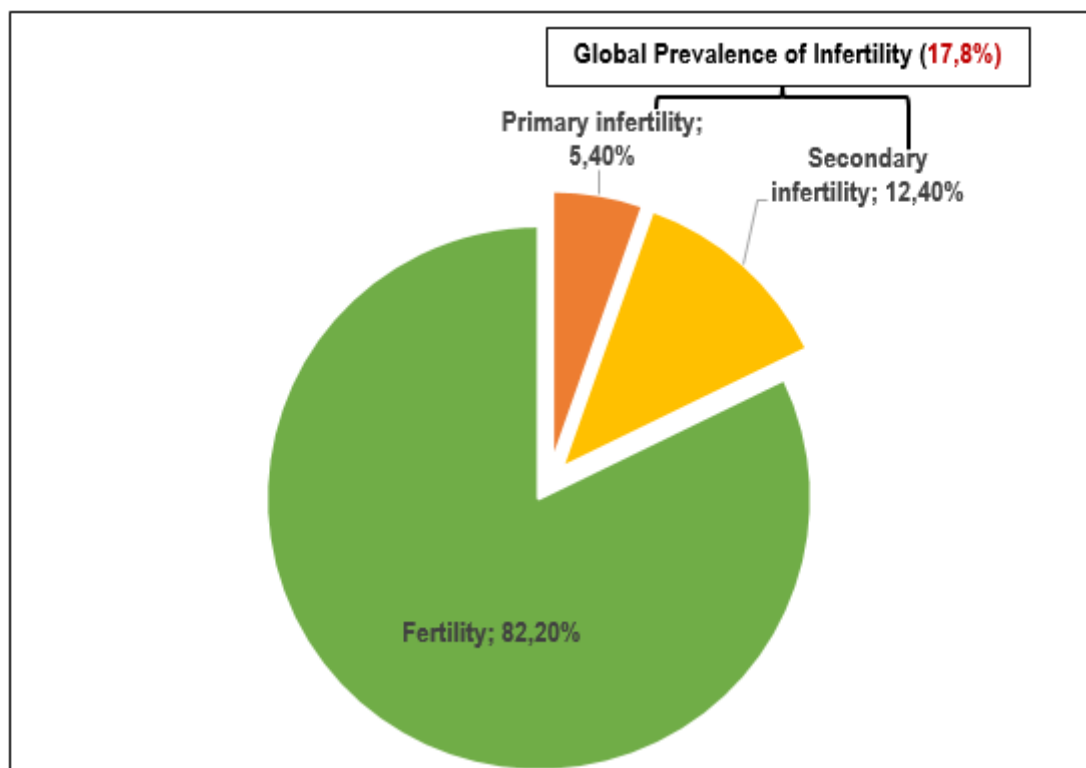
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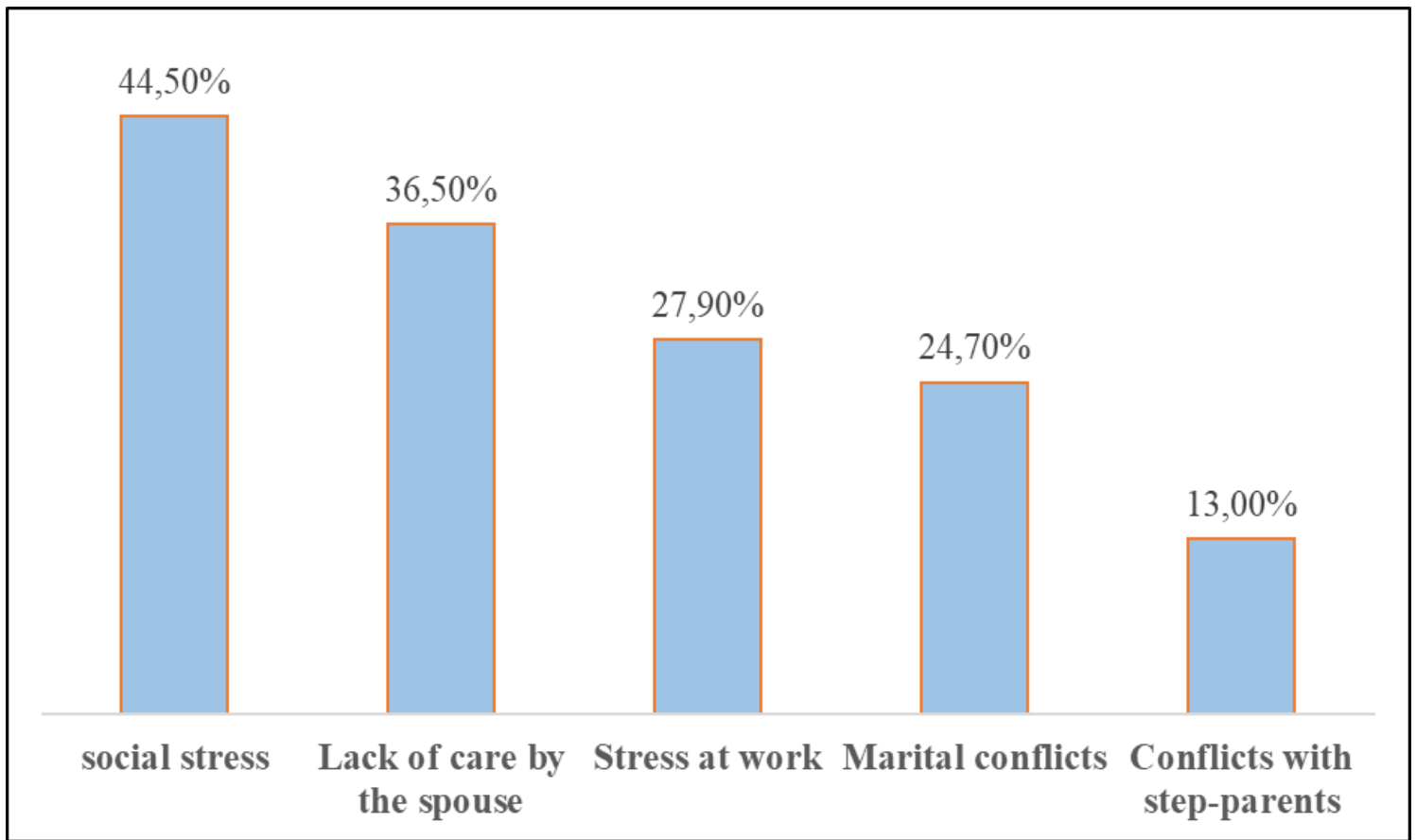
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## Figures



**Figure 1**

Prevalence of infertility among 4910 women of reproductive age interviewed about infertility in the five (5) municipalities of Conakry city, September-November 2021, Guinea ( $n=4910$ )



**Figure 2**

Consequences of infertility ( *conflicts and stress* ) among 872 women of childbearing age who were victims of infertility interviewed in five municipalities of Conakry city, September-November 2021, Guinea (n=872)