CAUSES AND TYPES OF INFERTILITY AMONGST COUPLES MANAGED AT KENYATTA NATIONAL HOSPITAL

A HOSPITAL BASED DESCRIPTIVE STUDY

THESIS SUBMITTED AS PARTIAL FULFILMENT FOR THE DEGREE OF MASTERS OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY AT THE UNIVERSITY OF NAIROBI

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DECLARATION

I declare that this is my original work and has not been presented for a degree in any other university.

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ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ART	Assisted Reproductive Technology
CS	Caesarian section
Etc	et cetera (among others)
HIV	Human Immunodeficiency virus
HSG	Hysterosalpingogram
IVF	Invitro fertilization
IUD	Intra-uterine device
KNH	Kenyatta National Hospital
PID	Pelvic Inflammatory Disease
RH	Reproductive Health
STI	Sexually Transmitted Infection
SVD	Spontaneous vaginal delivery
W.H.O.	World Health Organization

DEFINATIONS

1. **Fecundity** is the probability of achieving a live birth in 1 menstrual cycle.
2. **Fecundability** is the probability of being pregnant in a single menstrual cycle.
3. **Infertility** is the inability of a couple to conceive within 1 year of unprotected intercourse of reasonable frequency. Reasonable frequency in this context refers to sexual frequency of 2-3 times a week.
4. **Male infertility** is inability of a man to achieve a conception with his partner after 12 months of regular unprotected sexual intercourse.
5. **Primary Infertility** applies to those who have never conceived, whereas secondary Infertility designates those who have conceived at some time in the past.
6. **Sterility** is an intrinsic inability to achieve pregnancy.
7. **Sub-fertility** occurs when the couple has difficulty in conceiving because both partners have reduced fecundity.

ABSTRACT

Background

Infertility affects a relatively large number of couples (about 50 -80 million) worldwide with an estimated global prevalence of 8-12% but higher in Africa 20-30%. The magnitude of infertility in Kenya remains inadequately determined, however, a National infertility survey established that Infertility cases in Kenya comprises approximately 30% of all gynecological consultations at national referral hospitals,15% in district hospitals,4% in health centers and 2% in dispensaries in Kenya. The causes of infertility vary among populations and are dynamic. This study describes the current causes and types of infertility amongst infertile couples attending Kenyatta National Teaching and Referral Hospital (KNH). It forms a base line for the local infertility situation and basis for further scientific research on infertility.

Broad Objective

To determine the causes and types of infertility amongst infertile couples being managed at KNH in 2012.

Methodology

A hospital based descriptive study was done in KNH Infertility Clinic and Gynecological Outpatient Clinics between February and September 2012 .Recruitment was consecutive till a sample size of 79 was reached. A structured questionnaire was administered to capture key socio-demographic and reproductive health characteristics. The Investigation results and diagnosis were extracted from patients' records and entered into an SPSS Info data base, cleaned, and analyzed using SPSS (v.17) and STATA (v.11).

Results

Among infertile couples, the mean age of females was 30.5(SD 5.9) years while that of males was 36.5 (SD 7.8) years. This study found 41.8% of infertility to be due to female factor only, 16.5% male factor only, 35.4% combined male female factor and 6.3% due to unexplained causes. Majority of the infertile females had primary infertility (55.6%) compared to secondary infertility 44.3%.The commonest cause of female factor infertility was tubal factor 83.6% with a majority having bilateral blocked tubes (60.6%).Abnormal sperm characteristics were in about 52% of male partners in which 7.6% had azoospermia and 14.6% erectile dysfunction.

Conclusion

This study showed that the gender distribution of infertility causes is similar to earlier studies with exception of combined male and female factor infertility which was higher in this study. In addition, the mean age of infertile female was found to be higher than earlier studies. It also showed a high rate of tubal factor infertility and male factor infertility. Slightly more than half of the male partners had abnormal sperm characteristics with a significant proportion azoospermic, sexual dysfunction among male partners occurred in 15%.

Recommendations

1. To establish facilities in Kenyatta National Hospital capable of management of male infertility due to the high male factor infertility.
2. Strengthening of public health education on safe sex practices to prevent acquisition and transmission of sexually transmitted illnesses.

LITERATURE REVIEW

Background

Infertility is a major problem globally affecting 8-12% couples. The prevalence of primary and secondary infertility in the world range from 5-30% with variations from country to country [1].According to Rutstein and Shah, secondary infertility in developing countries increases exponentially with age, from about 5% at ages 20-24 to about 62% at ages 45-49 years. In Sub-Saharan Africa, infertility rates are as high as 30%[2].This high infertility rate is due to infection, either from sexually transmitted infections, after child birth or abortion[3].

In African societies human reproduction is highly valued and inability to conceive is considered a personal tragedy and a curse for couples, impacting on the entire family and local community. In addition, childless women are frequently stigmatized resulting in isolation, neglect, domestic violence and polygamy [4, 5]

In Kenya, infertility is a major reproductive health concern as reflected in a national infertility survey conducted in 2005/2006.The survey highlighted infertility related consultations to be as follows ;at teaching and referral (tertiary) hospitals 30%, in provincial hospitals 27%, in district hospitals 15%, in health centers 4% and in dispensaries to be 2%[4]. Earlier infertility studies conducted in Kenya had almost similar findings[6, 7].Infertility in Kenya is a significant family problem in all communities across the country, most people interviewed during the 2005/6 infertility survey cited infertility as woman problem since its' difficult to involve the men in fertility assessment. Furthermore, the impact to the individual and/or couple was summarized by statement from one of the groups as "children are valued and without them you are worthless …" this clearly demonstrates the stigma associated with infertility[4].

The National reproductive health policy (2007) recognizes infertility as an important public health concern in Kenya It prioritizes the following actions; improving access to quality infertility services to all levels, promoting community awareness especially among men and encouraging all aspects of research[8].

The pattern of infertility varies from population to population and is influenced by social cultural differences, level of sexual promiscuity, prevalence of sexually transmitted diseases and reproductive behavior [9, 10]. There is also evidence that a woman with high risk sexual history, multiple marital unions, and sexual initiation before puberty has a higher risk for infertility[10].

Causes of infertility

The causes of infertility are widely classified in four major categories: the female factor; the male factor; combined factors; and unexplained infertility. It is difficult to assign exact percentage to each of these categories; however, it is generally reported that in approximately 35% of cases, infertility is mainly due to a female factor, in 30% to a male factor, in 20% to abnormalities detected in both partners, and in 15% of cases no diagnosis can be made after a complete investigation. A WHO study of 3800 infertile couples in developed countries found female factor infertility to be due to the following; Ovulatory disorders 25%, endometriosis 15%, pelvic adhesions 12%, tubal blockage 11%, other tubal abnormalities 11% and hyperprolactinemia 7%[11].Locally a study by Gachara et al[6] found that 92% of women and 76% of men among infertile couples were between the ages 21-35 years at KNH, amongst these 35% had primary infertility while 65% had secondary infertility. Mati et al found that in 61.9% of couples in Kenya with infertility ,the cause of infertility could be attributed to female factor, 20.1% to male factor and 18% to both male and female[7]. Minor degrees of fertility impairment are not necessarily associated with couple infertility when present in only one partner but may reduce the couple's fertility when present in both partners[5]. In the US, 15-30% of infertile couples have unexplained infertility[12]. In these cases abnormalities are likely to be present but not detected by current methods. A diagnosis of unexplained infertility is assigned to a couple if results of a standard evaluation are normal. These include a semen analysis, assessment of ovulation, a hysterosalpingogram for tubal patency and if indicated, tests for ovarian reserve and laparoscopy[12].

Ovulatory disorders can be as a result of infrequent ovulation or absent ovulation .The World Health Organization has classified anovulation into three main groups, and recognizes hyperprolactinemia as an additional etiology .WHO class 1 is defined in women who have low or low- normal serum follicle stimulating hormone(FSH) concentration and low serum estradiol concentrations due to decreased hypothalamic secretion of gonadotropin -releasing hormone (GnRH) or pituitary unresponsiveness to GnRH. WHO class 2 is normogodotropic normoestrogenic anovulation, while class 3 is hypergonadotropic hypoestrogenic ovulation . This system is useful for defining and treating anovulatory disorders according to the underlying endocrine dysfunction[13].

Age is also an important characteristic affecting a woman's fertility. The decrease in fecundability with aging is likely due to a decline in both the quantity and quality of the oocytes. The germ cell complement of the ovary reaches its apex of 6 to 7 million follicles in the mid gestation female fetus, followed by a steady attrition from 1 to 2 million follicles at birth to 300,000 follicles at the onset of puberty. This rate of follicle loss accelerates after the woman reaches her mid-thirties[14].

Patent fallopian tubes, functional uterus and cervix are also essential for conception to take place .Tubal disease and pelvic adhesions can lead to infertility by preventing normal transport of the oocyte and sperm through the fallopian tube. The primary cause of tubal factor infertility is pelvic inflammatory disease caused by pathogens such as chlamydia or gonorrhea. Other conditions that may interfere with tubal transport include severe endometriosis, adhesions from previous surgery or nontubal infection (e.g. appendicitis, inflammatory bowel disease), and pelvic tuberculosis. Uterine abnormalities due to fibroid or anomalies can cause infertility by impaired implantation, either by mechanical or due to reduced endometrial receptivity. Müllerian anomalies are a significant cause of recurrent pregnancy loss, with the septate uterus associated with the poorest reproductive outcome. Other structural abnormalities associated with infertility include endometrial polyps, and synechiae from prior pregnancy-related curettage. However, data establishing a causal link between these uterine abnormalities and infertility are lacking [13].

Endometriosis is also thought to decrease infertility by anatomic distortion from pelvic adhesions, damage to ovarian tissue by endometrioma formation and surgical resection, and the production of substances such as cytokines and growth factors which impair the normal processes of ovulation, fertilization, and implantation[13].

Infertile couples have also been shown to have a higher prevalence of karyotype abnormalities (trisomies, mosaics, translocations, etc) than the general population[15]. The frequency of these abnormalities varies according to the cause of infertility and clinical history. The most common aneuploidies associated with infertility being 45, X (Turner syndrome) in women and 47, XXY (Klinefelter syndrome) in men.

Male factor infertility can be caused by numerous factors which can be categorized into pre-testicular, testicular and post- testicular[16, 17].Pre-testicular factors includes; Firstly, hypogonadotropic hypogonadism which may be as a result of elevated prolactin, medications,

illicit drugs like marijuana, pituitary damage and Kallmann syndrome[18];Secondly, hypergonadotropic hypogonadism whose most common cause include Klinefelters syndrome, which alter spermatogenesis; and lastly, other genetic disorders of gonadotropin secretion like multiorgan genetic syndromes such as the Laurence-Moon-Biedl syndrome, Prader-Willi syndrome, Lowe oculo-cerebral syndrome, and familial cerebellar ataxia [19].

Testicular factors include the following; Firstly, Varicocele whose association with infertility is not clear-cut, as it is also observed in about 10% of normozoospermic men[20].Though, it has also been related to semen abnormalities, decreased testicular volume and decline in leydig cell function[21]; Secondly, Cryptochidism which affects 1-3% of full term newborns with a higher prevalence in premature boys[22], is also associated with a 13% incidence of azoospermia if unilateral and up to 98% if bilateral and untreated[23];Thirdly, testicular cancer can lead to infertility by destroying and compressing the healthy testicular tissue and also from treatment for the testicular cancer. It is also found to have a higher incidence in infertile men(0.5-1%) compared to the general population (0.001-0.01%)[18]; fourthly, environmental factors like, hyperthermia is considered a major contributor of infertility in men with varicocele and cryptochidism; Lastly, other causes of male infertility include, testicular injury by direct trauma or indirect through infections like mumps ,kartageners syndrome, antisperm antibodies due to trauma and infection ,DNA damage can be caused by radiation, toxins, genital tract infections, varicocele, advanced paternal age and testicular hyperthermia, sertoli cell only syndrome, Ionizing radiation, chemotherapy and tobacco [24].

Post testicular characteristics include; congenital bilateral absence of the vas deferens, Young's syndrome, ejaculatory duct obstruction /seminal vesicle dysfunction commonly caused by cystic fibrosis spectrum disease, woffian or mullerian original cyst ,calcifications, tuberculosis, genitourinary infections, calculi and urinary instrumentation ,nerve injury ,medication,resection of the prostate causing retrograde ejaculation and lastly ,coital problems like erectile dysfunction and penile abnormalities such as hypospadias and chordee may interfering with semen deposition.

Local infertility situation

Infertility in Sub-Saharan Africa is caused by multiple etiological factors, including the following: male factor (40%), cervical factor (5-10%), uterine factor (15-25%), tubal factor (45-55%). About 4-12% has no identified cause of fertility after investigation and of this group about 60% of such unexplained cases of infertility will get pregnant after three years[25]. Other factors postulated include past history of ectopic pregnancy, previous tubal surgery and rupture of an appendix, pelvic tuberculosis, IUD use, septic abortion and sexually transmitted infections (STIs)[26].

The type and mode of infection varies from one developing country to another, but in sub-Saharan Africa, sexually transmitted infections are main cause of infertility[5]. In some, post-abortion and postpartum infections with salpingitis are more common. Non-sterile evacuation of the uterine cavity at abortion or delivery may be complicated by bacterial contamination, with ensuing fever, endometritis and ultimately salpingitis[27]. In addition, Abortions and deliveries performed by untrained people in rural areas greatly increase the risk of post abortion or postpartum infertility[27]. A review of iatrogenic infertility in Western Europe suggests that iatrogenic causes of infertility may be responsible for 5% of the total[28]. In Africa, however, the rate may be much higher. In one Egyptian study 15.5% of the infertile couples investigated had iatrogenic causes[29].

Male factor infertility in Kenya has been associated with tropical diseases such as Bancroftian microfiliarisis, leprosy, tuberculosis and schistomiasis[30].The study also, found hydrocele secondary to Bancroftian microfiliariasis to be associated with poor sperm quality and abnormal hormonal profile.In addition. there was decreased semen quality in male with lepromatous and tuberculous leprosy[30]. In another local study, Thagana et al[31]found 49% of azoospermic males at Kenyatta National Hospital had a palpable epididymal abnormality with 11% had varicocele. A conclusion was made that the commonest cause of azoospermia in KNH was obstructive lesions most likely as a consequence of urogenital infection. Lastly , occupation which involves riding a bicycle which is mechanical and has a nasal seat, has also been associated with erectile dysfunction in western Kenya[32].

Management of infertility

The clinical approach to investigation and management of infertility in Kenya varies considerably and depends on accessibility of services and level of expertise of the healthcare provider. An infertility survey in Kenya found that a significant number of healthcare providers have a limited knowledge on management of infertility. The health providers also reported that the conditions they were working in were suboptimal; in addition there was no clear referral system in place. Furthermore the survey found that laboratory facilities were restricted to teaching and referral hospitals but worse still they were rated poor (43%) fair (45%) good (16%) due to lack of equipment, trained personnel and poor reports respectively. The most common investigation done was HSG (41%), pelvic ultrasound (29%) and least hormonal profile (14%)[4].These investigation facilities are inadequate to make a conclusive diagnosis and these impacts negatively on the quality of care given to infertile couples in Kenya.

The WHO manual for the standardized investigation and diagnosis of the infertile couple provide clear guidelines and a logical sequence of steps which will quickly lead the clinicians or physicians to accurately diagnose the underlying cause of infertility[33]. This manual also provides a diagnostic classification for both male and female causes of infertility. The ESHRE Capri Workshop Group, 2000[34]evaluated investigations for infertility depending on their level of evidence and categorized infertility investigations into three groups' i.e. Tests which have an established correlate with pregnancy , Tests which are not consistently correlate with pregnancy and Tests which seem not to correlate with pregnancy. Tests with correlate with pregnancy include semen analysis, tubal patency tests and midluteal serum progesterone for diagnosis of ovulation. Tests which are not consistently correlate with pregnancy include zona hamster egg penetration tests, postcoital test and anti-sperm antibodies Assays. Tests which seem not to correlate with pregnancy include endometrial dating, varicocele assessment and Chlamydia testing. Thus the initial diagnostic tests should include a mid luteal phase progesterone assay, a semen analysis, and a test for tubal patency e.g. Hysterosalpingogram[34].

World Health Organization (WHO) published a new reference guideline for semen parameters in 2009. These guidelines were generated by evaluating 4,500 men in 14 countries

whose partners had less than or equal to 12 months time to pregnancy (TTP). WHO found that with a 95% confidence, men whose partners had TTP of 12 or fewer months had no less than the following-Semen volume-1.5 ml, Total sperm in the ejaculate-39 million, Sperm per ml: 15 million/ml; Vitality-58% live; Progressive motility-32%; Total Motility-40%; Morphologically Normal- 4% [35].

For the purpose of this study clinical assessment and investigation results as per case records were considered to arrive at a final diagnosis as per the WHO diagnostic criteria[33] (See Appendix 2). Semen analysis and hysterosalpingography or laparoscopy and 21day progesterone tests were considered for diagnosis. A woman was considered anovulatory if on two consecutive cycles in the secretory phase the serum progesterone values stayed below 20nm/L. Tubal factor was diagnosed if HSG or laparoscopy revealed abnormality. Though laparoscopy with chromotubation is the gold standard for evaluation of tubal patency, HSG was mainly used as a screening test because it is readily available .It has a sensitivity and specificity of 65% & 83% respectively [36, 37]. Those with abnormal HSG were done Laparoscopy.

Treatment of infertility should follow a thorough evaluation and firm diagnosis [33, 37-41].Etiology of infertility is important in determining mode of management. The specific interventions given in Kenyatta National Hospital include ovulation induction, surgery both open and laparoscopic, hormonal regulation of menses, reassurance and counseling. Nderitu[42], found significantly low success rates of pregnancy in KNH for open tuboplasty (3.7%) and laparoscopic tuboplasty (6.1%).This study demonstrated a general failure rate of 92.7% of any form of conception in both groups. Assisted Reproductive Technology(ART) which has demonstrated a success rate of 28% and which represent the only solution to most cases infertility is not available in KNH due to its high cost .IVF is indicated for tubal factors, cases of severe male factors, endometriosis, unexplained infertility and women with reduced ovarian reserve[43, 44].

JUSTIFICATION OF THE STUDY

The causes of infertility vary from population to population and are dynamic. The uncertain causal relationship between an abnormal infertility test and the actual cause of infertility makes it difficult to estimate the relative frequency of the causes of infertility. Nevertheless, the frequency of various infertility characteristics can be used as a proxy for their relative importance. This study determined the causes and types of infertility amongst an urban infertile population in Kenya, at Kenyatta National Hospital, a public national referral hospital. KNH attends to patients from the whole country and has readily available investigation facilities; hence reason for choice of the facility for the study. Previous studies on the pattern of infertility in KNH were done more than 25 years ago [7, 45].

Infertility in sub-Saharan Africa has been shown to be affected by social-economic and cultural characteristics which include ;low level education, poor hygiene, poverty, effects of modernization and cultural beliefs[46, 47]. Other factors which have been associated with infertility include ;sexually transmitted diseases, pelvic inflammatory disease, HIV, infection complications in pregnancy [10, 26, 48-50].Similarly, male factor infertility is also associated with previous infections of the genitourinary system [16, 20, 25, 51-53]. Several studies have documented reduced fecundity in HIV infected individual [54-57]. STI still remains one of the leading the disease burdens in Kenya despite improved access to STI treatment, use of syndromic management in treatment of STI and integration of STI treatment in reproductive health services[58]. These factors associated with infertility have significantly changed in Kenya over the last two decades[59, 60].Hence the justification for this study.

This study will also assist in planning and restructuring of the infertility clinic to provide services more efficiently by formulation of targeted management strategies. Furthermore, it forms a baseline for local infertility situation and further scientific research on infertility.

CONCEPTUAL FRAMEWORK

Infertility is associated with multiple characteristics which include,lifestyle,demographic, environmental, medical and personal characteristics.These characteristics are usually interdependent in most cases. Social characteristics such as education level, marital status and religion help determine aetiology of infertility because they may directly or indirectly lead to infertility.

Lifestyle characteristics include smoking both for medicinal or social making, taking alcohol and engaging in sexual acts or behaviours that may at times be risky. These characteristics can be stimulated by environmental or social characteristics to cause infertility.

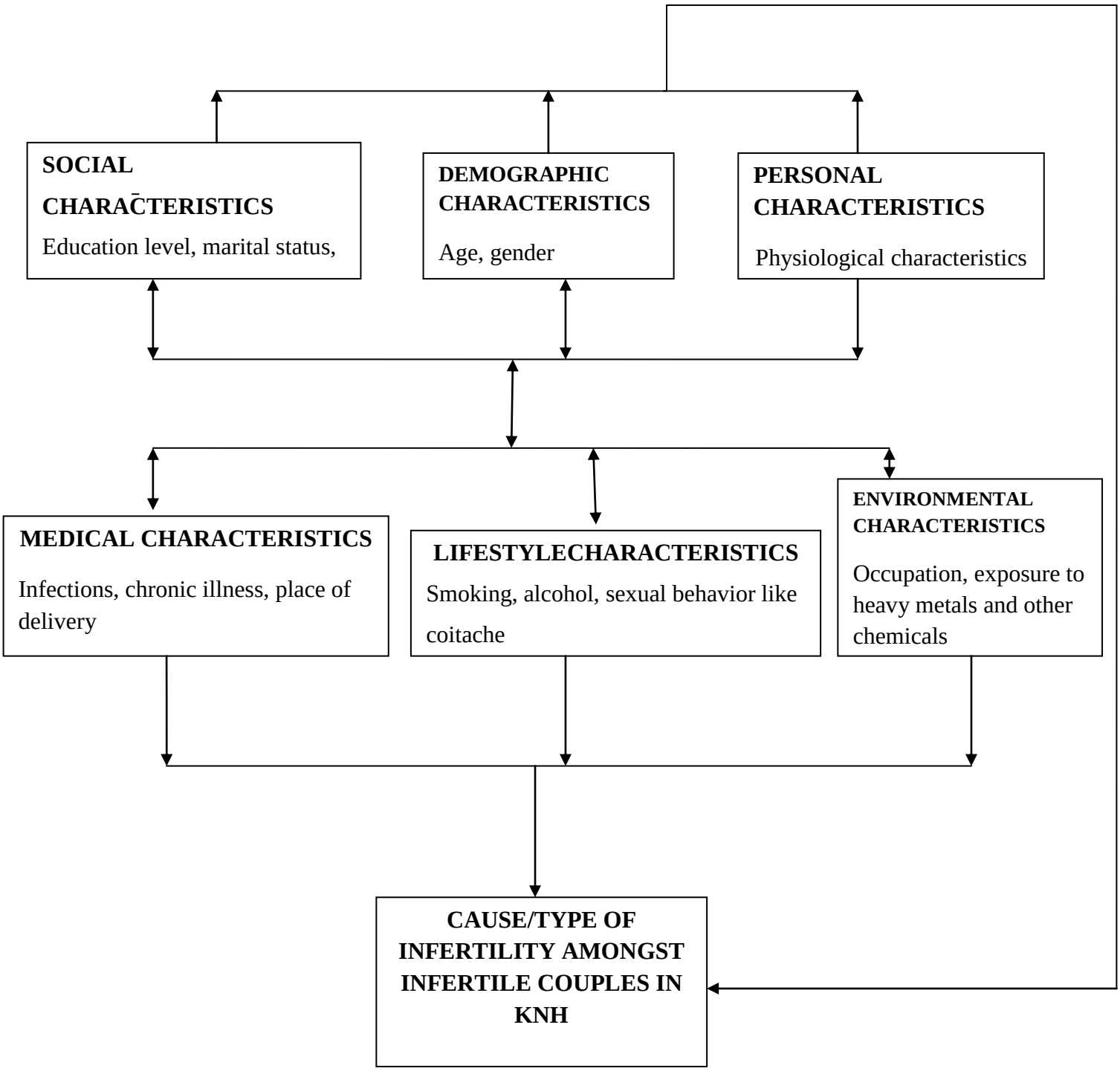
Occupation exposure to heavy metals and other chemicals, climatic conditions are some of the environmental changes which are ecological or ecofactors that are abiotic or biotic hence influence living organisms and in this case human thus causes infertility in one way or another. Heavy metals have been scientificaly proven as a factor in infertility. Apart from being influenced by personal characteristics to cause infertility, environmental characteristics may also influence lifestyle to take the same course.

Personal characteristics such as age, gender,social class and level of education among others, which are grouped as demographic characteristics can also influence infertility . These characteristics are self reported functional status and show the significance of social support hence they do get affected in case one or all of the above mentioned characteristics get affected.These characteristics may directly cause infertility or influence medical characteristics to cause infertilty.

Medical factors that may lead to infertility in human beings are those which are often construed to a medical condition associated with specific symptoms and signs and may be internal or external such as infections, chronic illness and place of delivery. Medical factors may be influenced by personal or demographic characteristics to cause infertility.

Personal characteristics that include physiological factors such as menarche, menstral patterns are some indicators of infertility and can be used as a proxy to genetic causes of infertility. They may also influence environmental or medical characteristics to cause infertility.

CONCEPTUAL FRAMEWORK OF CAUSES AND TYPES OF INFERTILITY AMONGST COUPLES BEING MANAGED AT KNH



RESEARCH QUESTION

What are the causes and types of infertility amongst infertile couples being managed at KNH in 2012?

OBJECTIVES

Broad Objective

To determine the causes and types of infertility amongst infertile couples being managed at KNH in 2012

Specific objectives

1. To determine the demographic, reproductive health, social and economic characteristics of couples being managed at KNH.
2. To determine the proportion of different causes of infertility amongst couples being managed at KNH.
3. To determine the association of the demographic, reproductive health, social and economic characteristics and different causes of infertility amongst couples being managed at KNH.

METHODOLOGY

Study Design

Across-sectional descriptive study was conducted amongst couples attending the KNH infertility clinic to determine their infertility characteristics and causes of infertility between February and September 2012.

Study site and setting

The study area was Kenyatta National hospital which is the teaching hospital of the University Of Nairobi School Of Medicine. It is situated three kilometers from the city centre. It caters mainly for the middle and low income patients. It has a bed capacity of 1800 beds. Infertility services are offered in the infertility clinic every Monday and Gynecology clinics every Tuesday, Wednesday and Thursday. The clinics are run by consultants and registrars in Obstetrics and Gynecology. Consultants see the patients on the first visit; subsequent consultations are mainly done by registrars. Patients are encouraged to be seen as a couple but there are no standard guidelines for patient management.

Study Population

The study population comprised infertile couples attending KNH infertility clinic and gynecology outpatient clinics.

Inclusion Criteria

The infertile couples were included in the study if the couples:

i. had a definitive diagnosis made
ii. had been started on treatment
iii. had given informed consent

Exclusion Criteria

The infertile couples were excluded in the study if:

i. either partner declined to participate in study

Sample Size Determination and formula used

The prevalence of infertility varies in Africa between 15 to 40%[52]. M'Imunya J.M et al found infertility related consultations of 30% among patients being seen in national referral hospitals in Kenya[4].The prevalence of male factor infertility in Africa is estimated to be 40%[25].This study used a prevalence of 30% to increase its power and the sample size was calculated using the Fishers formula[61].

$$n= \{z^2 . pq\}/d^2$$

Where:

n= the sample size needed.

z= 1.96 at 95% confidence level

p = the proportion estimate to be found in the target population (0.3)

q= 1 – p (0.7)

d = the width of the confidence interval chosen (±10%) because a significant proportion of infertile couples in KNH did not meet the inclusion criteria (definitive diagnosis and availability of spouse)

$$n= 1.96*1.96*0.3*0.7/ (0.1*0.1)$$

This gave a minimum sample size of **81** couples.

Sampling Frame

Each consecutive couple who met the inclusion criteria fell under the sample frame.

Sampling Technique

All infertile couples who met the inclusion criteria were identified from the Monday, Tuesday, Wednesday and Thursday clinics. They were approached by the research assistants, who introduced the study to them and obtained their consent after seeing the doctor.

The research assistants introduced themselves, stated the purpose of the study, described the procedure involved if they participated in study, enumerated the benefit of the study, assured the client of confidentiality and how it will be secured, indicated that there will be no compensation for participating in the study and participation was voluntary; and in case they chose not to participate they were not to be denied any service and were free to withdraw from the study at any time.

Clients who agreed to participate in the study were given the English or Kiswahili consent forms according to their preference to read and fill. Any questions about the study or their participation were answered promptly. Those who were recruited were allowed to see the doctor and be interviewed after their consultation. They were then subjected to an exit interview after their consultations with the doctor using a structured questionnaire. The interviews of husband and wife were done separately utilizing different questionnaires to promote confidentiality, though some couples chose to answer the questions together. The patient file was traced to enable completion of the questionnaires on investigation, findings and diagnosis.

Study Instrument

The study instrument that was used was a pretested and pre-coded questionnaire (See Appendix 1)

Data Collection and management

Data collection was done by two research assistants who administered pretested structured questionnaires and obtained more information from case notes after patient had been attended to. Strict confidentiality was maintained at all times. All personal identifiers were removed from questionnaires and allotment of questionnaire codes was done randomly. Completed questionnaires were coded for ease of data entry. Data was then cleaned and entered in IBM SPSS statistics version 19 daily. The data was entered into a password protected computer database by the principle investigator. In addition, the questionnaires and study records were kept in a lockable cabinet only accessible to the principle investigator and stastician.

Quality Assurance Procedures

The Questionnaire was pretested at KNH casualty gynecology room or family planning clinic 66. Research assistants were hired from nurses working in the infertility clinic to ensure continuity of care. They were further trained in data collection and research ethics. Data quality was further enhanced at all stages of data collection, entry and analysis. The quality of data was assessed by conducting consistency checks.

Data Analysis and Presentation

Data was analyzed using SPSS version 19 and STATA Version 11 software and results were presented in tables and text.

Continuous variable such as age was summarized using mean and standard deviation.

Categorical variables e.g. sex, occupation, level of school attended were summarized using proportions.

Association of categorical variables was demonstrated using the chi square tests and all statistical tests were performed at 5%significance level (95% confidence level).

Patients' characteristics were represented in form of tables which illustrated the distribution of social, economic demographic and reproductive health characteristics.

Ethical considerations

The study proposal was approved by the Kenyatta National Hospital Ethics and research committee. Informed consent was obtained from all study subjects who participated in the study. In addition privacy and confidentiality of the respondents was assured by removal of identifiers. Those couples who declined to participate in the study were not denied service and were given the same standard of care like those who consented. All couples were treated with dignity and no extra expense was incurred by couples who participated in the study. Lastly, no incentive was given to coerce patients to participate in the study.

Study limitations

1. Lack of uniform standards especially semen analysis because of different laboratory qualities. This was minimized by including only results from Laboratories which have adopted the WHO guidelines for semen analysis.
2. Recall bias for clients, which were minimized by guiding the respondents and probing intensively where applicable.
3. Case records which were incomplete, but this was minimized during the interview by capturing the missing information.

RESULTS

This study recruited 79 couples who were all included in the analysis. Table 1 below shows their social, economic and demographic characteristics .The mean age of females was 30.5(SD 5.9, Confidence interval 29.1- 31.8) years and for males 36.5(SD7.8, Confidence interval 34.75-38.2) years. Most of the couples were in a monogamous marriage (93.7%). Even though majority of the couples had attended school with most obtaining secondary and college education, most of the couples were self employed. Most of the respondents were in their first marriage (88.6% female 72.5% male), though a higher proportion of males were in their second marriage 22.8%.A small proportion of couples smoke cigarettes 7.6% of females and 27.8% of males. Only 15.2% of the female respondents drank alcohol compared to 36% of males. Only a small proportion reported exposure to heavy metals 2.5%, 13.9% for female and male respectively.

Table1: Social, economic and demographic Characteristics of infertile couples seen in the KNH

Demographic Factors	Female Freq.	%	Male Freq.	%
Age in years (n=79)				
< 20	4	5.1	-	-
20 – 24	8	10.1	-	-
25 – 29	24	30.4	12	15.2
30 – 34	27	34.2	22	27.8
35 – 39	7	8.9	27	34.2
40 – 44	9	11.4	7	8.9
45 – 49	-	-	5	6.3
> 49	-	-	6	7.6
Marital Status(n=79)				
Married (Monogamous)	74	93.7	70	88.6
Married (Polygamous)	2	2.5	5	6.3
Single	1	1.3	1	1.3
Cohabiting	1	1.3	1	1.3
Divorced/Separated	1	1.3	2	2.5
Ever Attended School(n=79)				
Yes	78	98.7	75	94.9
No	1	1.3	4	5.1
Education Level (n=79)				
Primary	27	34.2	18	22.8
Post Primary	1	1.3	3	3.8
Secondary	25	31.6	36	45.6
College	23	29.1	17	21.5
University	3	3.8	5	6.3
Occupation(n=79)				
Unemployed, looking for work	16	20.3	2	2.5
Unemployed, not looking for work	3	3.8	-	-
Self Employed	36	45.6	38	48.1
Salaried Employment	22	27.8	36	45.6
Casual laborer	1	1.3	3	3.8
Other	1	1.3	-	-
Number of times Married(n=79)				
Once	70	88.6	57	72.2
Twice	7	8.9	18	22.8
More than two times	1	1.3	2	2.5
Never	1	1.3	2	2.5
Smoking of Cigarettes n =79 (Yes)	6	7.6	22	27.8
Taking Alcohol n=79 (Yes)	12	15.2	29	36.7
Exposure to heavy metal n=79 (Yes)	2	2.5	11	13.9

Amongst the couples who were recruited 61(77.2%) of the female partners were found to have a cause of infertility attributable to her as depicted in table 5 thus were deemed to be infertile. These infertile women had a mean age of 30.8 (SD 5.6 years) as depicted in table 2 below.

Table 2: The social, economic and demographic characteristics of infertile female partners attending KNH (n=61)

Characteristics	**Freq.**	**%**
Age		
<20	2	3.3
20 – 24	6	9.8
25 – 29	17	27.9
30 – 34	24	39.3
35 – 39	6	9.8
40 – 44	6	9.8
Marital Status		
Married (Monogamous)	57	93.4
Married (polygamous)	2	3.3
Single	1	1.6
Divorced/Separated	1	1.6
Education Level		
Primary	21	34.4
Post primary	1	1.6
Secondary	19	31.1
College	17	27.9
University	3	4.9
Occupation		
Unemployed	16	26.2
Self Employed	27	44.3
Salaried employment	16	26.2
Casual laborer	1	1.6
Other	1	1.6
Number of times married		
Once	53	86.9
Twice	6	9.8
More than twice	1	1.6
Never	1	1.6
Smoking of cigarette (yes)	4	6.6
Drinking alcohol (yes)	10	16.4

Most of the infertile female couples were in a monogamous marriage 57(93.4%) and had been married once 53(86.5%), with only 2(3.3%) in a polygamous marriage. Though, majority were educated up to secondary school 19(31.1%) and college 17 (27.9%), most were unemployed16 (26.5%) or self employed27 (44.2%) with only16 (26%) in salaried employment. Only 4(6.6%) smoked cigarettes while only 10(16.4%) had a history of alcohol consumption

The most common form of infertility amongst the couples recruited was female factor only infertility 33(41.8%) as shown in table 3, followed by combined male and female factor infertility 28 (35.4%), Male factor infertility 13(16.5%) and lastly, unexplained infertility 5 (6.3%).

Table 3: Gender classification of type of infertility amongst infertile couples attending KNH (n=79)

Type of infertility	**Freq.**	**%**	**95% Confidence interval**
Female factor only	33	41.8	30.7-52.9
Male factor only	13	16.5	8.1-24.8
Combined male and female factor	28	35.4	24.7-46.2
Unexplained infertility	5	6.3	0.8-11.8

Primary infertility 34(55.7%) was the most common form of infertility, though a significant number had secondary infertility27 (44.3%) (Table 4).Among those who had secondary infertility 14(51.9%) had a previous delivery, 3(11.1%) ectopic pregnancy and 10 (37.0%) had experienced an abortion. Those who delivered did so in a hospital12 (85.7%), with only 2(14.3%) in a health center and none at home. The contraceptive prevalence was 37.7% among the infertile females. A significant proportion of infertile female partners 21(31.4%) had a history of treatment for an abnormal vaginal discharge. Similarly, 33(54.1%) had a history of pelvic surgery, with tuboplasty being the most common operation.

Table 4: The reproductive health characteristics of infertile female partners attending KNH (n=61)

Characteristics	Freq.	%
Type of Fertility(n=61)		
Primary infertility	34	55.7
Secondary infertility	27	44.3
Outcome (n=27)		
Live birth	14	51.9
Ectopic Pregnancy	3	11.1
Abortion	10	37.0
Place of birth(n=14)		
Hospital	12	85.7
Health Centre	2	14.3
Ever used contraceptives(n=61) (yes)	23	37.7
Age at first sexual intercourse(n=61)		
11-14	1	1.6
15-18	20	32.8
19-20	11	18.0
20+	29	47.6
Treated for abnormal vaginal(n=61) (yes)	21	34.4
Pelvic Surgery(n=61) (yes)	33	54.1
Type of pelvic surgery, some patients had more than one operation(n-=36)		
Ectopic	4	11.1
Tuboplasty	17	47.9
Myomectomy	5	13.9
Caesarian section	6	16.7
Others	4	11.1

In table 5 below, the most common cause of infertility was tubal peritoneal factor 51(83.6%), with 37(60.6%) having bilateral tubal blockage. Endocrine causes were identified in 10(16.4%) of the female infertile partners with 7(11.5%) having polycystic ovarian syndrome (PCOS) and 3(4.9%) hyperprolactinemia.

Table 5: Causes of infertility amongst infertile female partners attending KNH (n=61)

Cause	Freq.	%(confidence interval)
Bilateral tubal	37	60.6 (53.8-75.3)
Pelvic Adhesions	4	6.6 (2.3 – 9.7)
Acquired Tubal (hydrosalpinx)	10	16.4 (9.1-26.3)
PCOS	7	11.5 (5.1 – 12.4)
Hyperprolactinemia	3	4.9 (0.1 – 8.4)

There was no significant statistical difference in social, economic and demographic characteristics of female partners with female factor infertility and those with combined male-female infertility attending KNH as shown in table 6 below.

Table 6: comparisonbetween social, economic and demographic characteristics of female partners with female factor infertility and those with combined male-female infertility attending KNH (n=61)

Characteristics	Female factor only (n=33)		Combined Male female factor (n=28)		
	freq	%	freq	%	p value
Marital Status					
Married	32	96.7	28	100.0	0.541
Not Married	1	3.3	-	-	
Ever attended School	33	100.0	25	89.3	0.091
Yes	-	-	3	10.7	
No					
Occupation					
Unemployed	5	15.2	1	3.6	
Self-Employed	15	45.5	13	46.4	0.245
Salaried	12	36.4	12	42.9	
Casual	1	3.0	2	7.1	
Smoking					
Yes	3	9.1	7	25.0	0.164
No	30	90.9	21	75.0	
Drinking					
Yes	8	24.2	10	35.7	0.331
No	25	75.8	18	64.3	

In table 7, there was no statistical difference in the reproductive health characteristics of female partners with female factor infertility and those with combined male-female infertility attending KNH, even where there were big differences because this study was not powered to detect these differences.

Table 7: Comparison between reproductive health characteristics of female partners with female factor infertility and those with combined male-female infertility attending KNH (n=61)

Characteristics	Female factor only (n=33)		Combined Male female factor (n=28)		P value
	Freq.	%	Freq.	%	
Ever Pregnant (n=61)					
Secondary Infertility	17	51.5	10	35.7	
Primary Infertility	16	48.5	18	64.3	0.216
Ever used contraceptive(n=60)					
Yes	14	42.4	7	25.9	
No	19	57.6	20	74.1	0.183
Age at first intercourse(n=59)					
<19	14	47.8	7	25.9	
+/>19	18	56.2	20	74.1	0.269
Abnormal vaginal discharge (n=61)					
Yes	10	30.3	13	46.4	
No	23	69.7	15	53.6	0.195

There were no associations between the social, economic and demographic characteristics of infertile female partners attending KNH with tubal peritoneal factor infertility (table8).

Table 8: Association between social, economic and demographic characteristics of infertile female partners attending KNH with tubal factor (n=61)

Characteristics	Tubal factor				
	Yes (n=51)		No (n=10)		
	freq	%	freq	%	p value
Age					
< 30	21	41.2	4	40	
30+	30	58.8	6	60	0.945
Marital Status					
Married monogamous	47	92.2	10	100	
Married polygamous	2	3.9	-	-	
Single	1	2.0	-	-	
Separated	1	2.0	-	-	0.840
Ever attended School					
Yes	50	98.0	10	100	
No	1	2.0	-	-	0.655
Occupation					
Unemployed	13	25.5	3	30	
Self-Employed	22	43.1	5	50	
Salaried	14	27.4	2	20	
Casual	1	2.0	-	-	
Other	1	2.0	-	-	0.935
Smoking					
Yes	4	7.8	-		
No	47	92.2	10	100	0.36
Drinking					
Yes	10	19.6	-		
No	41	80.4	10	100	0.126
Any Chronic illness					
Yes	5	9.8	3	30	
No	46	90.2	7	70	0.084

In Table 9, there was no statistical difference in reproductive health characteristics of infertile female partners attending KNH with tubal peritoneal factor infertility with those without.

Table 9: Association between reproductive health characteristics of infertile female partners attending KNH with tubal factor (n=61)

Characteristics	Tubal factor				
	Yes (n=51		No (n=10)		
	freq	%	freq	%	p value
Ever given birth					
Secondary infertility	24	47.1	3	30	
Primary infertility	27	52.9	7	70	0.321
Treatment for abnormal vaginal discharge					
Yes	21	41.2	2	20	
No	30	58.8	8	80	0.206
Ever used contraceptives					
Yes	18	36	2	20	
No	32	64	8	80	0.534
Previous pelvic surgery					
Yes	28	54.9	5	50	
No	23	45.1	5	50	0.776
Coitache					
<19	18	35.3	3	30	
=/>19	31	60.8	7	70	
Can’t remember	2	3.9	-	-	0.776

Table 10 below shows no statistical difference in social, economic and demographic characteristics of infertile female partners attending KNH infertility clinic with secondary infertility with those with primary infertility except smoking (p= 0.020).

Table 10: Association between social, economic and demographic characteristics of infertile female partners attending KNH and type of infertility (n=61)

Characteristics	Secondary infertility (n=27)		Primary infertility (n=34)		
	Freq	%	freq	%	p value
Age					
< 30	9	33.3	16	47.1	0.279
30+	18	66.7	18	52.9	
Marital Status					
Married	26	96.3	34	100.0	0.258
Not Married	1	3.7	-		
Ever attended School					
Yes	26	96.3	34	100.0	0.258
No	1	3.7	-		
Occupation					
Unemployed	6	22.2	10	29.4	0.770
Self-Employed	14	51.9	13	38.2	
Salaried	7	25.9	9	26.5	
Casual	0	0	1	2.9	
Other	0	0	1	2.9	
Smoking					
Yes	4	14.8	-	-	0.020
No	23	85.2	34	100.0	
Drinking					
Yes	5	18.5	5	14.7	0.690
No	22	81.5	29	85.3	
Any Chronic illness					
Yes	4	14.8	4	11.8	0.726
No	23	85.2	30	88.2	

There was no statistical difference between reproductive health characteristics of infertile female partners attending KNH with secondary infertility and those with primary infertility as shown in table 11.

Table 11: Association between reproductive health characteristics of infertile female partners attending KNH and type of infertility (n=61)

Characteristics	Secondary infertility (n=27)		Primary infertility (n=34)		
	freq	%	freq	%	p value
Ever used contraceptive					
Yes	12	44.4	11	32.4	0.333
No	15	55.6	23	67.6	
Abnormal vaginal discharge					
Yes	10	38.5	11	32.4	0.623
No	16	61.5	23	67.6	
Previous pelvic Surgery					
Yes	18	66.7	15	45.5	0.100
No	9	33.3	18	54.5	

A total of 79 male partners were recruited into the study of which 41(51.9%) had abnormal spermatozoa and 38(48.1%) normal spermatozoa (Table 12).The most common semen abnormality was terato-oligozoospermia 33(41.8%), with a significant number having azoospermia 6(7.6%).

Table 12: Semen characteristics of male partners attending KNH (n=79)

Characteristics	Freq.	%(confidence interval)
Normal spermatozoa	38	48.1 (32.1-54.1)
Normal with agglutination	2	2.5 (0.1 – 4.2)
Teratozoospermia/Oligozoospermia	33	41.8 (34 – 62.1)
Azoospermia	6	7.6 (2.2 – 11.4)

The mean age of infertile male partners was 37.1 (SD 8.7) years, with age distribution as shown in table 13. Most were in a monogamous marriage 40(97.6%), with most in their first marriage31 (75.6%) and only 11(22%) in their second marriage. Majority had attained

secondary school 17 (41.5%) and college level education 8 (19.5%). The most common forms of employment among the infertile male partners was self employment 20(48.8%) and salaried employment17 (41.5%).Only 11(26.8%) smoked cigarettes and 14(34.5%) had a history of alcohol intake. There was no statistical difference in the social, economic and demographic characteristics of infertile male partners with normal semen characteristics and those with abnormal semen, apart from ever attend school (p=0.048) and marital status (p=0.035).

Table 13 Social, economic and demographic characteristics of male partners attending KNH and semen characteristics

		Semen characteristics (N=79)				
		Normal(n=38)		Abnormal(n=41)		
Characteristics		**Freq.**	**%**	**Freq.**	**%**	**p value**
Age Group	25 - 29	6	15.8	6	14.6	
	30 - 34	12	31.6	10	24.4	
	35 - 39	13	34.2	14	34.2	
	40 - 44	1	2.6	6	14.6	0.292
	45 - 49	4	10.5	1	2.4	
	50+	2	5.3	4	9.8	
Marital Status	Married (Monogamous)	30	80.0	37.4	97.6	
	Married (Polygamous)	5	13.2	-	-	
	Single	1	2.6	-	-	0.035
	Cohabiting	-	-	1	2.4	
	Divorced/Separated	2	5.3	-	-	
Attended School	yes	38	100.0	37	90.2	
	no	-	-	4	9.8	*0.048*
Occupation	Unemployed	1	2.6	1	2.4	
	Self Employed	18	47.4	20	48.8	
	Salaried employment	19	50.0	17	41.5	0.375
	Casual laborer	-	-	3	7.3	
Number of times Married	Once	26	68.4	31	75.6	
	Twice	9	23.7	9	22.0	
	More than two times	1	2.6	1	2.4	0.507
	Never	2	5.7	-	-	
Smoke Cigarette	yes	11	29.0	11	26.8	
	no	27	71.0	30	73.2	0.834
Drink alcohol	yes	15	39.5	14	34.2	
	no	23	60.5	27	65.8	0.624

Among the infertile male partners only 3(7.3%) had a history of purulent urethral/penile discharge as shown in table 14 below. Only a few had suffered from mumps 5(12.2%) and only 5 (12.2%) had experienced acute scrotal pain. Erectile dysfunction was reported in 6(14.6%) of the infertile male partners while 3(7.3%) reported experiencing an ejaculatory problem. There was no statistical difference between reproductive health characteristics of male partners and semen characteristics.

Table 14: Reproductive health characteristics of male partners attending KNH and semen characteristics

Characteristics	**Semen characteristics**				
	Normal (n=38)		**Abnormal (n=41)**		
	freq	**%**	**freq**	**%**	**p value**
Purulent Urethral/Penile discharge (yes)	3	7.9	3	7.3	0.923
History of Mumps (yes)	5	13.2	5	12.2	0.623
Acute scrotal pain (yes)	4	10.5	5	12.2	0.816
Surgery of Scrotum (yes)	0	0	1	2.4	0.333
Erectile status					
Normal	37	97.4	35	85.4	0.061
Inadequate	1	2.6	6	14.6	
Ejaculation Status					
Normal	36	94.7	38	92.7	0.379
Inadequate	1	2.3	3	7.3	

DISCUSSION

A hospital based descriptive study was carried out from February to September 2012 to determine the causes and types of infertility amongst infertile couples attending KNH in Nairobi, Kenya. This study found 41.8 %(30.7-52.9) of infertility to be due to female factor, 16.5% (8.1-24.8) male factor, 35.4 %(24.7-46.2) both couples and 6.3% (0.8-11.8) due to unexplained causes. These results compare well to the 1982-1985 WHO results which found female factor infertility to be 38% and male factor 20% but much lower infertility in both couples 27% with a higher proportion of indemonstrable cause of 15% [62].The results for male factor only contribution to infertility also compare to Mati et al who found it at 18% but differ significantly in female factor (61.9%) which was higher than this study and due to both couples which was lower (18%) than this study[7].This high rate of infertility due to both couple could be due to high rate of infertility due to abnormal spermatozoa found in the male partners. It could also be due to the fact that KNH is a referral hospital and could be receiving couples with male factor infertility who are not managed in lower facilities due to lack of capacity or facilities[4]. Due to the high proportion of infertile male found, it is important to investigate couples together and concurrently from the initial appointment because a couple can have multiple factors contributing to infertility.

In this study more females (55.7%) had primary infertility than (44.3%) secondary infertility. This was similar to Onyambu and Githiaria studies[45, 63]. It however differed from an earlier study by Gachara et al which had found more secondary infertility (65%) to primary infertility of 35%.[6] In addition, the mean age for infertile female partners was found to be higher 30.6(29.5-31.8) years than earlier studies [6, 48, 64, 65] . However ,this compared to results from a recent study[66].This shift could be attributed to postponement of conception to latter in life due to education and employment[67]. A high mean age of infertile female means a decrease in fecundity hence a call to be more vigilant during evaluation to check for ovarian reserve .Though there was a high proportion of secondary infertility, no significant statistical difference in infertility factors between primary and secondary infertility was found, this was similar to an earlier study [68].

A further analysis of the females with infertility found tubal-peritoneal abnormalities to be the most common type of infertility(83.6%).This confirms data in publications that tubal factor is still the highest cause of female infertility in sub Saharan Africa [25, 29, 37, 52, 69-

71]. Thus there is need to improve prevention and improvement of treatment for sexually transmitted infections. It was also noted from the study that most common surgery among female was tuboplasty which has been shown in an earlier study in KNH to have a significantly low success rates of pregnancy for both open and laparoscopic tuboplasty[42]. This calls for strengthening of prevention and treatment strategies of sexually transmitted infections. In addition, investment in ART for treatment of tubal factor infertility.

Male factor had a role in infertility of 51.9% of all infertile couples in KNH. These infertile males had abnormal spermatozoa, with a significant proportion of 7.6% having azoospermia. This high rate of male factor infertility is similar to findings of the WHO study which found male factor contribution of 47%[72]. This could be due to the decline in semen quality which has been observed in several studies [73-75]. This, however differs from an earlier study by Mati et al which had found male factor contribution to be much lower 30%.[7] A recent study by Ondieki showed a consistent high prevalence of male factor infertility (67%)[66]. Other significant findings from this study were a 14.6% of males had erectile dysfunction and 7.3% inadequate ejaculation .These results clearly highlight the urgent need for andrology laboratories where sperm wash for intra uterine insemination can be done.

CONCLUSION

This study was set out to describe the demographic, reproductive health, social and economic characteristics of couples being managed at KNH infertility clinic in 2012.It also sought to determine the proportion of the different causes of infertility and to find out whether the causes of infertility had any association with the demographic, reproductive health, social and economic characteristics of couples being managed at KNH infertility clinic in 2012. The general theoretical literature on this subject specifically in the context of sub Saharan Africa has shown that infertility is affected by social economic and cultural characteristics[46, 47]. This characteristics have changed in Kenya over the last two decades[59, 60]. Previous studies on the pattern of infertility in KNH was done more than 25 years ago[7, 45] .Hence, this study has determined the current characteristics of infertile couples attending KNH infertility clinic.

The significant findings of the study include; firstly, the mean age of infertile female was found to be higher than earlier studies [6, 48, 64, 65]. Secondly, the gender distribution of infertility causes is similar to earlier studies with exception of combined male and female factor infertility which was higher in this study[7, 52]. Thirdly, there was a high rate of tubal peritoneal factor infertility. Fourthly, slightly more than half of the male partners had abnormal sperm characteristics with a significant proportion with azoospermia (7.6%).There was also a significant proportion of infertile male partners (15%) with erectile dysfunction. Lastly, there were no statistical differences in the social, economic and demographic characteristics of infertile males and females with the various causes of infertility, apart from that of infertile male partner with semen characteristics and ever attend school ($p=0.048$) and marital status ($p=0.035$).

The findings from this study make several contributions to the current literature. Firstly, it shows a high mean age of infertile female attending KNH infertility clinic, which indicates possible postponement of conception to latter in life. Secondly, it confirms previous findings of a high rate of tubal peritoneal factor infertility in sub Saharan Africa. Thirdly, it shows a high proportion of infertility to be present in both partners, these calls for further research to confirm the findings and investigate possible contributing factors. Lastly, it contributes to additional evidence that suggest a high proportion of infertile males have abnormal sperm characteristics and a significant level of erectile dysfunction.

The main limitations of this study, however, were that it was a hospital based study hence its finding might not be generalizable and there was possible quality variability in the laboratory evaluation of semen even though results from laboratories which used the WHO guidelines were included. Nevertheless, it provides a basis for further scientific research.

In spite of the limitation of this study its strength lies in the recruitment of couples rather than individual partners and use of a strict inclusion criterion. In addition, unlike early studies which were retrospective, this study it was a cross section study. Thus, this study forms a baseline for the local infertility situation and further scientific research in infertility. It is also an information resource for planning and restructuring of the KNH infertility clinic to provide services more efficiently by providing targeted management strategies.

RECOMMENDATIONS

1. Improvement of prevention and treatment of sexually transmitted illness due to the high rates of tubal factor infertility.
2. To establish facilities capable of management of male infertility due to the high male factor infertility.
3. Further research to investigate the high rates of abnormal semen characteristics and combined male and female infertility.
4. To introduce Assisted Reproductive technology in Kenyatta national hospital due to the high rate of tubal factor infertility.
5. Though the study did not assess fecundity and ovarian reserve, the finding of a high mean age of infertile females' in KNH calls for; public health education on the importance of early conception as a delay may leads to decreased fecundity, early initiation of infertility investigation for couples who are 35 years and above and Inco-operation of evaluation of ovarian reserve in investigation protocols for infertile couples who are 35 years and above.

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Appendix 1: DATA COLLECTION TOOLS

FEMALE RESPONDENT QUESTIONNAIRE

STUDY NUMBER								
DATE OF THE INTERVIEW dd-mm-yyyy					2	0		

A. SOCIAL DEMOGRAPHIC FACTORS

101	Age in completed years	
102	What is your marital status? 1. Married (Monogamous) 2. Married (Polygamous) 3. Single 4. Widowed 5. Cohabiting 6. Divorced/ separated	
103	Have you ever attended school? 1. Yes 2. No	
104	If yes, what is the highest level of school attended? 1. Primary 2. Post primary/vocational 3. Secondary 4. College/middle level 5. University	
105	What is your occupation? 1. Unemployed, looking for work 2. Unemployed, not looking for work 3. Self employed 4. Salaried employment 5. Casual laborer 6. Sick/disabled and unable to work 7. Student 8. Other (specify.....……)	
106	How many times have you been married? 1. Once 2. Twice 3. More than two times 4. Never 5. Can't remember 6. Other (specify.....……)	
107	Do you smoke cigarettes? 1. Yes 2. No	
	If yes, how many **pack years**? (Specify……) (*Pack years is found by multiplying the average number of cigarettes smoked per day and number of years smoked and dividing the product by 20).*	
108	Do you drink alcohol? 1. Yes 2. No	
109	Do you suffer from any chronic illness? 1. Yes 2. No	

110	If yes Q109, which one? 1. Diabetes mellitus 2. Thyroid disease 3. Tuberculosis 4. Others (specify) ……)	
111	Does your work involve exposure to heavy metals e.g. lead, mercury, pesticides, paint? 1. Yes 2. No	

B. OBSTETRIC DATA

201	Have you ever been pregnant? 1. Yes 2. No (If no, skip to question 301)	
202	How many pregnancies were lost before 7 months? (Specify …….)	
203	How many children were born after 7th month of pregnancy (alive/dead)? (Specify ……)	
204	What was outcome of last pregnancy? 1. Live birth 2. Still birth 3. Ectopic pregnancy 4. Molar pregnancy 5. Abortion (If abortion, skip to Question 208) 6. Other (specify ……)	
205	Place of last delivery? 1. Hospital 2. Health center 3. Home (TBA) 4. Other (specify……)	
206	What was the mode of delivery? 1. SVD (Normal delivery) 2. Caesarian section 3. Vacuum extraction 4. Breech delivery	
207	Did you develop an offensive discharge after delivery? 1. Yes 2. No	
208	How was the abortion? 1. Spontaneous 2. Induced	
209	Did you develop an offensive smelling vaginal discharge after the miscarriage? 1. Yes 2. No	

C. GYNECOLOGY DATA

301	What age were you when you had your first menses?		
302	Do you experience low abdominal pain during your menses (dysmenorrheal) 1. Yes 2. No		
303	How long is your menstruation cycle? a) Average		
	b) Longest		
	c) Shortest		
304	Menstrual bleeding category 1. Normal 2. Oligomenorreah 3. Secondary amenorreah 4. Polymenorreah 5. Irregular menses		
305	Have you ever used any method of family planning? 1. Yes 2. No		
306	What age were you during your first intercourse? 1. Less than 11 years 2. 11-14 3. 15-18 4. 19-20 5. More than 20		
307	Have you ever been treated for an abnormal vaginal discharge and low abdominal pain? 1. Yes 2. No		
308	Do you have any history of nipple discharge? 1. Yes 2. No		
309	Have you ever had any pelvic surgery? 1. Yes 2. No		
310	If yes, what kind of surgery? 1. Ectopic 2. Tuboplasty 3. Myomectomy 4. Caesarian section 5. Appendicectomy 6. Other (specify……)		

D. FINDINGS ON INVESTIGATION

401	Progesterone 1. Ovulating 2. Non ovulating 3. Not done	
402	HSG 1. Normal 2. Acquired abnormality 3. Congenital abnormality 4. Not done	
403	Test for tubal patency 1. Left side normal	Y/N
	2. Left side occluded	Y/N
	3. Left side other abnormality	Y/N
	4. Right side normal	Y/N
	5. Right side occluded	Y/N
	6. Right side other abnormality	Y/N
404	Laparoscopy 1. Normal 2. Adhesions 3. Congenital abnormality 4. Acquired ovarian abnormalities 5. Acquired other tubal abnormality 6. Acquired uterine abnormalities 7. Endometriosis 8. Not done	
405	Major specific causes in the female partner 1. No demonstrable cause 2. Bilateral tubal occlusion 3. Pelvic adhesions 4. Acquired tubal abnormality 5. Anovulatory regular cycles 6. Anovulatory oligomenorreah 7. Ovulatory oligomenorreah 8. Hyperprolactinemia 9. Endometriosis	

INFERTILITY CLINIC
MALE RESPONDENT QUESTIONNAIRE

STUDY NUMBER									
DATE OF THE INTERVIEW	dd-mm-yyyy					2	0		

A. SOCIAL DEMOGRAPHIC FACTORS

505	Age in completed years	
502	What is your marital status? 1. Married (Monogamous) 2. Married (Polygamous) 3. Single 4. Widowed 5. Cohabiting 6. Divorced/ separated	
503	Have you ever attended school? 1. Yes 2. No	
504	If yes (Q503), what is the highest level of school attended? 1. Primary 2. Post primary/vocational 3. Secondary 4. College/middle level 5. University	
505	What is your occupation? 1. Unemployed, looking for work 2. Unemployed, not looking for work 3. Self employed 4. Salaried employment 5. Casual laborer 6. Sick/disabled and unable to work 7. Student 8. Other (specify.....…… ……)	
506	How many times have you been married? 1. Once 2. Twice 3. More than two times 4. Never 5. Can't remember 6. Other (specify.....……)	
507	Do you smoke cigarettes? 1. Yes 2. No If yes, how many **pack years**? (Specify……) (*Pack years is found by multiplying the average number of cigarettes smoked per day and number of years smoked and dividing the product by 20).*	
508	Do you drink alcohol? 1. Yes 2. No	
509	Do you suffer from any chronic illness? 1. Yes 2. No	
510	If yes Q509, which one? 1. Diabetes mellitus 2. Thyroid disease	

	3. Tuberculosis 4. Others (specify..... ……)	
511	How many children do you have? 1. None 2. 1 3. 2 4. 3 5. 4 6. 5 7. More than 5	
512	Does your work involve exposure to heavy metals e.g. lead, mercury, pesticides, paint? 1. Yes 2. No	

B. FACTORS ASSOCIATED WITH MALE INFERTILITY

601	Have ever experienced a purulent urethra/penile discharge or painful micturition? 1. Yes 2. No	
602	Have you ever suffered from mumps? 1. Yes 2. No	
603	Have you ever had acute scrotal pain? 1. Yes 2. No	
604	Do you suffer from any chronic illness? 1. Yes 2. No	
605	If yes, which one? 1. Diabetes mellitus 2. Tuberculosis 3. Chronic respiratory diseases 4. Neurological disease 5. Others (specify..... ……)	
606	Have you ever had surgery to the inguinal or scrotal region? 1. Yes 2. No	
607	If yes which kind of surgery 1. Vasectomy 2. Orchidectomy 3. Orchidopexy 4. Hernorrhaphy 5. Hydrocelectomy 6. Prostatectomy 7. Urethral stricture 8. Hypospadias 9. Other(specify..... ……)	
608	What age were you during your first sexual intercourse 1. Less than 15 years 2. 11-14 3. 15-18 4. 19-20 5. More than 20 6. Can't remember	

609	On average how many times do you have sexual intercourse in a month? 1. At least twice a month 2. Less than twice a month	
610	How do you describe your erection? 1. Normal 2. Inadequate	
611	How do you describe your ejaculation? 1. Normal 2. Inadequate	
612	Semen classifications from semen analysis results 1. Normal 2. Normal with agglutination, abnormal seminal plasma, white blood cells 3. Teratozoospermia 4. Oligozoospermia 5. Azoospermia 6. Aspermia	

FINDINGS IN BOTH PARTNERS

701	Findings in both partners 1. No cause found in either 2. Female cause only 3. Male cause only 4. Cause found in both	

END.

Appendix 2: DIAGNOSTIC CRITERIA

Objective criteria diagnostic categories in the simplified management of male infertility

1. Sexual and/or ejaculatory dysfunction
2. Immunological causes
3. No demonstrable cause
4. Isolated seminal plasma abnormalities
5. Iatrogenic causes
6. Systemic causes
7. Congenital abnormalities
8. Acquired testicular damage
9. Varicocele
10. Male accessory gland infection
11. Endocrine causes
12. Idiopathic oligozoospermia
13. Idiopathic asthenozoospermia
14. Idiopathic teratozoospermia
15. Obstructive azoospermia
16. Idiopathic azoospermia

Objective criteria diagnostic categories in the simplified management of female infertility

1. Sexual dysfunction
2. Hyperprolactinemia
3. Organic lesions of the hypothalamus
4. Amenorreah with elevated FSH
5. Amenorreah with adequate endogenous estrogen
6. Amenorreah with low endogenous estrogen
7. Oligomenorreah
8. Irregular menses and/or ovulation
9. Anovulation with regular menses
10. Congenital abnormalities
11. Bilateral tubal occlusion
12. Pelvic adhesions
13. Endometriosis
14. Acquired uterine or cervical lesions
15. Acquired tubal lesions
16. Acquired ovarian lesions
17. Genital tuberculosis
18. Iatrogenic causes
19. Systemic causes
20. Diagnosis not established (no laparoscopy)
21. Abnormal postcoital test

Appendix 3: CONSENT FORM FOR INTERVIEWEES

CAUSES AND TYPES OF INFERTILITY AMONGST INFERTILE COUPLES IN KNH

Principle investigator: Dr Charles Ondieki Otwori

Introduction

I **Dr. Charles Ondieki** of the Department of Obstetrics and Gynecology, University of Nairobi, am conducting a study on causes and types of infertility amongst infertile couples at Kenyatta National Hospital.

Purpose

The study will determine the causes and types of infertility amongst infertile couples attending infertility treatment at KNH. It also aims at describing the current causes of fertility and make recommendations on how to improve fertility management in Kenyatta.

Procedure

If you agree to participate in the study you will be asked questions after you have been attended to by the doctor. The nature of the questions will be about your illness and how you have received treatment so far. The interviewer will also access your file to identify your management plan. The questionnaires this information will be filled will be removed identifiers to protect your confidentiality.

Risks/Discomfort

There is no risk in participating in this study. Treatment will be given to you before the interview. However, you may experience some discomfort due to the personal nature of the questions but this will be asked in private and confidentiality will be maintained at all times.

Benefits

There will be no direct benefit in participating in the study but in case you have any question the interviewer will readily assist you. The study will help in improving clinical management of infertile couples in Kenyatta National Hospital and the country.

Confidentiality

Your confidentiality will be maintained at all times. There shall be no mention of names or identifiers in the report or publications which may arise from the study.

Compensation

There will be no compensation for participation in the study.

Voluntariness

Participation in the study is voluntary. If you choose not to participate, you will not be denied any service. You will be free to withdraw from the study at any time.

Your participation in the study will be highly appreciated.

I_____ hereby voluntarily consent to participate in the study. I acknowledge that a thorough explanation of the nature of the study has been given to me by Dr/Mr./Mrs._____. I clearly understand that my participation is completely voluntary.

Signature_____Date_____

Signature of Reseacher/Assistant_____Date_____

Contacts

If you have any questions regarding the study, you can contact Dr Charles Ondieki Otwori through telephone number 0721453111.

In case of any ethical concerns please contact

KNH/UON-ERC

PO BOX 19676 Nairobi (code 00202)

Telephone number (254-020)2726300 Ext 44355

Appendix 4

Swahili: Fomu ya ridhaa kwa mshiriki

Mtafiti mkuu: Dr.Charles Ondieki

Kibali cha kushiriki

Kwa majina naitwa **Dk .Charles Ondieki** kutoka Chuo Kikuu cha Nairobi,idara ya wa mama.Hili ni ombi kwa kukubali kushiriki katika utafiti. Lengo la fomu hii ya ridhaa nikukufahamisha yale utakayohitaji kakujua ili kukusaidia kuamua kushiriki katika utafiti . Tafadhali isome fomu hii kwa makini. Unaweza kuuliza maswali kuhusu yale utakayo hitajika kufanya,adhari zozote, manufaa na haki zako kama Mshiriki.

Lengo na manufaa ya utafiti

Utafiiti huu utatujulisha sababu zinazo changia mambo ya utasa na ugumba kwa watu walio oana ambao wanao

Hudumiwa kwenye kliniki ya utasa na ugumba KNH. Pia utafiti huu utasaidia kujua sababu halisia zinazo sabisha utas na ugumba nakutoa mapendekezo ya njisi ya kuboresha huduma ya masuala ya uzazi katika hospitali kuu ya Kenyatta.

Taratibu zitakazo fuatwa

Ukikubali kushiriki katika utafiti huu utaulizwa maswali baada ya daktari kukuhudumia. Maswali yatagusiya ugonjwa unaotibiwa na matibabu ambayo umepata. Mtafiti atarejea taarifa zako kwenye faili la matibabu ili kujua jinsi ambavyo umehudumiwa. Nambari maalum itatumika a kukutambulisha badala ya majina yako.

Madhara, matatizo, naadha

Kuna uwezekano wa haya au adha wakati wamahojiano kulingana na baadhi ya maswali utakayo ulizwa. Kushiriki kwako katika utafiti huu ni kwa hiari. Unaruhusiwa kutojibu swali litakalokutatiza na pia unaruhusiwa kujiondoa kwenye utafiti huu wakati wowote bila kuhujumiwa.

Siri

Taarifa zako zote wakati wa mahojiano zitahifadhiwa vyema na kwa siri. Namba pekee ndiyo itatakayo tumika kwa malengo ya utafitihuu .Jina lako halitatokea katika ripoti yeyote itakayo andaliwa baada ya utafiti huu.

Gharama

Hautahitajika kulipa chochote cha ziada ili kushiriki katik autafiti huu isipokua wakati wako.

Mimi ----------Nimekubali kushiriki katika utafiti huu kuhusian ana mambo ya utasa na ugumba. Nimeelezwa ya kwamba ni hiyari kushiriki na pia ni na uwezo wa kujiondoa katika utafiti huu wakati wowote bila kushurutishwa. Kuhusika ni bure na nimehakikishiwa kwamba mchango wangu utahifadhiwa kwa siri na kutumiwa kwa manufaa ya jamiii.

Sahihi _____

Mimi..... nina dhibitisha ya kwamba nimemueleza kwa uwazi na umakini bwana/bibi.....kuhusiana na utafiti wa mambo ya utasa na ugumba.

Sahihi _____

Kwa maswala yeyote kuhusiana na utafiti unaweza kuwasiliana na Dr. Charles Ondieki. Kutumia nambari 0721453111 unaweza pia kuwasiliana na Kenyatta Hospital Ethical and Research Committee kuhusiana na Haki zako za kuhusika na utafiti huu kutumia nambari 726300 Ext. 44355