

# Risk profile of Qatari women treated for infertility, 2018

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## Research

**Keywords:** primary infertility, secondary infertility, Qatar, risk profile

**Posted Date:** January 13th, 2020

**DOI:** <https://doi.org/10.21203/rs.2.20724/v1>

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# “Risk profile of Qatari women treated for infertility, 2018”

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## ABSTRACT

**Background:** female infertility is a multifactorial condition constituting a worldwide public health problem. Although many potential risk factors of female infertility can be preventable, there is no much attention directed toward preconception care.

**Aim:** to explore the risk profile of infertility among Qatari women and compare risk factors distribution among primary vs. secondary infertility.

**Methodology:** A hospital-based case control study was conducted from September 17th, 2017-February 10th, 2018. Cases (n=136) were enrolled from infertility clinic and controls (pregnant women, n=272), were enrolled from antenatal clinic, Women Hospital, Hamad Medical Corporation (HMC). Interview questionnaire was utilized to collect data about sociodemographic, history of marriage, lifestyle, menstrual, obstetric, gynaecological, medical, medication, surgical, birth-control, sexual and family, depression screening using patient health questionnaire (PHQ)-2 score, and anthropometric measurements. Logistic regression was used to identify the associated factors to infertility. Statistical significance was set at 0.05.

**Results:** 43 primary and 93 secondary infertility cases were included. Risk factors were age>35 years (OR=3.7), second-hand smoking (OR=2.44), steady weight gain (OR=4.65), recent weight gain (OR=4.87), menstrual cycle irregularities (OR=4.20), fallopian tube blockage (OR=5.45), and symptoms suggestive of sexually transmitted infections (STIs) including chronic lower abdominal/pelvic pain (OR=3.46), abnormal vaginal discharge (OR=3.32) and dyspareunia (OR=7.04). Predictive factors for secondary infertility were; longer time from previous conception (OR=5.8), history of stillbirth (OR=2.63) or miscarriage (OR=2.11) and postpartum infection (OR=3.75). Protective factors were higher education level (OR=0.44), higher income (OR=0.17), and awareness/loyalty to fertility window (OR=0.33)

**Conclusion:** awareness, prevention, and early management of modifiable risk factors is important for women at pre/post-conception periods.

## PLAIN ENGLISH SUMMARY

Infertility is defined by the failure to conceive after 1 year or more of regular unprotected sexual intercourse. It is considered as a stigmatizing condition more pronounced in Arab communities. Couples are distracted by the physical, financial, social and emotional hardship of the disease. It can also affects marriage stability, family relationships and job performance. Although male

and female are attributed equally to infertility (third of cases each), it appears that women is consistently held responsible and she is often impacted psychologically and socially as a consequence. Several risk factors of female infertility might be preventable particularly the ones related to behaviour and lifestyle.

This study attempts to explore the risk factors of female infertility to provide guidance for prevention and early management. We have interviewed infertile females (136) and fertile pregnant females (272) using questionnaires individually. We have classified infertility as primary (women with no previous conception) or secondary (women with previous conception).

Of the 136 infertile cases, 43 had primary infertility and 93 had secondary infertility. We found that the most associated risk factors to female infertility were age > 35 year, second hand smoking, steady weight gain since marriage, recent weight gain, irregular menstrual cycle, fallopian tube blockage, some symptoms that can be related to sexual transmitted infections including chronic lower abdominal pain, abnormal vaginal discharge, and pain during sexual intercourse. Risk factors for secondary infertility were identified as the following; history of stillbirth/miscarriage, postpartum infection or previous caesarean section. Higher education/income as well as awareness/loyalty to fertility window, were found to be protective against infertility.

In conclusion, infertility is a multifactorial disease that remain a significant burden for individuals, families and communities. Several modifiable risk factors were found to be associated with female infertility, which may be considered for planning of better reproductive healthcare in Qatar.

### **KEY MESSAGE POINTS**

- Lifestyle pattern mainly obesity and second-hand smoking, is contributed to the occurrence of female infertility among Qatari women.
- Screening for symptoms suggestive of sexual transmitted disease is an essential step for prevention of female infertility.
- Secondary female infertility is found to be linked to the rate of caesarean section, stillbirth and miscarriages.

### **INTRODUCTION**

Infertility is a disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse. <sup>(1,2)</sup> Primary infertility is defined as the inability to conceive after one year of unprotected sexual intercourse, with no previous conceptions, while secondary infertility is referred to couples who are unable to conceive after one year of unprotected intercourse following a previous pregnancy. <sup>(3,4)</sup> About one-third or more of all infertility cases are related to women's causes, another third due to male causes, the remaining are caused by mixed or by unknown factors. <sup>(5)</sup> Globally, every year, 60 - 80 million new couples suffer from infertility. <sup>(6)</sup> A systematic analysis published by the World Health Organization (WHO) in 2012, revealed that one in every four couples in developing countries are affected with infertility. <sup>(2)</sup> Infertility affects between 8 and 12% of reproductive-aged couples worldwide. <sup>(6,7)</sup> However, in some regions, the rates are much higher, reaching up to 30% in some populations such as Middle East and North Africa (MENA) region. <sup>(7-9)</sup> Infertility is a cause of instability in the lives of couples, particularly women, raising chances of divorce, lowering chances of entering into marriage and increasing the chances that

her husband will marry another wife, in religions where polygyny is permitted, as in the Islamic Arab world.<sup>(10)</sup> Treatment of infertility can be medically invasive, associated with adverse health problems and may cause psychological stress, anxiety or depression.<sup>(11)</sup> Female infertility risk factors range from non-modifiable such as older age, ethnic background, congenital anomalies of reproductive organ, certain genetic conditions, family history,<sup>(12-14)</sup> and modifiable factors that include sociodemographic, STIs, post-abort or postpartum infections leading to fallopian tube blockage, high risk sexual behaviour (e.g. early age at first sexual intercourse, multiple marriages/relations), environmental hazards (e.g. radiation exposure, chemotherapeutic and toxic agents), lifestyle factors (e.g. obesity, tobacco smoking, alcohol intake, emotional stress, etc.), some medical conditions (as menstrual cycle abnormalities, thyroid diseases, polycystic ovarian syndrome (PCOS)), and prior history of pelvic surgeries (e.g. caesarean section, appendectomy).<sup>(15-18)</sup> According to the United Nations (UN) "World Population Prospects": The 2015 Revision; total fertility rate in Qatar has dropped from 6.11 children per woman in 1965 - 1980 to 2.1 in 2010 - 2015. Projections show that total fertility will decline further to reach 1.76 in 2020 - 2025, which is below the replacement level fertility. The most important factors they unveiled are as increased age at first marriage, increased educational level of Qatari women, and more women integrated in the labour force.<sup>(19)</sup>

The aim of the present study was to explore infertility risk profile among Qatari females that will aid in planning preventive and management strategies to mitigate its burden, and consequently maternal and foetal morbidity, mortality and economic cost on families and on the healthcare system.

## **METHODOLOGY**

This was a case-control study 17<sup>th</sup> September 2017-10<sup>th</sup> February 2018. Cases were women within the reproductive age (15 - 49 years), who reports failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse, attending infertility clinic, by convenient sampling and controls were pregnant women recruited from antenatal clinic using systematic random sampling technique, at women Hospital, HMC, Qatar. Cases with male or combined infertility were excluded and controls with prior history of infertility or previously managed to treat infertility and those with the current pregnancy being a product of infertility management were excluded. A sample size of 408 (136 cases, 272 controls) was calculated using a case-control equation, according to the prevalence of common risk factors of female infertility in Qatar. A ratio of 2:1 was utilized for controls to cases, according to the rate of patients per month. Data were collected using predesigned interview questionnaire composed of the following components; Sociodemographic characteristics (age, education level, occupation, and income), marriage history (consanguinity, age at first marriage, recurrent marriage, duration of marriage, husband's absence), lifestyle history (smoking, alcohol, vigorous exercise, weight gain), menstrual history (age of menarche, regularity of menstrual cycle, duration of menstrual cycle, number of menstrual flow days, menorrhagia, intermenstrual bleeding, dysmenorrhea, secondary amenorrhoea, obstetric history (previous and time of previous conception, stillbirth, miscarriage, ectopic pregnancy, antenatal care, post-partum/abortal infection, gynaecologic history (chronic pelvic pain, abnormal vaginal discharge, painful urination, dyspareunia, gynaecological related fever, pelvic inflammatory disease (PID), tubal blockage, fibroid uterus, endometriosis or congenital anomaly of the reproductive organ, medical history (diabetes mellitus (DM), thyroid disease, hyperprolactinemia), medication history (cancer treatment, prolonged use of steroid, hormonal therapy, prolonged high dose of nonsteroidal anti-inflammatory drugs (NSAIDs), certain antihypertensive, anti-obesity, antidepressant/antipsychotic), surgical history (caesarean section, dilatation & curettage, appendectomy, pelvic or abdominal surgery), birth control

history (contraception use and methods; oral contraceptive pills, intrauterine device, natural/barrier methods), family history (female infertility, menstrual cycle irregularity, early menopause, PCOS, fibroid uterus, DM, thyroid disease), sexual history (knowledge & loyalty to fertility window, coital frequency). The second component of questionnaire was PHQ - 2. Medical review was performed as well as anthropometric measurement of weight, height and body mass index (BMI). A pilot study was done on 20 women to test the pre-designed questionnaire and modifications were done accordingly. These cases were not included in the study. The completed questionnaires were reviewed on daily basis and revised for data completion, consistency and coding. Data entry was done using Statistical Package of Social Science *IBM-SPSS*® version 22. *Student t-test* and *chi square* test were used to compare (mean +standard deviation) and (observed frequency) for numerical and categorical variables, consequently. Crude and adjusted odd ratios were calculated to examine the risk association between two variables. Variables having *p*-value equal or less than 0.05 at the bi-variable analysis were considered as statistically significant and were further included in the multivariate logistic regression. Two regression model using forward stepwise method were used; *Model I* was to obtain risk factors of primary and secondary infertility compared to controls, while *Model II* was to obtain risk factors of secondary infertility compared to controls with previous conception. Approvals were obtained from Research Ethics Committee of Women Hospital, Medical Research Center, and Institutional Review Board of Hamad Medical Corporation. Verbal informed consent was obtained after explaining the aim, objectives and possible benefits from the study. Participation was voluntarily and confidentiality of the information was strictly adhered to by assuring the women that no details about their status will be released and data will be used only for research purpose.

## PATIENT AND PUBLIC INVOLVEMENT

Patients were involved in identifying research priorities. They were interviewed during rotations at infertility clinic to identify the most important and relevant outcome measures. Patients worked with us in formulating the research questions, however it was difficult to involve patients in other areas of the study design due to data protection restriction and ethical considerations. Dissemination strategies will include raising awareness of preventive risk factors of female infertility among Qatari through media such as television programmes, newspaper and social media. Moreover, leaflets will be designed for Primary Health Care Centers to be available at premarital clinics, post-natal clinic and well-women clinic, as well as infertility clinics related to Hamad Medical Corporation.

## RESULTS

It was found that 68.4% of infertile participants were suffering from secondary infertility (n = 93), while 31.6% are primary (n = 43) as seen in **Figure (1)**.

**Table (1)** shows the distribution of cases and controls according to their sociodemographic characteristics. The mean age of cases and controls was  $32.5 \pm 6.6$  years and  $30.2 \pm 5.5$  years, subsequently. Regarding the educational level, majority of participants in both groups have completed secondary and/or university education or higher. More than half of cases and more than three quarter of controls had their average monthly income in the high category ( $\geq 25,000$  Qatari Riyals). Occupation showed no statistical difference between the two groups. Regarding the age at first marriage, 11.7% of infertile women got married at an age of 30 year or above as compared to only 5.1% of controls ( $p=0.024$ ). In respect to husband's absence, only 14.7% of control reported their husbands being absent from home, compared to as high as 31.6% of infertile participants, the difference was statistically significant ( $p = 0.001$ ). However,

consanguinity, recurrent marriage and duration of menstrual cycle had no statistical significance between groups.

**Table (2)** shows the distribution of study participants according to their lifestyle history. Only 2.2% of cases are currently cigarette smokers, compared to none of their fertile counterparts, who reported never being smokers either currently or previously. Similarly, nine cases (6.6%) are currently or previously smoked water pipe tobacco, while only 1.5% of controls have similar exposure, the difference was statistically significant ( $p = 0.006$ ). Around 58.1% of cases reported exposure to second hand smoke, the figure was significantly higher than their controls ( $p = 0.014$ ). None of the study participants reported alcohol consumption. Infertile participants reported practicing vigorous exercise (as swimming, fixed cycling and jugging) more commonly than their controls, 8.8% and 3.3% respectively ( $p = 0.017$ ). Around one fourth of cases had history of childhood obesity, while the majority of them reported steady weight gain since the start of marriage and/or recently during the last 6 months. On the other hand, controls significantly showed much lower figures.

**Table (3)** demonstrates the distribution of study participants according to gynaecological history. Majority of the cases and controls had normal age of menarche. Cases were more likely to report history of menstrual cycle irregularity of duration more than 6 months, as well as history of menorrhagia, intermenstrual bleeding, dysmenorrhea and secondary amenorrhea, with statistical significance differences. Symptoms suggestive of STIs (chronic pelvic pain, abnormal vaginal discharge, painful urination, dyspareunia) were highly significant among cases as compared to controls. Gynaecological related-fever had no statistical significance difference.

**Table (4)** shows the distribution of secondary infertility participants and controls according to their obstetric history. Most of secondary infertile cases and controls had their previous pregnancy within last 5 years. Secondary infertile women were more likely to report history of stillbirth, recurrent miscarriage, post-partum/abortal infection, caesarean section, while history of ectopic pregnancy or dilatation & curettage were not found to be statistically significant. Around 15% of secondary infertile cases reported not having antenatal care in their previous pregnancies, compared to only 7.8% of controls, the difference reached statistical significance.

**Table (5)** demonstrates the distribution of study participants according to medical/medication history. Hypothyroidism, hyperprolactinemia, depression were reported significantly higher among cases. More than half of the infertility cases were suffering from PCOS, versus 19.1% of their controls. Furthermore, around 17% of cases had fallopian tube blockage, compared to only 2.6% of their fertile controls. Secondary infertile women tended to have higher rate of fallopian tube blockage than women with primary infertility (20.4% vs. 9.3% respectively). Fibroid uterus was reported among 19.6% of cases compared to only 4.0% of controls. Endometrioses and reproductive congenital anomalies showed no statistical significance. More cases reported history of appendectomy compared to controls (8.3% vs. 3.3% respectively). Furthermore, the rate of surgical management of obesity (most commonly sleeve gastrectomy and/or liposuction) was significantly higher among cases compared to their controls (24.3% vs. 13.6% respectively). History of other pelvic surgeries was statistically more frequent amongst cases than controls (18.4% vs. 15.1% respectively). Cases were more likely to have history of prolonged use of steroid, hormonal therapy, prolonged high dose of NSAID, and anti-obesity. However, cancer treatment, anti-hypertensive and antidepressant showed no statistical significant difference.

**Table (6)** shows the distribution of study participants according to their birth-control/sexual history. Among contraception users, hormonal control was the most commonly adopted

method (71.7% and 50% among cases and controls subsequently), followed by natural/barrier method. However, the use of intrauterine devices as well as duration of birth control use, showed no statistical significant difference between the two groups. Controls were more likely to be aware and loyal to fertility window, while coital frequency showed no statistical significance difference.

**Table (7)** demonstrates the distribution of study participants according to their family history. Family history of female infertility was observed in 41.9% of cases compared to 27.6% of controls. Moreover, family history of menstrual cycle irregularity, PCOS, fibroid, DM and thyroid disease were all more distributed among cases, with a significant statistical difference.

**Table (8)** illustrates the distribution of study participants according to their WHO-BMI classification/ PHQ-2 results. The mean BMI values for cases was higher compared to their controls (mean $\pm$  standard deviation= 31.4  $\pm$  6.4 Kg/m<sup>2</sup> and 28.7  $\pm$  6.1 Kg/m<sup>2</sup>, respectively). Infertile women were more likely to be obese as compared to controls with statistical significance difference. With regard PHQ-2 results, 14% of infertile women screened positive against depression compared to only 5.5% of their controls, with a statistical significant difference.

Comparing the distribution of selected significant risk factors between primary and secondary infertility in bivariate analysis, it was found that husband's absence, older age, abnormal vaginal discharge, fallopian tube blockage, history of appendectomy and older age at first marriage, were more commonly found among secondary infertile women. **Figure (2)**

**Table (9)** describes the result of multivariate logistic regression analysis. Among the forty two entered significant factors only nine were found to be predictors of infertility [*Model I*:  $X^2$  (12) = 264,  $p < 0.001$ ] including; age >35 years, second hand smoking, steady weight since marriage, recent weight gain, menstrual cycle irregularity, chronic lower abdominal pain, abnormal vaginal discharge, dyspareunia and fallopian tube blockage. Furthermore, four variables were found to be predictors of secondary infertility (among those with history of previous conception) [*Model II*:  $X^2$  (4) = 57.3,  $p < 0.001$ ], including duration of 5 years or more from previous conception, stillbirth, recurrent miscarriage and post-partum/abortal infection.

## DISCUSSION

The studied sample revealed that 68.4% had secondary infertility, while 31.6% had primary infertility. A systematic analysis<sup>(2)</sup> of national health surveys conducted among 190 countries by Mascarenhas MN *et al.* (2012) found that secondary infertility was more prevalent than primary (10.5% vs. 1.9% respectively). However, regionally, a study in Kuwait<sup>(20)</sup> conducted by Omu FE and Omu AE (2002-2007), revealed that among 268 women attending infertility clinic, the rate of primary and secondary infertility were 65.7% and 34.3%, respectively.

### Risk factors for female infertility:

In the current study, It was found that age >35 years significantly increased the risk of infertility by around four times, (OR=3.72, 95% CI: 1.41 - 9.83,  $p=0.008$ ). It also revealed that with increasing age, the trend of infertility risk increases in a step manner. This is in consonance with a case-control study conducted in Lusaka, Zambia by Kalima-Munalula MN *et al.* (2017) who found a significant association between age and female infertility. There was an increasing trend of infertility risk, with increasing age, at age group 20 - 29y, the OR was 2.39; and OR of 8.42 at 30 - 39y.<sup>(21)</sup>

This study found that second hand smoking (aOR=2.44, 95% CI= 1.26 - 4.73,  $p=0.008$ ) and water-pipe smoking were significantly associated with female infertility (OR=4.75, 95% CI= 1.44 - 15.71,  $p=0.01$ ). In agreement to our study, the association between second-hand smoking and infertility was assessed in a prospective cohort of postmenopausal women by Hyland A. *et al.* (1993 - 1998). The study established that active-smokers were 1.14 (95% CI= 1.03 - 1.26) times more likely to have infertility and 1.26 times (95% CI= 1.16 - 1.35) more likely for earlier menopause than never-smoking women.<sup>(22)</sup> Moreover, the present study showed that obesity is a significant risk factors for female infertility. This was consistent with the results of a case-control study of 582 women, Algeria by MAÏ HA *et al.* (2015). It reported that women with BMI greater than 30 m<sup>2</sup>/kg were 3.26 times more likely to have infertility (OR=3.26, 95% CI= 1.62 - 6.80,  $p=0.019$ ).<sup>(23)</sup> Similarly, a study conducted in Saudi Arabia, King Fahad Medical City by Rafique M. *et al.* (2016), revealed that among 127 cases of female infertility, 33.2% were overweight and 48% were obese. In addition, PCOS was present in 30.8% of overweight and 38.7% of obese women.<sup>(24)</sup>

In the current study, it was found that menstrual cycle irregularity is a significant risk of female infertility (aOR=4.20, 95% CI=1.14 - 15.49,  $p=0.031$ ) including oligomenorrhea, menorrhagia, dysmenorrhea and intermenstrual bleeding. Similarly, Shamila S *et al.* (2011) in their survey found that menstrual cycle irregularity was a common observation reported among infertile females in the three study areas (40%, 44.85% and 44.11% respectively) and was positively correlated with female infertility ( $p < 0.01$ ).<sup>(25)</sup> Likewise, a case-control study in south-eastern Iran conducted by Ansari H *et al.* (2016), reported that women with irregular menstruation were nearly 4 times more likely to have secondary infertility, compared to their regular cycle counterparts (aOR=3.91, 95% CI= 1.5 - 6.7,  $p < 0.05$ ).<sup>(26)</sup> A study conducted in Korea by Kwon SK *et al.* (2014), found that among the studied 1080 women suffering secondary amenorrhea, PCOS was the most common cause (48.4%).<sup>(27)</sup> It was also found in this study that PCOS increased the risk of female infertility by nearly 5 times and these results correlate with the studies concerning the percentage of women suffering infertility problems due to PCOS by Wendy A *et al.* (54.6%)<sup>(28)</sup>, Susan M. *et al.* (40%)<sup>(29)</sup> and Kristi P *et al.* (56%).<sup>(30)</sup>

The present study found that symptoms suggestive of STIs were highly correlated with female infertility; dyspareunia (OR=7.04, 95% CI= 2.76 - 17.95,  $p=0.001$ ), while chronic lower abdominal pain or abnormal vaginal discharge increased the risk of infertility by more than three times. In Nigeria, Ogbu GI. *et al.* (2017) studied the relationship between *Chlamydia trachomatis* infection and tubal infertility found a statistically significant association between positive *C. trachomatis* antibody titre among cases with tubal factor infertility (75.0%) compared with controls (22.2%). They concluded that the clinical feature having the potential of identifying woman at high risk for *Chlamydia* infection were vaginal discharge (24.5%), followed by dysmenorrhea (24.5%) and lower abdominal pain (23.1%).<sup>(31)</sup> The present study also demonstrated that fallopian tube blockage is a risk factor for female infertility (OR=5.45, 95% CI= 1.75 - 16.95,  $p=0.003$ ). Fallopian tube blockage was much more common in secondary infertile females (20.4%) compared to only 9.3% of primary infertile. Tubal blockage is usually associated with chronic untreated STIs/PID, where screening could play a significant role.

In this study, hypothyroidism and hyperprolactinemia were found to be predictors for female infertility. This was also seen in a study by Hymavathi k *et al.* (2016), India to investigate the correlation of thyroid and prolactin hormones levels with female infertility. The study found that 27% of women with primary infertility were hypothyroid and 7% were hyperthyroid. Among those with secondary infertility the corresponding figures were 5% and 2%

respectively. Additionally, hyperprolactinemia was detected in 37% of infertile cases, more commonly among primary infertile women (79.4%) as compared to 20.6% secondary infertile. In addition, history of appendectomy was found to be an independent risk factor for female infertility, in present study. On contrary, a meta-analysis by [Elraiyah T et al. \(2014\)](#) showed that previous appendectomy is not significantly associated with increased incidence of infertility in women, (OR= 1.03, 95% CI= 0.86 - 1.24,  $p = 0.71$ ).<sup>(32)</sup>

Awareness and loyalty to fertility window were found in the current study to be protective against infertility. A cross-sectional study of fertility-awareness among women seeking fertility assistance in Australia by [Hampton KD et al. \(2013\)](#) found that 68.2% believed they had timed intercourse mainly within the fertile, but only 12.7% could accurately identify this window. Most infertile women were graded by the study as having either no fertility-awareness (11.8%) or poor fertility-awareness (52.5%).<sup>(33)</sup> Additionally, another study by [Blake D et al. \(1997\)](#), has investigated the fertility-awareness of infertile women seeking fertility assistance, they found that 74% of participants could not accurately identify the fertile window.<sup>(34)</sup>

### **Secondary infertility risk factors:**

The current study showed that recurrent miscarriages is significantly associated with secondary infertility and women with a history of stillbirth were 2.63 likely to be secondary infertile. History of post-partum / post-abort infection and caesarean section were also found to be significant predictors of secondary infertility in this study. In agreement, [Dhont N et al. \(2009\)](#) in their study conducted in Rwanda, found that secondary infertile women were two times more likely to have history of an adverse pregnancy outcome (miscarriage / ectopic pregnancy), aOR = 1.89, 95% CI= 1.17 - 3.04), history of stillbirth (aOR= 7.52, 95% CI= 2.97 -19.01), history of postpartum infection (aOR= 11.49, 95% CI= 3.31 - 39.89) or history of caesarean section (aOR= 11.49, 95% CI= 3.31 - 39.89) compared to their controls.<sup>(35)</sup>

## **CONCLUSION**

Infertility is a multifactorial complex disease that remains a significant burden for the individuals, families and communities. Several modifiable risk factors were found to be predictors of female infertility among Qatari females that maybe be considered for planning of better reproductive health care. Older age and delayed age at first marriage beyond 30 years were found to be independent risk factors for infertility. Lifestyle pattern including smoking whether water pipe of second hand, obesity, as well as symptoms suggestive of STIs can contribute significantly to infertile status. Furthermore, menstrual cycle abnormalities, PCOS, tubal blockage, fibroid, hyperthyroidism, hyperprolactinemia, appendectomy, post-partum infection, caesarean section, recurrent miscarriage, stillbirth, were all found to be risk factors of female infertility. Conversely, higher education/income and fertility window awareness were found to be protective against infertility. Therefore, primary prevention as well as screening and early management using cost-effective interventions targeting mainly modifiable risk factors are essential components of reproductive health care planning. Moreover, delivering integrated care through utilization of premarital, well women, antenatal, postnatal, and family planning clinics to raise awareness and screen for related risk factors.

## **LIST OF ABBREVIATIONS**

HMC: Hamad Medical Corporation

PHQ-2: Patient health questionnaire

STIs: Sexually transmitted infections

WHO: World Health Organization

MENA: Middle East and North Africa

PCOS: Polycystic ovarian syndrome

UN: United Nation

PVD: Pelvic inflammatory disease

DM: Diabetes mellitus

NSAIDs: nonsteroidal anti-inflammatory drugs

BMI: Body mass index

IBM-SPSS: Statistical Package of Social Science

## **DECLERATIONS**

### **ETHICS APPROVAL**

- Approvals were obtained from Research Ethics Committee of Women Hospital, Medical Research Centre and IRB-HMC.
- Director of obstetrics and gynaecology department was informed and permission was obtained.
- Participation was voluntarily and clients were instructed that they could withdraw at any time without any adverse consequences.
- Confidentiality and privacy have been assured throughout the study.
- Participants scored positive in PHQ-2 were advised for further assessment and referral.

The following approvals were obtained:

- A. Women's Hospital- HMC.
- B. Medical Research Center- HMC.
- C. Institutional Review Board (IRB)- HMC

## **CONSENT TO PARTICIPATE**

Informed consent, following the HMC-IRB standard template, was obtained from all participants. Patients were explained that participation is anonymous and results will be collectively presented and disseminated as educational materials and/or publication.

## **AVAILABILITY OF DATA AND MATERIAL**

The data that support the findings of this study are available from Hamad Medical Corporation (HMC) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Medical Research Center-HMC.

## **FUNDING**

The author disclosed receipt of the following financial support for the research, and publication.

- A. Personal cost: data collector.
- B. Supplies & Equipment: Laptop
- C. Conference
- D. Publication fees

## **AUTHOR'S CONTRIBUTION**

### **Author 1. S.M (principle investigator)**

- Conceptualization, designing, coordination of this study.
- Developed the theoretical framework of the study.
- Developed and validated the data collection tool.
- Performed data collection and entry.
- Conducted data analysis.
- Took the lead in writing the manuscript with input from co-author.
- Wrote the results and designed tables and figures with the assistance of co-author.
- Approved the final version to be published.

### **Author 2. S.O (co-author)**

- Assist in designing and conceptualization of the study.
- Contributed to development of data collection tool.
- Assist in data analysis and interpretation of the results.
- Assist in drafting and critical revision of the article.
- Contributed to the final version of the manuscript.
- In charge of overall direction and planning.

## **REFERENCES**

- 1- Egers-Hochschild F, Adamson GD, de Mouzon J, Ishihara O, Mansour R, Nygren K, *et al.* International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary of Assisted Reproductive Technology (ART) terminology, 2009. *Fertil Steril* 2009; 92: 1520-1524.
- 2- Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys. *PLoS Med.* 2012; 12(9): 1-12.
- 3- World Health Organization. Gender and genetics: assisted reproductive technologies (ARTs). Geneva, Switzerland: *World Health Organization*; 2003. Available from: <http://www.who.int/genomics/gender/en/index6.html>.
- 4- World Health Organization. Infertility: a tabulation of available data on prevalence of primary and secondary infertility. WHO: Geneva. Programme on Maternal and Child Health and Family Planning, Division of Family Health. 1991. Available from: [http://apps.who.int/iris/bitstream/10665/59769/1/WHO\\_MCH\\_91.9.pdf](http://apps.who.int/iris/bitstream/10665/59769/1/WHO_MCH_91.9.pdf)
- 5- Peterson BD, Gold L, Feingold T. The experience and influence of infertility: considerations for couple counselors. *Fam J.* 2007; 15(3): 251-257.
- 6- Mallikarjuna M, Rajeshwari B. Selected risk factors of infertility in women: case control study. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology. Int J Reprod Contracept Obstet Gynecol.* 2015; 4(6):1714-1719.
- 7- Ombelet W, Cooke I, Dyer S, Serour G, Devroey P. Infertility and the provision of infertility medical services in developing countries. *Human Reproduction Update.* 2008; 14(6): 605-662.

- 8- Ombelet W, Devroey P, Gianardi L, te Velde E. Developing countries and infertility. *Spec Issue Hum Reprod.* 2008; 1-17.
- 9- Nachtigall RD. International disparities in access to infertility services. *Fertil Steril.* 2006; 85(4): 871- 875.
- 10- Inhorn M, Patrizio P. Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the 21st century. *Human Reproduction Update.* 2015; 21 (4): 411-426.
- 11- Centers for Disease Control and Prevention. National Public Health Action Plan for the Detection, Prevention, and Management of Infertility. Atlanta, Georgia: *Centers for Disease Control and Prevention.* 2014 June. 23 p.
- 12- Cooke L, Nelson SM. Reproductive ageing and fertility in an ageing population. *The Obstetrician & Gynaecologist.* 2011; 13:161–16.
- 13- Osman AA. Aetiology of female infertility in Gezira (Central of Sudan). *Journal of Applied Science.* 2010; 10(19): 2333-2337.
- 14- Zorrilla M, Yatsenko AN. The Genetics of Infertility: Current Status of the Field. *Current Genetic Medicine Reports.* 2013; 1(4).
- 15- Romero R, Romero G, Abortes I, Medina HG. Risk factors associated to female infertility. *Ginecol Obstet Mex.* 2008; 76(12): 717-721.
- 16- Saoji AV. Primary infertility problems among female have been a source of concern in India lately. *Innovative Journal of Medical and Health Science.* 2014; 4(1): 332-340.
- 17- Jejeebhoy SJ. Infertility in India - levels, patterns and consequences: Priorities for social science research. *Journal of Family Welfare.* 1998 June; 44(2):15-24.
- 18- Melo AS, Ferriani RA, Navarro PA. Treatment of infertility in women with polycystic ovary syndrome: approach to clinical practice. *Clinics (Sao Paulo).* 2015 Nov; 70(11): 765–769.
- 19- United Nations. World Population Prospects: The 2012 Revision. Population Division, Dept. of Economic and Social Affairs. United Nation, New York 2013. Available from: [https://esa.un.org/unpd/wpp/publications/Files/WPP2012\\_HIGHLIGHTS.pdf](https://esa.un.org/unpd/wpp/publications/Files/WPP2012_HIGHLIGHTS.pdf).
- 20- Omu FE, Omu AE. Emotional reaction to diagnosis of infertility in Kuwait and successful clients' perception of nurses' role during treatment. *BMC Nursing.* 2010 Mar 18; 9(5): 1-10.
- 21- Kalima-Munalula MN, Ahmed Y, Vwalika B. Factors associated with Infertility among Women attending the Gynaecology Clinic at University Teaching Hospital, Lusaka, Zambia. *Medical Journal of Zambia.* 2017; 44(1): 41-44.
- 22- Hyland A, Piazza K, Hovey KM, Tindle HA, Manson AE, Messina C *et al.* Associations between lifetime tobacco exposure with infertility and age at natural menopause: the Women's Health Initiative Observational Study. *Tobacco control.* 2016; 25:706–714.
- 23- MAÏ HA, Demmouche A. A case-control study of body mass index and infertility in Algerian Women (Sidi Bel Abbes, West of Algeria). *International Journal of Infertility and Fetal Medicine.* 2015 Dec. 6(3): 103-107.
- 24- Rafique M, Nuzhat A. Role of obesity in female infertility and assisted reproductive technology (ART) outcomes. *Saudi Journal of Obesity.* 2016; 4(2): 75-79.

- 25- Shamila S, Sasikala SL. Primary report on the risk factors affecting female infertility in South Indian districts of Tamil Nadu and Kerala. *Indian Journal of Community Medicine*. 2011; 36(1): 59-61.
- 26- Ansari H, Azarkish F, Rigi SN, Rouhandeh R, Mohammadi Y. Menstrual-reproductive and socio-demographic factors of secondary infertile and fertile women in Zahedan: A case-control study in southeastern Iran. *Der Pharmacia Lettre*, 2016, 8(1): 348-353.
- 27- Kwon SK, Chae HD, Lee KH, Kim SH, Kim CH, Kang BM. Causes of amenorrhea in Korea: Experience of a single large center. *Clinical and Experimental Reproductive Medicine*. 2014 Mar; 41(1): 29-32.
- 28- March WA, Moore VM, Willson KJ, Phillips DI, Norman RJ, Davies MJ. The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic criteria. *Human Reproduction*. 2010; 25(2): 544-51.
- 29- Susan M, Kristen A. Pate. Epidemiology, diagnosis, and management of polycystic ovary syndrome. *Clinical Epidemiology*. 2014; 6: 1-13.
- 30- Kristi Panchuk, M. Judith Lynam. Polycystic ovary syndrome: appreciating the complexities and implications of diagnosis for primary care. *UBC Med J*. 2012 Sep; 4(1): 11-3.
- 31- Ogbu GI, Anzaku SA, Aimakhu C. Burden of Chlamydia trachomatis infection amongst infertile women compared with pregnant controls in North-central Nigeria. *International Journal of Research in Medical Sciences*. 2017 Sep; 5(9): 3819-3826.
- 32- Hymavathi K, Tadiseti S, Pusarla D, Pambadi P. Correlation of serum thyroid hormones and prolactin levels to female infertility. *International Journal of Reproduction, Contraception, Obstetrics and Gynaecology*. 2016 Nov; 5(11):4018-4024.
- 33- Hampton KD, Mazza D, Newton JM. Fertility-awareness knowledge, attitudes and practices of women seeking fertility assistance. *Journal of Advanced Nursing*. 2013; 69(5), 1076-1084.
- 34- Blake D, Smith D, Bargiacchi A, France M, Gudex G. Fertility awareness in women attending a fertility clinic. *Australian and New Zealand Journal of Obstetrics and Gynaecology*. 1997 Aug; 37(3): 350-352.
- 35- Dhont N, Luchters S, Muvunyi C, Vyankandondera J. The risk factor profile of women with secondary infertility: an unmatched case-control study in Kigali, Rwanda. *BMC Women Health*. 2011; 11 (32): 1-7.

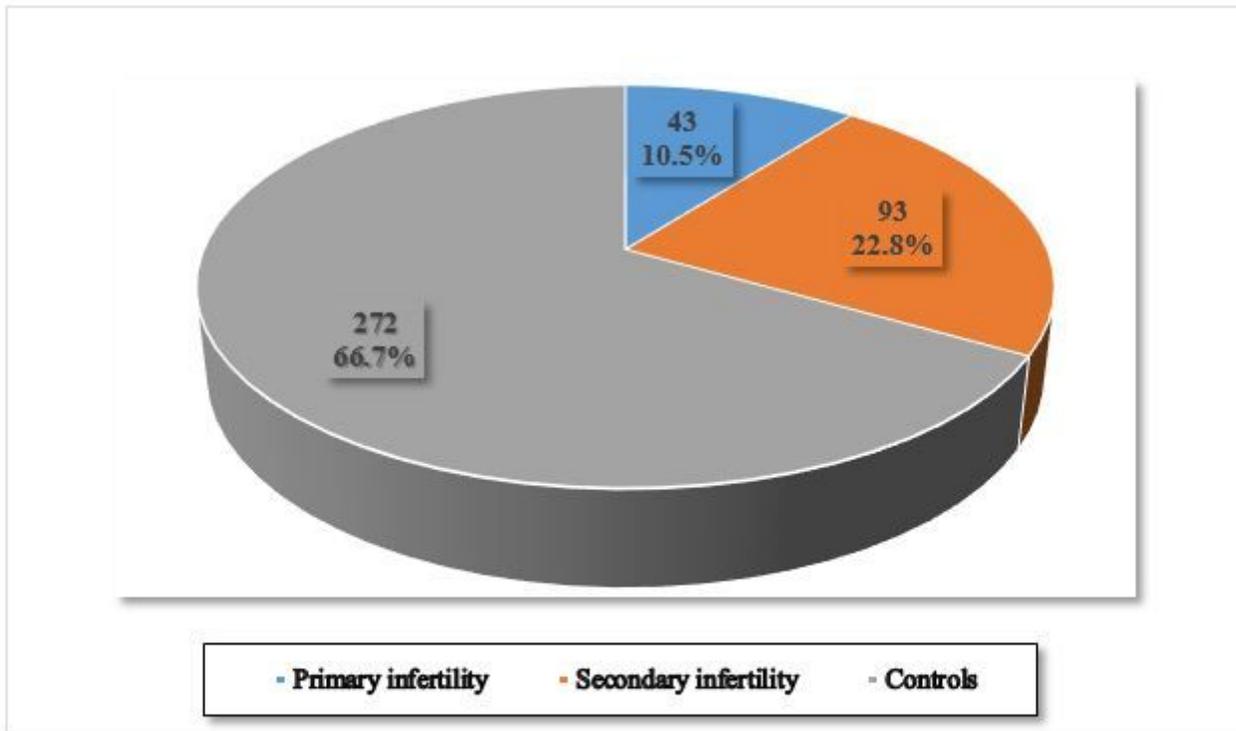
## **ACKNOWLEDGMENT**

*I would like to convey thanks to all participants of this study, who sacrificed their precious limited time and valuable information. I would like to thank my co-supervisors Dr. Noora Al Kubaisi and Dr. Hessa Shahbic for their assistance and guidance. Their comments, advices, and efforts were invaluable. I would like also to express my warm appreciation for Dr. Rajvir Singh, the Senior Consultant of Biostatistics in Hamad Medical Corporation for his sincere assistance, professional guidance, truthful encouragement and continuous support. My thanks are extended to Dr. Noora Al Malki, for her dedicated genuine help, and for the time she devoted to timely and perfectly accomplish the data collection part of this work.*

## **COMPETING INTERESTS**

The author declare that they have no competing interests.

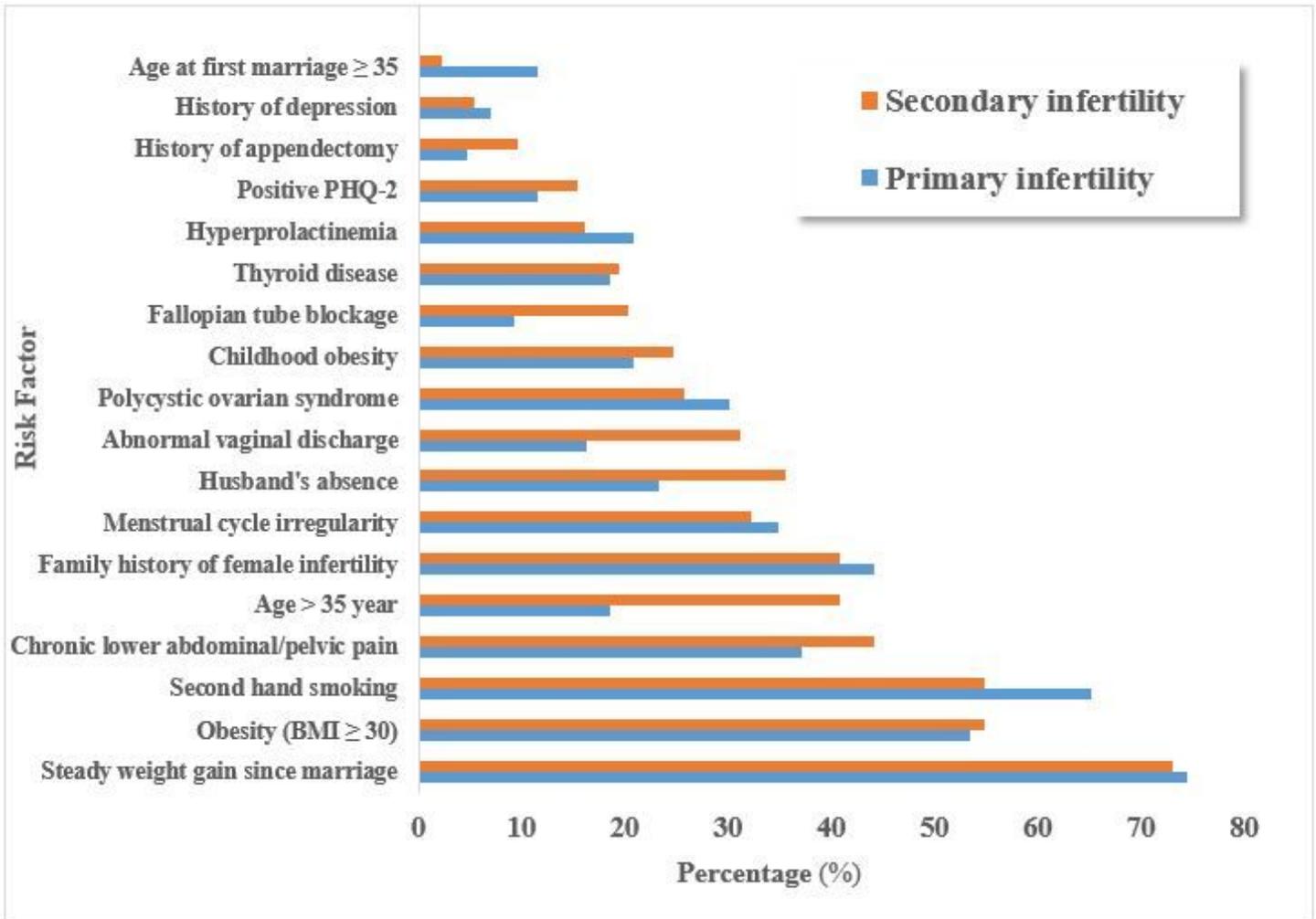
## Figures



**Figure (1): Distribution of study participants according to their fertility status, Women Hospital-Hamad Medical Corporation, 2018**

### Figure 2

Distribution of study participants according to their fertility status, Women Hospital-Hamad Medical Corporation, 2018



**Figure (2): Distribution of some risk factors among primary and secondary infertile participants.**

**Figure 4**

Distribution of some risk factors among primary and secondary infertile participants.

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