

KNOWLEDGE AND CONCERNS ON INFERTILITY AND ASSISTED REPRODUCTIVE TECHNOLOGY AMONG GRADUATING STUDENTS OF KAHS AT IIUM KUANTAN

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ABSTRACT

Introduction: Infertility is a disease that is common in one in six people today. One of the ways to reduce the rate of infertility is perhaps by raising basic knowledge and awareness especially in the young adults, as they will most likely embark on family life following completion of their studies. This study aimed to investigate the knowledge on infertility and assisted reproductive technology including the association to the level of physical, emotional and economical concerns on in vitro fertilization and intracytoplasmic sperm injection infertility treatments among graduating students of the Kulliyah of Allied Health Sciences at International Islamic University Malaysia in Kuantan. **Methods:** The sample of the study consisted of 124 graduating students with a breakdown of 102 females and 22 males. The sampling method used in this research was purposive sampling. Online survey data from respondents were run in SPSS version 26. **Results:** It was found that the score of knowledge of infertility and assisted reproductive technology and the score of concerns on in vitro fertilisation and intracytoplasmic sperm injection procedures among these students were of a good level, being more than 80% achievement. However, there were no differences observed in the knowledge and awareness on infertility and assisted reproductive technology ($p=0.813$), as well as concerns on in vitro fertilisation and intracytoplasmic sperm injection procedures ($p=0.264$) between male and female students. A positive correlation was shown between knowledge of infertility and assisted reproductive technology and concerns on in vitro fertilisation and intracytoplasmic sperm injection procedures ($\rho=+0.249$, $p=0.005$). **Conclusion:** The graduating students of the Kulliyah of Allied Health Sciences at IIUM have adequate knowledge of infertility and assisted reproductive technology but concerns regarding related treatment procedures seemed substantial. These findings indicate that implementing an awareness program could be advantageous for individuals who are at a stage where they are considering starting a family.

KEYWORDS: infertility, assisted reproductive technology, *in vitro* fertilisation, intracytoplasmic sperm injection, concerns

INTRODUCTION

Infertility is the inability to achieve pregnancy or to conceive after one year or longer of unprotected sex, as defined by the World Health Organization (WHO) (WHO, 2020). In its new report on infertility prevalence estimates, WHO reported that globally, one in six people have experienced infertility in some stage of their lives (WHO, 2023). Couples believe themselves infertile when their partners did not achieve successful pregnancy after a year of unprotected sexual intercourse (Maheshwari, 2020) and this mindset may lead to stress and disturbance to mental health consequently affecting daily lives and reproductive capacity. According to Department of Statistics Malaysia, live births rate in the country for the last two years was the lowest in a decade. It was also mentioned that the total fertility rate (TFR) in Malaysia continued to decline over three decades, from 4.9 children per woman in 1970 to approximately 1.7 children in 2020 (Department of Statistics Malaysia, 2021). Migration and mortality notwithstanding, a TFR of 2.1 children per woman is an indicator of a stable population but as a whole, fertility rate reflects the economic and social status of a country and is an important element of population growth (OECD, 2023). Multiple factors influence the TFR of countries across the world and various correlations have been shown towards level of education, religiosity, contraception prevalence rates, gross domestic product as well as family planning programs (Götmark and Andersson, 2020).

Assisted Reproductive Technology (ART) is one of the mainstays of infertility treatments and this includes procedures such as in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI). IVF was introduced in the early 1960s and this procedure is a process of fertilisation in which an egg is combined with sperm in a laboratory dish. Three decades after the birth of the IVF method, another type of ART was established mainly to treat severe cases of male infertility. This is known as intracytoplasmic sperm injection (ICSI), where a single sperm is injected directly into the cytoplasm of an egg (Wennerholm & Bergh, 2020). IVF and ICSI involve many steps from collection of gametes to in vitro fertilization process and especially the selection of the most viable embryo or sperm for transfer or injection into the oocyte, all in the hope to provide couples with healthy live offspring (Woodward, 2018).

In this era where information is at our fingertips, it is expected that adults, especially married couples, are aware and have at least some basic knowledge regarding ART. Nevertheless, it is unfortunate that not everyone has an equal level of understanding about ART and available fertility services due to lack of awareness. There is heterogeneity in fertility awareness and it has been suggested that fertility programmes in family planning settings, target men and people with low education (Pedro, et al., 2018). It is also believed that it serves the best interests of graduating students entering married life following graduation to be aware of infertility issues as well as available infertility treatments in order to better prepare themselves. Improving their level of knowledge regarding IVF and ICSI may be of assistance in achieving successful pregnancy should they choose to have a family. Hence, this research aims to focus on knowledge and awareness of infertility and ART, alongside procedures of IVF and ICSI, among graduating students of the Kulliyyah of Allied Health Sciences (KAHS) at the International Islamic University Malaysia (IIUM) of Kuantan campus.

MATERIALS AND METHODS

Study population

This study was designed based on cross-sectional study methods. Purposive sampling was done to identify the available respondents among the male and female graduating students (fourth year) of KAHS at IIUM Kuantan. Participants that are married and fourth-year students who were not graduating at the time of the research due to study extension or insufficient credit hours were excluded from participation. A total of 124 respondents participated in this research. Ethical approval of this research had been obtained from the IIUM Research Ethics Committee (IREC) (ID: IREC 2022-KAHS/DBMS/5).

Development and validation of questionnaire

The questionnaire consists of four sections as follows.

Section A	Consent
Section B	Socio-demographic (2 questions)
Section C	Knowledge on infertility and ART (10 questions)
Section D	Concerns on IVF and ICSI treatments (8 questions)

Answer options for knowledge and concerns sections included 'yes', 'no' and 'not sure'. Content validity of the questionnaire had been checked through ratings by experts (n=4; S-CVI=0.8), followed by a pilot study (n=16) to assess consistency and reliability of the content and items. The Cronbach's Alpha test of the pilot study gave values of 0.73 for the section on knowledge on infertility and ART and 0.70 for concerns on IVF and ICSI treatments.

The data from the target group was collected by using an online survey. Basic questions such as the definitions, causes and treatments were self-developed to assess participant's knowledge regarding infertility and ART including adapted from themes in the study by Peddie et al. (2005). Questions in the section on concerns were adapted from an online forum that discussed the physical, emotional and financial concerns regarding infertility treatments (Kaliarnta et.al, 2011).

Scoring systems

Table 1 is used as the scoring system for each response. All items in the questionnaire are true statement questions except for question no. 8 in section D for aspect of concerns.

Level of knowledge and concerns were evaluated based on the percentage of marks gained and later categorised into three groups which were good (or substantial), moderate and poor (or low) using modified Bloom's cut off point as adapted from Ramli et al. (2018) (Table 2).

Table 1 Categorisation for level of knowledge on infertility and ART and level of concerns on IVF and ICSI

Response	Score
Section C: Knowledge	
Correct statement:	
Yes	3
Not Sure	2
No	1
False statement (No false statement in this section)	
Section D: Concerns	
Correct statement:	
Yes	3
Not Sure	2
No	1
False statement (For statement question no. 8):	
Yes	1
Not Sure	2
No	3

Table 2 Categorisation for level of knowledge on infertility and ART and level of concerns on IVF and ICSI

Percentage (%)	Total scores on knowledge	Total scores on concerns	Scoring level indicator
80-100	25 - 30	20 -24	Good/Substantial
60-79	19 - 24	15 -19	Moderate
≤ 59	0 - 18	0-14	Poor/Low

Statistical analysis

This study was a quantitative study and since both independent and dependent variables were nominal, non-parametric testing was used. The non-parametric tests used included descriptive statistics, Spearman’s Correlation Coefficient and Mann Whitney test. The tests were run in the Statistical Package for Social Sciences (SPSS) software version 26. Details are as follows.

Data analysis	Test / Scoring used
Level of knowledge on infertility and ART	Descriptive statistics and Mann-Whitney test
Level of concerns on IVF and ICSI	
Comparison of responses between male and female respondents	Median ± IQR
Association between the level of knowledge of infertility and ART with the level of economical, physical and emotional concerns on IVF and ICSI	Descriptive statistics and Spearman’s Correlation Coefficient test

RESULTS AND DISCUSSIONS

Characteristic of respondents

Frequency and proportion of respondents showed responses from 102 female and 22 male students (Table 3).

Table 3 Gender of respondents (n=124)

Gender	Frequency	Percentage (%)
Male	22	17.7
Female	102	82.3

Level of knowledge on infertility and ART and concerns on IVF and ICSI

Table 4 shows the category of knowledge scores on infertility and ART, together with scores for concerns on IVF and ICSI, including its frequency and percentage for each category. Ten statement questions about knowledge of infertility and ART were included in the questionnaire, and one hundred percent of the respondents scored in the good knowledge category. Eight statement questions were included in the questionnaire for concerns on IVF and ICSI treatments. 82.3% of respondents scored in the substantial category for concerns while 17.7% indicated moderate concern for the said infertility treatments. None of the respondents scored poor or low in both categories.

Table 4 Categories of Knowledge of Infertility and ART and Concerns of IVF and ICSI

Categories	Frequency	Percentage (%)
Knowledge Score		
Good / Substantial	124	100
Moderate	0	0
Poor / Low	0	0
Concerns Score		
Good / Substantial	102	82.3
Moderate	22	17.7
Poor / Low	0	0

Knowledge on infertility and ART

Aspects of knowledge such as definition of related terms, risk factors and common infertility treatments have been assessed by ten questions that are all correct statements. Data have been analysed by using descriptive statistics. The distribution of knowledge on infertility and ART based on items in the statement questions and frequency of answers are as presented in Table 5. Most respondents indicated good knowledge on the subject matter. Following determination of scores, the association of knowledge of infertility and ART between male and female respondents indicated a *p*-value of 0.813 as shown in Table 6.

Table 5 Overall distribution of knowledge of infertility and assisted reproductive technology (ART) among graduating students of KAHS, IIUM (n= 124)

Statement Questions	Frequency of Answers		
	Yes (%)	No (%)	Not Sure (%)
1) Infertility is the inability to get pregnant (conceive) after one year (or longer) of unprotected sex.	123 (99)	1 (1)	0 (0)
2) Both male and female infertility are the possible causes of inability to conceive a child.	117 (94.4)	3 (2.4)	4 (3.2)
3) Abnormal sperm function, injury at scrotum/testicles, immature sperm and unhealthy diet and lifestyle are some of the possible causes of male infertility.	124 (100)	0 (0)	0 (0)
4) Polycystic ovary syndrome (PCOS), ovulation disorders, endometriosis and unhealthy diet and lifestyle are some of the possible causes of female infertility.	123 (99)	0 (0)	1 (1)
5) There are prescribed medications to treat infertility.	96 (77.4)	0 (0)	28 (22.6)
6) There are surgeries to treat infertility.	93 (75)	1 (0.8)	30 (24.2)
7) <i>In vitro</i> fertilization (IVF) is a process of fertilisation in which an egg is combined with sperm in a laboratory dish.	113 (91.1)	0 (0)	11 (8.9)
8) Intracytoplasmic sperm injection (ICSI) is a process where a single sperm is injected directly into the cytoplasm of an egg.	77 (62.1)	0 (0)	47 (37.9)

9) There is a high risk of getting IVF and ICSI, including multiple births, congenital deformity and chromosomal abnormalities.	89 (72)	1 (0.8)	34 (27.4)
10) There are fertility centres in Malaysia that help to assist couples or individuals, who want to become parents but for medical reasons have been unable to achieve this goal via the natural course.	41 (33)	3 (2.5)	80 (64.5)

Table 6 Comparison of level of knowledge on infertility and assisted reproductive technology (ART) between male and female graduating students of KAHS, IIUM (n=124)

Gender	n	Score on Knowledge (Median ± IQR)	p-value
Male	22	60.89	0.813
Female	102	62.85	

Concerns on *in vitro* fertilization (IVF) and intracytoplasmic sperm injection (ICSI)

Eight statement questions were used to assess concerns regarding common infertility treatments specifically IVF and ICSI. The statement questions included were based on economic concern (1 question), physical concern (1 question) and on emotional concerns (6 questions). All of the questions under this aspect are correct statements except for statement question no. 8. Distribution of findings are presented in Table 7.

Table 7 Distribution of concerns regarding *in vitro* fertilization (IVF) and intracytoplasmic sperm injection (ICSI) treatments among graduating students of KAHS, IIUM (n= 124)

Statement Questions (Type of Concern)	Frequency of Answers		
	Yes (%)	No (%)	Not Sure (%)
<i>Economical Concern</i>			
1) <i>In vitro</i> fertilization (IVF) and intracytoplasmic sperm injection (ICSI) are costly.	101 (81.5)	0 (0)	23 (18.5)
<i>Physical Concern</i>			
2) IVF and ICSI procedures are painful but bearable.	73 (58.9)	2 (1.6)	49 (39.5)
<i>Emotional Concern</i>			
3) Getting an IVF or ICSI treatment will emotionally bring you down.	84 (67.7)	5 (4)	35 (28.3)
4) IVF and ICSI treatment will breach both you and your partner's privacy.	92 (74.2)	5 (4)	27 (21.8)
5) The decision of getting an IVF or ICSI treatment will distance your relationship with your partner.	58 (46.8)	16 (12.9)	50 (40.3)

6) IVF and ICSI treatment will help you and your partner to become emotionally stronger.	88 (71.0)	0 (0)	36 (29.0)
7) The support from partners and families are highly needed during the IVF and ICSI phase and lack of understanding from them will cause disappointment to you.	105 (84.7)	0 (0)	19 (15.3)
8) IVF and ICSI procedures are against nature.	5 (4)	62 (50)	57 (46)

A total of 81.5% of the respondents have concerns related to financial implications of the infertility treatments while for physical concerns, 58.9% of the respondents replied 'yes', 1.6% 'no' and 39.5% 'not sure'. Findings on emotional concerns showed that an average of 58% of respondents answered 'yes', 12% 'no' and 30% 'not sure' as a whole. Following the scoring step, *p*-value for the association of concerns of IVF and ICSI between male and female respondents was found to be 0.264 (Table 8).

Table 8 Comparison of level of concerns on IVF and ICSI treatments between male and female graduating students of KAHS, IIUM (n=124)

Gender	n	Score on Concerns (Median ± IQR)	<i>p</i> -value
Male	22	70.16	0.264
Female	102	60.85	

Association between level of knowledge and awareness of infertility and ART with level of concerns on IVF and ICSI treatments

To investigate the association, the raw data was first analysed by reviewing the histogram, mass and skewness. The normality assumptions were however not met. Therefore, Spearman's Correlation Coefficient was used in this study. Results are as shown in Table 9 and Figure 1.

Table 9 Correlation between knowledge and awareness of infertility and ART with concerns of IVF and ICSI

Variables	Spearman's Correlation Coefficient, ρ	<i>p</i> -value
Knowledge score - Concerns score	+ 0.249	0.005

* ρ (rho) value shows a weak positive correlation.

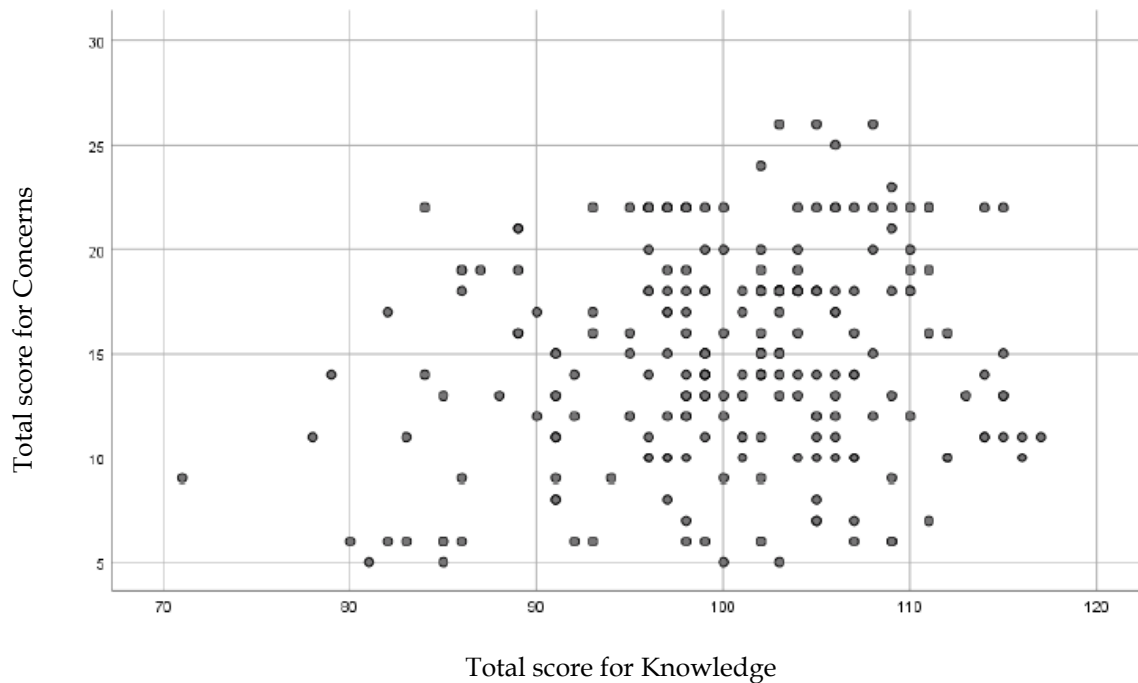


Figure 1 Correlation between knowledge of infertility and ART with concerns of IVF and ICSI

The discrepancy between the number of male (17.7%) and female (82.3%) respondents among the fourth-year students of KAHS in IIUM Kuantan can be explained by the trend that have been observed for many years in every intake for health sciences programs in the faculty. The results with regards to knowledge on infertility and ART, whereby all respondents fell into the 'good knowledge' category, are expected as these graduating students are science- and biomedical-based and should have some knowledge on the reproductive system as well as some awareness of technologies important in the treatment of infertility. Studies such as that conducted by Nouri et al. (2014), have found that students with a medical background had more understanding and awareness of infertility than students without a medical background. Sound levels of knowledge and awareness regarding ART, specifically IVF and ICSI, were also observed. This study highlights that all respondents agreed with the definition cited from the WHO except for the 1% who disagreed.

In the concerns section, it is interesting to find that most respondents in this study believed that infertility can be caused by both genders and not solely due to possible causes belonging to females. In the survey done by Afolabi, et al. (2017), the majority of respondents claimed that women are more usually blamed in society for infertility. This may be true in a lot of cultures hence it is valuable to know that respondents among students of KAHS have a perspective that failure to conceive and achieve successful pregnancy may be due to multiple factors and not specific to any gender. In addition, WHO has also emphasized that infertility is the disease of male or female reproductive system (World Health Organization, 2020).

It seemed that the aetiologies of male and female infertility were not foreign to the respondents as the students were well aware of disorders of the reproductive system either in male or female such as abnormal sperm function, injury at the scrotum or testicles as well as polycystic ovary syndrome (PCOS) and endometriosis. The majority of the respondents were also aware about the risks associated with infertility treatments such as IVF and ICSI. These findings gave an impression that students belonging to the health sciences faculty would have attended lectures and talks or may have had exposure to reproductive biology and disorders throughout their tertiary study. However, it was apparent that a high number of the respondents (64.5%) were unsure of available fertility services as well as centres which could assist in matters of infertility. This is a clear indication that perhaps fertility centres can enhance engagement efforts in order to increase the awareness on available fertility services and support in the community.

A high score with regard to concerns on IVF and ICSI (82.3%), suggested substantial concerns regarding the treatments. The *p*-value of 0.264 indicated that concerns on IVF and ICSI were not statistically significant between male and female respondents. This may be appropriate as both treatments would need the participation of both genders and economical, physical and emotional

concerns could affect anyone. One of the main issues that is closely related to services of ART is the cost implications. In the analysis of low- and middle-income countries done by Njagi et al. (2023), access to the services and the unaffordable high costs of ART have hindered the progress of infertility treatments to those who are in need. Affordability by patients can be realised with better policies and financial mechanisms which could be provided by the government. Couples who are not financially stable and unable to afford but are still planning to proceed with the fertility treatments shall undoubtedly be in debt due to the exorbitant prices of these ART services.

It is noteworthy to find that in terms of physical concerns, 58.9% of the respondents (n=73) agreed that IVF and ICSI are painful treatments but the pain is bearable. Pain is inherently a subjective experience and pain levels vary from one individual to another. As for emotional concerns, almost all of the respondents (n= 92, 74.2%) agreed that IVF and ICSI treatments will violate their privacy. Being present at a fertility centre or consulting a fertility expert may cause embarrassment to the couples as it may label them as being infertile. A previous qualitative study on women's decision-making on IVF treatment has shown that it is hard for them to reach the point of acceptance of childlessness. Being childless is something they feel forced into since facing up to the fact that they are unable to conceive is incredibly upsetting (Peddie et al., 2005).

CONCLUSION

In our study, the association between the level of knowledge of infertility and ART with the level of concerns on IVF and ICSI showed a correlation coefficient (r) of +0.249, indicating a weak positive correlation between both aspects but the association between the variables were significant ($p=0.005$). This finding showed that a good knowledge on infertility and ART among the students surveyed may not necessarily allay their concerns with regards to the infertility procedures involved. Being students who are about to graduate and possibly embarking on married life may be daunting in itself and this would be even disconcerting when planning to have children. The study by Fauser et al., (2019) recommended potential discussions between patients and stakeholders in support of infertility treatments and ART. Likewise, a heightened awareness programmes on the subject matter by the government and authorities in-charge in Malaysia could well benefit all ages of our community and especially among the young adults.

REFERENCES

Afolabi, B. M., Ajayi, A., Ajayi, V., Biobaku, O., Oyetunji, I., & Aikhuele, H. (2017). Awareness, knowledge and perception of in-vitro fertilization among final-year medical students in south-west nigeria. *International Journal of Pregnancy & Child Birth*, 2(1). <https://doi.org/10.15406/ipcb.2017.02.00007>

Department of Statistics Malaysia Official Portal. (2021). Vital Statistics, Malaysia Retrieved from <https://www.dosm.gov.my/v1/index>.

Fauser, B. C., Boivin, J., Barri, P. N., Tarlatzis, B. C., Schmidt, L., & Levy-Toledano, R. (2019). Beliefs, attitudes and funding of assisted reproductive technology: Public perception of over 6,000 respondents from 6 European countries. *PLOS ONE*, 14(1). <https://doi.org/10.1371/journal.pone.0211150>

Götmark, F., Andersson, M. (2020). Human fertility in relation to education, economy, religion, contraception, and family planning programs. *BMC Public Health* 20, 265. <https://doi.org/10.1186/s12889-020-8331-7>

Kaliarnta, S., Nihlén-Fahlquist, J., & Roeser, S. (2011). Emotions and ethical considerations of women undergoing IVF-treatments. *HEC forum: an interdisciplinary journal on hospitals' ethical and legal issues*, 23(4), 281-293. <https://doi.org/10.1007/s10730-011-9159-4>

Maheshwari, A. (2020). *Obstetrics, Gynaecology & Reproductive Medicine*, 30(2), 48-54. doi:<https://doi.org/10.1016/j.ogrm.2019.11.002>

Njagi, P., Groot, W., Arsenijevic, J., Dyer, S., Mburu, G., & Kiarie, J. (2023). Financial costs of assisted reproductive technology for patients in low- and middle-income countries: a systematic review.

Human reproduction open, 2023(2), hoad007. <https://doi.org/10.1093/hropen/hoad007>

Nouri, K., Huber, D., Walch, K., Promberger, R., Buerkle, B., Ott, J., & Tempfer, C. B. (2014). Fertility awareness among medical and non-medical students: A case-control study. *Reproductive Biology and Endocrinology*, 12(1). <https://doi.org/10.1186/1477-7827-12-94>

OECD (2023), Fertility rates (indicator). Retrieved from <https://data.oecd.org/pop/fertility-rates.htm> doi: 10.1787/8272fb01-en

Peddie, V. L., van Teijlingen, E., & Bhattacharya, S. (2005). A qualitative study of women's decision-making at the end of IVF treatment. *Human Reproduction*, 20(7), 1944-1951. <https://doi.org/10.1093/humrep/deh857>

Pedro, J., Brandão, T., Schmidt, L., Costa, M., & Martins, M. (2018). What do people know about fertility? A systematic review on fertility awareness and its associated factors. *Upsala Journal of Medical Sciences*, 123, 71 - 81. <https://doi.org/10.1080/03009734.2018.1480186>.

Ramli, N., Rahman, N. A. A., & Haque, M. (2018). Knowledge, Attitude, and Practice Regarding Osteoporosis Among Allied Health Sciences Students in a Public University in Malaysia. *Erciyes Medical Journal/Erciyes Tip Dergisi*, 40(4)

Wennerholm U, Bergh C. (2020). Perinatal outcome in children born after assisted reproductive technologies. *Upsala Journal of Medical Sciences*, 125(2), 158-166. <https://doi.org/10.1080/03009734.2020.1726534>

Woodward, B. (2018). In Vitro Fertilization and Intracytoplasmic Sperm Injection. *Clinical Reproductive Science*, 291. <http://dx.doi.org/10.1002/9781118977231.ch24>

World Health Organization. (2020). Infertility. World Health Organization. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/infertility>

World Health Organization. (2023). Infertility prevalence estimates. Retrieved from <https://www.who.int/publications/i/item/978920068315>