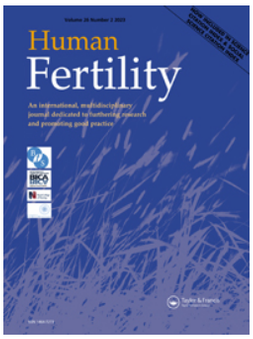

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ORIGINAL ARTICLE

Fertility awareness education improves fertility cycle knowledge and may reduce time-to-pregnancy in subfertile women

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ABSTRACT

Research suggests that low fertility awareness (FA) may be a contributing factor to infertility. The aim of this study was to determine whether education improves knowledge in FA and to explore the associations between FA knowledge and time to pregnancy (TTP). A 20-point self-administered FA questionnaire (FAQ) was completed by 180 subfertile women on their first visit to a hospital-based fertility assessment and research clinic, followed by an education session on FA. Women completed the same FAQ after receiving the education session. There was an increase in the FAQ score after the women received FA education (post-education FAQ score: mean, M = 15.68, SD = 1.8) compared with the score before the session [(pre-education FAQ score: M = 13.87, SD = 1.9), $t(179) = -10.547$, $p < 0.001$]. Pregnancy was achieved in 88 women (49%). Women with a higher post-education FAQ score (≥15 points) had a shorter TTP (M = 6.4 months, SD = 4.1) than women with post-education FAQ scores <15 [M = 8.8 months, SD = 6.0, $t(86) = 2.231$, $p = 0.028$]. Greater time trying to conceive was negatively predictive of the hazard for achieving a pregnancy (b = –0.021, se = 0.008, $p = 0.005$), while age had no significant effect. FA knowledge in women attending a fertility clinic significantly improved after education. Higher FA may reduce TTP in subfertile women who are actively trying to conceive naturally.

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KEYWORDS
Fertility awareness; fertility education; fertility knowledge; subfertility; fertility clinic

Introduction

Fertility awareness (FA) is defined as the understanding of reproduction, fecundability and related individual and non-individual risk factors that affect family planning (Zegers-Hochschild et al., 2017). Fertility awareness methods can be used to avoid pregnancy, achieve pregnancy or as a way to monitor a woman's reproductive health (Danis et al., 2017). Healthcare professionals need comprehensive knowledge of FA so they can assist women who are seeking help for infertility by (1) identifying fertile and infertile periods, (2) detecting pathologies, and (3) contributing to education on affectivity and sexuality (Vigil et al., 2012).

Studies that assessed fertility knowledge in university students (Alfaraj et al., 2019; Lucas et al., 2015; Meissner et al., 2016) and in medical students (Danis et al., 2017; Roberts et al., 2020; Vujčić et al., 2017) report a sub-optimal fertility knowledge among these populations. Infertile women attending fertility clinics have sub-optimal FA knowledge and this may be a contributing factor among women trying to conceive naturally (Hampton et al., 2013). There is a need to further explore the FA knowledge of women with infertility in the hospital setting. While the previous research has explored the FA knowledge of women attending an assisted reproductive technology (ART) clinic (Hampton et al., 2013), general practice (Hampton & Mazza, 2015), and in the general population (Bunting et al., 2013), the knowledge of women referred by their general practitioner (GP) to a hospital-based non-ART fertility clinic is currently unknown.

While previous research has suggested that timing intercourse with the fertile phase of the menstrual cycle improves pregnancy rates (Wilcox et al., 1995), other research has shown that it makes no difference in time-to-pregnancy (TTP) (Manders et al., 2015) or fecundability (Stanford et al., 2014). It is unknown whether increased fertility knowledge is associated with a shorter TTP. In the context of poor FA broadly in the population, and particularly with infertile

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women, it is important to determine whether the provision of formal education improves this knowledge and understanding. The aim of this study was to determine whether a standardised 1h 30 min education session on FA improves women's knowledge of FA. A secondary aim was to explore preliminarily the associations between FA knowledge and TTP.

Materials and methods

Participants

Women in this study were outpatients in the Fertility Assessment and Research (FAR) Clinic of the Mater Mothers' Hospital in Brisbane, Australia. All women were referred by their general practitioner for their diagnosed subfertility (at least 12 months attempting to achieve pregnancy) and attended the FAR clinic seeking fertility assessment and treatment between 2016 and 2021. A total of 180 consecutive women completed a post-intervention FA questionnaire and were included in this study.

Questionnaires

This was a pre-test/post-test study of FA knowledge. All women were asked to complete two preliminary questionnaires (a demographic woman's medical history questionnaire and a fertility awareness questionnaire (FAQ)), prior to receiving a standardised 1h 30min FA education session on the sympto-thermal method, delivered by a midwife accredited by the Australian Council of Natural Family Planning (ACNFP). After attending the session, women were asked to complete only the FAQ again.

1. Woman's medical history questionnaire–included demographic information, conceiving-related behaviour, menstrual and gynaecologic history, family planning (e.g., time trying to conceive), pregnancy history, previous fertility investigations and treatment, medication use and medical history.
2. Fertility awareness questionnaire–Consisted of 20 statements, designed to assess a woman's working knowledge of fertility. It was designed by specialists in obstetrics and gynaecology and midwives accredited by the ACNFP and tested by eight clinicians with expertise in FA. Amendments were made as a result of the pilot testing and some statements were re-written to provide clarity or avoid ambiguity. The questionnaire underwent an ethical review before being launched as part of the clinical service. Knowledge of fertility for purposes of family planning was assessed with 20 true/false statements across five domains: (1) Lifestyle (four statements: *'Alcohol does not affect body temperature'; 'Stress can alter or stop your menstrual cycle'; 'Fertility is a joint responsibility'; 'Weight change can alter your fertility'*), (2) Physiology (six statements: *'Women are fertile for about 12-20 hours per menstrual cycle'; 'The menstrual cycle is divided into two main phases'; 'Most women ovulate on day 14'; 'The post-ovulation phase is known as luteal phase'; 'The post-ovulation phase is variable in length for each woman'; 'The corpus luteum produces oestrogen'*), (3) Male factor (three statements: *'Sperm can live for 3-7 days in fertile cervical mucus'; 'Fertility relies on egg and sperm survival, and cervical mucus quality'; 'Sperm take about 3 months to reach maturity'*), (4) Charting (four statements: *'Temperature is known to rise after an ovulation'; 'Fertile mucus is usually clear, stretchy, and lubricative'; 'A temperature rise is defined as a 0.2 degree Celsius rise for 3 days'; 'A vaginal temperature needs to be taken upon waking, at about the same time'*) and (5) Pregnancy (three statements: *'The other important hormone in the cycle is known as HCG'; 'The first signs of pregnancy include fatigue, breast tenderness, bloating'; 'Urine pregnancy tests will usually be positive by day 8 post ovulation'*). A score was allocated to each respondent, based on the number of correct answers (out of 20 possible points). A higher score represented higher FA/knowledge.

Statistical analysis

Formal participant analysis included a descriptive review of demographics and FAQ scores, a cumulative time to pregnancy rate and an exploration of the fertility awareness score and pregnancy achievement outcome. Participants' characteristics were summarised by descriptive statistics (absolute and relative frequencies for categorical variables). Prevalence of pregnancy was calculated and TTP, was defined as the time (expressed in months) needed to reach pregnancy from when the woman first attended the FAR clinic and undertook the educational intervention. Descriptive statistics were used to summarise the correct answers to each of the statements in the FAQ. A computed score was created from correct answers to questions in the FAQ, each correct answer was allocated a score of 1, 20 being the maximum possible. A paired sample *t*-test was conducted to calculate the

mean differences between FA scores pre and post-education sessions. Change scores from pre and post-education questionnaires were also calculated.

Cumulative pregnancy rates by TTP were calculated by using the log-rank (Mantel Cox) test applied to the Kaplan-Meier method to build survival curves. Comparisons were carried out between women with higher (≥15) or lower (<15) post-education scores in the FAQ and between categories in change scores from the questionnaires completed at baseline (pre) and after (post) FA education. Change scores were categorised as: (1). Decreased, (2). Increased 1 to 4 points and (3). Increased ≥5 points. Additionally, Cox proportional hazards survival regression analyses were performed to assess the effects of individual predictors (such as time trying to conceive (TTC) and woman's age) on the shape of the survival curve. To further explore the relationships between FA and pregnancy, Chi-square tests were used to compare the questionnaire scores of women who achieved a pregnancy with those who did not achieve a pregnancy. All analyses were conducted using SPSS Statistics version 25. Significance was set at $P < 0.05$.

Ethical approval

This study was conducted in accordance with the *National Health and Medical Research Council's (NHMRC) National Statement on Ethical Conduct in Human Research (2007), updated 2018* and was approved by the Mater Misericordiae Ltd Human Research Ethics Committee (EC00332) (Approval # AM/MML/44585). All participants provided informed written consent. All collected data were anonymised and de-identified prior to analysis.

Results

Participants' characteristics

Table 1 describes the socio-demographic, behavioural, health characteristics and menstrual history of the participants. Notably, the average age was 32.5 years (SD 7.2) and the average body mass index (BMI) was 25.8 kg/m^2 (SD 5.3) while a quarter of women reported having irregular periods. Women were also asked to report their pregnancy history (Table 2). Of note, forty per cent had never been pregnant, while 30% had experienced a live birth. Another 40% reported experiencing at least one miscarriage. Upon review of the gynaecological and infertility investigations undertaken in this subfertile population showed that thirty-one per cent had undertaken tubal flow studies, and a fifth had previously undergone laparoscopic surgery. Previous gynaecological history and fertility journey (Table 3) disclosed one fifth diagnosed with polycystic ovarian syndrome and 7% previously having undertaken IVF. Additional information concerning the frequency and timing of intercourse, medications, supplements, and other therapies used by the participants are presented in Supplementary Tables 1 and 2.

Table 1. Socio-demographic, behavioural and health characteristics of the participants included in the study.

Characteristic	*N* (%)
Socio-demographic	
Age (years)	
17–23	11 (6.1)
24–29	40 (22.2)
30–35	68 (37.8)
36–41	47 (26.1)
42–47	9 (5.0)
≥48	2 (1.1)
Missing	3 (1.7)
Behavioural	
Smoking (# cigarettes/day)	
None	165 (91.7)
1 to 9	4 (2.3)
10 or more	4 (2.3)
Missing	7 (3.9)
Health	
Body mass index	
Underweight (<18.5 kg/m)	6 (3.3)
Normal weight (18.5–24.9 kg/m^2)	91 (50.6)
Overweight (≥ 25 kg/m^2)	47 (26.1)
Obese (≥30 kg/m^2)	36 (20.0)
Menstrual history	
Age at menarche	
≤10	9 (5.0)
11 to 13	117 (65.0)
14 to 16	50 (27.8)
≥17	3 (1.7)
Missing	1 (0.6)
# of days of bleeding	
None	1 (0.6)
1 to 4	58 (32.2)
5 to 8	110 (61.1)
9 to 12	6 (3.3)
≥13	3 (1.7)
Cycle regularity	
Regular	113 (62.8)
Irregular	52 (28.9)
No periods	8 (4.4)
Missing	7 (3.9)
Period pain requiring prescription medication	
No	154 (85.6)
Yes	23 (12.8)
Missing	3 (1.7)
Bowel disturbances at the time of period	
No	110 (61.1)
Yes	68 (37.8)
Missing	2 (1.1)
Blood in bowel motions at time of period	
No	170 (94.4)
Yes	6 (3.3)
Missing	4 (2.2)

Fertility awareness

Questions in the 'lifestyle' domain (alcohol, stress, weight) were responded correctly by the majority of

Table 2. Pregnancy history reported by the participants.

Characteristic	None N (%)	One N (%)	Two N (%)	Three N (%)	Four N (%)	Five or more N (%)
Gravity	77 (42.8)	38 (21.1)	24 (13.3)	12 (6.7)	12 (6.7)	17 (9.5)
Parity	128 (71.1)	42 (23.3)	6 (3.3)	4*(2.3)		
Miscarriages		29 (16.1)	18 (10.0)	15 (8.3)	13^ (7.3)	
Termination		16 (8.9)	5 (2.8)			
Ectopic		8 (4.4)				

*3 or more.
^4 or more.

Table 3. Previous gynaecological and fertility history reported by the participants.

Characteristic	*N* (%)
Gynaecological history	
Irregular bleeding	39 (21.7)
Ovarian cysts	55 (30.6)
Chlamydia	15 (8.3)
Gonorrhoea	2 (1.1)
Pelvic inflammatory disease	1 (0.6)
Symptoms of menopause	1 (0.6)
Fertility investigations	
Day 21 blood test	65 (36.1)
Pelvic ultrasound	137 (75.0)
Tubal flow studies	56 (31.1)
Hysteroscopy	25 (13.9)
D&C	31 (17.2)
Other fertility-related blood tests	85 (47.2)
Diagnoses	
Polycystic ovaries	55 (30.6)
Fibroids	26 (14.4)
Polyps	25 (13.9)
Pelvic adhesions	20 (11.1)
Unexplained recurrent miscarriage	18 (10.0)
Unexplained infertility	4 (2.2)
Endometriosis	2 (1.1)
Surgery	
Laparoscopy	39 (21.7)
Ovarian cystectomy	10 (5.6)
Endometriosis surgery	9 (5.0)
Ovarian drilling	1 (0.6)
Laparotomy	4 (2.2)
Polypectomy	1 (0.6)
Cervix surgery	16 (8.9)
Treatments	
Practiced timed intercourse 1 (Under medical guidance) add timing	26 (14.4)
Oral ovulation induction*	29 (16.1)
Attempted IUI*	11 (6.1)
Undertaken IVF	11 (6.1)
Others	
Applied for adoption	2 (1.1)

*missing data: $n = 1$.
IUI: intrauterine insemination; IVF: *in vitro* fertilization; D&C: Dilatation and curettage.

the women. At baseline, more than 95% of the women responded correctly to the four statements in this component (See Table 4). The 'physiology' component (fertility timing, duration, cycle characteristics) of the fertility awareness questionnaire had the lowest percentage of correct answers (53.2%). At baseline, 60% of the women correctly identified that women are fertile for about 12–20 hours per menstrual cycle, and three-quarters of the women (75.6%) knew that the menstrual cycle is divided into two main phases. Three quarters (76.6%) of women incorrectly agreed with the statement 'most women ovulate on day 14'. The overall percentage of correct answers in this component increased to 61% after the fertility awareness education was received.

Baseline knowledge of the 'male factor' domain (sperm health) showed broad understanding at 73% correct responses. However, only a third of the women could correctly identify that sperm take about three months to reach maturity. This percentage increased to 76% after women received fertility awareness education ($P = 0.002$). Almost all the women could identify the 'charting' characteristics of the fertile mucus and more than three-quarters correctly identified the true

Table 4. Correct responses to items in the fertility awareness questionnaire from pre and post-education session. Sample includes participants who completed both questionnaires.

	Correct answer (T/F)	Baseline questionnaire $N = 180$	Post-education session $N = 180$
Lifestyle			
Alcohol does not affect your body temperature.	F	162 (90.0)	164 (91.1)
Stress can alter or stop your menstrual cycle.	T	178 (98.9)	177 (98.3)
Fertility is a joint responsibility.	T	175 (97.2)	178 (98.9)
Weight change can alter your fertility.	T	173 (96.1)	175 (97.2)
Physiology			
Women are fertile for about 12–20 hours per menstrual cycle.	T	109 (60.6)	136 (75.6)
The menstrual cycle is divided into two main phases.	T	136 (75.6)	153 (85.0)
Most women ovulate on day 14.	F	44 (24.4)	65 (36.1)
The post-ovulation phase is known as the luteal phase.	T	153 (85.0)	172 (95.6)
The post-ovulation phase is variable in length for each woman.	F	17 (9.4)	27 (15.0)
The corpus luteum produces oestrogen.	T	116 (64.4)	105 (58.3)
Male factor			
Sperm can live for 3–7 days in fertile cervical mucus.	T	159 (88.3)	166 (92.2)
Fertility relies on egg and sperm survival, and cervical mucus quality.	T	173 (96.1)	178 (98.9)
Sperm take about 3 months to reach maturity.	T	60 (33.3)	137 (76.1)
Charting			
Temperature is known to rise after ovulation.	T	139 (77.2)	167 (92.8)
Fertile mucus is usually clear, stretchy, and lubricative.	T	175 (97.2)	179 (99.4)
A temperature rise is defined as a 0.2 degree Celsius rise for 3 days.	T	140 (77.8)	162 (90.0)
A vaginal temperature needs to be taken upon waking, at about the same time.	T	136 (75.6)	175 (97.2)
Pregnancy			
The other important hormone in the cycle is known as HCG.	F	47 (26.1)	64 (35.6)
The first signs of pregnancy include fatigue, breast tenderness, and bloating.	T	159 (88.3)	175 (97.2)
Urine pregnancy tests will usually be positive by day 8 post ovulation.	T	98 (54.4)	97 (53.9)

T: True; F: False; HCG: Human chorionic gonadotropin.

statements about temperature rise at and after ovulation. A further improvement in this knowledge was observed in the post-education questionnaire.

Exploring the 'pregnancy' component (symptoms and timings), 56% were able to correctly state the first signs of pregnancy. There was an increase in the number of women who recognised human chorionic gonadotropin (hCG) was not an important part of the menstrual cycle (26% to 36%, $P < 0.001$). The correct responses (frequencies and percentages) to each statement in the FAQ comparing pre and post-education sessions are presented in Table 4.

When mean scores of the questionnaires (from the five domains) at both time points were explored, there was a significant increase in the overall FAQ score after the women received the FA education session (post-education FA score: mean, M = 15.68, SD = 1.8) compared with the score before the session [(pre-education FA score: M = 13.87, SD= 1.9), $t(179) = -10.547$, $P < 0.001$].

Time-to-pregnancy

Of the 180 women completing both pre and post-FAQs, 88 achieved a pregnancy (49%). When all the pregnancies were taken into account, women with a higher post-education FA score (≥15 points) had a significantly lower TTP (M = 7.0 months, SD = 4.7) as observed represented in green in the survival curve, compared with FA scores <15 (represented in blue) [M = 8.8 months, SD = 6.0, $t(86) = 2.231$, $P = 0.028$] (Figure 1). To assess whether the age of the study women could affect TTP, the mean age at which the pregnancies occurred in the two groups of women (those whose FAQ score was <15 vs ≥15 points) was compared. Women's age was not significantly different in the groups explored [FAQ score <15 points: mean age = 31.1, SD = 6.7; FAQ score ≥15 points M = 30.9, SD = 7.5, $t(86) = 0.094$, $P = 0.911$].

In our analysis, a prolonged time of subfertility correlated to a negative likelihood of achieving pregnancy during this study (b=–0.021, se = 0.008, P = 0.005), while the age of the participants had no significant effect on the survival curve (b = 0.005, se = 0.019, $P = 0.806$). When change scores in FAQs (comparing pre-to-post education scores) were explored, mean TTP in women whose FA score increased (increased 1 to 4 points: M = 7.55 months, SD = 4.8; increased 5 points or more: M = 3.32 months, SD = 1.5) was shorter than in women whose score decreased (M = 9.14 months, SD = 7.1) ($P = 0.002$).

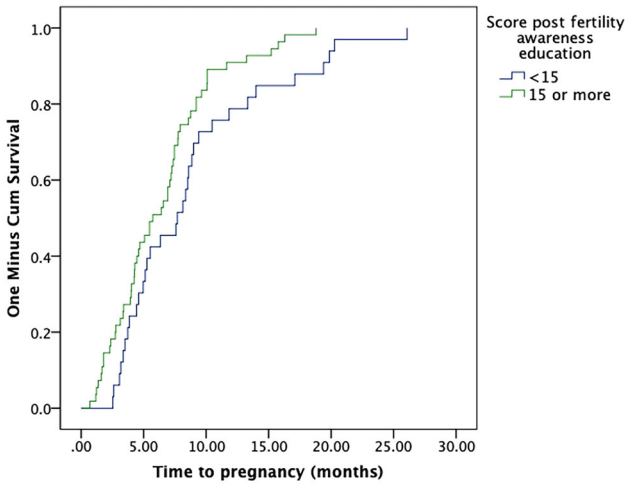

Figure 1. Cumulative pregnancy rates stratified by scores post fertility awareness education.

Discussion

The aim of this study was to determine whether education improves knowledge in fertility awareness and to explore in a preliminary way the associations between fertility awareness knowledge and time-to-pregnancy. This study also provides information about the demographics and reproductive health history of a small cohort of subfertile Australian women and adds to the limited available literature surrounding fertility awareness knowledge. This study's focus is on medically diagnosed subfertile women who wish to conceive naturally. This is a population in which fertility knowledge and its impact on time-to-pregnancy is an important clinical question.

The average age of women in this study (32.5 years) was approximately eighteen months more than the rising national average age of women who gave birth in Australia in 2019 (30.8 years). This seems to reflect the trend in delayed parenthood that is observed (Beaujouan, 2020) and our study findings may be applicable to the broader population of preconception women. Previous fertility focussed investigations included pelvic ultrasound in the majority of women, and at least a Day 21 blood test and tubal flow studies in a third of women. While the Day 21 test of ovulation is problematic in women with long or irregular cycles, it does highlight the care and attention offered in general practice prior to referral.

When assessing FA in this study population, pre-intervention knowledge levels were generally better than previously reported elsewhere (Mahey et al., 2018). It may be that once a woman receives a diagnosis of subfertility, knowledge of FA is self-acquired, in an attempt to understand or improve fertility. Indeed, previous research has shown that interest in FA rises sharply in women who experience infertility (Hampton et al., 2013) likely explaining the higher levels of FA knowledge observed in our study.

Most women were aware of lifestyle factors that can affect fertility (Stern et al., 2013), and most were knowledgeable of the role of the male factor in fertility. It is important to note the 'physiology' component of the questionnaire had the lowest percentage of correct answers. We observed that after women attended the education session, their post-intervention knowledge generally improved. It is possible that there was more margin for improvement in some women if their FA knowledge was low at baseline, highlighting the importance of individualised fertility education, where possible, in this clinical space. More importantly, those women who performed better in the post-education questionnaire, displaying a better-working fertility knowledge reduced their TTP. This relationship however was affected by time TTC as our results showed that greater time TTC was negatively predictive of the hazard of achieving a pregnancy. On the other hand, we observed that the age of the participants had no significant effect on the survival curve.

One benefit of this secondary healthcare programme (as women were referred by their general practitioner in primary care) is that it offers midwife-led and case-managed care, allowing for the continuity of patient-centred care. A previous study has shown that the provision of formal education improves the standardisation of care (Perez Capotosto, 2021) and this approach seems to be supported in our infertility cohort.

Strengths and limitations

The strengths of this study include the strong patient-centred focus, the inclusion of a FAQ with clear, identifiable themes and the objective scoring of individual fertility knowledge. This is the first time, to our knowledge, that FA and time-to-pregnancy have been explored in a sample of subfertile women.

One limitation of this study is the inclusion of only subfertile women with a desire to conceive naturally, being a cohort more likely to be motivated to learn and retain FA knowledge and introducing a recognised bias. Additionally, these findings do not take into account absolute medical or surgical factors for infertility when considering the pregnancy rate, given these questionnaires were undertaken at the start of their diagnostic and treatment journey. Our findings may not be applicable to other culturally diverse communities where a standardised fertility education

model may not be helpful. Furthermore, this study relied on self-reported reproductive history and conceiving-related behaviour, data which may be susceptible to social desirability and recall bias.

Conclusions and recommendations

Findings from this study support the need to improve fertility knowledge among women diagnosed with subfertility. A short, standardised education session objectively improves FA knowledge and seems to decrease time-to-pregnancy. Such a standardised training intervention is a feasible and affordable strategy toward optimising conceiving-related behaviour in subfertile women. We would recommend this being provided in primary care by practice nurses/midwives or through a broader formalised online platform prior to referral to secondary care providers. While this study shows promising results for increasing FA and reducing TTP, future research is needed in varying cultural and clinical care model settings.

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Disclosure of interest

No potential conflict of interest was reported by the author(s).

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References

Alfaraj, S., Aleraij, S., Morad, S., Alomar, N., Rajih, H. A., Alhussain, H., Abushrai, F., & Thubaiti, A. A. (2019). Fertility awareness, intentions concerning childbearing, and attitudes toward parenthood among female health professions students in Saudi Arabia. *International Journal of Health Sciences*, *13*(3), 34–39.

Beaujouan, E. (2020). Latest-late fertility? Decline and resurgence of late parenthood across the low-fertility countries. *Population and Development Review*, *46*(2), 219–247. https://doi.org/10.1111/padr.12334

Bunting, L., Tsibulsky, I., & Boivin, J. (2013). Fertility knowledge and beliefs about fertility treatment: Findings from the international fertility decision-making study. *Human Reproduction*, *28*(2), 385–397. https://doi.org/10.1093/humrep/des402

Danis, P. G., Kurz, S. A., & Covert, L. M. (2017). medical students' knowledge of fertility awareness-based methods of family planning. *Frontiers in Medicine*, *4*, 65. https://doi.org/10.3389/fmed.2017.00065

Hampton, K., & Mazza, D. (2015). Fertility-awareness knowledge, attitudes and practices of women attending general practice. *Australian Family Physician*, *44*(11), 840–845.

Hampton, K. D., Mazza, D., & Newton, J. M. (2013). Fertility-awareness knowledge, attitudes, and practices of women seeking fertility assistance. *Journal of Advanced Nursing*, *69*(5), 1076–1084. https://doi.org/10.1111/j.1365-2648.2012.06095.x

Lucas, N., Rosario, R., & Shelling, A. (2015). New Zealand University students' knowledge of fertility decline in women via natural pregnancy and assisted reproductive technologies. *Human Fertility*, *18*(3), 208–214. https://doi.org/10.3109/14647273.2015.1006694

Mahey, R., Gupta, M., Kandpal, S., Malhotra, N., Vanamail, P., Singh, N., & Kriplani, A. (2018). Fertility awareness and knowledge among Indian women attending an infertility clinic: A cross-sectional study. *BMC Women's Health*, *18*(1), 177. https://doi.org/10.1186/s12905-018-0669-y

Manders, M., McLindon, L., Schulze, B., Beckmann, M. M., Kremer, J. A., & Farquhar, C. (2015). Timed intercourse for couples trying to conceive. *The Cochrane Database of Systematic Reviews*, (3), CD011345. https://doi.org/10.1002/14651858.CD011345.pub2.

Meissner, C., Schippert, C., & von Versen-Höynck, F. (2016). Awareness, knowledge, and perceptions of infertility, fertility assessment, and assisted reproductive technologies in the era of oocyte freezing among female and male university students. *Journal of Assisted Reproduction and Genetics*, *33*(6), 719–729. https://doi.org/10.1007/s10815-016-0717-1

Perez Capotosto, M. (2021). An integrative review of fertility knowledge and fertility-awareness practices among women trying to conceive. *Nursing for Women's Health*, *25*(3), 198–206. https://doi.org/10.1016/j.nwh.2021.04.001

Roberts, L. M., Kudesia, R., Zhao, H., Dolan, S., & Rose, M. (2020). A cross-sectional survey of fertility knowledge in obstetrics and gynecology residents. *Fertility Research and Practice*, *6*(1), 22. https://doi.org/10.1186/s40738-020-00091-2

Stanford, J. B., Smith, K. R., & Varner, M. W. (2014). Impact of instruction in the Creighton model fertilitycare system on time to pregnancy in couples of proven fecundity: Results of a randomised trial. *Paediatric and Perinatal Epidemiology*, *28*(5), 391–399. https://doi.org/10.1111/ppe.12141

Stern, J., Larsson, M., Kristiansson, P., & Tydén, T. (2013). Introducing reproductive life plan-based information in contraceptive counselling: An RCT. *Human Reproduction*, *28*(9), 2450–2461. https://doi.org/10.1093/humrep/det279

Vigil, P., Blackwell, L. F., & Cortés, M. E. (2012). The importance of fertility awareness in the assessment of a woman's health a review. *The Linacre Quarterly*, *79*(4), 426–450. https://doi.org/10.1179/002436312804827109

Vujčić, I., Radičević, T., Dubljanin, E., Maksimović, N., & Grujičić, S. (2017). Serbian medical students' fertility awareness and attitudes towards future parenthood. *The European Journal of Contraception & Reproductive Health*, *22*(4), 291–297. https://doi.org/10.1080/13625187.2017.1368478

Wilcox, A. J., Weinberg, C. R., & Baird, D. D. (1995). Timing of sexual intercourse in relation to ovulation—Effects on the probability of conception, survival of the pregnancy, and sex of the baby. *The New England Journal of Medicine*, *333*(23), 1517–1521. https://doi.org/10.1056/NEJM199512073332301

Zegers-Hochschild, F., Adamson, G. D., Dyer, S., Racowsky, C., de Mouzon, J., Sokol, R., Rienzi, L., Sunde, A., Schmidt, L., Cooke, I. D., Simpson, J. L., & van der Poel, S. (2017). The International Glossary on Infertility and Fertility Care, 2017. *Human Reproduction*, *32*(9), 1786–1801. https://doi.org/10.1093/humrep/dex234