

An Investigation into Fertility Awareness amongst the child-bearing population

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Abstract

Introduction

Fertility knowledge amongst the general population is poor with over-estimation of ability to conceive. A shift towards delayed age of first pregnancy has led to an increased need for Assisted Reproductive Techniques. The aim was to identify knowledge and attitudes towards fertility amongst the child-bearing population.

Methods

This was a cross-sectional study. An online self-report survey, The Fertility Awareness Survey, was disseminated to individuals of child-bearing age. Participants were recruited in an outpatient Gynaecology setting and via the affiliated University student database. Descriptive and inferential statistics were carried out in SPSS V26.0

Results

Of 480 respondents, 70.6% (n=339) were female and 29.3% (n=141) were male. Over 95% believe smoking (n=468) and alcohol (n=454) negatively affect fertility. The respondents feel IVF is 30 to 60% effective (n=360, 75%), with no significant gender differences. Forty-eight percent (n=228) correctly believe assistance should be sought after one year for individuals below 35 years. Gender played a significant role in beliefs regarding IVF costs, age related fertility issues and egg freezing success.

Discussion

By better understanding knowledge and attitudes towards delayed reproduction and ART, fertility care can be improved. Understanding where individuals sit with their knowledge allows dissemination of accurate information to empower informed decision-making.

Abbreviations:

ART: Assisted Reproductive Techniques

IVF: In Vitro Fertilisation

CUMH: Cork University Maternity Hospital

CREC: Clinical Research Ethics Committee of the Cork Teaching Hospitals

HFEA: Human Fertilisation and Embryology Authority.

Introduction

Fertility knowledge amongst the general population is poor with international findings repeatedly showing this.^{1,2} Individuals repeatedly over-estimate their ability to conceive.^{2,3,4} Society has shifted towards delayed child-bearing and age at first pregnancy. The Irish Central Statistics Office report that between 1975 and 2015 the average age of first-time mothers rose by 7.5 years inside marriage.⁵ This is also evident throughout Europe with births to mothers aged 30 and above at over 40%.^{2,6} Further afield, first birth rates in American women over 35 increased 6-fold over the last 40 years and continue to rise.⁷

There is not one reason for this, rather it is a combination of complex medical, social, financial, educational and employment factors. The make-up of families and women's careers have changed alongside improved contraceptive access and Assisted Reproduction Techniques (ART), altering fertility perceptions.²

Despite societal changes, the consequences of delaying child-bearing cannot be ignored. These include increasing infertility, dependency on reproductive medicine and complex maternal and fetal outcomes.² Ultimately such delays can lead individuals and couples to have fewer children than expected, or none, with many regretting their wait.^{2,8,9,10,11}

These consequences are likely to be more acceptable if informed decisions were made. Would as many individuals postpone child-bearing if they were aware of age-related fertility decline, ART limitations, the potential adverse maternal and child outcomes associated with older parents and the possibility of permanent childlessness?² Furthermore, in some jurisdictions ART is not equally accessible. The Irish Government currently do not fund fertility treatment for the general public however this is set to change from September 2023. At time of writing, it was estimated '3,000 couples may be able to avail of publicly funded IVF' this year.¹² Essentially, the financial cost of ART as well as unequal access means delaying reproduction can have significant burdens. As an example, the average price of one fresh ART cycle in 2006 in the United States was 13,048 dollars, equivalent to 46% of annual disposable income.^{13,14} The Centers for Disease Control and Prevention reported that 'non-Hispanic black women are over 80% more likely to report infertility than non-Hispanic white women, but they are over 20% less likely to receive any fertility services', further highlighting these inequalities.^{13,15,16}

The question posed by Daniluk et al. (2012)², and replicated here, is what exactly do individuals of child-bearing age know about fertility, ART and what are their attitudes? A global study of 17,500

individuals revealed that knowledge is scant^{1, 2} It has also been shown that women overestimate their times of ovulation and their most fertile period.^{2,3,17,18,19} Attitudes towards ART have evolved and are now part of daily discourse, especially In Vitro Fertilisation (IVF).² A study of 8,000 adults worldwide showed almost 90% had heard of IVF but under 25% know what is involved, the success rates and costs associated.^{2,3} More recently, as elective oocyte preservation becomes more accessible for some, women of child-bearing age underestimate the effect of age-related fertility changes and overestimate how successful ART are.^{2,3,11,17,18,19}

The aims of this study are to identify the knowledge and attitudes to fertility, ART and delayed child-bearing amongst the Irish population. By understanding reasons for delaying, assessing knowledge base, and understanding attitudes to ART, fertility care and how it is discussed and delivered in Ireland can be improved. To our knowledge this was the first investigation of these topics in Ireland.

Methods

Study design

This was a cross-sectional study. The study was approved by the Clinical Research Ethics Committee of the Cork Teaching Hospitals (CREC) in University College Cork.

Study participants

Four hundred and eighty participants were recruited. The inclusion criteria was any individual over the age of 16, regardless of child-bearing status. Participants were recruited during clinics at CUMH and via the University student email database. It is impossible to generate a response rate of all clinic attenders as participants were recruited verbally first and only emailed when they agreed. The total number approached was not retained. For the student population, in 2020 UCC reported 14,263 students giving a response rate of 1.55%.

Materials

The Fertility Awareness Survey, a self-report survey based on previous work by Daniluk et al. (2012), was disseminated via email.² Male and female versions of the study were used. There were minimal differences, and these were related to sex-specific actions (e.g., egg or sperm freezing).

The Fertility Awareness Survey (FAS) includes demographic questions and two self-ratings: the first on fertility knowledge and second on ART knowledge. Twenty-eight questions using a 5-point Likert scale were used to assess fertility and ART knowledge.² Questions regarding timing of conception, when to seek assistance and success of ART were asked. Some elements of the survey were removed or altered to suit the Irish population e.g., cost of ART.

All participants answered the survey in English. To ensure anonymity and safe data collection and analysis, Google Forms was used to disseminate the survey via email.

Data analysis

All data was collected and compiled into a Microsoft Excel spreadsheet. Descriptive and inferential statistics were carried out in SPSS V26.0.

Results

Four hundred and eighty participants responded, with 70.7% (n=339) female and 29.3% (n=141) male.

Table 1: Sample characteristics by sex

	Male N (%)	Female N (%)	Total N (%)
Age in years			
<25	56(46.1)	149(44.2)	214(44.8)
25-29	9(6.4)	69(20.5)	78(16.3)
30-34	35(24.8)	80(23.7)	115(24.1)
35-39	21(14.9)	32(9.5)	53(11.1)
≥40	11(7.8)	7(2.1)	18(3.8)
Country of birth			
Ireland	122(87.1)	276(82.6)	398(84.0)
United Kingdom	7(5.0)	21(6.3)	28(5.9)
Other	11(7.9)	37(11.1)	48(10.1)
Education			
Non-degree qualification	39(28.1)	78(23.1)	117(24.6)
Undergraduate degree	64(46.0)	136(40.4)	200(42.0)
Postgraduate degree	36(25.9)	123(36.5)	159(33.4)
Employment status			
Paid employment	69(49.3)	148(43.7)	217(45.3)
Full-time student	68(48.6)	154(45.4)	222(46.3)
Other	3(2.1)	37(10.9)	40(8.4)
Relationship Status			
Married	27(19.3)	49(14.5)	76(15.9)
In a relationship	54(38.6)	163(48.1)	217(45.3)
Single	59(42.1)	127(37.5)	186(38.8)

Lifestyle factors

Over 95% believe smoking (n= 468) and alcohol (n= 454) negatively impact ability to conceive whilst 92% (n= 439) think bodyweight plays a role. Ninety-four percent (n= 451) feel diet impacts fertility. Sixty-one percent (n= 290) believe fertility supplements improve fertility. There were no significant gender differences.

Knowledge

Women were more likely to think that the age of a man is an important factor affecting a couple's fertility (2.59 (SD 1.23) vs 2.99 (SD 1.18); p=.001).

Women were more likely to believe the total cost of one IVF cycle is under 6000euro (3.37 (SD 1.09) vs 3.31 (1.06); p=0.042). Marital status, age and employment status revealed significant differences regarding IVF cost.

Female respondents were significantly more likely to report that irrespective of their age, women who use IVF have a better chance of becoming pregnant than women who do not (3.44 (SD 1.09)) vs (3.32 (SD 1.12); p<0.0001).

Women were more likely to report that there would be a significant decline in sperm quality before the age of 50 (3.05 (SD 1.11) vs 2.98 (SD:1.14); p= 0.03). The age of respondents and employment status revealed significant differences.

Men were more likely to report a progressive decrease in a woman's ability to become pregnant over 35 years (1.95 (SD 0.8) vs 1.83 (SD 0.84); p= 0.040). They were also more likely to report that a woman's weight affects fertility (2.1 (SD 1.06)) vs 1.96 (SD 0.99); p= 0.043).

Marital status and employment revealed significant differences in knowledge of egg freezing. Those who were married (3.46 (SD 0.87)) were more likely to think that by freezing her eggs a woman has at least a 50% percent chance of having a baby in comparison to single participants (3.16 (SD 0.87); p=0.002).

Table 2: Fertility Awareness Survey (FAS) knowledge item distribution, mean and standard deviation (SD).

FAS Knowledge Item	Total		Male		Female		p-value
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
There is a marked decrease in a woman's ability to become pregnant around 37 years of age	47 9	1.78(0.8 9)	14 1	1.89(0.9 7)	33 8	1.73(0.8 5)	0.81

Prior to a woman reaching menopause, ART (e.g. IVF) can help most women to have a baby using their own eggs	47 9	2.24(0.9 6)	14 1	2.18(2/2 6)	33 8	2.26(0.9 7)	.389
A woman's eggs are as old as she is	48 0	2.64(1.4 8)	14 1	2.78(1.6 1)	38 8	2.58(1.4 2)	.168
A man's age is related to an increased risk of birth defects	47 9	3.23(1.1 9)	14 1	3.20(1.1 8)	33 8	3.25(1.2 1)	.696
Taking birth control pills for more than 5 years negatively affects a woman's fertility	47 8	3.42 (1.20)	14 1	3.21(1.0 3)	33 7	3.51(1.2 6)	.011*
Using ART allow most women to have a baby with their own eggs at any age	47 7	3.52(1.0 5)	14 1	3.50(1.0 4)	33 6	3.52(1.0 6)	.848
The rates of miscarriage are significantly higher for women in their 40s than for women in their 30s, even for physically fit women in excellent health	48 0	1.82(0.9 1)	14 1	1.84(0.9 0)	33 9	1.81(0.9 1)	.803
Egg freezing before the age of 35 can significantly prolong a woman's fertility	48 0	2.41(1.0 3)	14 1	2.33(0.9 8)	33 9	2.45(1.0 5)	.237
Most couples have to go through IVF more than once to have a baby	47 7	2.27(1.0 5)	14 1	2.40(1.0 4)	33 6	2.22(1.0 6)	.082
Most Irish fertility clinics will not provide treatment to women over the age of 45	47 8	2.62(0.9 1)	14 1	2.84(0.7 9)	33 7	2.53(0.9 4)	.000*
At most fertility clinics in Ireland there are no age	47 7	3.53(0.9 3)	14 1	3.40(0.8 7)	33 7	2.53(0.9 4)	.042*

restrictions on when a woman can receive treatment							
In vitro fertilization (IVF) success rates differ depending on a woman's age	47 7	2.01(0.8 3)	14 1	1.99(0.7 9)	33 6	2.01(0.8 4)	.791
By freezing her eggs a woman has a least a 50% chance of having a baby	47 8	3.15(0.9 4)	14 1	3.11(0.8 8)	33 7	3.17(0.9 7)	.577
Sexually transmitted infections such as Chlamydia and Gonorrhoea are high risk factors for infertility	47 9	1.87(0.9 9)	14 1	1.93(1.0 5)	33 8	1.85(0.9 7)	.422
Women over 35 years are more likely to have a baby with chromosomal abnormalities such as Downs Syndrome compared with younger mothers	47 9	1.94(1.0 3)	14 1	2.00(1.1 1)	33 8	1.92(0.9 9)	.423
When using in vitro fertilization (IVF) there are no associated risks for a woman	47 9	4.02(0.8 9)	14 1	3.95(0.8 7)	33 8	4.04(0.9 0)	.295
When using in vitro fertilization (IVF) there are no associated risks for a child	47 8	3.58(1.0 2)	14 1	3.56(1.0 1)	33 7	3.56(1.0 3)	.393
The majority of fertility problems are female- related	47 8	3.64(1.0 8)	14 1	3.58(1.1 0)	33 7	3.67(1.0 7)	.409
With fertility treatments a woman in her 40s has at least a 50% chance of having a baby using her own eggs	47 7	3.17(0.9 3)	14 1	3.12(0.7 8)	33 6	3.20(0.9 8)	.415

The upper age limit for a man to be treated at most Irish fertility clinics is 55 years of age	47 4	2.75(0.7 9)	14 1	2.10(1.0 6)	33 6	1.90(0.9 5)	.245
Smoking cigarettes or marijuana can reduce the quality of a man's sperm	47 7	1.63(0.8 4)	14 1	1.63(0.8 6)	33 6	1.63(0.8 4)	.998
Children born to fathers over the age of 45 have higher rates of learning disabilities, autism, schizophrenia and some forms of cancer	47 6	3.08(1.0 9)	14 1	3.06(1.1 4)	33 5	3.09(1.0 7)	.793

Success rates and when to seek treatment

Seventy-five percent of participants (n=360) feel that IVF is between 30 and 60% successful regarding live-birth rates. There were no gender differences.

Higher proportions of participants think IVF will be successful if completed under 35 years. Overall, the success rates reported for IVF use over the age of 35 are more in line with how successful respondents feel IVF is in general.

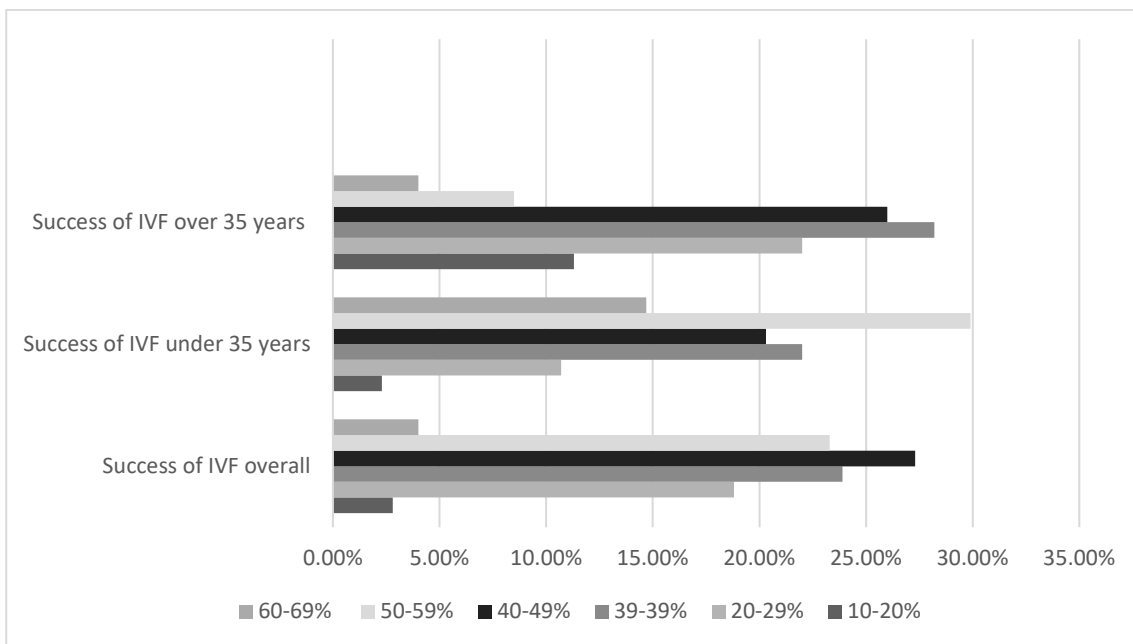


Fig 1: Perception of IVF success

Under half of all respondents (48%, n=228) correctly believe individuals should seek treatment after one year of trying to conceive under the age of 35. In addition, 40% (n=189) correctly believe individuals over the age of 35 should seek assistance after 6 months. The gender difference noted relates to when individuals under the age of 35 should seek assistance with men believing it should be earlier than women think $\chi^2(1, N=474) = 17.46, p < .005$.

Entitlement to fertility treatment

Age played an important role in perception of right to ART. Respondents over the age of 40 were significantly less likely to believe that anyone has the right to IVF compared to those under 40. This discrepancy was noted across heterosexual couples, same sex couples (male or female), single women and men, transgender men and women. For example, individuals over the age of 40 (7.06 SD (2.6)) were less likely to think heterosexual couples are entitled to IVF than those between 35 and 39 (7.92 SD (1.23)); $p=0.0002$).

Knowledge sources

Table 3: Most popular knowledge sources for fertility information

Preferred knowledge sources	Male (N=97)	Female (N=224)	Total (N=321)
Family & Friends	22.5% (31)	24.7% (82)	23.5% (113)
Internet	11.6% (16)	28.6% (95)	23.1% (111)
Books, magazines, literature	36.2% (50)	14.2% (47)	20% (97)

Discussion

This study supports international findings of gaps in understanding and awareness.^{2,3,6} Although knowledge regarding lifestyle factors and fertility is strong, discrepancies in individuals' perception of fertility, ART and its success remain. The population studied were young and well-educated. Despite potentially posing limitations, it could be argued that it is younger people who need the most education regarding these topics. Notable results included significant differences in perceptions of IVF cost, success of egg freezing and decline in sperm quality.

The predominant age group of respondents was under 25 (44.8%). This was followed by another crucial audience, those aged 30-34 years (24.1%). The main reason for this is a university database was the primary recruitment method. The results obtained from these groups provide information regarding educational needs dependent on life stage. It is likely that the majority of under 25s are not currently considering child-bearing, reinforced by the fact that the average age of Irish mothers

in 2018 was 32.9.²⁰ Reassuringly, almost half of all participants were correct in their responses regarding timing of seeking assistance to conceive.

In 2019 the Irish Times reported that most IVF clinics were advertising one cycle between €4,500 and €5,000 euro for standard care.²¹ In addition to women believing IVF costs less than €6,000, findings show that married respondents, over 40s and individuals involved in unpaid work were more likely to believe the cost of one cycle is under 6000 euro. It may be that more women, married individuals and those over 40 years have investigated IVF cost. This lack of awareness has been identified before with less than 25% of 8194 adults worldwide correctly estimating ART'S financial burden.³

Responses to egg freezing success varied. Both married individuals and student responders were more likely to agree that 'by freezing her eggs a woman has at least a 50% chance of having a baby'. The Human Fertilisation and Embryology Authority (HFEA) report that women who use their own frozen eggs for treatment have a success rate of 18% for livebirth, yet this is still less than the 26% success rate of IVF overall.²² Perhaps married individuals have not considered egg freezing as readily as others. The same could be argued for younger students, it may be abstract, leading to heightened idealisation. Benzies et al. found women were confident that ART would assist them in conceiving if needed²³, like the unrealistic success rates cited by some respondents.

Women, individuals over the age of 40 and those who identified as "Other" regarding employment status were more likely to report that there would be a significant decline in quality of a man's sperm before the age of 50. A 2011 review stated that male age impacts reproduction and fertility.²⁴ It is possible that women, and those over 40, have greater insight regarding the impact of male fertility, due to lived experience.

The strengths of this study lie in the broad assessment of awareness and knowledge. Completing this survey in Ireland allows for understanding and confirmation of knowledge and attitudes internationally. Finally, the age of respondents is a strength as the majority were either under 25 or between 30 and 34. These are key categories for fertility education with the former requiring general guidance and the latter needing focused, specific information.

This study assessed individuals with and without children. This adds an interesting perspective to the survey initially used amongst childless women.² By surveying those with and without children, a broader view of delayed child-bearing and ART attitudes was obtained. It is reasonable to suggest that by assessing childless individuals only, analysis regarding their delay in child-bearing, by choice or not, could be skewed in favour of ART. This does not appear to have occurred. Ultimately by examining a variety of individuals, overall knowledge and attitudes can be understood before more specific nuances are accounted for.

These results must be acknowledged in the context of limitations. As discussed in a study of Obstetric trainees' fertility knowledge, email-based recruitment leads to self-selection bias.²⁵ This renders researchers unable to compare characteristics and answers of non-responders and so results may not be an accurate representation of the population.²⁵ In addition, gender bias was also evident with a skew towards females. Considering the subject matter and the process of recruitment for some participants through clinics, it is not surprising. Within the female population studied, the age range is slightly younger than previous work. It should be highlighted that overall the population surveyed were of a higher socio-economic status than the general population; 42% of all respondents completed undergraduate degrees and over 90% of participants were either in paid employment or full-time education. These results are only a snapshot of a far more diverse child-bearing population in Ireland.

Regarding future research, the differences in knowledge and ART amongst those with children could be explored. In addition, identifying differing trends between populations could give insight into where education is needed. The differing social reasons for delay in child-bearing amongst groups (e.g., student versus employed) could provide ample understanding of how needs can be met in a streamlined fashion.

Conclusion

This research is the first to survey the knowledge and attitudes of an Irish child-bearing population towards fertility and ART. Although encouraging results suggest the general population have some basic knowledge regarding fertility, there is broad scope for enhanced education, communication, and decision-making.

Declarations of Conflicts of Interest:

None declared.

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References:

1. American Fertility Association. World Fertility Awareness Month. What you never know about fertility. American Fertility Association 2006.
2. Daniluk J, Koert E, Cheung, E. Childless women's knowledge of fertility and assisted human reproduction: identifying the gaps. *Mental Health, Sexuality and Genetics. Fertil Steril* 2012 Feb 97.
3. Adashi EY, Cohen J, Hamberger L, et al. Public perception on fertility and its treatment: an

- international survey. *Hum Reprod* 2000; 15: 330–4.
4. Blake D, Smith D, Bargiacchi A, et al. Fertility awareness in women attending a fertility clinic. *Aust New Zealand Journal of Obstetrics and Gynaecology* 1997; 37: 350–2.
 5. Central Statistics Office. Population and Labour Force Projections, 2017-2051. Available from <https://www.cso.ie>.
 6. Nicoletti C, Tanturri ML. Differences in delaying motherhood across European countries: empirical evidence from the ECHP (Rep. No. 2005–04). Colchester: University of Essex, Institute for Social and Economic Research; 2005.
 7. Shadyab AH, Gass MLS, Stefanick ML, et al. Maternal Age at Childbirth and Parity as Predictors of Longevity Among Women in the United States: The Women’s Health Initiative. *Am J Public Health* 2017; 107: 113-119.
 8. Maheshwari A, Porter M, Shetty A, et al. Women’s awareness and perceptions of delay in childbearing. *Fertil Steril* 2008; 90: 1036–42
 9. Berrington A. Perpetual postponers? Women’s, men’s and couple’s fertility intentions and subsequent fertility behaviour. *Popul Trends* 2004; 117: 9–19.
 10. Stephen EH, Chandra A. Updated projections of infertility in the United States: 1995–2015. *Fertil Steril* 1998; 70: 30–4.
 11. The Practice Committee of the American Society for Reproductive Medicine. Aging and infertility in women. *Fertil Steril* 2006; 86: S248–52.
 12. Regan, M. 3,000 couples may be able to avail of publicly funded IVF treatment next year. RTE, 2022. Accessed on 12th April 2023 at <https://www.rte.ie/news/health/2022/0928/1326027-budget-2023-ivf-treatment/>
 13. Kissin DM, Boulet SL, Jamieson DJ. Fertility Treatments in the United States: Improving Access and Outcomes. *Obstet Gynecol* 2016 Aug 128: 387-390.
 14. Chambers GM, Hoang VP, Sullivan EA, et al. The impact of consumer affordability on access to assisted reproductive technologies and embryo transfer practices: an international analysis. *Fertil Steril* 2014; 101: 191–8.e4.
 15. Chandra A, Copen CE, Stephen EH. Infertility and impaired fecundity in the United States, 1982–2010: data from the national Survey of family growth. *Natl Health Stat Report* 2013: 1–18.
 16. Chandra A, Copen CE, Stephen EH. Infertility service use in the United States: data from the National Survey of Family Growth, 1982–2010. *Natl Health Stat Report* 2014: 1–21.
 17. Bretherick KL, Fairbrother N, Avila L, et al. Fertility and aging: do reproductive-aged Canadian women know what they need to know? *Fertil Steril* 2010; 93: 2162–8.
 18. Lampic C, Skoog Svanberg, A, Karlstrom P, et al. Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics. *Hum Reprod* 2006; 21 :558–64.
 19. Tyden T, Svanberg AS, Karlstrom P, et al. Female university students’ attitudes to future motherhood and their understanding about fertility. *Eur J Contracept Reprod Health Care* 2006; 11: 181–9.

20. Central Statistics Office. Vital Statistics Annual Report; Births 2018. Accessed March 2021. Available from <https://www.cso.ie>
21. Ryan J. The high, mysterious and added costs of IVF. The Irish Times 2019 April 10.
22. Human Fertilisation and Embryology Authority. Press Release: Age is the key factor for egg freezing success. 2018. Accessed March 2021. Available from <https://www.hfea.gov.uk/about-us/news-and-press-releases/2018-news-and-press-releases/press-release-age-is-the-key-factor-for-egg-freezing-success-says-new-hfea-report-as-overall-treatment-numbers-remain-low/>
23. Benzie K, Tough S, Tofflemire K, et al. Factors influencing women's decisions about timing of motherhood. J Obstet Gynecol Neonatal Nurs 2006; 35: 625–33.
24. Harris ID, Fronczak C, Roth L, et al. Fertility and the Ageing Male. Reviews in Urology 2011; 13: e184-e190.
25. Yu L, Peterson B, Inhorn MC, et al. Knowledge, attitudes and intentions toward fertility awareness and oocyte cryopreservation amongst obstetrics and gynaecology resident physicians. Hum Reprod 2016; 31: 403-41.