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Financing future fertility: Women's views on funding egg freezing

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Abstract Like other assisted reproductive technology (ART) procedures, the cost of egg freezing (EF) is significant, presenting a potential barrier to access. Given recent technological advancements and rising demand for EF, it is timely to reassess how EF is funded. An online cross-sectional survey was conducted in Victoria, Australia and was completed by 656 female individuals. Participants were asked their views on funding for both medical and non-medical EF. The median age of participants was 28 years (interquartile range 23-37 years) and most participants were employed (44% full-time, 28% part-time, 33% students). There was very high support for public funding for medical EF (n = 574, 87%), with 302 (46%) participants indicating support for the complete funding of medical EF through the public system. Views about funding, 150 (23%) supported coverage through private health insurance, and 204 (31%) indicated that non-medical EF should be self-funded. If faced with the decision of what to do with surplus eggs, a high proportion of participants indicating that eggs surplus to requirements could be a potential source of donor eggs. This study provides insights that could inform policy review, and suggests revisiting whether the medical/non-medical distinction is a fair criterion to allocate funding to ART.

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Introduction

Demand for egg freezing (EF) for fertility preservation has increased dramatically in recent years. The number of EF cycles undertaken in Australia/New Zealand increased by 311% from 2010 to 2015, and by 880% in the USA from 2010 to 2016 (Johnston et al., 2021). EF was initially offered to women who faced premature infertility as a result of illness, such as endometriosis or premature ovarian insufficiency, or medical treatments, such as chemotherapy for cancer (referred to as 'medical' EF). However, recent studies suggest that the dramatic increase in EF cycle numbers is the result of increased demand for 'non-medical' EF (Balkenende et al., 2018; Gürtin et al., 2019; Human Fertilisation and Embryology Authority, 2018; Schon et al., 2017). Women seek non-medical EF as a pre-emptive measure to increase their chance of conceiving later in life when their fertility may be compromised due to age-related fertility decline.

Financial considerations for EF are significant; for many people, the cost of EF is prohibitively high and prevents access (Anazodo and Gersti 2016; Inhorn et al., 2018b, 2019; Petropanagos et al., 2015; Santo et al., 2017). A study in the USA that investigated women's experience of EF found that cost was the greatest barrier to pursuing EF. One-third of participants reported that they sought financial support, mainly from family members, to help cover procedural costs (Hodes-Wertz et al., 2013). The cost of one cycle of EF varies around the world, ranging from US\$3200 in Israel to US\$10,000 in the USA (Inhorn et al., 2019); in Australia, one cycle can cost up to US\$7500 (Bowden, 2015).

Healthcare funding greatly assists people in their ability to access expensive medical treatments; traditional sources of funding are public/government funding and private health insurance (PHI). In many nations, public funding via taxpayer contributions is available for selected assisted reproductive technology (ART) treatments because procreation is recognized as an important life goal, and funding is justified with the reasoning that the decision to have children should not depend on income (Pennings et al., 2008). However, funding for EF is inconsistent around the world; in a survey of 27 European countries in which EF is available, 14 countries had some form of public healthcare funding for medical EF, but none of them offered funding for nonmedical EF (Shenfield et al., 2017). In Australia, women seeking medical EF are eligible for rebates via Medicare (the public healthcare system) (Australian Government Services Australia, 2019), but women seeking non-medical EF are not eligible for Medicare funding and must self-fund the procedure. There is some debate amongst feminist scholars and bioethicists on the ethical issues raised by EF (Harwood, 2015), including whether EF enhances reproductive freedom or constitutes undue pressure and promotes pronatalist views (Petropanagos et al., 2015; Ravitsky and Lemoine, 2014). These issues, and the impact that funding EF may have on them, will be discussed in a forthcoming publication that explores the rising trend of employers offering financial support for their employees to access EF (Johnston et al., 2021b).

In 2012, after many years of development, EF was declared to be a 'non-experimental procedure' (Ethics Committee of the American Society for Reproductive

Medicine, 2013). Despite this change in status and the huge surge in uptake of EF (Schon et al., 2017), policies governing access to, and funding for, EF have not been updated in Australia. Presently, EF is not a stand-alone item for rebate in the Australian Medicare system; it is claimed under item numbers that are used for standard in-vitro fertilization cycles. The recent increase in demand for EF prompts the need to review how EF is funded.

A few studies have investigated the public's views about how EF should be funded. A Canadian survey of 500 childless women reported that support for public funding for EF varied by indication: 80.2% versus 45.5% for medical EF and non-medical EF, respectively (Daniluk and Koert, 2016). Funding for EF was positively received in a recent study that surveyed 71 women of childbearing age from Hong Kong; 93% supported funding for medical EF and 77% supported funding for non-medical EF (Hong et al., 2019). In Italy, a report on 930 female tertiary students indicated divided opinions on how non-medical EF should be funded; approximately half of the respondents indicated that it should be self-funded, one-third supported public healthcare funding, 13.9% supported funding via PHI, and 2.5% supported employers covering the costs of non-medical EF for their female staff (Tozzo et al., 2019).

These previous studies suggest that opinions are divided about funding for EF. However, people's opinions towards, and evaluations of, healthcare systems are influenced by their experiences and knowledge of their own healthcare systems (Kikuzawa et al., 2008; Schneider, 2020). Currently, little is known about the views of Australian women about funding EF in terms of who should cover the costs of EF, and if funding arrangements should differ depending on whether the indication for EF is medical or non-medical. In addition, little is known about the disposition of surplus eggs following EF, which might influence assessments of the costs associated with EF. Given that some women may freeze their eggs but never use them, the costs of unused eggs might be seen to add to the costs associated with EF. Conversely, Polyakov and Rozen (2021) suggest that surplus eggs that result from EF have tangible benefits for society if they are donated, and this could also weigh into funding considerations.

The aim of this study was to investigate women's opinions about how EF should be funded, and to explore their views on the fate of frozen eggs that are not required for personal use.

Materials and methods

An online, cross-sectional survey was conducted in Victoria, Australia between April 2018 and May 2018. The project was approved by an institutional human research ethics committee. The survey was hosted through the Research Electronic Data Capture (REDCap) platform and consisted of 35 questions, adapted with permission from the Fertility Preservation Survey designed in Canada by Daniluk and Koert (2016). The questionnaire collected general demographics, and included questions on parenting aspirations, opinions about fertility preservation, and decision-making considerations related to EF. The survey also collected data on women's views about access to medical and non-medical EF, which have been reported elsewhere recently (Johnston et al., 2020) and are referred to in the current study to inform part of the analysis.

This article reports on a section of the survey that invited participants to respond to questions about funding for EF, and intentions about the disposition of surplus eggs. Participants were asked to consider how the costs of EF should be covered in two instances: (i) where medical conditions threaten fertility (e.g. severe endometriosis or undergoing treatment for cancer); and (ii) where fertility is threatened for non-medical reasons. Non-medical reasons included: lacking a suitable partner with whom to have children; deferring childbearing due to education/career advancement: or not feeling financially secure enough to raise a child at the time. Participants responded via fixedresponse items. Full coverage options included: publicly funded, funded by PHI, or self-funded. Partial funding included: co-payment shared between the public system and the individual, or co-payment shared between the public system and PHI. In addition, participants could suggest other possible funding options via a free text box. To investigate decisions about the disposition of eggs that are no longer required after EF, participants were asked to indicate whether they would consider the following options, via a five-point Likert scale (never/not likely/somewhat likely/likely/definitely):

- (i) donate surplus eggs to medical research;
- (ii) donate to a friend or family member (known recipient);
- (iii) donate to an egg donor programme (unknown recipient); and
- (iv) dispose of surplus eggs.

In the following analysis, the options 'never' and 'not likely' were combined and are reported as 'unlikely', and the options 'likely' and 'definitely' were combined and are reported as 'likely'.

Participants

The survey was advertised online through social media and parenting forums. Female, Australian residents aged 18-60 years were invited to complete the survey. A wide age range was used to invite the views of women who may be interested in EF, as well as those who have passed their reproductive years but could have accessed ART in their lifetime and could reflect upon their available options, choices and experiences.

Statistical analysis

Data were analysed using Stata Version 15 (StatCorp, College Station, TX, USA). Categorical data are presented as frequencies and percentages. Age is presented as median and interquartile range (IQR; 25th and 75th percentiles). Opinions on preferred funding source for medical or non-medical EF were converted to binary variables (i.e. yes or no) for each of the five possible responses: public funding, funded by PHI, self-funded, co-payment by the individual and the public system, and co-payment by the public system and PHI. Unadjusted Poisson regression with robust/sand-wich estimator for variance [preferred estimator for relative risk with binary outcomes (Barros and Hirakata, 2003)] was used to examine the relationship between opinions on who should cover the cost of EF (dependent variable). The results





Fig. 1 Proportional Venn diagram representing opinions on 'How should medical egg freezing be funded?' Almost half of the participants thought that medical egg freezing should be covered completely through the public funding system.

were reported as risk ratios (RR) with 95% confidence intervals (CI). Associations between opinions on access to EF and opinions on funding were explored using Chi-squared test. Venn diagram visualization was created using BioVinci Version 1.1.5 (BioTuring Inc., San Diego, CA, USA). Vertical bar graphs were created using GraphPad Prism Version 8.4.2 for macOS (GraphPad Software, San Diego, CA, USA) and horizontal bar graphs were created using Microsoft Excel Version 16.31 (Microsoft Corp., Redmond, WA, USA). Qualitative description, as described by Sandelowski (2000), was used to analyse the small number of free text responses received.

Results

Participants

In total, 656 participants were included in the analysis. The median age of the sample was 28 years (IQR 23-37 years) and approximately half (n = 327) were either living with a partner or married. The majority of participants were employed [290 (44%) full-time and 186 (28%) part-time], and 213 (33%) were students. As per the Socio-Economic Indexes for Areas (Australian Bureau of Statistics, 2011), most participants (n = 460, 70%) resided in areas of high socio-economic advantage, and two thirds of the sample (n = 441, 67%) had PHI. Most participants (n = 497, 76%) did not have children, and a high proportion (n = 584, 89%) knew of someone who had either experienced infertility or had accessed ART, including EF, in the past. As reported previously, almost all participants (98%) supported access to medical EF, and a considerable proportion (72%) supported access to non-medical EF (Johnston et al., 2020).

Funding for medical egg freezing

The majority of participants (87%) supported public funding (full or partial) for medical EF (Fig. 1). Just under half of the

survey sample (46%) indicated that the costs of medical EF should be covered completely through the public system. In relation to the possibility of co-payment, there was more support for payment shared between the public system and PHI than there was for co-payment by the public system and the individual (31% versus 11%, respectively). A small number of participants (8%) endorsed complete coverage by PHI for medical EF. Similarly, very few participants thought that medical EF should be solely self-funded (2%). Fourteen individuals provided suggestions about alternative options for funding, which are reported further below.

Relationship status had a significant influence on support for certain types of funding (P = 0.011). Partnered participants were more likely than single participants to support full public funding (living with partner 55% versus single 37%, RR = 1.50, 95% CI 1.18–1.91, P = 0.001; married 52% versus single 37%, RR = 1.43, 95% CI 1.13–1.82, P = 0.003). Similarly, participants with children were more likely to support full public funding compared with childless participants (58% versus 42%, RR = 1.37, 95% CI 1.16–1.62, P < 0.001).

Funding for non-medical egg freezing

Opinions on how non-medical EF should be funded were divided (Fig. 2). Forty-two percent of participants suggested that the public system should support non-medical EF to some degree. Of these individuals, 6% indicated that complete public funding for non-medical EF is appropriate. There was more support for partial funding of EF than complete funding through the public system. Twenty-one percent of participants supported co-payment by the public system and the individual, and 15% supported co-payment by the public funding for non-medical EF; 31% thought it should be completely self-funded and 23% supported coverage by PHI. Twenty-four individuals suggested alternative funding options which are reported below.



How should non-medical egg freezing be funded?

Fig. 2 Proportional Venn diagram representing opinions on 'How should non-medical egg freezing be funded?'. Participant opinions were divided; approximately one in three participants supported self-funded non-medical egg freezing.

Age was significantly correlated with support for certain types of funding (P < 0.001); participants aged \geq 40 years were significantly more likely to support self-funding than participants aged <25 years (50% versus 29.9%, RR = 1.67, 95% CI 1.28–2.19, P < 0.001). Relationship status was also significantly correlated with support for certain types of funding (P = 0.013); married participants were significantly more likely to support self-funding than single participants (38% versus 27%, RR = 1.40, 95% CI 1.03–1.90, P = 0.033).

Views about access to non-medical EF were correlated with support for certain types of funding (P < 0.001) (Fig. 3). People who did not support access to non-medical EF were less likely to support public funding of EF and more likely to support self-funding. Participants who supported access to non-medical EF indicated broad support for different funding sources; they were more likely to support co-payment by the public system and PHI, but less likely to support self-funding.

Funding for 'other' options

A small percentage of participants provided suggestions via a free text box for additional comments about how EF should be funded; 24 (4%) suggested an alternative funding option for non-medical EF, with the majority suggesting copayment by the individual and PHI. Similarly, of the 2% of participants that provided suggestions for how medical EF should be funded, the majority supported co-payment by PHI and the individual, with the exception of three unique comments that focused on equity, income testing and severity of the risk to infertility, respectively, as illustrated by the following direct quotes:

I'm unsure. Egg freezing is not a necessary procedure, but on the other hand, why should wealthy people be able to access it, but not poorer people? [51-year-old, married student without PHI].

It should be income tested and if the person can afford it, then they should pay half, or their insurance should pay half. But in cases of young women with endometriosis/PCOS [polycystic ovary syndrome], it



Fig. 3 Opinions on how non-medical egg freezing should be funded based on support for access to non-medical egg freezing. People who did not support access to non-medical egg freezing had little support for public funding of egg freezing, while people who supported access to non-medical egg freezing had broad support for different funding sources.

should be entirely [publicly] subsidised so young women of 19–20 can go ahead and freeze their eggs [57-yearold, married volunteer with PHI].

[Publicly funded] but depends on likelihood of adverse risk being realised; i.e. if her medical condition has a 50% chance of making her infertile in the next 2years, as opposed to 0.1% chance [24-year-old dating, without PHI].

Disposition intentions

Participants were invited to consider the hypothetical situation that they had undergone EF and were faced with the decision of what to do with surplus eggs. In response to this hypothetical situation, most participants (71%) indicated that they would be likely to donate eggs to medical research. More than half of the participants indicated that they would be likely to donate eggs to someone else, with slightly more indicating support for donating to someone known to them (59%) compared with an unknown recipient (52%). Approximately one-quarter (24%) of participants indicated that they would be likely to discard any surplus eggs (Fig. 4).

Discussion

To the authors' knowledge, this is one of very few studies, and the first Australian study, to report on women's views about how EF, for both medical and non-medical indications, should be funded. The research found that a very high proportion of participants (87%) support some form of public funding for medical EF, with 46% indicating support for full coverage of the costs of medical EF by the public system. There was half as much support for public funding of non-medical EF, with 42% indicating support for some form of financial support through the public system, and 6% supporting complete coverage by the public system. Over 50% of participants indicated that if they froze their eggs but did not use them, they would consider donating them to a recipient or for use in medical research.

Interestingly, the views reported on public funding for both medical and non-medical EF do not reflect the current funding scheme operating in Australia. Currently, only medical EF is eligible for rebates through Medicare, and only approximately 50% of the costs are rebated. The findings from this study suggest that almost one in two participants believe that Medicare should cover the full cost of medical EF, and over 40% of participants believe that Medicare should cover a proportion of the costs associated with non-medical EF. However, this view was not shared by all participants; those aged \geq 40 years, married participants and those who did not support access to non-medical EF were more likely to prefer self-funding for non-medical EF.

The discrepancy between views about public funding for medical and non-medical EF suggests that some participants do not consider them to be analogous or equally eligible for public healthcare funding. This finding is consistent with findings of earlier studies, which suggest greater acceptance for the use of public funding for medical EF than for



Fig. 4 Opinions on disposal intentions for surplus eggs amongst participants. The majority of participants indicated that they would be likely to donate surplus eggs to research or someone else.

non-medical EF (Daniluk and Koert, 2016; Hong et al., 2019). Views about when EF should be funded may reflect the public's views about what constitutes a medically necessary intervention. In a German study, respondents who considered infertility to be a disease were more likely to support complete public funding for ART treatments (Rauprich et al., 2010). Additionally, in a large multinational survey of 6110 people, over 50% of participants supported public funding for ART for individuals with primary infertility or decreased fertility as a result of a medical condition (e.g. cancer); however, \leq 30% supported public funding for individuals seeking ART after having a child, or in instances where childbearing had been delayed (Fauser et al., 2019). The findings from these earlier studies along with the present findings suggest that the public are more supportive of funding for ART treatments that they consider to be medically necessary.

Some scholars have raised arguments against funding non-medical EF. One objection to the funding of nonmedical EF is that the usage rate is too low to make it cost-effective (Ben-Rafael, 2018). Given that the uptake of non-medical EF has only increased recently, the present authors agree with previous observations that it may be too early to draw conclusions about the true utilization of eggs stored for non-medical reasons (Cobo et al., 2016; Human Fertilisation and Embryology Authority, 2018). However, early investigations have reported rates of return that range between 3% and 26% (Cil et al., 2019; Gürtin et al., 2019; Hammarberg et al., 2017; Jones et al., 2019; Wennberg et al., 2019). In comparison, a few studies investigating rate of return after medical EF report that very few women have returned to thaw their eggs (0-7%) (Dahhan et al., 2014; Garcia-Velasco, et al., 2013; Gürtin et al., 2019; Martinez, et al., 2014). In addition, sperm freezing, which is also offered for fertility preservation, is supported with subsidies by the public healthcare system for men facing gonadotoxic treatments (MBS Online, 2018), and the rate of return of men for frozen sperm is also low (4-8%) (Ferrari et al., 2016; Tournaye et al., 2004). It is suggested that despite the disanalogies between EF and sperm freezing, it is inconsistent to use low return rates as a rationale against the funding of non-medical EF.

Cost-effectiveness is a common criterion used to determine whether a medical intervention justifies public funding; however, evaluating cost-effectiveness for ART treatments is complex (ESHRE Capri Workshop Group et al., 2015). Quality-adjusted life years (QALY) is a standard indicator used to assess cost-effectiveness among clinical treatments; however, there is debate about the appropriateness of using QALY to assess ART treatments (-Goldhaber-Fiebert and Brandeau, 2015). First, the question arises as to which life or lives to assess in calculating the QALY gained following ART- the individual, the couple, the child, the family or the extended family. Second, it is difficult to measure the value of ART and fertility treatment as the benefits are multifaceted and the outcomes are varied. Although there are concerns about the use of OALY to assess cost-effectiveness, robust alternatives have not been identified (Carlson et al., 2020). A few studies have attempted to determine whether EF is cost-effective, but have reached different conclusions regarding whether, and at what age, EF is cost-effective (Devine et al., 2015; Hirshfeld-Cytron et al., 2012; van Loendersloot et al., 2011). All of these studies have used the number of resultant live births to measure the success of EF. However, many of the individuals who undergo EF do so as a preemptive measure to safeguard their reproductive futures in the event that they are unable to conceive naturally, rather than with the intention of using these eggs to conceive (Hong et al., 2019; Pritchard et al., 2017). Furthermore, many women have suggested that the benefit of EF is the feeling of reassurance provided by taking up the opportunity to safeguard or increase the chance of having a baby in the future (Baldwin, 2018; Stoop et al., 2015), and many do not regret undergoing EF even if it proves to be unsuccessful (Greenwood et al., 2018; Jones et al.,

2019). It is suggested that EF can provide individual benefits irrespective of whether women return to access their frozen eggs in the future, and the use of live birth data alone to measure the value of EF may not be a true reflection of the utility of EF.

Over 50% of participants in this study indicated that if their frozen eggs became surplus to requirements, they would be most likely to consider donating their eggs to medical research or to an infertile recipient. This high level of support for donating eggs is similar to reports in previous studies. Hodes-Wertz et al. (2013) surveyed 183 women who had undergone EF, and found that 63% were willing to donate their eggs to research if they did not use them, and 11% said that they would consider donating their eggs to supply a donor programme at an infertility clinic. Another survey reported that of the 71 women surveyed, almost half indicated that they would consider donating eggs to infertile patients (34% to a friend or family member, 10% to a donor programme), and 16% indicated that they would consider donating eggs to research (Hong et al., 2019). These findings, along with the present findings, support the suggestions of others (Lockwood and Fauser, 2018; Polyakov and Rozen, 2021) that eggs frozen for personal use that are not required by the individual can be of benefit in other ways, for example when they are donated to an infertile individual or couple, or used for medical research. Therefore, the benefits of EF may extend beyond just that of the individual, and could likely include benefits to the broader community. It is acknowledged that there are some potential barriers to egg donation - for example, legal requirements such as medical screening, mandatory counselling, and the lack of donor anonymity in parts of Australia (VARTA, n.d.). Future research could examine disposition practices in 5-10 years' time to see how actions compare to the views reported in this study and other research.

The results of this study suggest that many women would welcome the funding of EF through either the public system or PHI. However, healthcare funding is limited, and determining the best way to distribute limited funding is notoriously difficult and contested. Worldwide, ART regulation is heterogeneous with regard to the services offered, the share of public funding allocated, and eligibility criteria for access and funding. Across Europe, 39 countries provide some form of public financial support for ART; however, of these, 29 countries impose additional eligibility criteria. These can include female age, existence of previous children, or patient body mass index (Calhaz-Jorge et al., 2020). It is not clear how these various eligibility criteria are justified, and the lack of consistency in the criteria used may lead to inequity. The medical/non-medical criterion is used in the allocation of EF funding across the world (Shenfield et al., 2017); however, this distinction can be difficult to define, and the categorization of conditions as either medical or non-medical is contested (Colleton, 2008) and subject to change as the views of society evolve (Gilman, 2018). In addition, the results of the present study suggest that some individuals regard medical and non-medical EF as analogous. These challenges to the use of the medical/ non-medical distinction to determine the allocation of public funding warrant further consideration. Further,

the present findings suggest other possible funding approaches to EF, such as the possibility of distributing funding via income testing, or whether funding should be allocated based on the severity of the risk of infertility. Future research could investigate the fairness and feasibility of these novel options.

Access to ART is limited by costs (Ethics Committee of the American Society for Reproductive Medicine, 2015; McDowell and Murray, 2011; Nachtigall, 2006) and, despite the availability of public funding that covers a portion of cycle expenses, disparities in access to ART still exist as many individuals find it difficult to afford the out-ofpocket expenses (Bitler and Schmidt, 2006; Gorton, 2019; Harris et al., 2016; Inhorn et al., 2018a). As articulated by one participant, 'why should wealthy people be able to access it, but not poorer people?'; the current user-pay approach to EF privileges the wealthy and challenges the principle of equity of access, and prompts further deliberation about the suitability of this approach.

Limitations

Like all surveys that rely on self-selected participation, it is likely that this study attracted participants who had an interest in, or were more supportive of, ART in general. In order to reduce the impact of bias, the study was advertised widely, and the inclusion criteria were kept intentionally broad. A high proportion of participants were young women of high socio-economic status, and therefore they may not have had reason to reflect upon fertility or access to fertility preservation. Further, the sample was much younger than the average age of individuals currently accessing egg freezing [approximately 38 years (Cil et al., 2019; Human Fertilisation and Embryology Authority, 2018; Johnston et al., 2021a)]. However, this study was not seeking to be representative; rather, the aim of the study was to collect views on EF which are largely unknown, especially in Australia, and to contribute to discussions on future funding options for EF as well as disposition preferences for surplus eggs.

Conclusion

In many nations, the approach to funding EF appears to have followed the approach taken to funding 'standard' ART cycles (Calhaz-Jorge et al., 2020), suggesting that funding for EF may not have been considered specifically. The results of this study indicate that there is significant support for public funding for medical EF, and, in particular, for potentially increasing the proportion of costs that are subsidized through the public system in Australia. This study also found some support for the funding of non-medical EF via the public system or PHI. Further investigation and discussion are needed about the possibility of expanding funding to include non-medical EF. In addition, this article describes challenges to the medical/non-medical distinction, and questions whether it is a fair basis on which to determine eligibility for funding; this also warrants further discussion. As affordability is a significant determinant of accessibility, care is needed to develop policies that promote equity of access for all.

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References

- Anazodo, A., Gersti, B., 2016. Young people with cancer should have affordable options to preserve their fertility. The Conversation. https://theconversation.com/young-people-withcancer-should-have-affordable-options-to-preserve-their-fertility-63457. Date accessed: 28/12/2020
- Australian Bureau of Statistics, 2013. Census of population and housing: Socio-economic Indexes for Areas (Seifa), Australia, 2011.
- Australian Government Services Australia, 2019. Education Guide Billing Assisted Reproductive Technology Services. Australia.
- Baldwin, K., 2018. Conceptualising women's motivations for social egg freezing and experience of reproductive delay. Sociol. Health Illn.
- Balkenende, E.M.E., Dahhan, T., Van Der Veen, F., Repping, S., Goddijn, M., 2018. Reproductive outcomes after oocyte banking for fertility preservation. Reprod. BioMed Online 37, 425–433.
- Barros, A.J., Hirakata, V.N., 2003. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med. Res. Methodol. 3, 1–13.
- Ben-Rafael, Z., 2018. The dilemma of social oocyte freezing: Usage rate is too low to make it cost-effective. Reprod. BioMed. Online 37, 443–448.
- Bitler, M., Schmidt, L., 2006. Health disparities and infertility: Impacts of state-level insurance mandates. Fertil. Steril. 85, 858-865.
- Bowden, T., 2015. Fertility doctors warn women not to leave it too late to freeze eggs for IVF, even though science is improving odds. https://www.abc.net.au/news/2015-05-15/fertility-doctors-warn-women-not-to-leave-it-too-late-to-freeze/6473282. Date accessed: 28/12/2020
- Calhaz-Jorge, C., De Geyter, C.H., Kupka, M.S., Wyns, C., Mocanu,
 E., Motrenko, T., Scaravelli, G., Smeenk, J., Vidakovic, S.,
 Goossens, V., 2020. Survey on art and iui: Legislation, regulation, funding and registries in European countries: The European IVF Monitoring Consortium (EIM) for the European Society of Human Reproduction and Embryology (ESHRE). Hum. Reprod.
 Open.
- Carlson, J.J., Brouwer, E.D., Kim, E., Wright, P., McQueen, R.B., 2020. Alternative approaches to quality-adjusted life-year estimation within standard cost-effectiveness models: Literature review, feasibility assessment, and impact evaluation. Value Health.
- Cil, A.P., Abali, R., Boza, A., Karakis, L.S., Ceyhan, M., Aksakal, E., Keles, I., Oktem, O., Ata, M.B., Bahçeci, M., Urman, B., 2019. A 5-year analysis of demographics, cycle characteristics and reproductive outcomes of 907 egg freezing cycles in patients with diminished ovarian reserve and age-related fertility decline. Fertil. Steril. 112, e108.
- Cobo, A., García-Velasco, J.A., Coello, A., Domingo, J., Pellicer, A., Remohí, J., 2016. Oocyte vitrification as an efficient option for elective fertility preservation. Fertil. Steril. 105, 755–764.e8.
- Colleton, L., 2008. The elusive line between enhancement and therapy and its effects on health care in the US. J. Evol. Technol. 18, 70–78.

- Dahhan, T., Dancet, E.A., Miedema, D.V., Van Der Veen, F., Goddijn, M., 2014. Reproductive choices and outcomes after freezing oocytes for medical reasons: A follow-up study. Hum. Reprod. 29, 1925–1930.
- Daniluk, J.C., Koert, E., 2016. Childless women's beliefs and knowledge about oocyte freezing for social and medical reasons. Hum. Reprod. 31, 2313–2320.
- Devine, K., Mumford, S.L., Goldman, K.N., Hodes-Wertz, B., Druckenmiller, S., Propst, A.M., Noyes, N., 2015. Baby budgeting: Oocyte cryopreservation in women delaying reproduction can reduce cost per live birth. Fertil. Steril. 103, 1446–53.e1-2.
- Eshre Capri Workshop Group, Baird, D.T., Barri, P.N., Bhattacharya,
 S., Devroey, P., Evers, J.L.H., Gianaroli, L., Somigliana, E.,
 Tapanainen, J.S., Van Wely, M., Crosignani, P.G., Diedrich, K.,
 Fraser, L., Geraedts, J.P.M., Lundin, K., Sunde, A., Tarlatzis, B.,
 Van Steirteghem, A., Veiga, A., Bhattacharya, S., Crosignani, P.
 G., Evers, J.L.H., Somigliana, E., 2015. Economic aspects of
 infertility care: A challenge for researchers and clinicians. Hum.
 Reprod. 30, 2243–2248.
- Ethics Committee of the American Society for Reproductive Medicine, 2013. Fertility preservation and reproduction in patients facing gonadotoxic therapies: A committee opinion. Fertil. Steril. 100, 1224–1231.
- Ethics Committee of the American Society for Reproductive Medicine, 2015. Disparities in access to effective treatment for infertility in the united states: An ethics committee opinion. Fertil. Steril. 104, 1104–1110.
- Fauser, B.C.J.M., 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, e0211150–e0211150.
- Ferrari, S., Paffoni, A., Filippi, F., Busnelli, A., Vegetti, W., Somigliana, E., 2016. Sperm cryopreservation and reproductive outcome in male cancer patients: A systematic review. Reprod. BioMed. Online 33, 29–38.
- Garcia-Velasco, J.A., Domingo, J., Cobo, A., Martínez, M., Carmona, L., Pellicer, A., 2013. Five years' experience using oocyte vitrification to preserve fertility for medical and nonmedical indications. Fertil Steril. 99, 1994–1999.Gilman, S.L., 2018. Historical situatedness of categories' meanings in medicine. AMA J. Ethics 20, E1188–E1194.
- Gilman, S.L., 2018. Historical situatedness of categories' meanings in medicine. AMA J. Ethics 20 (12), E1188–E1194.
- Goldhaber-Fiebert, J.D., Brandeau, M.L., 2015. Evaluating costeffectiveness of interventions that affect fertility and childbearing: How health effects are measured matters. Med. Decis. Making 35 (7), 818–846. https://doi.org/10.1177/ 0272989X15583845.
- Gorton, M., 2019. Helping victorians create families with assisted reproductive treatment. The Victorian Govenment: Melbourne. https://www2.health.vic.gov.au/about/publications/researchandreports/final-report-independent-review-assistedreproductive-treatment. Date accessed: 28/12/2020.
- Greenwood, E.A., Pasch, L.A., Hastie, J., Cedars, M.I., Huddleston, H.G., 2018. To freeze or not to freeze: Decision regret and satisfaction following elective oocyte cryopreservation. Fertil. Steril. 109, 1097–1104.e1.
- Gürtin, Z.B., Shah, T., Wang, J., Ahuja, K., 2019. Reconceiving egg freezing: Insights from an analysis of 5 years of data from a UK clinic. Reprod. Biomed. Online 38, 272–282.
- Hammarberg, K., Kirkman, M., Pritchard, N., Hickey, M., Peate, M., Mcbain, J., Agresta, F., Bayly, C., Fisher, J., 2017. Reproductive experiences of women who cryopreserved oocytes for nonmedical reasons. Hum. Reprod. https://doi.org/10.1093/humrep/dew342.
- Harris, K., Burley, H., Mclachlan, R., Bowman, M., Macaldowie, A., Taylor, K., Chapman, M., Chambers, G.M., 2016.

Socio-economic disparities in access to assisted reproductive technologies in Australia. Reprod. BioMed. Online 33, 575–584.

- Harwood, K.A., 2015. On the ethics of social egg freezing and fertility preservation for nonmedical reasons. Medicolog. Bioeth. 5, 59–67.
- Hirshfeld-Cytron, J., Grobman, W.A., Milad, M.P., 2012. Fertility preservation for social indications: A cost-based decision analysis. Fertil. Steril. 97, 665–670.
- Hodes-Wertz, B., Druckenmiller, S., Smith, M., Noyes, N., 2013. What do reproductive-age women who undergo oocyte cryopreservation think about the process as a means to preserve fertility? Fertil. Steril. 100, 1343–1349.
- Hong, Y.H., Park, J.W., Kim, H., Kim, S.K., Choo, C.W., Jee, B.C., Suh, C.S., Kim, S.H., 2019. A survey on the awareness and knowledge about elective oocyte cryopreservation among unmarried women of reproductive age visiting a private fertility center. Obstet. Gynecol. Sci. 62, 438–444.
- Human Fertilisation & Embryology Authority, 2018. Egg freezing in fertility treatment London. https://www.hfea.gov.uk/media/ 2656/egg-freezing-in-fertility-treatment-trends-and-figures-2010-2016-final.pdf. Date accessed: 28/12/2020
- Inhorn, M.C., Birenbaum-Carmeli, D., Birger, J., Westphal, L.M., Doyle, J., Gleicher, N., Meirow, D., Dirnfeld, M., Seidman, D., Kahane, A., Patrizio, P., 2018a. Elective egg freezing and its underlying socio-demography: A binational analysis with global implications. Reprod. Biol. Endocrinol. 16, 70.
- Inhorn, M.C., Birenbaum-Carmeli, D., Westphal, L.M., Doyle, J., Gleicher, N., Meirow, D., Dirnfeld, M., Seidman, D., Kahane, A., Patrizio, P., 2019. Patient-centered elective egg freezing: A binational qualitative study of best practices for women's quality of care. J. Assist. Reprod. Genet. 36, 1081–1090.
- Inhorn, M.C., Birenbaum-Carmeli, D., Westphal, L.M., Doyle, J., Gleicher, N., Meirow, D., Raanani, H., Dirnfeld, M., Patrizio, P., 2018b. Medical egg freezing: How cost and lack of insurance cover impact women and their families. Reprod. Biomed. Soc. Online 5, 82–92.
- Johnston, M., Richings, N.M., Leung, A., Sakkas, D., Catt, S., 2021a. A major increase in oocyte cryopreservation cycles in the USA, Australia and New Zealand since 2010 is highlighted by younger women but a need for standardised data collection. Hum. Reprod. 36, 624–635. https://doi.org/10.1093/humrep/ deaa320.
- Johnston, M., Fuscaldo, G., Richings, N.M., Gwini, S.M., Catt, S., 2021. Employer-sponsored egg freezing: Carrot or stick? AJOB Empir Bioeth, DOI: https://doi.org/10.1080/23294515.2021. 1941413.
- Johnston, M., Fuscaldo, G., Richings, N.M., Gwini, S., Catt, S., 2020. Cracked open: Exploring attitudes on access to egg freezing. Sex. Reprod. Health Matters 28.
- Jones, B.P., Kasaven, L., L'heveder, A., Jalmbrant, M., Green, J., Makki, M., Odia, R., Norris, G., Bracewell Milnes, T., Saso, S., Serhal, P., Ben Nagi, J., 2019. Perceptions, outcomes and regret following social egg freezing in the UK; a cross-sectional survey. Acta Obstet. Gynecol. Scand.
- Kikuzawa, S., Olafsdottir, S., Pescosolido, B.A., 2008. Similar pressures, different contexts: Public attitudes toward government intervention for health care in 21 nations. J. Health Soc. Behav. 49, 385–399.
- Lockwood, G., Fauser, B.C.J.M., 2018. Social egg freezing: Who chooses and who uses? Reprod. BioMed. Online 37, 383–384.
- Martinez, M., Rabadan, S., Domingo, J., Cobo, A., Pellicer, A., Garcia-Velasco, J.A., 2014. Obstetric outcome after oocyte vitrification and warming for fertility preservation in women with cancer. Reprod. BioMed. Online 29, 722–728.
- Mbs Online, 2018. New item for cryopreservation of semen. Australia. http://www.mbsonline.gov.au/internet/mbsonline/ publishing.nsf/Content/Factsheet-Cryopreservation#:~:text= What%20are%20the%20changes%3F,pubertal%20males%20under-

going%20gonadotoxic%20treatment. Date accessed: 28/12/2020.

- Mcdowell, S., Murray, A., 2011. Barriers to continuing in vitro fertilisation – why do patients exit fertility treatment? Aust. N. Z. J. Obstet. Gynaecol. 51, 84–90.
- Nachtigall, R.D., 2006. International disparities in access to infertility services. Fertil. Steril. 85, 871–875.
- Pennings, G., De Wert, G., Shenfield, F., Cohen, J., Tarlatzis, B., Devroey, P., 2008. Eshre task force on ethics and law 14: Equity of access to assisted reproductive technology. Hum. Reprod. 23, 772–774.
- Petropanagos, A., Cattapan, A., Baylis, F., Leader, A., 2015. Social egg freezing: Risk, benefits and other considerations. CMAJ 187, 666–669.
- Polyakov, A., Rozen, G., 2021. Social egg freezing and donation: waste not, want not. J. Med. Ethics. https://doi.org/10.1136/ medethics-2020-106607.
- Pritchard, N., Kirkman, M., Hammarberg, K., Mcbain, J., Agresta, F., Bayly, C., Hickey, M., Peate, M., Fisher, J., 2017. Characteristics and circumstances of women in Australia who cryopreserved their oocytes for non-medical indications. J. Reprod. Infant Psychol. 35, 108–118.
- Rauprich, O., Berns, E., Vollmann, J., 2010. Who should pay for assisted reproductive techniques? Answers from patients, professionals and the general public in Germany. Hum. Reprod. 25, 1225–1233.
- Ravitsky, V., Lemoine, M.E., 2014. We need a culture thaw, not frozen eggs. Globe Mail, 2.
- Sandelowski, M., 2000. Whatever happened to qualitative description? Res. Nurs. Health 23, 334–340.
- Santo, E.V.E., Dieamant, F., Petersen, C.G., Mauri, A.L., Vagnini, L. D., Renzi, A., Zamara, C., Oliveira, J.B.A., Baruffi, R.L.R., Franco Jr., J.G., 2017. Social oocyte cryopreservation: A portrayal of Brazilian women. JBRA Assist. Reprod. 21, 101–104.
- Schneider, S.M., 2020. Beyond endogeneity in analyses of public opinion: Evaluations of healthcare by the foreign born across 24 European countries. PLoS ONE 15, e0233835.
- Schon, S.B., Shapiro, M., Gracia, C., Senapati, S., 2017. Medical and elective fertility preservation: Impact of removal of the experimental label from oocyte cryopreservation. J. Assist. Reprod. Genet. https://doi.org/10.1007/s10815-017-0968-5.
- Shenfield, F., De Mouzon, J., Scaravelli, G., Kupka, M., Ferraretti, A.P., Prados, F.J., Goossens, V., 2017. Oocyte and ovarian tissue cryopreservation in European countries: Statutory background, practice, storage and use. Hum. Reprod. Open.
- Stoop, D., Maes, E., Polyzos, N.P., Verheyen, G., Tournaye, H., Nekkebroeck, J., 2015. Does oocyte banking for anticipated gamete exhaustion influence future relational and reproductive choices? A follow-up of bankers and non-bankers. Hum. Reprod. 30, 338–344.
- Tournaye, H., Goossens, E., Verheyen, G., Frederickx, V., De Block, G., Devroey, P., Van Steirteghem, A., 2004. Preserving the reproductive potential of men and boys with cancer: Current concepts and future prospects. Hum. Reprod. Update 10, 525– 532.
- Tozzo, P., Fassina, A., Nespeca, P., Spigarolo, G., Caenazzo, L., 2019. Understanding social oocyte freezing in Italy: A scoping survey on university female students' awareness and attitudes. Life Sci. Soc. Policy 15, 3–3.
- VARTA, n.d. Becoming a donor. https://www.varta.org.au/understanding-donor-conception/becoming-donor, https:// www.varta.org.au/understanding-donor-conception/becomingdonor. Date accessed 25/04/2021
- Van Loendersloot, L.L., Moolenaar, L.M., Mol, B.W., Repping, S., Van Der Veen, F., Goddijn, M., 2011. Expanding reproductive lifespan: A cost-effectiveness study on oocyte freezing. Hum. Reprod. 26, 3054–3060.

Wennberg, A.L., Schildauer, K., Brannstrom, M., 2019. Elective oocyte freezing for non-medical reasons; a six-year report on utilization and IVF results from a Swedish center. Acta Obstet. Gynecol. Scand. https://doi.org/ 10.1111/aogs.13673.

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