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The ambiguities of ‘social’ egg freezing and the challenges of informed consent

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The ambiguities of ‘social’ egg freezing and the challenges of informed consent

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Abstract

Fertility clinics (and some employers) in the UK and other high-income countries have recently started to offer egg freezing to women concerned about their age-related fertility decline. Because the use of egg freezing for this purpose is new, there is no reliable evidence of its usefulness, or otherwise. There are no guarantees that egg freezing will work, and for many and perhaps most women, their frozen eggs will never be used. It is also unclear whether egg freezing is a positive development for women in general. It offers an additional choice, and it may enable some women to have genetically-related children more easily in the future. At the same time, it could be argued that egg freezing individualises and medicalises the social problem of a mismatch between female fertility and when women and men feel ready to have children. This article suggests that egg freezing is an ambiguous technology, whose benefits are as yet speculative, and that women therefore need as much clear and frank information as possible in order to navigate this new and by no means straightforward choice.

Keywords: egg freezing, fertility, informed consent, medicalization, egg donation.

1. Introduction

‘Social’ egg freezing is an ambiguous technology; it expands the options available to some women, while at the same creating new dilemmas. By enlarging the market for infertility treatment to include fertile young women, egg freezing also represents a lucrative marketing opportunity for the fertility industry. Given the complexities of ‘social’ egg freezing, both for individual women and for woman in general, it is important that it is not oversold as a simple way for women to ‘stop the biological clock’. Women now in their twenties and thirties are navigating choices that were unavailable to previous generations of women. To paraphrase Rayna Rapp (1999, p. 317), these women are the “contemporary moral pioneers” of this new technology. My purpose in this article is to argue that these pioneering women need access to

comprehensive, clear and balanced information about egg freezing's implications, uncertainties and ambiguities.

2. Egg freezing: A new clinical option

The first birth from a frozen oocyte was reported thirty years ago (Chen, 1986), but until very recently success rates were too low for egg freezing to be considered standard treatment (Lockwood, 2011). This has changed following the development of a new and more successful 'fast-freezing' technique, known as vitrification (literally, turning to glass) (Kuleshova *et al*, 1999; Lockwood, 2011). At the end of 2012, in a guideline published in early 2013, the American Society of Reproductive Medicine declared that oocyte cryopreservation "should no longer be considered experimental" (Practice committees of the SART and ASRM, 2013).

Egg freezing undoubtedly expands the choices available to women who have been diagnosed with cancer, and who are concerned that their cancer treatment will leave them infertile. In the past, women who might want to have children after having been treated for cancer would be advised to freeze embryos rather than eggs. This would leave the woman vulnerable to her partner, or the sperm donor, subsequently withdrawing his consent to the embryos' storage and use. In the UK, the storage and use of embryos is lawful only with both gamete providers' ongoing consent. As a result, if the man whose sperm was used to create the embryos withdraws his consent to their continued storage, clinics have no option other than to dispose of them.

In 2007, in the case of *Natallie Evans*, a woman who had created six embryos before undergoing treatment for ovarian cancer, and whose ex-partner subsequently withdrew his consent to the embryos' storage and use, the Grand Chamber of the European Court of Human Rights confirmed that the UK statutory provision (Human Fertilisation and Embryology Act 1990, sch. 3, para 4), which effectively gives men (and women) the right to veto their ex-partners' use of their embryos was compatible with the European Convention on Human Rights (*Evans v United Kingdom* Application no 6339/05 (2007)).

When the Human Fertilisation and Embryology Act 1990 was updated in 2008, it provided for a new 12-month 'cooling-off period' for couples who disagree about their embryos' storage and use (Human Fertilisation and Embryology Act 1990, sch. 3 para. 4A), but if agreement cannot be reached within a year, the right of veto remains. As a result of egg

freezing, however, this scenario is unlikely to arise in the future, because a cancer patient in Natallie Evans' position would now freeze her eggs instead, and would therefore be able to use them in the future, with a new partner or with donor sperm.

In addition, egg freezing provides a new option for women concerned about their age-related fertility decline. A woman's chance of conceiving naturally declines steadily from her late twenties onwards, and rapidly in her late thirties and forties (Dunson *et al*, 2002). Her risk of miscarriage also increases: at age 40, the risk of miscarriage is 40 per cent; at 45, it is 75 per cent (Lockwood, 2011). Contrary to public perception, IVF does not offer a solution to women's age-related fertility decline: As Daly and Bewley (2013) explain: "Assisted reproduction treatment may be able to assist a man with a low sperm count or overcome the problem of a woman with blocked Fallopian tubes, but unfortunately it is not designed to overcome egg degeneration". According to the most recent Human Fertilisation and Embryology Authority (HFEA) data, the pregnancy rate, per embryo transfer, for women receiving IVF treatment using their own fresh eggs drops between the ages of 35 and 45 from 38.2 to 2.2 per cent (HFEA, 2016). If a woman froze some of her eggs in her early thirties, IVF using those frozen eggs would be more likely to work into her late thirties and forties.

What is controversially (Stoop *et al*, 2014) described as 'social' egg freezing presents women who think that they might want to have a baby in the future, and who can afford it, with a new choice to make. Because 'social' egg freezing is so new, we do not know how many women will actually use their stored eggs, and how many will experience involuntary childlessness, despite having frozen their eggs. There is therefore considerable uncertainty over whether egg freezing is a sensible precautionary step, or a physically invasive waste of money.

The latest HFEA data suggest that, for women undergoing IVF with thawed eggs, there is a pregnancy rate, per embryo transfer, of 22.2 per cent, and a live birth rate of 13.9 per cent (HFEA, 2016). Without giving percentages, the HFEA warns that: "The birth rate in the older age group, aged 38 years and over, is substantially lower" (HFEA, 2016). The number of women returning to use their previously frozen eggs in treatment is as yet so small that these data should be treated with caution, especially since some women may be using eggs that were frozen using slow-freezing, rather than vitrification, when success rates could be predicted to be very low indeed. Also based on small and imperfect samples, data from the Society for Assisted Reproductive Technology (SART) registry in the US suggest a live birth rate per warming cycle of around 24 per cent (Alter *et al*, 2015). Although reliable data are scarce, it is clear that, while egg freezing may increase a woman's chances of conceiving

through IVF into her forties, just as with natural reproduction, there can be no guarantee that her frozen eggs will lead to the birth of a healthy child. An American Society for Reproductive Medicine (ASRM) patient factsheet puts this bluntly:

Will my frozen eggs guarantee a future baby? No. Even in younger women (i.e., <38-years-old), the chance that one frozen egg will yield a baby in the future is around 2-12%. As women get older and egg quality goes down, the pregnancy rate per frozen egg drops further (ASRM, 2014).

Since vitrification became widely available, there has been a steady increase in the number of women freezing their eggs. In the UK, according to the latest HFEA data, 816 women froze eggs for their own future use in 2014, compared with 652 women in 2013 (HFEA, 2016), a 25 per cent increase. In 2015, research carried out for a private ‘clinic comparison’ website found that “egg freezing has seen the sharpest annual rise in demand of all fertility treatments, with enquiries within the UK up 407% and to Spanish clinics up 867%” (Whatclinic.com, 2015). In the US, almost 5,000 women froze their eggs in 2013, and it has been predicted that this figure will rise to 76,000 by 2018 (Alter *et al*, 2015).

In the UK, egg freezing is regulated by the Human Fertilisation and Embryology Act 1990, as amended in 2008, and by the HFEA. It would be a criminal offence to store eggs without a licence from the HFEA (Human Fertilisation and Embryology Act 1990, s. 4(1)). A woman’s consent to the storage of her eggs must be in writing (Human Fertilisation and Embryology Act 1990, sch. 3, para. 1), and must specify what is to happen to her eggs in the event of her death or incapacity (Human Fertilisation and Embryology Act 1990, sch. 3, para. 2(2)). Before giving consent, women should have been given the opportunity to receive “proper counselling” about egg freezing’s implications (Human Fertilisation and Embryology Act 1990, sch. 3, para. 3(1)(a)), and they “must be provided with such relevant information as is proper” (Human Fertilisation and Embryology Act 1990, sch. 3, para. 3(1)(b)). There is also an overarching responsibility upon those in charge of clinics, known as Persons Responsible, to ensure that only “suitable practices” are used in the clinic (Human Fertilisation and Embryology Act 1990, s.17(1)(d)).

While there is a clear statutory requirement, in addition to the doctor’s ordinary duty of care (*Montgomery v Lanarkshire Health Board* [2015] UKSC 11) to ensure that women have access to proper information before consenting to egg freezing, it is inherently difficult to provide accurate and comprehensive information about a new treatment’s risks and benefits, especially when clinicians are unable to rely upon data from large-scale clinical trials. There is a long history of fertility treatments being introduced to the clinic “without

appropriate development and evidence-based medicine to show that the procedure is safe and beneficial to the patient” (Harper *et al*, 2012). As Hans Evers (2016) has memorably put it, in the context of the overuse of ICSI (intracytoplasmic sperm injection):

We all have pledged to ‘first do no harm’. But how? By critically appraising the literature, by making rational clinical decisions, by implementing new treatments only if based on robust evidence (and, in the absence of such evidence, by doing the necessary trial), by weeding out inappropriate use of tests and treatments, by contemplating the role of our own beliefs, biases, bigotries and dogmas, and by adjusting our clinical care when and where necessary, we ultimately will serve our patients best. Not by playing Santa Claus and doling out nicely wrapped presents of unnecessary, ineffective and costly care.

Even more bluntly, Susan Bewley (2016) has suggested that “[i]n the global fertility industry, patients effectively pay extra for their putative children to become human experimental subjects”.

Of course, it is not always possible to carry out randomised controlled trials of new fertility treatments, because it will often be impossible to have a non-treatment control group (Harper *et al*, 2012). But while it may be acceptable to use new reproductive techniques in the clinic when there is a reasonable – and evidence-based – likelihood of their safety and efficacy, clinicians should nevertheless be honest with their patients about the absence of data (and they should also be trying to gather data that might be useful to future patients). In relation to egg freezing, clinicians can explain what they know about egg freezing, but it is equally important that they are frank about what is not yet known or understood.

This is especially important given that women commonly first encounter information about egg freezing through the print and online media, rather than via the HFEA’s website, or the websites of licensed clinics. Women’s magazines like *Vogue*, *Cosmopolitan* and *Grazia*, and newspapers including *The Guardian* and the *Daily Telegraph* regularly carry feature articles about egg freezing. These sometimes make extravagant claims, such as: “stopping the biological clock through egg freezing has long been the ultimate feminist fantasy” (Hass, 2011). Typical titles include “Freezing eggs - is this what we're all doing now?” (Richards, 2013c); “Egg freezing: the perfect 30th birthday gift for women” (Peck, 2014) and “I’m so glad I’ve frozen my eggs” (McBride, 2013). Clinics report that these articles, many of which include enthusiastic first-person accounts of the experience of egg freezing, often prompt a spike in inquiries (Waldby, 2015b). It is therefore critical that when a woman first approaches a clinic to inquire about egg freezing, the information she receives represents an evidence-based corrective to anecdotal media hyperbole.

3. An ambiguous technology

Women contemplating freezing their eggs have to navigate a series of difficult choices about when to freeze, and whether it is worth doing at all. Egg freezing's wider implications are also ambiguous: does it liberate women from the constraints of their reproductive biology or is it a medical solution to a social problem? Does the marketing of egg freezing to young women reinforce the idea that motherhood is women's natural destiny, or does it potentially level the 'playing field' for working men and women? At the same time, might it widen the gap between rich and poor women's experiences of childbearing? In what follows, I will set out the multiple ambiguities of social egg freezing, for individual women and for women more generally, before turning to consider the challenges of obtaining informed consent when so little is known about the long term utility of egg freezing.

(a) Why freeze?

Despite the novelty of social egg freezing, a few small-scale studies have been carried out into the motivations of women who have frozen their eggs. The most common reason women give for freezing their eggs is that they do not have a suitable partner (Baldwin *et al*, 2015). A recurring theme is that egg freezing relieves the pressure that women who might want to have children in the future otherwise experience as a result of their declining fertility. It is a way to "keep their options open" for longer (Waldby, 2015a). Egg freezing buys women more time in which to create a stable household, and to feel "mature enough" for childbearing (Birch Petersen *et al*, 2015). Catherine Waldby's interviewees believed that egg freezing "gave them a more equal footing in the complex game of thirty-something couple formation, because, like men, they did not need to fret about each passing year" (Waldby, 2015a).

It is common for women to describe "their banked eggs as a form of insurance" (Waldby, 2015a). Clinicians too have invoked the metaphor of insurance when describing egg freezing. Gillian Lockwood (2011), for example, has said that "It could be that early oocyte cryopreservation will be regarded as equivalent to an insurance premium that one is prepared to pay, hoping that the policy need never be claimed on but being reassured to think it is there if the worst happens and natural pregnancy does not occur". Given the cost of egg freezing, however, and its modest success rates, Mertes and Pennings (2011) suggest that "a

lottery ticket would be a better metaphor for a cryopreserved oocyte than an insurance policy, especially for women freezing in their late thirties or later”.

Nevertheless, given that no other insurance policy exists against age-related fertility decline, taking the initiative to freeze one’s eggs, in order to try to exercise some control over one’s declining fertility, may ‘feel’ better than doing nothing. As a woman interviewed for a Guardian feature article on egg freezing explained:

Even if it doesn’t work, at least I’ve given it a shot... If there is some chance, I would rather do something than nothing. You’re not going to regret having had a go. If you end up trying for a baby and you can’t conceive – and you’d thought about freezing at 29 but decided you’d rather spend the money on a holiday – you’d never forgive yourself (Lydia Cowell, quoted in Sarner, 2015).

The possibility of regretting *not* freezing one’s eggs may tip the balance for many women: you may or may not need to use your frozen eggs, but if you do need them and you chose not to freeze your eggs when you still had that option, you might be likely to blame yourself (Richards, 2013a; Richards 2013b). Rather than providing insurance against future infertility, it might then be more accurate to say that egg freezing offers insurance against future *regret*.

Economists and social psychologists have studied the role anticipated regret plays in decision-making (Loomes and Sugden, 1982; Sandberg and Conner, 2008; Krähmer and Stone, 2013). Regret is an unpleasant, negative emotion that people strive to avoid by anticipating the future possibility of regret and acting accordingly; we are, as Zeelenberg (1999) has pointed out, “regret averse”. The fear of regretting childlessness might even be especially powerful, because of a “widely shared (implicit) belief that childless people who regret not having children are *right*” (Mertes, 2016, emphasis in original).

Anticipated decision regret is often a powerful motivating factor in people’s decisions to take up the offer of new technologies, and this is the case even when success rates are low. (Tymstra, 2007). Tymstra (2007) suggests that wanting to avoid looking back and saying “if only I’d ...” makes it difficult for people to refuse to take advantage of a new technology. In the context of IVF, for example, and in line with Sarah Franklin’s finding that fertility patients commonly feel as though they have “no-choice-but-to-choose” IVF (Franklin, 1997), Tymstra (1989) found that with a chance of success as low as two per cent, women still feared regretting not trying: 92 per cent of her respondents agreed that “Now that the IVF method exists I feel that I should make use of it; then at least I will have tried everything possible”.

(b) When to freeze?

In the studies carried out to date, most egg freezers have been in their late thirties, with an average age of 37 or 38 (Nekkebroeck *et al*, 2010; Mertes *et al*, 2012, Baldwin *et al*, 2014; Waldby, 2015b). As an indication of the age at which women first contemplate freezing their eggs, this average may be misleading low because it does not include those women who are advised against egg freezing on the grounds of their age, or the results of ovarian reserve testing (Mertes and Pennings, 2011). If women are first thinking about freezing their eggs a decade after their fertility has started to decline, it might, at first sight, look as though they are doing it at the wrong time (Tsafrir *et al*, 2015). If we are concerned only with clinical success rates, women should be advised to free their eggs in their twenties or even late-teens. There are, however, weighty considerations that pull in the opposite direction.

First, egg freezing itself is expensive: one cycle of egg retrieval can cost as much as £6000 (ter Keurst *et al*, 2016), and more than one will often be necessary in order to retrieve sufficient eggs to have a reasonable chance of pregnancy in the future (the recommended minimum number of eggs to freeze is 15). If a fertile woman freezes her eggs at the age of 25, she is more likely than not to be able to conceive naturally in the future, and hence is unlikely ever to use her frozen eggs. The younger the woman is at the time of freezing, the more likely it is that egg freezing will have been a physically invasive waste of time and money. For a woman of 38, whose fertility is already in decline, the chance that she will use her stored eggs is higher. It may cost more, if more cycles are needed (Mertes and Pennings, 2011), and the chances of IVF working in the future are lower, but the woman is more likely to return to use the frozen eggs. Her investment in egg freezing is less likely to have been a waste of money, even though it is also less likely to work. Mesen *et al* (2015) calculated that although egg freezing was most likely to work when eggs are frozen before a woman is 34 years old, it was most likely to be cost-effective for women who freeze at the age of 37.

Second, in most countries, there are statutory time limits on the storage of eggs, sperm and embryos. In the UK, women can store their frozen eggs for no more than 10 years (Human Fertilisation and Embryology Act 1990, s. 14(3)), unless “a registered medical practitioner has given a written opinion that ...[she] is prematurely infertile or is likely to become prematurely infertile” (Human Fertilisation and Embryology (Statutory Storage Period for Embryos and Gametes) Regulations 2009, reg. 4(3)(b)). According to the Department of Health’s Impact Assessment for the 2009 Regulations, this should be

interpreted in the same way as the previous 1991 and 1996 Regulations, which permitted extensions to the time limit only for “medical cases of premature infertility” (Department of Health, 2009). This will be satisfied for women who have gone through early menopause, but women who experience the normal age-related decline in their fertility are not “prematurely infertile”, and, unless clinicians are, with the acquiescence of the HFEA, willing to certify that women facing normal age-related fertility decline are likely to suffer from “premature infertility”, they will be ineligible for an extension to the 10-year storage period. This means that a woman who freezes her eggs at the age of 30 ordinarily will not be able to use them after the age of 40. Indeed, a 30-year-old egg freezer might find herself having to use donor eggs in the future, if she struggles to conceive after the storage time limit for her own eggs has expired.

If a consequence of the statutory storage time limit is the clinically unnecessary use of donor eggs, it could plausibly be argued that its application to social egg freezing is contrary to good clinical practice, and represents a disproportionate interference with egg freezers’ right to respect for their private and family life (Jackson, 2016). But unless the time limit is effectively ‘fudged’ by clinics and the HFEA, or there is an amendment to the Regulations, in order to permit extensions to the time limit for people who are not yet ready to use their stored gametes in treatment (Jackson, 2016), women need to understand that their eggs may have to be disposed of 10 years after they were frozen. A woman who is thinking about freezing her eggs in her mid-twenties should be told that the storage limit may result in the disposal of her eggs *before* she reaches the age at which she might benefit from having frozen eggs in storage.

The London Egg Bank’s “freeze and share” scheme, through which women under the age of 32 receive free egg freezing, and one year’s free storage, in return for donating half of their eggs for use in the treatment of another woman, may be attractive to younger women, unable otherwise to afford the cost of egg freezing (London Egg Bank website, 2016). Indeed, the scheme is currently oversubscribed and the clinic’s website warns that “There is currently a six month waiting list to be matched with a recipient” (London Egg Bank website, 2016). Women who freeze at this scheme’s upper age limit of 31 will have until the age of 41 to use their eggs; but for younger women, the storage limit might expire before she reaches her forties. If the 10-year time limit is reached when a woman is in her mid-thirties, then unless she has a medical condition such as early menopause, it would be impossible for a clinician to certify that she is, or is likely to become “prematurely infertile”.

Women choosing to freeze their eggs have to balance a complex set of odds. Do it too early, and your eggs are likely to be unused and/or legally unusable. Do it too late, and it will be more expensive, and if more cycles are needed, more invasive; and the frozen eggs may be less likely to result in a live birth (Mertes and Pennings, 2011). The choice about when to freeze is therefore inherently complicated: the best time to freeze, in terms of success rates, is not the same as the best time to freeze in terms of cost-effectiveness and having sufficient time to use one's eggs before their statutory storage period expires. If the average age at which women are freezing their eggs is 38, then, on the one hand, this has the advantage that women are more likely to use their frozen eggs, and to have sufficient time in which to do so, while on the other hand, it has the disadvantage that the live birth rate per cycle is like to be "substantially lower" (HFEA, 2016) than if they had frozen their eggs in their twenties or early thirties.

(c) Medicalisation

There are two ways in which egg freezing might be said to involve medicalisation. First, some commentators have claimed that it offers a medical 'solution' to what is, in fact, a social problem (Lemoine and Ravitsky, 2015). If women are putting off childbearing because it is too difficult to combine motherhood and a career in their twenties and early thirties (Inhorn, 2013), it seems obvious that the problem is not solved by enabling wealthy women to freeze their eggs. Rather, if career structures are often incompatible with young motherhood, family-friendly career paths for women and men would offer a more inclusive and progressive solution than turning some women into fertility patients, so that they can keep the option of genetic motherhood open into their forties (Harwood, 2009).

Imogen Goold and Julian Savulescu maintain that the choice is not a binary one, between egg freezing on the one hand, or improving working conditions for young mothers, on the other. Rather campaigning for family-friendly workplaces could go hand in hand with the recognition that some women might have their choices expanded by being able to freeze their eggs (Goold and Savulescu, 2009). Social egg freezing might enable those women who wish to do so to keep the option of genetic motherhood open for longer, and the fact that we may prefer that society was ordered so that women feel able to become mothers earlier in life does not make that option illegitimate.

Others are alarmed by the prospect of female employees coming under pressure to freeze their eggs in order to concentrate on their careers. As Seema Mohapatra (2014) warns, “choosing not to freeze one’s eggs may be seen as a sign that a woman is not serious about her career”. It might also be easier and cheaper for employers to fund egg freezing for their young female employees, rather than investing in generous maternity leave and subsidised childcare. The announcement, in 2015, that Facebook and Apple were planning to offer egg freezing as a workplace benefit was greeted by some critics as the first indication that women might come under pressure from their employers to delay motherhood, and freeze their eggs instead of having a baby in their twenties or early thirties (Lemoine and Ravitsky, 2015; Baylis, 2015).

In practice, however, the question of whether it is in employers’ interests for their female employees to delay motherhood until their late thirties or forties is not clear-cut, and depends upon several other variables, such as maternity leave entitlements and health insurance. In the UK, where women are entitled to statutory maternity leave, older mothers are likely to be more senior, and their maternity leave will therefore be more expensive and inconvenient. For UK employers, unless they are adopting an exceptionally short-sighted approach towards the economic productivity of their female workforce (which is, of course, possible), encouraging employees to have children later in life might cost more than providing maternity leave for younger mothers (Inhorn, 2013). In contrast, in the US, where maternity leave is not compulsory, and where employers’ health insurance may cover the costs of their older female employees’ IVF treatment, egg freezing might be a cost-effective investment (Bennett, 2014).

It is also not necessarily clear that the only consideration in employers’ decisions to offer their female staff egg freezing is its economic rationality. It has, for example, been suggested that the provision of egg freezing to employees “could help companies, especially tech companies, attract women and correct a notorious gender imbalance” (Bennett, 2014). Heidi Mertes also points out that it would be unfair to accuse Facebook of offering egg freezing in order to deter motherhood among its employees, given that, in the US where it is under no obligation to offer paid maternity leave, Facebook gives all of its employees four months of paid maternity and paternity leave, including for adoptive parents; that it provides financial assistance for IVF and adoption, designated breast-feeding rooms at work, and an upfront cash payment to employees on the birth of a child (Mertes, 2015).

In addition, it is worth noting that this criticism of egg freezing does not reflect women’s reasons for freezing their eggs. As we saw earlier, in the few small-scale studies

carried out to date, by far the most common reason women give for freezing their eggs is the absence of a suitable partner. Workplace conditions are seldom mentioned. This is consistent with the findings of studies into why women delay childbearing, in which the lack of a partner is cited much more frequently than the inflexibility of the workplace (Hodes-Wertz *et al*, 2013; Hammarberg and Clarke, 2005).

Of course, the reasons why women find themselves childless and single in their late thirties may not be unrelated to the fact that the career ladder that they were climbing in their twenties was a poor fit with motherhood. But even if family-friendly workplaces might help some women to have children earlier in life, it is important to acknowledge that the demand for egg freezing is not driven solely by employers' attitudes to young motherhood, but that men's attitudes to younger parenthood may play a part as well. As Angel Patropanagos (2015) explains:

For women who seek to co-parent with a male partner, men's reproductive choices matter and influence women's decisions to delay childbearing....Men need to find earlier childbearing more attractive and be willing and able to share in childrearing responsibilities. If men fail to value earlier childbearing or are unwilling or unable to share childrearing responsibilities, some women may continue to find themselves without a suitable parenting partner.

The second way in which egg freezing might be said to involve medicalisation is that it is part of the trend towards individual risk management in healthcare (Moynihan, 2010). Rather than future ill health, or future infertility, being in the 'lap of the Gods', and attributable to brute bad luck, responsible citizens are now encouraged to take control of, and responsibility for their future health needs. Egg freezing converts anticipated future infertility into a new condition (Martin, 2010), for which anticipatory, preventative treatment is available. With the possibility of ovarian reserve testing, and the option of egg freezing, women's responsibility for taking care of their own risk of future infertility could become an aspect of a more general "obligation to 'stay informed' about possible futures [which] has become mandatory for good citizenship and morality, engendering alertness and vigilance as normative affective states" (Adams *et al*, 2009).

On this analysis, egg freezers are simply responsible "biological citizens" (Petryna, 2013; Rose and Novas, 2004). If private "insurance" against future infertility in the form of egg freezing is available, then the individual becomes responsible for insuring herself (Ericson *et al*, 2000). As Lucy van de Wiel puts it, "reproductive ageing becomes refigured as a variable over which agency can be exerted, rather than exclusively a given 'fact of life'" (van de Wiel, 2015). Like other types of private tissue-banking, egg freezing might be

described as “unpooled, personalised risk management ... as a hedge against the uncertainties of the future” (Waldby, 2015a). Parents store their newborn baby’s cord blood not because they are likely to use it, but “as a form of biological security in the face of worst-case scenarios” (Waldby, 2015a). Indeed, the chance of using the stored tissue can be very low indeed without disrupting the logic that storing tissue for possible future use is a sensible precautionary step. The market in private insurance against future risk thrives upon uncertainty and fear: “As insurers and other traffickers in security products know only too well, there is money to be made from uncertainty and the emotions that flow from it” (Ericson, 2005).

Egg freezing significantly expands the potential customer base for private infertility treatment to include all pre-menopausal women who have not ruled out having (more) children. The market for fertility services is therefore no longer confined to those who are unable to conceive naturally, rather egg freezing can be marketed to young, fertile women with no immediate interest in starting a family. Of course, the representation of egg freezing as a responsible choice for all women who might want to have children in the future is at odds with the complex issue of timing, discussed earlier, and with its unaffordability for almost all women. Nevertheless, as we saw earlier, once a preventative option is available, women may feel under pressure to take it up in order to avoid blaming themselves if they experience difficulty conceiving in the future. The flipside of medicalisation, and the increasing emphasis upon taking responsibility for one’s future health needs, may be the possibility of blame and recrimination if one has failed to do so.

(d) Constructions of motherhood

It could be argued that the marketing of social egg freezing relies upon the twin assumptions that almost all women want to have children (Hartouni, 1997), and that they will go to considerable steps to avoid the ‘tragedy’ of involuntary childlessness (Callahan and Roberts, 1996). Might the very availability of egg freezing then reinforce “the social norms and expectations that construe motherhood as a central aspect of womanhood?” (Petropanagos *et al.*, 2015).

Women who freeze their eggs are undergoing costly and physically burdensome treatment in order to keep the option of genetic motherhood open for longer, or, in some cases, to accommodate their partner’s unwillingness or inability to commit to fatherhood

(Stoop, 2010). They are therefore simultaneously exercising ‘choice’ and demonstrating maternal self-sacrifice. In the context of IVF more generally, Gay Becker has drawn attention to the way in which women may “experiment with their bodies out of a sense of responsibility to produce a pregnancy” (Becker, 2000). Additional reproductive options are not always simply and straightforwardly life-enhancing; rather, as Pam Lowe has argued, “ideas about good motherhood” and “the notion that women should be prepared to make sacrifices for the good of their future children, in practice, constrain and discipline women’s lives” (Lowe, 2016).

But while a woman who freezes her eggs is going to considerable lengths to keep the option of genetic motherhood open, at the same time, she is currently either unable or unwilling to become a mother. In the media representation of women who freeze their eggs, a distinction is often drawn between egg freezers who are actively refusing motherhood now, and those whose desire for motherhood is currently thwarted (van de Wiel, 2014). Women who are said to have ‘lifestyle’ reasons for freezing their eggs are portrayed as selfish and self-indulgent. In contrast, women facing cancer treatment, or women are ‘involuntarily single’, are selflessly undergoing egg freezing in order to preserve the possibility of motherhood within a stable family unit, despite its current impossibility for them (van de Wiel, 2014).

As Lucy van de Wiel (2014) further points out, some women may choose to freeze their eggs “not out of reproductive desire, but out of reproductive ambivalence”. A woman who freezes her eggs is not committing herself to motherhood, but may instead be delaying the need to make a decision about it. Women’s fertility decline has the practical impact of making it progressively more difficult to conceive, but it also has considerable symbolic resonance, especially in a culture which prizes youthfulness in women (Rosen, 2013). As van de Wiel (2014) puts it, “fertility is a rich cultural concept that signifies a particular relation to gender and age identities”. The preservation of a woman’s younger, fresher eggs might therefore help her to maintain her identity as potentially reproductive, and hence more youthful, for longer.

(e) Class implications

It has been argued that egg freezing has the potential to equalise the position of career-focused men and women, enabling women to concentrate on their careers in their twenties

and thirties, without feeling that the time to start a family is slipping away from them. June Carbone and Naomi Cahn (2015) have described this as “a reproductive game of chicken”:

Delay in childbearing pays off in terms of higher status matches, more stable families and greater emotional and financial resources to invest in children – and increases the risk that the woman will not be able to bear children at all.

By extending women’s window for genetic motherhood, does egg freezing give women the chance to ‘have it all’ (Slaughter, 2012)? Or as an article in *Time* magazine suggested, could employer-funded egg freezing be “An equalizer among both gender ... and class”, providing “An egalitarian ‘peace of mind’” (Bennett, 2014).

But while egg freezing could make the lives of affluent, well-educated women more like those of affluent, well-educated men (Rosen, 2013), it may make their lives less like those of low-income women. If women have to pay for egg freezing out-of-pocket, it will be an option only for women in relatively high-income and/or high-status work. Employer-funded egg freezing may broaden access, but it will continue to be unavailable to unemployed women, and it is unlikely to be extended to women on temporary or zero-hour contracts, or in low-wage and low-status jobs. Insofar as most women who wish to freeze their eggs will have to pay for it themselves, very few women will be willing and able to spend several thousand pounds on treatment which is not immediately necessary. As Petropanagos *et al* (2015) explain, “It is important to consider the ways in which this technology may work to privilege the family-making projects of already privileged women, and to exclude others who cannot pay for it”.

In Baldwin *et al*’s study of 23 UK egg freezers, all were educated to degree level, and most also had postgraduate or professional qualifications (Baldwin *et al*, 2015; see also Waldby, 2016b). For affluent, high-achieving women, egg freezing could “reorient [their] lives to match the cycles of the male-oriented workplaces they have won the right to enter” (Carbone and Cahn, 2013), but it is unlikely to make any difference to the working lives of low-income women. Richer women already have children later than poorer women: in the UK, 65 per cent of mothers aged under 30 are “from households employed in intermediate and routine occupations”; while 63 per cent of mothers aged 30 and over are “from households employed in higher managerial, administrative and professional occupations” (Office of National Statistics, 2015). Insofar as egg freezing facilitates even later motherhood for wealthy women, it has the potential to further widen the gulf between women’s experience of motherhood, depending on their social class. By transforming “the way elite

women think about reproduction”, egg freezing could “turn existing class differences into a chasm” (Carbone and Cahn, 2013).

4. The challenges of informed consent

In order to give properly informed consent, women need information about the processes involved in egg retrieval, and the tests that must be carried out before egg retrieval takes place. But women also need to be prompted to consider some of the longer term implications of freezing, or not freezing their eggs, and they should be given the opportunity to think about some of the dilemmas that they may face in the future. This is inherently difficult, however, because the routine clinical use of vitrification is so new that no reliable data exists about its longer term utility. It can be difficult to communicate effectively about uncertainty, and there is evidence that patients find admissions of clinical uncertainty challenging and unsatisfactory (Politi *et al*, 2011). But it is important that the informed consent process includes discussion of the uncertainties of egg freezing, including the fact that “it is far from certain that the woman will eventually use her cryopreserved oocyte reserve” (ESHRE Task Force on Ethics and Law, 2012).

Perhaps most important of all, potential egg freezers need to understand that even if eggs survive the thawing process, there are no guarantees that a future IVF cycle will be successful. Françoise Baylis explains that “consenting to oocyte cryopreservation is but a first step on the path to future IVF”, because “oocytes in storage are of no personal value to a woman who wants to make a baby unless she chooses to reproduce using IVF” (Baylis, 2015). IVF is expensive, invasive and stressful (Franklin, 1997), and every cycle is more likely to fail than it is to succeed. As Susan Bewley (2016) puts it, “We know that the joy-filled, constantly rising number of X million babies born via ART is accompanied by an unspoken, larger number of Y million couples disappointed, financially challenged and grieving”. Women contemplating freezing their eggs should therefore be properly informed about the costs and burdens of IVF, as well as the processes involved in egg retrieval (Petropanagos *et al*, 2015).

A further challenge to informed consent is evidence that people find their own fertility loss difficult to understand. As well as information about the pros and cons of egg freezing, women and men may need to be told that their “best chances of having a healthy child are through natural reproduction at a relative early age” (ESHRE Task Force on Ethics and Law,

2012). There is evidence that women and men tend to overestimate their own reproductive capacity and underestimate their risk of future infertility (Daniluk and Koert, 2013). In their survey of Australians of reproductive age who wanted to have children, Hammarberg *et al* (2013) found that the “majority of participants underestimated, by about 10 years, the age at which male and female fertility starts to decline”. It is therefore unsurprising that the average age at which women have frozen their eggs is in their late thirties (Klein *et al*, 2016; Nekkebroeck *et al*, 2010), when they have started to feel vulnerable to infertility. Before then, as John Robertson (2014) puts it, “the optimism bias of the relatively young” makes the risk of future infertility “seem quite distant”.

As well as underestimating their own risk of infertility, there is also evidence that women and men overestimate the likely success of fertility treatment (Bretherick *et al*, 2010; Maheshwari *et al*, 2008; Daniluk and Koert, 2013), and in particular, that they overestimate “the effectiveness of assisted reproductive treatments to overcome age-related infertility” (Wyndham *et al*, 2012). Taken together, this makes it especially important that potential egg freezers are not sold “false hope” (Mertes, 2011), and are not encouraged in the belief that by freezing their eggs in their late thirties, they have preserved their fertility indefinitely.

As Lauren Martin (2010) has pointed out, ‘fertility preservation’ is in any event a misnomer for egg freezing: “Women who use their own thawed eggs because they cannot conceive on their own are no more fertile than those women who use donated eggs for the same reason” (Martin, 2010). What is preserved through egg freezing is not a woman’s fertility, but her “ability to transmit [her] genetic material to future generations”. Indeed, given the failure rates of IVF, it is not even clear that egg freezing ‘preserves’ a woman’s ability to have genetically-related offspring. Rather a woman contemplating egg freezing needs to understand that having frozen eggs in storage simply means that, in the future, she would be able to attempt IVF, which may or may not work, with her own stored eggs, rather than with eggs from a younger egg donor.

Women also need to be forewarned about some of the complex decisions they are likely to face in the future. The decision to dispose of one’s eggs, or having their disposal forced upon one after the expiry of the statutory storage period, can be difficult. In the context of stored embryos, there is evidence that patients put off making decisions about their disposal or donation, and that they do not find these decisions straightforward (Karpin *et al*, 2013). We know that it is not uncommon for ex-patients to fail to reply to letters from clinics about the disposal, donation or continued storage of their stored gametes and embryos (Pennings, 2000), not because they do not mind what happens to them, but because of their

“desire to avoid irreversible statements and a general uneasiness and unfamiliarity in thinking about these issues” (Pennings, 2000).

Because of ‘social’ egg freezing’s novelty, we do not know what impact the UK’s 10-year statutory time limit will have upon women who are choosing to freeze their eggs now. In the first years after their eggs were stored, women will simply have to pay an annual storage fee. Towards the end of the 10-year period, women might feel under pressure to use their eggs, perhaps using donor sperm. Ironically, the time limit might even be experienced as a new (non-)biological clock. It may be possible for women nearing the end of their statutory storage time limit to apply to export their eggs to another country where eggs can lawfully be used after 10 years, but this is not without costs and practical difficulties (HFEA, 2015). Clinics therefore need to give women unambiguous information about the existence of the 10-year time limit, and the implications it may have for them.

Almost all clinics’ patient information sheets do mention the 10-year time limit, but some are vague about the options for extension, as is evident in this sample of five current patient information leaflets:

- For medical reasons, eggs can be stored until 55 years of age [this was the case under the 1991 Regulations]. With social egg freezing, eggs can be stored for up to ten years (London Women’s Clinic)
- Eggs can normally be stored for up to 10 years, provided that you renew your consent to storage each year by informing the BFC annually (in writing) that you require storage to continue...In special circumstances we may be able to store eggs for more than 10 years – this depends on the reason for storage (Bath Fertility Centre).
- Eggs may be stored until the patient wishes to try to conceive with them. Currently eggs may be stored for a maximum of 10 years, although this period may be extended if the woman is rendered prematurely infertile, in which case they can be stored for 55 years from the date they were frozen (Midland Fertility).
- The statutory storage period for eggs is ten years. At the end of the ten-year period you may be able to extend the time of storage. By law we can store samples for 55 years, provided you meet the medical criteria of having or be likely to develop premature infertility (Leicester Fertility Centre).
- There are a number of forms that need to be completed as egg freezing is regulated in the UK by the Human Fertilisation and Embryology Authority (HFEA) [no mention of storage limits] (Nuada Gynaecology).

Of course, it should not be assumed that this information is all that women receive, and the implications of the 10-year time limit are likely to be explored in more detail during oral discussions about the implications of egg freezing. But it could be argued that the practical

significance of the storage time limit is sufficiently serious that written patient information sheets should contain a blunt and unambiguous warning, such as: “if you are not medically and prematurely infertile, or likely to become prematurely infertile, the clinic will have to dispose of your frozen eggs after 10 years”.

5. Future implications

As more women make individual decisions to freeze their eggs, the result will be the storage, in tanks of liquid nitrogen, of large numbers of frozen eggs. Just as with the long-term storage of sperm and embryos, clinics must have robust mechanisms in place to maintain the safety and security of the eggs, and of women’s personal information (Human Fertilisation and Embryology Act, section 33A). Measures must be in place to prevent inadvertent thawing (HFEA Code of Practice, para. 17.5), and, should this occur, women might be said to have property rights in their stored eggs (Skene, 2012), and are likely to be able to sue the clinic for damages in negligence (*Yearworth v North Bristol NHS Trust* [2009] EWCA Civ 37).

‘Social’ egg freezing is unlikely ever to be funded by the NHS (Arie, 2015). Writing from a Belgian perspective, Heidi Mertes and Guido Pennings (2012) suggest that complex questions might arise if women who have paid to freeze their eggs are eligible subsequently for publicly-funded fertility treatment. Using their previously frozen eggs will make their publicly-funded IVF treatment significantly cheaper than it would have been if they had embarked on fertility treatment afresh at, say, age 39. They will not need to undergo ovarian stimulation or retrieval, and they will have needed less stimulation and fewer cycles of treatment. In countries, like the UK, where at least one cycle of publicly-funded IVF treatment is, in theory at least, available to women up to the age of 42 (National Institute of Health and Care Excellence, 2013), egg freezers might therefore be privately subsidising their future state-funded fertility treatment.

Should women who subsequently use their frozen eggs, when they would have been entitled to a full cycle of publicly-funded IVF treatment, therefore have the costs of their previous egg freezing reimbursed? As Mertes and Pennings point out, there will have been a considerable time lag between the original investment in egg freezing and the subsequent IVF, so the refund might ‘be experienced as a considerable financial “bonus”’. Indeed, they

suggest that it is even possible that some women who could conceive naturally might be tempted to undergo IVF in order to claim this reimbursement (Mertes and Pennings, 2012).

In the UK, the financial pressures on the NHS are such that state-funded reimbursement for private egg freezers is implausible, but it is certainly possible that egg freezing could have implications for egg donation. Currently, egg donors are either non-patients, or they are recruited through egg sharing schemes, in which women under the age of 36 who are in need of IVF donate some of their eggs to other women, in return for free or reduced price IVF; or, as we saw earlier, women under the age of 32 might share their eggs in return for free egg freezing. Non-sharing donors undergo egg retrieval solely for the purpose of donating eggs to other women, and they can receive a maximum of £750 per cycle of donation, to cover all of their expenses.

Given that it seems likely that a significant proportion of women who have frozen their eggs are unlikely to use them (ESHRE Task Force on Ethics and Law, 2012), in the future, these unused frozen eggs could, with the egg freezers' consent, become a new source of donor eggs. Egg freezers under the age of 36 could donate their unwanted eggs for the treatment of others without undergoing any additional clinical risk or discomfort. Of course, in order to become egg donors, women might have to undergo additional screening tests, and they would have to agree to be identifiable to any resulting children. But if sufficient women under the age of 36 at the time of freezing were willing to donate their leftover frozen eggs for use by women who are unable to use their own eggs in treatment, there would be no need to recruit egg donors in the future. There might also be advantages to using frozen eggs, rather than recruiting fresh egg donors, because it would facilitate testing for infectious conditions such as HIV, and would eliminate the need to synchronise the cycles of recipient and donor (Mertes *et al*, 2012).

The upper age limit for egg donors in the UK is currently 35, so if most women are freezing their eggs in their late thirties, they would be too old to donate those eggs for the treatment of others. But older egg freezers (and younger freezers, if they had qualms about donation for use in others' treatment) could donate their unwanted eggs for research purposes. This is potentially significant because the recruitment of egg donors for research purposes has been both difficult and controversial (Baylis and McLeod, 2007; Beeson and Lippman, 2006). If leftover frozen eggs could be used instead, they might represent an invaluable scientific resource.

6. Conclusion

Egg freezing presents women concerned about age-related fertility loss with a new option. Although this might seem self-evidently desirable, there can be costs associated with having additional choices (Irons and Hepburn, 2007), including the possibility of future regret and recrimination for failing to take advantage of them. Women might be spending significant sums of money on retrieving and freezing eggs that they are unlikely to use, not because we know it to be a prudent thing to do, but in order to avoid the possibility of future regret. As Judith Daniluk (2015) explains, women are already blamed for ‘waiting too long’:

This “blame the woman for waiting too long” discourse is devoid of any acknowledgment of the myriad economic, career, and social costs of having and raising children—costs that constrain and circumscribe women’s reproductive autonomy.... Further contributing to this reproductive “Catch 22” is the social responsibility burden placed on women to ensure they have, and raise, their children within the context of a loving, stable, two-parent relationship and secure home.

In the future, women might be blamed not only for ‘waiting too long’, but additionally for failing to insure against the risks of ‘waiting too long’ by freezing their eggs? If a woman’s future infertility becomes something over which she could exercise some control, does it also thereby become her responsibility? It is alarming to contemplate a future in which a woman who ‘chose’ not to freeze her eggs might be regarded as having ‘chosen’ to become infertile later in life (Mohapatra, 2014).

Women now in their twenties and thirties have an option that was not available to previous generations of women, and while some women may benefit from having decided to freeze their eggs, it is important to acknowledge that the decision is not straightforward, but is instead beset with uncertainties and ambiguities. Through egg freezing, increasing numbers of women are choosing to become fertility patients, and are undergoing invasive treatment that will have a modest chance of success only if they become IVF patients in the future.

Given that egg freezing has only become standard clinical treatment within the last few years, we do not know how many women will regret not freezing their eggs, or how many women will be glad that they did so. It is impossible for an individual woman, or the healthcare professional advising her, to know whether egg freezing is the right thing to do; instead a woman contemplating freezing her eggs can only speculate about her future relationships, and about how she might feel in the future about her decision to freeze, or not freeze her eggs. Today’s pioneering egg freezers (and non-freezers) have a new option, but they also face new dilemmas, and the possibility of feeling responsible for having made the

‘wrong’ choice, with the benefit of hindsight. When a generation of women faces a choice that was unavailable to women ten years their senior, they need access to as much information as possible, including an honest admission from the clinician treating her that there is as yet no evidence of the long term utility of ‘social’ egg freezing.

References

Adams, V., Murphy, M. and Clarke, A.E. (2009) Anticipation: Technoscience, life, affect, temporality. *Subjectivity* 28:246-265.

Alter, C., Tsai, D. and Trianni, F. (2015) What You Really Need to Know About Egg Freezing. *Time*. July 16.

ASRM (2014) Can I freeze my eggs to use later if I’m not sick? Alabama: ASRM.

Arie, S. (2015) Is too much hope placed in egg freezing? *British Medical Journal* 351:h5955.

Baldwin, K., Culley, L., Hudson, N. and Mitchell, H. (2014) Reproductive technology and the life course: current debates and research in social egg freezing. *Human Fertility*, 17: 170-179.

Baldwin, K., Culley, L., Hudson, N., Mitchell, H. and Lavery, S. (2015) Oocyte cryopreservation for social reasons: demographic profile and disposal intentions of UK users *Reproductive BioMedicine Online* 31:239-245.

Baylis, F. (2015) Left out in the cold: arguments against non-medical oocyte cryopreservation. *Journal of Obstetrics and Gynaecology Canada*, 37:64-67.

Baylis, F. and McLeod, C. (2007) The stem cell debate continues: the buying and selling of eggs for research. *Journal of Medical Ethics* 33: 726-731.

Becker, G. (2000) *The elusive embryo: How women and men approach new reproductive technologies*. Los Angeles: University of California Press.

Beeson, D. and Lippman, A. (2006) Egg harvesting for stem cell research: medical risks and ethical problems. *Reproductive BioMedicine Online*, 13: 573-579.

- Bennett, J. (2014) Company-paid egg freezing will be the great equalizer. *Time* October 15: 1-2.
- Bewley, S. (2016) Shock! Horror! Or business as usual? *Bionews*. 6 June.
- Petersen, K.B., Hvidman, H.W., Sylvest, R., Pinborg, A., Larsen, E.C., Macklon, K.T., Andersen, A.N. and Schmidt, L.,
- Birch Petersen, K. *et al* (2015) Family intentions and personal considerations on postponing childbearing in childless cohabiting and single women aged 35–43 seeking fertility assessment and counselling. *Human Reproduction* 30: 2563-2574.
- Bretherick K.L. *et al* (2010) Fertility and aging: do reproductive-aged women know what they need to know? *Fertility and Sterility* 93: 2162–2168.
- Callahan, J.C. and Roberts, D.E. (1996) *Feminist Social Justice Approach to Reproduction-Assisting Technologies: A Case Study on the Limits of Liberal Theory*. *Kentucky Law Journal* 84:1197.
- Carbone, J. and Cahn, N. (2013) *Gender/Class Divide: Reproduction, Privilege, and the Workplace*. *Florida International University Law Review* 8: 287.
- Carbone, J. and Cahn, N. (2015) The triple system for regulating women's reproduction. *The Journal of Law, Medicine & Ethics* 43:275-288.
- Chen, C. (1986) Pregnancy after human oocyte cryopreservation. *The Lancet* . 327: 884-886.
- Daniluk, J.C. (2015) “Sleepwalking into Infertility”: The Need for a Gentle Wake-Up Call. *The American Journal of Bioethics*, 15: 52-54.
- Daniluk J.C. and Koert, E. (2013) The other side of the fertility coin: a comparison of childless men's and women's knowledge of fertility and assisted reproductive technology. *Fertility and Sterility* 99:839–846.
- Daly, I and Bewley, S. (2013) Reproductive ageing and conflicting clocks: King Midas’ touch. *Reproductive BioMedicine Online* 27: 722-732.
- Department of Health (2009) *Impact Assessment for the Human Fertilisation and Embryology (Statutory Storage Period for Gametes and Embryos) Regulations*. London: Department of Health.
- Dunson, D.B., Colombo, B. and Baird, D.D. (2002) Changes with age in the level and duration of fertility in the menstrual cycle. *Human reproduction* 17:1399-1403.

- Ericson, R. (2005) Governing through risk and uncertainty. *Economy and Society* 34:659-672
- Ericson, R., Barry, D. and Doyle, A. (2000) The moral hazards of neoliberalism: lessons from the private insurance industry. *Economy and Society* 29:532–558.
- ESHRE Task Force on Ethics and Law (2012) Oocyte cryopreservation for age-related fertility loss. *Human Reproduction* 27:1231-1237.
- Evers, J.H. (2016) Santa Claus in the fertility clinic. *Human Reproduction* 31: 1381-1382.
- Franklin, S. (1997) *Embodied Progress: A Culture Account of Assisted Conception*. Routledge: London.
- Goold I. and Savulescu, J. (2009) In Favour of Freezing Eggs for Non-Medical Reasons. *Bioethics* 23:47–58.
- Hammarberg, K. and Clarke, V.E. (2005) Reasons for delaying childbearing—A survey of women aged over 35 years seeking assisted reproductive technology. *Australian Family Physician* 34:187–189.
- Hammarberg, K. *et al* (2013) Knowledge about factors that influence fertility among Australians of reproductive age: a population-based survey. *Fertility and sterility* 99:502-507.
- Harper, J. *et al* (2012) When and how should new technology be introduced into the IVF laboratory? *Human reproduction* 27:303-13.
- Hartouni, V. (1997) *Cultural conceptions: On reproductive technologies and the remaking of life*. Minneapolis: University of Minnesota Press.
- Harwood, K. (2009) Egg freezing: a breakthrough for reproductive autonomy? *Bioethics*, 23: 39-46.
- Hass, N. (2011) Time to Chill? Egg-freezing Technology Offers Women a Chance to Extend Their Fertility. *Vogue*. April 28.
- Hodes-Wertz, B. *et al*, (2013) What do reproductive age women who undergo oocyte cryopreservation think about the processes as means to preserve fertility? *Fertility and Sterility* 100:1343–9.
- Homburg, R., van der Veen, F. and Silber, S.J. (2009) Oocyte vitrification: Women's emancipation set in stone. *Fertility and Sterility* 91:1319-320.

Human Fertilisation and Embryology Authority (2015) General Directions 0006 version 4 Import and export of gametes and embryos. London: HFEA.

Human Fertilisation and Embryology Authority (2016) Fertility Treatment 2014: Trends and Figures. London: HFEA.

Inhorn, MC (2013) Women, Consider Freezing Your Eggs. CNN April 9.

Irons, B. and Hepburn, C. (2007) Regret theory and the tyranny of choice. *Economic Record*, 83:191-203.

Jackson, E. (2016) 'Social' egg freezing and the UK's statutory storage time limits. *Journal of Medical Ethics*. Online First: 23 August 2016.

Karpin, I.A., Millbank, J., Stuhmcke, A. and Chandler, E., (2013) Analysing IVF Participant Understanding of, Involvement in, and Control over Embryo Storage and Destruction in Australia. *Journal of Law and Medicine* 20:811-830.

Klein, J. *et al*, (2006) P-486: preliminary experience of an oocyte cryopreservation program: are patients presenting too late? *Fertility and Sterility* 86:S315.

Krähmer, D. and Stone, R. (2013) Anticipated regret as an explanation of uncertainty aversion. *Economic Theory* 52: 709-728.

Kuleshova, L. *et al* (1999) Birth following vitrification of a small number of human oocytes: Case Report. *Human Reproduction* 14: 3077-3079.

Lemoine, M.E. and Ravitsky, V. (2015) Sleepwalking Into Infertility: The Need for a Public Health Approach Toward Advanced Maternal Age. *The American Journal of Bioethics* 15:37-48.

Lockwood, G.M. (2011) Social egg freezing the prospect of reproductive "immortality" or a dangerous delusion? *Reproductive BioMedicine Online* 23: 334-340.

Lockwood, G. and Johnson, M.H. (2015) Having it all? Where are we with "social" egg freezing today? *Reproductive BioMedicine Online*, 31:126-127.

London Egg Bank website (2016) <http://www.londoneggbank.com/how-do-i-freeze-my-eggs/freeze-and-share> accessed 14 September 2016.

Loomes G. and Sugden, R (1982) Regret Theory: An Alternative Theory of Rational Choice Under Uncertainty *The Economic Journal* 92: 805-824.

- Lowe, P. (2016) *Reproductive Health and Maternal Sacrifice: Women, Choice and Responsibility*. Basingstoke: Palgrave Macmillan.
- Maheshwari, A., Porter, M., Shetty, A. and Bhattacharya, S. (2008) Women's awareness and perceptions of delay in childbearing. *Fertility and sterility* 90:1036-1042.
- Martin, L.J. (2010) Anticipating infertility: Egg freezing, genetic preservation, and risk. *Gender and Society* 24: 526-545.
- McBride, C. (2013) I'm so glad I've frozen my eggs *The Guardian*, 14 December 2013.
- Mertes, H. (2011) Social egg freezing: for better, not for worse' *Reproductive BioMedicine Online* 23:824-829.
- Mertes, H. (2015) Does company-sponsored egg freezing promote or confine women's reproductive autonomy? *Journal of Assisted Reproduction and Genetics* 32:1205-9.
- Mertes, H. (2016) The role of anticipated decision regret and the patient's best interest in sterilisation and medically assisted reproduction *Journal of Medical Ethics Online First*: 7 October 2016.
- Mertes, H. and Pennings, G. (2011) Social egg freezing: for better, not for worse. *Reproductive BioMedicine Online* 23: 824-829.
- Mertes, H. and Pennings, G. (2012) Elective oocyte cryopreservation: who should pay? *Human Reproduction* 27: 9-13.
- Mertes, H., Pennings, G., Dondorp, W. and de Wert, G. (2012) Implications of oocyte cryostorage for the practice of oocyte donation. *Human Reproduction* 27: 2886-2893.
- Mesen, TB *et al* (2015) Optimal timing for elective egg freezing. *Fertility and Sterility* 2013: 1551-6 e1-4.
- Mohapatra, S. (2014) Using egg freezing to extend the biological clock: fertility insurance or false hope? *Harvard Law and Policy Review* 8: 382.
- Moynihan, R (2010) Prediseases: Who benefits from treating prehypertension? *British Medical Journal* 341:c4442.
- Nekkebroeck J., Stoop, D. and Devroey, P. (2010) A preliminary profile of women opting for oocyte cryopreservation for non-medical reasons *Human Reproduction* 25: i14-i17.

National Institute for Health and Care Excellence (2013) Fertility: Assessment and treatment for people with fertility problems. London: NICE.

Office of National Statistics (2015) Births by Parents' Characteristics in England and Wales: 2014. London: ONS.

Peck, S. (2014) Egg freezing: the perfect 30th birthday gift for women. The Daily Telegraph, 27 October 2014.

Pennings, G. (2000) What are the ownership rights for gametes and embryos? Advance directives and the disposition of cryopreserved gametes and embryos Human Reproduction 15:979-989.

Petropanagos, A. (2015) Is Advanced Maternal Age a Public Health Issue? The American Journal of Bioethics 15:56-58.

Petropanagos, A., Cattapan, A., Baylis, F., & Leader, A. (2015) Social egg freezing: risk, benefits and other considerations. Canadian Medical Association Journal 187: 666–669.

Petryna, A. (2013) *Life exposed: biological citizens after Chernobyl*. Princeton: Princeton University Press. 2013).

Politi, M.C., Clark, M.A., Ombao, H., Dizon, D. and Elwyn, G. (2011) Communicating uncertainty can lead to less decision satisfaction: a necessary cost of involving patients in shared decision making? Health Expectations 14:84-91.

Practice committees of the SART and ASRM (2013) Mature oocyte cryopreservation: a guideline. Alabama: ASRM.

Rapp, R. (1999) *Testing Women, Testing the Fetus: The Social Impact of Amniocentesis in America*. New York: Routledge.

Richards, S.E. (2013a) Why I Froze My Eggs (And You Should, Too. The Wall Street Journal, May 3.

Richards, S.E. (2013b) *Motherhood, Rescheduled: The New Frontier of Egg Freezing and the Women Who Tried It*. New York: Simon and Schuster.

Richards, S.E. (2013c) Freezing eggs - is this what we're all doing now? Cosmopolitan, 15 June.

Rienzi *et al*, L. (2010) Embryo development and gestation using fresh and vitrified oocytes. Human Reproduction 25: 1192–1198.

- Robertson, J. (2014) Egg freezing and egg banking: empowerment and alienation in assisted reproduction' *Journal of Law and the Biosciences* 1:113-136.
- Rose, N. and Novas, C. (2004) Biological citizenship. In: Ong, A. and Collier S.J. (eds.) *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems*. Oxford, Blackwell Publishing. pp. 439-463.
- Rosen, C. (2013) The Ethics of Egg Freezing. *Wall Street Journal* 4 May.
- Sandberg, T. and Conner, M. (2008) Anticipated regret as an additional predictor in the theory of planned behaviour: A meta-analysis. *British Journal of Social Psychology* 47: 589–606.
- Sarner, M. (2015) I'm 29, should I free my eggs? *The Guardian* 14 August.
- Skene, L. (2012) Proprietary interests in human bodily material: Yearworth, recent Australian cases on stored semen and their implications: *Kate Jane Bazley v Wesley Monash IVF Pty Ltd* [2010] QSC 118; *Jocelyn Edwards; Re the estate of the late Mark Edwards* [2011] NSWSC 478. *Medical Law Review* 20:227-245.
- Slaughter, A.M. (2012) Why women still can't have it all. *The Atlantic*, June 13.
- Stoop, D. (2010) Social oocyte freezing. *Facts, Views and Vision in ObGyn* 2:31–34.
- Stoop, D. *et al* (2015) Does oocyte banking for anticipated gamete exhaustion influence future relational and reproductive choices? A follow-up of bankers and non-bankers *Human Reproduction* 30: 338-344.
- ter Keurst, A., Boivin, J. and Gameiro, S. (2016) Women's intentions to use fertility preservation to prevent age-related fertility decline. *Reproductive biomedicine online* 32: 121-131.
- Tsafir, A. *et al* (2015) Ovarian stimulation for oocyte cryopreservation for prevention of age-related fertility loss: one in five is a low responder. *Gynecological Endocrinology* 31:779-782.
- Tymstra, T. (1989) The Imperative Character of Medical Technology and the Meaning of "Anticipated Decision Regret". *International Journal of Technology Assessment in Health Care* 5:207-213.

- Tymstra, T. (2007) “At least we tried everything”: about binary thinking, anticipated decision regret, and the imperative character of medical technology. *Journal of Psychosomatic Obstetrics and Gynecology* 28:131.
- Van de Wiel, L. (2014) For whom the clock ticks: Reproductive ageing and egg freezing in Dutch and British news media. *Studies in the Maternal* 6(1).
- Van de Wiel, L. (2015) Freezing in anticipation: Eggs for later. *Women Studies International Forum* 53:119-128.
- Waldby, C. (2015a) The Oocyte Market and Social Egg Freezing: From scarcity to singularity. *Journal of Cultural Economy* 8: 275-291.
- Waldby, C. (2015b). ‘Banking time’: egg freezing and the negotiation of future fertility. *Culture, health and sexuality*, 17: 470-482.
- WhatClinic.com (2015) Demand for Private Fertility Treatments in UK More than Doubles in One Year. (available at <http://www.whatclinic.com/about/press/>, accessed 13 September 2016).
- Wyndham, N., Figueira, P.G.M. and Patrizio, P. (2012) A persistent misperception: assisted reproductive technology can reverse the “aged biological clock”. *Fertility and sterility* 97:1044-1047.
- Zeelenberg, M. (1999) Anticipated regret, expected feedback and behavioural decision making. *Journal of Behavioral Decision Making*. 12:93–106.