

**Technology, Fertility and Public Policy:  
A Structural Perspective on Human Egg Freezing and Gender Equality.**

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**Abstract:** Marketed as the smart way of planning career and reproduction, fertility ‘insurance’ technology aimed at the fertile woman (‘social egg freezing’) is becoming big business. Drawing on the work of political theorists, Iris Marion Young and Sally Haslanger, I develop a structural perspective on the promotion of social egg freezing as a means of better managing career prospects. I critically engage with the work of prominent ethicists, such as Julian Savulescu and others, who advocate the promotion of social egg freezing as a resource for increasing gender equality in the workplace. In so doing, I argue for public policy design with a wider structural focus.

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“Last fall, I went to an egg freezing cocktail hour. The downstairs bar of the glossy SoHo Hotel was thronged with women in heels and sleek business attire. Club music thumped, cameras flashed.... The evening was hosted by Eggbanxx<sup>2</sup>, a startup that sells financing for egg freezing, framed as fertility insurance for the forward-thinking urban professional woman” (Rabinowitz 2015).

Just before his death in January 2015 at the age of 91, Carl Djerassi (leader of the scientific team that developed oral contraception in 1951)<sup>3</sup> made a prediction about the future of fertility. He estimated that by 2050, it would be commonplace for fertile professional women to undergo elective ‘routine’ oocyte cryopreservation, otherwise known as ‘social egg freezing’ to give themselves more control over the relationship between their fertility and career. Djerassi’s prediction, which only a few years ago would have seemed fantastical, now has growing force as we see the continued expansion of a global fertility industry currently estimated to be worth \$30 billion (Harris Williams & Co 2015, Global Market Insights 2017) with some private fertility clinics such as the London Women’s Clinic seeing over 100% rise in social egg freezing in just three years (Gurtin 2017).<sup>4</sup>

There is no doubt that reproductive technologies have had and will continue to have a profoundly positive impact on the lives of many people seeking to become parents - some with fertility issues, some using the technology to avoid passing on inherited genetic disorders, some wishing to use assisted reproductive technologies to have children with a same sex partner or perhaps those who have yet to find the right partner (see for example, Baldwin 2017, Golombok 2015, Inhorn 2017, Waldby 2015). My purpose in this article however, is to consider the promotion of social egg freezing aimed at fertile women as a means of delaying childbearing for employment and career prospects. I begin with a brief technical account of human egg freezing which is essential for understanding the driving forces behind the proliferation of fertility insurance technologies. The first of these is the prevalence of low replacement birth rates in many rich economies where women tend to have (fewer) children later in life. The second is the attraction of ‘add on’ technologies to egg freezing such as pre-implantation genetic technologies (PGTs) which offer genetic

screening and, in the future, gene trait selection. Following on from these, I consider the arguments put forward by prominent ethicist Julian Savulescu<sup>5</sup> and others who advocate the promotion of social egg freezing as a means to increasing gender equality in the workplace. This sort of perspective sees social egg freezing as widening women's fertility options so as to bring women closer to men in terms of their range of life-style choices.

Drawing on the work of feminist political theorists, Iris Marion Young and Sally Haslanger, I consider some of the potential structural consequences to wide-spread use of social egg freezing in the contemporary public policy context. In so doing, I suggest that overly-individualist claims such as Savulescu's are unpersuasive. Fertility and technology-use should not be weighted too heavily in terms of individual responsibility but rather ought to feature more prominently in political debate and public policy design with a wider structural focus.

*A very brief account of human oocyte cryopreservation (egg freezing).*

Women are born with all of their 'potential eggs' (follicles) but by the time the average woman is in her early to mid-30s these numbers will have declined dramatically: she will have approximately 12% remaining which will reduce to about 3% by her early 40s and continue to decline until the menopause at around 50 years of age (Wallace and Kelsey 2010). Women who decide to freeze their eggs for future use will first undergo a range of medical tests, followed by two-four weeks of hormone treatment to stimulate the ovaries (superovulation) to produce multiple follicles/eggs. This process increases the production of follicles/eggs to as many as 40 per cycle via superovulation (compared to the typical production of only 1 follicle/egg in a regular menstrual cycle). Once the follicles are

sufficiently large the eggs are collected<sup>6</sup>. The number of eggs retrieved can significantly vary but the recommended minimum number for freezing is 15 eggs (Lockwood and Johnson 2015). The harvested eggs are then dehydrated, treated with cryoprotectant ('anti-freeze'), frozen (increasingly through the process of vitrification<sup>7</sup>) and stored in liquid nitrogen for up to 10 years. When a woman who has frozen her eggs wishes to attempt to become pregnant, her eggs are defrosted and then fertilized by the *in vitro* fertilization intracytoplasmic sperm injection (IVF/ICSI) method.<sup>8</sup> Multiple embryos are created and (having matured for 4-5 days) one or sometimes two are chosen for implantation into the patient's uterus in the hope of pregnancy (see for example Konc et al 2014) and Rodriguez-Wallberg and Oktay 2012).

#### *Drivers of the Fertility Insurance Technology Services*

“Smart women freeze” (EggBanxx 2017).

The first driver of this new 'insurance market' is demographic context. Predictions that social egg freezing will become routine for future generations of fertile professional women in richer economies, is predicated on what Djerassi called the “mañana [tomorrow] generation” - a generation defined by delayed reproduction resulting in 'geriatric states' (Djerassi 2014, 73). These are states where the total fertility rate (TFR), is less than 2.1 - the rate needed for population replacement.<sup>9</sup> If we look at the United States where the TFR is 1.8 (Central Intelligence Agency 2016) and at Europe,<sup>10</sup> where collectively the TFR is 1.55, there is not a single country with a TFR of 2.1 or above. Indeed, the number of live births across the EU-28 states dramatically declined from 7.5 million in 1964 to 5.1 million

in 2015 (Eurostat 2016). The key factor in this downward trend is that women are having children later in life and consequently fewer of them. Currently, the mean age of women at childbirth in the EU is 30.3 years (Eurostat 2016) and the same figure stands for the UK, where the TFR is 1.8. (ONS 2016). Djerassi suggests that the UK female graduate population as a typical *mañana* generation and certainly, the UK data shows that female graduates are far less likely to have children by the age of 30 (only 9% of whom had dependent children compared to 41% of non-graduate women (ONS, 2013). Here the claim is that the more normalized late-motherhood becomes, particularly for professional women, the more attractive (and rational) fertility insurance will become for those who can afford it.

However, Djerassi's predictions regarding social egg freezing are based not only on the fact that many women are choosing to delay (or feeling they have to delay) motherhood but also on the perception that using such technologies carries other benefits, which may be especially appealing to wealthier prospective parents. He describes how women will;

“choose this approach [egg freezing] as insurance, providing them the freedom, in the light of professional decisions... of not having to worry about the inexorable clicking of the biological clock. However, I predict that many of these women will in fact eventually decide to be fertilized by IVF methods for the simple reason that concurrent with the improvements in assisted reproductive techniques, enormous advances have occurred in the area of genomics with pre-implantation genetic diagnosis [which will become] *the ultimate factor*” (Djerassi 2014, 74, emphasis added).

Pre-implantation genetic technologies (PGTs) are commonly offered as ‘add on’ services to egg-freezing (see for example Brezina and Kutteh 2015, Franklin 2013). Why might they be the ultimate factor in driving the fertility insurance industry? In addition to the decline in the quantity of eggs, the genetic ‘quality’ of eggs also deteriorates with age, in the sense that the risk of genetic disorders in children born from older eggs is significantly higher (see for example, Loane et al 2013). The conventional method for genetic testing (frequently routine for older mothers) is the amniocentesis procedure which is performed between the 11<sup>th</sup> and 20<sup>th</sup> week of pregnancy and which comes with a 1/100 risk of miscarriage.<sup>11</sup> Franklin refers to the procedure as “high-tech reproductive roulette” (2013, 7) and if a genetic abnormality is detected via amniocentesis then for some prospective parents this will result in the decision to terminate the pregnancy. However, if a woman were to choose the alternative IVF route to pregnancy (having frozen her younger-self eggs previously), pre-implantation genetic diagnosis can be used to test for genetic disorders in embryos *before* they are selected for transference into the womb, thereby significantly reducing elective terminations or the number of children being born with a genetic disorder.

In the UK, for example, there are 350 genetic disorders that can be tested for by PGTs (such as Muscular Dystrophy Haemophilia, Down’s Syndrome, Cystic Fibrosis).<sup>12</sup>

Ethicists Goold and Savulescu argue that with the use of PGTs, “egg freezing could potentially eliminate many genetic abnormalities” (2009, 49). Currently PGTs are used for potential parents who have a family history of genetic disorder but Djerassi argues that

future generations of women will see PGTs as a “major incentive” (Djerassi 2014, 74) to produce children via IVF rather than through coital means.

Bostrum and Savulescu (2009, 10) argue that as PGTs become more available, parents will not stop at screening out genetic disorders but move on to genetic selection (2009, 10).

Bostrum argues that parents of the future will be motivated by the “virtual guarantee that the child would be highly talented and free from genetic predispositions to diseases”(2014, 39) and in a similar vein to Djerassi, he surmises that as genetic selection “becomes more common, particularly among social elites, there might be a cultural shift toward parenting norms that present the use of selection as the thing that responsible enlightened couples do,” (ibid) adding that, “[m]any of the initially reluctant might join the bandwagon in order to have a child that is not at a disadvantage relative to the enhanced children of their friends and colleagues” (ibid).<sup>13</sup> Savulescu argues that parents ought to be “morally obligated to genetically modify their children” to give them “the best opportunity of the best life” (Savulescu 2005, 36)<sup>14</sup> and Harris argues that parents would in fact be negligent if they didn’t enhance when possible; “to decide to withhold a benefit is in a sense a harm to the individual we decline to benefit” (Harris, 2009, 131).

How accurate these ‘positive-trait gene selection’ technologies turn out to be is yet to be established. Certainly there is significant scepticism.<sup>15</sup> Nevertheless, there can be little doubt that gene selection will create a lucrative market for those attracted by the allure of creating enhanced children – what Nozick predicted as a “genetic supermarket”(1974, 315). Once PGT markets are established, Djerassi goes on to argue, “IVF will start to become a ‘normal’ non-coital method of having children” (Djerassi 2014, 74)<sup>16</sup> and therefore, if

decided with foresight, the freezing of ‘optimal’ young eggs years before becoming pregnant will become increasingly popular for those able to pay.

The prospect of gene selection markets has generated much concern. Sandel, for example, writes, that a world in which some parents “became accustomed to specifying the sex and genetic traits of their children, would be a world inhospitable to the unbidden, a gated community writ large” (2007, 86). Similarly, Buchanan et al (2000) and Habermas (2003) lament the immense potential that gene selection markets would have for heightening inequality and injustice. Although this is a very important topic, in this article my attention to PGT is as a driver of the fertility insurance market and my particular focus is rather on the promotion of social egg freezing as a means to better managing one’s career.

### **Social egg freezing - good for gender equality?**

Goold and Savulescu begin their argument in the same place as Djerassi; “Unassisted fertility declines with age, due mainly to a decrease in the number and quality of oocytes” (2009, 48) and suggest that this presents a particular challenge to working women:

“[t]he thirties represent a crucial time in the careers of many women, and an interruption to bear children at that point can seriously prejudice a woman’s chance of advancement... In short, egg freezing can assist in women pursuing their career goals..... [and] can be viewed as kind of reproductive affirmative action” (2009,50).



This is rather a problematic interpretation of affirmative action. In the context of the labor market, taking affirmative action usually means taking active steps to increase the numbers of women in employment where they have been historically limited or excluded (Browne 2014). As Anderson (2010, 135) explains, affirmative action refers to policy that “aims to increase the participation of a disadvantaged social group in the mainstream institutions, either through “outreach” (targeting the group for publicity and invitations to participate) or “preferences (using group membership as criteria for selecting participants).” In the context of the workplace, such policies are intended to give women opportunities to bypass the cultural and structural biases they face in recruitment or promotion processes (Feinberg 2005). For Goold and Savulescu, by comparison, affirmative action in the form of social egg freezing offers a woman the choice to free herself up biologically so as to secure for herself “the opportunity to enjoy the same choices as men” (Goold and Savulescu, 2009, 52).

To some extent, this idea has recently been adopted by some of the world’s most well-known companies, including Apple and Facebook, which now offer social egg freezing to their employees as part of their employment (‘perk’) packages. Sheryl Sandberg, the COO of Facebook, explains that in addition to four months company paid maternity and paternity leave in the first year, women are able to claim up to \$20,000 for egg freezing and storage (Sandberg, 2015). In a recent interview with both Sandberg and Richard Branson (founder of Virgin Group), Branson stated, “we are going to steal the [egg freezing] policy for our women [at Virgin Group]....*it’s women’s choice*. If they want to carry on working, they can carry on working. If they haven’t met the man of their dreams at 35, 36, 37, 38 - freeze the eggs!” (Branson 2015, emphasis added). Other companies are reportedly

following suit or at least considering it - including Citigroup, JP Morgan and Google (Bennett 2014). According to ICM, 84% of people surveyed in their poll believe egg freezing is ‘justifiable to improve opportunities for career progression’ and 37% add that it should be a corporate benefit.<sup>17</sup> In a similar vein, Djerassi enthusiastically welcomed Apple and Facebook’s announcements on social egg freezing: “People forget that these are options.... The procedure is expensive at the moment. If the company offers up to \$20,000, I find it very enlightened” (Djerassi 2014b).

As we can see, social egg freezing is viewed by many as expanding individual women’s reproductive choice and as therefore being emancipatory. However, these sorts of arguments are too narrow in that the framing of social egg freezing as a rational choice on the part of the individual is over-emphasised and the collective social aspects of technology-use are underplayed. Here, the sort of structural perspective that feminist political theorists Iris Marion Young (2011) and Sally Haslanger (2015) advocate can fruitfully help us to think through some potentially troubling aspects of the promotion of social egg freezing as a means to better managing career prospects.

### **A Structural Perspective on Social Egg Freezing.**

In what follows, I outline what taking a structural perspective means and then apply it to the promotion of social egg freezing in the context of delaying motherhood for career purposes.

Drawing on a wide range of structural theorists,<sup>18</sup> both Young and Haslanger argue that the propensity to see people's life-decisions, material consequences and future prospects from an overly individualist perspective is likely to lead to an insufficient account of, and response to, social structural processes: "Structural explanations consider the phenomenon to be explained as part of a larger phenomenon that sets constraints on the behaviour of the interdependent parts" (Haslanger 2012, 1). The application of such explanations ranges broadly from "deep social phenomena such as the wage-labor system of industrial capitalism and the heteronormative and bionormative nuclear family" to "much more local and flexible phenomena such as the social structure of a particular institution such as a school, church or business" (Haslanger 2016, 113). In a similar vein, Young's work focuses on the multiple structural elements of poverty including those as diverse as the costs of commuting, the rise in rents, the stagnation of wages and declining employment opportunities (Young 2011, 44).

Central to the structural perspective are the ways in which we are structurally related to each other when we live or work together in a given society, labor market or institution - what Young calls a "macro-social space" (Young 2011, 53). The macro-social space is a term intended to capture the interconnectedness of individuals and institutions. It refers to the ways in which our positions within society are related to one another in such a way that beliefs, habits and actions, in combination with the practices of surrounding institutions, impact on the options and choices of each individual (see also Haslanger, 2016). In such a context, each individual's actions are oriented by social structural processes which constrain (or facilitate) aspects of people's lives and are "a consequence of many individuals and institutions acting to pursue their particular goals and interests, for

the most part within the limits of accepted rules and norms” (Young 2011, 52). Young and Haslanger are particularly interested in social structural processes that serve to constrain. Such social processes “can be seen to result in undesirable consequences when looked at structurally” (op. cit. 63) and potentially can be understood as indirectly, often unintentionally and cumulatively constraining or coercive (Haslanger 2016, Reiman 2012, Young 2011).

Haslanger uses the example of Larry and Lisa’s unequal economic status in society to demonstrate how structural constraints are rendered invisible if we rely on individual explanations to explain social outcomes:

“Larry and Lisa are equally intelligent, talented, educated and experienced in the workplace; they have equal power in their relationship, have no prejudices about gender roles and are equally capable of domestic tasks and childrearing tasks. Larry and Lisa decide to have children. They live in a community where decent childcare is beyond their means. Moreover, in this community, as elsewhere there is a wage gap: women, on average, make only 75% of what men make.... Under these conditions, unless Larry and Lisa have special reasons to think that they are unusual in their earning capacities, it is reasonable for Larry to work full-time and for Lisa to make adjustments in her work, e.g, to work part-time, to take time off, to take a less demanding job” (Haslanger 2016, 122-123).

The consequences of this are such that men tend to dominate higher rank occupations and accordingly earn more. Additionally, employers come to think of men as the right fit for

such jobs and consequently, women (particularly mothers or potential mothers) come to be thought of as the wrong fit. This then is a pattern perpetually and structurally reinforced under these conditions.

How would an individualist approach rationalise Lisa's predicament? One answer is to say that the *status quo* is merely evidence of revealed preferences – in other words that “women prefer to spend time with children over being in high-paying jobs (for whatever reason), so they choose to forego economic success” (Haslanger 2016, 122). Another would be provided by advocates of social egg freezing (such as Savulescu) who are likely to say that Lisa should simply freeze her eggs, concentrate on her career, and when she has achieved sufficient financial security and status, she can thaw her eggs and start a family (with or without Larry).

In individualist terms, social egg freezing offers an expansion of choice for women to manage their fertility in line with their career and economic status. Indeed, Goold and Savulescu argue that; “There are reasons to think it is actually better for women to have children *later* in life. Many women who have children when they are older will have higher incomes” (Goold and Savulescu 2009, 54). However, it would be short-sighted to be satisfied with either of these individual explanations of Lisa's economic status, without first considering whether there might be structural forces at play and if there are, what effective policy measures might counter them.

In the context of substantively increasing women's choice, for instance, consider the likely effects of comprehensive child care schemes and a well-paid parental leave scheme that enables both fathers (or co-parents) and mothers the opportunity to take up a primary-care

parenting role in equal measure. The default parental leave model for example assumes equal primary care roles for parents (mothers, fathers and co-parents) with the option to opt out of the equal split into whatever distribution of leave works for the family unit over the course of a year (Browne 2013). Such a policy focuses on the structural constraints facing women by enabling families to negotiate with their employers from a default position of parental equality and according to the particular needs of each family structure in such a way that counteracts traditional gender binary cultures and societal pressures to fit in with gender stereotypes. Open to all workers irrespective of gender, income levels and professional status, the default parental leave model would operate as a genuine facilitator to those who want to become parents in the *present* rather than delaying childbearing until their supposedly ‘wealthier future’ as Goold and Savulescu advocate.

Many companies (like Facebook) and national public policy programs have improved in terms of recognizing fathers’ and co-parents’ primary care roles in the upbringing of their children. However, and as many feminist scholars have pointed out, existing parental (and maternity and paternity) leave schemes – even the seemingly best Nordic models – cannot sufficiently address gender inequality (see for example, Browne 2013, Gheaus and Robeyns 2011, Gornick and Meyers 2008, Haas and Rostgaard 2011, Hobson 2002, Kamerman and Moss 2009). Most schemes, are too short, unsupported by affordable childcare alternatives, insufficiently paid and overly restricted to the mother thereby locking in a gender split even when parents wish to take on more equal primary parenting roles. The United States provides no federal provision for paid leave at all (Browne 2013). Lack of such structurally-focused policy places potential parents in the same dilemma as Haslanger’s example of Larry and Lisa.

Goold and Savulescu do accept to some extent that structural dynamics affect women's work experiences; "We should proactively seek to change this situation to ensure that women have the opportunity to pursue a career as they choose rather than having to fit into a model designed without them in mind. But such a desire for change is not necessarily undermined by allowing access to technological advances that can remove some of the constraints women face in their employment" (2009, 50). Until the workplace is better suited to women, Goold and Savulescu argue, social egg freezing is a good way of moving towards gender equality in the workplace: "We [argue] in favour of allowing and promoting access to egg freezing for social reasons: benefits to women and equality" (ibid 49). Their confidence, however, seems misplaced in a context where the policy space is increasingly conceded to the private sector and in which there is little democratic debate or oversight (as I shall discuss further on). The risk here is that fertility insurance policies would 'crowd out' more structurally focused policies and become a substitute for them. If individualised solutions to combining career with parenthood such as social egg freezing continue to rise, as they are predicted to, without at least sufficient correlative policies aimed at the structural dimensions of gender inequality (such as the default parental leave scheme and wide-scale affordable childcare services) the onus of responsibility will shift ever more firmly onto individual women to guarantee their 'financially viable reproductive future'. As Cattapan et al describe, the promotion of social egg freezing creates "a moral imperative to engage in social egg freezing ('just in case')... That is, if we are women who have the option to freeze our eggs, then we should do so, and any negative consequences arising from our failure to control the future through our decision not to freeze our eggs are our responsibility and fault alone" (2014, 239).<sup>19</sup> In the same vein,

Haslanger points out, “[t]he focus on individuals.....reinforces fictional conceptions of autonomy and self-determination that prevents us from taking up responsibility for our social milieu...” (2015, 10). Similarly, Phillips (2016) refers to social egg freezing as the “very troubling individualisation of a problem which is to do with employment patterns.” Here the rise in employer-provided social egg freezing packages is key.

After Facebook’s social egg freezing policy announcement, ‘EggBanxx’ adopted the slogan ‘Lean in. But freeze eggs first!’ referring specifically to *Lean In: Women, Work and the Will to Lead* written by Facebook COO, Sheryl Sandberg, which argues that women ought to be much more assertive at work in order to succeed professionally (Sandberg 2013). Both pieces of advice included in EggBanxx’s slogan– ‘Lean in. But freeze eggs first!’ - are squarely directed at individualizing a woman’s responsibility for her combined reproductive and career successes. As Rabinowitz (2015) argues, “With this move [the introduction of egg freezing policies], the tech companies effectively endorsed the new fertility technology, adding to a widespread conviction that freezing your eggs as a childless, 30-something woman who can afford the out-of-pocket price tag (\$10,000-\$15,000 just for the drugs and egg retrieval process) is the obvious thing to do.” Big employers such as Apple and Facebook may wish to provide such an opportunity to their female workers as part of the range of ‘retention policies’ aimed at valuable employees. No doubt this will be an attractive policy matched by other employers but such provisions will be uneven, incomplete and unlikely to engage with underlying structural issues, being as they are primarily intended to improve the standing of private companies than to combat the problems of society as a whole. Moreover, as Young (2011, 63) argues, structural processes are commonly “uncoordinated and unintended.” In fact, ‘these



unintended outcomes even run counter to the intentions of most of the actors' (ibid; see also Haslanger 2015, 2016). As employer provided social egg freezing increases, the expectation on women to egg freeze at their employer's expense is bound to increase. Indeed the idea that one ought to delay motherhood until a time more convenient to the individual could well extend to a time more convenient to her employer (affording more time to 'lean in') and become a point of negotiation. Given the cost of social egg freezing,<sup>20</sup> (set against a backdrop of, for example, increasing student debt, high house-prices, and stagnant wages), one can imagine that it might even appear irrational for many women not to egg freeze at the employer's expense when others around are taking 'responsible' measures. These pressures create what Haslanger describes as "a choice architecture" which in turn structures "the possibility space for agency" (2016, 127). The structural perspective thus provides an interpretation of the positioning of the individual in the 'space for agency' which can't be transformed by the intentions or actions of the individual alone (Haslanger, 2015). That is, solutions to such structures are inherently political and require collective, coordinated action.

## **Risk, Regulation and the Public Interest**

One of the most important forms of coordinated action is state regulation which has the dual function of both managing risk and protecting the public interest. Regulation of the public interest, however, can itself be understood in both individualist and structural terms. From an individualist perspective, the public interest is served by regulation designed to protect the individual from, for example, mal-practice or false advertising, in other words, making the market function according to a required set of minimum

standards for users. However, from a structural perspective, regulation's function is also to coordinate the operations of the market to align with wider conceptions of the public interest such as questions of equality and fairness.

Taking an individualist perspective, Goold and Savulescu (2009, 56) argue that the medical risks women take on when using social egg freezing are outweighed by the advantages of fertility insurance: so long as clinics operate responsibly and so long as each client is fully informed about the risks involved then “her autonomous choice [to use social egg freezing] should be respected” (op.cit 51) and conclude that there are “few, if any, drawbacks that we cannot adequately address”(op.cit 57). However, the UK's Human Fertilisation and Embryology Authority (HFEA), which is both the oldest regulatory public body<sup>21</sup> of reproductive technology services and produces the most longitudinal and detailed data, reports that confidence in social egg freezing technologies is currently based on a small existing sample in what are still the early stages of the egg freezing commercial market. For example, the first child to be born in the UK using the vitrification technique on a patient's own eggs (5 months frozen) was only born in 2010.<sup>22</sup> The latest HFEA data shows that up to 2014, 3,676 women<sup>23</sup> had frozen their eggs in the UK and that the uptake of this technology was increasing at approximately 25-30% per annum.<sup>24</sup> On the global scale, Konc et al (2014, 6) report that as yet, something in the region of 15,000 babies have been born worldwide using frozen eggs. They show that follow-up studies on, for example, organ malformations or other development problems in offspring are based on small numbers and that adequate research is yet to be completed before conclusions can be firmly drawn. The American Society for Reproductive Medicine (ASRM, 2013, 42) report that; “While oocyte cryopreservation has been shown to be safe and effective in select

populations, more data are needed before this technology should be used routinely.” Aside from risks to the offspring, risks to women undergoing the treatment include ovarian hyperstimulation syndrome in the context of egg collection,<sup>25</sup> a higher likelihood of multiple-birth pregnancy (and the associated risks of late miscarriage, high blood pressure and pre-eclampsia as well as a higher risk of stillbirth, neonatal death, and disability for the child (HFEA 2016a)). Women who become pregnant over 40 years of age, face significantly higher risks of thrombosis, hypertension, gestational diabetes and pre-eclampsia (Dietl et al 2015). Here we can see that although technologically spectacular, the whole process of egg freezing and IVF/ICSI can present women with significant health risks as well as there still being considerable gaps in knowledge on the long term health risks of humans born via the vitrification technique.

Präg and Mills report that in many countries where reproductive technologies are common, such as India, Japan, and the United States, service providers operate ‘largely on voluntary guidelines’ (2015, 9). The United States, for example, has no public regulatory body but rather an advisory professional association (the American Society for Reproductive Medicine) which is far from sufficient in effectively regulating the reproductive technology industry; “Issuance [on best practice] by a self-interested and resource-limited professional association risks establishing minimum rather than optimal standards of care, with no effective means of enforcement. Despite best efforts, those standards may be internally inconsistent, are time-dependent, and may be quickly outmoded. Unsurprisingly, they may also reflect the interests of those issuing the guidelines or their sponsors” (Robertson 2014, 20). Others go further still; “[i]n the U.S.

this unregulated industry’s nickname is the Wild, Wild West of American medicine” (Tsigdinos 2014).

The UK’s HFEA is widely credited as a well-functioning model of regulation (although even it is not without its critics - see Savulescu 2011, for example). Of particular interest to this paper is that it permits a structural perspective on reproductive services such as social egg freezing. Aside from licensing and regulating research institutions and fertility clinics in the UK, the HFEA is also charged with providing advice to Government for parliamentary debate, legislation and policy. This is done in part through public consultation, not only with professional bodies, research and clinical institutions but crucially with members of the public and lay groups with a special interest. In this way, a core part of the HFEA’s function chimes with what Young sees as crucial for taking up structural perspectives on the dynamics of the macro-social spaces we inhabit in society. Young (2011) argues the public must be given substantive opportunities to directly discuss, debate and critique the details and consequences of institutional practices and policies (in this case social egg freezing) and have an opportunity to collectively influence state level policy and legislation. Thus mechanisms facilitating direct public engagement with reproductive technology policy design ought to be further enhanced to advise Government on the wider structural dynamics of technology use – including, for example, promotion of social egg freezing as the “smart” thing for women to do *per se* or the growth of workplace social egg freezing policies unmatched by sufficient parental leave schemes. However, as my current research shows (Browne, forthcoming) the UK Government has recently challenged the status and function of the HFEA, making it very unlikely that the HFEA would be able to develop in this way. Under new guidelines the HFEA is required

to align its functions with the Government’s goal to enhance ‘[o]pen and competitive markets with the minimum of regulation’ (HM Treasury 2015, 1). This approach compromises the HFEA’s ability as a public regulating body to protect the public interest – limiting it to a minimal conception of risk management for individual technology-users. By restricting the role of the regulator to merely ensuring that the market functions (in the individualist sense), serves to disconnect the ethical impact of that market from wider policy debates with a structural focus.

## Conclusions

The social egg freezing market is set to grow. There is little doubt, that driven by rising living costs and declining birth rates in modern economies, in combination with the attractions of ‘add-on’ technologies such as PGTs, that professional women will increasingly invest in ‘fertility insurance’. Moreover, though these technologies may not be adopted universally, through their impact on shared macro-social spaces such as the workplace, they do affect us all. It is therefore important that we consider the likely impact of such technology-use on various aspects of our lives, such as gender equality, and determine in what conceptual framework we should best formulate our response.

Goold and Savulescu claim that under current conditions, social egg freezing should be promoted as a means to increasing gender equality in the workplace at a level of medical risk and uncertainty that can be outweighed by the benefits to individual women. I have argued that these claims are not persuasive. These sorts of arguments underplay the social aspects of technology-use and fail to sufficiently recognize the potential for structural pressures on women to make fundamental life-decisions on unduly narrow terms whilst at

the same time taking on significant medical risks and uncertainties. A lack of sufficient consideration as to how our reproductive decisions are inter-connected and influenced by structural dynamics substantially limits the debate on how new reproductive technologies should be used in conjunction with other (long-called for) policies to achieve substantive gender equality. Fertility should not be perceived only in terms of individual responsibility but rather ought to feature more prominently in public policy design that genuinely facilitates parents to cope practically with balancing work and care duties. Finally, if fertility insurance services rise as they are predicted to do, it is imperative that effective regulatory bodies, independent of industry, are maintained and well resourced, not only so they can license and regulate medical and technological practice but also so that they can encourage the public to exercise its political responsibility to assess and influence the ways in which we engage with new technologies and the effects they have in terms of structuring the ‘choice architecture’ of individuals. This is a vital political task that requires structural analysis at its core.

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## NOTES

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feedback and also to the public audience at the Cambridge University Festival of Ideas for thought-provoking questions and comments. **Biographical Note:** Jude Browne is The Jessica and Peter Frankopan Director of the University of Cambridge Centre for Gender Studies, Reader in Gender and Politics, Department of Politics and International Studies, University of Cambridge and Fellow of King's College, University of Cambridge. Email: [jmb63@cam.ac.uk](mailto:jmb63@cam.ac.uk)

<sup>2</sup> See for example EggBanxx, 2014.

<sup>3</sup> Djerassi led the research group that developed norethindrone, the basis of oral contraception at the Syntex Laboratory, Mexico in 1951. See [www.djerassi.com](http://www.djerassi.com) for detailed accounts of Djerassi's life and work.

<sup>4</sup> Dr Zeynep Gurtin, London Women's Clinic – direct correspondence, 6<sup>th</sup> November 2017.

<sup>5</sup> Professor Julian Savulescu is Uehiro Chair in Practical Ethics, Director of The Oxford Centre for Neuroethics, Director of the Oxford Uehiro Centre for Practical Ethics, Director of The Institute for Science and Ethics, The Oxford Martin School University of Oxford.

<sup>6</sup> Retrieval is conducted by using a long needle passed into the ovary through which the eggs are collected by suction - transvaginal ultrasound aspiration.

<sup>7</sup> The human egg is high in water content and consequently prone to ice crystallization which can cause significant cryodamage to genetic material in the freeze-thaw process (see for example, Rodriguez-Wallberg and Oktay, 2012). Vitrification, designed to reduce cryodamage, is the increasingly preferred freezing technique which involves a much faster flash-freeze process than the previous slow cooling methods (see for example, Al-Hasani et al 2007).

<sup>8</sup> IVF/ICSI is increasingly the standard technique whereby one sperm is directly injected into the egg to heighten the chances of successful fertilization (instead of the traditional method of IVF whereby sperm is combined with the eggs in a clinical dish and left to culture in an incubator).

<sup>9</sup> A total fertility rate of 2.1 live births per woman is calculated as the average number of live births per woman required to maintain population numbers constant in the absence of immigration to or migration from a given country (Eurostat 2016).

<sup>10</sup> At the time of writing, EU membership stands at 28 member states and the UK is yet to formally exit the EU having triggered Article 50.

<sup>11</sup> The procedure consists of inserting a syringe into the amniotic sac that surrounds the foetus. This risk figure of 1/100 is for the UK - see the UK National Health Service guide for more details: <http://www.nhs.uk/conditions/Amniocentesis/Pages/Introduction.aspx>.

<sup>12</sup> See the HFEA guide on pre-implantation genetic diagnosis  
<http://guide.hfea.gov.uk/pgd/>

<sup>13</sup> Also see Lewens (2015).

<sup>14</sup> Following Agar (2004), Savulescu (2009, 2014) thinks of this as “liberal eugenics”.

<sup>15</sup> For example, environmental conditions are key to the expression of genetic traits and as Resnik and Vorhaus (2006) argue, most genetic traits are the result of a combination of genes operating together. The ways in which organisms convert collective genetic information into traits significantly differs from one to another, thereby weakening the idea that we can simply select for traits such as empathy for our future children’s personality (ibid).



<sup>16</sup> According to Djerassi, the final consequence will be sterilization post egg-freezing; enabling young people to be free, he argues, to enjoy sex without unwanted pregnancies or abortions (Djerassi 2015).

<sup>17</sup> 2013 ICM Poll of 2,013 people in the UK.

<sup>18</sup> For example, Blau (1977); Frye (1983); Bourdieu (1990); Jackson & Phillip (1992); Sewell (2005); Reiman (2012).

<sup>19</sup> Another relevant point here is made by Sherwin (1987) that the promotion of reproductive technologies serves to remind career women that however satisfying their careers are, they should nevertheless want to have children eventually.

<sup>20</sup> For UK see for example current prices at the London Women's Clinic:

[http://www.londonwomensclinic.com/london/treatment\\_costs](http://www.londonwomensclinic.com/london/treatment_costs)

<sup>21</sup> The HFEA was founded in 1991 in accordance with the provisions set out in The Human Fertilisation and Embryology Act of 1990.

<sup>22</sup> Olivia Bate born at Midland Fertility Clinic, Tamworth in December 2010 (Midland Fertility Clinic 2012).

<sup>23</sup> See dataset No.19 'Egg freezing - clinics, cycles and patients' accompanying HFEA (2016b).

<sup>24</sup> To give an indication of success rates, the HFEA (2016b) sets out the progress of 80 egg thaw cycles started in 2013: "Of the nearly 700 eggs thawed, 12 babies were born, in 11 births. The number of the thawed eggs which were mixed with sperm can give an indication of the survival of eggs after freezing; in this year 432 of the 693 eggs survived to be mixed (62.3%) and 261 were discarded" (op cit. 28). The pregnancy rate, per embryo transfer using frozen eggs was 21.9% in 2013, and 22.2% in 2014 (HFEA 2016b).

<sup>25</sup> The collection of high numbers of eggs (over 20) per cycle has been positively correlated with ovarian hyperstimulation syndrome potentially affecting ovaries and major organs such as kidneys, lungs and liver (see for example, Aljawoan et al 2012) as well as ovarian cancer (van Leeuwen et al 2012).

## References

Agar, Nicholas (2004) *Liberal Eugenics: In defence of human enhancement*. Oxford. Wiley-Blackwell.

Al- Hasani, Safaa., Ozmen, Bathuan., Koutlaki Nikoleta., Schopper, Beata., Diedrich, Klaus., Schultze-Mosgau, Askan (2007) Three years of routine vitrification of human zygotes: is it still fair to advocate slow-rate freezing? *Reproductive Biomedicine Online*, 14 (3). 288-293.

Aljawoan, Fatimah., Linda, Hunt., and Uma, Gordon. (2012). Prediction of ovarian hyperstimulation syndrome in coasted patients in an IVF/ICSI program. *Journal of Human Reproductive Science*. Vol 5. (1). 32-36.

American Society for Reproductive Medicine. (2013). Mature oocyte cryopreservation: a guideline'. *Fertility and Sterility*. Vol 99. No. (1) 37-43.

[https://www.asrm.org/uploadedFiles/ASRM\\_Content/News\\_and\\_Publications/Practice\\_Guidelines/Committee Opinions/Ovarian tissue and oocyte\(1\).pdf](https://www.asrm.org/uploadedFiles/ASRM_Content/News_and_Publications/Practice_Guidelines/Committee_Opinions/Ovarian_tissue_and_oocyte(1).pdf)

Anderson, Elizabeth (2011) *The Imperative of Integration*. Princeton: Princeton University Press.

Baldwin, Kylie. (2017) I suppose I think to myself, that's the best way to be a mother': How ideologies of parenthood shape women's use for social egg freezing technology. *Sociological Research Online*, 22 (2)2.

Bennett, Jessica. (2014). Company-paid egg freezing will be the great equalizer. October 15<sup>th</sup>. New York: *Time Magazine*. <http://time.com/3509930/company-paid-egg-freezing-will-be-the-great-equalizer/>

Bostrom, Nick. (2014). *Superintelligence: Paths, Dangers and Strategies*. Oxford: Oxford University Press.

Blau, Peter., (1977) *Inequality and Heterogeneity: A primitive theory of social structure* New York Free Press.

Bostrom, Nick., and Julian, Savulescu. (2009). Human enhancement ethics: The state of the debate', in (Eds) Nick, Bostrom, and Julian, Savulescu *Human Enhancement*. Oxford: Oxford University Press. 1-22.

Branson, Richard. (2015). *Sandberg and Branson defend Facebook's egg freezing policy*. 24<sup>th</sup> April interview with Emily Chang. New York: Bloomberg; <http://time.com/3835233/sheryl-sandberg-explains-why-facebook-covers-egg-freezing/>

Brezina, Paul., and Kutteh, William, (2015) Clinical applications of preimplantation genetic testing. *British Medical Journal*. 350: g7611

Browne, Jude. (2013). The Default Model: Gender equality and structural constraint, *Politics & Gender*. Vol 9, (2) 152-173.

Browne, Jude. (2014). The Critical Mass Marker Approach: Female quotas and social justice', *Political Studies*. Vol. 62, (4) 862-877.

Browne, Jude (forthcoming) The Regulatory Gift.

Bourdieu, Pierre (1990) *The Social Structures of the Economy. Book 1*. Trans. Chris Turner  
Stanford: Stanford University Press.

Buchanan, Allen., Dan, Brock., Norman, Daniels., and Daniel, Wikler. (2000) *From Chance to Choice*. Cambridge: Cambridge University Press.

Cattapan, Alana., Kathleen, Hammond., Jennie, Haw., and Lesley, Tarasoff. (2014).  
Breaking the ice: Young feminist scholars on reproductive politics reflect on egg freezing.  
*The International Journal of Feminist Approaches to Bioethics*. Vol 7. (2) 236-247.

Central Intelligence Agency (2016) United States: country comparison - total fertility rate'.

*The World Factbook* <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2127rank.html>

Dietl, Anna., Susanne, Cupisti., Matthias, Beckmann., Michael, Schwab., and Ursula, Zonner. (2015). Pregnancy and obstetrical outcomes in women over 40 years of age. *Geburtshilfe Frauenheilkd.* Vol. 75(8) 827-832.

Djerassi, Carl. (2000). *An Immaculate Misconception: Sex in an Age of Mechanical Reproduction*. London: Imperial College Press.

Djerassi, Carl. (2014). *In Retrospect: From the Pill to the Pen*. London: Imperial College Press.

Djerassi, Carl. (2014b). Carl Djerassi father of the contraceptive pill. Interview with Clive Cookson. *The Financial Times*. 21<sup>st</sup> November. London. FT.  
<https://www.ft.com/content/2257f88e-6f77-11e4-b50f-00144feabdc0>

Djerassi, Carl. (2015). Carl Djerassi: chemist hailed as 'the father of the Pill' whose work helped pave the way for the sexual revolution. L. Arnold for *The Independent*. 2 February 2015. <http://www.independent.co.uk/news/people/news/carl-djerassi-chemist-hailed-as-the-father-of-the-pill-whose-work-helped-pave-the-way-for-the-sexual-10019100.html>

EggBanxx (2014). *EggBanxx Hosts 3<sup>rd</sup> Egg Freezing Party to Address Women's Fertility Health Concerns*. New York: EggBanxx.

<http://www.prweb.com/releases/2014/09/prweb12160924.htm>

Eurostat. (2016). *Fertility Statistics*. Brussels: European Commission.

[http://ec.europa.eu/eurostat/statistics-explained/index.php/Fertility\\_statistics#Main\\_statistical\\_findings](http://ec.europa.eu/eurostat/statistics-explained/index.php/Fertility_statistics#Main_statistical_findings)

Feinberg, Walter. (2005) Affirmative action in Hugh LaFollette (Ed) *The Oxford Handbook of Practical Ethics*. Oxford: Oxford University Press. 272 – 299.

Franklin, Sarah. (2013). *Biological Relatives: IVF, Stem Cells and the Future of Kinship*. London: Duke University Press.

Frye, Marilyn,. (1983) Oppression in *The Politics of Reality: Essays in Feminist Theory*. Trumansburg, N.Y., The Crossing Press.

Gheaus, Anca, and Ingrid Robeyns. (2011). Equality—Promoting Parental Leave. *Journal of Social Philosophy* 42 (2): 173–91.

Golombok, Susan. (2015) *Modern Families: Parents and Children in New Family Forms*. Cambridge: Cambridge University Press.

Gornick, Janet C., and Marcia K. Meyers. (2008). *Creating Gender Egalitarian Societies*:

An Agenda for Reform. *Politics and Society* 36 (3): 313–49.

Global Market Insights (2017) Assisted Reproductive Technology Market Size. Delaware:

Global Market Insights [https://globenewswire.com/news-](https://globenewswire.com/news-release/2016/07/05/853690/0/en/Assisted-Reproductive-Technology-ART-Market-size-worth-USD-31-Billion-by-2023-Global-Market-Insights-Inc.html)

[release/2016/07/05/853690/0/en/Assisted-Reproductive-Technology-ART-Market-size-](https://globenewswire.com/news-release/2016/07/05/853690/0/en/Assisted-Reproductive-Technology-ART-Market-size-worth-USD-31-Billion-by-2023-Global-Market-Insights-Inc.html)

[worth-USD-31-Billion-by-2023-Global-Market-Insights-Inc.html](https://globenewswire.com/news-release/2016/07/05/853690/0/en/Assisted-Reproductive-Technology-ART-Market-size-worth-USD-31-Billion-by-2023-Global-Market-Insights-Inc.html)

Goold, Imogen., and Julian, Savulescu. (2009). In Favor of Freezing Eggs for Non-Medical Reasons. *Bioethics*. Vol 23. (1) 47-58.

Habermas, Jürgen. (2003). *The Future of Human Nature*. Oxford: Polity Press.

Harris, John. (2009). Enhancements are a Moral Obligation, in (Eds) Nick, Bostrom, and Julian, Savulescu *Human Enhancement*. Oxford: Oxford University Press. 131-154.

Harris Williams & Co (2015). Fertility Market Overview. Richmond Virginia: Harris Williams & Co.

[http://www.harriswilliams.com/sites/default/files/content/fertility\\_industry\\_overview -](http://www.harriswilliams.com/sites/default/files/content/fertility_industry_overview_-_2015.05.19_v10.pdf)  
[2015.05.19 v10.pdf](http://www.harriswilliams.com/sites/default/files/content/fertility_industry_overview_-_2015.05.19_v10.pdf)

Haas, Linda, and Rostgaard, Tine. (2011). Father's Rights to Paid Parental Leave in the Nordic Countries: Consequences for Gendered Division of Leave. *Community, Work and Family* 14 (2): 177–95.

Haslanger, Sally (2012) 'Structural Injustice: What is it and how is it hidden'. *MOW Lecture* 19/27/12: 1-3.

[http://www.wiu.edu/cas/philosophy and religious studies/pdf/MOWhdo.pdf](http://www.wiu.edu/cas/philosophy_and_religious_studies/pdf/MOWhdo.pdf)

Haslanger, Sally. (2015) Distinguished lecture: Social structure, narrative and explanation, *Canadian Journal of Philosophy*, 45 (1): 1-15.

Haslanger, Sally. (2016) What is a (social) structural explanation?, *Philosophical Studies* 173 (1): 1113-30.

Her Majesty's (HM) Treasury. (2015). *Fixing the Foundations: Creating a more prosperous nation*. CM9098. London: HMG.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/443898/Productivity Plan web.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443898/Productivity_Plan_web.pdf)

Hobson Barbara, ed. (2002). *Making Men into Fathers: Men, Masculinities and the Social Politics of Fatherhood*. Cambridge: Cambridge University Press.

Human Fertilisation and Embryology Act. (1990, 2008). UK Act of Parliament. London: HMG.

[http://www.legislation.gov.uk/ukpga/2008/22/pdfs/ukpga\\_20080022\\_en.pdf](http://www.legislation.gov.uk/ukpga/2008/22/pdfs/ukpga_20080022_en.pdf)

Human Fertilisation and Embryology Authority (HFEA). (2016a). *Multiple births and single embryo transfer*. London: HFEA [http://www.hfea.gov.uk/Multiple-births-after-](http://www.hfea.gov.uk/Multiple-births-after-IVF.html)

[IVF.html](http://www.hfea.gov.uk/Multiple-births-after-IVF.html)



Human Fertilisation and Embryology Authority (HFEA). (2016b). *Fertility Treatment: Trends and figures 2014*. London: HFEA. [Accompanying dataset <http://www.hfea.gov.uk/10243.html>]

Inhorn, Marcia, C. (2017) Egg Freezing in America: Women's Desires amidst Demographic Disparities (paper given at The Future of Female Fertility? Egg Freezing and Social Change 25<sup>th</sup> March 2017. The Bridge Centre, London. Forthcoming publication).

Jackson, Frank, and Pettit, Phillip. (1992). Structural explanation in social theory. In David Charles & Kathleen Lennon (Eds.), *Reduction, explanation and realism*. Oxford: Oxford University Press.

Kameman, Sheila, and Moss, Peter, eds. (2009). *The Politics of Parental Leave Policies: Children, Parenting, Gender and the Labour Market*. Bristol: The Policy Press.

Lewens, Tim. (2015). *Crossing the Germline; Or, Genome Editing meets Town Planning*. CRASSH Blog. Cambridge: University of Cambridge. 20 October 2015 <http://www.crassh.cam.ac.uk/blog/post/crossing-the-germline>

Loane, Maria., Joan, K., Morris., Marie-Claude, Addor., Larraitz, Arriola., Judith, Budd., Berenice, Doray., Ester, Garne., Miriam, Gatt., Martin, Haeusler., Babak, Khoshnood., Kari Klungsøyr Melve., Anna, Latos-Bielenska., Bob, McDonnell., Carmel, Mullane.,

Mary, O'Mahony., Annette, Queißer-Wahrendorf., Judith, Rankin., Anke, Rissmanm., Catherine, Rounding., Joaquin, Salvador., David, Tucker., Diana, Wellesley., Lyubov, Yevtushok., and Helen, Dolk. (2013). Twenty-year trends in the prevalence of Down syndrome and other trisomies in Europe: impact of maternal age and prenatal screening. *European Journal of Human Genetics*. 21(1): 27-33.

Lockwood, Gillian. and Johnson, Martin (2015) Having it all? Where are we with “social egg freezing today? *Reproductive Biomedicine Online*. 31(2), pp126-127.

Konc, János., Katalin, Kanyo., Rita, Kriston., Bence, Somoskoi., and Sándor, Cseh. (2014). Cryopreservation of embryos and oocytes in human assisted reproduction. *Biomedical Research International*. Volume 2014: 1-9.

Rodriguez-Wallberg, Kenny., and Kutluk, Oktay., (2012). Recent advances in oocyte and ovarian tissue cryopreservation and transplantation. *Best Practice Research Clinical Obstetrics and Gynaecology*. Vol 26, No 3: 391–405.

Midland Fertility Clinic. (2012). *The MFS 25<sup>th</sup> Anniversary 25 Milestone Babies*. Tamworth. MFS. <http://www.midlandfertility.com/2012/07/newsletter-issue-25-made-in-aldridge/>

Nozick, Robert. (1974). *Anarchy, State and Utopia*. New York. Basic Books.

Office for National Statistics (2013) Full Report: Graduates in the UK Labour Market 2013. London: HMG UK ONS.

[http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171776\\_337841.pdf](http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171776_337841.pdf)

Office for National Statistics (2016) Total Fertility Rates (TFR) for UK and non UK born women in the UK, 2004 to 2015.

<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/conceptionandfertilityrates/adhocs/006295totalfertilityratestfrforukandnonukbornwomenintheuk2004to2015>

Präg, Patrick and Melinda, Mills. (2015). Assisted reproductive technology in Europe: Usage and regulation in the context of cross-border reproductive care. *European Union Families and Societies Working Paper Series*. <http://www.familiesandsocieties.eu/wp-content/uploads/2015/09/WP43PragMills2015.pdf>

Phillips, Anne. (2016). Interview with Eva Wiseman: We need to talk about egg freezing. *The Guardian* 7<sup>th</sup> February 2016 <https://www.theguardian.com/society/2016/feb/07/life-on-hold-with-frozen-eggs>

Rabinowitz, Abby (2015) Why Egg Freezing is an impossible choice: I don't want to surrender to lottery but will I regret not playing? *Nautilus*. March 19. <http://nautil.us/issue/22/slow/why-egg-freezing-is-an-impossible-choice>

Reiman, Jeffrey (2012) 'The structure of structural injustice: Thoughts on Iris Marion Young's responsibility for justice', *Social Theory and Practice*, Vol. 38, No. 4: 738-751.

Resnik, David, and Daniel, Vorhaus. 2006. Genetic modification and genetic determinism. *Philosophy, Ethics, and Humanities in Medicine* Vol. 1:9 on-line  
<http://peh-med.biomedcentral.com/articles/10.1186/1747-5341-1-9>

Robertson, John (2014) Egg freezing and egg banking: empowerment and alienation in assisted reproduction. *Journal of Law and the Biosciences* ;1(2), pp. 113-136

Sandberg, Sheryl. (2013). *Lean In. Women, Work and the Will to Lead*. London: Radom House Publishing.

Sandberg, Sheryl. (2015). *Sandberg and Branson defend Facebook's egg freezing policy*. 24<sup>th</sup> April interview with Emily Chang. New York: Bloomberg:  
<http://time.com/3835233/sheryl-sandberg-explains-why-facebook-covers-egg-freezing/>

Sandel, Michael. (2007). *The Case Against Perfection: Ethics in the Age of Genetic Engineering*. Cambridge MA: Harvard University Press.

Savulescu, Julian. (2005). New breeds of humans: The moral obligation to enhance.' *Reproductive BioMedicine Online*. 10 (1): 36-9.

Savulescu, Julian (2009) Genetic interventions and the ethics of enhancement of human beings in (Ed) Bonnie Steinbock *The Oxford Handbook of Bioethics*. Oxford: Oxford University Press. 492-516.

Savulescu, Julian. (2011) 'The HFEA has restricted liberty without good cause'. *The Guardian*. 7 February 2011.

<https://www.theguardian.com/commentisfree/belief/2011/feb/07/hfea-reproductive-technology-research>

Savulescu, Julian (2014) Interview with XX of Ideas.Ted.Com. As a species, we have a moral obligation to enhance ourselves. February 19<sup>th</sup>/TED Guest Author.

<https://ideas.ted.com/the-ethics-of-genetically-enhanced-monkey-slaves/>

Sewell, William. A. (2005) A theory of structure: Duality, agency and transformation, in *Logics of History: Social Theory and Social Transformation*. Chicago: Chicago University Press.

Sherwin, Sue. (1987) Feminist ethics and in vitro fertilization, *Canadian Journal of Philosophy*, Supplementary Vol 13 (265): 264-284

van Leeuwen, Flora., Helen, Klip., Thea, Mooij., Jojanneke, van de Swaluw., Cornelis, Lambalk., Marianne, Kortman., Joop, Laven., Cees, Jansen., Frans, Helmerhost., Ben, Cohlen., Wim, Willemsen., Jasper, Smeenk., Arnold, Simons., Fulco, van der Veen.,

Johannes, Evers., Peter, van Dop., Nicholas, Macklon., and Curt, Burger. (2011). Risk of borderline and invasive ovarian tumours after ovarian stimulation for in vitro fertilization in a large Dutch cohort. *Human Reproduction*. Vol 26. (12): 3456-65.

Tsigdinos, Pamela Mahoney (2014) Wired (online) The sobering facts about egg freezing that nobody's talking about. <https://www.wired.com/2014/10/egg-freezing-risks/>

Wallace, Hamish and Kelsey, Thomas (2010) Human ovarian reserve from conception to the menopause. PLoS ONE 5(1): e8772. <https://doi.org/10.1371/journal.pone.0008772>

Waldby, Catherine (2015) The oocyte market and social egg freezing: From scarcity to singularity. *Journal of Cultural Economy*. 8(3): 275-291

Young, Iris Marion. (2011). *Responsibility for Justice*. Oxford. Oxford University Press.