Chapter 2
Late Motherhood in Low-Fertility Countries: Reproductive Intentions, Trends and Consequences

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Introduction

Delayed parenthood is one of the defining features of the massive transformation of family and reproduction in rich countries [1]. The "contraceptive revolution" that started in the late 1960s, together with relatively easy access to abortion in most countries, have given women and couples an effective control over their pregnancies and contributed to changing family and partnership relations [2]. Young people in Western Europe today are sexually active for more than a decade before becoming parents. Policy concerns about high rates of teenage pregnancies, common in many Western countries a few decades ago [3], have gradually given way to heated debates about late motherhood and ticking biological clock [4, 5]. In the United Kingdom, The Royal College of Obstetricians and Gynaecologists [6] declared later maternal age as an "emerging public health issue" that needs to be thoroughly studied.

Scientific and media debates on delayed motherhood take different angles, reflecting upon the advantages as well as drawbacks of this phenomenon. Some view late parenthood as an opportunity and a positive experience [7]. Older parents may offer children higher living standards and more stable family arrangements, improving their future life chances [8]. Often, delayed parenthood is portrayed as risky, potentially endangering mother's and children's health or leading to involuntary childlessness and demographic decline [9, 10]. Discussions in popular press often blame women (and occasionally men) who wait for "too long,"

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presenting them as selfish, career-oriented, irresponsible, and breaking the "natural order" [11, 12]. Some of these concerns are justified. It has been repeatedly shown that even well educated women are often poorly informed about female reproductive aging, infertility and the increased risk of pregnancy complications, and they often overestimate the chances of becoming pregnant at higher reproductive ages [13–16].

In this chapter we analyse the shift to later parenthood and review its consequences for children and parents, especially mothers. First we analyse the trends in birth rates at advanced reproductive ages (35+), including trends at very high reproductive ages (50+), which were characterised by a rapid rise in first and second birth rates. We show that a relatively high share of childless women and women with one child aged 35–44 still plan to have a child in the future. Subsequently, we analyse success rates of assisted reproduction at advanced reproductive ages and its role in fuelling the trend towards delayed motherhood. Next we discuss the key drivers of delayed parenthood and its demographic consequences. Finally, we briefly review the consequences of delayed motherhood for pregnancy outcomes, maternal and child health and highlight selected positive consequences of later parenthood for mothers and children, which provide economic and social rationale for late reproduction. Our main focus is on developed countries in Europe, North America, Oceania and East Asia which have experienced a continuing shift to delayed reproduction in the last four decades.

Shifting Childbearing to Advanced Reproductive Ages

The Long-Term Trend Towards Late Motherhood

The trend to later motherhood first started in Western and Northern Europe, the United States, Canada, Australia and Japan in the early 1970s, thus reversing the shift towards earlier first births observed during the post-war baby boom era [17]. Other developed countries and regions followed during the 1980s and 1990s. Recently, the mean age at first birth among women has surpassed 30 in several European countries including Italy and Spain, and in South Korea where it reached 31.1 in 2014, the record-high among rich countries (Fig. 2.1). In the most developed countries the age at starting a family among women has shifted from 22–25 in 1970 to 26–30 in 2014, without showing signs of stabilising or reversing.

In most other world regions women still become mothers early in life, but even many of the less developed countries with high fertility have seen postponement of first marriage and first birth and a decline in adolescent births in the last two decades ([21]: 38). A gradual trend towards delayed motherhood has been reported for many middle-income countries with relatively low fertility, including China, Iran, and the countries of Northern Africa, and Latin America (including Chile, Fig. 2.1) [22, 23].

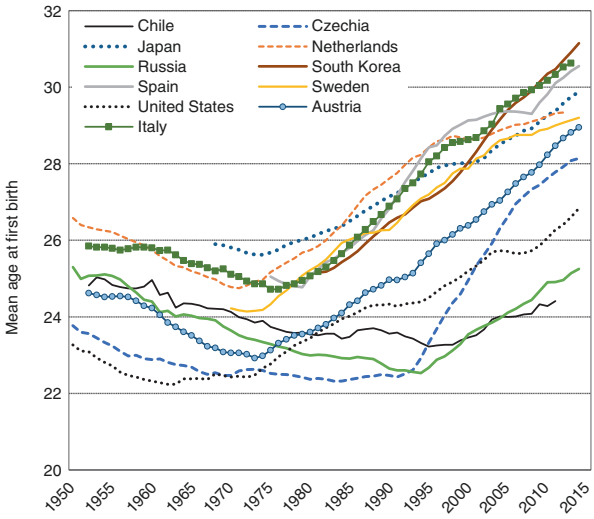

Fig. 2.1 Mean age of women at first birth in selected low-fertility countries, period 1950–2014. Sources: Human Fertility Database [18], Human Fertility Collection [19]. Data for Korea kindly provided by Sam Hyun Yoo [20]

More Frequent Late First and Second Births

Childbearing at higher reproductive ages is not a new phenomenon. Late births had been historically much more common than today, owing to many women having a large family and continuing reproducing until experiencing sterility. In the era of large families until the early twentieth century, childbearing was common even among women past age 40.

With the decline in family size, and a virtual disappearance of large families with more than four children, the historical pattern of having a fourth, fifth or sixth birth at late reproductive ages has been replaced with a new pattern of having a first or a second child later in life. This is especially the case in countries characterized by low fertility rates and a rapid shift to late motherhood, including Italy and Spain. Across the rich low-fertility countries the share of births to women aged 35 and older has risen quickly since 1980 and this increase has been particularly steep for first and second births and at ages 40+ (Table 2.1). For instance, in Japan, the share of first birth rates that took place among women aged 35 and over jumped from 2% in 1980 to 17% in 2014 and the share of second birth rates at these ages jumped from 4 to 26%. At the same time the contribution of women aged 40 and over to total fertility in Japan went up from a low of 0.5 to 3.8% (Table 2.1).

Despite these dramatic shifts, childbearing at ages 40 and higher still remains rather infrequent. In Spain and Sweden, where the shift to late motherhood is well advanced, women gave birth to 0.08 children on average after age 40 in 2014. This amounts to less than 6% of their theoretical reproductive capacity above age 40 estimated at 1.43 children per woman [24]. Late births are even less common in most other rich countries [18].

Table 2.1 Contribution of women aged 35+ and 40+ to total fertility rates (TFR), first birth rates and second birth rates in six developed countries, 1980–2014

	Age 35+			Age 40+		
	Total	First births	Second births	Total	First births	Second births
Japan						
1980	4.3	2.1	3.7	0.5	0.3	0.3
2000	13.3	7.2	14.1	1.5	0.8	1.2
2014	23.0	17.0	25.9	3.8	3.0	3.9
United States						
1980	6.4	1.9	3.9	1.1	0.2	0.4
2000	11.8	6.4	11.5	2.0	1.1	1.7
2014	16.7	9.7	16.6	3.1	1.8	2.7
Netherlands						
1980	6.5	2.1	4.2	1.2	0.3	0.5
2000	16.1	8.6	17.4	2.0	0.9	1.8
2014	19.7	12.0	21.6	2.8	1.7	2.5
Russia						
1980	6.5	1.7	5.4	1.4	0.3	0.7
2000	6.2	2.1	6.7	1.0	0.3	0.8
2014	13.4	4.4	14.9	2.4	0.7	2.2
Spain						
1980	14.0	4.6	7.8	3.7	1.4	1.4
2000	20.2	11.2	25.8	2.8	1.5	2.6
2014	30.3	22.3	38.3	6.1	4.5	6.9
Sweden						
1980	8.4	3.1	6.4	1.3	0.4	0.7
2000	16.3	8.1	15.7	2.6	1.1	2.1
2014	22.1	12.8	22.7	4.1	2.4	3.6

Source: Own computations from the Human Fertility Database [18]

Childbearing at Very High Reproductive Ages

Advances in assisted reproductive technology (ART), especially oocyte cryopreservation, have partly eroded the conventional boundaries of female reproductive lifespan marked by follicular depletion and menopause (see Kat and Broekmans in Chap. 1). In the United States, the number of births to women aged 50+ tripled from 255 in 2000 to 743 in 2014 [25, 26]. In the European Union countries (including the United Kingdom) the number of births to women aged 50+ in 2002–2014 jumped from 287 to 1019 ([27], own computations). Wikipedia [28] provides an extensive list of women who gave birth at age 50 or older, with the three oldest mothers reportedly being all from India and giving birth at age 70 between 2008 and 2016. The oldest mother with fully verified age is Maria del Carmen Bousada from Spain

who gave birth to twin boys shortly before her 67th birthday, after receiving ART using donor oocytes in the United States.

Childbearing Intentions and Their Realisation at Higher Reproductive Ages

High Share of Childless Women Aged 35+ Intends to Have a Child

The *Generations and Gender Surveys* (GGS) for six European countries that took place in the 2000s reveal that many women still plan to have a child at an age when their reproductive capacity is declining [29]. This is especially the case in Austria, France, Italy, and Russia where 28–32% of women aged 35–39 intended having a(nother) child (Fig. 2.2). Perhaps more surprising is that more than one in ten women aged 40–44 in Austria, Italy and Russia intended having a(nother) child. These shares were much lower in Czechia and Poland, two post-communist countries where reproduction took place at relatively young ages until the 1990s. However, women at older reproductive ages also express uncertainty about their plans: in each analysed country the share of women responding they "probably" intend to have a child outnumbers the share responding they are "certain" about their intention.

Another consistent finding is a strong family size gradient in reproductive intentions: the plan to have a child later in life is very common among childless women aged 35–39, with a majority of these women intending to become mothers. Also many women with one child still planned to have a second child in the future. In contrast, only a few women having two or more children intended to have another child at later ages (Fig. 2.2b). Very similar gradient is found also for women aged 40–44 and for men at advanced reproductive ages (not shown here; see [30]).

Actual Fertility at Higher Reproductive Ages Matches More Closely the Earlier Reproductive Intentions Among Mothers Than Those Among the Childless

How are intentions to have children later in life related to the actual fertility rates at higher reproductive ages? For three European countries, Austria, Italy, and the Netherlands, we compared survey data on reproductive intentions with the aggregate data on childbearing probabilities by age and parity included in the Human Fertility Database [18] and Human Fertility Collection [19]. We did not follow up

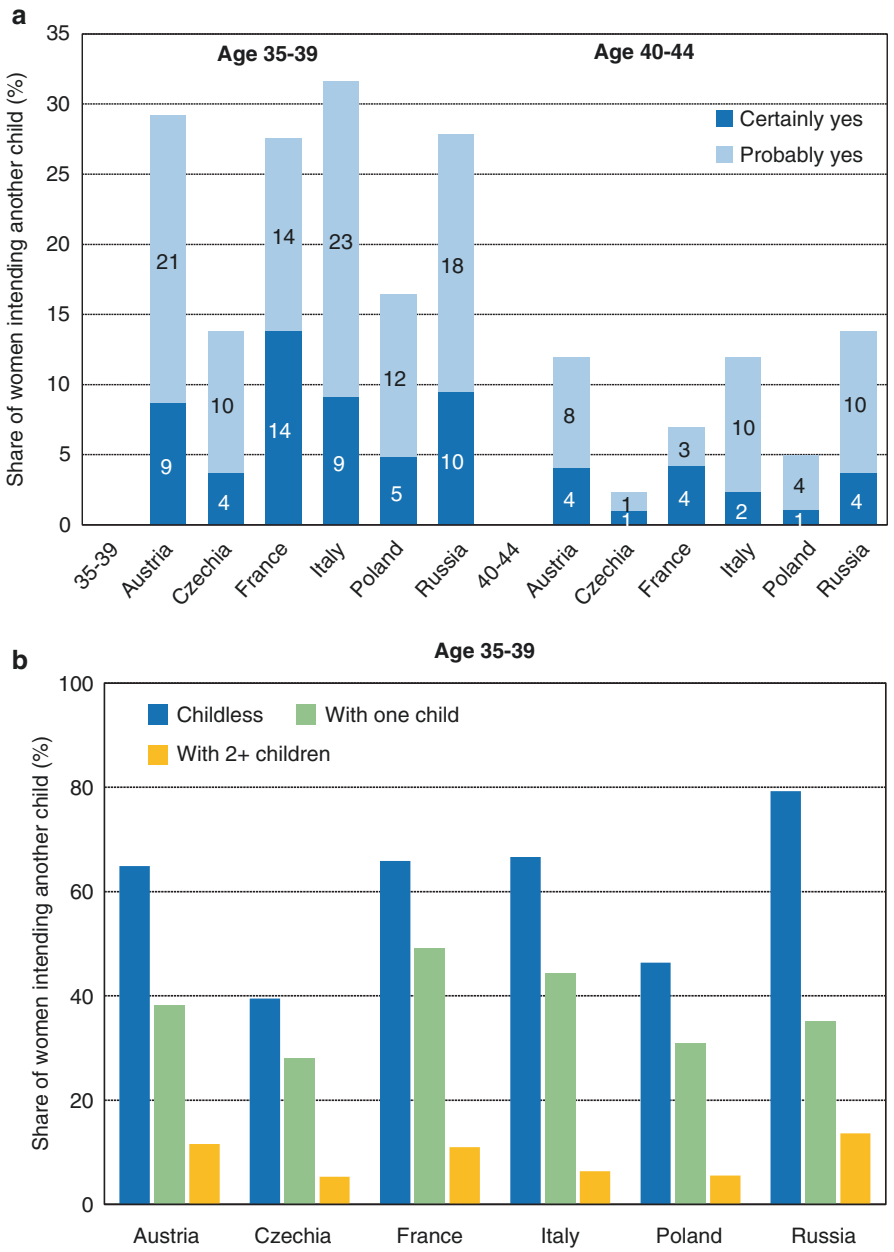

Fig. 2.2 (**a**) Share of women aged 35–39 and 40–44 stating they intend to have a(nother) child in the future; six European countries, surveys organized in 2000s. (**b**) Share of women aged 35–39 stating they intend to have a(nother) child in the future by the number of children they already have; six European countries. The graph combines "probably yes" and "certainly yes" answers. Source: Own computations from the Generations and Gender Survey (GGS) data for Austria 2008–2009, Czechia 2004–2005, France 2005, Italy 2003–2004, Poland 2010–2011, Russia 2004 (see [29] for questions asked and for more details about the data)

Table 2.2 Percentage of Italian women aged 35–39 and 40–44 intending to have a(nother) child (Multiscopo survey in 2009) and the share of women giving birth to a child in the following years (population-level statistics, in percent)

	2009 Multiscopo survey				Population-level fertility data	
	Intention to have a child, %			N	Share having a child (% of all women irrespective of their intention)	Share having a child related to the share intending
	Yes	Probably yes	Total			
Age 35–39						
Childless	24	40	64	463	31	0.48
1 child	14	34	49	411	33	0.67
2+ children	2	10	12	764	9	0.75
Total	12	25	37	1638	22	0.59
Age 40–44						
Childless	7	27	34	362	7	0.20
1 child	3	14	17	436	6	0.33
2+ children	1	1	2	967	1	0.60
Total	3	10	13	1765	4	0.28

Source: Own computations from Multiscopo ISTAT—Family and Social Subjects (2009) survey

the women interviewed at the time of the survey, but we compared their plans with population-wide data on the likelihood of having a child by the end of their reproductive life among all women who were of the same age and had the same number of children in the year intention estimates were calculated.

Table 2.2 illustrates this correspondence for Italy, where 37% of women aged 35–39 intended to have a child in the future (including those saying "probably yes") according to the 2009 Multiscopo survey. This compares with the aggregate data showing that 22% of women of that age gave birth in the years following the survey. A similar correspondence is found for Austria (24% intended to have a child vs. 15% have had a child; see [30], Table 2.2a) and yet closer relationship is found for the Netherlands (20% vs. 16%) (results for Austria and the Netherlands not shown here). These comparisons indicate that women aged 35–39 wishing to have a child in the future still have a relatively good chance of achieving their goal, even when taking into account that those giving birth to a child are not always those who intended to have one.

The gap between reproductive intentions and actual pregnancies becomes much wider at later ages, 40–44, when many women are infertile and the potential mothers often widely overestimate their chances of becoming pregnant (see data for Italy in Table 2.2). In addition, childless women aged 35+ consistently show a larger gap between their reproductive intentions and subsequent childbearing. This gap is partly related to considerable uncertainty about the reproductive plans reported by these women, but it is also due to their unrealistic expectations and adverse life circumstances (which often include not having a partner). Selectivity plays a role as well, with more frequent health problems and higher infertility among the childless.

Assisted Reproduction and Delayed Childbearing

Rising ART Use and Declining ART Success Rates at Higher Reproductive Ages

Many women planning to have a child in their late 30s and early 40s are likely to face infertility and turn to ART treatment. This trend is partly fuelled by widespread misperceptions about the ability of ART to compensate for infertility at later reproductive ages [31], giving women an illusion of fertility control at higher reproductive ages [32, 33]. Despite many rich countries not subsidizing ART for women after a certain age threshold, the number of ART cycles is rising fastest at age 40 and higher. In the United States, 21% of all ART cycles in 2013 (i.e., 34 thousand cycles) were initiated by women aged 41+ (own computations from the Centers for Disease Control and Prevention data [34]).

In Europe, the incomplete data show that the number of registered ART cycles at ages 40+ increased much faster in 2002–2012, by a factor of 3.1, than the number of cycles initiated by younger women, which increased by a factor of 1.8 (computations based on [35, 36]). Especially steep rise was reported for ART using donor oocytes, which quadrupled in the same period. Overall, the share of ART cycles initiated by women aged 40+ jumped from 12 to 19% in 2002–2012, contributing about 7% of all children born to women over age 40.

Success rates of non-donor assisted reproduction, measured especially by the percentage of ART cycles that result in pregnancies and live births or single-infant live births, decline rapidly with age among women past age 32 ([34], Fig. 14). Figure 2.3 illustrates this pattern using the data for the United States. Among women undergoing non-donor ART in 2013, pregnancy rates per cycle reached 46% at ages below 35, 25% at age 40 and only 4% at ages 45+. Because of high rates of miscarriage at higher ages, the fall in the likelihood of live birth following ART cycle is even steeper with age: 40% of non-donor ART cycles initiated at ages <35 resulted in live birth in 2013, compared with 17% of the cycles initiated at age 40 and 2% at ages 45+ (Fig. 2.3). The likelihood of live birth has improved only gradually among women past age 40. A majority of women do not achieve pregnancy leading to live birth after age 40 even after six or more ART cycles [37, 38].

Conventional ART using non-donor oocytes therefore cannot offset age-related fertility decline and for many women it does not provide a realistic chance of having a child after age 40 [31, 39, 40]. Also the cost of ART treatments per live birth delivery rises steeply after age 40, making conventional non-donor ART use problematic, especially after age 45 [41].

In contrast, ART with donor oocytes shows remarkably stable success rate with age of women treated, with the percentage of ART cycles resulting in live births staying over 50% even for women in their 40s according to the US data for 2013 ([34]: Fig. 40) (for more details on treatment options see Drakopoulos and Polyzos in Chap. 3). Therefore, despite higher costs and despite the fact that in case of successful treatment the child will not be genetically related to the mother, the use of donor oocytes increases rapidly. In the United States, donor oocytes accounted for

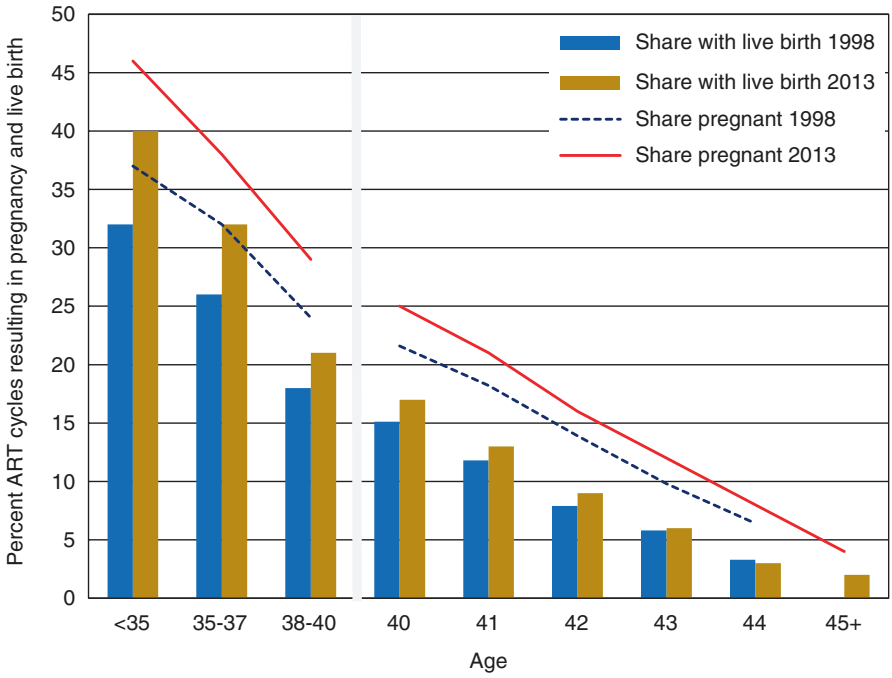

Fig. 2.3 Success rates of ART cycles with non-donor oocytes or embryos by age in the United States: Percentage of cycles resulting in pregnancies and live birth, 1998 and 2013. Source: [34] (Figs. 15 and 17) and 2000 (Figs. 10 and 12). Note: Data for single years of age published only for ages 40–44

37% of ART cycles among women aged 41+ and for around 78% of live births among ART users of that age; for Europe the corresponding estimates were 17% and 41%, respectively (own computations from [34] data and [35] data). In addition, the cryopreservation of oocytes has rapidly evolved and reached the stage when it has become widely available ([42]; see also Chap. 8 and other chapters in this volume). In the US, the number of oocyte or embryo banking cycles rose dramatically from around a thousand in 2006 to over 27 thousand in 2013 [34]. Surprisingly many of these freezing cycles, 30%, are taking place at ages 41+, i.e., at ages when the quality of oocytes deteriorates rapidly, implying lower chances of successful pregnancy and delivery later in life.

Main Factors Contributing to Later Parenthood

A review by Mills et al. [43] identified the following key drivers of the shift towards later parenthood: expanding education, increased employment among women, economic uncertainty and precarious forms of employment, low availability and high costs of housing, delayed and more unstable partnerships, more individualized

values including higher acceptance of childlessness, and lower levels of gender equality. These factors often reinforce each other and their importance differs by country and time period [17]. The shift towards later parenthood was supported by widely available efficient contraception, especially the pill [44, 45] and, more recently, by the spread of "emergency contraception" that is used especially among young adult women [46].

Being in education is commonly perceived as incompatible with parenthood [47]. The continuing expansion of higher education in the rich countries during the last four decades has been repeatedly identified as a central driver of delayed parenthood [48, 49]. However, in many countries including the United States, United Kingdom and Norway, highly educated women increasingly shifted childbearing well beyond the time of completing their education, often towards their mid- or late-30s [50–52]. This leads to rising contrasts ("polarization") in first birth timing by social status, especially in Southern Europe and in English-speaking countries [53]. Unemployment and unstable economic conditions have been documented as important factors especially in Southern Europe, where policies supporting family formation are weak and many young adults face precarious labour market situation [54]. At an individual level, not having a suitable partner and, more generally, "not feeling ready" for motherhood are frequently cited as important reasons for delaying motherhood [55, 56].

Demographic Consequences of Delayed Childbearing

The shift to later motherhood has important population-level consequences. It negatively affects period birth rates as some women who would otherwise have had a child in any given year shifted their childbearing plans towards the future. As a result, period total fertility rates are depressed and often decline well below the corresponding indicators of cohort family size [57, 58]. Delayed childbearing implies wider age distance between generations, which in turn means that women and men having children later in life are less likely to survive to see their grandchildren when compared with younger parents or they might not remain in good health when becoming grandparents [59, 60]. The stretched intergenerational interval also implies a slower pace of population decline when fertility rates are below the replacement-level threshold of around 2.07 children per woman in low-mortality countries [61].

Later motherhood can also result in higher childlessness and reduced family size in the population. Leridon and Slama [62] simulated the impact of a postponement of the first pregnancy attempt by 30 and 69 months, initially starting at age 25 on average. The shift by 69 months would reduce the final number of children per woman by more than 10% (from 2.00 to 1.77) and would increase the share of childless couples from 11.7 to 17.7%. Te Velde et al. [63] used similar micro-simulation models, estimating that first birth postponement in six European countries between 1970 and 2007 led to an increase in permanent childlessness in the range of 4% in Czechia to 7% in Spain.

Delayed childbearing is closely associated with higher frequency of multiple births. Their increase with age of the mother is attributable to higher multiple follicle growth with age [64] and to high rates of multiple births following ART. In the highly developed countries the frequency of twin deliveries increased rapidly between 1970 and 2013, typically doubling, but in some cases (Greece, Hong Kong) tripling during that period [65]. In the United States, the number of twin live births per thousand live births went up from 18.9 in 1980 to 33.9 in 2014 ([25], Table 27). The analysis of data for 32 countries by Pison et al. [65] shows that ART use was the main reason for the rising frequency of twin births, contributing on average to three quarters of their observed rise between 1970 and 2005. As single embryo transfers are increasingly preferred by health professionals, the guidelines regulating ART use are being revised. Consequently, the frequency of twin and triplet deliveries peaked in 13 countries including Nordic countries, Australia, Japan, the Netherlands and Japan between 1998 and 2010 and then started declining [65–69].

Consequences of Delayed Motherhood for Pregnancy Outcomes, Maternal and Child Health

Extensive medical literature documents the effects of pregnancy and childbearing at advanced reproductive ages on pregnancy outcomes, foetal development, and maternal and child health (e.g., [60, 70–74]). Many risks are related to "natural pregnancies", but some including multiple deliveries are more typical for ART use. We give only brief highlights of the most important findings; more details are discussed elsewhere in this volume.

Pregnancy complications and foetal loss are more frequent at higher maternal ages. The frequency of miscarriages (spontaneous abortions), ectopic pregnancies as well as stillbirths increases rapidly with age among women in their late 30s and older [60, 75]. Danish register-based study found that at age 42 and older, more than half of pregnancies intended to be carried to term (i.e. excluding induced abortions) resulted in foetal loss, compared with 13.5% of pregnancies across all ages [75]. Male partner's age was also found to be an independent risk factor for miscarriage [76]. Interestingly, women using donor oocytes do not show an increase rise in pregnancy loss with age [77, 78], which again suggests that the age and quality of oocytes are the main factors determining reproductive success (see also Kat and Broekmans in Chap. 1). A combination of rising infertility and more frequent pregnancy losses with age implies that women who have a strong childbearing desire and a preference for larger family should aim to have children relatively early in life. Habbema et al. [79] showed that women planning only one child and willing to take a 50% risk that they do not succeed can start their pregnancy attempt at age 41 (or 42 if they are willing to use ART). Those planning three kids and wanting to have a 90% chance they succeed should start as early as at age 23.

Advanced maternal age is also a risk factor in preterm births [80, 81] and complications during pregnancy and delivery, including high rate of Caesarean delivery, excessive labour bleeding, and higher frequency of diabetes and chronic and pregnancy-induced hypertension among mothers [71, 73, 74]. Older mothers are more likely to suffer from obesity, take medication or experience morbidity (see [82] for obesity). Multiple births, more common at later childbearing ages, constitute an additional risk factor associated with low birth weight of infants, pregnancy complications, maternal risks, and higher long-term morbidity [83, 84]. Among children, advanced maternal age is often linked to higher incidence of congenital anomalies and chromosomal aberrations, as discussed in Chap. 1 by Kat and Broekmans.

Positive Consequences of Parenthood at Later Ages for Parents and Children

The Economic Rationale of Parenthood at Later Ages

Among higher educated women with better-paid jobs and good career prospects there is a strong economic rationale for delaying parenthood well beyond the period of completing education. It is based on a need for couples to accumulate resources before family formation, to have enough resources to rear their children and support their education as they grow up, to qualify for paid maternity and parental leaves, and to minimize the income loss linked to childcare-related career break.

Achieving financial security is often cited by couples as one of the most important factors in their parenthood decisions [16]. In many countries, especially in Southern and Eastern Europe, rental housing is scarce or too costly. Young couples may need to accumulate considerable savings and achieve a stable income before purchasing their own flat or a house—which is often seen as a precondition to having children [85, 86]. Married couples living in US cities with highest rents and housing sales prices were having their first child by 3–4 years later than the couples living in metropolitan areas with cheap housing [87]. In addition, raising children is costly, especially in countries where costs of childcare, healthcare and education shouldered by parents are high. In the US, the cost of raising a child from childbirth up to age 18 was estimated at 245,000 US Dollars for middle-income families, based on the 2013 computations by US Department of Agriculture [88]. This again motivates couples to put off childbearing until both partners achieve stable employment and steady income.

In countries which provide paid maternity and parental leave, including Nordic countries, their level is often linked to pre-leave income and a minimum period of uninterrupted employment before the leave. As this policy is focused on compensating parents their foregone earnings, it motivates prospective parents to get established on the labour market and achieve a stable full-time position before having a

child, potentially delaying their parenthood [89]. Finally, among mothers with higher socio-economic position, earning losses due to childcare leave are substantially lower at higher childbearing ages when they are more advanced in their careers, have more secure employment, and experience lower skill depreciation [90–92]. The US data analysed by Herr [93] show that fertility delays are paying off especially for college graduates: for them, each year of delaying motherhood after their labour market entry implies a 2.9% increase in their wage after a 20-year period, accounting for 5.5% of their total wage growth.

Non-economic Positive Consequences of Delayed Parenthood

The positive consequences of delayed parenthood extend beyond resource accumulation, more stable careers and lower income losses. However, the research in this area is relatively limited and the evidence so far is often based on small datasets or data pertaining to one country. Many papers do not address selection effects—the fact that older mothers are also, on average, better educated and healthier, and therefore the possible effects of late motherhood reported below might be more closely associated with their education and health rather than age [94, 95]. Therefore, these findings do not imply causality and have to be interpreted with caution.

Later parenthood is linked with a lower likelihood for children to be born to a mother living without a partner [60] and a lower percentage of unintended pregnancies and births [96, 97]. Children born to older parents experience less frequent parental separation [98] and therefore they also experience living with a single mother or with stepparents less often than the children born earlier in life. The research on three indicators of child's cognitive and behavioural outcomes at the age of three summarised by Hansen et al. [99] showed these outcomes peaking among children born to mothers in their 30s. While much of this developmental advantage was attributable to their mothers' higher education, the positive effect of later motherhood persisted even when mothers' education, return to employment and childcare use were controlled for. Myrskylä and Margolis [100] found that parents at older ages (35+) show more positive happiness trajectory after the childbirth than the younger parents.

Barclay and Myrskylä [101], working with Swedish data, demonstrated additional benefit of late motherhood for children. Children born to older mothers are also born in a later time period, reaping the benefits of improving social conditions over time. They are taller, more likely to attend university and perform better at standardised tests than their siblings born when their mothers were younger. Among mothers, late age at childbearing is associated with better health and longevity [102, 103]. These findings again suggest that some of the benefits of later motherhood might be explained by selectivity of mothers who are fertile (and presumably healthyier) at later ages.

Discussion: The Contrasting Biological and Social Rationales for and Against Late Parenthood

As longevity continues rising, life courses of men and women stretch and they experience many important transitions later in life [104]. They complete their education, move from parental home, enter the labour market, or retire at ever higher ages. The fast increase in the number of women who are childless past age 35 and plan to have a child in the future appears perfectly in line with this trend. With some simplification, children born to older parents are also born to more stable, happier and wealthier families. Many social and economic rationales speak for having children late in life. However, these rationales clash with "inconvenient biology" [105] as there is also a clear biological and health rationale for having children much earlier in life [9, 106]. The steep rise in the number of ART cycles at later reproductive ages illustrates the scale of infertility and unfulfilled pregnancy desires among women who arguably postponed parenthood for too long.

The rise of ART with donor oocytes and the advances in "social egg freezing" have gradually eroded the biological limits to fertility marked by follicular depletion and menopause. The number of post-menopausal women getting pregnant is increasing fast, although from very low numbers. At the same time, a vast majority of women still plan to get pregnant without the help of medically assisted reproduction. They are often caught between the conflicting motivations for and against having children and struggling with the ever more pertinent question of "How long can you wait to have a baby?" [4, 5, 107]. As Habbema et al. [79] demonstrate, the answer depends on family size preferences and the strength of these preferences.

Key Messages

1. A sharp increase in the number of women having their first or second birth after age 35 has taken place across the highly developed countries. Also the frequency of motherhood among post-menopausal women past age 50 is rising fast, but from extremely low levels.
2. Childbearing intentions past age 35 are especially common among the childless women, many of whom will face infertility when trying to realise these plans.
3. Assisted reproduction use has been rising faster among women past age 40 than among the younger age groups. However, success rates of ART using fresh non-donor oocytes remain low at ages 41+, with ART using donor oocytes or women's own cryopreserved oocytes being much more effective and rapidly expanding alternatives.
4. The massive expansion of university education is the main factor behind the shift to later motherhood, followed by unstable labour market and deteriorating economic position of young adults as well as rapid changes in partnership behaviour and the availability of highly efficient contraception.
5. Prospective parents face conflicting rationales for having children earlier or later in life. Biological and health rationales for early childbearing clash with economic and well-being rationales for later reproduction, which include higher family stability and higher happiness among older parents.

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for fertility preservation without a medical indication should not be encouraged." [11]. Given the explosion of new research data in the years that followed, several authors have called directly upon ASRM and ESHRE for a less restrictive attitude [12, 13]. This resulted in a revision of the ESHRE-guidelines in 2012, now stating that "[i]n the light of new scientific developments, and after considering relevant ethical arguments […] oocyte cryopreservation to improve prospects of future child bearing should also be available for non-medical reasons" [14]. The ASRM, however, despite lifting the 'experimental' label from OC for medical purposes in 2012, maintained its stance that OC should not be offered for non-medical reasons due to a lack of data for this specific indication and due to the fact that "[m]arketing this technology for the purpose of deferring childbearing may give women false hope and encourage women to delay childbearing" [15].

In this chapter, the different arguments pro and con OC to counter age-related fertility decline will be presented and critically assessed. This overview will show that although there are no strong arguments against the principle of AGE-banking, the ethical concerns that are voiced in regard to the technology do point at legitimate concerns about the way it is/should be offered to patients. As a preliminary remark, please note that although safety is obviously an important ethical concern for all new medical technology, it will not be discussed in this chapter.

Fundamental Objections Against AGE Banking

The Argument from Nature

A first set of fundamental objections against AGE-banking relate to the idea that this technology pushes the boundaries of nature. The age at which the average woman becomes infertile is then not merely labelled as a biological fact, as the age at which women *can* no longer have children, but rather as the age at which women *should* no longer have children. In ethical theory, this phenomenon is known as the is-ought fallacy. Unless if one starts from the religious belief that everything was created for a clear purpose and that we live in the best of all possible worlds, the (average) natural state of things does not teach us anything about how things ought to be. This also implies that there is no obvious reason why medical interventions should be limited to preserving or restoring the natural state of things—as is done in 'medical' egg freezing—and should not be used to counter natural phenomena that have a negative impact on our wellbeing. It should be remarked that many illnesses are age-related, just as the decline in female fertility, and that many medical interventions are performed to solve inconveniences that may be considered 'normal' if they occur at a certain age. In fact, not much of modern day medicine would remain, if we were to cancel all interventions for age-related health problems. Yet, nobody seems to be opposed to the treatment of Alzheimer's disease or osteoporosis. The distinction between medical and non-medical egg freezing based on the idea that aging is not a medical problem is therefore problematic. If we have good reasons to counteract

infertility for women with a desire for parenthood, then it matters little what the cause of the pending infertility is.

Also, besides the fact that the distinction between medical and non-medical OC is irrelevant, it is also a false distinction in the sense that there is a grey area in between these two applications [9]. For instance, should women who request OC due to a prognosis of unexplained premature ovarian insufficiency be regarded as freezing for medical or non-medical reasons? Even for cancer patients, certain regimens of radiation or chemotherapy will lead to immediate sterility in (reproductively speaking) older women, but not in younger women. The reasons for the former to store oocytes are therefore both disease-related and age-related. In this chapter, I will maintain the term 'AGE banking', which allows for a wide interpretation, although many of the objections discussed will be aimed primarily at egg freezing for healthy women.

Medicalization

A related objection against AGE-banking is that it provides a medical solution for a problem that in essence is not a medical problem, but a societal one, namely the steady rise in women's age at first childbirth (now on average between 25 and 35 years old). This can then be attributed either to the woman herself or to the way the labour market is structured.

If women are held accountable for 'delaying' childbearing due to 'lifestyle choices', the non-medical alternative to OC is obvious and simple: women should reproduce earlier. This is however easier said than done. The most important reason for banking eggs in healthy women is the lack of a partner [16–18]. Should we thus encourage women to become single mothers? Should we advise them not to wait for Mr. Right, but go for Mr. Good Enough? Besides the most important factor of finding a suitable partner to share parenthood with, several studies have found that women also find it increasingly important to first complete their education, have financial security and good housing before taking on the responsibility of parenthood [19, 20]. These are not trivial desires, but relevant for the wellbeing of themselves and their future children. Bonneux et al. [21] have therefore argued that the rise in the age at first childbirth is a trend that increases overall wellbeing and that should not be regretted in itself, even if it is regrettable that the peak of natural female fertility does not coincide with the moment at which women would preferably have their children.

Alternatively, rather than holding women accountable for the rising age at first childbirth, society might be blamed, in the sense that many women experience difficulties in starting a parental project during their reproductive lifespan due to professional obligations. While fertility preservation can offer a solution to this problem once it presents itself, it does not tackle the root cause. As mentioned by Goold and Savulescu [22], "one might ask whether we actually help women […] by taking for granted their bad employment situation and offering them egg freezing to deal with

it". Fertility preservation for social reasons is then a type of unnecessary medicalization of society that can be avoided by creating a better social climate for working mothers. However, societal change takes time. While we might attempt to tackle the (hypothetical) root cause of delayed childbearing by making it easier for young parents (both women *and* men) to combine personal and professional responsibilities, this is unfortunately not a solution for women who are in their late thirties and involuntarily childless today. Therefore, long term solutions to the benefit of future generations should not prevent us from offering practical solutions to the present generation [23, 24]. Moreover, keeping in mind that lack of a partner is the primary reason to request AGE banking, we should be sceptical that reforms in the labour market will reduce the demand for AGE banking. At the same time, we should remain vigilant that the option of AGE banking is not invoked as an excuse to invest less in reforms in the labour marked that enable a better combination of professional and parental obligations.

A Negative Impact on Society

Related to the argument that women's employment situation does not allow them to reproduce at a young age, there is a concern that the offer of AGE banking will increase the pressure on women to invest in their careers while they are young at the expense of pursuing parenthood. This concern became especially convincing when Facebook and Apple announced that they would start offering OC to their female employees. As argued elsewhere, even if AGE banking in itself may not be ethically problematic, the offer by employers is [25]. For such a policy to be implemented with respect for women's reproductive autonomy, a substantial number of conditions need to be fulfilled, which can be reduced to three categories: (1) women should understand the benefits, risks and limitations, (2) women should feel no pressure to take up the offer; (3) the offer should have no negative effect on other family-friendly policies and should in fact be accompanied by such policies. Fulfilling these conditions may turn out to be impossible. Thus, regardless of companies' possible good intentions, women's reproductive autonomy is not well served by offering them company-sponsored AGE banking.

Another concern is that the offer of AGE-banking may cause an increase in the average age at which women become mothers. Although this effect is possible, there are various reasons why it is unlikely that this effect would be significant. First, the number of women opting to bank oocytes is likely to remain a small fraction of all women desiring to become mothers, as the procedure requires a substantial physical and financial effort. Second, it is wrong to assume that these women make a choice between reproducing 'now' or reproducing a couple of years later. For many of the women opting for AGE banking, reproducing at the moment of freezing is not an option (due to lack of a partner, as mentioned). The more likely alternatives are thus either not reproducing at all, or reproducing via donor oocytes. Third, women who bank oocytes on average do so in their late thirties and on average consider the

maximum age to use the oocytes below 44 years [26]. This means that even for the small fraction of women who would consider a pregnancy at the time of freezing if AGE banking were not available, motherhood is only 'deferred' for about 5 years. In conclusion, the most likely effect of offering fertility preservation to healthy women is not a decline in the number of young mothers but a small incline in the number of older mothers. Whether an increase in the age of mothers is problematic in itself, is discussed in Chap. 12.

Fundamental Arguments for AGE Banking

Gender Equality

An argument in favour of AGE banking is that this intervention is emancipatory in nature as it can fix the factual discrimination between men and women in regard to their reproductive lifespan: if men are able to conceive children at an advanced age, then women should have the same liberty. This is again an example of the is-ought-fallacy. The mere biological fact that a 70-year old man is capable of conceiving children, says nothing about the moral reasons for (not) doing so. However, as reproductive freedom is highly valued in our society, we do not impose forced sterilization on men above a certain age. Reproduction at an advanced age is thus a liberty right, but that does not mean that it is also a claim right. That means that if an infertile senior citizen (male or female) applies for IVF treatment, it may not be granted based on considerations regarding the welfare of the future child. Given the fact that pregnancy complications are an additional concern in the case of women, a lower cut-off age in ART for women than for men may be justified.

Reproductive Autonomy

The main argument for AGE banking is that it increases reproductive autonomy. Due to this new technology, women are theoretically able to extend their reproductive lifespan and are thus less dependent on donor oocytes if they wish to reproduce at an age at which their ovarian reserves are depleted (see below). As mentioned above, the age at which women desire to have children rises and not all women succeed in finding a partner with whom to share parenthood before the decline of their fertility. When single, childless women reach their late thirties and still want to become mothers, they—unlike men—are under pressure to find a partner fast and embark on parenthood with that new partner fast, or resort to single parenthood. AGE banking can relieve women of this pressure by offering them a couple more years to find a suitable partner, thus allowing for more autonomous choices. Caveats are that only a limited number of oocytes can be banked, so that a pregnancy—let alone a live birth—can certainly not be guaranteed and that women still face legal

restrictions on the age until which they can use their banked oocytes to (try to) establish a pregnancy.

An absolute prerequisite for AGE banking to positively influence reproductive autonomy is that women receive correct information about the possibilities and limitations. The overly optimistic portrayal of AGE banking as 'insurance against infertility' or as a means to defer childbearing while retaining fertility misguides women about the limitations. If a woman with a very strong desire for parenthood would defer childbearing relying on banked oocytes and subsequently fails to achieve a pregnancy with those banked oocytes, her reproductive autonomy was very ill-served by AGE banking.

Psychological Benefit

Linked to reproductive autonomy and the pressure on finding a suitable partner when a woman approaches the end of her reproductive lifespan is the observation that women may not only derive a clinical benefit (the chance of conceiving a child), but also a psychological benefit from knowing that there is still 'a chance' for her to have children, regardless of whether she ever actually uses her stored eggs. Research by Stoop et al. [26] shows that even women who have banked oocytes but have never used them or no longer envisage using them do not regret their decision to bank and would do so again in similar circumstances. Also, some women decide a couple of years after banking that they will embark on single parenthood although their preferential life plan involved building a family with a partner. Banking then allowed them some extra time to consider the option of single parenthood without Damocles' sword hanging above their heads.

Self-donation

A strong argument for allowing AGE banking is that it is in fact a form of oocyte donation which does not involve a third party [13, 27]. If a woman is currently unable to conceive due to a depletion of her ovarian reserve, she can establish a pregnancy with donor oocytes, but there are some drawbacks to this option. First, the resulting child will not have a genetic connection with the mother. Although this is not necessarily problematic, it is a suboptimal option for many people, either because they identify parenthood with genetic parenthood (or at least presuppose that one is 'more' of a parent when there is a genetic connection) or because they fear a disruption of their family unit if the donor would claim a role or if the child would regard the donor as the 'real' mother [28]. Second, oocyte donation requires that a healthy woman is subjected to ovarian stimulation and oocyte retrieval. These are unpleasant and time-consuming procedures with (limited) risks involved, which hold no benefit for the woman who is subjected to these risks. Both donor

anonymity and open identity donation are potentially problematic for the donor, in the former case because she might want to know the person resulting from her donation, in the latter case because she might *not* want to be contacted by that person. As we currently allow donor conception despite these drawbacks, it would be inconsistent not to allow a woman to donate oocytes to her future self. In this case the genetic link is maintained and the person subjected to the risks of ovarian stimulation is the same person as the one who reaps the benefit of (potential) parenthood. The only dissimilarity that might be invoked to justify a different approach is that in the case of 'regular' oocyte donation, the need for a donor oocyte is present, whereas when a woman decides to bank oocytes for future use, she can never be certain that there will ever be an actual need. Therefore, the effort might be in vain.

Concerns About Improper Introduction into the Clinic

Utility

The major problem for AGE banking is that in many cases, it will be a medical intervention without clinical benefit. Few women will mimic the best case scenario—which is the one that commercial companies offering AGE banking are most likely to highlight—in which women between 30 and 35 realise that they will not be in ideal circumstances to reproduce in the coming years, store their oocytes, then meet Mr. Right, build up a stable relationship and come back to the clinic to use their oocytes around age 40 (when their ovarian reserve is depleted), establish a pregnancy and become mothers. If women bank their oocytes at a younger age, the quality of these oocytes—and therefore the chance to achieve a healthy live birth—is better, but then there is a large chance that they will never return to use them, as there is still a big chance that they will be able to reproduce naturally during their reproductive lifespan. If women bank their oocytes at an older age, there is a larger chance that they might need them (in the sense that their window of opportunity for natural reproduction is about to close), but the odds of achieving a live birth are a lot smaller as the quality of the oocytes will be a lot poorer [29]. In practice, it turns out that most 'AGE bankers' correspond more to the latter category. Women do not proactively freeze eggs during their twenties or early thirties in a well thought-out plan of achieving their career goals first and focussing on parenthood later. Instead, women turn to AGE banking as a last resort. This also means that many women present themselves at the clinic at a moment when the intervention can bring little benefit for them because ovarian stimulation may only yield a couple of bad quality oocytes which are unlikely to lead to a viable pregnancy.

Although it is too early to draw any definitive conclusions, preliminary studies indicate that the eventual utility of the procedure may indeed be low. For example, Garcia-Velasco et al. [30] report that from 560 non-oncological patients banking oocytes between 2007 and 2012, only 30 had returned for treatment in 2013 and of those 30 there were 5 live births and 8 on-going pregnancies at the time

of publication. In a study by Stoop et al. [26] only half the women who banked oocytes anticipates using them in the future. However, this study also confirms that besides the clinical utility of achieving a live birth, there is also a psychological benefit to consider, as the great majority of women was still positive about the decision to store oocytes, also if they anticipate not using them. In any case, counselling for women who inquire about the possibility of oocyte banking should include information about the possibly low utility of the procedure and thus of their investment.

Information

Not only information about utility needs to be provided to potential oocyte bankers, but also, as previously argued, information about the success rates, stratified by age [29]. Ideally, not the chance of a live birth per oocyte should be given, but the cumulative live birth rate with the number of oocytes that are expected to be banked. This information is however not always available. Cil et al. [31] have constructed a model for the age specific probability of live-birth for different numbers of thawed oocytes (based on a meta-analysis) and report a probability of live-birth for a 38-year old woman (at the time of freezing) of 15% for 6 thawed oocytes (after vitrification). 37–38 has been reported as the average age of women opting for AGE-banking [16, 18, 32–35]. It is clear that for this group, metaphors such as 'putting fertility on ice', 'stopping the reproductive clock', 'fertility insurance' or 'fertility preservation' are misleading, as the chance that they will not be able to conceive with their banked oocytes appears to be larger than the chance that they will succeed.

Also for younger women, the danger of misinformation is lurking. Although there are currently few reports of young women storing oocytes with the explicit purpose of postponing motherhood, some commercial companies are definitely aiming at young women invested in their careers to 'sell' their intervention to, targeting them through events such as egg freezing parties. In this situation, the danger is that women do not realise that postponing parenthood always results in a decline in the chance of establishing a pregnancy, even when eggs are banked, as these banked eggs are always limited in number. A woman may thus enter into AGE banking believing that her desire for children is 'safe', while it is not. According to the model by Cil et al., a 28 year old women would have a 27% live birth rate for 6 thawed oocytes (after vitrification).

Misleading and Coercive Offers

Concerns regarding the clinical utility and the provision of information are both linked to the commercialisation of autologous oocyte banking. When financial profit becomes a factor that influences the offer of oocyte banking or even becomes

the goal, the probability that women's attention will be drawn to the drawbacks or that they will be encouraged to reconsider their plans of banking is low. Reference is easily made to reproductive autonomy in this context: if women want to bank their oocytes—even despite the low utility—they should have the liberty to do so and therefore commercial companies should be free to offer it to them. However, respecting an autonomous choice requires that the choice is truly autonomous, that is, that it is based on all the relevant information and free from outside pressure. This is more easily achieved in a non-commercial context.

Besides the fear for misleading offers by commercial egg banking companies, fears exist regarding coercive offers by employers. As discussed above (see section "A Negative Impact on Society"), even if the rationale behind including egg banking in a benefit package would be to increase reproductive autonomy, the chance that the opposite—a decrease in reproductive autonomy—would result is very large.

Access

If employers cannot include egg banking in their healthcare benefit package, then how should egg banking be financed? If the banking woman pays, there are concerns about distributive justice in the sense that this technology will only be available to the segment of society that can afford it. However, allocating public healthcare funds to AGE banking is not straightforward either, given the fact that healthcare funding is limited and should thus be allocated to the most urgent healthcare needs. Also, the limited utility is an argument against incorporating AGE banking in publicly funded healthcare. Cost-efficiency is also a relevant factor to be considered here. However, as argued elsewhere [36], in a system where IVF is reimbursed, it would be inconsistent to cover IVF treatment with donor oocytes for women who are infertile due to aging, but not with their own previously banked oocytes. Thus, in such a context, at least the second part of the procedure, that is thawing, fertilising and transferring any resulting embryos, should be reimbursed. This does not necessarily imply that the first step of the procedure, namely the costs related to ovarian stimulation, oocyte retrieval, oocyte freezing and storage need to be covered, although there are good reasons to argue for full coverage, a cash back-system or more free transfer cycles [36].

Conclusion

Despite the original opposition against AGE banking for healthy women, AGE banking has found its way to the clinic rather fast. One reason for this evolution may be that a number of the initial ethical objections to oocyte freezing for so-called 'social' or 'non-medical' reasons were not very convincing, especially given the contrast with the warm welcome oocyte banking received in the field of

oncofertility. The arguments that we should not try to circumvent natural boundaries, solve societal problems with medical solutions or that AGE banking will have a negative impact on society are either flawed or only partially convincing. On the other side of the debate, the argument that we should allow AGE banking to combat gender inequality in terms of the maximal age at childbirth was dismissed, but the argument that women's reproductive autonomy should be respected, that this technology may not only clinically, but also psychologically benefit patients and that it is inconsistent to support egg donation by others, but not autologous egg donation appear to carry some weight.

However, even if there are good arguments to bring AGE banking to the clinic, a cautious approach is warranted. First of all, the utility of the procedure may be low and women may be overly optimistic about their chances of conceiving after AGE banking. They should therefore be properly counselled and sufficiently informed about their personal chances of success. Misleading information by commercial companies and coercive offers from companies to their female employees are to be avoided and finally, reflection is needed on access to the technology and on the extent in which reimbursement by public healthcare is desirable.

Key Message

1. The distinction between oocyte cryopreservation for medical reasons or non-medical/social reasons is ill-founded.
2. In principle, oocyte cryopreservation for healthy women could increase reproductive autonomy and benefit women both clinically and psychologically.
3. The biggest ethical concerns are linked to the implementation in the clinical context.
4. Proper counselling aimed at insuring realistic expectations towards the success rate of the procedure and countering misleading information is a necessary condition that should be guaranteed at all times.
5. Reflection is needed on access to the technology.

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