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# Bioethics of Assisted Reproductive Technology

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## Abstract

There is no doubt that for a couple who are having difficulties in conceiving, having a child is an objective good. However, it is also indisputable that assisted reproduction techniques raise clear ethical issues. In order to begin this bioethical reflection, it should be clearly established that the early embryo, which can be manipulated or destroyed using these techniques, is a living being of our species. We believe this is unquestionable from a biological point of view, and it therefore deserves our full respect. The bioethical assessment of assisted reproduction techniques includes analysis of the embryo losses caused by their selection and manipulation through preimplantation genetic diagnosis, 'social freezing' or the possible lack of rigour in the information provided by the clinics involved, to which must be added the higher morbidity reported in babies born as a result of these procedures.

**Keywords:** assisted reproduction, in vitro fertilisation, ICSI, bioethical considerations, loss of human embryos

## 1. Introduction

There is no doubt that for a couple who are having difficulties in conceiving, having a child is an objective boon. In an attempt to achieve this goal, many will avail assisted reproductive technology (ART) or natural family planning methods [1–3].

ART refers to a number of techniques, primarily: (a) in vitro fertilisation (IVF), in which the fertilisation of an egg by sperm takes place in a laboratory setting; (b) intracytoplasmic sperm injection (ICSI), in which a single sperm is introduced into the egg to be fertilised, also in a laboratory setting; (c) artificial insemination, which involves artificially delivering semen to the female genital tract—the semen may be from the woman's own partner or a donor; and (d) gamete intrafallopian tube transfer (GIFT), which involves removing eggs laparoscopically after controlled ovarian hyperstimulation, followed by introduction of the mixture of the couple's eggs and sperm into the fallopian tube so that fertilisation occurs in the body, unlike IVF and ICSI, in which it takes place 'in vitro' although several modifications of these techniques have been proposed [4].

## 2. Efficacy of ART

One important aspect to consider is the efficacy of these techniques, which is generally calculated based on two parameters: the pregnancy rate (PR) and the live birth rate (LBR) per ovarian stimulation cycle.

Based on data published by the European Society of Human Reproduction and Embryology (ESHRE) in 2014 [5–18], the PR and LBR following IVF in Europe between 1997 and 2010 varied between 22.28 and 29.2% for the PR, with a mean rate of 26.41%, and between 13.07 and 22.4% for the LBR, with a mean rate of 18.81%.

When ICSI was used, these same rates varied between 23.37 and 29.9% for the PR, with a mean rate of 27.22%, and between 12.68 and 21.10% for the LBR, with a mean rate of 18.31% [6].

ARTs have wide social acceptance today. Following the birth of the first girl, Louise Brown, by IVF in 1978, more than 200,000 children are now born annually worldwide using these techniques [19], i.e. more than 3% of all children born [14], with the total number of births estimated at over 5 million [20].

### **3. Ethical assessment of ARTs**

Nevertheless, regardless of the medical and social benefits they offer, it is also a reality that ARTs may present bioethical issues that are worth considering. These may be moral or ethical. Moral implications are related with the fact that they involve the instrumental manipulation of fertilisation, disregarding its natural environment, the sexual act, and the implications that may arise from this. Ethical implications entail the bioethical problems related to the medical aspects of these techniques, which are the concerns that we shall analyse in this chapter.

These ethical concerns include those related to:

1. Children born by these techniques.
2. Couples who use IVF.
3. The surplus human embryos that are frozen, as well as the problems that may arise from the treatment given to such embryos.
4. The loss of embryos that occurs in IVF.
5. The embryo selection that is carried out using preimplantation genetic diagnosis (PGD) to transfer only the best quality embryos.
6. Gamete donation, especially the right to privacy of donors and of children to know their parents.
7. The production of saviour siblings.
8. The possible use of these techniques for social purposes, unrelated to the woman's own fertility, such as 'gestational surrogacy' and 'social freezing'.
9. The possible hyperinflated success rates in advertisement of assisted reproduction clinics may present to attract customers.

### **4. Medical problems in children born by ART**

Children born by ART have a higher percentage of adverse medical effects than those conceived naturally [21–29], which gives rise to unanswered bioethical questions.

Thus, these children have higher rates of prematurity and low birth weight [30] as well as an increased risk of birth defects [31–33], especially cardiac malformations [34, 35] and chromosomal abnormalities [36], than children conceived naturally. Another study nonetheless failed to confirm these differences when children were stratified according to the age of their mothers, parity and gestational age [37].

Although some evidence has suggested that these types of medical disorders extend to early childhood [38] and even longer term [30], a recent article assessing whether the negative side effects are maintained until 25–30 years after birth found that these abnormalities are not detected in adulthood [39].

In addition to the disorders mentioned above, children born by ART may also show an increase in acquired medical problems, such as: impaired psychomotor development, cerebral palsy, autism and even asthma [38, 40, 41].

Another issue that has also arisen is whether the increased risk of these negative side effects occurs equally in children born by IVF or by ICSI. Most researchers' opinions are that there seem to be no differences between both techniques [42–45], although others have found a greater number of problems when ICSI is used as compared to IVF [25].

With respect to the cause of the problems in children born by ART, this seems to be multifactorial, and it may basically be due to the technique itself (the manipulation of gametes, the practice of PGD, the culture medium and the time that embryos have been frozen), ovarian hyperstimulation of the mother [46, 47] and also due to paternal subfertility [21]. In particular, it may be related to the greater number of multiple pregnancies that occur in ART [48–52], since multiple pregnancies are known to be accompanied by more foetal congenital abnormalities [49, 53–55], although these are also found in singleton pregnancies using ART [21, 23, 28, 47, 56].

It has recently been suggested that the medical problems found in children born by ART could also be related to epigenetic modifications, which may occur during maturation of the gametes, fertilisation or in the early stages of embryonic development [21, 22, 28, 30, 57, 58].

## **5. Medical problems in mothers who use ART**

A majority of adverse medical events that occur in women who use ART seem due to the greater number of multiple pregnancies that occur in them [49–52, 59] since, as has already been mentioned, obstetric problems are known to be more common in multiple compared to singleton pregnancies [49, 53–55].

Nevertheless, ART-conceived singleton pregnancies also present a higher risk of adverse events in mothers, such as antepartum haemorrhage, hypertension during pregnancy, premature rupture of membranes or gestational diabetes, than naturally conceived singleton pregnancies [60].

## **6. Ethical problems related to frozen surplus embryos from ART and how their untoward situation can be resolved**

As already mentioned, the efficacy of IVF is low. In order to improve this, a large number of embryos are typically produced, usually between 10 and 12, of which 1 or 2 are transferred and the rest frozen. This practice inevitably means that the number of frozen human embryos is gradually increasing.

Knowing what to do with these frozen embryos raises objective bioethical problems. In our view, there are four solutions for these embryos: (a) leave them frozen

indefinitely; (b) use them for biomedical experimentation; (c) thaw them and let them die; and (d) adoption.

Of these four solutions, the most widely employed is the second—using them for biomedical experiments—but this solution clearly poses obvious bioethical problems, since it entails the inevitable destruction of the embryos used.

The solution that presents least ethical problems is the adoption of such embryos by the biological parents, but this is not always possible. What occurs most frequently is the adoption by a couple biologically unrelated to the embryo in question.

The ethics of this type of adoption can be considered from three aspects: (a) from moral philosophy; (b) from secular ethics; and (c) from the point of view of the morality of the monotheistic religions [61].

### **6.1 Frozen embryo adoption in the light of moral philosophy**

There are very few studies that address the moral licitness or illicitness of frozen human embryo adoption in the light of moral philosophy. In our view, this has been addressed in most depth by Antonio Pessina [62].

In his opinion, ‘two lines of argument can be raised when evaluating frozen embryo adoption. In the first, it is assumed that human life is an absolute value, immeasurable, and as such is not comparable to any other. In the second, it is recognized that human life is a basic value, because it is a necessary condition to uphold other human goods, but not sufficient to achieve the specific ends of man, which means that the value of human life can be deferred to other values, for example, by giving one’s life for another’.

If we accept the first principle, ‘there would be no objection to the adoption of frozen embryos; it could even be presented as morally positive and not only licit’. If the second line of argument is accepted, ‘the life of the human embryo should be defended only by proportionate, ordinary and morally legitimate means, in this sense the only possibility being to invite the biological mother to have her child’s frozen embryo implanted and to carry the pregnancy to term. Other options could be considered disproportionate and extraordinary, which could lead to the violation of other fundamental values related to the dignity of the human person and of human procreation’.

In conclusion, Pessina declares himself morally opposed to frozen embryo adoption.

### **6.2 Frozen embryo adoption from the perspective of secular ethics**

From secular ethics, there does not appear to be any difficulty for frozen embryo adoption. In fact, it is even considered to be a positive solution for these embryos, since, according to it, if the embryos are not used by the parents for reproductive purposes, their adoption is ethically more defensible than any other fate that may be given them. Undertaking a reproductive process to try to have a child born is in their opinion the best solution, since the aim is to help build families, i.e. to help infertile couples to have a child, and also to protect a primary good of the embryo, its life. Consequently, many experts or lay institutions see in frozen embryo adoption an alternative for the fate of such embryos that is ethically better than using them for biomedical research, destroying them or leaving them stored indefinitely [61].

### **6.3 Frozen embryo adoption from the perspective of the monotheistic religions**

In relation to Islam, Sunni Muslims are not in favour of considering third-party gamete donation as morally acceptable nor, by analogy, frozen embryo adoption; however, Shiite Muslims are more agreeable to morally accepting this practice [61].

In relation to Judaism, it is difficult to find specific texts that refer to the moral assessment of frozen embryo adoption [61]. There are, however, texts on third-party gamete donation [63] so, again by analogy, that assessment could be extrapolated to frozen embryo adoption. In practice, though, most Orthodox rabbis are hesitant about the moral licitness of frozen embryo adoption [61].

Evangelists consider frozen embryo adoption as analogous to gestational surrogacy [64].

In relation to Catholicism [65], there are two documents in the Magisterium of the Catholic Church that address the issue of embryo adoption: the Instruction *Donum Vitae*, published by the Congregation for the Doctrine of the Faith in 1978 [66], and *Dignitas Personae*, published on 8 September 2008, by the same Congregation [67]. The Instruction *Dignitas Personae* is the last document of the Magisterium of the Catholic Church in which the topic of embryo adoption is explicitly addressed. Proposals to *use these embryos for research* or *for the treatment of disease* are obviously unacceptable because they treat the embryos as mere 'biological material' and result in their destruction. The proposal that these embryos could be put at the disposal of infertile couples as a *treatment for infertility* is also ethically unacceptable for the same reasons that make artificial heterologous procreation and any form of surrogacy illicit [67].

## 7. Human embryo loss in IVF

Among the negative bioethical aspects of IVF, possibly the most significant is the high number of embryos—human lives—that are lost.

We have attempted to calculate this figure [68] based on previous data from a published article [61]. This study in question evaluated 572 ovarian stimulation cycles that yielded 7213 oocytes, i.e. 12.6 oocytes per cycle. A total of 2252 embryos were produced and 326 live babies were born (226 from fresh embryos and 64 from frozen embryos). Based on these figures, the number of live babies born for every 100 embryos was 14.47; or to put it another way, for every 100 embryos produced, 85.53 embryos were lost, i.e. 6.9 embryos were lost for every live baby born.

Another more recent study by the same group [69] analysed 191 ovarian stimulation cycles performed on 53 female donors. The donors were classified into two groups: 28 were highly successful donors, and 23 were classified as standard. The highly successful donor group yielded a total of 2470 oocytes from 130 ovarian stimulation cycles. This produced 779 embryos; 342 were transferred as fresh embryos and 437 were cryopreserved. A total of 125 live babies were born. The standard donor group yielded 1044 oocytes from 61 ovarian stimulation cycles. This produced 336 embryos; 131 embryos were transferred and 205 were cryopreserved. The total number of live babies born was 26. Based on these figures, a total of 1115 embryos were produced and a total of 151 live babies were born. Consequently, the number of live babies born per 100 embryos was 13.54; in other words, the number of embryos lost for every 100 embryos produced was 86.46. Thus, for every live baby born, 7.38 embryos were lost.

Accordingly, based on the above data, if approximately 6 or 7 embryos are lost for every child born by IVF, and since 1978, the year in which Louise Brown was born, around 5 million children have been born [20], we can estimate that, so far, around 30 million human lives may have been lost worldwide as a result of the use of IVF [68]. This leads one to say—while admitting that it is a very strong assertion—that IVF is a medical practice that, for the time being, generates more death than life. The natural cycle itself is associated with follicle recruitment followed by dominance and selection, while the nondominant follicles undergo atresia in the same cycle. The

controlled ovarian stimulation has an advantage of opening the follicular window and rescuing this cohort of follicles who would have undergone atresia if the FSH window was not kept open and multiple follicles salvaged. The current scenario is practical nonavailability of embryos for embryo donation to aspiring couples where female partners are undergoing endometrial preparation for transfer for Donor embryos. Though there are concerns for discarded embryos, the fertility clinics are in practise at a deficiency of embryos that can be transferred. The ethics of embryo transfer should be discussed in a clinically practical rational scenario.

## **8. Use of preimplantation genetic diagnosis in IVF: ethical assessment**

PGD is a laboratory method especially directed to the genetic study of embryos before they are transferred and, therefore, before implantation in the uterus. The aim of this procedure is to determine if the embryos have a genetic or chromosomal abnormality, or if they are carriers of a genetic risk factor of disease, especially in those couples in which at least one of the partners presents a high risk of having a genetic condition that they could transmit to their offspring [70]. Another common indication in the field of assisted reproduction is aneuploidy screening to ensure the implantation of euploid embryos [70]. Similarly, PGD is currently and increasingly often being used to try to prevent diseases that can appear in adulthood [71]. In general, it may be said that PGD is used in IVF to improve its efficacy.

The technique essentially involves in vitro culture of the embryos to be examined, so that when these reach an adequate number of cells, a single cell can then be extracted for study.

There different biopsy methods are used for PGD at present [72]. The most common is the biopsy of one or two blastomeres on Day 3 of embryonic development, during the screening or cell segmentation phase. However, the ESHRE recommends extracting six or more cells in the embryos [72, 73], because more cells can be biopsied in this phase with less risk of damaging the embryo [72].

As regards its use for improving IVF outcomes, this seems controversial, since many authors obtain positive outcomes using it, while others have been unable to detect such an improvement. Furthermore, Mastenbroek concludes that, not only does it fail to improve IVF outcomes, but it lowers the LBR in women of advanced maternal age, with no beneficial effects in the rest of the women [74].

When assessing this practice bioethically, the main difficulties are: (1) that it treats the human embryo as experimental material, objectifying it, which is absolutely incompatible with its intrinsic dignity, and (2) practising embryo selection for health reasons is a clearly eugenic practice.

Nevertheless, there are authors who not only are not opposed to the use of PGD, but also encourage its use, due to the benefit that it may bring for children by trying to prevent them from being born with a genetic or chromosomal disease or who have the risk of having one of these diseases in the future. In fact, some even advocate the positive duty of parents to use PGD when they consider that its use may be beneficial for their children [75, 76].

To circumvent the ethical difficulties of the use of PGD, and to maintain its hypothetical advantages, it has been proposed to analyse one of the two polar bodies of the oocyte, to thus determine whether said oocyte is a carrier of its mother's disease before the zygote is formed. In this way, only the healthy eggs would be fertilised [72, 77, 78], although this technique has the limitation that it could only be used in women.

It is also known that the oocyte is surrounded by several cell layers and that those layers play a key role in its normal function, ovulation, fertilisation and

embryo development. However, the study of gene expression of these cell layers could be the basis of a non-invasive method for predicting oocyte quality, serving as a biomarker for selecting oocytes and embryos, as an alternative to the use of PGD [79]. Another alternative constitutes trophoctoderm biopsy in human blastocysts, where extraembryonic material can be obtained by this technique for preimplantation diagnosis of genetic disorders [80].

## **9. Ethical problems arising from donor gametes in IVF, especially the right to privacy of donors and of children to know their parents**

From a bioethical point of view, in our opinion, there are a number of issues with respect to whether the donation of gametes, both eggs and sperm, should be anonymous or not. We consider these four the most important: (a) to know whether the good of the child should prevail in the overall assessment of the process, as we believe it should; (b) to determine whether the privacy of the donors should be ensured; (c) to assess whether the interests of assisted reproduction clinics should be safeguarded; and (d) to establish whether even the good of society should be ensured.

### **9.1 Good of the child**

With regard to children, it seems obvious that they have the right to know their biological origin, i.e. to know who their parents are. This is not only for emotional reasons, which must also be considered, but mainly for medical ones, since it cannot be ruled out that it may be necessary during the child's life to know who his parents are, if he has a genetic disease that needs to be identified, in order to be diagnosed and treated.

Moreover, this policy is in accordance with the first major document developed by the United Nations in 1989, on the 'Rights of the Child', which, in Article 7, defines that one of those rights is the right of the child to know his or her parents.

### **9.2 Good of the donors**

In relation to donors, there is a trend towards suppressing anonymity in gamete donation, which may be a negative factor for donors. This is because, if the parent-child relationship can be established, it could lead to parental obligations for the donors that they may not want to assume. This is especially so if we also take into account that there are websites specialising in genetic matters that can match people who were born through gamete donation, so it can be determined if they have a genetic relationship [81].

### **9.3 Good of the assisted reproduction clinics**

There is no doubt that suppressing anonymity in gamete donation can dramatically reduce the number of donors who attend those clinics, as has already happened in the United Kingdom, which is undoubtedly an added difficulty for these practices. In addition, it is also possible that if anonymity is suppressed, it will particularly affect younger donors, which could be detrimental to IVF procedures, since gametes from older donors are usually of lower quality.

### **9.4 Good of society**

One risk of anonymous donation is that a donor can make a donation repeatedly and in different places, in the absence of real control over the process. This could

facilitate marital consanguinity, which is certainly a not insignificant public health problem.

It has also been argued that in a society immersed in a clear demographic winter, reducing births by IVF (given the high number of these) could negatively impact it.

To prevent any difficulties that anonymous donation might have, the creation of an 'Assisted Human Reproduction Information System' (SIRHA) has been proposed. This would collect data on all donations made, identifying donors through a European code, and thus avoiding the problems posed by multiple donations from the same donor.

Certainly, the solution to this problem is controversial, so it would probably be positive to consider the one already proposed by Pennings in 1997 with his 'double track' policy, an option that would allow donors to participate in an anonymous or non-anonymous programme. However, and also in our opinion, while this proposal could guarantee the hypothetical rights of assisted reproduction clinics, donors and the couples who use these techniques, does it guarantee the right of children to know their parents if the latter choose the option of anonymous donor? [82].

## **10. Use of IVF for the production of saviour siblings**

Saviour siblings are children produced by IVF who are used as donors of haematopoietic material to treat a sick sibling. Their use entails objective medical, social and ethical issues.

A first ethical aspect to consider is the low efficacy of use. Thus, initial studies by Verlinsky found that 33 embryos were used to produce only one saviour sibling, i.e. its efficacy was 3% [83]. In another paper by the same group, the percentage was 2.5% [84] and in another, approximately 1% [85]. Even in a larger study, in which data were collected from the Reproductive Genetics Institute in Chicago itself and other leading assisted reproduction centres in Australia, Belgium, Turkey and the United States, the efficacy was 1.15% [86].

Obviously, the low efficacy of this technique overshadows the bioethical judgement it merits. But in addition, in order to establish such a judgement, it must also be considered that: (1) with the production of saviour siblings, the child produced is being instrumentalised; (2) to achieve this end requires the use of means that inevitably necessitate the destruction of human embryos, in part, as a consequence of the technique itself and, in part, due to the eugenic selection by PGD to find a 'histocompatible sibling' who is suitable as a donor; and (3) there are alternative techniques to obtain the desired good ethically: the use of umbilical cord blood stored in public or private banks may be an alternative in the near future, from both a medical and bioethical point of view, to treat children who require transplantation of haematopoietic material and who do not have an immunologically compatible family member who can act as a donor. That is to say, in all likelihood, saviour siblings will have ceased to be useful before their production becomes widespread.

## **11. Possibility of using IVF for social purposes other than women's fertility**

### **11.1 Gestational surrogacy**

'Surrogate motherhood is an assisted procreation practice by which a woman gestates an embryo with which she has no biological relationship on behalf of a contracting couple or individual, having to relinquish the child to them after its birth. This practice normally entails a financial remuneration for the pregnant

woman; when this is not the case, it is called altruistic surrogacy. From a medical perspective, potential problems for the surrogate and for children born through this practice should be taken into account, especially the existence of possible disabilities in the child. The bioethical aspects are of most interest because the practice of surrogacy objectifies the expectant mother, by using her body for a purpose other than her own good, treating her as a commodity, as a thing. The same is true for the child because it makes him a disposable object, something that can be instrumentalized, similarly objectifying him' [87].

However, it could be argued that acceptance of the pregnancy by the surrogate could be justified as an expression of their personal autonomy, although in the vast majority of cases, it is reasonable to admit that their autonomy is expressed against a background of desperation and vulnerability, so it is difficult to accept this practice uncritically.

This practice, however, presents objective bioethical difficulties for the surrogate. First of all, commercial surrogacy objectifies the woman, by using her body for an end other than her own good, by treating her as a commodity, as something that can be bought and sold, like a thing, which is incompatible with the dignity of women and their rights.

Secondly, it is not ethically admissible because of the social injustice that non-altruistic surrogacy entails, given that only those contracting parents or individuals who are financially well off can benefit from it, i.e. it could become exploitation of economically weak women by economically strong couples or individuals.

Third, surrogacy ruptures what has come to be called the 'mother-child bond', which can be defined as the emotional relationship developed by the mother towards her child during pregnancy. This emotional and biological relationship between mother and child strengthens throughout pregnancy and is important for the normal development of the child [88]. It seems that this 'bond' is largely biological [89], so it also affects altruistic surrogacy.

Fourth, in our ethical assessment of surrogacy there is a further difficulty, due to the selection processes to which potential surrogates are often subjected. These clearly and directly undermine their dignity, since very strict personal requirements are commonly insisted upon to guarantee the quality of the 'product' that the woman may gestate.

Fifth, it should also be taken into account whether future surrogate mothers are always informed of the problems that their pregnancy may entail, i.e. if they are guaranteed to sign an informed consent, which, it seems, is not always the case [90].

It also presents objective bioethical issues related to the children, because a child is always a gift that is given to parents, never a right of parents to acquire it. If this right to a child were prioritised, he or she would be denied the consideration of absolute good in and of himself. He would become a disposable object, something instrumentalisable, i.e. he would be treated as an object. Not all that one wishes acquires the category of right. Desires for parenthood have as their limits the dignity of children and the protection of their fundamental rights. Defending the right of parents to have a child—with no ethical limitations whatsoever—could violate the rights of the child, although it should be established that the right to a child should not be confused with the right to parenthood, because no one can prevent the autonomous decision to have children.

Whatever the reasons put forward to defend the right of parents to a child, no action justifies violation of the fundamental right of children not to be treated as an object. If children were an object of desire of parents, their life would have no more value than that which the parents wished to give it, which is clearly unacceptable.

A further bioethical issue that arises in relation to gestational surrogacy is the consideration that it is not ethically acceptable whenever it is paid, but it is acceptable when it is altruistic surrogacy. In our view, the latter is not admissible either,

because it also objectifies the child by demanding quality standards, which if they are not met may affect their fundamental rights, and even their life.

### **11.2 Social freezing**

As we discussed in a previously published paper [91], ‘when eggs or ovarian tissue are not frozen for medical causes, the process is called “social freezing”. In this case, there are two fundamental reasons why a woman might choose to undergo this procedure: the first is that she has not found a partner who she considers suitable for a matter as important as creating a family, and the second is for professional reasons. In the latter case, the woman considers that becoming pregnant at a young age—usually before age 35—could harm her professional career, prompting her to freeze her eggs for use at a later date. The biological reasons that underlie social freezing are that women’s fertility declines with age, especially due to a decrease in ovarian function, owing to a reduction in the number of eggs’.

### **11.3 Ethical assessment**

Aside from the aforementioned biomedical and social problems, social freezing unquestionably presents ethical concerns. In our opinion [91], ‘the main one is that, although not explicit, it implicitly objectifies the woman by prompting her to make a decision that is disguised a good for her when, as reported, this practice entails objective negative medical consequences for the user and also for her child’. According to Martinelli et al., “Social egg freezing” is a paradigmatic demonstration of how the medicalization of women’s bodies can be used to mask social and cultural anxieties about aging’.

However, ‘we believe there is another ethical difficulty, derived from the fact that it is hard to guarantee the autonomy of women to make such a decision if they are not provided with adequate information on the risks and benefits entailed in social freezing, something that is not always easily verifiable, as previously mentioned’ [91].

‘Another ethical problem that social freezing may pose is the possible social inequality between groups of women who work in economically powerful companies, which can bear the costs of social freezing for their employees and those who work in companies that cannot do so. Another question therefore arises: to avoid social injustice, should social freezing be supported with public funds? We believe the answer should be that, given the myriad of objective medical problems that exist—some of vital importance—and that have to be treated with these funds, would it not be creating a problem of distributive justice? Finally, it should also be pointed out that social freezing implies that fertile women, capable of conceiving and carrying a child naturally, renounce this, substituting natural conception for IVF.

This not only reduces the possibilities of eventually becoming pregnant but also, as mentioned, increases the health risks for mother and child. It must be carefully considered whether the advantage of using young eggs compensates for the risks derived from the processes required in social freezing’ [91].

## **12. Possible misleading advertising that assisted reproduction clinics may present to attract clients**

The main vehicle used by assisted reproduction clinics to attract new customers is to advertise their efficacy, expressed in terms of pregnancy rates and live births achieved per ovarian stimulation cycle.

However, an ethical issue that may occur is if the data presented by these clinics are correct or are manipulated to improve their efficacy, i.e. whether there is 'misleading advertising' aimed at bringing in more clients.

We evaluated this issue in a recent paper [92], the most relevant aspects of which are presented below.

Based on data published by the ESHRE in 2014, the PR and LBR following IVF in Europe between 1997 and 2010 varied between 22.28 and 29.2% for the PR, with a mean rate of 26.41%, and between 13.07 and 22.4% for the LBR, with a mean rate of 18.81%.

When ICSI was used, these same rates varied between 23.37 and 29.9% for the PR, with a mean rate of 27.22%, and between 12.68 and 21.10% for the LBR, with a mean rate of 18.31%.

The aforementioned data refer to the PR and LBR per ovarian stimulation cycle. However, these data do not seem to be the most appropriate to evaluate the efficacy of assisted reproduction clinics, because normally women who attend them undergo more than one cycle (usually three) to increase the efficacy of the technique, in terms of having the desired child. We therefore feel that it is better to use the 'cumulative pregnancy rate' (CPR) or the 'cumulative live birth rate' (CLBR), understood as the success rates that are achieved after all ovarian stimulation cycles that the woman undergoes.

After analysing data from the 13 studies that we consider most representative, the mean CLBR is 26.6%, after one cycle; 38.3% after two cycles; 57.4% after three cycles and 66.0% in cases of more than three cycles, with a mean rate of 56.3% [92].

The CLBR varies by country of course, and thus the lowest in Europe is Italy, with 18.3% and the highest in Poland, with 36.5%. This rate is 24.7% in Russia, 38.1% in Canada and 41.8% in the United States, the country with the highest rate in the world.

To compare the data referred to above with the data published by private assisted reproduction clinics on their websites, we analysed the data presented by 123 private clinics [92]. Surprisingly, none of the clinics we looked at provides data on the CLBR. These rates ranged between 28.0 and 72.2%, with a mean of 47.2%. The same rates for women under 35 years of age varied between 39.0 and 82.4%, with a mean of 59.0%; for women between the ages of 35 and 39 years of age, it ranged from 27.0 to 77.8%, with a mean of 47.4%; and for women older than 40 years of age, it varied between 12.0 and 48.6%, with a mean rate of 30.7%.

When the data provided by the 169 assisted reproduction clinics on their websites were compared with the data reported by the same clinics to various scientific societies, it was found that the mean PR per stimulation cycle was 47.2% when autologous oocytes were used and 65.0% with donor oocytes, according to their websites. However, the rates per ovarian stimulation cycle of these same clinics presented by the Fertility Society were 30.55% for IVF and 32.59% for ICSI, which means that the figures provided by the 169 assisted reproduction clinics on their websites are 49.5% higher than reported by the same clinics to the relevant scientific societies when autologous oocytes are used and 108.9% higher when donor oocytes are used.

Another rather startling aspect is that 16 of these clinics claim on their websites to guarantee that a pregnancy will be achieved in 100% of cases.

In conclusion, it may be said that many countries, assisted reproduction clinics present data on their websites that are not consistent with those obtained from the scientific societies. It is also notable that those clinics do not present data on LBRs, which is the rate that best matches the real likelihood that assisted reproduction treatments will eventually lead to the goal of parenthood [92].

### **13. Final conclusion**

As we mentioned at the beginning of this chapter, having a child for a couple who wishes to have one and has difficulty in doing so, turning to assisted reproduction, is certainly an objective good, which has contributed to the wide social acceptance of such techniques.

Nevertheless, this good should be balanced by the bioethical difficulties these techniques present, and that we have analysed in depth in this chapter.

We therefore believe that it should be an important bioethical objective that in assisted reproduction clinics, prospective clients are informed of the risks and adverse effects of ARTs, as well as providing reasonable accurate data on the chances of success of the techniques we have analysed here. Thus, having been well informed, they can make a well-founded, well-informed personal or couple's decision, because ultimately, personal freedom is what should decide the option taken. Respect for the bioethical principle of patient autonomy requires it and counselling needs to be informative and nondirective.

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