

Oocyte cryopreservation beyond cancer: tools for ethical reflection

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Received: 23 March 2015 / Accepted: 22 June 2015 / Published online: 3 July 2015
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Abstract

Purpose This article offers physicians a tool for structured ethical reflection on challenging situations surrounding oocyte cryopreservation in young healthy women.

Methods A systematic literature review offers a comprehensive overview of the ethical debate surrounding the practice. Ethical Counseling Methodology (ECM) offers a practical approach for addressing ethical uncertainties. ECM consists of seven steps: (i) case presentation; (ii) analysis of possible implications; (iii) presentation of ethical question(s); (iv) explanation of ethical terms; (v) presentation of the ethical arguments in favor of and against the procedure; (vi) examination

of the individual patient's beliefs and wishes; and (vii) conclusive summary.

Results The most problematic aspects in the ethical debate include the distinction between medical and non-medical use of oocyte cryopreservation, safety and efficiency of the procedure, and marketing practices aimed at healthy women. Female empowerment and enhanced reproductive choices (granted oocyte cryopreservation is a safe and efficient technique) are presented as ethical arguments supporting the practice, while ethical reservations towards oocyte cryopreservation are based on concerns about maternal and fetal safety and wider societal implications.

Conclusions Oocyte cryopreservation is gaining popularity among healthy reproductive age women. However, despite promised benefits it also involves risks that are not always properly communicated in commercialized settings. ECM offers clinicians a tool for structured ethical analysis taking into consideration a wide range of implications, various ethical standpoints, and patients' perceptions and beliefs.

Capsule Oocyte cryopreservation is an established method used to preserve fertility for cancer patients, but it is also gaining popularity among healthy reproductive age women. The article presents an overview of ethical arguments supporting and rejecting this procedure and also offers a structured counseling tool for approaching individual cases of social oocyte cryopreservation.

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Keywords Egg freezing · Ethical counseling · Oocyte cryopreservation · Reproductive technology ethics

Introduction

Oocyte cryopreservation, also known as egg banking or egg freezing, is increasingly gaining popularity among healthy women of reproductive age. The procedure is perceived as a means to “buy some extra time” or an “insurance policy” against declining fertility due to age. Oocyte cryopreservation has been declared an established method of fertility preservation for cancer patients by the American Society of Reproductive Medicine (ASRM), the European Society of Human Reproduction and Embryology (ESHRE) [1], the American

Society of Clinical Oncology (ASCO) [2] and the European Society of Medical Oncology (ESMO) [3] with some reservations from ESHRE defining it just as “innovative” [4]. None of the above professional organizations encourage or endorse oocyte cryopreservation for use by otherwise healthy patients in order to plan their reproductive lives. Despite this, the procedure was marketed for healthy women even before the lift of its experimental label [5] and started to receive more public attention after some corporate world giants announced that they were covering oocyte cryopreservation costs for their female employees. All of the above echoes an emerging egg freezing enterprise which often advertises its services at fertility awareness events referred to as “egg freezing parties” [6, 7]. This article will introduce the reader to an ethical debate surrounding the use of oocyte cryopreservation by healthy women. It will then proceed by presenting and commenting on the ethical arguments offered to support and oppose this practice from an individual and societal point of view. Furthermore, the structured tool called Ethical Counseling Methodology (ECM) will be presented by using it to analyze two oocyte cryopreservation cases. ECM consists of seven easy-to-follow steps and offers clinicians some assistance in addressing ethical issues which arise when healthy female patients request oocyte cryopreservation.

Major ethical issues

A vast amount of biomedical literature focuses on fertility preservation for patients who need fertility impairing treatments such as chemotherapy, radiotherapy, or surgery. Some reproductive age women are also interested in having their oocytes cryopreserved as a means to prolong their reproductive years. The latter is still controversial and various concerns have been raised. It is widely debated whether oocyte cryopreservation for medical and non-medical reasons ought to be approached differently, as well as what is the effectiveness and safety of the procedure. Oocyte cryopreservation advertising practices are also questioned.

Some ethics scholars argue that oocyte cryopreservation should be equally available to women facing gonadotoxic treatments and those who wish to undergo the procedure for social reasons [8, 9]; others only support restoring reproductive function in cancer survivors but do not agree to extend it beyond the borders of age-dependent fertility [10]. Some suggest to drop the tag of “social” and “medical” by calling the procedure “a preventive oocyte cryopreservation for anticipated gamete exhaustion” [5, 11]. Secular scholars suggest that there are no morally relevant differences between the women who opt for oocyte cryopreservation because of fertility impairing disease or for social reasons such as career or the absence of a partner [8, 12].

Another concern is safety and efficacy of oocyte cryopreservation, which is equally relevant to cancer patients and healthy women who consider this procedure. Professional organizations have not endorsed the procedure for the use by healthy women because most data available today comes from experience with oocytes which were retrieved from young donors, frozen for a relatively short time and used for IVF cycles in patients younger than 35 years of age [13]. Moreover, since women who opt for social egg freezing tend to be in their late 30s or plan to delay pregnancy for later years [14], a number of possible risks associated with pregnancy in advanced maternal age appear. Such risks include gestational diabetes, preeclampsia [15], and placentation defects [16]. Therefore, it has been argued that before making oocyte cryopreservation available for everybody, the procedure should meet criteria of efficiency, safety, and justice [8]. Long-term follow-up schemes should also be established [9], emphasizing that expected benefits should be proportionate to its costs [8].

Despite safety and efficacy concerns, oocyte cryopreservation has already been marketed to healthy women for some years [5]. A recent study from the USA reveals that out of 147 clinics offering social oocyte cryopreservation, only 7 present all relevant information to their prospective clients, while 119 fail to provide sufficient information for making an informed choice [17]. Moreover, some testimonies of women who chose oocyte cryopreservation as a last chance to “buy some more reproductive time” have been documented. Their experiences reveal that in some cases the hype about oocyte cryopreservation only nurture an illusion that motherhood is still an option [18]. One such example is the low yield of oocytes despite promising blood test and ovarian ultrasound results. In such cases, when only three or five oocytes are harvested, the chances of successful pregnancy using them can be very low, and patients are left wondering if they should even try IVF with those oocytes [18, 19]. Furthermore, poor ovarian response can be associated with higher risk of miscarriage [20]. The following section provides some arguments which favor or object to the procedure from an individual and societal point of view.

Systematic review of ethical arguments supporting and challenging the use of oocyte cryopreservation by healthy women

In order to provide a full range of different ethical standpoints, a systematic literature search [21] was performed, using the following search terms in the PubMed database (“egg freezing” or “oocyte freezing” or “cryopreservation”) and “ethics”). The search, limited to English articles published between October 2009 and October 2014, resulted in 70 articles. The aim of the search was to unveil arguments

supporting or rejecting oocyte freezing when there are no clearly indicated medical reasons to offer the procedure to a patient. Abstracts were screened to identify which articles provide reasons to support or oppose elective/social/age-related egg freezing. Articles solely concerning specific diseases were excluded. These criteria reduced the collection to 21 articles. After reading full texts only four articles [12, 22–24] were found explaining reasons or arguments for or against the use of oocyte cryopreservation by healthy women. Two articles [25, 26] were added to the collection after cross-referencing. Hence, the following review includes a total of six articles.

Arguments supporting oocyte cryopreservation by healthy women

One of the most elaborated arguments in favor of oocyte cryopreservation for otherwise healthy women is that such a procedure enhances reproductive freedom and personal autonomy by offering women an opportunity to seek education, establish a career, and prepare for motherhood [23]. However, the latest empirical data suggests that the lack of a partner, rather than other factors, encourages women to seek oocyte cryopreservation and “buy more time” before their reproductive age is over [14, 27]. Since one of the major obstacles of conceiving in advanced age is oocyte quality, oocyte freezing at a younger age has the potential to ensure a chance of genetic parenthood [26], whereby patients need not rely on donor oocytes [28]. Critics of this view argue that overemphasis on genetic parenthood might mean that eventually other ways to pursue parenthood become less acceptable or even stigmatized [12, 29].

Once oocyte cryopreservation is an established, efficient, and safe technique, it could also be considered a “gender equalizer” as was the case with the invention of the contraceptive pill. However, currently this is not the case due to relatively low effectiveness in certain populations. One could still speculate that oocyte cryopreservation allows women to feel and act equal to men in all areas of life, when making reproductive choices. This would mean that women could choose to become mothers in their 50s or 60s, while naturally they are facing biological constraints at around the age of 40 [30].

In response to this argument, a number of critics say that it might be harmful for a child to have a mother of advanced age, suggesting that older parents in general might have less energy to look after their children and might die before their children reach maturity [23, 25]. However, it is still not clear how many current utilizers of oocyte cryopreservation would even consider motherhood in their 50s or 60s. Some preliminary data suggest that most women intend to use their frozen oocytes in their early 40s [14] possibly taking into account higher health risks associated with advanced maternal age. Hence, testimonies of women who actually are older mothers suggest that

there can also be advantages in choosing to parent at an older age, such as less need to worry about family finances or pursuing personal goals and just enjoying parenthood [19]. Presenting younger mothers as better mothers by default still lacks empirical evidence from longitudinal observation studies of children. Nevertheless, some argue that women have an important role not only as mothers but also as grandmothers [31], which supports the rejection of significantly delayed motherhood as this would deprive children from benefiting of social contact with their grandparents [25].

One more argument in favor of oocyte freezing is that people who reject embryo cryopreservation due to moral reasons (attributing a special moral status to the embryo) prefer this procedure [26]. Some theologians only see ovarian tissue cryopreservation when used for autologous transplantation as morally unproblematic because it does not require IVF for procreation [10]. Additionally, oocyte cryopreservation provides women the possibility to have a genetically related child when they might not have a partner at the time of the procedure. This aspect leads women to favor oocyte cryopreservation over embryo cryopreservation, a well-established and more effective procedure than the prior one [2].

Arguments opposing oocyte cryopreservation by healthy women

One of the major objections to oocyte cryopreservation is its safety [22], together with possible consequences to future children as well as mothers who opt for pregnancy later in life. The rather high degree of uncertainty means that the precautionary principle is worth considering and extra caution should be exercised when making use of oocyte cryopreservation. Harms to the physical health of children conceived from previously frozen oocytes are not well studied, but early reports suggest that these children do not have worse health outcomes as compared to children conceived naturally [32]. Psycho-social harms can also occur as a result of having an older mother with respect to ordinary reproductive scenarios [25, 33].

Another critique emphasizes the harm to women who choose to cryopreserve their oocytes, because the procedure might offer “false hope” and give a false sense of security [22]. Cryopreserving oocytes does not guarantee a successful future pregnancy, and live birth rates are still low and difficult to predict before attempted pregnancy. Therefore, investing time and money for oocyte cryopreservation might be considered a waste of resources [33] as well as a threat to the emotional wellbeing of a woman pursuing her reproductive goals by using this technology. Moreover, there are known health risks associated with advanced maternal age [15, 16].

A final objection is related to the possible social implications that such a procedure would have, if widely adopted. It could threaten women’s reproductive autonomy by ignoring

female biology and social structures [12, 22, 25], and establish social norms, which would require women to freeze their eggs if they wanted to pursue a career and also have biologically and genetically related children [26]. In such cases, what was initially seen as a tool to enhance reproductive autonomy and empower women, by allowing them to participate in education and the labor market with more flexibility, could become a tool of oppression [12]. Women might not have a choice anymore, but instead, would be required to pursue parenting later in life or refrain from it overall [26].

Practical approach to ethical problems raised by oocyte cryopreservation

As shown above, oocyte cryopreservation, when sought by healthy patients, is still controversial and involves many uncertainties. Therefore, the use of Ethical Counseling Methodology (ECM) could offer some assistance when reflecting on ethical issues present in individual cases. This particular methodology has been developed by Boniolo and Sanchini¹, and it implies seven simple steps. Following these steps, clinicians could identify the ethical implications of oocyte cryopreservation, clarify potential ethical standpoints, and explore the ethical arguments in favor of and against the procedure, while at the same time, take into account particular patients' views and preferences. ECM is a patient-centered tool, since in its developers' view, the patient is perceived as the privileged decision-maker. ECM does not aim to find a specific solution and is conceived as non-directive. It focuses on the ethical analysis rather than the ethical solution of the problem, serving as a tool for steering patients and clinicians through ethical dilemmas and developing possible ways to solve them. Moreover, although ECM considers the foreseeable effects and implications of a procedure, it does not endorse or favor one moral theory or propose a specific list of mid-level ethical principles² as such. On the contrary, looking at the foreseeable consequences helps one to better understand which actors are involved and how they might be affected by a decision. This enables an ECM user to explore a wide range of standpoints and reasons for supporting or rejecting possible solutions. Such exploration could also potentially help identify and better understand individual patients' perspectives, especially in

¹ The forthcoming book by these authors is dedicated to the explicit description of the methodology and its application to the practical issues [61].

² The most widely used moral theories are Utilitarianism, judging the rightness of action by the consequences; Deontology (or Kantianism), focusing on duties; and Virtue Ethics, with an emphasis on moral character. Widely acknowledged mid-level biomedical ethics principles are autonomy, non-maleficence, beneficence, and justice.

cases when patients' views significantly differ from those of clinicians. It must be acknowledged, however, that the developers of ECM give high importance to personal autonomy in decision-making processes when ethical issues are involved. ECM does not place restrictions on how to follow its steps in practice as it is meant to guide rather than direct the user. It is expected to serve as the backbone for a structured conversation with a patient concerning ethical issues in a wide range of clinical scenarios.

Using the seven steps of ECM, we now explore the cases of two young women to illustrate the problematic aspects of oocyte cryopreservation. We highlight possible implications, questions procedure raises, different ethical standpoints patients might choose to take, and arguments supporting or rejecting the choices that two young women are looking to make. Table 1 provides a summary of the ECM steps, which can be used as a reference.

Step 1: Case presentations

Case one

Prue (26) is a primary school teacher working in a small town. Two months ago, her mother (50) has been diagnosed with breast cancer. Her aunt Gwendolyn had breast cancer at 36. Fortunately, after receiving six cycles of chemotherapy, she seems to be fine. However, treatment has left her sterile, which is something Gwendolyn regrets a lot. Prue knows that just like her mother and her aunt, she also has a pathogenetic BRCA1 gene mutation. As much as Prue is worried about getting cancer, she is also troubled with the fear that cancer treatment might impair her ability to have children, but she does not want to rush to have a family. She is still waiting to meet the right person. Looking up her university colleagues on a social networking site, Prue sees that Olga is hosting an "egg-freezing party" just across the border in a neighboring country (there are some procedural barriers for accessing assisted reproduction services in her home country because Prue is single). Attendance to the egg-freezing event is free, and she can make it in 1 day. There are also discounts offered to the attendees who opt for the procedure. A significant amount is still to be paid when the travel expenses, medication, procedure itself, and storage fees are added up. Prue also has a student loan to pay, which does not seem to be a problem now, but if her mother's condition deteriorates, she might have to take some time off work to look after her mother. Prue wonders whether buying an "egg insurance policy" is something she can afford.

Case two

Anna (33) is an aspiring professional who is about to launch an international career. She has worked hard for it, spending

Table 1 A summary of ethical counseling methodology (ECM)

ECM steps	Key points to consider
1. Case presentation	<ul style="list-style-type: none"> • Patient’s age • General health • Relationship status • Patient’s expectations • Individual circumstances
2. Possible implications	<ul style="list-style-type: none"> • Medical • Financial • Psycho-social • Legal • Relational
3. Ethical question(s)	<i>This step provides a space to define ethical concerns (e.g., Should the patient cryopreserve her oocytes even though it is an expensive and not always efficient procedure?)</i>
4. Definition of ethical terms	<i>This step can be used to explain or clarify the definitions of terms which might be ambiguous (e.g., personal autonomy)</i>
5. Ethical arguments	<ul style="list-style-type: none"> • Supporting the procedure • Rejecting the procedure
6. Examination of individual beliefs	<p><i>This step allows to explore and understand individual beliefs better:</i></p> <ul style="list-style-type: none"> • What are the patient’s reasons for considering oocyte cryopreservation? • What are the patient’s core beliefs about reproduction? • What religious beliefs does the patient have?
7. Conclusive summary	<p><i>In this step, ethical summary of the case can be offered and some evaluative questions asked:</i></p> <ul style="list-style-type: none"> • Is the patient fully informed and understands the risks and benefits of deciding for the procedure? • What are the possible outcomes of this now and in the future? • Is the patient’s reasoning and choice consistent with their core beliefs? • Are there any additional concerns? • Is any specialized counseling necessary to address these concerns? Is it available?

sleepless nights studying at university and staying over time at her first job. She was also lucky to be raised by a family with a well-established business where her grandfather’s connections got her access to the best schools and invitations to catwalk events. Now, however, those sunny days are over. Just a few years back, as the world economy was changing, her father had to sell the few generations’ old business leaving him with just enough for his and Anna’s mother’s retirement needs. Anna recognizes that demands for staying in a corporate world are high. Just last week, she was offered her dream job which not only requires relocation overseas, but also provides numerous benefits, including oocyte cryopreservation for female employees. The top priority for Anna is financial security as she would like her future children to “have it all”, just as she did: the best schools, elite cultural events, and exotic travels. Meanwhile, Paolo whom she’s been seeing for the past 5 years does not have the same aspirations nor does he see fatherhood as his top priority in life. This makes Anna frustrated. Cyndi, Anna’s high-school friend who works in the Silicon Valley,

was telling her that she just had her “eggs put on ice” and her employer paid for everything. Anna is puzzled and makes an appointment with her doctor to decide whether oocyte cryopreservation might be the right choice for her.

Step 2: What are the implications if patients opt in favors of oocyte cryopreservation?

Based on ethical debates and individual cases, the implications of oocyte cryopreservation can be of varying nature: medical, financial, psycho-social, legal, and also relational. Such grouping, however, serves for structural purposes only, and one must acknowledge that all of these implications are related and intertwined.

Medical implications

Both patients, in case they opt for oocyte cryopreservation, would need to go through the oocyte retrieval procedure,

which includes ovarian stimulation with gonadotropins. The procedure is not considered very risky, with complications of minor vaginal bleeding occurring in about 18 % of cases [34]. Adverse reactions such as ovarian bleeding [35] or ovarian hyperstimulation syndrome [36] are not very common, but have to be taken into consideration. It should also be clearly stated that having oocytes cryopreserved does not guarantee a successful pregnancy in the future. The chances that each frozen oocyte will result in a live birth are still low, ranging around 5–7 % [37], which presupposes that from 20 oocytes retrieved, only one live birth could be expected. However, this does not mean that the number of frozen oocytes is the only determinant for successful pregnancy. A major factor to consider is oocyte quality, mainly related to a woman's age at the time of retrieval and possibly affected by the thawing procedure [38, 39]. The implantation rate per thawed oocyte with vitrification technique is 9.5 % [15] but without adjustment for a woman's age and other factors. Successful implantation does not necessarily yield a live birth. IVF pregnancies have higher reported miscarriage rates as compared to natural conception. Miscarriage rates also increase with maternal age [40]. In addition, it has been suggested that oocyte cryopreservation for social reasons should be considered an experimental rather than a consolidated procedure because there is very little data on the reproductive outcomes when frozen oocytes are used for conception by older women [41].

Financial implications

Oocyte freezing costs vary depending on the country: a single oocyte collection cycle costs GBP 4000–5000 in the UK [42], CHF 3000–5300 in Switzerland [25], and EUR 3000 in Germany [43]. In the USA, Fertility Authority³ and affiliated commercial websites advertise costs ranging between USD 6500 and 18,000. Israel is one of the first countries to promote oocyte freezing for avoiding age-related fertility loss [44], where associated costs are generally covered by the various healthcare funds [25]. It is important to bear in mind that costs are not limited to oocyte retrieval and storage expenses. If and when patients decide to use frozen oocytes, additional fees for IVF will apply.⁴ One study suggests that cryopreserving oocytes at the age of 35 for IVF conception at the age of 40 is not

³ Fertility Authority's Fertility Network sites include: FertilityAuthority.com, FertileThoughts.com, EggBanxx.com, IVFAdvantage.com, EggFreezingCosts.com, GenderSelectionAuthority.com, and HowMuchDoesIVFCost.com.

⁴ IVF with ICSI may be necessary due to alterations to the oocyte membrane caused by the cryopreservation process; it will also include hormonal treatment to the woman to prepare her uterus for embryo transfer. Fees for these procedures are market driven when sought privately.

cost-effective compared to just IVF at the same age [45]. Another study shows that neither oocytes nor ovarian tissue cryopreservation is cost-effective for otherwise healthy women planning to delay childbearing until their 40s and undergoing fertility preservation procedures at the age of 25 [46]. However, very little data is available on the subsequent use of frozen oocytes or effectiveness of this procedure to start a family after women's prime reproductive years. Preliminary studies suggest that less than 10 % have returned to use the oocytes they previously banked [47] and only half consider using their frozen oocytes in the future [48].

Psycho-social implications

There is very little empirical data on attitudes towards social egg freezing [42, 49, 50]. Three different studies report positive attitudes towards the procedure under the condition that it is safe for patients and their future children. The number of women who would consider oocyte cryopreservation for themselves varies between 30 and 70 %. However, none of these studies analyze the reasons why women would opt for the procedure. It is interesting to note that a majority of women in Denmark and the UK do not think they need this procedure [42], while Belgian [49] and Singaporean women [50] are more likely to identify themselves as potential oocyte freezers. Moreover, some reports reveal that the absence of a partner (88 %) rather than professional reasons (24 %) is an influencing factor for American women to undergo oocyte cryopreservation [27]. Moreover, research on the influence of oocyte banking for future reproductive choices suggests that in a majority of cases, women choose the procedure as an "insurance" and do not view it as a preferred scenario [48]. This corresponds with the previously described prototype of wise proactive women who take control of their fertility rather than seeming selfish or exploited in the labor market [5, 28].

Legal implications

The most problematic feature of oocyte cryopreservation from a legal standpoint is the undefined status of gamete ownership. Despite essential differences in the technique itself, implications of oocyte cryopreservation can be modeled upon representative examples from experiences of sperm cryopreservation [51, 52]. Moreover, future use of oocytes, including the possibility of their posthumous use, should be discussed with patients prior to the procedure and documented in a consent form, which could later serve as an advance directive [53, 54]. Possible options include destruction, donation to research, donation to a third party's procreation, or leaving them in the custody of a surviving partner or other relatives [54]. Moreover, gametes can only be used for procreation purposes posthumously if the donor explicitly states this intention. ASRM recognizes the right to avoid posthumous procreation [55],

and ESHRE recommends a waiting period of at least 1 year post-mortem before using gametes of the deceased [54]. In addition, one must take into account some very practical considerations. For example, if an employer pays for oocyte freezing, how does it affect the employment contract? Speculations have been made that even if it does not become an enforceable condition of the contract, it could lead to the expectation that a female employee will not get pregnant for a certain period of time [56]. Moreover, it should also be clarified who will bear the cryostorage costs if the employee is laid off or terminates her contract with the employer.

Relational implications

These implications refer to the impact which Prue and Anna's choices will have for their family members and present or future partners. Relational implications also address the support, pressure, and expectations that family members and other significant relations have towards the two women. Both women might feel pressure from their parents to pursue motherhood, which might over ride their own preferences; having their oocytes cryopreserved might also mean that both women are expected to use them even if they later decide not to pursue motherhood [41, 57].

Discussion of social oocyte cryopreservation usually involves single women or women in relationships like Anna's, where the partner does not prioritize the option of becoming a parent. At this time, it is difficult to speculate if this way of "making a baby" will be acceptable for future partners even if some women choose oocyte cryopreservation, because it would allow having a child, who is genetically related to the future partner. However, some women might choose to pursue motherhood alone, using donated sperm or even artificial gametes [58]. Hence, the latter option still remains theoretical.

Step 3: Presentation of ethical issues in question

Both patients wonder whether they should opt for future "fertility insurance" by cryopreserving their oocytes, because the procedure is expensive, its success rates vary widely, and it is difficult to speculate about potential outcomes.

Step 4: Definition of ethical terms

This section explains the background and usage of ethical terms which are relevant to the debate and referred to in ECM's other steps:

Personal autonomy is a self-rule that is free from others' control and limitations caused by inadequate understanding of a procedure [59]. *Genetic parenthood* is when parents have genetic ties with their children; it is distinguished from *biologic (or gestational) parenthood* where donor gametes are used for conception. *Gestational parenthood* is different from

surrogate parenthood where pregnancy is achieved using gametes of the intended parents or donors and carried by a gestational carrier. Finally, *proportionality when balancing risks and benefits* corresponds closely with the principles of *non-maleficence*, which requires abstaining from causing harm to others, and *beneficence*, which requires contributing to the welfare of others [59].

Step 5: Ethical arguments for and against the procedure

Prue has a family history and genetic predisposition to cancer, so even though her health has not been affected by cancer at this point, some would consider her as a cancer "previvor" [60]. However, there is still the possibility that Prue will not be affected by cancer during her reproductive years. She can pay for the oocyte cryopreservation procedure now, but she can also put that money aside choosing to wait and see while having regular check-ups with her doctor. Paying for the procedure now, especially if she has to take another loan, can put Prue through financial difficulties if she has to stop working and take care of her mother. On the other hand, if she puts money aside, she will be able to use it for the same procedure or other needs later. Having money in the bank might be a more cost-effective and economically safer option for Prue. However, having her oocytes cryopreserved now might relieve some of the stress and pressure she faces. It could even have a therapeutic value if she is diagnosed with cancer before having children as preserving her fertility seems to be a very important aspect for her. At the same time oocyte cryopreservation can turn into a false hope as the future success will depend on multiple factors.

In Anna's case oocyte cryopreservation at her employer's expense can help her relieve some of the stress she currently faces in her relationship. On the other hand, such a gesture can be associated with her employer expecting Anna to delay motherhood to later than she would want herself.

In both cases, oocyte cryopreservation might enhance the opportunity for both women to have genetically related children. However, the safety of oocyte retrieval and pregnancy in advanced maternal age are the strongest arguments against the procedure.

An advantage both patients have is their age since oocyte quality is known to start decreasing after age of 35 [20], so this might be the optimal time to cryopreserve their oocytes in order to expect the favorable outcome should they need to use them in the future. Overall, to make a well-informed choice, patients should understand the medical risks associated with the procedure, accept the financial implications attached to it and be comfortable with the idea that cryopreserving their oocytes now does not guarantee a successful gestational or surrogate pregnancy in the future.

Step 6: Examination of patients' beliefs

Both women are in their prime reproductive years and considering motherhood in the future. Therefore, both could be identified as “social egg freezers”, especially from a relational point of view. Prue is single and does not want to rush into a relationship. Anna is not sure if her current partner is willing to commit to having children in the future. Anna is aware that her fertility will start declining in a few years' time while Prue is more concerned with the possibility of being affected by cancer before she has a chance to complete her family. In addition, both women might have strong emotions towards motherhood, defined by their upbringing and cultural context in which they live. Witnessing her aunt's battle with cancer and sorrows because of treatment-induced sterility might play a significant role in Prue's perception of fertility preservation. So Prue might mainly focus on the ability to have children, while Anna is very much concerned with what she will be able to offer her future children.

Both women seem to prioritize rational reasoning over their emotions but the decisions they take might still be based on emotional intuitions. However, it could be reasonable to expect that having considered the arguments supporting and opposing the use of the procedure in their particular circumstances, they will make a decision based on their personal philosophy⁵ which best reflects their values and views of life.

Step 7: Conclusive summary

These cases illustrate that despite the uncertainties surrounding cryopreserved oocytes' success rates some healthy young women still have an interest in this procedure. The ethical reflections made by going through the ECM steps suggest that there are arguments supporting either choice by each patient. However, depending on the situations, one might need to ask further clarifying questions (Table 1).

Conclusions

The theoretical debate surrounding oocyte cryopreservation focuses on the question of whether a distinction ought to be made between medical and non-medical use of the procedure. One of the major objections to use of the procedure by otherwise healthy women is the lack of data about its efficacy and health risks associated with pregnancy in advanced maternal age. The most often used argument in support of the procedure

⁵ This term is understood by the authors as a coherent and justified set of beliefs, assumptions, principles, and values each individual possesses. Personal philosophy characterizes the individual in the way he or she sees, understands, and approaches the world, life, and death.

is its potential to enhance reproductive freedom and personal autonomy by allowing women to plan their reproductive lives with greater flexibility. However, some worry oocyte cryopreservation for social reasons might have wider implications. The two cases illustrate that individual patients might have very practical uncertainties which can be medical, financial, psycho-social, legal, or/and relational in nature. Moreover, rapid commercialization of oocyte cryopreservation service seems to market the benefits, leaving aside information about the risks and efficiency of the procedure.

Therefore, a number of scholars encourage physicians to make sure that they do not offer “false hopes” to patients [9, 12, 22, 33] and work towards enabling them to make well-informed and autonomous choices. This might require more in-depth conversation with patients in order to understand what they value, what life goals they are keen to cherish, and which trade-offs they find acceptable to make, based upon their cultural and religious background and personal philosophy. Oocyte cryopreservation is still a new and expensive procedure with questionable efficacy in some cases. Despite varying levels of ethical reflection, ECM could be a useful tool for clinicians. It can offer assistance in clarifying ethical concerns and exploring them deeper to acquire better insight to problems. ECM can also improve the process of shared decision making between physicians and their patients. It is not meant to give one correct answer, but rather guide one through the reasoning process by “cleaning the windows” through which we look at oocyte cryopreservation.

Acknowledgments Part of this paper was presented at Tecnobios Procreazione Symposium in Rome on October 9–11, 2014 (A.L.). The authors would like to thank Dorit Barlevy, PhD candidate at the University of Basel (Switzerland) who kindly provided editorial assistance and suggestions for manuscript development and three anonymous reviewers for their insightful comments and suggestions on an earlier draft.

Informed consent The above cases are fictional. The aim of such fictional case presentation is to provoke the reader and contribute to the ethical debate on the topic of social oocyte cryopreservation.

Conflict of interest The authors declare that they have no conflict of interest.

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