Patients’ conceptualization of cryopreserved embryos used in their fertility treatment

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BACKGROUND: Although IVF treatments using cryopreserved embryos are offered by most infertility centres, little is known about patients’ opinions regarding treatment using these embryos. The objective of this study is to describe how patients think about (treatment with) cryopreserved embryos.

METHODS: In-depth interviews based on the method of interpretative phenomenological analysis were conducted with patients undergoing IVF/ICSI treatment at the Department of Reproductive Medicine of the Ghent University Hospital between May and July 2006. Seven couples (one couple considered as one participant) and 11 female patients who attended the clinic without their partner were interviewed.

RESULTS: Most participants knew little about medical-technical procedures involved in treatment with cryopreserved embryos. This was compensated by a high confidence in the medical team. However, seven of the eighteen participants thought the quality of cryopreserved embryos diminished during the storage period. A lack of knowledge about medical-technical procedures was compensated by metaphors related to other domains of experience, especially kitchen metaphors: this might add to the belief that frozen embryos have an expiry date.

CONCLUSIONS: The beliefs of infertile patients about (the effectiveness of treatment with) cryopreserved embryos encompass misconceptions, and doubts and fears which may influence their decision-making but which are seldom discussed with the medical staff.

Key words: embryo conceptualization / cryopreservation / embryo disposition / qualitative research / IVF

Introduction

Cryopreservation of high quality supernumerary embryos created in the context of IVF is widely used to improve patients’ chances to become pregnant and avoid complications (e.g. multiple pregnancy) (Queenan, 2000; Tiitinen et al., 2004; Borini et al., 2006; Le Lannou et al., 2006; Wang et al., 2008). Cryopreservation has brought about questions, such as what to do with frozen embryos that are left over after treatment (Pennings, 2000; Newton et al., 2007). However, despite the growing literature on embryo cryopreservation techniques or embryo disposition decisions, few studies have focused on how patients conceptualize their own cryopreserved embryos as such during their treatment.

de Lacey (2005) pointed out that participants in a study on embryo disposition decisions had difficulties speaking about embryos because there is no language available that adequately portrays the experience of having potential human life outside the body and in cryostorage. Parry found that ‘non-viable’ or spare embryos were not viewed in the same way as ‘viable embryos’ in a study that focused on how patients who undergo fertility treatment feel about the use of embryos in stem cell research (Parry, 2006). On the basis of a Swedish mail survey, Skoog Svanberg et al. (2001a) found that 18% of women and 27% of men were uncertain about using their cryopreserved embryos in a subsequent treatment cycle. This study also asked patients in an open question if they had any thoughts about the frozen embryos. However, the response rate for that question was low and the answers varied.

Overall, studies that addressed patients’ conceptualization of their embryos most often did so in the context of the disposition question (de Lacey, 2005, 2007; Nachtigall et al., 2005; Parry, 2006). Even
studies that at first sight seem to deal with the more basic topics about patients’ understanding of (cryopreservation of) embryos did not focus on how patients view cryopreservation of their own embryos and the subsequent use of them (Skog Svanberg et al., 2001b; Bankowski et al., 2005; Krones et al., 2006). Nevertheless, embryo disposition decisions typically have to be made about cryopreserved embryos and patients’ beliefs about the cryopreservation and storage of embryos might influence these decisions. Increasing knowledge about these beliefs can be helpful to understand decisions patients make about their treatment and about the disposition of their super-numerary frozen embryos later on.

In this study, we examine how patients think about the use of cryopreserved embryos in fertility treatment and what their beliefs are about the possibilities and implications of using these embryos. Interpretative phenomenological analysis (IPA) was used to examine how patients who (are about to) undergo IVF and have given their informed consent to the cryopreservation of super-numerary embryos are making sense of this aspect of their treatment (Smith and Osborn, 2008). This qualitative method allowed the introduction of new and unexpected topics that can be further explored in future research (Shaw, 2001). Furthermore, the method was chosen because it allows us not only to reflect on the patients’ experience as subjective and unshared but also on the shared aspects of experience that are constructed within the subculture of medically assisted reproduction, in which the use of cryopreserved embryos has become part of the standard practice (Shaw, 2001).

Materials and Methods

This study is part of another study on the beliefs of infertile patients about their embryos and their disposition preferences (Provoost et al., 2009). Data collection and analysis was based on the method of IPA that aims at illuminating participants’ subjective experiences and emotions, through an interactive process with the interviewer’s interpretations (Smith and Osborn, 2008). This method has been used increasingly in other studies about healthcare phenomena (Fade, 2004; Brocki and Wearden, 2006; Osborn and Smith, 2006) and specifically in studies regarding infertility and gamete donation (Turner and Coyle, 2000; Todorova and Kotzeva, 2006). IPA has also been used as the framework for studies that did not focus on concrete experiences (only) but on views, beliefs and even expectations within the broader context of experience. In some of these studies also ‘pre-experience’ data was included (Shaw et al., 2008; Bulley et al., 2009).

All participants were infertility patients who received IVF/ICSI treatment at the Department of Reproductive Medicine of the Ghent University Hospital. A sampling table was used to guarantee maximum variation (purposeful sampling) on a number of patient characteristics: treatment history (number of planned embryo transfers including the present cycle); whether the present treatment cycle was a fresh or frozen cycle; and whether they had children (from IVF/ICSI and/or cryopreserved embryos). All patients had in common that they had been informed about IVF (including the cryopreservation and storage of embryos and the use of these embryos for subsequent transfers) and that they had given consent to the cryopreservation of super-numerary embryos. We selected patients with different levels of experience with the treatment and with cryopreserved embryos because level of experience with IVF could play a role in patients’ attitudes towards topics related to IVF and we wanted to study the views of a wide-ranging group of patients who are about to have treatment or had received treatment in which cryopreserved embryos could be, or were, used. Both female patients and couples were selected. In interview studies with infertility patients, couples and female patients are often both included (de Lacey, 2007; van Rooij et al., 2009; Wilkes et al., 2009).

A nurse or midwife selected the patients based on a sampling table containing inclusion criteria (the characteristics presented as profile categories and subcategories with combinations of criteria) and exclusion criteria (non-Belgian patients and patients for whom donor gametes were used). The researcher adapted the sampling table regularly and equally increased the number of patients wanted per (sub)category based on the ongoing interviews. When enough participants with a certain characteristic were included, only patients with other characteristics were approached. This process was stopped when data saturation was reached for embryo themes and preferred disposition options for the total group of participants. Between May and July 2006, a total of 23 participants (patients and couples) were contacted, of which five refused to participate.

Clinic staff informed selected participants about this study during consultations and provided written information. Participants were informed that their participation or refusal was not linked in any way to their treatment, and that participation or refusal would have no impact on their relationship with the fertility team. After obtaining the patients’ consent, the researcher contacted the patients following their consultation or treatment to schedule the interview. Written consent was obtained from all participants before the interview. The Medical Ethics Committee of the University Hospital Ghent approved the study.

All in-depth interviews were conducted by a researcher (V.P.) who was not involved in patient care and were carried out at the Department of Reproductive Medicine. Couples were interviewed together. Interview duration ranged from 25 to 60 min, with an average of 38 min. The interviews were recorded and transcribed verbatim. They were made anonymous by replacing names and places by pseudonyms.

The questionnaire was semi-structured and started with open questions to invite the participants to speak about their experiences and beliefs about their embryos in their own words (conversational style). Interview questions in this part of the study addressed patients’ intentions at the moment of cryopreservation of the embryos or when giving consent for the cryopreservation, and their opinions about infertility treatment with cryopreserved embryos (knowledge, preferences and perceived effects of cryopreservation on treatment success, their health and the health of future children, etc.). The purpose of the knowledge questions was 2-fold: (i) to get a broad idea of what patients knew about the procedures their embryos were subjected to, and more important (ii) to detect beliefs about embryos in patients’ answers and their use of language when talking about these embryos. Furthermore, the interview focused on the meaning of embryos outside the female body through participants’ descriptions and metaphors, and their reactions to embryos that do not survive thawing or are not suitable for transfer. The questionnaire contained 38 questions under six main headings. The main headings and the topics of the questions have been described in Table I.

Analyses were conducted through an iterative process of coding recurrent themes. The qualitative data analysis software Altas.ti was used (Muhr, 1997). Investigator triangulation was achieved through a second researcher analysing a selection of the transcripts. Differences in interpretations were discussed until consensus was reached and data were re-analysed with the adjusted code-list. Quotes (throughout the text or in separate paragraphs per interview with a patient or a couple) are used to illustrate the findings. When partners who were interviewed together did not agree on a topic, this was taken into account in the analyses and both views were fully considered.
Table I Main headings and topics in the questionnaire used to investigate the opinions of infertile patients regarding treatment using their cryopreserved embryos.

<table>
<thead>
<tr>
<th>Introductory questions: treatment and embryos</th>
<th>Inviting the patients to speak about their experiences and beliefs about their treatment and their embryos in their own words</th>
</tr>
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<tbody>
<tr>
<td>Embryos in storage</td>
<td>Intentions at the moment of cryopreservation of the embryos or when giving consent for the cryopreservations; opinions about infertility treatment with cryopreserved embryos (knowledge, preferences and perceived effects of cryopreservation on treatment success, their health and the health of future children), beliefs about (cryopreserved) embryos; meaning of embryos outside the female body; perceived differences between embryos that are/were cryopreserved versus other embryos; preferences for one type of embryo, reactions to embryos that do not survive thawing or are not suitable for transfer; knowledge(^a) and beliefs about the technical procedures involved in cryopreservation, storage and thawing of embryos, disclosure to future children, etc.</td>
</tr>
<tr>
<td>Information about cryopreservation of embryos and embryo disposition, and consent</td>
<td>How was the participant informed, what are the information needs of the participant, etc.</td>
</tr>
<tr>
<td>Embryo disposition decision</td>
<td>Beliefs about the options (donation to other couples for reproductive purposes, donation for science, discarding), current preferences, etc.</td>
</tr>
<tr>
<td>Use of embryos for scientific research</td>
<td>Knowledge, beliefs, etc.</td>
</tr>
<tr>
<td>Characteristics of the participant</td>
<td>Age, current treatment, history of infertility, history of fertility treatments</td>
</tr>
</tbody>
</table>

\(^a\) The questions were asked in a neutral and open way in order to allow the participant to talk about their treatment and their (cryopreserved) embryos in their own words.

\(^b\) The purpose of the knowledge questions was 2-fold: (i) to get a broad idea of what patients knew about the procedures their embryos were subjected to, and more important (ii) to detect beliefs about embryos in patients’ answers and their use of language when talking about these embryos.

Results

The participants

Seven couples and 11 female patients who attended the clinic without their partner were interviewed (Table II). At the time of the interview 10 participants (a participant is a female patient or a couple) had frozen embryos being stored at the Department of Reproductive Medicine (ranging from 1 to 26 embryos). Some participants rarely had supernumerary embryos because they did not have enough eggs of good quality after retrieval, or the poor quality of their embryos ruled out cryopreservation. For one woman (Peggy) only one embryo was cryopreserved following 11 retrieval procedures. Two participants (Emily and Karen) had children resulting from IVF/ICSI treatments using cryopreserved embryos.

Table II Characteristics of infertile patients in a study of conceptualization of the cryopreserved embryos used in their treatment.

<table>
<thead>
<tr>
<th>Interview situation</th>
<th>n</th>
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</thead>
<tbody>
<tr>
<td>Couple</td>
<td>7</td>
</tr>
<tr>
<td>Female patient</td>
<td>11</td>
</tr>
<tr>
<td>Age female patient</td>
<td>(years)</td>
</tr>
<tr>
<td>Range</td>
<td>24–39</td>
</tr>
<tr>
<td>Mean</td>
<td>32</td>
</tr>
<tr>
<td>Current treatment</td>
<td>n</td>
</tr>
<tr>
<td>First fresh cycle</td>
<td>3</td>
</tr>
<tr>
<td>Fresh cycle (but not the first)</td>
<td>7</td>
</tr>
<tr>
<td>Cycle with cryopreserved embryos</td>
<td>8</td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>No children yet</td>
<td>8</td>
</tr>
<tr>
<td>No children in the present relationship; but one or both partners have children from a previous relationship</td>
<td>2</td>
</tr>
<tr>
<td>One child of both partners, conceived naturally</td>
<td>3</td>
</tr>
<tr>
<td>Children of both partners, from previous IVF/ICSI treatments using fresh embryos</td>
<td>3</td>
</tr>
<tr>
<td>Children of both partners, from previous IVF/ICSI treatments using cryopreserved embryos</td>
<td>2</td>
</tr>
<tr>
<td>History of fertility treatments: number of IVF/ICSI embryo transfers(^a)</td>
<td></td>
</tr>
<tr>
<td>Undergoing their first fresh cycle</td>
<td>3</td>
</tr>
<tr>
<td>Been through two treatment cycles</td>
<td>3</td>
</tr>
<tr>
<td>Been through three treatment cycles</td>
<td>2</td>
</tr>
<tr>
<td>Been through four treatment cycles</td>
<td>2</td>
</tr>
<tr>
<td>Been through between five and ten treatment cycles</td>
<td>5</td>
</tr>
<tr>
<td>Been through more than ten treatment cycles</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^a\) Including planned transfers that were cancelled, transfers from both IVF and ICSI treatments, transfers of both fresh and cryopreserved embryos, and the planned transfer in the current treatment cycle.

Participants who spontaneously shared what they knew about the cryopreservation process mentioned different aspects. Four participants referred to the decrease in temperature and three mentioned the (liquid) nitrogen. Two participants described this procedure as arresting the developmental process of the embryo. Although talking about what they knew or did not know about this procedure, two participants said they did not feel they needed this kind of information. Their confidence in the department and the medical team compensated for a lack of knowledge or made knowledge of these medical-technical aspects superfluous. Gina described it as follows: ‘We place it in their hands’. Furthermore, some participants indicated that this kind of knowledge was unnecessary.

Sandra: we don’t know very much about it. But I wonder: how much is there really to know?

Patrick: perhaps yes, I don’t know if one should know this, I think… Whether they freeze them, thaw them… They [the embryos] go on dividing so that they can be used again, and if they don’t go on dividing, then they’ve died, so… That’s the only thing one has to know about them. Not how they are build euh, or chromosomes, or… whatever… .

Sandra: no, you see, that’s way beyond our understanding anyway, right?
One woman (Peggy) did not want to know these things. She doubted the usefulness of this knowledge and even feared that it could raise her worries about the treatment and make her even more preoccupied with it.

Nearly half of the participants believed that the quality of the embryo diminished during storage. Four participants who had embryos in storage at the time of the interview thought that there was a maximum storage period for cryopreserved embryos because the quality of the embryos diminished during this period. The maximum periods they mentioned varied from 2 to 3 years. Some of these participants thought that this process started early on. Therefore, two participants who had mentioned a maximum storage period, even thought that the ideal storage period should be much less than the 2–3 years they mentioned as a maximum. Hannah thought that because the embryos were kept in very low temperatures the decrease in quality probably would not be an issue. However, she compared the cryopreservation and storage of embryos with freezing meat in the food industry and mentioned 6 months as a maximum storage period. Tessa already had doubts about the embryo quality, regarding embryos that had been frozen for a month.

Hannah: goh ... Obviously, you shouldn't let ten years go by. Now it has been about five or six months. I don't think that will be too much. If you look at the food industry [laughs] meat may be frozen for a maximum period of three, euh six months. Preferably a little less ... But yes, ok.

Tessa: now I thought: 'it's already one month that they're kept frozen, is that going to be ok still, or will it still work, by now it isn't good any more', you see. Then I do wonder about two years and so ... I say, one doesn't know these things, the quality probably doesn't change all that much, of such an embryo! [Asks the interviewer]

However, none of the participants who had doubts about the quality of frozen embryos addressed this point with members of the medical team.

Regarding the thawing of the embryos, 13 participants pointed out that they knew little or nothing about it. Only a few of them described certain aspects of the procedure: raising the temperature or the use of a type of oven. Marco referred to this oven by using the metaphor of the microwave.

Marco: microwave? [laughs].

Veronica: [laughs along and makes a bell sound] Ting, it’s done.

Marco: The child is ready.

When asked what they knew about the freezing or thawing of embryos, Jeff and Emma and Karen raised some questions about the possibility of mixing up embryos during these processes. It was something they had thought about during their treatment. Emma said it had made her feel uncomfortable. However, these patients did not address this question to the medical team. Instead, they tried to reassure themselves or to set these thoughts aside.

Emma: because it's been on TV ... We saw those post-its, or how you call them, those little yellow things. We thought 'what if a door opens and a few of them get blown off'.

Jeff: we suppose there should be a better system for this somewhere. Or at least, we hope that they don't just use those post-its.

Emma: yes that it was just something extra. One shouldn’t think about it too much.

Most participants did not want any further information about medical-technical procedures involved in treatment with cryopreserved embryos. Only Tessa and Linda and Michael indicated a current need for more information. Especially Tessa said that she would try to get as much information as possible. She also expressed the wish to visit the laboratory and see the procedures herself.

Differences between (treatment with) fresh and frozen embryos

When asked whether they thought there was a possible difference between fresh and frozen embryos, Gina and John said they had never thought about that and that they were not sure. Half of the participants thought that there was no difference between using fresh and frozen embryos in terms of treatment outcome, although Olivia and Joanna referred to the repeated failure of their own treatment cycles with cryopreserved embryos, which could indicate their doubts about the possibility for success.

Of the other seven participants, Ruth clearly expressed her doubts about the effectiveness of using cryopreserved embryos, although Veronica and Marco, and Frances and Andy said that they had wondered about this in the past. Four women or couples perceived fertility treatment using cryopreserved embryos compared with using fresh embryos as unnatural and referred to it as something strange or a 'weird thought'.

Sandra: it is not natural, you know. Something that you have put in the freezer and later on ... In fact, I can imagine that you get pregnant from a frozen embryo and that ... I see myself telling my child later on ‘you have been in the freezer at first’. You know, as a matter of speaking. You do look at it differently, a little anyway. Obviously, if it would work with that, I would love it, right. Whether it is a fresh or a frozen embryo ... It is a child, you know. It is our child, so that stays the same. But anyway, in the beginning I always had the feeling ... You know, it is something strange. That it is possible. Like, they put the development on hold really and then ... That it can go on again ...

Five participants pictured the thawing as a risky process in which survival of the embryo was at stake. They described the embryo as something coming back to life and continuing to divide again. This ‘coming back to life’ was the main aspect in participants' perception of the cryopreservation, and especially thawing, of embryos as something out of the ordinary.

Caroline: the thought that it isn’t alive anymore really ... The thought that it has been in the freezer ... euh in nitrogen probably, and comes back to life ... A strange feeling, yes.

The fact that the cryopreservation and thawing of embryos is experienced as extraordinary had some positive connotations, as in Karen’s description of the fact that the embryo starts to grow again after being frozen as ‘something special’. However, most descriptions of treatment with cryopreserved embryos as ‘something strange’ had a more negative connotation. Caroline for instance, described it in a negative way when she said she would want treatment with cryopreserved embryos, despite this thought.

Caroline: it's just the thought, you know, I think. If you have frozen embryos, that it is not the same as a fresh embryo. I think so. But I would do it anyway, you know. Yes. Although the thought is quite different.
Eight participants thought there were some differences between fresh and frozen embryos. According to five of them the main difference is that the quality of the embryo decreases by the procedures of cryopreservation and thawing, leading to lower success rates. This topic was discussed also by participants when they talked about their knowledge of the medical-technical procedures involved in treatments with cryopreserved embryos (see above).

Tessa: the embryo that has been transferred. . . . that was a quality 3, so I don’t think that it was of good quality as it was. And then again I think by being frozen that its quality diminished further. That, in the end, it really doesn’t have the quality required to be transferred. But I don’t know now: is it the thawing process that brings that on or is it the freezing itself?

Conversely, as described above, for some this decrease in embryo quality was an effect of the duration of the storage period, rather than of the cryopreservation or thawing procedures. Furthermore, the fact that frozen embryos were perceived as embryos of lower quality could be associated with the selection process by the embryologist. Marco, who thought that the quality of cryopreserved embryos was lower than fresh ones pointed at the fact that, at the time of the transfer in the fresh cycle, the medical team had already used the best ones available. As a result, the frozen ones were considered to be ‘leftovers’ from that selection anyhow and thus of less quality compared with the selected one(s).

When asked whether they had a preference for either fresh or frozen embryos, nine participants said they did, and six participants preferred fresh embryos. The idea that their thawed embryos might be of low quality was the main reason. Peggy’s preference for fresh embryos showed that she did not mind the fact that she never had a lot of embryos to freeze: instead of being disenchanted, she believed this prevented her from having pointless hope followed by disappointment.

Olivia’s beliefs about the decreased quality of her frozen embryos even influenced her decision about donating them to other couples in case she would no longer need them for her own treatment in the future. In the 4 years prior to the interview, Olivia had more than ten transfers of both fresh and frozen embryos without the result she hoped for. She would not really consider donation to others because she did not want to give other patients false hope. She said donation to others would definitely have been an option if she would think that her embryos were of good quality.

Olivia: you know, with us, that quality is perhaps not so good. . . . I don’t think you should give other people hope if you know ‘hmmm, the chance is very small’. You know, I don’t think that’s fair towards those people who maybe put all their hopes in these embryos while you have thought yourself ‘that will not work’ I don’t think it’s fair.

No clear relationship was found between the negative experiences with frozen-thawed cycles of the participants (described as cancelled cycles because no embryos had survived, or unsuccessful transfers of frozen-thawed embryos) and their beliefs about this type of treatment or about the frozen or frozen-thawed embryo itself.

None of the patients who thought that treatment with cryopreserved embryos was something weird or less effective compared with treatment cycles with fresh embryos ever considered refusing this treatment option. Joanna even seems to go ahead with these cycles only because it has been suggested.

Joanna: I think, with those frozen embryos . . . I don’t give it a chance. The professor always says ‘you know, there is always a chance’. But to me, it’s like . . . We do it, but really . . . I’ve been pregnant three times out of six IVF-attempts and it always was a fresh cycle. So that with those . . . I also have had perhaps already ten times tried with a thawed. . . . And that has never worked. For me it’s like, ok, we do it, but in the end . . .

I: you do not really think it can be successful?

Joanna: no, and if it does work, well all the better but I do not think it will, no . . .

In contrast to the patients mentioned above, Hannah, Ruth and Karen expressed a clear preference for treatments using cryopreserved embryos because this treatment was perceived as having major advantages compared with the fresh treatment cycle. The main advantages mentioned were that a treatment with cryopreserved embryos is less invasive and painful. Seven other participants also referred to these advantages of treatment with cryopreserved embryos. Hannah and Karen, who preferred treatment with frozen embryos, even thought there might be an increase in the chance of success compared with fresh cycles. For Karen, previous treatment successes could play a role in this belief. However, this could not be confirmed by the data.

Karen: I rather have a positive feeling about it. I feel like my body . . . after a pick-up . . . I don’t know . . . I won’t say traumatised, that’s not it, but . . . I’ve got pregnant last year with a frozen embryo. So I have a very positive feeling about that. So after the pick-up, an immediate transfer . . . I’ve never had a positive result from it. I always have the feeling that perhaps my body is still a little stunned from that procedure. I don’t know. So that’s the feeling I have. And than those frozen embryos . . . That’s done in a more natural way, without having those hormones and then it’s just the natural cycle. And I actually have a very positive feeling about that.

**Effects on the health of future children**

Despite a lack of knowledge about the procedures of freezing and thawing, when asked whether they thought the cryopreservation and/or thawing of the embryo could have a possible effect on the health of future children, nine participants thought there was no negative effect.

Hannah: not in the future, no. I can’t imagine that. I just think: either they survive, or they don’t survive, now at the transfer, when it’s an embryo. But definitely not in the future.

Karen referred to her own healthy children, resulting from cryopreserved embryos to illustrate her opinion and Sandra remembered a media account of a baby born following a treatment cycle with an embryo that had been frozen for 12 years. Tessa and Karen even thought children resulting from IVF-treatments with cryopreserved embryos might be healthier than others because these embryos had successfully passed an extra selection test.

Tessa: I think, in any case, every embryo that comes through IVF or ICSI or has been placed into the womb after being frozen, if they survive and they really result in a pregnancy, that that will be, you know, strong children. Because they have had to undergo such a process, I think they will have, you know, a kind of solidity.

Karen: I do not think it is worth any less. I think it. . . . On the contrary, it’s an even bigger miracle that it started to grow again after being frozen for a while. I think . . . They have fought for it, you know.
Six participants formulated some doubts about the absence of negative consequences of the freezing-thawing procedures on the health of the future child. However, they did not seem to have thought about refusing this type of treatment. Three of these participants (Michael, Emma and Jeff and Ruth) mainly expressed their hopes that freezing-thawing would not have an effect. Also Ruth was not very sure that there would be no negative effects, despite the fact that she had expressed a preference for frozen-thawed cycles because they were less invasive.

Emma said that if she would become pregnant following treatment with a frozen embryo, she would link a possible health problem with the cryopreservation.

Some of the participants thought that there was a difference between frozen and fresh embryos (for instance a decrease in quality because of the procedures of freezing/thawing) but that there was no effect for the health of the future child. The belief that there will be no negative effects on the health of the future children, was associated with a high level of confidence in medical science in general and in the medical team who treated them.

Emily: no. Well, then they wouldn’t do that. I’m very confident about that.

Disclosure

Participants were asked whether or not they would tell a future child that it resulted from an IVF treatment with an embryo that had been cryopreserved if that was the case. Only one couple preferred not to let their child know about the treatment at all, although they would consider telling if the child would have a significant chance to inherit the fertility problem. For three other participants the fact that the fertility problem could be inherited was also an important factor in the decision to disclose this information to the child.

The other participants would tell their future child about the treatment and 10 of them would also talk about the fact that the embryo had been cryopreserved. Hannah, Olivia and Joanna indicated that they did not consider the fact that the embryo had been cryopreserved as an important aspect in the story of how the child was conceived. Emily said that she would inform her child about the IVF, but would only consider telling the child about the cryopreservation of the embryo if he or she would ask further questions about the treatment.

Emily: yes, we are going to be very open about that. Especially because my son has a big chance to have the same thing as my husband has. It’s genetic. And I think that you... I don’t think it is a shame. I think those children should know that, like ‘look, that’s happened and that’s how it is’. Yes, I think so. Even if my son would not have that... In the end, it is possible that he doesn’t have it, but there’s a big chance. Even then I would be honest about it. When they’re old enough to... I wouldn’t tell that [coming from a frozen embryo]... You know, if they would ask about it. If they wouldn’t ask too many questions I would just say, look, we’ve done that, that treatment, because otherwise we couldn’t have you. And if they would go on asking questions, yes, then I would be honest about it, yes.

Most of the participants who would disclose, said they would do so because they did not want to make a secret out of it. Some pointed out that one could create problems just by making it a secret, whereas being open about it would avoid negative reactions from the child. Tessa compared this with giving children information in the case of adoption.

Tessa: I think if you have a problem with it, you will create a problem...

Caroline said that she would tell because she herself would like to know this kind of information and for her, the child was entitled to this kind of information or had ‘a right to know’. When talking about how they would tell their children, Sandra, Peggy and Joanna pointed out that they did find it a slightly ‘weird’ or ‘funny’ thing to say. They illustrated this mainly by referring to the freezer like the one they had in the kitchen. In general, the use of the word ‘freezer’ in that way, was found in 6 out of 18 interviews (range 1–11 times).

Peggy: and I say ‘in the freezer’. I think that’s such an odd way of putting it. I might say, being a bit of a joker, that he came out of the freezer and things like that. [laughs]

Informed consent and intentions at the moment of freezing

To explore participants’ intentions at the moment of freezing the embryos or giving consent to freeze them, we asked them whether they ever thought about not having their embryos frozen. None of the participants had considered this possibility. Tessa and Frances saw the cryopreservation of the embryos as a way to hold on to all the chances they could have, even though Tessa had some doubts about the chance of success with these embryos. Once the embryos were stored, she used them because she did not want to leave an opportunity unused.

Tessa: if you have them, you’re not going to say like: no, I’m not going to take them. I’ve got to grab every chance right. But I don’t count that as... as a real transfer. For me now, if they would say: you can come back for two more times to have a frozen embryo transferred, then I don’t consider that as... I only count my pick-ups in fact. That’s strange, but...

I: as a real treatment?

Tessa: Yes.

Most participants indicated that they saw the cryopreservation of their supernumerary embryos as part of the procedure and not as a decision to be made by them.

Beth: oh? No, in fact they automatically do that, you know. If they [the embryos] are reasonably good; they [medical staff] automatically freeze them, right.

Anne: you know, yes, that’s the procedure and the way they work.

Joanna: it is a part of it, yes, first a fresh attempt and then we do it a few times with a thawed and then again a fresh. I just was on... ‘on that train’ if I can put it like that, and we just did what was said here. [laughs] I have never really thought about that, like euh yes, I’m going to have to do something with those frozen...

According to Hannah’s perception, it was something the medical staff told her and she did not really have the choice whether or not to freeze supernumerary embryos. Ruth even said that she did not know that the medical staff was to freeze her embryos at the time of her retrieval, while this is standard procedure.

Hannah: we actually didn’t have that choice, you know. Well, they just said like: there are three remaining; we are going to freeze them, not like...
Ruth: euhm, I didn’t really know that. You see, I knew there would be eggs picked up. These get fertilized. You know, than they look and put one back. But I did not know straight away that there were some that were going to be frozen or how many. That I only knew that afterwards.

I: ah yes, yes. So the freezing, they told you about it afterwards?

Ruth: Yes.

However, these participants all have signed a form in which they gave permission to the Department of Reproductive Medicine to store their embryos, as Tessa remembered.

In the same way, some participants did not see the disposition decision as a decision they were required to make. When Emily was asked about what disposition option she would prefer for her superfluous embryos in the future, she said: ‘I think I would rather let them euh … let them die on their own or so’.

**Discussion**

In this study in-depth interviews based on the method of IPA were conducted with 18 infertility patients for the purpose of describing how patients think about (treatment with) cryopreserved embryos.

Patients said they knew very little about the medical-technical procedures involved in cryopreservation, storage and thawing of embryos. Nonetheless, most participants did not show a need for this kind of knowledge. A basic confidence in medical science and in the medical team performing these procedures made further knowledge superfluous.

On the whole, patients frequently made comparisons with food storage, which can give rise to a number of misconceptions, such as there is a maximum storage period for frozen embryos, and that embryos can reach their expiry date as is the case with frozen food. The Dutch words for ‘fresh’ and ‘frozen’ embryos are used in the context of food as well as in the clinical setting of IVF. These words are used widely by patients as well as medical staff to indicate cryopreserved embryos (for example, in patient information brochures). This could reinforce patients’ association of cryopreserved embryos with frozen food. This association may be seen as an expression of the patients’ instrumentalist attitude towards their embryos as ‘ingredients’ in their reproductive treatment. However, the wide-spread use of these words could also reinforce an instrumentalist view of the embryo.

This association with food might explain why a substantial number of patients for whom embryos are stored at infertility centres never make a decision about their fate (McMahon et al., 2000; Newton et al., 2007). McMahon et al. already suggested that in patients’ perceptions there might be a fifth option besides continuing storage for further treatment, donation to others for reproductive purposes, donation for science, and having the embryos discarded, i.e. delaying the decision and continuing storage in the meantime (McMahon et al., 2000). Patients may opt for a never-ending storage of their embryos as a way to avoid making a final decision. There might even be a sixth option in patients’ perspectives, namely the discarding of the embryo without an external intervention. In this view, the couple would wait until the embryos ‘expire’ so that they can no longer be used for further treatment, research or donation to others.

Another finding is that patients rarely discuss the moral status of their cryopreserved embryos. This also has been found in the way these patients make an embryo disposition decision (Provoost et al., 2009). There was no major role for the moral status of the embryo in their decision-making, in contrast to the attention given to this topic in the ethical literature.

Although the participants had a high confidence in medical science and in the medical team, some of them had questions about the use of cryopreserved embryos. One of the worries was that the embryo quality would diminish as a result of the manipulation of the embryo during cryopreservation and/or thawing, the duration of the storage period or as a mere side-effect of selection by embryologists of the highest quality embryos for transfer during the ‘fresh cycle’.

Parents of IVF children were reported to demonstrate a greater level of protectiveness towards their children compared with other parents (Weaver et al., 1993; Hahn and DiPietro, 2001). However, studies about parenting attitudes have not made a distinction between children resulting from cryopreserved embryos and other IVF children and long-term follow-up data of children born after cryopreservation of embryos are scarce (Wennemerholm et al., 2009). The fact that a child was born following the transfer of a cryopreserved embryo could play a role in the construction of family narratives and parenting attitudes. For instance, it is possible that parents who perceive the process of cryopreservation and thawing as a test, or selection, attach a special status to the child (e.g. fighter), resulting in different parental attitudes.

A study about attitudes towards assisted reproduction in adult IVF-offspring indicated that IVF-children find it important to be informed by their parents about the circumstances of their conception (Siegel et al., 2008). Studies that focused on disclosure of the mode of conception to children of IVF or ICSI without donor gametes showed that the majority of parents intended to tell their child (Peters et al., 2005; Ludwig et al., 2008). However, parents were unsure as to the most appropriate timing and the method of disclosure (Greenfeld et al., 1996; Peters et al., 2005) Interestingly, the type of treatment was identified as an influencing factor in the parents’ disclosure decision, with parents of ICSI children tending to disclose more often than parents of conventional IVF children (Peters et al., 2005) Fertility clinics could support patients by addressing the disclosure decision in their patient information brochures and counselling sessions.

Instead of using cryopreserved embryos as an expression of an active wish to maximize their success, our data show that these patients were rather passive users of this aspect of their treatment. It is interesting to learn that despite the doubts of some respondents about the chances of success of cycles using cryopreserved embryos or the feared negative effects on the health of future children, none of the participants even considered refusing this type of treatment. There are several possible explanations for this but our data do not provide conclusive answers. It is possible that patients do not consider this aspect of the IVF treatment as something they can actively choose (as might be expected from the informed consent they gave at the start of their treatment) but rather as part of an aspect of the standard procedure which they could not refuse without wasting chances or without openly questioning the work of the medical staff. Most patients with doubts had not talked about them to the medical staff. As a consequence, although their doubts and fears could be significant factors in patients’ decisions about their treatment, the medical staff might not be aware of them. Literature shows that some couples
had already disposed of cryopreserved embryos, whereas they went on with treatment, creating new fresh embryos (McMahon et al., 2000). Similar decisions have been made by patients in the past at the Department of Reproductive Medicine of the Ghent University Hospital. These decisions may follow on from the association of cryopreserved embryos with frozen food and the idea that the quality of cryopreserved embryos diminishes during storage. Since July 2007, the Belgian law obliges patients to use their frozen embryos before initiating a new fresh cycle. However, patients could still temporarily stop treatment, have their embryos discarded, and come back for treatment a few months later. Patients are informed about this rule before the start of their treatment. Since introduction of the law in 2007, only one couple has refused the cryopreservation of their embryos. The fact that this number is so low confirms the finding in this study that patients who have these doubts or fears do not refuse cryopreservation. In a study in 1995, Laruelle and Engert (1995) also found that only a very small minority (2%) did not accept cryopreservation of spare embryos. This small group of patients mainly consisted of couples with an unusually high anxiety level for unknown cryopreservation risks for the children-to-be. Anxieties about possible effects on a potential child have been found in other studies (Skoog Svanberg et al., 2001). Besides these studies, ambivalent thoughts of patients about effects of cryopreservation, storage or thawing for the future child are rarely reported. However, as found by Laruelle and Engert (1995) these doubts may influence patients’ decisions on whether or not to continue treatment (Laruelle and Engert, 1995). The association of frozen embryos with frozen food points out a need for patients to be given information about embryo storage (and especially the quality of stored embryos). To prevent misconceptions about cryopreserved embryos playing a major role in patients’ decisions, the information given to patients at the start of their treatment should address these points. Besides basic information, it might be helpful for patients if these misconceptions could be named and addressed in a ‘true-or-false’ section of the brochure in the same way as is done with ‘frequently asked questions’. Examples of statements could be: ‘The quality of my embryo diminishes during the storage period (false)’ and ‘Embryos that are going to be cryopreserved can be of similar quality compared with the embryo(s) that will be transferred (true)’. With each answer (true or false) some extra information should be given. Furthermore, the possibility to refuse the cryopreservation of embryos should be stated in patients’ information brochures and patients’ beliefs and fears about cryopreserved embryos should be re-addressed some time after they received this information.

A problematic finding is that several participants in our study did not remember being asked whether they wanted to have their supernumerary embryos cryopreserved, although this is standard procedure. In other studies, similar examples were found of patients who struggled to remember what they had consented to or even what the form looked like (de Lacey, 2005; Parry, 2006).

In general, the beliefs and in some cases misconceptions of patients about their frozen embryos may play an important role in their decisions about further treatment or the disposition of supernumerary embryos. Several studies have already shown that conceptualization of the (frozen) embryo influences the disposition decision patients make about them. (McMahon et al., 2000; de Lacey, 2005, 2007; Nachtigall et al., 2005; Parry, 2006; Fuscaldo et al., 2007).

Although fertility research is frequently based on interviews with female patients as well as couples, the fact that couples were interviewed together can be viewed as a limitation of the study (van Rooij et al., 2009; Wilkes et al., 2009). It is possible that if both partners were interviewed separately their views would differ. However, both partners have to reach a joint decision about the treatment, the use and the disposition of their cryopreserved embryos.

This study has shown that there is a gap in the literature about patients’ beliefs concerning cryopreservation and use of their embryos, despite the widespread use of this technique for many years. Future research could focus on differences between partners in their attitudes towards different aspects of the treatment, such as the use of cryopreserved embryos. A Swedish study found that cryopreserved embryos meant a lot to the majority of male and female patients but that at the time of the cryopreservation women were more certain than men about using the embryos in subsequent cycles and men reported more anxiety about a possible negative effect on the future child (Skoog Svanberg et al., 2001a). Furthermore, considering the substantial numbers of patients who fail to make a disposition decision, it would be worthwhile to study whether patients consider the choice to allow ‘nature’ to take its course and decide the fate of their embryos by default (let the embryo pass the expiry date) as an additional disposition option and to what extent this can explain unclaimed embryos. Further research will also have to determine what causes these misconceptions and whether there is a direct association between these beliefs about cryopreserved embryos and the specific options patients choose for their embryos. In addition, it would be interesting to study the association with food-related language based on a discourse analysis of data gathered through focus group conversations with patients or the written communication between patients on the websites of patient organizations. And finally, different strategies for informing patients should be evaluated to identify approaches that prevent or decrease the number of patients with misconceptions.

In conclusion, the beliefs of infertile patients about (the effectiveness of treatment with) cryopreserved embryos encompass misconceptions, and doubts and fears which are seldom discussed with medical staff. However, these beliefs may be important in patients’ decision-making about the subsequent use of these embryos in their treatment and the disposition of embryos that still remain after their families are completed.

**Authors’ Role**

All authors take full responsibility for the reported research. We warrant that all authors have participated in the concept and design; analysis and interpretation of data; drafting or revising of the manuscript and that they have approved of the manuscript as submitted.

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References


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