

EMBRYO RELINQUISHMENT FOR FAMILY BUILDING: HOW SHOULD IT BE CONCEPTUALISED?

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ABSTRACT

This article discusses two competing conceptualisations of the relinquishment of unused cryopreserved embryos for family building, as either ‘embryo donation’ or ‘embryo adoption’. The evidence on how embryo relinquishment is conceptualised, and the views, experiences, and perceptions of fertility patients with unused cryopreserved embryos, are examined by reviewing 41 English-language research papers published between 1995 and 2010 located by means of an extensive search of electronic databases and other sources. The article then formulates proposals for a multi-model approach to embryo relinquishment for family building that reflects individual choice and the diversity of contemporary cultures and communities and facilitates access to information about their genetic origins by individuals conceived as a result of embryo relinquishment.

INTRODUCTION

The report on embryo relinquishment for family building published by the American Society for Reproductive Medicine’s (ASRM) Ethics Committee (2009) challenges the concept of ‘embryo adoption’, a model akin to infant adoption. Instead, the ASRM endorses the term ‘embryo donation’, a technical reproductive practice that sees its end result as the production of a pregnancy – much the same as sperm or oocyte donation. The debate between these contrasting conceptualisations is more than a matter of semantics. Rather, it has implications for both the conduct of the process and the nature of future relationships between the parties involved. To address this debate, this article has two central aims: first, to review empirical evidence concerning the views and behaviour of fertility patients who have unused cryopreserved embryos; and second, to consider the

implications of this evidence for policy and practice regarding the conceptualisation and organisation of embryo relinquishment. Based on the review and analysis, we conclude that a multi-model approach to embryo relinquishment for family building that takes into account the diversity of contemporary societies and maximises choice for both those with unused embryos, potential recipients, and individuals conceived following embryo relinquishment is the most appropriate.

In this article, we use the neutral term 'embryo relinquishment' rather than either 'embryo donation' or 'embryo adoption' for our own reference to the transfer of embryos from one couple to another (or individual) for family building. We use the term 'unused' to avoid negative connotations associated with other terms found in the literature, such as 'excess', 'left over', 'spare', 'surplus' or 'supernumerary'. Finally, we have also avoided using the term 'embryo transfer', since this has an existing and different meaning within the context of assisted reproductive technology.

The article outlines the development of embryo relinquishment, and discusses the emergence of embryo 'adoption' as a discrete concept. It then reviews published empirical studies exploring disposition decisions of fertility patients who have stored cryopreserved embryos and discusses how their conceptualisation of their embryos can inform the establishment of family-building services utilising embryo relinquishment.

DEVELOPMENT OF EMBRYO RELINQUISHMENT FOR FAMILY BUILDING

[Trounson et al \(1983\)](#) first reported embryo relinquishment for family building, the same year in which the first pregnancy from a previously cryopreserved human embryo was reported ([Trounson and Mohr, 1983](#)) and a year prior to the first live human birth resulting from embryo cryopreservation in March 1984 ([Downing et al, 1985](#)). Restrictions on the number of embryos transferred in a single *in vitro* fertilisation (IVF) treatment cycle (to reduce the risks associated with multiple-embryo pregnancy and multiple births) combined with the ability to successfully cryopreserve embryos mean that women can be offered the opportunity to cryopreserve unused viable embryos for implantation in a subsequent cycle. Consequently, following completion of their own treatment, some women may have unused cryopreserved embryos for which there are four disposition options, to:

- (1) keep the embryos in store,
- (2) allow them to be destroyed,
- (3) make them available for research, or

- (4) relinquish them to one or more couples or individuals using reproductive technology for family building.

Relinquished embryos may be used for family building for the following clinical conditions: where a couple are carriers of a genetic disease or a chromosomal abnormality that may cause significant morbidity in the child, or where – combined with severe male factor infertility – a woman is experiencing premature or incipient menopause, or has not responded to conventional ovarian stimulation (Söderström-Anttila et al, 2001). However, they may also be utilised in other circumstances:

- (1) as an alternative to either sperm or oocyte donation by couples when one partner has impaired fertility and the couple would prefer their child not to be genetically related to either of them so as to avoid misalignment in parent/child genetic relationships,
- (2) where pre-existing embryos may be more readily available than donated oocytes,
- (3) to avoid the more physically intrusive procedure for the recipient of ovarian stimulation and oocyte retrieval associated with conventional IVF,
- (4) for economic reasons by avoiding the expense of conventional infant adoption or an ovarian stimulation and oocyte retrieval cycle (and – where donor payment is the norm – the cost of donated gametes¹), and
- (5) where several embryos are available to provide recipient families with the opportunity to have more than one child, all of whom will be full genetic siblings to each other (and – at the same time – to enable those relinquishing their embryos to avoid having full genetic siblings of their children dispersed among several different families).

While most users of relinquished embryos are likely to be heterosexual couples, a single woman, a single man or individuals of either gender in a same-sex relationship who use a gestational carrier may also use relinquished embryos for family building.

Relinquishment of embryos for family building is one of the more contentious forms of collaborative reproduction. As Table 1 below illustrates, relinquishment of embryos for family building is expressly forbidden in several jurisdictions, including those in which gamete donation is permitted and, where legislation is absent, is less readily available than gamete donation. The operation of both legislation and professional guidelines suggests that lawmakers and practitioners in a number of jurisdictions consider the practice to be qualitatively different from, and more problematic than, gamete donation.

Table 1. Statutes, regulation, and practice relating to gamete donation and embryo relinquishment

	Sperm donation	Oocyte donation	Embryo relinquishment
Jurisdictions governed by statute (<i>n</i> = 105)			
Permitted	32	35	22
Prohibited	10	13	22
Not mentioned	8	2	5
Jurisdictions operating under guidelines (<i>n</i> = 39)			
Permitted	25	24	22
Prohibited	11	10	12
Not mentioned	3	5	5
Jurisdictions with neither legislation nor guidelines (<i>n</i> = 31)			
Practiced	20	19	12
Not practiced	11	12	19

Source: Jones et al (2010: 44).

Note: Respondent for one jurisdiction with legislation unsure of the legal position regarding embryo relinquishment.

The extent to which embryo relinquishment is practised, even where it is permitted, is difficult to ascertain. For example, in the USA, of the 430 fertility clinics reporting to the Centers for Disease Control and Prevention (CDC) in 2007 (the most recent year for which data are available), 67% offered 'donor embryo' services. However, the CDC data indicate neither the number of clinics that actually perform the service, the prevalence of uptake, nor the number of infants conceived as a result of embryo relinquishment (CDC, 2009). Kingsberg et al.'s (2000) survey of US fertility clinics revealed a significant discrepancy between the offer and provision of donor embryo services. Seventy-eight (72%) responding clinics offered a service, but only 37% had actually undertaken it. In a later national survey of 341 clinics, to which 217 (64%) responded, Gurmankinn et al (2004) reported that 158 (76%) offered 'donor embryo' services. However, this study does not report on service provision. A year later, Hurwitz et al (2005), surveyed 392 clinics, receiving a 64% response rate (252 clinics). Of these, 150 (60%) confirmed that they had undertaken embryo transfer with relinquished embryos, suggesting that more clinics than previously reported were actually providing the service, although almost two thirds had performed no more than ten such procedures. Finally, Hammond et al (2009) reported a more recent, but less systematic, study in which representatives of 56 clinics attending a third-party-reproduction symposium were polled regarding embryo relinquishment services. Twenty-three (41%) claimed to currently offer a programme and 10 were considering doing so. Further evidence of the availability of embryo relinquishment services is revealed through the reporting

mechanism operated by Centers for Disease Protection and Control under the Fertility Clinic Success Rate and Certification Act 1992. Table 2 shows that half of the centres filing reports in 1998 offered donor embryo services and two-thirds did so in 2007. However, as with the previously cited sources, the prevalence of the practice is not indicated.

Because embryo relinquishment is recorded even less rigorously in some other jurisdictions, little systematic evidence is available regarding its prevalence or outcomes.

Table 2. US fertility centers offering donor embryo services 1998–2007 (% of total filing annual reports to CDC)

1998	1999	2000	2001	2002	2003	2004	2005	2007	2007
50	51	54	58	60	64	64	65	65	67

Source: [Centers for Disease Control and Protection \(2010\)](#).

EMBRYO ADOPTION – THE CONCEPT

The concept embryo adoption was initiated in 1997 by Nightlight Christian Adoptions, a California-based infant adoption agency, which launched Snowflakes® Embryo Adoption Program. Nightlight had become aware of the existence of unused cryopreserved embryos in the UK that were to be destroyed upon expiry of the statutory storage limit, and of large numbers of cryopreserved embryos in the USA that – unlike in the UK – were under no threat of destruction, but for which plans for their disposition seemed uncertain. At the same time, a Nightlight client undergoing fertility treatment was offered an anonymously relinquished embryo by her fertility clinic. However, she was interested in doing so only if she knew the identity of the genetic parents and the process could be handled like an infant adoption. In the absence of such a service, Nightlight subsequently created an ‘adoption programme’ for embryos, Snowflakes® (Nightlight Christian Adoptions, personal communication 22 May 2006). The concept of embryo adoption received a boost in 2002 by means of significant federal government funding to promote ‘public awareness campaigns on embryo adoption’ ([Federal Register, 2002](#)), which raised considerable, albeit controversial, public exposure and debate. By 2010, the federal administration had disbursed a total of \$17,489,000 to several agencies under this programme ([Office of Population Affairs, 2010](#)). Currently, seven agencies in the USA are reported as offering embryo adoption services ([EmbryoAdoption.org, 2010](#)). As far as we are aware, currently no embryo adoption agencies operate outside the USA, although a newly instituted agency, Beginnings Family Services (2010), that draws

on the embryo adoption approach, has begun operations in Canada. The dominance of Snowflakes® in this field of family building may be gauged by its penetration of contemporary American lexicology, with Glowka et al (2007) citing ‘Snowflake’, ‘snowflake baby’, ‘Snowflakes baby’, ‘snowflake child’ as descriptors for a child resulting from the *in utero* transplantation of a cryopreserved embryo.

Key elements of the embryo adoption model include:

- (1) provision of counselling for relinquishing couples,
- (2) the ability of relinquishing couples to select and meet potential recipient(s) of their embryo(s) in advance of the transfer of the embryo(s),
- (3) completion of a home study (including both education and counselling) and screening of potential recipient(s), and
- (4) the ability of relinquishing couples and recipients to agree on arrangements for future information exchange and contact.

As of 27 April 2010, Snowflakes® had ‘matched 441 genetic families (with ~3,234 embryos) with 302 adopting families. There are 223 Snowflakes children and 14 adopting families are currently expecting 19 babies’ (Snowflakes®, 2010). While Snowflakes® is an explicitly Christian organisation, it works with ‘families from all religious backgrounds. We need all types of families to meet the various adopting and genetic parents’ criteria’ (Snowflakes®, 2010). Existing studies of embryo relinquishment have provided little detail as regards the criteria used by relinquishing couples to determine who will receive their embryo(s). However, Paul et al’s (2010: 264) research of embryo relinquishment via a Christian embryo adoption agency showed that relinquishing couples considered a diverse range of factors for selecting recipients for their embryos:

For many, these included religious, racial/ethnic and physical similarity, marital status, sexual orientation, health, and socioeconomic status of the recipients, the availability of extended family and options for future contact with recipients.

In particular, relinquishing couples did not necessarily look for their own religious beliefs to be shared by their recipients.

Opposition to the concept of embryo adoption is evident not only from within the fertility industry, as noted at the outset of this article, but also from other commentators as well as infant adoption stakeholders. As an example of the former, Crockin (2005) has expressed concern about ‘language creep’ designed to elevate to ‘constitutionally protected personhood’ the status of embryos in public perceptions – ‘part of a thinly disguised anti-choice agenda and an

all-out cultural war on modern reproductive medicine, stem cell research, and personal choice'. Freundlich (2002: 2), expressed infant adoption concerns that a focus on embryo adoption diverts attention from existing children who need families, thus 'diminish[ing] the reality of the lives of actual children who are in residential care and require a family' and scepticism of what she perceives as unwarranted confidence in the competence of community and faith-based embryo adoption agencies and medical personnel to provide the necessary high-quality and professional services that underlie federal government support.

HOW COUPLES WITH UNUSED EMBRYOS CONCEPTUALISE EMBRYO RELINQUISHMENT

Using the terms 'embryo donation', 'embryo adoption', 'embryo disposition', and 'embryo disposal', relevant existing research was identified from the following electronic databases: CINAHL, Ingenta Connect, ISI Web of Knowledge, JSTOR, Medline, PsycINFO, Pubmed, Science Direct, Scopus, Swetswise and Wiley InterScience, and from references cited in primary sources. The search yielded 41 English language studies published between 1995 and 2010 relating to disposition decisions regarding unused embryos and which have included the possibility of relinquishment for family building.

These studies, undertaken in Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Italy, Spain, Switzerland, UK, and USA, used both quantitative and qualitative methodologies to study disposition intentions and/or decisions, as well as retrospective clinical reviews of patients' disposition decisions. Some of the latter include data that allow comparison of disposition intentions recorded at the outset of treatment with actual disposition decisions. Four key phenomena have consistently emerged from the empirical research:

- (1) couples with unused embryos find the disposition decision an emotionally difficult one,
- (2) relinquishment to other couples for family building is frequently the least-favoured disposition option,
- (3) couples who initially indicate an intention to relinquish unused embryos to another couple for family building frequently change their mind when faced with the reality of making a disposition decision – especially if they have been successful in conceiving a child, and
- (4) individuals' and couples' conceptualisation of their embryos underlies their eventual disposition decisions, although in contradictory ways.

The emotional difficulty experienced by patients in deciding on disposition has been reported in several studies (de Lacey, 2005; Fuscaldo et al, 2007; Hammarberg and Tinney, 2006; McMahan et al, 2000; 2003; McMahan and Saunders, 2009; Nachtigall et al, 2005; Newton et al, 2003; Oke et al, 1998). One significant feature of all reported studies is the relatively low response rates achieved. It has been speculated that low response, and the widely reported parallel phenomenon of clinics losing contact with patients who have stored cryopreserved embryos, are indicative of the difficulty in making embryo disposition decisions and patients' preference to avoid making them (Brzyski et al, 2000; Dawson, 1997; de Lacey, 2007a). However, Provoost et al (2010) offered an alternative explanation. Since some patients liken cryopreserved embryos to frozen food, the apparent abandonment of stored embryos may, at least in part, result from patients' assumptions that their embryos have passed their 'use by' date, are, therefore, of no use for any purpose, and so no useful decision is either required or can be made.

Table 3 provides summary data from reviewed empirical studies providing quantitative data regarding disposition decisions. These illustrate that *relinquishment of embryos for family building is frequently – although not invariably – the least-favoured alternative* chosen by couples with unused embryos, and is actually chosen by few couples.

Reported intentions are different than actual behaviour relative to relinquishment. While some researchers (eg, Bangsbøll et al, 2004; Laruelle and Englert, 1995; Lyerly et al, 2006; Mohler-Kuo Zellweger et al, 2009), indicated moderately high levels of support for relinquishment among those with unused embryos *in principle* (29%, 39%, 28%, and 52%, respectively), most reports indicate that fewer than 10% of patients with unused embryos actually relinquish them to other couples for family building.

How the embryo is conceptualised is a major determining factor in the decision relative to relinquishment for family building. For most couples, their personalised conceptualisations of their unused embryos have more salience in regard to their disposition decision than abstract philosophical or religious beliefs about the intrinsic sanctity of embryos *per se* (Bangsbøll et al, 2004; Burton and Sanders, 2004; de Lacey, 2005, 2007b; Fuscaldo et al, 2007; Hammarberg and Tinney, 2006; Klipstein et al, 2001; Laruelle and Englert, 1995; Lyerly et al, 2006, 2010; McMahan et al, 2000, 2003; McMahan and Saunders, 2009; Melamed et al, 2009; Mohler-Kuo et al, 2009; Nachtigall et al, 2005, 2009; Newton et al, 2003, 2007; Oke et al, 1998; Provoost et al, 2009; 2010; Van Voorhis et al, 1999; Zweifel et al, 2007).

Two key aspects impacting couples' disposition decisions are their perception of the embryos first as their 'virtual' or 'future' children and second, were the embryos to become children, as the full genetic

Table 3. IVF patients' decisions regarding disposition of unused cryopreserved embryos

Authors, year of publication	Location	Nature of study	Disposition decisions
Laruelle and Englert (1995)	Belgium	Disposition decision recorded during initial consultations with 200 couples about to undergo IVF.	78 (39%), relinquishment; 24 (12%), donation and experimentation; 38 (19%), experimentation; 60 (30%), discard.
Lornage et al (2005)	France	Questionnaires sent to 145 couples with embryos in store >12 months to compare initial disposition intentions with final decisions. Data reported relate to 124 couples for whom initial disposition intentions are recorded and for 136 couples for whom final decisions are recorded. NB there appears to be some discrepancy in data in this paper. Of the initial total of 145 patients, 'no information' was recorded for 21 couples at initial decision stage ($n = 124$). However, 'no information' was recorded for only nine couples in respect of the final decision ($n = 136$). Therefore, information is included for 124 patients in respect of initial decisions, but for 136 in respect of final decisions.	Initial intentions: 58%, own use; 1.6%, research; 25.8%, relinquishment; 14.5%, discard. Actual decisions: 54%, own use; 7.4 %, research; 17.6%, relinquishment; 20.6%, discard. Eight of the 32 couples who initially planned anonymous relinquishment subsequently changed their mind.
Saunders et al (1995)	Australia	Written request for information on disposition decision sent to 438 couples who had undergone IVF and had embryos in store 3–10 years. In total, 229 responded (52%)	132, continued storage; 39 (17%), initially considered relinquishment (of whom only 8 [3.5%] decided to do so; 11 discarded or donated to research [4.8%], and 20 were unable to decide [8.7%]) NB unclear what the remaining 58 respondents decided.
Syrop et al (1995)	USA	In total, 200 patients with cryopreserved embryos in storage > 2 years asked about dispositions decisions at the end of the 2 year period. Ninety-two responded (46% response).	17 (18%), discard; 10 (11%), research; 18 (20%), anonymous relinquishment; 47(51%), continued storage.

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Cooper (1996)	USA	Clinic follow-up of 107 couples with embryos in storage for >2 years to ascertain current disposition decisions. Eighty-five couples (79%) responded.	48%, continued storage; 19%, own use; 13%, research; 12%, discard; 4%, transfer to another clinic; 5%, relinquishment (four couples, two of which subsequently changed their minds). During initial consultations, 'many' couples opt to relinquish their unused embryos but the study showed a 'dramatic change of heart by most couples' (page 205). But actual numbers regarding initial intentions are not provided.
Hounshell and Chetkowski (1996)	USA	Clinical review of disposition decisions made by 83 couples in respect of 98 cryopreserved embryos in store for 5–7 years.	71 (72%), own use; 17 (17.4%), discard; 4 (4.1%); relinquishment; 6 (6.1%), continued storage in absence of disposition decision. In consent form signed at time of treatment 6/17 couples who discarded had indicated relinquishment in the event of death of the partners.
Shelden et al (1997)	USA	Retrospective analysis of disposition decisions made by 576 patients with 3,665 cryopreserved embryos in a single centre between January 1988 to December 1996.	62%, own use; 113 (3.1%), transferred to other centres; 124 (3.3%), donated for research; 26 (0.7%), discard; 33, lost contact; 1,149, continued storage.
Oke et al (1998)	Australia	Registered letter sent to >400 couples with embryos in store 5–10 years to ascertain disposition decision. Analysis based on 104 questionnaires and 50 counselling interviews.	5%, relinquishment; 50%, discard; 5%, continued storage; 30%, no reply/untraceable/could not make a decision; 10%, own use; 5, private burial of embryos (NB #, not percentage).
Schnert and Chetkowski (1998)	USA	Retrospective review undertaken of embryo disposition decisions made by 89 couples and single women with embryos in storage on average 30 months since treatment cycle.	52 (55.3%), own use; 26 (27.7%), continued storage; 5 (5.3%), discard; 11 (11.7%), relinquishment.
Darlington and Matson (1999)	Australia	Letter sent to 170 patients with cryopreserved embryos in store following IVF to remind them of the 3 year statutory storage period and to enquire about disposition decision. Responses received from 154 patients (91%).	96 (62%), continued storage; 10 (6.5%), relinquishment; 14 (11.6%), own use; 32 (20.8%), discard; 2 (1.3%), export.

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Van Voorhis et al (1999)	USA	Correspondence with 365 IVF patients with embryos cryopreserved >2 years to determine disposition intentions. Seems like 100% response rate.	40 (11%), anonymous relinquishment; 2 (1%), relinquishment to known recipient; 161 (44%), continue storage; 125 (34%), discard; 37 (10%), research.
McMahon et al (2000)	Australia	Interviews with 75 mothers with at least one child aged 5 years following IVF and with cryopreserved embryos in storage to ascertain disposition decision.	Of the 25 participants who had already used at least some of their stored embryos: 18, own use; 3, anonymous relinquishment; 2, research; 3, discard.
Oghoetuoma et al (2000)	UK	Letter sent to 359 IVF patients with embryos in store > 5 years at a private clinic (160) and an NHS hospital (199) to ascertain disposition decisions at completion of statutory storage period. In total, 182 patients responded – 48 from private clinic (30%) and 134 from NHS hospital (67%).	Private clinic: 10%, continued storage; 38%, discard; 21%, research; 23%, relinquishment; 8%, continued storage + own use NHS hospital: 43%, continued storage; 26%, discard; 21%, research; 7%, relinquishment; 3%, continued storage + own use.
Brzyski et al (2001)	USA	Review of embryo disposition decision of 11 patients with unused embryos expressing interest in relinquishment.	3, discard; 1, no decision; 4, relinquishment; 3, in process of relinquishment. Embryos of all 7 relinquishing patients created using donor oocyte.
Klipstein et al (2001)	USA	Retrospective chart review of 385 couples' disposition decisions in the event of divorce or death of one or both partners made when undergoing first IVF cycle to ascertain gender differences.	In the event of death of the female: 22%, relinquishment; 59%, discard; 18%, use by male's new partner; in the event of death of the male: 9%, relinquishment; 32%, discard; 58%, use by female; in the event of death of both partners: 35%, relinquishment; 64%, discard; in the event of divorce: 17%, relinquishment; 58%, discard; 22%, use by female; 1%, use by male's new partner.

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Klock et al (2001)	USA	Study of 91 couples who had had IVF but were not still in treatment and had embryos in store after the 3 year storage deadline to ascertain disposition decisions. 52 couples responded (57%).	17 (33%), discard; 7 (13%), relinquishment; 5 (10%), research; 15 (29%), continued storage; 6 (12%), own use; 2 (4%), unable to make a decision. Current disposition decision compared to earlier planned disposition decision for 41 couples. Only 12 (29%) maintained their initial disposition choice: 13/22 couples initially opting for discard now wished to use or donate their embryos [NB authors do not distinguish between use and donation]9/11 couples initially opting for relinquishment no longer wished to do so (2, own use; 2, discard; 3, continued storage; 2, research) 7/8 couples initially opting for research decided to use them or to discard them.
Moutel et al (2002)	France	Retrospective analysis of quantitative data collected by 17 storage centres over a 5-year period and qualitative study regarding the fate of cryopreserved embryos.	51% of couples with cryopreserved embryos untraceable; 23.6%, continuing storage; 12%, donation to medical research; 9.1%, relinquishment; 7.2%, no information.
Boada et al (2003)	Spain	Written questionnaire sent to 312 couples with frozen embryos in current cycle to enquire about disposition decision; 155 responses (48.6%). In Spain neither donation for research nor destruction are permitted.	120 (77.4%), own use; 16 (10.3%), own use or relinquishment; 10 (6.5%), relinquishment; 6 (3.9%), declined own use or relinquishment; 3 (1.9%), disagreement between couple.

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Hoffman et al (2003)	USA	Nationwide survey of all 430 ART practices in US in January-April 2002. Responses from 340 clinics; 90 practices did not respond and unstated number of clinics indicating that they did not store embryos – 85% response rate - 396,526 embryos in store as of April 2002.	349,830 (88.2%), own use; 8,840 (2.2%), discard; 11,238 (2.8%), donation to research; 752 (0.19%), quality assurance; 9,225 (2.3%), relinquishment; 13,878 (3.5%), other (13 different categories – eg, lost contact with patient, patient died, embryo abandoned, waiting for shipment out, donate to research or relinquish, embryology training, waiting 7 years to discard, wishes not specified on permit/no permit, divorce of parties – awaiting final decision, awaiting transfer to long-term storage).
Kovacs et al (2003)	Australia	Retrospective audit of disposition decisions made by 1,246 couples with cryopreserved embryos over a period of 11.5 years. Subgroup of 596 couples storing embryos following legislative change in 1998 to limit embryo storage to 5 years maximum.	89.5%, discard; 10%, relinquishment; NB of the subgroup; 88%, discard; 1%, undecided; 11%, relinquishment.
McMahon et al (2003)	Australia	Questionnaire sent to 509 couples with embryos in store 3 months to 12 years to ascertain attitudes towards donation of embryos for research; 152 women (30%) and 123 male partners (24%) responded.	80%, 'inclined to think of embryo as a potential child' (51% – definitely); 10%, probably donate to research; 34%, possibly donate to research; 56%, very unlikely to donate to research.
Newton et al (2003)	Canada	Postal questionnaire to ascertain IVF patients' reasons for not claiming unused embryos in store for 3–8 years and their attitudes towards relinquishment. Fifty-one couples from an initial pool of 105 were successfully located. Forty-one agreed to participate – 36 women and 31 men returned questionnaires (68%).	Success in achieving family goals the major reason for not claiming stored embryos 73%, moderately or completely agreed with relinquishment; 12%, 'definitely consider' relinquishment if programme available; 18%, might consider conditional relinquishment (ability to exercise some choice in respect of potential recipients).

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Bangsbøll et al (2004)	Denmark	Questionnaire sent to 284 couples who had IVF/ICSI whose cryopreserved embryos were destroyed because the cryopreservation period exceeded the legislative limit of 24 months to ascertain reasons for not using embryos and their attitudes towards potential embryo donation for specific purposes. 207 couples responded (74%).	Levels of agreement to concept of: 60%, donation for infertility research; 57%, donation for stem cell research; 49%, donation for stem cell treatment; 29%, relinquishment.
Burton and Sanders (2004)	Australia	Anonymous questionnaire sent to 235 couples who had embryos in storage for between 9 and 38 months to ascertain attitudes to embryo donation for research; 126 couples responded (57%).	29%, research to improve IVF; 27%, stem cell research; 15%, relinquishment.
Cattoli et al (2004)	Italy	Letter sent to 855 couples with cryopreserved embryos who had been out of contact with clinic for >2 years to enquire about disposition decision. 612 responded (72%).	34.2%, discard; 42.7%, extend storage; 12.3%, embryo transfer; 2.6%, research; 8.3%, relinquishment.
Elford (2004)	Canada	Retrospective case review of disposition outcomes of 782 cryopreservation cases with embryos stored for between 1 and 11 years.	60%, own use; 26%, extend storage; 8%, discard; 5%, research; 1%, anonymous relinquishment.
de Lacey (2005)	Australia	Interviews with 12 couples and 9 women who had initially agreed to relinquish their embryos at the commencement of IVF, but who subsequently discarded them following treatment, 6–17 months following embryo disposal.	Initial decision to relinquish embryos described as an 'idealistic plan' rather than a 'purposeful decision'. Change of disposition decision due to a change in (i) circumstances from a childless couple to parents and (ii) symbolism of the embryo from representing a chance to become pregnant to representing a 'virtual' child and embryo relinquishment as child relinquishment.
Nachtigall et al (2005)	USA	Ethnographic qualitative interview with 58 couples who had conceived using a donor egg and who had at least one embryo in storage.	72% had not reached a disposition decision. Of the 16 couples reaching and acting upon a disposition decision: 2, own use; 7, research; 5, discard; 2, relinquishment.

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Authors, year of publication	Location	Nature of study	Disposition decisions
Lyerly et al (2006)	USA	Semi-structured in-depth interviews with 53 individuals (31 women, 8 men, 7 couples) participating in IVF programmes, at four stages in IVF – those who had: (i) not yet undergone IVF or were early in the IVF process – no pregnancy (5 individuals/couples); (ii) undergone IVF and had achieved pregnancy with fresh or frozen embryos (21 individuals/couples); (iii) undergone IVF and had not achieved pregnancy (13 individuals/couples); (iv) embryos in storage >5 years (7 individuals/couples).	33 individuals/couples (68%) expected to use some embryos for own use; 18 (39%), willing to donate for research; 13 (28%), willing to relinquish; 4 (8%), willing to discard; 16 (34%), undecided.
de Lacey (2007b)	Australia	Interviews with 33 patients (9 women and 12 couples) who discarded embryos and 15 (7 women and 4 couples) who relinquished embryos.	'Adoption', 'tissue donation', and 'pregnancy termination' metaphors influential in disposition decisions. Participants discarding embryos emphasised adoption metaphor, while relinquishing participants emphasised pregnancy termination. Each group's decision was driven by consideration of the least-acceptable option.
Fuscaldo et al (2007)	Australia	Individual, couple, or group interview with 42 people (9 male-female couples, 2 men, and 22 women) who had completed IVF treatment and had cryopreserved embryos approaching the legal storage limit of 5 years.	Four main reasons given for deciding against relinquishment: (i) belief held by many participants that child resulting from relinquishment would still be 'my child', and also 'belong to my whole family'; (ii) strong emotional tie with any children born as result of relinquishment; (iii) responsibilities to children born as result of relinquishment; (iv) concern about future welfare of children born from relinquishment – including how child might be raised and by whom.

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Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Newton et al (2007)	Canada	Exercise to contact 232 couples who had undergone IVF and had not returned for cryopreserved embryos in store for over 5 years to examine changes in embryo disposition preferences and the relevance of a two-stage process for obtaining consent; 209 couples (90%) were located and a current mailing address was confirmed. Two couples provided a telephone directive requesting continued storage. Of the remaining 207 couples, 142 provided an updated directive (69% response rate).	Initial disposition decision: 35 (24%), discard; 94 (65%), research; 15 (10%), no decision; final disposition decision: 64 (45.1%), discard; 47 (33.1%), research; 18 (12.7%), relinquishment; 15 (10.6%), continue storage.
Zweifel et al (2007)	USA	Qualitative and quantitative interview with 45 couples donating embryos to stem cell research following IVF treatment to assess information needs and decision making.	20% of embryos created with donor gametes; 53% of respondents viewed embryos as 'completely different' from children (5% as 'identical' and 42% as 'somewhere in between'); 31% and 27% considered embryo donation 'identical' to organ and blood donation, respectively (and 24% and 29% respectively as 'completely different'); 49% uncomfortable with idea of having 'unknown genetic children somewhere in the world'; 22% concerned about having unidentified biological siblings to their own children and potential complications, eg consanguinity; 22% felt discomfort at the thought of someone else raising their biological child; 9% initially wished to anonymously relinquish embryos, but donated to stem cell research instead after learning that there was an insufficient number of embryos to relinquish.

(Table continues on next page)

Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
McMahon and Saunders (2009)	Australia	Anonymous postal questionnaire sent to 283 couples with cryopreserved embryos in storage for 3 or more years to ascertain (i) intention to relinquish embryos for family building; (ii) attitudes toward conditional relinquishment; (iii) extent to which conditional relinquishment would influence decision making; 99 women (35%) and 66 male partners (23%) responded.	4%, likely to relinquish; 48%, thought providers should be able to specify characteristics of recipients; 41%, more likely to relinquish under conditional relinquishment arrangement.
Melamed et al (2009)	Brazil	Interviews with 22/50 female patients who had undergone successful IVF cycles, and had cryopreserved embryos in storage 6 months and 3 years to explore the disposition decision-making process, seeking views on options for the embryos' destination, and the factors that influence these decisions (44% response).	Options chosen for frozen embryos (22 patients to 29 answers): 9 (31.1%), continued storage; 9 (31.1%), research; 7 (24.1%), discard; 3 (10.3%), relinquishment; 1 (3.4%), unable to make decision; NB each participant able to give more than one response.
Mohler-Kuo et al (2009)	Switzerland	Questionnaire to 888 couples with at least one embryo in store (and who potentially had to make disposition decision in the near future) to ascertain attitudes toward embryo disposition and views on the status of the embryo; responses from 458 men (52%) and 468 women (53%).	52% supported concept of relinquishment (although illegal in Switzerland).
Provoost et al (2009)	Belgium	Semi-structured interviews with seven couples and 11 female patients at varying stages of IVF/ ICSI to ascertain patients' perceptions of their embryos and to investigate relationship between patients' narratives and disposition preferences.	All but two participants spontaneously considered embryo disposition options as a two-stage decision sequence: (i) relinquishment – presence of the themes 'genetic link' and 'symbol of the relationship' linked with clear reluctance to relinquish; (ii) options of donation for research and discarding considered. At this stage, participants' confidence in medical science and the instrumental value they attached to the embryo were related to their decisions.

(Table continues on next page)

Table 3 (continued)

Authors, year of publication	Location	Nature of study	Disposition decisions
Lanzendorf et al (2010)	USA	Retrospective review of patient records involving 149 embryo disposition requests to discontinue storage.	38%, discard; 59%, research; 3%, relinquishment (four to known recipient; two to anonymous recipient).
Lyerly et al (2010)	USA	Self-administered questionnaire sent to 2210 patients with cryopreserved embryos in storage to ascertain disposition intentions. 1,020 patients responded (46%).	54%, very likely to use embryos for own use; 21%, very likely to donate for research; 6%, very likely to discard; 7%, very likely to relinquish; 4%, very likely to store indefinitely; 7%, very likely to place embryos in woman's body at infertile time; 7%, very likely to hold disposal ceremony.
Nachtigall et al (2010) [NB Nachtigall et al (2009) earlier report of same study]	USA	Series of three qualitative interviews with 110 women and 74 men from 106 families who had children following IVF and had stored embryos for average of 5 years and about which they had not made a disposition decision at the time of recruitment.	By the end of the study: 26 families (24%), extend storage indefinitely; 42 (39%), research; 6 (6%), own use; 7 (7%), relinquishment; 3 (3%), discard; 22 families (21%) still had not made a disposition decision.
Paul et al (2010)	USA	Semi-structured email interviews with 18 couples and 7 wives who had relinquished embryos via an embryo adoption agency.	Dominant findings relating to disposition decision included: unwillingness to destroy potential child/sibling to existing children; responsibility for future care of child conceived following embryo relinquishment; least worse option.

siblings of their children. However, where a disposition decision has to be made, such conceptualisations impact parental disposition decision in one of two contradictory ways:

- (1) many couples who perceive their embryos as their virtual or future children or who have conceived children themselves appear less likely to consider relinquishing unused embryos to facilitate the building of someone else's family – a decision they liken to relinquishment of a child for adoption (see de Lacey, 2005; McMahon and Saunders, 2009; Melamed et al, 2009; Nachtigall et al, 2009; Roberts, 2007; Zweifel et al, 2007). Personalised conceptualisations of embryos have been identified as associated with a constellation of key factors that contra-indicate relinquishment for family building:

- (a) the inconceivability of giving their own kin to another family,

- (b) perceived responsibility for the future well-being of their embryo(s) – including concerns about the adequacy or suitability of alternative caretakers,
 - (c) concerns relative to lack of knowledge about any children born from the relinquished embryos and lack of involvement in their life,
 - (d) concerns regarding the separation of their own children from full genetic siblings reared in another family, and
 - (e) fears associated with future contact between siblings and establishment of a romantic relationship with each other in ignorance of their genetic relationship.
- (2) Contrarily, Elford et al (2004) describe the decision of 11 couples in their study to anonymously relinquish their embryos as being based on a reluctance to discard what they considered to be their ‘unborn children’. Participants in Paul et al’s (2010) study who had relinquished embryos via an embryo adoption agency perceived their embryos as potential life, potential siblings to their own children, to whom they felt compelled to give a chance of life – and with whom they looked forward to future contact.

Newton et al. (2003: 883) found that patients most likely to relinquish embryos held views ‘more congruent with a model of ‘embryo adoption’ than with a model of traditional medical donation’ (ie, perceptions relating to the future welfare of their embryos, including concerns that they were going to ‘suitable’ recipients and that any child born would be well cared for).

DISCUSSION: A SUGGESTED MULTI-MODEL APPROACH TO EMBRYO RELINQUISHMENT

The ASRM’s endorsement of a ‘one-size fits all’ model of embryo relinquishment that equates it with (its own version of) gamete donation appears to us an oversimplification of what is conceptually complex, perpetuating a profession-dominated service ethic that pays scant regard to patient-centred care (Little et al, 2001; Mead and Bower, 2002; Ontario Medical Association, 2010; Stewart, 2001). The exclusive use of the model of gamete donation promoted by the ASRM fails to acknowledge the perceptions and motivations of the creators of the embryo as key differentiators between gamete donation and embryo relinquishment. In the case of sperm and oocyte donation, donors’ participation from the outset is predicated on their intention to assist the family-building efforts of someone else, and not to engage in their own parental project. Contrarily, embryos available for relinquishment are the by-product of a determined parental project on the part of

those who created them, after which they could be faced with no ideal final options, to destroy life or give away their own potential children to someone else. This element situates the embryo in a different 'place' and kinship relationship for individuals relinquishing their embryos than those who donate their gametes to others.

Underlying many concerns about terminology lie fears of elevating the status of the embryo to personhood and the consequent risk of entanglement in abortion politics – and which have been articulated especially in the USA. However, it seems eminently possible that practices and procedures to protect children who would not exist save for collaborative reproductive efforts, such as embryo relinquishment, can be promoted without at the same time affording embryos a high, protected status that could adversely impact women's right to choose (Collard and Kashmeri, 2009). Indeed, the implications of the emerging evidence regarding embryo relinquishment have not been lost on some service providers and commentators. For example, Newton et al (2003: 883) acknowledge that:

Rather than preferring an anonymous, disinterested gift, typical of tissue and organ donation, individuals in our study who were willing to consider [embryo relinquishment], wanted to be part of a potential child's life in terms of providing information about themselves that might be important to the child, and were more open to some form of future relationship with the child.

Similarly, de Lacey (2005), Fuscaldo and Savulescu (2005), Fuscaldo et al. (2007), Kovacs et al. (2003), MacCallum (2009), McMahan and Saunders (2009), and Nachtigall et al. (2010) proposed known, 'open', or 'directed' embryo relinquishment more in line with some adoption programmes, as a means of promoting embryo relinquishment through 'metaphorically re-framing' (de Lacey, 2005). However, de Lacey observed that 'discursively, embryo donation sits somewhere between adoption and tissue donation. There is a need for further research to explore the cultural meaning of relinquishing/donating an embryo for gestation within a social context where genetic relationship is a dominant discourse' (de Lacey, 2005: 1668).

The concept of embryo adoption *per se* re-ignites previous debates concerning the extent to which adoption – or at least the model of 'stranger' infant adoption practised in the West – can be applied to gamete donation. A medical model of gamete transfer is focused exclusively on achieving a pregnancy for the recipient in which the relinquished tissue is perceived as no more than a 'bundle of cells' that is often transferred anonymously, the donor as having no on-going interest in the outcome of her or his donation, and the donor-conceived individual as a *tabula rasa* whose identity and sense of being are shaped by the family in which he or she is raised. Contrarily, a psychosocial model of gamete transfer locates it firmly as

a method of family building, in which donors may well have an interest in the outcome of their donation (Crawshaw et al., 2007; Daniels et al., 2005) and in which those who are donor conceived, much like adopted people, have an interest in their genetic, as well as their social, origins (Paul and Berger, 2007).

At the same time, for those experiencing fertility difficulties, adoption, gamete donation, and embryo relinquishment may be perceived as more or less interchangeable forms of family building, the route actually followed as much a result of opportunity or serendipity as of rational decision making. Within this context, at least some elements of adoption policy and practice may be considered relevant to gamete donation (Blyth et al, 2001; Crawshaw, 2002).

Indeed, the conventional model of gamete/embryo donation, in which it is assumed that donors have no interest in the outcome of their donation, that donor and recipient(s) and donor and offspring will remain anonymous to each other, and that offspring will have little information about the nature of their conception, or of their donor or other genetic relatives is subject to increasing challenge, based at least in part, on the experience of adoption. In some jurisdictions, embryo relinquishment, sharing some elements of 'embryo adoption' practice, is accommodated within existing provisions for gamete donation that enable offspring to access identifying information about both their conception and genetic relatives (Blyth and Frith, 2009). Elsewhere, in the absence of a legislative mandate, some fertility clinics and service providers have established donor programmes that facilitate information disclosure, such as the Sperm Bank of California's Identity Release® Program (Sperm Bank of California, 2010). Additionally, families built using donor conception have taken into their own hands the pursuit of information exchange, most successfully exemplified by the internet-based Donor Sibling Registry that has helped connect more than seven thousand half-siblings (and/or donors) (DSR, 2010).

CONCLUSIONS

The reality is that both embryo donation and embryo adoption are likely to continue to operate as alternative systems to facilitate the relinquishment of unused embryos for family building. Despite a steadily accumulating evidence base, this review has indicated that ambiguous and contradictory elements remain as regards disposition decision making warranting further systematic study, particularly in diverse cultural contexts.

In our view, there is no compelling case to justify the pre-eminence of a single model for embryo relinquishment. A dual or even multi-model

system is preferable that takes account of the diversity of contemporary societies, maximising choice for both those with unused embryos and potential recipients – which a single model would invariably restrict. The views of individuals with unused embryos indicate that it is possible to conceive of unused embryos as ‘unborn children’ and as ‘unborn siblings’ of existing children and yet permit their destruction or endorse a woman’s right to terminate a pregnancy, thus avoiding adversely impacting women’s right to choose and embroilment in abortion politics. The research evidence base suggests that for the majority of couples in the sample populations, the key to disposition decision making is their kinship relationship with their embryo, rather than ideological or religious perceptions of the status of the embryo *per se*. And while we have no wish to minimise acknowledgement that such a choice is a *hard* choice, it is, nevertheless, not an *impossible* choice. Thus, a ‘right-to-choose’ approach – the right of relinquishing couples to dispose of unused embryos as they see fit and the right of recipients to receive relinquished embryos for family building that does not impact on others’ rights to choose – seems to us the most appropriate way forward in principle for maximising acceptable disposition options for otherwise unused embryos.

However, there is in our view a clear merit inherent in the embryo adoption model that does not apply to embryo donation in many jurisdictions where it is practised. That is the explicit focus in the former on considering the potential interests of the individual conceived and especially where conception has resulted from the involvement of a third party, rather than merely as a clinical procedure designed to achieve a pregnancy. Some jurisdictions have introduced provisions requiring account to be taken of the interests of individuals conceived as a result of assisted reproductive procedures (Blyth, 2007) and of the interests of individuals conceived as a result of third party-assisted conception procedures in accessing information about their biographical and genetic history (Blyth and Frith, 2009). Universal application and extension of such measures would go some way towards ensuring adequate protection of the interests of those whose very existence results from assisted conception procedures.

NOTES

¹While Jain and Missmer (2008) found that 56% of American female infertility patients approved of the sale of embryos for family building, even in the USA where commercial procurement of *gametes* is the norm, payment for *embryos* is rare: 95% of programmes responding to Kingsberg et al (2000) study claimed not to offer financial compensation for embryo relinquishment.

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