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Article Title: Parenting and child development in families with a child conceived through embryo donation.

Year of publication: 2007

Link to published version: <http://dx.doi.org/10.1037/0893-3200.21.2.278>

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PARENTING AND CHILD DEVELOPMENT IN FAMILIES WITH A CHILD
CONCEIVED THROUGH EMBRYO DONATION

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We would like to thank the clinics that recruited the participating assisted reproduction families including Sheffield Fertility Centre, Manchester Fertility Services, the Assisted Conception Unit at St James's Hospital, and especially the staff at Bourn Hall Clinic. We would also like to thank Bedfordshire, Hertfordshire, and Surrey Social Services for their help in contacting adoptive families.

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Abstract

Concerns have been raised regarding the potentially negative effects of conception using donated embryos on parenting and child development. Findings are presented of an exploratory study of families with a child conceived through embryo donation. Twenty-one embryo donation families with a child aged 2-5 years were compared with 28 adoptive families and 30 *in vitro fertilisation* (IVF) families on standardized interview and questionnaire measures of the parents' marital and psychological state, the quality of parent-child relationships and the child's development. The differences indicated higher emotional over-involvement and defensive responding in the embryo donation families, along with greater secrecy about the child's origins. The children themselves were not at increased risk of psychological problems. The study provides interesting but preliminary findings on parent-child relationships and child development in a new family form.

Keywords

Parent-child relationships; social and emotional development; embryo donation; adoption; *in vitro fertilisation*

Introduction

In 1978, a new era of human reproduction was introduced when the first baby conceived through *in vitro fertilisation* (IVF) was born (Steptoe & Edwards, 1978). Subsequent developments in reproductive medicine have led to the creation of new family forms, making possible the dissociation of genetic, gestational and social aspects of parenting. One such technique is embryo donation, where a donor embryo is transferred to a woman with the intention that she and her partner will raise the resulting child. This treatment can be recommended either when both members of the couple are infertile, or when previous attempts at IVF using the couples' own genetic embryos have been unsuccessful. In the majority of cases, the embryos used had originally been created by another couple in their own attempts at conception through IVF. Thus, the recipient couple will parent a child that is genetically that of the donor couple; a situation structurally similar to adoption. Unlike in adoption, however, embryo donation parents experience the pregnancy and birth of the child.

Concerns have been raised regarding the effect of conception through embryo donation on family functioning and child development. Attachment theory claims that the crucial factor influencing a child's social and emotional development is the parent-child relationship in the early years, and specifically the child's attachment to the parents (Bowlby, 1988). The nature of this attachment is related to the quality of parenting provided, particularly aspects such as parental warmth and sensitivity (Ainsworth, Bleher, Waters, & Wall, 1978). It is possible that the absence of a genetic link to the child will influence parents' feelings about the child, and consequently, the quality of parenting. From an evolutionary psychology perspective, it is argued that one of the paramount reasons why parents invest so much time and effort in their children is to ensure the continuance of their own genes (Bjorklund, Younger, & Pellegrini, 2002). Thus, non-genetic parents may be less

invested in their children, and behave less positively towards them, with subsequent negative consequences for parent-child relationships.

Research on other types of assisted reproduction using donor gametes is relevant here. In the case of donor insemination, the child is genetically related to the mother but not to the father who raises the child, whereas with egg donation the reverse is true. In particular, fathers have been predicted to be more distant towards a non-genetic child (Baran & Pannor, 1993). However, there is no evidence to suggest that either quality of parenting or children's psychological development is negatively affected by the absence of a genetic link between one parent and the child (Golombok, Lycett et al., 2004). Donor insemination fathers have been found to be as warm towards their child as are natural conception fathers (Golombok, Brewaeys et al., 2002). Similarly, egg donation mothers are able to form close relationships with their child (Raoul-Duval, Bertrand-Servais, Letur-Konirsch, & Frydman, 1994).

However, in embryo donation *both* parents lack a genetic relationship to the child, more closely resembling families who have adopted a child. Adoption research indicates that when adopted children are placed with a family at or close to birth, the situation most analogous to embryo donation, parent-child relationships are generally positive (Brodzinsky, Smith, & Brodzinsky, 1998). There is no difference in the security of mother-infant attachment between families with an early adopted child and non-adoptive families (Singer, Brodzinsky, Ramsay, Steir, & Waters, 1985), and adoptive parents show high levels of warmth and affection towards their child (Hoopes, 1982).

Adoptive parents generally start to disclose to the child the circumstances of their birth from a young age (Brodzinsky & Pinderhughes, 2002). In contrast, the majority of donor insemination and egg donation parents do not tell their child about the nature of their conception (Brewaeys, 2001; Murray & Golombok, 2003). There has been much concern about secrecy in donor conception, chiefly that non-disclosure will damage family

relationships (Clamar, 1989; Daniels & Taylor, 1993). The fact that embryo donation parents have a biological link to the child through gestation allows them to keep the non-genetic relationship from others and from the child, if they so desire (Widdows & MacCallum, 2002). In addition, embryo donors have, until recently in the UK, been anonymous. Although new legislation came into force in April 2005 which allows donor offspring access to the identity of the donors, this law does not apply retrospectively. A lack of available information on donors has previously been cited as a reason for non-disclosure by donor conception parents (Murray & Golombok, 2003; Nachtigall, Pitcher, Tschann, Becker, & Szkupinski Quiroga, 1997). Therefore, embryo donation parents may follow the pattern of other gamete donation parents in keeping the child's origins relatively private.

The presence of the gestational relationship in embryo donation may also affect the quality of parenting. Over the past 20 years, there has been increasing recognition that attachment between mother and infant begins before birth, with the mother forming a relationship to the foetus (Laxton-Kane & Slade, 2002). This prenatal attachment is important since it has been shown to be modestly but significantly associated with the postnatal attachment styles of infants (Muller, 1996). Thus, the experience of pregnancy could facilitate positive parenting in embryo donation families.

It has been suggested that conceiving a child through any form of assisted reproduction may affect parenting. Arguments include the notion that the emotional stress of infertility and its treatment could lead to dysfunctional parenting patterns (Burns, 1990), and that parents who have extreme difficulty conceiving may view their child as very precious or special, leading to the development of over-involved parenting attitudes (van Balen, 1996). Emotional over-involvement can be seen as a negative parenting trait, since it may produce children who do not develop age-appropriate autonomy and have elevated levels of anxiety (Thomasgaard & Metz, 1993). Studies of families with genetically related children conceived

by IVF have found generally good parent-child relationships (Golombok et al., 2002; van Balen, 1998). However, a tendency of some IVF parents towards over-protective and over-involved parenting has been observed (Gibson, Ungerer, Tennant, & Saunders, 2000; Golombok et al., 2002). Embryo donation parents may show similar raised levels of over-involvement, since they too undergo the experience of infertility and assisted reproduction.

A further possible consequence of assisted reproduction was seen in a study of IVF parents which assessed the levels of defensive responding, i.e. the extent to which parents were reluctant to report negative feelings about parenting (McMahon, Gibson, Leslie, Cohen, & Tennant, 2003). For IVF mothers, the level of defensive responding was related to the number of failed IVF treatment cycles, with higher levels of treatment predicting greater defensive responding. The trait of defensive responding may have negative consequences for children if it is indicative of a non-communicative family environment. Since embryo donation parents have often been through failed IVF treatments, they may show similarly high levels of defensive responding.

Extrapolating from previous research, there is little basis for expecting severe dysfunctions in embryo donation families. However, there is as yet little or no actual information available on parenting and child development in this new family form. The aim of the current investigation was to examine the experience of a sample of families with children conceived through embryo donation. These families were compared with a group of families with a child adopted in infancy, allowing an exploration of whether the gestational link results in more positive parenting in the embryo donation families. A second comparison group of families with a child conceived through IVF using the parents' own gametes was included to investigate whether there was an effect of the lack of genetic relationships in the embryo donation families. IVF families were studied in preference to natural conception families to control for the use of assisted reproductive technology and the accompanying

emotional stress. Patterns of disclosure to the child regarding their genetic origins were also assessed to examine whether embryo donation parents tend towards secrecy or openness.

Method

Participants

Embryo Donation (ED) families

Twenty-one families with a child conceived through the use of donated embryos were recruited through three fertility clinics in the UK. All two-parent heterosexual families with an embryo donation child aged 2-5 years at each of the participating clinics were contacted by letter (children born at less than 30 weeks gestation or with severe congenital abnormalities were excluded). Thirty-seven families were contacted and 29 families replied, giving a response rate of 72% of those whom it was possible to trace (since the couples had been treated up to 5 years ago, some had since moved). Due to confidentiality restrictions, no further information was available on those families who refused to take part. Fifteen of the participating families had singleton children and six had twins.

Adoptive (AD) families

The comparison group of adoptive families was obtained through three state adoption services in the UK. The inclusion criteria were that the child had been placed with the adoptive family at or below the age of 12 months, and was currently aged 2-5 years. Forty-one parents were contacted by a letter from the adoption agency and 28 agreed to take part, representing a response rate of 70%. All of the target children were singletons.

IVF families

The second comparison group of thirty families with a child conceived through IVF was obtained through one fertility clinic in the UK. Inclusion criteria were that the child had been conceived using the parents' own gametes and was currently aged 2-5 years. The same exclusion criteria were applied as for the embryo donation families. Thirty-five families were

contacted giving a response rate of 86%. Nine of the participating families had twins and the remainder had singleton children.

Demographic Characteristics

There were similar proportions of boys and girls in each group and the age of the target child did not differ between groups ($M = 42$ months). However, there was a significant group difference in the age of mothers, $F(2, 76) = 9.09, p < .001$. The ED mothers were the oldest ($M = 43$ years) and the IVF mothers were the youngest ($M = 37$ years), with the adoptive mothers in between ($M = 40$ years). There was also a significant difference between groups in the length of time for which couples had been trying to start a family before succeeding, $F(2, 76) = 16.40, p < .001$. The ED families had been trying for the longest ($M = 15\frac{1}{2}$ years), with the means for the adoptive and IVF groups being 12 years and 9 years, respectively.

No differences were found between the groups for marital status (1 ED couple and 3 IVF couples had divorced or separated), the family size, or the birth order of the child, with 67% of target children being the first-born. A group difference was found for social class, $\chi^2(6, N = 79) = 18.76, p < .01$, as measured by the highest-ranking occupation of either parent according to the Registrar General's classification (OPCS and Employment Department Group, 1991), ranging from 1 (professional) to 6 (unskilled). This difference represented a higher proportion of adoptive parents in professional occupations; 36% compared to 5% of ED parents and 7% of IVF parents, reflecting the relatively high SES of adoptive parents in the UK. The vast majority of parents in the study (95%) were of Caucasian origin.

Procedure

The study was approved by the ethics committee at City University, where the research team was then based. A research psychologist trained in the study techniques visited the families at home. Data were collected from the mother and father separately by tape-recorded interview and by questionnaire. The interview with the mother took 1-2 hours and the interview with

the father took 45-60 minutes. Interviews were conducted with 100% of mothers and 75 % of fathers. Fewer fathers than mothers were available for interview due either to work commitments (although evening interviews were conducted) or to a reluctance to discuss personal issues with a stranger. Questionnaire data were obtained from 86% of mothers and 75% of fathers. The groups did not differ with respect to the proportions of fathers who took part, or the proportions of mothers or fathers who completed questionnaires.

Measures

Parent's Marital and Psychological State

Quality of Marriage. The quality of the marital relationship was assessed both by interview and by questionnaire. A rating of *marital level* was made from the interviews for each parent separately using a standardized procedure for which predictive validity with marital breakdown has been demonstrated (Quinton & Rutter, 1988; Quinton, Rutter, & Rowlands, 1976). This variable was scored on a 6-point scale from 1 (marriage/cohabitation positive source of support and enjoyment) to 6 (history dominated by discord/breakdown, or failure to establish relationships), and represents an overall assessment of the quality of the relationship assessed from the couple's reported behaviours, feelings and attitudes. A Pearson product-moment inter-rater reliability coefficient for *marital level* was calculated at .58, based on randomly selected interviews coded by a second interviewer who was "blind" to family type, using data from a study running concurrently involving the same interview and the same researcher (Golombok, Murray, Jadv, MacCallum, & Lycett, 2004).

Both mothers and fathers also completed the Golombok Rust Inventory of Marital State (GRIMS: Rust, Bennun, Crowe, & Golombok, 1988; Rust, Bennun, & Golombok, 1990), a 28-item self-report measure of the quality of the marital relationship, with scores in the range of 30-33 representing 'average' marital satisfaction using norm-referencing standardization, and higher scores indicating poorer marital quality. The GRIMS has split-

half reliability of .91 for men and .87 for women, and has been shown to discriminate well between couples who are about to separate and those who are not.

Psychological Adjustment. Parents were administered the short form of the Parenting Stress Index (PSI/SF: Abidin, 1990), a standardised assessment of stress associated with parenting, with higher scores reflecting greater stress. A total score greater than 90 represents clinical levels of stress since it is in the 90th percentile of the normative group. Test-retest reliability for the total score over 6 months is .85. The short form correlates highly with the full-length version, and concurrent and predictive validity for the full-length PSI has been demonstrated. Parents completed the Trait Anxiety Inventory and the Edinburgh Depression Scale (Cox, Holden, & Sagovsky, 1987; Spielberger, 1983; Thorpe, 1993) to assess anxiety and depression, respectively. Both of these instruments have good reliability and discriminate between clinical and non-clinical groups, with higher scores representing greater difficulties. Scores of greater than 9 for the Edinburgh Depression Scale, and of 50 and above for the Trait Anxiety Inventory are considered to represent clinical problems, as compared to norms.

Quality of Parenting

The mothers and fathers were interviewed using an adaptation of a standardized interview developed to assess quality of parenting (Quinton & Rutter, 1988). Detailed accounts were obtained of the child's behaviour and the parent's response to it, with particular reference to interactions relating to issues of parental warmth and control. The interview procedure has been validated against observational ratings of mother-child relationships in the home, and has shown a high level of agreement between global ratings of the quality of parenting by interviewers and observers (Quinton & Rutter, 1988).

The following overall ratings of parenting quality were made for mothers and fathers separately according to strict coding criteria, taking into account all information obtained from the entire interview: (1) *expressed warmth* was rated on a 6-point scale from 0 (none) to

5 (high), and was based on the parent's tone of voice, facial expressions and gestures when speaking about the child, spontaneous expressions of warmth, sympathy and concern about any difficulties experienced by the child, and interest in the child as a person; (2) *emotional over-involvement* was rated on a 4-point scale from 0 (little or none) to 3 (enmeshed) and measured the extent to which family life and the parent's emotional functioning was centred on the child, whether the parent had interests or activities that were not related to the child, and the degree of over-concern or over-protectiveness shown towards the child. Reluctance to be separated from the child for short periods of time, and general ability to see the child as an individual with separate needs were relevant; (3) *defensive responding* was rated on a 5-point scale from 0 (not at all defensive) to 4 (extremely defensive), and was concerned with the degree to which the parent appeared defensive in response to questioning about the child or about family life. This was based on willingness to answer questions in the interview, and to admit to difficulties where they existed, as well as the general extent to which they appeared to be trying to present as the 'perfect' family; (4) *sensitive responding* was assessed for mothers only and was rated on a 5-point scale from 0 (none) to 4 (very sensitive) and assessed the mother's ability to recognise and respond appropriately to her child's fears and anxieties; and (5) *parent-child interaction* was rated on a 5-point scale from 0 (very poor) to 4 (very good) and measured how much the parent and child spent time together, enjoyed each other's company, and showed affection to one another. Inter-rater reliability coefficients for expressed warmth, emotional over-involvement, defensive responding, sensitive responding, and parent-child interaction for mothers, derived as above, were .65, .54, .58, .47 and .69, respectively, and the coefficients for expressed warmth, emotional over-involvement, defensive responding, and parent-child interaction for fathers were .82, .70, .64, and .59 respectively (Golombok, Murray et al., 2004).

Disclosure of method of family creation

Parents in all three groups were administered additional sections of the interview that focused on the extent of their openness about the method of family creation. Systematic data were obtained from mothers on whether or not the parents planned to tell the child about his or her assisted conception or adoption, and the parents' reasons for their decision regarding disclosure. The data were rated according to strict coding criteria derived from previous theory and investigations of disclosure in gamete donation families (e.g., Cook, Golombok, Bish, & Murray, 1995). Further details of coding categories are given in the results section.

Children's socio-emotional adjustment

The presence of behavioural or emotional problems in the children was assessed using the pre-school version of the Strengths and Difficulties Questionnaire (SDQ: Goodman, 1994, 1997) administered to mothers. The SDQ produces an overall score of the child's adjustment (*total deviance score*), along with four subscale problem scores: *hyperactivity*, *conduct problems*, *emotional difficulties* and *peer problems*. For each scale, higher scores represent higher levels of problematic behaviour. The SDQ has been shown to have good reliability, with correlations between parent and teacher total deviance scores reported to be .62.

Evidence for validity of the SDQ comes from the high correlations between the total deviance score and the total score of the Rutter Parent Questionnaire, $r = .88$ (Rutter, Tizard, & Whitmore, 1970), which was designed to assess child psychiatric disorder. In addition, the SDQ discriminates well between psychiatric and non-psychiatric samples.

Results

To investigate for group differences, multivariate analyses of covariance (MANCOVAs) were conducted individually for the parental variables relating to each of three constructs of interest (quality of marriage, parental psychological adjustment, and quality of parenting), with separate MANCOVAs for mothers and fathers. A MANCOVA was also carried out for child socio-emotional adjustment, using the SDQ sub-scale scores. The covariates were

mother's age and social class, since these demographic variables differed significantly between family types. Duration of infertility was not included as a separate covariate since it correlated highly with mother's age, $r = .73$ (when analyses were re-run replacing mother's age as a covariate with duration of infertility, the same results were obtained). Where a significant group difference was found, the following contrast analyses were performed on each variable within the MANCOVA to answer specific questions: (1) Embryo Donation vs. Adoptive Families [ED vs. AD] - this examined whether families where parents experience the pregnancy and birth of a child to whom they are not genetically related differed from families where the child was adopted in infancy; and (2) Embryo Donation vs. IVF Families [ED vs. IVF] - this examined whether families created by assisted reproduction with donated embryos differed from families created by assisted reproduction using the parents' own gametes. Bonferroni corrections were applied to these contrasts to account for multiple comparisons ($p < .025$). Power for each of the contrasts for a large effect size (0.8 sd) is .68. Where the family had twins, one twin was randomly chosen for data analysis to avoid bias associated with non-independence of measures. To check for the effects of individual children, all the analyses were re-run using the data relating to the other twin. The results from each of the analyses were the same and only the first analysis is reported here.

Parents' Marital and Psychological State

Separate MANCOVAs were conducted for mothers' and fathers' reports of the quality of marriage, using the *marital level* variable and the GRIMS score (see Table 1). Wilks's λ was not significant for either analysis, indicating no difference between groups for the quality of the marital relationship as reported by mothers or fathers. The mean GRIMS scores for all family types were in the ranges designated as representing 'good' or 'very good' marriages (Rust et al., 1988). For psychological adjustment, scores on the PSI, the Trait Anxiety Inventory and the Edinburgh Depression Scale, were entered into MANCOVAs separately

for mothers and fathers. As Table 1 shows, Wilks's λ was not significant for either MANCOVA, and none of the groups were obtaining mean scores in the clinical or 'problem' range for any of the three measures (Abidin, 1990; Spielberger, 1983; Thorpe, 1993).

Parent-Child Relationships

Mothers

The parenting variables (*expressed warmth, emotional over-involvement, defensive responding, sensitive responding, and mother-child interaction*) were entered into a MANCOVA and Wilks's λ was significant, $F(10, 142) = 2.39, p < .05$, indicating an overall group difference (see Table 2). Contrast analyses for the individual variables showed a significant group difference for *emotional over-involvement*, with embryo donation mothers rated as more over-involved than adoptive mothers [ED vs. AD], $t = 2.42, p < .05$, effect size = .93. However, embryo donation mothers and IVF mothers did not differ in terms of emotional over-involvement [ED vs. IVF]. Family types also differed significantly with respect to *defensive responding*, with embryo donation mothers showing higher levels of defensive responding than both adoptive mothers [ED vs. AD], $t = 2.81, p < .01$, effect size = .91, and IVF mothers [ED vs. IVF], $t = 3.70, p < .001$, effect size = 1.15. No significant contrasts were found for *expressed warmth, sensitive responding or mother-child interaction*, and the mean scores for these three variables for all family types were above the ratings designated as 'average' for this measure (Quinton & Rutter, 1988).

Fathers

The variables relating to parenting quality derived from the father's interview (*expressed warmth, emotional over-involvement, defensive responding and father-child interaction*) were entered into a MANCOVA. Wilks's λ was significant, $F(8, 98) = 2.16, p < .05$ (see Table 2). Contrast analyses for the individual variables found significant group differences for *emotional over-involvement*. Embryo donation fathers showed greater

emotional over-involvement than both adoptive fathers [ED vs. AD], $t = 2.72, p < .01$, effect size = 1.07, and IVF fathers [ED vs. IVF], $t = 2.69, p < .01$, effect size = 1.22. There was also a significant difference between family types for *defensive responding*, reflecting a greater level of defensive responding by embryo donation fathers than adoptive fathers [ED vs. AD], $t = 2.48, p < .05$, effect size = 1.12, but embryo donation fathers and IVF fathers did not differ significantly on this variable [ED vs. IVF]. Nor were there any group differences for *expressed warmth* or *father-child interaction*, and the means for these two variables for all three family types were higher than the ‘average’ ratings (Quinton & Rutter, 1988).

Children’s socio-emotional adjustment

The SDQ subscales of *hyperactivity*, *conduct problems*, *emotional difficulties*, and *peer problems*, were entered into a MANCOVA. Wilks’s λ was significant, $F(8, 118) = 2.48, p < .05$, indicating an overall group difference (see Table 2). Individual contrast analyses showed a significant group difference for *conduct problems*, with higher scores for adopted children than embryo donation children [ED vs. AD], $t = -2.47$, effect size = 3.35, but no difference between embryo donation children and IVF children [ED vs. IVF]. No significant contrasts were found for *hyperactivity*, *emotional difficulties*, or *peer problems*.

For the *conduct problems* subscale, a χ^2 analysis was used to test if a greater proportion of adopted children exceeded the cut-off for the SDQ, or if they were still within the normal range despite scoring higher than the other family types. Approximately 20% of children in a community sample would be expected to score above the borderline cut-off for each subscale (Goodman, 1997). The difference between groups was significant, $\chi^2(2, N = 66) = 9.35, p < .01$; a higher proportion of the adopted children (56%) were rated as showing conduct-related problem behaviours than were children from the other two groups (ED = 18% and IVF = 21%).

Disclosure of method of family creation

Embryo Donation Families

Of the 21 embryo donation families, only 2 (9%) had already told the child about the method of their conception, with 5 couples (24%) reporting that they were planning to tell the child in the future. Forty-three per cent ($n = 9$) had definitely decided that they would never tell the child, and the remaining 24% ($n = 5$) were undecided. In contrast, none of the adoptive and IVF families reported that they had decided against telling the child about the circumstances of their birth, $\chi^2(6, N = 79) = 56.31, p < .001$ (see Table 3). All of the adoptive parents had either already told the child or were planning to tell them (79% told, 21% planning to tell). Thirty per cent of the IVF parents ($n = 9$) had already told their child something of their method of conception, 63% ($n = 19$) were planning to tell, and 7% ($n = 2$) were undecided.

For those parents who had disclosed to their child or planned to do so in the future, their reasons for this decision were classified according to the following categories: i) child has a right to know, ii) to avoid accidental disclosure, and iii) no reason not to. Parents could give more than one reason, and each of these was rated. The most commonly cited reason for disclosure (given by 68% of disclosing parents) was a fear that the child would accidentally discover the fact at a later date. This was reported by 71% of embryo donation parents and 71% of adoptive parents, although by only 32% of IVF parents. Approximately half (46%) of all disclosing parents felt that the child had a right to know the truth. This was given as a reason for disclosure by 57% of embryo donation parents, 54% of adoptive parents, and 43% of IVF parents. In addition, 29% of embryo donation parents, 14% of adoptive parents, and 57% of IVF parents reported that there was no reason not to tell their child. Comparing the 'already told' group with the 'planning to tell' group, there were no differences in the reasons given in favour of disclosure. However, children who had already been told were significantly older ($M = 46$ months) than those whose parents intended to disclose at a later date ($M = 38$ months), $t = -2.93, p < .005$, suggesting that those who were planning to tell may have been waiting until their child was older.

Similarly, the reasons given for their decision by those who had decided against telling the child or were undecided, were coded into the following categories: i) to protect child, ii) to protect family relationships, iii) no need to tell, and iv) don't know what/how to tell. Both of the non-disclosing IVF parents (100%) and 64% of the non-disclosing embryo donation parents expressed a desire to protect the child from the possible negative consequences of disclosure. Forty-three per cent of the non-disclosing embryo donation parents expressed a concern that disclosure would damage family relationships, particularly between the parents and the child. The same proportion, 43%, reported that there was quite simply no need for disclosure. One embryo donation couple and one IVF couple stated that they were inclined towards non-disclosure due to uncertainty over how to tell their child. Comparing the 'uncertain' group with the 'not telling' group, there were no differences in the reasons given in favour of non-disclosure.

Discussion

The results of this study indicate that in some aspects the embryo donation families resembled adoptive families and/or IVF families, whilst in other aspects they differed from these family types. Embryo donation families did not demonstrate less positive parenting than IVF families, suggesting that a genetic bond is not essential for good parent-child relationships. In fact, contrary to the proposition suggested by evolutionary psychology theory (Bjorklund et al., 2002), neither the embryo donation families nor the adoptive families showed evidence of reduced investment in their non-genetic child. This replicates findings from previous research on gamete donation families, where no evidence has been found for poorer quality parenting from a non-genetic parent (Brewaeys, 2001; Golombok, Lycett et al., 2004). Since maternal warmth and sensitivity in the embryo donation families is high, it is unlikely that there will be negative consequences for attachment relationships (Ainsworth et al., 1978). The desire of embryo donation parents to become parents, and the

efforts they have made to achieve this, seems to result in a strong commitment to parenthood that can outweigh the potential drawbacks of genetic unrelatedness. The implication from this and previous research is that, for humans, the psychological and social rewards of parenting may be equally, if not more, important than the evolutionary benefits.

There was no evidence that the gestational link in embryo donation families resulted in more positive parenting than in adoptive families. This suggests that prenatal attachment is not an essential prerequisite for parent-child bonding. In line with this, previous studies of infant-adopted children in early childhood have found no dysfunction in attachment patterns or parent-child relationships (Hoopes, 1982; Singer et al., 1985). Further support comes from research on surrogacy families, where mothers who had not carried the pregnancy actually exhibited greater warmth and attachment-related behaviour towards their infants than did natural conception mothers (Golombok, Murray et al., 2004). For adoptive mothers and surrogacy mothers, the lengths to which they have gone to have a child imply a high commitment to motherhood. It is possible that the inability to carry a pregnancy is compensated for by other components of parenthood, such as the nurturing role of the mother or the opportunity to raise a much-wanted child with their partner.

With respect to specific aspects of parenting, both embryo donation mothers and fathers exhibited higher levels of emotional over-involvement than the adoptive mothers and fathers. Similar findings have been reported previously for mothers, but not fathers, of children conceived through assisted reproduction (Gibson et al., 2000; Golombok et al., 2002). The suggestion is, therefore, that emotional over-involvement may be associated with the experience of high-tech reproductive procedures, and to the bonds formed to the child during pregnancy. Support for this proposition comes from the finding that embryo donation mothers' levels of emotional over-involvement did not differ from those of IVF mothers, who had been through a similar sequence of infertility followed by high-tech assisted conception

followed by pregnancy. This result also implies that higher emotional over-involvement is not associated with the genetic links between parents and their children.

However, it should be noted that that embryo donation fathers showed more over-involvement than did IVF fathers. One possible explanation is that the increased extent of fertility treatment the embryo donation couples have experienced renders embryo donation fathers particularly vulnerable to developing over-protective or over-anxious parenting, once the much longer-for child arrives. Possibly, different processes are at work in the formation of over-involved parenting styles for fathers and mothers. In relation to over-involvement, it is important to note that previous research on assisted reproduction children has not found any evidence that parental over-protectiveness is related to increased risk of child adjustment problems (Gibson et al., 2000; Golombok et al., 2002). Furthermore the mean ratings for embryo donation parents in the current study represented moderate over-involvement rather than pathological levels. This difference is illustrated by the fact that an 'enmeshed' parent might refuse to be separated from the child at all, not let anyone else look after them for even short periods, and not allow the child to play with other children. A moderately over-involved parent, on the other hand, will go out without the child, albeit rarely, and will leave the child, but only with immediate family. Therefore, it appears that, having had such difficulty conceiving, perhaps the embryo donation parents simply wanted to spend as much time with their children as possible.

Embryo donation mothers were more likely to respond defensively when asked questions about their child and family life than were adoptive or IVF mothers. Embryo donation fathers showed similarly increased levels of defensive responding compared to adoptive fathers, although not to IVF fathers. Again, this could be related to the extent of treatment, in accordance with the finding of McMahon et al. (2003) that defensive responding in IVF mothers was associated with levels of treatment experienced. From this perspective,

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high levels of defensive responding in embryo donation parents may represent unwillingness to admit to problems, or a feeling that they have no right to feel frustrated with the child after such a struggle to conceive. Alternatively, it may be that greater defensive responding is a result of the social stigma still felt to be attached to embryo donation. Whereas adoption and IVF are seen as common routes to parenthood nowadays, donor conception is still relatively unusual. In addition, it is possible that parents who opt for embryo donation are generally more private, and more reluctant to discuss personal matters.

In line with this greater defensiveness, embryo donation parents were less inclined towards disclosing information about the method of family creation to their child, with only 33% of embryo donation parents having told or planning to tell. This contrasts sharply with the other family types, where all of the adoptive parents and over 90% of the IVF parents had already disclosed this information or intended to do so in the future. Embryo donation parents are following the pattern seen in earlier studies of gamete donation families (Golombok et al., 1999). However, a recent study examining donor conception parents of infants conceived between 1999 and 2001 found some evidence of a change in attitudes, with 46% of donor insemination parents and 56% of egg donation parents reporting planning to disclose to their child (Golombok, Lycett et al., 2004). It appears that embryo donation parents, who both lack a genetic link to the child, may be even more private about this issue than other types of donor conception families.

The most common reason given for non-disclosure was to protect the child either from the distress of discovering that he/she is genetically unrelated to both parents, or from the upset of not being able to discover any information about the donor. The same reasoning has been found consistently among non-disclosing donor insemination and egg donation parents (Murray & Golombok, 2003; Nachtigall et al., 1997), and may be particularly salient for embryo donation parents who have no information on the child's genetic background.

Another frequently cited reason for non-disclosure in previous studies was the protection of family relationships, especially between the non-genetic parent and the child (Cook et al., 1995; Golombok, Lycett et al., 2004). For embryo donation families, the fear is that disclosure would lead to the child rejecting both parents. Overall, embryo donation parents' attitudes towards disclosure closely resemble those of other donor conception parents, rather than following the adoption model. This may in part be due to the fact that, although it is mandatory for patients to be offered counselling prior to assisted reproductive treatment, couples referred to receiving little guidance from the clinic regarding disclosure. In comparison, the adoptive parents had discussed disclosure at length with social workers as part of the adoption process.

The increased secrecy of embryo donation parents does not appear to have adversely affected their children at this age, with no raised levels of emotional or behavioural problems seen. In addition to positive parent-child relationships, low levels of parental psychiatric disorder and marital conflict are conducive to healthy child psychological development (Cummings & Davies, 1994). Since there was no evidence of emotional or marital problems among embryo donation mothers or fathers, and they were providing high quality parenting, it is perhaps not surprising that embryo donation children do not appear to be at increased risk for psychological maladjustment. It must be remembered, however, that the children studied were very young, and problems may emerge later in life, particularly as children enter adolescence and issues of identity become more salient.

One major limitation of the study is the small size of the sample of embryo donation families, and the resulting low power of the analyses. To some extent, this was unavoidable since embryo donation treatment is still relatively uncommon compared to other forms of assisted reproduction, or to adoption. Therefore, there was a far larger population of IVF and adoptive families to draw from than there was of embryo donation families. The participating

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clinics were in different areas of the country, ensuring that the families were dispersed across regions in an attempt to recruit as representative a sample as possible, and the response rate for these families was moderate to high. However, it is not known whether the families who refused to participate were those who were experiencing problems. Small sample sizes inevitably lead to a reduction in the statistical power of any analyses conducted, but despite the low power figures for this study, significant differences between the family types were found. Given the small sample size, the magnitude of the effect sizes of the differences identified was reassuring.

In any investigation using parental self-report, particularly with those families who are concerned about negative attitudes surrounding their method of family creation such as donor conception, one must be aware of the potential for social desirability bias. This may partly account for the elevated levels of defensive responding seen in the embryo donation families. Observational data would have helped to combat this bias, but was not possible due to time constraints, and also due to the embryo donation parents' concerns regarding secrecy, which would have made them reluctant to allow assessments of this kind. Instead, multiple measures (standardised interviews and questionnaires) and more than one informant (mothers and fathers) were used. Confidence in the findings can be inspired by the fact that similar patterns were obtained from mothers and fathers. The variables derived from the interview were rated according to strictly defined coding criteria by an interviewer with several years experience of studies of this type.

The nature of the interview process, and the fact that parents were questioned about their infertility experiences, made it impossible for the interviewer to be 'blind' to family type, raising the possibility of interviewer bias. However, as mentioned above, the researcher had extensive experience of objective interviewing of parents in non-traditional families, and detailed coding criteria were utilised. Although one researcher conducted all interviews,

inter-rater reliabilities derived from a concurrently running study involving the same researcher and the same interview were generally good (Golombok, Murray et al., 2004).

Overall, this study provides preliminary findings that embryo donation families with young children are faring well, with warm parent-child relationships, and positive child development. Nevertheless, evidence was found of increased emotional over-involvement, defensive responding and secrecy within the family, which may have negative consequences later in the child's life. Therefore it would be valuable to follow up these families in the future to examine whether issues relating to the method of family creation change over time. Furthermore, the findings need replication, and more children have now been born through embryo donation, enabling a larger sample to be examined. It is possible that as embryo donation becomes a more commonly used procedure, parents will be less likely to be defensive. Additionally, any changes made to legislation regarding donor anonymity, such as the law allowing donor identification which came into force in the UK in April 2005, could encourage more disclosure to children. Research on embryo donation families in the UK with children conceived after the implementation of the new legislation would help in addressing these questions. Embryo donation families can be seen as offering a 'natural experiment' with a complete separation of genetics from environment, including the prenatal environment. Thus, different aspects of parenting that usually occur together, including genetic, gestational, and social contributions, can be teased apart. Such research can assist in increasing understanding of the importance of genetic and gestational relationships between parents and their children.

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Tables

Table 1: Means, Standard Deviations and *F* values for Comparisons of Parents' Marital and Psychological State by Family Type

Variable	ED (<i>N</i> = 21)		AD (<i>N</i> = 28)		IVF (<i>N</i> = 30)		<i>F</i>
	M	SD	M	SD	M	SD	
Mothers							
Marital quality							.89
Marital level	1.94k	.54	1.92	.56	1.70	.72	
GRIMS	21.27	12.18	21.52	9.51	24.14	9.11	
Psychological state							.65
PSI	66.79	20.51	62.28	18.73	63.12	10.92	
EDS	6.12	4.59	4.48	3.03	6.13	2.97	
TAI	36.35	10.55	34.00	6.08	37.44	8.13	
Fathers							
Marital quality							1.26
Marital level	1.93	.62	1.75	.72	1.70	.66	
GRIMS	21.66	8.81	15.61	5.36	21.18	9.43	
Psychological state							.85
PSI	66.42	15.26	59.06	14.38	59.06	12.38	
EDS	4.17	4.28	3.22	2.90	3.94	3.01	
TAI	32.58	9.99	31.83	5.98	33.50	6.07	

Note. ED = Embryo donation; AD = adoptive; GRIMS = Golombok Rust Inventory of Marital State; PSI = Parenting Stress Index; EDS = Edinburgh Depression Scale; TAI = Trait Anxiety Inventory

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Table 2: Means, SD, and *F* values for Comparisons of Parent-Child Relationships and Child Development by Family Type

Variable	ED (<i>N</i> = 21)		AD (<i>N</i> = 28)		IVF (<i>N</i> = 30)		<i>F</i>	Contrasts	
	M	SD	M	SD	M	SD		ED vs. AD	ED vs. IVF
Mother-child relationships							2.39*		
Expressed warmth	4.12	.71	4.18	.72	4.38	.59		<i>ns</i>	<i>ns</i>
Over-involvement	1.50	.91	.68	.67	.87	.80		<.025	<i>ns</i>
Defensive responding	1.58	.95	.68	.72	.46	.68		< .01	< .001
Sensitive responding	2.69	.84	2.93	.60	2.90	.64		<i>ns</i>	<i>ns</i>
Interaction	3.58	.70	3.36	.68	3.44	.55		<i>ns</i>	<i>ns</i>
Father-child relationships							2.16*		
Expressed warmth	4.00	.89	4.38	.67	4.40	.50		<i>ns</i>	<i>ns</i>
Over-involvement	.81	.91	.14	.36	.05	.22		< .01	< .01
Defensive responding	1.13	.89	.33	.48	.40	.50		< .025	<i>ns</i>
Interaction	3.25	.58	3.38	.59	3.10	.31		<i>ns</i>	<i>ns</i>
Child socio-emotional development							2.48*		
SDQ hyperactivity	3.00	2.83	4.20	2.43	2.75	1.67		<i>ns</i>	<i>ns</i>
SDQ conduct	1.94	1.95	2.96	2.11	1.50	1.06		< .025	<i>ns</i>
SDQ emotional	1.41	1.46	1.28	1.43	.88	.95		<i>ns</i>	<i>ns</i>
SDQ peer	1.47	1.23	.72	.84	1.46	1.44		<i>ns</i>	<i>ns</i>

Note. ED = Embryo donation; AD = adoptive; SDQ = Strengths and Difficulties

Questionnaire

* *p* < .05.

Table 3: Comparison of Extent of Disclosure to Child by Family Type

Disclosure status	ED		AD		IVF		χ^2	<i>p</i>
	N	%	N	%	N	%		
							56.31	< .001
Already told	2	9.5	22	78.6	9	30.0		
Planning to tell	5	23.8	6	21.4	19	63.3		
Uncertain	5	23.8	0	0.0	2	6.7		
Not telling	9	42.9	0	0.0	0	0.0		

Note. ED = Embryo donation; AD = adoptive