

Parent psychological adjustment, donor conception and disclosure: a follow-up over 10 years

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STUDY QUESTION: What is the relationship between parent psychological adjustment, type of gamete donation (donor insemination, egg donation) and parents' disclosure of their use of donated gametes to their children.

SUMMARY ANSWER: Disclosure of donor origins to the child was not always associated with optimal levels of psychological adjustment, especially for fathers in donor insemination families.

WHAT IS KNOWN ALREADY: Cross-sectional analyses have found mothers and fathers who conceived a child using donated sperm or eggs to be psychologically well-adjusted, with few differences emerging between parents in gamete donation families and parents in families in which parents conceived naturally. The relationship between mothers' and fathers' psychological well-being, type of gamete donation (donor insemination, egg donation) and parents' disclosure decisions has not yet been examined.

STUDY DESIGN, SIZE, DURATION: In this follow-up study, data were obtained from mothers and fathers in donor insemination and egg donation families at 5 time points; when the children in the families were aged 1, 2, 3, 7 and 10. In the first phase of the study, 50 donor insemination families and 51 egg donation families with a 1-year-old child participated. By age 10, the study included 34 families with a child conceived by donor insemination and 30 families with a child conceived by egg donation, representing 68 and 58% of the original sample, respectively.

PARTICIPANTS/MATERIALS, SETTING, METHODS: Families were recruited through nine fertility clinics in the UK. Standardized questionnaires assessing depression, stress and anxiety were administered to mothers and fathers in donor insemination and egg donation families.

MAIN RESULTS AND THE ROLE OF CHANCE: Mothers and fathers in both donor insemination and egg donation families were found to be psychologically well-adjusted; for the vast majority of parents' levels of depression, anxiety and parenting stress were found to be within the normal range at all 5 time points. Disclosure of the child's donor origins to the child was not always associated with optimal levels of parental psychological adjustment. For example, disclosure was associated with lower levels of psychological well-being for certain groups in particular (such as fathers in donor insemination families), at certain times (when children are in middle childhood and have a more sophisticated understanding of their donor origins).

LIMITATIONS, REASONS FOR CAUTION: Owing to small sample sizes, the value of this study lies not in its generalizability, but in its potential to point future research in new directions.

WIDER IMPLICATIONS OF THE FINDINGS: Donor insemination and egg donation families are a heterogeneous group, and future research should endeavour to obtain data from fathers as well as mothers. Support and guidance in terms of disclosure and family functioning might be most beneficial for parents (and especially fathers) in donor insemination families, particularly as the child grows older. The more that is known about the process of disclosure over time, from the perspective of the different members of the family, the better supported parents and their children can be.

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Key words: donor insemination / egg donation / psychological well-being / disclosure / gamete donation

Introduction

Parental psychological adjustment is an important aspect of family functioning. The psychological adjustment of both mothers and fathers has been found to be associated with children's psychological development. For example, children living with a mother who is depressed are at increased risk for behavioural difficulties and a variety of psychiatric problems, including depression (Lovejoy et al., 2000). Likewise, anxiety disorders have been found to cluster within families (Turner, 2003), with children of anxious parents being seven times more likely to develop an anxiety disorder themselves than the children of non-anxious parents (Turner et al., 1991). Similarly, high levels of parenting stress (i.e. stress that is caused by day-to-day parenting) has been shown to be an important factor in the development of child psychopathology (Deater-Deckard, 1998) and, in particular, behavioural problems (Barry et al., 2005).

Mothers' and fathers' mental health problems influence their children's development in a number of different ways (Goodman and Gotlib, 1999). First, children with a depressed or anxious parent may have a genetic predisposition to psychopathology. Secondly, mothers with psychopathology may expose their children to negative cognitions, behaviours and affect, which then place the child at an elevated risk for developing psychopathology themselves. For example, depressed mothers have been found to be more disengaged, hostile, manipulative and inconsistent in their discipline than non-depressed mothers (Dix and Meunier, 2009). Likewise, anxious mothers have been found to be less warm and less positive in their interactions with their children, granting less autonomy to, and being more critical of, their child in general when compared with non-anxious mothers (Whaley et al., 1999). It is also important to consider that mental health problems do not exist in isolation, but within a social and familial context (Cicchetti et al., 1998). Therefore, children growing up in households in which one or both parents are experiencing mental health problems may experience increased levels of marital discord and family conflict, factors that have been identified as having a detrimental effect on children's psychological adjustment.

The influence of fathers' psychological adjustment on family functioning and child outcomes has received less attention by researchers than that of mothers (Phares and Compas, 1992). A recent meta-analytic review of 28 studies concluded that paternal depression has a significant, though small, effect on parenting, with depressed fathers demonstrating fewer positive parenting behaviours and more negative parenting behaviours (Wilson and Durbin, 2010). The effect size for the relationship between paternal depression and parenting behaviours was found to be comparable to those found for mothers, indicating that psychological adjustment affects fathers' parenting behaviours to the same extent as it does for mothers.

Parents' psychological adjustment may differ between families created by gamete donation and families in which parents conceived naturally for a number of reasons. The parenting experience may be different for heterosexual couples who conceive using donated sperm or eggs compared with those who conceived naturally, as one parent lacks a genetic relationship with the child (the father in donor insemination families, and the mother in egg donation families). Parents who conceive using donated sperm or eggs have also experienced a different route to parenthood, typically having experienced infertility and undergone fertility treatment, which may have lasted for many years. These

parents have had to accept that they are unable to experience the pregnancy and birth of a child who is their shared genetic offspring, which may have involved feelings of grief and loss (Hammer et al., 2006). Although the stress of infertility has traditionally been thought of as being more pronounced for women (Greil, 1997), research in the past decade indicates that men likewise experience feelings of sadness and anxiety and may feel unable to talk to their friends or family about this experience (Dooley et al., 2011; Fisher and Hammarberg, 2012). It has been questioned whether parents who have experienced infertility and conceived using assisted reproductive technologies will be able to parent effectively having endured a long period of infertility (van Balen, 1998).

Another reason why parental psychological well-being may differ in families created by gamete donation is the issue of disclosure. Parents who have conceived using donated sperm or eggs have a choice as to whether to tell their child about their donor origins and if so, how and when to do so. In the UK, parents are generally encouraged to tell their child that they were conceived using the egg or sperm of a donor at a young age, with the hope that there will never be a time when this information is new or shocking (HFEA, 2004; Nuffield Council on Bioethics, 2013). An increasing number of parents in both donor insemination and egg donation families are choosing to tell their children about their donor origins, although most two-parent heterosexual parent families in the UK appear not to do so (Readings et al., 2011). Keeping a secret within the family may cause high levels of anxiety and has been described as being psychologically 'hard work' (Lane and Wegner, 1995), as individuals or couples may become preoccupied with the secret, and feel anxious and uncomfortable when topics related to the secret are raised in conversation (Karpel, 1980). On the other hand, it has been recognized that the disclosure of secrets may not always be an easy option (Vrij et al., 2003) and may result in a reaction that is psychologically damaging (Caughlin et al., 2009).

Despite concerns about the experience of infertility and the issue of disclosure, mothers and fathers who have conceived a child using donated sperm or eggs have been found to be psychologically well-adjusted, with few differences emerging between parents in gamete donation families and comparison groups of parents who conceived naturally (Golombok et al., 1996, 2002a,b; Murray et al., 2006). Of the small number of cross-sectional studies that have compared family functioning in disclosing and non-disclosing gamete donation families, no differences have been found in mothers' or fathers' psychological well-being (Nachtigall et al., 1997; Golombok et al., 2002a,b; Lycett et al., 2004).

The analysis presented in the paper aims to build upon what we know about parent psychological well-being in donor conception families in relation to disclosure. Owing to the highly sensitive nature of research in this area, the recruitment of families is challenging and sample sizes are typically small, therefore donor insemination and egg donation families are often treated as homogenous group. In the exploratory analysis presented in this paper, mothers' and fathers' psychological adjustment in relation to disclosure is examined in donor insemination families and egg donation families over a 10-year period. The more that is known about parent psychological adjustment in donor insemination and egg donation families over time, in relation to the disclosure of the child's donor origins, from the perspective of both mothers and fathers, the better supported parents and their children can be.

Materials and Methods

Participants

Data were collected as part of larger study of heterosexual, two-parent families created by assisted reproduction in the UK. This larger study aimed to examine family functioning in families created by donor insemination, egg donation, surrogacy and a control group of families in which children were naturally conceived. Data have obtained from parents at five time points, when the children were aged 1 (Golombok *et al.*, 2004), 2 (Golombok *et al.*, 2005), 3 (Golombok *et al.*, 2006), 7 (Golombok *et al.*, 2011; Readings *et al.*, 2011) and 10 years (Golombok *et al.*, 2013).

The donor insemination and egg donation families were recruited through nine fertility clinics in the UK. All two-parent heterosexual families with a child aged between 9 months and 1-year-old were asked to take part in the research. The exclusion criteria were severe congenital abnormalities and multiple births (Golombok *et al.*, 2004). At this initial stage, 50% of donor insemination families ($n = 50$) and 75% of egg donation families ($n = 51$) agreed to take part. No information is available on those families that declined.

By age 10, the study included 34 families with a child conceived by donor insemination and 30 families with a child conceived by egg donation, representing 68 and 58% of the original sample, respectively (response rates for each phase of the study are presented in Table I). Rather than having actively withdrawn, the majority of those families from whom data were not obtained had moved home and could not be traced. The response rate has been calculated per family rather than for mothers and fathers separately. At some phases of the study, fathers completed questionnaire booklets but were unavailable for interview (mostly due to work commitments). The number of mothers and fathers in each family type from whom we obtained questionnaire data are presented in Tables II and III.

Those families who participated when the children were aged 10 (responders) were compared with those who did not (non-responders). There was no association between whether families participated at age 10, and mothers' or fathers' intentions regarding whether to tell their child about the nature of their conception reported at age 1. Likewise, there was no association between maternal or paternal psychological well-being (levels of depression, anxiety and stress) at age 1, and whether families participated at age 10.

Table I Response rates for all family types at each phase of the study.

Child's age (years)	Donor insemination	Egg donation
1	50	51
2	46	48
% original sample	92%	94%
3	41	41
% original sample	82%	80%
7	36	32
% original sample	72%	67%
10	34	30
% original sample	68%	59%

Sample sizes need not always decrease over time, as in some cases families were unable to participate during one phase of the study (e.g. a family event, moving house) but were then able to participate at a later phase.

Procedure

Ethical approval for the earlier phases of the study (when children were aged 1, 2 or 3) was obtained from the City University Ethics Committee, and ethical approval for the latter phases (when children were aged 7 and 10) was granted by the Cambridge Psychology Research Ethics Committee.

When children were aged 1, 2, 3, 7 and 10, a research psychologist trained in the study techniques visited the families at home. Standardized questionnaires relating to parents' psychological adjustment were administered to mothers and fathers individually. Standardized interviews were also conducted with mothers and fathers, a section of which dealt with disclosure (for more information see Blake *et al.*, 2010).

Measures

Disclosure status (age 1, 2, 3, 7 and 10 years)

Parents' disclosure status was rated using data obtained during interviews with mothers. When children were aged 1, 2 and 3, parents' disclosure status was categorized according to parents' intentions, given the young age of their children and their children's inability to understand. At age 1, 46% of donor insemination ($n = 23$) and 56% of egg donation parents ($n = 29$) reported that they intended to disclose in the future.

When children were aged 7, 29% of mothers in donor insemination families ($n = 10$) and 41% of mothers in egg donation families ($n = 13$) reported that they had started the process of disclosure. At the latter phases of the study, we defined disclosure status according to actual behaviour (rather than intentions) as most parents who disclose do so by the time their child is 7-year-old (Blake *et al.*, 2010; Mac Dougall *et al.*, 2007a).

To clarify, disclosure status was categorized as follows:

- Age 1, 2 and 3: 'disclosing' families refers to those in which mothers planned to tell the child about their donor origins in the future or had already started doing so; 'non-disclosing' refers to those who did not plan to do so or were uncertain as to how to proceed.
- Age 7 and 10: 'disclosing' refers to those families in which mothers reported that they had started the process of telling their children about their donor origins; all other families were categorized as 'non-disclosing'.

Edinburgh depression scale (age 1, 2, 3, 7 and 10 years)

To assess parents' level of depression, the Edinburgh depression scale (EDS; Thorpe, 1993) was administered to both mothers and fathers. This 10-item measure produces a total score ranging from 0 to 30, with higher scores indicating higher levels of depression. Scores of 13 or above are indicative of the presence of a depressive illness for women (Cox *et al.*, 1987) and scores above 10 have been shown to be indicative of a depressive illness in men (Matthey *et al.*, 2001). The questionnaire has been found to have satisfactory validity, split-half reliability and to be sensitive to changes in depression over time (Cox *et al.*, 1987). Although it was originally devised for use with women in the post-partum period, the scale has been shown to be applicable to mothers outside of the post-partum period and to fathers (Matthey *et al.*, 2001).

Trait anxiety inventory (age 1, 2, 3, 7 and 10 years)

The trait anxiety inventory (TAI; Spielberger, 1983), a 20-item questionnaire measuring the individual's general level of anxiety, was also administered to mothers and fathers. Scores on this questionnaire range from 20 to 80, with higher scores indicating greater anxiety. This questionnaire is one of the most well-established measures of anxiety, used in over 3000 studies (Spielberger, 1989). It has been shown to have good reliability and to discriminate well between clinical and non-clinical samples (Spielberger, 1983).

Table II Mothers' psychological well-being.

Family	Disclosure	n	Mean	SD	Statistically significant effects ^a
Age 1					
Parenting stress					Disclosure $F = 4.97, P = 0.03$
DI	Non-disclosing	26	62.88	15.16	
	Disclosing	21	58.38	11.83	
ED	Non-disclosing	19	65.84	11.68	
	Disclosing	26	57.23	15.73	
Depression					Disclosure $F = 3.45, P = 0.07$
DI	Non-disclosing	26	6.42	3.35	
	Disclosing	21	4.67	4.47	
ED	Non-disclosing	19	6.58	4.71	
	Disclosing	27	5.11	4.15	
Anxiety					None
DI	Non-disclosing	26	35.50	8.42	
	Disclosing	21	36.52	9.88	
ED	Non-disclosing	19	37.68	8.59	
	Disclosing	27	37.22	10.11	
Age 2					
Parenting stress					None
DI	Non-disclosing	21	65.81	20.48	
	Disclosing	21	65.43	15.50	
ED	Non-disclosing	15	71.07	11.96	
	Disclosing	21	66.05	19.33	
Depression					None
DI	Non-disclosing	21	6.14	3.72	
	Disclosing	21	4.19	3.47	
ED	Non-disclosing	15	6.07	3.20	
	Disclosing	21	5.62	4.73	
Anxiety					None
DI	Non-disclosing	21	37.38	8.63	
	Disclosing	21	34.76	8.13	
ED	Non-disclosing	15	36.80	8.36	
	Disclosing	21	36.05	9.51	
Age 3					
Parenting stress					None
DI	Non-disclosing	20	64.05	16.24	
	Disclosing	18	63.83	17.25	
ED	Non-disclosing	8	61.75	9.45	
	Disclosing	25	64.96	17.95	
Depression					None
DI	Non-disclosing	20	6.25	4.04	
	Disclosing	18	4.83	4.85	
ED	Non-disclosing	8	5.63	4.78	
	Disclosing	25	5.44	4.38	
Anxiety					None
DI	Non-disclosing	19	34.58	7.86	
	Disclosing	18	34.11	10.47	
ED	Non-disclosing	7	34.86	8.19	
	Disclosing	25	35.60	9.76	
Age 7					
Parenting stress					None
DI	Non-disclosing	23	57.83	12.40	
	Disclosing	10	60.20	13.03	
ED	Non-disclosing	19	61.95	12.70	
	Disclosing	12	61.58	15.64	

Continued

Table II *Continued*

Family	Disclosure	n	Mean	SD	Statistically significant effects ^a
Depression					Disclosure $F = 7.45, P = 0.01$
DI	Not disclosed	25	4.88	3.03	
	Disclosed	9	3.78	3.19	
ED	Not disclosed	17	7.18	4.33	
	Disclosed	11	3.27	2.15	
Anxiety					None
DI	Not disclosed	23	28.13	9.24	
	Disclosed	9	24.78	10.90	
ED	Not disclosed	19	26.47	12.59	
	Disclosed	11	29.27	18.47	
Age 10					
Depression					None
DI	Not disclosed	24	5.08	3.92	
	Disclosed	9	5.67	4.18	
ED	Not disclosed	16	7.25	4.04	
	Disclosed	13	4.92	3.64	
Anxiety					Interaction $F = 6.77, P = 0.01$
DI	Not disclosed	23	33.57	7.51	
	Disclosed	9	35.67	9.63	
ED	Not disclosed	16	39.81	7.31	
	Disclosed	13	31.08	6.95	

^aFactorial ANOVA for differences between family type, disclosure status and interaction between them.

Parenting stress index (age 1, 2, 3 and 7 years only)

The short form of the parenting stress index (PSI; Abidin, 1990) is a standardized assessment of stress associated with parenting, was completed by mothers and fathers. This 36-item questionnaire comprises three subscales (parental distress, parent-child dysfunctional interaction and difficult child) which are summed to produce a total stress score, with higher scores representing greater levels of stress experienced in the role of parent. A total stress score above 90 indicates clinically significant levels of stress. Test-retest reliability for the total score was reported to be 0.96 over a 1–3-month interval and 0.65 over a year. Concurrent and predictive validity have been demonstrated for the full-length questionnaire, and the short form has been reported to correlate very highly with the full-length version (Abidin, 1990). The PSI was not administered at age 10; the battery of tests given to parents changed at each time point and some questionnaires were eliminated so that others, which were more pertinent to families in which children were aged 10, could be included.

Analytical approach

A cross-sectional factorial analysis of variance (ANOVA) design was utilized, which allowed differences between family type (donor insemination versus egg donation families), disclosure (disclosing versus non-disclosing) and the interaction between family type and disclosure status to be examined at each time point. An ANOVA approach was taken as opposed to the more complex MANOVA approach in order to avoid any further loss of data and to aid the interpretation of findings. Owing to relatively small sample sizes at the latter time points of the study (especially for data obtained from fathers), a longitudinal analytical approach was not taken, as it would have involved a considerable loss of data.

Demographic variables were compared between the different family types at each phase of the study. Mothers in egg donation families were significantly older than mothers in donor insemination families at age 1, 2, 7 and 10. In

addition, there was a statistically significant difference in family size at age 1 and 3, with children in egg donation families being more likely to be only children. There was no difference between groups in socioeconomic status, as measured by the parent with the highest-ranking occupation according to a modified version of the Registrar General's Classification (The Population and Census Statistics [OCPS] and Employment Department Group, 1991). At each time point, the relationship between demographic variables that differed between groups and the outcome variables were examined. No significant relationships were found.

The statistic eta-squared (η^2) was calculated and the square root of this value (the effect size r) has been reported. Effect sizes are classified as small ($r = 0.1-0.23$), medium ($r = 0.24-0.36$) and large ($r > 0.37$) (Cohen, 1992). η^2 has been criticized for providing an overestimation of the effect size (Field, 2009), but was considered appropriate due to the unequal sample sizes in each group.

Results

Age 1

Mothers' scores on questionnaires assessing depression, stress and anxiety were entered into factorial ANOVAs (see Table II). The effect of family type (donor insemination versus egg donation) was non-significant for all three measures of psychological well-being. The interaction effect between family type and disclosure was non-significant for all three measures of psychological well-being.

The effect of disclosure (disclosing versus non-disclosing) approached statistical significance for mothers' levels of depression ($F(1) = 3.45, P = 0.07, r = 0.19$) and was statistically significant for mothers' levels of parenting stress ($F(1) = 4.97, P = 0.03, r = 0.23$). For mothers in

Table III Fathers' psychological well-being.

Family	Disclosure	n	Mean	SD	Statistically significant effects	
Age 1						
Parenting stress						
DI	Non-disclosing	23	57.35	10.53	Disclosure $F = 6.31$, $P = 0.02$	
	Disclosing	18	61.89	17.68		
ED	Non-disclosing	17	61.88	11.67		
	Disclosing	23	63.00	14.06		
Depression						
DI	Non-disclosing	24	3.25	3.23		
	Disclosing	18	5.22	4.60		
ED	Non-disclosing	17	3.53	2.65		
	Disclosing	23	4.09	3.26		
Anxiety						
DI	Non-disclosing	24	32.79	7.74		
	Disclosing	17	33.41	9.84		
ED	Non-disclosing	17	32.18	6.47		
	Disclosing	23	37.22	7.19		
Age 2						
Parenting stress						
DI	Non-disclosing	20	59.25	12.09		
	Disclosing	14	67.93	19.49		
ED	Non-disclosing	13	64.85	13.23		
	Disclosing	16	62.25	11.10		
Depression						
DI	Non-disclosing	20	3.40	2.96		
	Disclosing	14	5.21	5.51		
ED	Non-disclosing	13	4.46	3.78		
	Disclosing	16	6.13	4.11		
Anxiety						
DI	Non-disclosing	20	30.45	7.40		
	Disclosing	14	36.14	9.83		
ED	Non-disclosing	13	32.77	7.41		
	Disclosing	16	37.25	7.10		
Age 3						
Parenting stress						
DI	Non-disclosing	15	65.93	18.17		
	Disclosing	14	63.14	14.41		
ED	Non-disclosing	6	67.83	17.22		
	Disclosing	20	68.35	12.53		
Depression						
DI	Non-disclosing	17	4.94	4.78		
	Disclosing	13	5.08	4.82		
ED	Non-disclosing	6	4.67	4.63		
	Disclosing	20	4.15	2.85		
Anxiety						
DI	Non-disclosing	17	44.82	5.56		
	Disclosing	13	43.46	3.18		
ED	Non-disclosing	6	45.17	4.26		
	Disclosing	20	42.70	2.89		
Age 7						
Parenting stress						
DI	Non-disclosing	15	50.53	11.24		
	Disclosing	7	63.71	8.98		
Interaction $F = 5.47$, $P = 0.02$						

Continued

Table III *Continued*

Family	Disclosure	<i>n</i>	Mean	SD	Statistically significant effects
ED	Non-disclosing	14	65.14	17.25	
	Disclosing	9	59.67	8.20	
Depression					
DI	Not disclosed	17	3.71	2.73	
	Disclosed	5	4.40	2.07	
ED	Not disclosed	14	3.64	3.23	
	Disclosed	8	2.00	1.31	
Anxiety					
DI	Not disclosed	17	30.12	6.37	Disclosure $F = 5.38, P = 0.03$ Interaction $F = 2.90, P = 0.1$
	Disclosed	7	38.43	9.03	
ED	Not disclosed	14	34.50	6.35	
	Disclosed	9	35.78	5.59	
Age 10					
Depression					
DI	Not disclosed	14	3.57	2.62	Interaction $F = 4.23, P = 0.05$
	Disclosed	7	5.86	2.97	
ED	Not disclosed	9	4.67	2.78	
	Disclosed	9	3.33	2.35	
Anxiety					
DI	Not disclosed	14	29.50	6.78	Disclosure $F = 2.90, P = 0.1$
	Disclosed	7	36.57	7.72	
ED	Not disclosed	9	32.33	5.52	
	Disclosed	8	32.63	5.48	

both donor insemination and egg donation families, levels of depression and stress were lowest for mothers who planned to tell their child about their donor origins.

Fathers' scores from the EDS, PSI and TAI were entered into factorial ANOVAs (as shown in Table III). For all three measures of psychological well-being, the effects of family type, disclosure status and interaction effects were not statistically significant.

Age 2

Mothers

At age 2, mothers' scores for depression, parenting stress and anxiety were entered into a factorial ANOVA. For all three measures of psychological well-being, the effects of family type, disclosure status and interaction effects were not statistically significant.

Likewise, when fathers' scores on the EDS and PSI were entered into an ANOVA, the main effects of family type, disclosure status and interaction effects were not statistically significant.

However, for fathers' scores on the TAI the effect of disclosure was statistically significant ($F(1) = 6.31, P = 0.02, r = 0.31$). For fathers in both donor insemination and egg donation families, levels of anxiety were lowest in non-disclosing families.

Age 3

At age 3, the effects of family type, disclosure status and interaction effects were not statistically significant on any of the measures of psychological well-being for mothers or for fathers.

Age 7

When children were aged 7, mothers' scores from the EDS, PSI and TAI were entered into factorial ANOVAs. The effect of family type was non-significant for all three measures of psychological well-being. The interaction effect between family type and disclosure was non-significant for all three measures of psychological well-being.

The effect of disclosure was statistically significant for mothers' levels of depression ($F(1) = 7.45, P = 0.01, r = 0.34$). For mothers in both donor insemination and egg donation families, levels of depression were lowest for mothers in families in which parents had started the process of disclosure.

For fathers' scores on the EDS, TAI and PSI, the effect of family type was non-significant for all three measures of psychological well-being.

The main effect of disclosure was statistically significant for fathers' levels of anxiety ($F = 5.38, P = 0.03, r = 0.33$). Levels of anxiety were lowest for fathers in families in which parents had not disclosed. The main effect of disclosure was non-significant for fathers' levels of depression and parenting stress.

The interaction effect between family type and disclosure for fathers' levels of anxiety approached statistical significance ($F(1) = 2.90, P = 0.1, r = 0.25$), as shown in Table III. For fathers in donor insemination families, levels of anxiety were lowest for fathers in non-disclosing families. For fathers in egg donation families, levels of anxiety were more similar between disclosing and non-disclosing families.

There was also a significant interaction effect for fathers' levels of parenting stress ($F = 5.47, P < 0.02, r = 0.34$) as shown in Table III. For

fathers in donor insemination families, levels of stress were lowest for fathers who had not disclosed, whereas for fathers in egg donation families, levels of parenting stress were lowest for fathers in families who had started the process of disclosure.

Age 10

Mothers' scores on the EDS and TAI at age 10 were entered into factorial ANOVAs (see Table II). The effect of family type and disclosure status were non-significant for both measures of psychological well-being.

The interaction effect between family type and disclosure was statistically significant for mothers' anxiety scores ($F(1) = 6.77, P < 0.01, r = 0.33$) as shown in Table II. For mothers in donor insemination families, anxiety levels were lowest for those mothers who had not disclosed. Conversely, for mothers in egg donation families, levels of anxiety were lowest for those mothers who had started the process of disclosure.

Fathers' scores on the EDS and TAI at age 10 were entered into factorial ANOVAs. The effect of family type was non-significant for both measures of psychological adjustment.

The effect of disclosure was marginally significant for anxiety ($F(1) = 2.90, P = 0.1, r = 0.28$), with levels of anxiety being lowest for fathers in non-disclosing families.

The interaction effect for fathers' levels of depression was statistically significant ($F(1) = 4.23, P = 0.05, r = 0.33$) as shown in Table III. For fathers in donor insemination families, levels of depression were lowest for those fathers who had not told. Conversely, for fathers in the egg donation group, levels of depression were lowest for fathers in families who had disclosed.

Discussion

This study examined the relationship between mothers' and fathers' psychological adjustment, type of donation (donor insemination, egg donation), and disclosure of donor origins to the child at ages 1, 2, 3, 7 and 10. Two main findings emerged. First, mothers and fathers in both donor insemination and egg donation families were found to be psychologically well-adjusted: for the vast majority of parents' levels of depression, anxiety and parenting stress were found to be within the normal range at all five time points. Secondly, disclosure of the child's donor origins to the child was not always associated with optimal levels of parental psychological adjustment. For example, for fathers in donor insemination families, it was non-disclosure that was associated with higher levels of psychological functioning at age 2, 7 and 10.

The majority of mothers and fathers in both donor insemination and egg donation families were found to be psychologically well-adjusted at all five time points. These findings add to the body of literature that has found high levels of parent psychological well-being in families created using assisted reproductive technologies (e.g. Golombok et al., 1996; Golombok et al., 2002a,b; Murray et al., 2006). Low levels of parental psychological disorder have been found to be beneficial to children's psychological development. In this respect, gamete donation families therefore appear to provide children with a positive family environment in which to grow.

However, in terms of the relationship between disclosure of donor origins to children and psychological adjustment, different patterns were found for mothers and fathers. For example, greater levels of psychological adjustment were found for mothers who planned to tell their

child about the nature of their origins from age 1 compared with those who did not. Whereas fathers in non-disclosing families at age 2 had greater levels of psychological well-being than fathers in disclosing families. Similarly, at age 7, higher levels of psychological well-being were found for those mothers who had started the process of disclosure, whereas for fathers, higher levels of psychological well-being were found in non-disclosing families. Also of note is that interaction effects (examining the relationship between family type and disclosure) were more prominent for fathers than they were for mothers. For those families in which parents had disclosed more positive findings emerged for egg donation families (where fathers have a genetic link with the child) compared with donor insemination families (where fathers do not).

Owing to its design and analytical approach, this study cannot speak to causation. Fathers have been found to have little involvement in the process of disclosure, particularly in egg donation families (Blake et al., 2010). It is possible that disclosure is less challenging in egg donation families because both parents have a biological relationship to the child (mothers have a gestational link and fathers have a genetic link), or it may be the case that infertility holds less stigma for women than for men, and that disclosure is therefore a less threatening and difficult task (Raoul-Duval et al., 1992; Appleby et al., 2012). Research of an in-depth qualitative nature may be better suited to unpacking the differences and similarities between men and women in the disclosure process in both donor insemination and egg donation families.

It is also important to note that the dichotomy between disclosure and non-disclosure is not always simple, with some parents engaging in 'layers' of disclosure, telling their family members and children about some aspects of their origins, but not others (Daniels, 1995; Readings et al., 2011). It is also important to note that although families in this analysis were categorized as 'disclosing', the children in these families may not have an understanding of what it means to be donor conceived, and families may have only discussed this topic once or twice (Blake et al., 2010).

The analyses presented in this paper are limited by small sample sizes (as indicated in Tables II and III), particularly in terms of data obtained from fathers in the latter phases of the study. Sample sizes smaller than 30 are often considered to be acceptable in psychology, yet Rosnow et al. (2000) emphasize that it would be difficult for significant small or medium effects to be found at the 0.05 level when the smaller of the two samples is < 30 . Underpowered analyses have a substantial risk of missing significant results. As emphasized throughout the paper, the analyses in this study are exploratory and any generalizations from this dataset made from this analysis should be made with great caution. However, the data presented in this analysis are valuable, as they have been obtained from donor insemination and (lesser-studied) egg donation families over a 10-year span. Therefore, the value of the findings of this analysis lies in its potential to point researchers in new directions. Fathers are often neglected in research on families created by assisted reproductive technologies, and in family research at large, therefore we echo the call for the greater inclusion of fathers in research in this field (e.g. Culley et al., 2013), as assuming that the experiences and perceptions of mothers and fathers are equivalent may be misleading. The findings of this study also suggest that the process of disclosure may be different in donor insemination and egg donation families and that they should not be treated as a homogenous group. Although we are beginning to understand more about the early phases of disclosure when children are young (e.g. Mac Dougall et al., 2007a,b; Blake et al., 2010), it is

now crucial to understand what happens next in the disclosure process, in adolescence and beyond.

Although early disclosure is generally recommended and encouraged (Nuffield Council on Bioethics, 2013), the difficulty of carrying out this task should not be ignored. The findings of this exploratory analysis suggest that disclosure might be difficult for certain groups in particular (such as fathers in donor insemination families), at certain times (when children are in middle childhood). The reasons for these patterns are unclear, and the cross-sectional analyses presented in this paper do not allow us to infer causation. Research that begins to explore which aspects of disclosure are particularly challenging and why, and what kind of information or support parents and offspring in these families would find helpful, would be of great value. Factors that would be worthy of further investigation might be how parents' disclosure decisions change over time and why, and how this is dealt with by mothers and fathers. Ultimately, the more that is known about the process of disclosure over time, from the perspective of the different members of the family, the better supported parents and their children can be.

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Authors' roles

All authors contributed to the acquisition and interpretation of data for this study. L.B. drafted this manuscript and all authors have contributed to its revision and approved the final version for publication.

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Conflict of interest

None declared.

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