Examining differences in psychological adjustment problems among children conceived by assisted reproductive technologies

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The aim of this study was to examine whether there was variation in levels of psychological adjustment among children conceived through Assisted Reproductive Technologies using the parents’ gametes (homologous), sperm donation, egg donation, embryo donation and surrogacy. Information was provided by parents about the psychological functioning of 769 children aged 5 to 9 years who had been born using ART (from the five groups described). Comparisons were made between the different conception groups, to UK national norms and, for a sub-sample of multiple births, to an age-matched twin sample. No differences were found between the conception groups except that fathers from the egg donation group rated children higher in conduct problems compared to other ART groups. No effects were observed by ART treatment type (ICSI vs. IVF, GIFT and IUI). There was some evidence of lower conduct problems and prosocial behaviour among children conceived through homologous IVF compared to national norms. Taken together, however, consistent differences between groups and in comparison to naturally conceived children were not apparent for mother- or father-rated adjustment problems. Children conceived with assisted reproductive technologies, regardless of whether they are genetically related or unrelated to their parents or born by gestational surrogacy do not differ in their levels of psychological adjustment. Nor do they appear to be at greater risk of psychological adjustment problems in middle childhood compared to naturally conceived children.

Keywords: ART; child adjustment; egg donation; embryo donation; IVF; sperm donation; surrogacy

In vitro fertilization (IVF) is a common means of conception. Between 1.3 and 4.2% of births in Europe occur via the use of some form of assisted reproduction technology (ART; Anderson, Gianaroli, Felberbaum, de Mouzon, & Nygren, 2006). Most commonly, children conceived via these methods are genetically related to their mother and father and the mother who undergoes the pregnancy (homologous IVF). However some offspring are related to the mother only (sperm donation), the father only (egg donation), or to neither parent (embryo donation). With gestational surrogacy both parents are genetically related to the child but a surrogate experiences the pregnancy. There remains concern about the health and well-being of children conceived with ART (e.g., Winston & Hardy, 2002).

Some research findings suggest higher rates of congenital anomalies (Hansen, Bower, Milne, de Klerk, & Kurinczuk, 2005), developmental delay (Strömberg et al., 2002), lower birth weight (Schieve et al., 2002) and health-related cardiovascular changes (Cecelen et al., 2008). Such biological risk may be increased through epigenetic effects and congenital anomalies (Hansen, Bower, Milne, de Klerk, & Kurinczuk, 2005), developmental delay (Strömb erg et al., 2002), lower birth weight (Schieve et al., 2002) and health-related cardiovascular changes (Cecelen et al., 2008). Such biological risk may be increased through epigenetic effects and congenital anomalies (Hansen, Bower, Milne, de Klerk, & Kurinczuk, 2005), developmental delay (Strömb erg et al., 2002), lower birth weight (Schieve et al., 2002) and health-related cardiovascular changes (Cecelen et al., 2008). Such biological risk may be increased through epigenetic effects and congenital anomalies (Hansen, Bower, Milne, de Klerk, & Kurinczuk, 2005), developmental delay (Strömb erg et al., 2002), lower birth weight (Schieve et al., 2002) and health-related cardiovascular changes (Cecelen et al., 2008).
Ungerer, Leski, Saunders, & Tennant, 1998). Some studies indicate that children conceived with ART do not show problems in key domains of psychological functioning including cognitive and socio-emotional development (see Golombok & MacCallum, 2003). However, the increasing uptake of such treatments combined with the rapid advances made in ART mean that it is crucial to consider whether the technique used to facilitate or assist conception has implications for children’s mental health.

Mode of conception and children’s socio-emotional and behavioural adjustment

Previous research has not found systematic differences in levels of psychological adjustment problems for children of different ages conceived with homologous IVF in comparison to age-matched samples conceived with natural conception (Cederblad et al., 1996; Golombok, MacCallum, Goodman, & Rutter, 2002b; Hahn & DiPietro, 2001; Levy-Shiff et al., 1998). Similarly, no consistent differences have been reported for children born following donor insemination (where the father is not genetically related to the child) with some studies finding less optimal adjustment compared to naturally conceived children (Brewaeyrs, Golombok, Naaktgeboren, de Bruyn, & van Hall, 1997), and others finding no differences (Golombok et al., 2002b).

Fewer studies, however, have examined the outcomes for children conceived with egg or embryo donation. One study by Golombok and colleagues (Golombok, Murray, Brinsden, & Abdalla, 1999) compared the adjustment of children aged 4–8 years conceived via egg donation (n = 21), homologous IVF (n = 41), donor insemination (n = 45), and adopted children (n = 55) and found no significant differences. The absence of differences between the groups remained in a follow-up study when the children were aged 12 (Murray, MacCallum, & Golombok, 2006). To our knowledge, only one study to date has examined the adjustment of children conceived with embryo donation (MacCallum, Golombok, & Brinsden, 2007). Twenty-one children conceived following embryo donation were compared to 30 children conceived with homologous IVF and 28 adopted children. No differences were found in levels of children’s psychological adjustment. Finally, there are few studies of the adjustment of children born following surrogacy. Golombok and colleagues (Golombok, MacCallum, Murray, Lycett, & Jadva, 2006) found no differences in the adjustment of 37 2-year-old children born following surrogacy, compared to 48 children born following egg donation and 68 naturally conceived children. The existing studies are of younger children and include children conceived with various types of surrogacy arrangement – “straight surrogacy”, where the surrogate is the genetic mother and the commissioning father is the genetic father, and “gestational or host surrogacy”, where the commissioning couple (who bring the child up) are the genetic parents and either a related or unrelated surrogate experiences the pregnancy. It is possible that the adjustment of families and children may differ between these different types of surrogacy arrangement (although the work of Golombok and her colleagues in young children does not suggest this). Overall, relatively little is known about the profile of psychological well-being in children conceived with less common ART techniques, specifically egg donation, embryo donation and surrogacy.

Rates of multiple births are elevated with ART. In the United Kingdom, 26% of births following ART are multiple births, compared to 1% of births through natural conception (Human Fertilisation and Embryology Authority, 1996). Although research suggests that twins conceived with ART do not differ from naturally conceived twins in their profile of psychological adjustment (Goody et al., 2005; Montgomery et al., 1999; Tully, Moffitt, & Caspi, 2003), there remain concerns about the associated birth complications linked with IVF twins with a paucity of data at long-term follow-up (Reddy et al., 2007).

The effects of treatment type

The present study also aimed to examine whether differences were evident in children’s profiles of psychological adjustment as a function of whether the treatment method involved fertilization in vitro, GIFT (gamete intrafallopian transfer), intruterine insemination (IUI) or intracytoplasmic sperm injection (ICSI). Concerns have been raised about potential adverse biological risks to the offspring when particular methods are used, notably ICSI (where a single sperm is injected directly into the egg to create an embryo) which has been linked with effects on child health and cognitive development (Bowen et al., 1998; Knoester et al., 2007; Ponjaert-Kristoffersen et al., 2004). ICSI is somewhat controversial therefore, and the psychological outcomes in children conceived with this method are of interest (see Golombok & MacCallum, 2003). Specifically, while previous research indicates higher rates of malformation and possible developmental delay in children conceived with ICSI compared to children conceived with IVF and natural conception, little is known about the broader psychological profile in middle childhood, including emotional and behavioural functioning.

The present study

IVF treatments and surrogacy differ in the use of gametes from one or both parents and in the use of a genetically-related or non-related surrogate for the pregnancy. The overall impression provided by research conducted to date is that children conceived with ART are psychologically well adjusted and have an overall profile of mental health that does not differ from children who are naturally conceived. However, these conclusions have been primarily derived from samples of children born through the more common methods of ART, such as homologous IVF where both parents provide genetic material. The changing demographic profile of parents conceiving using ART (i.e., older age of conception; Collins & Crosignani, 2005) has led to the increased use of techniques besides homologous IVF (such as egg and embryo donation). Research that has examined psychological adjustment among children conceived with ART has been based on relatively small samples and no studies to our knowledge have compared the profile of adjustment in middle childhood across five or more groups simultaneously.

The primary aim of this study was to examine whether there is variation in psychological adjustment problems among children conceived with ART from different conception groups. Based on the existing literature, we expected no differences in the profile of psychological adjustment between children from these groups. A second aim was to confirm previous findings in a much larger sample (that included rare conception groups) that children conceived with ART do not differ in levels of psychological adjustment compared to children from natural conception families. Third, we explored
whether the treatment type that parents underwent (ICSI versus other conception groups) was associated with differences in levels of child psychological adjustment. Finally, we examined the number of children with neuro-developmental disorders in the sample based on comments about the scientific community regarding the potential risks of foetal abnormality among children born after ART, and recent research suggesting that children conceived with ART may have higher rates of autism spectrum disorders (Knoester et al., 2007; Winston & Hardy, 2002).

Method

Assisted reproduction technologies sample

Families who had a live birth between 1994 and 2002 (children aged 4 to 10 years), following successful ART treatment from any of the five conception groups described were recruited from 18 UK clinics and one USA clinic (Thapar et al., 2007). We required that gamete donors and surrogates were unrelated to either parent. The study received approval from the Multi Centre Research Ethics Committee for Wales, UK. All data were collected by postal questionnaires, sent to families with children in the appropriate age range as identified by participating clinics. Nineteen of the 22 clinics contacted about the study agreed to participate and recruited families, representing a response rate of 86%. Clinic staff recruited 807 families who provided questionnaire data (548 fathers and 792 mothers).

The present study uses information provided by parents of children in the middle childhood years (mean = 6.80 years; SD = 1.28, range = 5–9 years) to facilitate comparison with national norms for adjustment problems on the measures of interest. Some 38 families were therefore excluded from the sample study, leaving a total sample size of 769 (information was provided by both parents in 510 families, 66% of the sample). The number of families in each conception group was: 386 homologous IVF (parents’ own gametes used 50%; 378 mothers; 264 fathers), 182 IVF with sperm donation (24%; 180 mothers; 133 fathers), 153 IVF with egg donation (20%; 151 mothers; 100 fathers), 27 IVF with embryo donation (3.5%; 26 mothers; 16 fathers) and 21 IVF with gestational surrogacy where the commissioning parents were the genetic parents but an unrelated surrogate experienced the pregnancy (2.7%; 19 mothers; 13 fathers). Some 23% of the children were a multiple birth (22.9%; n = 176; 156 twins and 19 triplets), a proportion comparable with UK rates of multiplicity in ART (Adamson et al., 2006). Of 768 families with information on treatment type, 593 received IVF (77.2%), 110 received ICSI (14.3%), 15 received GIFT (2%) and 50 received IUI (6.5%). Over two-thirds of the sample used a method of transfer whereby the embryo was transferred immediately after fertilization (76%), while 24% used an embryo that had been cryo-preserved and transferred some time after the original IVF cycle.

Twin sample

The comparison sample of twins was drawn from the South Wales cohort of the longitudinal Cardiff Study of All Wales and North West of England Twins (CaStANET). The CaStANET register is a population-based twin register, including twins born between 1976 and 1991 in the Cardiff area of South Wales and between 1980 and 1991 for the rest of Wales and the North-West of England. In 1997, questionnaires were mailed to parents of twins aged 5–16 years assessing various aspects of family functioning, parent health and child psychological health. The CaStANET study received approval from the Multi Centre Research Ethics Committee for Wales, UK. Demographic statistics indicated that the sample was representative of British families living in the UK region of England and Wales with regard to family constitution, ethnicity, employment and economic factors (ONS, 2004). Further information about the sample is provided elsewhere (van den Bree et al., 2007). The present study used a sub-sample of 636 twin pairs aged 5 to 9 years (mean = 7.71 years, SD = 1.28), where the same questionnaire data collected in the ART study were available. This is a distinct sub-sample of families from that reported by Goody et al. (2005). The majority of the sample was White British/Irish (95.2%).

Measures

Mothers and fathers were asked to complete questionnaires that included measures of child psychological adjustment and demographic variables.

Conduct problems. Mother- and father-reported conduct problems were assessed using the conduct problems subscale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). Parent reports of conduct problems had lower but adequate levels of internal consistency in the present sample compared to the other measures of adjustment (α = .54 and .54, for mothers and father, respectively; mothers’ report in the twin sample α = .64).

Attention Deficit Hyperactivity Disorder symptoms. Mother and father reports of ADHD symptoms were assessed using a modified version of the DuPaul ADHD rating scale (DuPaul, 1981). The scale included 14 DSM-IV symptoms of ADHD (American Psychiatric Association (APA), 1994). Symptoms were rated on a 4-point scale of severity, with items summed to give a total ADHD symptom score. The internal consistency estimate for the present sample was good for mothers (α = .90) and fathers (α = .90).

ODD symptoms. Six items indexing DSM-IV symptoms of Oppositional Defiant Disorder IV (ODD; APA, 1994) were used. Items included, “Spiteful or vindictive”, “Often deliberately annoys others”, “Often touchy or easily annoyed by others”. Each item was rated 0 = “Doesn’t apply”, 1 = “Applies somewhat” or 2 = “Certainly applies”. Respondents reported on behaviour over the past six months. Parent reports demonstrated acceptable internal consistency in the present sample (α = .74 and .69, for mothers and father, respectively).

Depressive symptoms. The short version of the Mood and Feelings Questionnaire (MFQ; Angold et al., 1995) was administered to assess children’s DSM-IV symptoms of depression (APA, 1994). Internal consistency in the present sample was good for mothers and fathers, respectively (α = .77 and .79; mothers’ report in the twin sample α = .87).

Anxiety. Mothers and fathers reported on their child’s anxiety levels in the past three months by completing an 8-item checklist of the DSM-IV symptoms of generalized anxiety disorder (APA, 1994). Sample items include “Worries”, etc.
“Restless, feels on edge”, “Easily tired”, “Irritable”. Internal consistency in the present sample was good for mothers and fathers, respectively ($\alpha = .73$ and .74).

**Somatic problems.** Seven items from the Child Behavior Checklist (Achenbach, 1991) assessed somatic complaints: “Complains of aches or pains”, “Complains of headaches”, “Complains of nausea/feels sick”, “Has rashes or other skin problems”, “Complains of muscle tension”, “Has stomach aches or cramps”, “Other”. Items were rated from $0 =$ “not true” to $2 =$ “very true”. Internal consistency in the present sample was good for mothers and fathers, respectively ($\alpha = .64$ and .62).

**Peer problems.** The peer problems subscale of the SDQ (Goodman, 1997) was used. Parent reports of problems with peers demonstrated adequate internal consistency in the present sample ($\alpha = .59$ and .52, for mothers and fathers, respectively; mothers’ report in the twin sample $\alpha = .54$).

**Prosocial behaviour.** The prosocial behaviour subscale of the SDQ (Goodman, 1997) was used. Parent reports of prosocial behaviour demonstrated acceptable internal consistency in the present sample ($\alpha = .69$ and .66, for mothers and fathers, respectively; mothers’ report in the twin sample $\alpha = .68$).

**Neuro-developmental disorders.** Parents were asked if their child had any disability or a major medical condition. If parents answered yes to either of these questions, they were asked to specify the condition. We noted if children had neuro-developmental disorders according to parental report.

**Statistical analyses**

Statistical analysis comprised four steps:

1. The study aim of examining differences between conception groups was tested for each parent’s reports of child psychological adjustment using multivariate analysis of variance (MANOVA). A MANOVA was conducted for each parent’s reports of (a) conduct problems, ADHD symptoms and ODD symptoms; (b) depressive symptoms, anxiety and somatic problems; (c) peer problems and prosocial behaviour. For each MANOVA, adjustment was made for child age, birth weight; nor was an association found with the occupational classification of the family ($\chi^2 = 37.06, p > .10$). Children who were conceived with egg donation were significantly younger than children conceived with sperm donation. No other differences between groups for child age were found. Differences were found between conception groups as a function of parental and maternal age at the child’s birth. Mothers in the embryo donation, egg donation and gestational surrogacy groups were older than mothers in the homologous IVF and sperm donation groups. Fathers in the embryo donation group were older than all other conception groups. Fathers in the egg donation group and sperm donation groups were older than the homologous IVF group.

**Results**

**Demographic information on the ART sample**

The sample included 394 boys (51.2%) and 375 girls (48.8%). The average age of the children was 6.80 years ($SD = 1.23$). The average family income for the sample was between £30,000 and £40,000 (range: < £10,000 to > £60,000). The US sample all reported an average family income greater than $60,000 (approximately £30,000). The majority of mothers and fathers were employed either full or part time (84% mothers; 85% fathers) while approximately 15% were unemployed or not in paid employment (e.g., housewife). The majority of mothers and fathers were White UK or Irish (93% mothers; 93% fathers), while smaller proportions described their ethnicity as other European (approximately 3%), White American (3%), Bangladeshi, Indian or Pakistani (1%). Thus, 1% of mothers and 2% of fathers described their ethnicity as African or Afro Caribbean, S.E. Asian or other.

Table 1 provides demographic information for each of the five conception groups that form the ART study sample. These figures show that there were approximately equivalent proportions of males and females within each conception group and similar proportions of multiple births within each group. There was no association between method of conception, gestational age, birth weight; nor was an association found with the occupational classification of the family ($\chi^2 = 37.06, p > .10$). Children who were conceived with egg donation were significantly younger than children conceived with sperm donation. No other differences between groups for child age were found. Differences were found between conception groups as a function of parental and maternal age at the child’s birth. Mothers in the embryo donation, egg donation and gestational surrogacy groups were older than mothers in the homologous IVF and sperm donation groups. Fathers in the embryo donation group were older than all other conception groups. Fathers in the egg donation group and sperm donation groups were older than the homologous IVF group.

**Psychological adjustment in the ART sample**

There was a high level of agreement between mothers and fathers in their reports of child adjustment. Associations ranged from $r = .58, p < .001$ for prosocial behaviour to $.71, p < .001$ for ratings of ADHD symptoms. Table 2 provides descriptive information for mother and father reports of children’s psychological adjustment for each of the five conception groups.

There was no association between conception group and mother reports of conduct problems, ODD and ADHD symptoms ($F(12,2127) = .991, p > .10$). For father reports, there was a significant association between conception group and conduct problems but not ODD or ADHD symptoms ($F(12,1458) = 1.902, p < .05$). Simple effects tests using the Bonferroni correction indicated that fathers in the egg donation group rated children higher in conduct problems than fathers in the homologous IVF group and the sperm donation group ($F(4,517) = 3.86, p < .01$, partial $\chi^2 = .03$).

Non-significant associations were found between conception group and mother and father reports of child anxiety, depressive symptoms and somatic problems (mothers: $F(12,2130) = 1.117, p > .10$; fathers: $F(12,1503) = 0.929, p > .10$). A non-significant association was found between conception group and social outcomes (peer problems and prosocial behaviour; mothers: $F(8,1448) = 0.250, p > .10$; fathers: $F(8,998) = 0.526, p > .10$).
Comparing adjustment scores in the ART sample with normative data

One-sample t-tests were conducted comparing the mean levels of adjustment among all children in the five ART conception groups (excluding the 28 families recruited from the US clinic) in relation to the British norms for parent reports for the conduct problems, peer problems and prosocial behaviour subscales of the SDQ (Meltzer, Gatward, Goodman, & Ford, 2000). The significance level was adjusted to \( p < .01 \) to take account of the number of comparisons made. Fathers in the homologous IVF group, but not the other four groups, rated children lower in levels of conduct problems compared to British norms (homologous IVF fathers, mean = 1.38; SD = 1.29; British norm, mean = 1.6; SD = 1.7; \( t = 2.72, p < .01 \)). Thus, none of the five conception groups appear to have elevated levels of conduct or peer problems in comparison to British norms. In contrast, however, IVF homologous fathers also rated their children lower in prosocial behaviour compared to British norms (homologous IVF fathers, mean = 8.6; SD = 1.7; British norm, mean = 9.1; SD = 1.6; \( t = 3.22, p < .01 \)). No differences were found between mother ratings in the five conception groups in relation to the British norms for parent reports for the conduct problems, peer problems and prosocial behaviour subscales of the SDQ.

### Table 1

Demographic information by conception group

<table>
<thead>
<tr>
<th></th>
<th>Homologous IVF Mean (SD)</th>
<th>Sperm donation Mean (SD)</th>
<th>Egg donation Mean (SD)</th>
<th>Embryo donation Mean (SD)</th>
<th>Gest. surrogacy Mean (SD)</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child age (years)</td>
<td>6.78 (1.19)</td>
<td>7.07 (1.29)</td>
<td>6.60 (1.22)</td>
<td>6.37 (1.49)</td>
<td>6.80 (1.23)</td>
<td>4.01**</td>
</tr>
<tr>
<td>Maternal age at birth (years)</td>
<td>34.12 (3.49)</td>
<td>33.81 (3.87)</td>
<td>40.00 (6.68)</td>
<td>37.00 (5.53)</td>
<td>35.14 (4.74)</td>
<td>37.20**</td>
</tr>
<tr>
<td>Paternal age at birth (years)</td>
<td>36.77 (5.81)</td>
<td>38.67 (6.98)</td>
<td>38.98 (6.60)</td>
<td>45.43 (7.53)</td>
<td>38.19 (6.18)</td>
<td>12.98**</td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>38.46 (1.11)</td>
<td>38.38 (2.77)</td>
<td>37.96 (2.79)</td>
<td>38.13 (2.27)</td>
<td>37.33 (4.39)</td>
<td>1.47</td>
</tr>
<tr>
<td>Birth weight (gms)</td>
<td>3080.67 (654.00)</td>
<td>3075.55 (730.49)</td>
<td>3097.83 (715.49)</td>
<td>3039.34 (715.49)</td>
<td>3012.79 (934.63)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Child gender  
- Male  
  Mean (n) 207 (53.6) 88 (48.4) 78 (51.3) 9 (33.5) 12 (60) 5.56  
- Female  
  Mean (n) 179 (46.4) 94 (51.6) 74 (48.7) 18 (66.7) 8 (40)

Multiple birth  
- Yes  
  Mean (n) 81 (79) 47 (74.2) 36 (76.3) 6 (77.8) 6 (71.4) 2.13  
- No  
  Mean (n) 305 (21) 135 (25.8) 116 (23.7) 21 (22.2) 15 (28.6)

**\( p < .01 \); *\( p < .05 \).

### Table 2

Descriptive statistics for mother and father ratings of children's psychological adjustment

<table>
<thead>
<tr>
<th></th>
<th>Homologous IVF Mean (SD)</th>
<th>Sperm donation Mean (SD)</th>
<th>Egg donation Mean (SD)</th>
<th>Embryo donation Mean (SD)</th>
<th>Gest. surrogacy Mean (SD)</th>
<th>F</th>
</tr>
</thead>
</table>
| Mother report  
  Conduct problems  
  ODD symptoms  
  ADHD symptoms  
  Depressive symptoms  
  Anxiety  
  Somatic problems  
  Peer problems  
  Prosocial behaviour | 1.47 (1.37) 1.34 (1.43) 1.61 (1.48) 1.54 (1.30) 1.75 (1.83) | 0.991  
  F(12,2127)  
  2.28 (2.17) 2.37 (2.35) 2.40 (2.02) 1.92 (1.87) 2.35 (2.11) | 1.117  
  F(12,2130)  
  10.46 (7.62) 9.62 (7.36) 11.68 (7.53) 10.21 (6.44) 12.30 (8.23) | 0.250  
  F(8,1448)  
  2.95 (3.02) 3.03 (3.18) 2.49 (2.41) 2.15 (2.11) 2.05 (2.04) | 0.929  
  F(12,1503)  
  2.39 (2.47) 2.27 (2.46) 2.07 (1.98) 2.15 (1.85) 2.00 (1.86) | 0.526  
  F(8,998)  
  1.69 (1.83) 1.79 (1.91) 1.58 (1.71) 1.20 (1.19) 1.15 (1.79) | 0.050  
  1.36 (1.61) 1.28 (1.62) 1.36 (1.62) 1.23 (1.45) 1.26 (1.59) | 0.928  
  F(8,1448)  
  8.38 (1.68) 8.48 (1.66) 8.34 (1.66) 8.77 (1.45) 8.25 (1.92) | 1.902**  
  F(12,1458)  
  1.38 (1.29) 1.32 (1.41) 1.85 (1.51) 2.25 (1.77) 1.38 (1.33) | 1.902**  
  F(12,1503)  
  2.16 (1.92) 2.24 (2.17) 2.35 (2.17) 2.88 (2.09) 2.00 (2.38) | 0.929  
  F(12,1503)  
  10.65 (7.07) 9.64 (6.98) 12.18 (7.58) 13.75 (6.88) 12.30 (8.91) | 0.526  
  F(8,998)  
  2.58 (2.91) 2.81 (3.01) 2.46 (2.75) 2.38 (3.01) 1.58 (1.93) | 0.526  
  F(12,1503)  
  2.18 (2.39) 2.30 (2.55) 1.82 (2.02) 2.44 (2.00) 1.31 (1.49) | 0.929  
  F(12,1503)  
  1.37 (1.64) 1.52 (1.74) 1.37 (1.43) 2.13 (2.25) 0.62 (0.96) | 0.929  
  F(12,1503)  
  1.42 (1.60) 1.27 (1.35) 1.20 (1.28) 1.53 (1.88) 0.92 (0.95) | 0.526  
  F(8,998)  
  8.24 (1.67) 8.56 (1.77) 8.28 (1.67) 8.31 (2.12) 8.50 (1.73) | 1.902**  
  F(12,1458)  

Note. ADHD Symptoms, Attention Deficit Hyperactivity Disorder symptoms; ODD, Symptoms of Oppositional Defiance Disorder.

*\( p < .05 \). Means in the same row with different superscripts differ significantly at \( p < .05 \).
ART groups and the British norms and no other differences were found for fathers.

Comparing ART twins with an age-matched sample of naturally conceived twins

Mothers’ reports for children who were a twin or triplet from families in the ART sample were compared to mothers’ reports for an age-matched sample of naturally conceived twins (NCT) on measures of depressive symptoms, peer problems, prosocial behaviour and conduct problems. The significance level for the t-test comparison was adjusted for the number of comparisons made (four, \( p < .01 \)). Levels of conduct problems, depressive symptoms, peer problems and prosocial behaviour did not differ between the two groups (see Table 3).

Effects of treatment type

The present study investigated the presence of differences in psychological adjustment as a function of treatment type (ICSI vs. homologous IVF, GIFT and IUI) was associated with psychological adjustment, with an adjustment to the significance level made for the number of comparisons. There was no evidence to indicate differences in levels of psychological adjustment as a function of treatment type (\( t \) ranged from 0.18 to 1.54, \( p > .10 \)).

Parental report of neuro-developmental disorders

Twenty-two parents reported that their child had a neuro-developmental condition: autistic spectrum disorders (10); attention deficit hyperactivity disorder (2); epilepsy (4); dyspraxia (3); 1 child with an autistic spectrum disorder was also described as having dyspraxia). Thus, a relatively high proportion of children (10; 1.3% of the sample) were described as having an autistic spectrum disorder (autism, Asperger’s or pervasive developmental delay). This contrasts with an estimated prevalence of 0.2% in the general population (Williams et al., 2002b, 2002a). We found no association between conception group (\( \chi^2 = 2.67, p > .10 \)) or treatment type (\( \chi^2 = 2.66, p > .10 \)) and the presence of a neuro-developmental condition. Six of the 22 children with a condition were a twin or triplet but there was no association between the presence of a condition and being a multiple birth (\( \chi^2 = 0.62, p > .10 \)).

Discussion

The present study investigated the presence of differences in the psychological adjustment of a large sample of children conceived with different assisted reproductive techniques. The findings suggest that ART, even when conception involves the child being genetically unrelated to one or both parents, when a surrogate mother undergoes the pregnancy and regardless of the method of embryo transfer, is not associated with child psychological adjustment. Furthermore, children conceived with ART do not appear at increased risk of adjustment problems compared to naturally conceived children.

In general, the findings mirror those based on smaller samples of families with children conceived with different methods of ART (sample sizes typically less than 300) conducted in Europe, the USA and Australia (e.g., Cederblad et al., 1996, \( n = 99 \); Gibson et al., 1998, \( n = 65 \); Golombok et al., 2002b, \( n = 298 \)), and provide insights regarding the psychological well-being of children in the middle childhood years who have been conceived with the more “conventional” (homologous IVF) and less common assisted reproductive techniques (embryo donation; gestational surrogacy). Previous studies have typically compared groups of children conceived with two or three methods of ART while this study examined the profile of adjustment across five different conception groups and made comparisons against normative and population-based data where available. In addition, the present study was able to assess two different raters within the family who possessed unique perspectives on family functioning and children’s adjustment.

In comparisons between the different reproductive groups, the genetically-related fathers of children where the mother was not genetically related (egg donation group) rated their children higher on conduct problems compared to fathers in the homologous IVF and sperm donation groups. This effect may reflect fathers’ beliefs regarding the origins of behavioural characteristics in their offspring. However, if this was because of genetic relatedness, then we would also expect higher scores in the embryo donation group. As such, this finding should be interpreted with caution until replicated. Another possibility is that given that fathers in the egg donation group were on average older than fathers in the homologous IVF group, this finding reflects generational differences in expectations regarding children’s behaviour. However, parent age was controlled in analyses and the pattern of contrasts across groups does not indicate an age effect on ratings. Given that parental knowledge on the method of conception may affect their ratings, future research should strive to obtain teacher reports of child adjustment in order to address this issue (Rutter, 2006).

The results comparing the ART sample to normative data (British norms and an age-matched sample of twins) are somewhat conflicting. Fathers in the homologous IVF group reported lower conduct problems but also lower levels of

<table>
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<td>Mean</td>
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prosocial behaviour (compared to British norms). On the one hand, the finding of lower prosocial behaviour in this group concurs with previous work by Levy-Shiff et al. (1998) who reported poorer adjustment to school among children conceived with homologous IVF or embryo donation compared to those naturally conceived children. A recent study indicates a relationship between prosocial behaviour and children’s adjustment in school, as indexed by their appraisals of the classroom environment (Oliver, Pike, & Plomin, 2008). Also, it is well known that prosocial behaviour promotes peer acceptance (Denham, McKinley, Couchoud, & Holt, 1990). On the other hand, the published British norms for the SDQ (Melzer et al., 2000) present an overall score for parents but the information was provided primarily by mothers. The differences found for fathers in the homologous IVF group in comparison to the published British norms for the SDQ may be an artefact of general differences that exist between parents in how they perceive child behaviour.

A relatively high proportion of parents in the present study described their children as having autistic spectrum disorders (these children were not excluded from the analysis). Our data on neuro-developmental delay are descriptive and may be a chance finding. Yet they do concur with at least one other study which found an elevated rate of ASD among a sample of children conceived with ICSI (3.4%; Knoester et al., 2007). There is a need to follow up these families at a second time point which will likely assist in determining whether these are anomalous or potentially meaningful differences.

Finally, the present study is among the first to consider the effect of treatment type on children’s psychological adjustment. Analyses revealed no differences in the mental health outcomes of children based on treatment type (ICSI vs. IUI, GIFT, IVF). The finding of an absence of differences across these groups is important given the risks that are associated with ICSI and the accompanying concerns about its use (Golombok & MacCallum, 2003; Winston & Hardy, 2002). Moreover, unlike many studies of the adjustment of children born following ART which have included only healthy singleton births born at term, we did not exclude families on the basis of perinatal risk, thus these results reflect the range of children born following ART. Taken with the comparison to population-based samples, the overall impression is that despite the exceptional constellation of biological, psychological and interpersonal factors that characterize the conception of children through ART, there appears to be no detrimental effect in middle childhood with regard to mental health.

Limitations

The present study used parent reports of children’s psychological adjustment. There is some evidence to indicate that parents who conceive using IVF may be inclined to idealize parenthood and under-report negative affect and parenting problems (McMahon, Gibson, Leslie, Cohen, & Tennant, 2003). That being the case, the finding of lower levels of conduct problems among the homologous IVF and sperm donation groups in comparison to British norms may partly reflect socially desirable responding about children’s psychological adjustment and behaviour (McMahon et al., 2003).

These findings are in line with other research conducted with families who have conceived using reproductive technologies, which suggests they reflect more than some facet of response bias. An important direction for future research is to obtain child and teacher reports of adjustment problems (e.g., Golombok et al., 2002a). This would also be useful in light of the comparatively low internal consistency estimates derived for parent ratings for some study variables (e.g., children’s peer problems, $\alpha = .59$ and .52). Obtaining information from other sources, in addition to parents, should provide a richer dataset for understanding the profile of psychological adjustment among children this age conceived with ART. A second limitation of the present study was the relatively small number of families in the gestational surrogacy and embryo donation groups in comparison to the homologous IVF, sperm and egg donation groups. However, this represents the reduced use of these treatment types relative to homologous, sperm donation and egg donation (Adamson et al., 2006). UK estimates are not available for surrogacy, but in the USA, less than 0.6% of IVF cycles involve gestational surrogacy (Jones & Cohen, 2007). Nonetheless, replication of these analyses with larger sample sizes is required to further illuminate the profile of psychological adjustment among children (aged 5–9) conceived with these methods. Finally, we did not ask parents whether they had told their children about their conception method or intended to tell them. Theoretical and empirical evidence suggests that secrecy about the child’s method of conception may affect family functioning and child adjustment and that the way information is shared is important (Daniels & Thorn, 2001; Golombok & MacCallum, 2003). Future work with this sample will address this question. However, given that the families in this study were only assessed on a single occasion, it was not deemed sensitive to ask about intended disclosure at the first assessment.

Conclusion

The findings of this study indicate that the children conceived with ART from different conception groups do not differ in their levels of psychological adjustment in middle childhood. Furthermore, of the comparisons made between children conceived with ART and available national norms and twin data, there is little evidence that children conceived with assisted reproductive technology are at increased risk for psychological and behavioural adjustment problems. Yet, just as Winston and Hardy (2002) argued for ongoing monitoring and better child follow-up in relation to elevated rates of malformations and birth defects among children born after IVF, it is also important not to be complacent about the psychological well-being of children conceived with ART which, likewise, requires continued scientific inquiry.

References


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