

The influence of assisted reproduction on family functioning and children's socio-emotional development: results from a European study

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BACKGROUND: ICSI is used with increasing frequency, but there is less information about the children born following this method of assisted reproduction than other forms of IVF. Some authors have suggested that it may contribute to more family stress than IVF. **METHODS:** ICSI conceived children were compared with IVF conceived children and naturally conceived (NC) controls. They were selected in five European countries: Belgium, Denmark, Greece, Sweden and the UK, and seen for psychological testing and a paediatric examination when they were 5 years old. In all countries, except Greece, mothers and fathers were asked to complete questionnaires about parental well-being, family relationships, parenting and child behaviour. **RESULTS:** Very few differences were found between the ICSI and NC group or the ICSI and IVF group. The only significant differences were that mothers in the ICSI conceived group reported fewer hostile or aggressive feelings towards the child and higher levels of commitment to parenting than the mothers of NC children. **CONCLUSIONS:** The study confirms the results of previous work with IVF families. This should be encouraging for families using these techniques in the future.

Key words: ICSI/IVF/child behaviour/parent–child relationship/parenting

Introduction

Compared with natural contraception, any type of assisted reproductive therapy (ART) may be associated with more parental stress, which could influence adaptation to the parental role, parental relationships, parent–child relationships and children's socio-emotional development.

Studies performed so far into outcomes of ART have focused primarily on physical problems such as birth defects and neurodevelopmental outcomes (Bonduelle, 2003). Some studies have been performed looking specifically at children's socio-emotional development, but have tended to be small samples (Mushin *et al.*, 1995; Gibson *et al.*, 2000a) and have not studied the newer types of IVF such as ICSI which, it could be argued, raise additional risks (Sutcliffe, 2000, 2002) because the more invasive nature of the procedure may lead to extra stresses on the couples undergoing treatment. Questions have been raised about the physical and socio-emotional development of children born using this technique (Sutcliffe, 2000) linked with possible strains on parents and their relationship with their children. Using this technique, particularly useful in

the treatment of male infertility, a single sperm is selected and treated, then injected into an oocyte (Palermo *et al.*, 1992). There is less information about the children born following this method of assisted reproduction than other forms of IVF.

Potential sources of strain following a period of childlessness and then undergoing ART of any type include the failure to work through feelings towards infertility (Mushin *et al.*, 1995). The child may be a constant reminder to one parent of their infertility, possibly acting as a 'narcissistic injury' or creating asymmetry in the marital relationship (Colpin *et al.*, 1995). In most countries, ICSI has been used primarily for male factor infertility (Sutcliffe, 2002), which could have specific implications for fathers.

A review of issues related to the development of IVF children (Van Balen, 1998) suggested that the main concerns are: the child might be seen as very 'precious' and then be subject to overprotection; parents may have exaggerated expectations of their child; after a long period of infertility, parents may have difficulty adapting to the reality of child rearing; and the child conceived using IVF may be perceived as

different by other people in the family's social network. Nevertheless, on the basis of the studies included in the review, Van Balen (1998) concludes that no negative differences can be found in parent-child relationships or children's psychological development. He remarks on the small size of most of the studies available, although this does not preclude the detection of clinically relevant differences.

Similarly, research into parent-child relationships in families who used IVF has not, by and large, confirmed the predictions of difficulties, although to date most studies have not included large samples. Mothers who became pregnant using IVF are generally reporting more pleasure in their children, more warmth towards them and more parental competence than naturally fertile mothers (Golombok *et al.*, 1995; Van Balen *et al.*, 1996). An international study including children from Italy, The Netherlands, Spain and the UK (Golombok *et al.*, 1996) compared children conceived using either donor insemination (DI) or IVF with naturally conceived (NC) controls and adopted children, aged between 4 and 8 years. During in-depth interviews, mothers in both assisted reproduction groups and the adoptive mothers expressed more warmth about their child than mothers of NC children. The fathers in the IVF and DI groups were more involved and mothers reported less stress overall than mothers in the NC control group.

It has been suggested, however, that these results may be an indication of the tendency to report socially desirable responses (Colpin *et al.*, 1995). Some detailed observational work in a small-scale study from Belgium found that, at 2-3 years, comparing only those mothers currently employed and who had used IVF were less able to allow their young children autonomy in a problem-solving task than mothers who had conceived naturally (Colpin *et al.*, 1995). However, a study conducted in Australia comparing 65 children conceived using IVF with 61 NC controls did not replicate these findings (Gibson *et al.*, 2000a). No differences were identified between IVF and comparison families in observed parent-child attachment, nor were any differences identified in maternal sensitivity, structuring or hostility during videotaped free play. However, this same group found that the IVF fathers expressed lower self-esteem and less marital satisfaction than those in the NC control group (Gibson *et al.*, 2000b), although measure of general adjustment and parenting showed no differences.

All the studies reported above have included IVF births, but in the last 10 years there has been increasing use of ICSI (Sutcliffe, 2000; Nygren and Nyboe Andersen, 2002). Developed initially to address male infertility factors, it has been increasingly used for 'non-male factors' where fertilization has failed with normal IVF. However, the implications of this newer technique for family relationships has not been fully investigated. It may have no impact, but there is a possibility that male factor 'problems' may lead to more secrecy about disclosure and more marital discord (McWhinnie, 1995). The potential for chemical and mechanical damage is greater using this technique, as is the likelihood of introducing foreign material into the oocyte. Some uncontrolled outcome studies have found a higher rate of sex chromosome abnormalities (Bonduelle *et al.*, 1996) or delayed development (Bowen *et al.*,

1998). Thus parents may be more anxious over time about children conceived using this method. Finally, it may have been used after traditional IVF, thus there could be a longer period of childlessness prior to conception. It is important to investigate both physical and emotional development of children born following ICSI, and the relationship between child behaviour and family characteristics, comparing them both with children conceived using traditional IVF and with NC children.

Here we present the results from a large-scale, multisite European study which was designed to compare ICSI conceived children with NC controls, and to examine the relative levels of stress in the family, as well as parental well-being and adaptation to their parental role, and the children's socio-emotional development. A group of children conceived using traditional IVF was also included to determine any differences between the two ART groups. Including information from a number of countries, apart from increasing the sample size for the relatively new population of children conceived using ICSI, has enabled there to be an examination of effects on children and parents both within and across different cultures.

The aims of the study are to address the following hypotheses: (i) ICSI is associated with increased family stress and marital discord compared with families who have conceived naturally; (ii) parents who have conceived using ICSI have more mental health problems and difficulties in adapting to the role of parent than those who have conceived naturally; (iii) parents who have conceived using ICSI will report that their children have more psychosocial adjustment problems at the age of school entry than parents who have conceived naturally; and (iv) parents who have conceived using ICSI will be comparable with those who have conceived using IVF.

Materials and methods

Participants

The children and their mothers and fathers were recruited in five European countries: Belgium, Denmark, Greece, Sweden and the UK, and were seen when they were 5 years old. However, the Greek team did not distribute parental questionnaires.

According to centre size, the aim was to recruit groups of ICSI, IVF and NC children with 175 children per group in Britain/Belgium and 66 children per group in Denmark/Sweden. The final totals were close to this (see Table I). Children were recruited so that at the time of assessment they would be between 4.5 and 5.5 years. Children were eligible if they were singleton, Caucasian, born after at least 32 weeks gestation, first or second born and whose mother tongue was respectively English, Dutch, Danish, Swedish or Greek.

In the UK and Belgium, ICSI conceived children were recruited mainly from established cohorts already assessed in their second year (Bonduelle *et al.*, 1998; Sutcliffe *et al.*, 2001, 2004). Additional children were recruited from major fertility clinics. In Sweden, ICSI children were conceived after treatment at two fertility clinics and recruited from their consecutive birth records. In Denmark, most ICSI children were recruited from one clinic, but additional children were recruited from three other clinics. In Greece, the children were recruited from several clinics. In Belgium and the UK, the ICSI families had been contacted when their children were younger.

Table I. Numbers of participants in the study, participation rates (where known) and response rates by mothers and fathers to the CBLC in each country

	ICSI	IVF	NC
Belgium	190 (45%)	135 (45%)	188 (–)
Maternal response	124 (65.3%)	92 (68.1%)	103 (54.8%)
Paternal response	95 (50.0%)	56 (41.5%)	79 (42.0%)
Denmark	68 (68%)	67 (56%)	70 (34%)
Maternal response	56 (82.2%)	62 (92.5%)	65 (92.9%)
Paternal response	47 (69.1%)	55 (82.1%)	62 (88.6%)
Sweden	67 (96%)	66 (96%)	67 (78%)
Maternal response	43 (64.1%)	53 (80.3%)	45 (67.2%)
Paternal response	42 (62.7%)	50 (75.8%)	41 (61.2%)
UK	189 (90%)	156 (–)	163 (–)
Maternal response	120 (63.5%)	94 (60.3%)	99 (60.7%)
Paternal response	102 (54.0%)	85 (54.5%)	74 (45.4%)

However, the impact of this in terms of bias is unclear since participation was higher in the UK than in the other countries, but lowest in Belgium (see Table I).

A comparison group of children conceived with standard IVF (i.e. without ICSI) was also recruited using the same criteria. The IVF comparison groups were recruited from participating fertility clinics in all countries in a similar manner to the ICSI conceived children.

NC controls were selected according to the above criteria and the groups were matched as closely as possible in each country to the ICSI and IVF groups for maternal age, maternal education and parental socio-economic status, gender and birth order. Due to differing national laws and quality of child health records, strategies for the recruitment of NC control and comparison groups differed from country to country. In the UK, Belgium and Greece, local schools and nurseries were used to recruit matched NC controls. In Sweden, NC controls were recruited via the Swedish medical birth registry. In Denmark, recruitment was from the participating hospital's birth registry. The participation rate (where known) is indicated in Table I. The different recruitment strategies used for each groups, and across countries, may have introduced some selection bias. The ideal situation would have been to have a national birth register in each country. In the absence of that resource, the control groups recruited in Belgium and the UK may have been biased towards children and families with few problems, or alternatively to those with many problems who wished to share these with a psychologist.

Procedures

Close to their fifth birthday, children received a paediatric examination and an assessment of their cognitive development using the WPPSI-R and subtests from the McCarthy Scales of Child Development (the results of medical and the cognitive testing are reported elsewhere; Kristoffersen *et al.*, 2003; Sutcliffe *et al.*, 2003).

Children were also presented with a procedure designed to investigate their perception of parents, the Bene–Anthony Family Relations Test (Bene, 1985). This test allows them to attribute 16 positive feelings [e.g. Who does (child) like to play with? Who smiles at (child)?] and 16 negative feelings [e.g. Who is naughty? Who makes (child) cry?] to their mother, father, siblings, themselves or to nobody in the family. An additional eight items reflect dependence [e.g. Who should help (child) get dressed in the morning?] giving a total score for each family member that can range from 0 to 40. The family members are represented by cardboard shapes attached to a 'posting box' base into which each statement can be posted.

The countries used different strategies for this, some asking parents to complete the questionnaires at the same time as the child assessment, other countries using postal distribution and return. In all tables, the sample size is indicated together with the countries included in the analysis. The response rates of mothers and fathers in each country to the most frequently completed questionnaire [the Child Behaviour Checklist (CBCL)] are shown in Table I.

Parental well-being and family functioning

Measures were only included that assessed current well-being and family functioning. It would have been useful to include other instruments examining a history of mental health difficulties and family stresses (such as life events) during the 5 years since birth, but there was pressure to keep the number of questionnaires to a minimum. As an indication of current emotional well-being, parents completed the 28 item version of the General Health Questionnaire (GHQ; Goldberg and Hillier, 1979) describing four dimensions: somatic symptoms, anxiety, social dysfunction and severe depression, each with seven items (scored 0, 1, 2 and 3) with scores ranging from 0 to 21 and a total symptom score (range 0–84). Current stress regarding parenting was examined using the Parenting Stress Index (PSI), Short Form (Abidin, 1990) which has a subscale indicating Parental Distress (PD) consisting of 12 items with a 5-point response scale (range 12–60; e.g. there are quite a few things that bother me about my life).

Marital relationships were key to this study since some previous studies had found more discord in families who have conceived using IVF. The Dyadic Adjustment Scale (DAS; Spanier, 1976) measures the quality of the parental relationship. It has four subscales: consensus (range 0–65; e.g. agreement making major decisions); satisfaction (range 0–50; e.g. ever discussed divorce?); affectional expression (range 0–12; e.g. not showing love); and cohesion (range 0–24; e.g. share outside interests) and a total adjustment score (range 0–151).

Undergoing ART involves a substantial commitment to becoming a parent. Measures were included to examine current commitment to parenting (range 17–102; e.g. I cannot imagine a satisfying life without children) and (for most adults their other major role) to their identity as a worker outside the home (range 17–102; e.g. I find that I put work responsibilities ahead of family responsibilities) (Greenberger and Goldberg, 1989). Each scale consists of 17 items with a 6-point Likert-type agree to disagree response scale. A higher score indicates more commitment.

Parent–child relationship

There have been suggestions of overprotection or higher levels of warmth in relation to IVF children. However, stress within the parent–child relationship is also relevant. The PSI has a 'Parent–Child Dysfunctional Interaction' subscale (P-CDI) derived from 12 items indicating difficulties in the parent–child relationship (range 12–60) (e.g. my child smiles at me much less than I expected). The Parental Acceptance–Rejection Questionnaire (PARQ; Rohner, 1999) asks parents how they usually treat their child and measures both warmth and negative aspects of the parent–child relationship. It consists of 60 items each with a 4-point scale (strongly agree to strongly disagree). Scores are derived for warmth/affection (range 20–80; e.g. I say nice things about my child), aggression/hostility (range 15–60; e.g. I nag or scold my child when he/she is bad), neglect/indifference (range 15–60; e.g. I ignore my child) and rejection (range 10–40; e.g. I wonder if I really love my child). By taking the warmth score from 100, the four scales make up a total acceptance/rejection score, with higher scores indicating more rejection in the parent–child relationship.

Table II. Mean parental mental health (SD) from the GHQ by conception type

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value	<i>Post hoc</i> comparisons
Mothers	<i>n</i> = 228	<i>n</i> = 214	<i>n</i> = 209			
Total GHQ score	2.26 (3.72)	2.71 (4.20)	2.88 (4.30)	1.35	0.26	
Somatic symptoms	0.96 (1.67)	1.08 (1.64)	0.93 (1.65)	0.43	0.65	
Anxiety and insomnia	0.70 (1.38)	0.94 (1.61)	1.02 (1.70)	2.52	0.08	
Social dysfunction	0.48 (1.17)	0.57 (1.35)	0.65 (1.43)	0.92	0.40	
Severe depression	0.12 (0.50)	0.13 (0.63)	0.26 (0.83)	3.18	0.04	
Fathers	<i>n</i> = 201	<i>n</i> = 194	<i>n</i> = 185			
Total GHQ score	2.2 (3.8)	2.0 (3.5)	2.9 (4.2)	2.27	0.10	
Somatic symptoms	0.83 (1.51)	0.65 (1.37)	0.98 (1.65)	2.24	0.11	
Anxiety and insomnia	0.78 (1.53)	0.77 (1.52)	0.94 (1.60)	0.72	0.49	
Social dysfunction	0.46 (1.08)	0.45 (1.01)	0.79 (1.53)	4.84	0.008	C>ICSI 0.02 C>IVF 0.02
Severe depression	0.17 (0.82)	0.19 (0.79)	0.15 (0.50)	0.16	0.85	

Data are from Denmark, Sweden and the UK.

Childrens' socio-emotional development

To understand parenting, it is important to have information about the children themselves. While it would have been preferable to obtain this independently (for instance from teachers), this was not possible. Consequently, parents were asked to complete a personality or 'temperament' scale, the McDevitt and Carey (1978) temperament questionnaire. The 72 items each have a 7-point Likert-type scale ranging from 'hardly ever' to 'almost always' which reflect how much the parent considers each of the behaviours is typical of their child (e.g. when my child objects to wearing certain clothing he/she argues loudly, yells and cries). Nine temperamental dimensions (activity, rhythmicity, approach, intensity, mood, persistence, distractibility, threshold and adaptability) are derived by taking the mean of the eight item scores for that dimension so that each dimension's score ranges from 1 to 7 and the total temperament score ranges from 9 to 63 (a higher score indicating a more 'difficult' temperament).

The CBCL (Achenbach, 1991) gives information about children's emotional and behavioural problems. Descriptions of 113 problems are presented and the parent indicates whether they are 'not true', 'somewhat or sometimes true' or 'very true or often true' of their child, with item scores of 0, 1 or 2. The total score (adding all items) is converted to a T score to normalize the distribution and to take into account child age (range 23–100), with different conversion tables for boys and girls. The symptoms are subdivided further into externalizing problems (e.g. fights, temper tantrums) and internalizing problems (e.g. worries) which are also converted to normalized T scores, with a score of 50 representing the 50th percentile. A T score of 60 is at the bottom of the clinical range, with T scores of 64 or more representing marked problems.

The PSI Short Form (Abidin, 1990) Difficult Child (DC) subscale consists of 12 items (e.g. I feel that my child is very moody and easily upset) to which the parent has to agree or disagree (5-point Likert-type scale), resulting in a total 'difficult child' score ranging from 12 to 60.

Statistical analysis

For each questionnaire, data were only included in the analysis if the total response rate for the country was at least 60%. In all countries, there were lower response rates for fathers' questionnaires. In some cases, this led to severely reduced sample size for fathers since the countries with the largest samples (Belgium and the UK) had the lowest response rates. In these cases, to increase sample size, results are presented including countries with at least a 50% response rate.

Univariate analyses were conducted, using ANOVA in SPSS 11.5 for Windows, to determine differences in mean scores between the children conceived using ICSI, IVF and the NC controls. Where a group effect was identified *post hoc* at a significance level of $P < 0.001$,

Tukey's test was conducted. The level of significance was chosen to take into account alpha inflation.

In those instances where there was a significant group effect on mean values at $P < 0.001$, linear regression analyses were conducted in SPSS 11.5, using the 'Enter' method, to control for demographic differences between the conception groups. Dummy variables were created for each conception group, and the reference group was the NC controls. All the demographic descriptors for which there was a significant univariate conception group effect were included: maternal education, maternal age, paternal education and paternal age. Country was also entered along with child's gender if there was a significant difference between boys and girls on the outcome variable. The reference country was chosen for each regression as the one with the lowest score for the outcome variable under consideration.

Results

Differences between the groups

Table I shows the final sample and the response rate for the most frequently completed questionnaire, the CBCL. The mean child age at the time of assessment was similar for all three groups (ICSI 5.02 ± 0.33 ; IVF 5.04 ± 0.31 ; NC control 5.05 ± 0.33 ; means \pm SD). There were, however, significant differences between the conception groups in terms of maternal age and paternal age; parents in both the ICSI and IVF groups were significantly older than the NC control group, but similar to each other [maternal age (years) ICSI 33.4, IVF 33.9, NC control 30.6; $F = 64.21$, $P < 0.001$; paternal age (years) ICSI 34.6, IVF 35.2, NC control 31.9; $F = 52.47$, $P < 0.001$]. Both maternal and paternal education were significantly related to conception group; more parents in the NC control group tended to have higher levels of qualifications and fewer had none (maternal $\chi^2 = 44.44$, $P < 0.000$; paternal $\chi^2 = 27.43$, $P < 0.002$). Maternal occupation, paternal occupation and family social class were not associated with conception group.

Parental well-being and family functioning

There were no conception group differences in maternal well-being according to the GHQ total score or any of the subscales (see Table II). Furthermore, no group differences were identified in the total GHQ for fathers. Rates of problems on the subscales were generally low, the only difference being a conception group effect on social dysfunction (see Table II).

Table III. Mean parental stress and parent–child dysfunctional interactions (SD) according to the PSI by conception type

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value
Mothers	<i>n</i> = 341	<i>n</i> = 294	<i>n</i> = 309		
Parental distress	22.4 (7.1)	22.7 (7.6)	23.1 (7.4)	0.90	0.41
Parent–child dysfunctional interaction	16.8 (5.1)	16.8 (5.1)	17.1 (5.3)	0.41	0.67
Fathers	<i>n</i> = 201	<i>n</i> = 190	<i>n</i> = 186		
Parental distress	23.5 (7.6)	24.3 (7.6)	24.8 (7.7)	1.33	0.27
Parent–child dysfunctional interaction	18.2 (6.7)	17.9 (5.5)	17.7 (5.0)	0.35	0.71

Data are from all countries for mothers and from all except Belgium for fathers.

Table IV. Mean marital satisfaction (SD) from the DAS by conception type

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value
Mothers	<i>n</i> = 208	<i>n</i> = 214	<i>n</i> = 209		
Consensus	50.8 (7.3)	51.5 (6.8)	51.2 (7.0)	0.44	0.64
Satisfaction	35.6 (6.0)	36.2 (6.6)	36.1 (6.4)	0.43	0.65
Affectional expression	8.7 (2.3)	8.4 (2.2)	8.8 (2.3)	1.15	0.32
Cohesion	14.3 (3.7)	14.0 (3.7)	14.6 (3.8)	1.26	0.29
Total DAS marital adjustment	109.2 (16.1)	110.2 (15.5)	109.9 (17.5)	0.22	0.80
Fathers	<i>n</i> = 90	<i>n</i> = 101	<i>n</i> = 99		
Consensus	51.1 (6.9)	51.9 (7.1)	51.2 (6.9)	0.31	0.73
Satisfaction	38.2 (6.3)	38.9 (6.3)	39.8 (5.5)	1.68	0.19
Affectional expression	8.3 (2.3)	8.4 (2.4)	8.6 (2.1)	0.54	0.58
Cohesion	14.8 (3.4)	14.8 (3.6)	15.3 (3.5)	0.69	0.50
Total DAS marital adjustment	112.0 (17.9)	114.2 (16.1)	115.0 (14.1)	0.90	0.41

Data are from Denmark, Sweden and the UK for mothers, and from Denmark and Sweden for fathers.

Table V. Mean parent–child relationships (SD) according to the PARQ by conception type

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value	<i>Post hoc</i> comparisons
Mothers	<i>n</i> = 225	<i>n</i> = 209	<i>n</i> = 210			
Warmth	77.0 (3.3)	76.2 (3.8)	76.5 (3.6)	2.67	0.07	
Hostility/aggression	25.3 (5.2)	26.2 (6.3)	27.4 (5.8)	8.06	0.0001	C>ICSI 0.001
Neglect/indifference	20.4 (3.9)	21.2 (4.0)	21.4 (3.7)	3.75	0.02	
Rejection	14.5 (3.0)	14.8 (3.3)	15.1 (3.4)	2.47	0.09	
Total PARQ	83.7 (12.9)	85.7 (12.6)	87.2 (12.8)	4.11	0.02	
Fathers	<i>n</i> = 184	<i>n</i> = 177	<i>n</i> = 174			
Warmth	74.9 (4.9)	74.3 (4.6)	73.9 (5.0)	1.78	0.17	
Hostility/aggression	25.0 (5.7)	24.9 (6.0)	26.0 (6.5)	1.69	0.19	
Neglect/indifference	22.6 (4.7)	22.4 (4.7)	23.3 (4.5)	1.64	0.20	
Rejection	14.6 (3.8)	14.5 (3.3)	14.8 (3.7)	0.25	0.78	
Total PARQ	87.3 (14.8)	87.5 (14.3)	90.1 (15.5)	1.94	0.14	

Data are from Denmark, Sweden and the UK.

However, this difference was not evident for either group in the regression analyses, after taking demographic factors and country into account (ICSI standardized $\beta = -0.09$, $t = -1.76$, $P < 0.08$; IVF standardized $\beta = -0.12$, $t = -2.38$, $P < 0.02$).

There were no significant conception group differences in levels of parental stress, according to the PSI, PD subscale (see Table III). Similarly, there were no differences between the three groups in marital discord according to the total DAS or any of the subscales, as reported by either mothers or fathers. In fact, the three groups were remarkable for their similarity across each of the subscales of the questionnaire (see Table IV).

Parent–child relationship

There were no significant group effects on the P-CDI scale of the PSI (see Table III).

Mothers who had conceived using ICSI reported fewer negative feelings towards their children than mothers in the naturally conceived group (PARQ total) and were specifically less likely to report aggressive or hostile feelings (PARQ aggression; see Table V). There were no significant differences on the father's responses to the PARQ (see Table V).

The effect of conception method on maternal hostility/aggression scores remained in the regression analyses after taking into account demographic variables that differentiated the conception groups, and country (PARQ hostility: ICSI versus NC $\beta = -0.17$, $t = -3.47$, $P < 0.001$).

On the basis of children's responses to the Bene–Anthony, there were no conception group effects for children's positive or negative feelings towards or total involvement with either mother or father (see Table VI).

Table VI. Mean child perceptions of parent–child relationships from the Bene–Anthony Family Relations Test (SD) by conception group

	ICSI (<i>n</i> = 484)	IVF (<i>n</i> = 403)	NC control (<i>n</i> = 502)	<i>F</i>	<i>P</i> -value
Positive feelings, mother	7.0 (3.8)	6.9 (3.7)	7.1 (3.6)	0.18	0.37
Negative feelings, mother	2.1 (2.6)	2.2 (2.4)	2.4 (2.7)	0.99	0.37
Total involvement, mother	11.7 (5.6)	11.4 (5.9)	12.0 (5.6)	0.59	0.55
Positive feelings, father	4.9 (3.6)	4.7 (3.3)	4.4 (3.2)	2.63	0.07
Negative feelings, father	3.3 (3.3)	3.3 (3.4)	3.2 (3.0)	0.40	0.67
Total involvement, father	9.4 (5.3)	9.1 (5.3)	8.8 (4.9)	1.15	0.32

Data are from all countries.

Table VII. Mean parental commitment to work and commitment to parenting (from the Greenberger scales) (SD) by conception type

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value	<i>Post hoc</i> comparisons
Mothers	<i>n</i> = 302	<i>n</i> = 270	<i>n</i> = 275			
Commitment to work	58.3 (13.5)	56.5 (12.1)	59.8 (11.9)	4.71	0.009	C>IVF 0.006
Commitment to parenting	75.5 (7.9)	73.2 (7.9)	72.7 (8.4)	10.90	0.001	ICSI>C 0.001 ICSI>IVF 0.001
Fathers						
Commitment to work	59.1 (11.0), <i>n</i> = 198	58.0 (11.5), <i>n</i> = 190	61.2 (11.9), <i>n</i> = 182	3.72	0.03	
Commitment to parenting	71.4 (8.2), <i>n</i> = 198	70.6 (6.8), <i>n</i> = 192	69.3 (7.8), <i>n</i> = 178	3.67	0.03	

Data are from all countries for mothers and from Denmark, Sweden and the UK for fathers.

Parental attitudes to family life

Univariate comparisons identified significant effects of conception type on mothers' commitment to work and to parenting, and fathers' commitment to parenting. Mothers with children conceived through IVF tended to be less committed to their work role than the NC controls, and mothers who had conceived using ICSI were more committed to their role as a parent than either NC controls or the IVF group. There were no significant differences between the groups in father's commitment to work (see Table VII).

However, the conception group effect (IVF greater) on maternal commitment to work did not remain once demographic variables (maternal and paternal age and education) and country had been taken into account in the regression. The only significant effects were country variability (Denmark, Sweden and Belgium all higher than the UK, $\beta = 0.23, 0.16$ and 0.54 ; $t = 5.99, 3.85$ and 12.05 , respectively; all significant at $P < 0.0001$), and the highest maternal education group (degree or professional qualification) was higher than the lowest (no qualifications; $\beta = 0.16, t = 2.63, P < 0.001$).

The conception group effect remained for maternal commitment to parenting. Those mothers who had used ICSI had more commitment to their parental role than the NC group (adjusted $R^2 = 0.11, F = 6.76, P < 0.0001$; ICSI versus NC standardized $\beta = 0.20, t = 4.94, P < 0.0001$). In addition, there was a significant country effect, with mothers in Belgium and the UK reporting more commitment than those in Sweden ($\beta = 0.27$ and $0.13, t = 5.38$ and 2.50 , respectively). Parental age and education were unrelated.

Child personality and socio-emotional development

There were no significant conception group differences in total temperament of the children according to mothers or fathers (see Table VIII), nor were there any differences on the

subscales. On the basis of the DC scale or the PSI, there were no significant differences between conception groups (see Table VIII).

Children in the assisted reproduction groups also did not differ overall in terms of behaviour problems as rated on the CBCL, nor were there differences in the proportion of children above the clinical cut-off points (see Table VIII).

Discussion

This study includes a substantial number of children and parents from different European countries. Overall it confirms and substantiates the results of previous smaller studies in that mothers and fathers who have experienced conception using IVF or the newer technique of ICSI are no more likely to have marital difficulties, mental health problems or family stress than families who have conceived naturally. Few differences were identified between parents who had conceived using IVF and those who had used the newer technique of ICSI. Therefore, concerns for parental well-being related to differences in the technique would seem unnecessary.

Parents of children born using both methods of assisted reproduction reported their children as having similar temperaments and similar levels of behaviour problems to the NC group.

Mothers (but not fathers) in the ICSI group were more committed to being a parent than the NC control mothers. Duncan and Edwards (1999) have identified three 'gendered moral rationalities' used by women to explain their roles, based on identities and responsibilities to children: those who see themselves as primarily a mother; those who see themselves primarily as a worker; and those with an integrated mother–worker role. The mothers who have experienced ICSI are closest to the primarily mother identity. This may indeed have some implications in years to come. Women who have negated

Table VIII. Mean child socio-emotional problems (SD) and percentage above the clinical cut-off by conception type according to the CBCL, mean scores on the PSI DC scale and mean total temperament scores from the Carey–McDevitt scale

	ICSI	IVF	NC control	<i>F</i>	<i>P</i> -value
Mothers					
CBCL total T	49.1 (9.1), 5.2%, <i>n</i> = 345	48.9 (9.0), 6.0%, <i>n</i> = 301	49.9 (9.5), 10.9%, <i>n</i> = 310	1.02	0.36
CBCL internalizing T	47.6 (9.1), 4.7%	47.4 (10.0), 5.6%	48.0 (10.0), 6.7%	0.33	0.72
CBCL externalizing T	49.0 (8.3), 5.0%	49.3 (8.6), 5.3%	50.4 (8.7), 8.3%	2.08	0.13
PSI DC	23.3 (7.7)	23.9 (8.0)	23.5 (7.9)	0.43	0.65
Total temperament	38.7 (3.5)	38.4 (3.0)	38.8 (2.9)	0.40	0.67
Fathers					
CBCL total T	46.9 (8.6), 6.3%, <i>n</i> = 193	46.5 (8.3), 4.1%, <i>n</i> = 191	48.0 (9.4), 4.7%, <i>n</i> = 175	1.35	0.26
CBCL internalizing T	44.5 (8.1), 2.1%	44.5 (9.6), 4.0%	45.9 (9.8), 5.5%	1.39	0.25
CBCL externalizing T	46.5 (7.8), 4.9%	46.4 (7.9), 3.2%	48.6 (8.7), 7.0%	4.24	0.02
PSI DC	24.0 (7.8)	23.3 (11.3)	24.0 (7.3)	0.45	0.64
Total temperament	38.7 (2.7)	38.5 (3.0)	38.9 (2.9)	1.22	0.30

Data are from all countries for mothers and from all except Belgium for fathers.

their role in the ‘outside world’ in order to commit to parenting may, as they see their chances of career development receding, regret this approach. Thus it is vital to follow these families as their children grow and the families have different priorities.

However, at this point in their children’s lives, there is no evidence of any resentment. The PARQ allows the respondent to report on the parent–child relationship, including a number of questions elicited. Using this, we are able to report that mothers who have used ICSI were less likely to be hostile or aggressive about their child than those mothers in the NC control group, although, in contrast to Golombok *et al.* (1995), we did not find higher levels of expressed warmth. Possibly, as Van Balen (1996) suggests, they may be trying to be overprotective by suppressing negative feelings about their child, which might also have implications during adolescence, a time when children become more independent from their parents and may display a range of emotional and behavioural problems not typical of younger children. Following these and similar families over time will be required to address this issue.

Nevertheless, the limitations of the study need to be kept in mind. The variable, and low in some cases, response rate in each country for the questionnaires may have influenced the results. Families experiencing difficulties may have been less likely to complete the questionnaires, especially in the ART groups who have ‘worked harder’ to become parents. Another possible factor which inevitably distorts the comparison is that the families who have conceived from fertility treatment implicitly represent the successful ones, i.e. the ones who have followed the stressful processes involved to completion. They are a selected group and their intrinsic qualities undoubtedly have contributed to the success of their treatment, whereas when children are the result of natural conception, it may or may not have been planned, which could have implications for parenting. Therefore, this should be considered when interpreting the more positive feeling couples report towards their children after ART. Finally, it would have been useful to know about the experiences of these families in the 5 years since their child was conceived. There may have been stressful events, or periods of marital discord that differentiated the groups. A more detailed retrospective examination of family histories in face to face interviews could have examined that, but the

available funding did not allow that amount of face to face contact with parents. This could be explored in future research.

The results from this study should be of immense importance in understanding the implications of using ICSI, both for the child outcomes and for the impact on family life. Temperament most closely reflects any inherited aspects of children’s style of responding to the world, and the children conceived by ICSI cannot be distinguished from those conceived using standard IVF or those conceived naturally. Families are coping well and no strains were identified in marital or parent–child relationships. Therefore, clinicians can confidently assure families that there is no additional risk of negative socio-emotional impact for either parents or children.

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