Mental health of mothers and fathers of twins conceived via assisted reproduction treatment: a 1-year prospective study

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BACKGROUND: Although twin deliveries after assisted reproduction treatment (ART) are common, the mental health of the parents has scarcely been addressed. Therefore, we evaluated the psychological well-being of ART and spontaneously conceiving parents of twins and singletons. Furthermore, the impact of parity and children’s health-related factors on mental health was evaluated.

METHODS: We conducted a prospective longitudinal questionnaire study among ART parents of 91 pairs of twins and of 367 singletons and on control parents of 20 pairs of twins and of 379 singletons in the 2nd trimester of pregnancy (T1), and when the children were 2 months (T2) and 1-year old (T3). Symptoms of depression and anxiety, sleeping difficulties and social dysfunction were addressed via a questionnaire. The effects of parity and child-related factors were assessed at T2.

RESULTS: At T1, ART mothers of twins showed fewer symptoms of depression than control mothers of twins (P < 0.05). At T2, both ART and control mothers of twins had more symptoms of depression and anxiety than all mothers of singletons (F = 5.20, P < 0.05 and F = 3.93, P < 0.05, respectively). At T3, both ART and control mothers of twins continued to report more symptoms of depression than the mothers of singletons (F = 10.01, P < 0.01), but a difference in anxiety symptoms was seen only in the control group. All fathers had similar mental health at T1. At T2, ART and control fathers of twins reported more symptoms of depression (F = 4.15, P < 0.05) and social dysfunction than fathers of singletons. At T3, both ART and control fathers of twins had more symptoms of depression (F = 4.29, P < 0.05) and anxiety (F = 5.40, P < 0.05) than fathers of singletons. Control fathers of twins had more sleeping difficulties than fathers of singletons (F = 6.66, P < 0.01). Parity did not differently affect parental mental health at T2 in the study groups. Prematurity did not affect maternal mental health, but it had a negative impact on control fathers’ social dysfunction (F = 3.34, P < 0.05).

CONCLUSIONS: Twin parenthood, but not ART, has a negative impact on the mental health of mothers and fathers during the transition to parenthood. ART parents’ mental health was not affected by parity or children’s health-related factors.

Key words: assisted reproduction treatment / twins / depression / anxiety / prematurity
Introduction

Assisted reproductive treatment (ART) has made parenthood possible for many infertile couples. During the early years of ART, multiple embryo transfer was accepted as a routinely used method in IVF and its variants in order to achieve acceptable pregnancy rates, as cryopreservation of surplus embryos was not yet possible. This practice resulted in a remarkable increase of multiple deliveries (Templeton et al., 1999). Even after the introduction of elective single embryo transfer (eSET) at the end of the 1990s as a method of reducing multiple delivery rates after ART, they have remained high, being 23.1% for all multiple deliveries and 22.0% for twin deliveries in Europe in 2003 (Andersen et al., 2007). Compared with singleton pregnancies, multiple pregnancies carry more risks for both the mother and the unborn children (Senat et al., 1998; Schieve et al., 1999). These risks, prematurity is the most important, affecting 64% of twin deliveries in ART pregnancies in 2004 (Wright et al., 2007). In addition, prenatal and neonatal complications can result in health problems later in the children’s lives (Luke and Keith, 1992).

The transition to parenthood is a period of change and stress, and especially so for the parents of twins. They have to cope with two simultaneously born infants whose needs may be demanding as a result of prematurity, perinatal complications or disability. This may cause feelings of insufficiency and uncertainty and can lead to increased parental stress, depression and anxiety (Alin Akerman, 2001). Following spontaneous conception, more depression has, indeed, been reported in mothers after multiple births (Thorpe et al., 1991; Fisher and Stocky, 2003). Maternal anxiety and stress may also have an effect on the psychosocial well-being of the whole family. Furthermore, the birth of twins can be challenging for the previous children in the family and can increase the workload and stress of the parents even more (Hay et al., 1987; Neifert and Thorpe, 1990).

Achieving an ongoing pregnancy after ART often follows years of stress, uncertainty and multiple treatment failure. It is not self-evident that an induced pregnancy would be followed by an unproblematic change from an infertile to a fertile identity (Daniels, 1999). Symptoms of anxiety and depression, seen in approximately every fifth infertile woman during infertility treatments (Souter et al., 2002; Verhaak et al., 2005), usually diminish or become resolved when singleton pregnancy begins (Reading et al., 1989; Gibson et al., 2000; Klock and Greenfeld, 2000; Repokari et al., 2005), but there is also evidence showing increased levels of depression, lower self-esteem and anxiety among ART parents of singleton during pregnancy (Beaurepaire et al., 1994; McMahon and Gibson, 2002; Hjelmstedt et al., 2007).

Although infertile couples often consider twin pregnancy as the most desirable outcome of ART, most of them do not realize the psychosocial consequences of having twins (Gleicher et al., 1995; Grobman et al., 2001; Kalra et al., 2003; Pinborg et al., 2003a; Child et al., 2004; Ryan et al., 2004). On the other hand, the couple’s desire for a twin pregnancy may relate to beliefs of a better chance of pregnancy following transfer of two embryos rather than of a single embryo (Murdoch, 1997). Recent research shows the complex nature of factors affecting the decision-making process concerning the number of embryos to transfer both at the level of patients and the ART professionals (Newton et al., 2007; van Peperstraten et al., 2008).

During long periods of waiting and frustration, the image of oneself as a parent may become idealized. Formerly infertile parents may also find it difficult to utilize the available pregnancy support resources. Because of the unique demands of parenting twins, it could be expected that ART parents of twins would be at increased risk of stress and mental disorders. Compared with mothers of naturally conceived twins (Cook et al., 1998) or to ART mothers of singletons (Glazebrook et al., 2004; Olivennes et al., 2005; Golombok et al., 2007), increased parenting stress has, indeed, been observed in ART mothers of twins and triplets. However, Tully et al. (2003) found no differences in parental adjustment among mothers of twins conceived by way of infertility treatment or spontaneously.

Information about the mental health of ART mothers after multiple delivery is controversial. Sheard et al. (2007) showed that the risk of depression was increased in mothers of ART twins and triplets compared with mothers of ART singletons at 6 weeks post-partum. Mental disorders may even persist for a prolonged time, as higher levels of depression have been seen in mothers of toddler to preschool-aged ART twins than in mothers of respective age ART singletons (Olivennes et al., 2005). However, in another study, no significant difference in levels of maternal depression was found in twin families with 5-year-old children conceived via ART or naturally (Tully et al., 2003). Up to now, only a few studies have involved analysis of the mental health of ART fathers of twins. In contrast to ART mothers, fathers of twins have shown no difference in parenting stress or in psychosocial well-being when compared with the fathers of spontaneously conceived twins (Colpin et al., 1999; Baer et al., 2004).

Psychological well-being during the transition to parenthood is affected by social and child-related factors, eg. the health and temperament of the child. Previous research shows that prematurity, very low birthweight and disability of the child have a negative impact on the psychosocial well-being of the parents (Cronin et al., 1995; Tommiska et al., 2002; Raina et al., 2005). The mothers of prematurely born children have shown anxiety and depression for a longer time after childbirth than mothers of full-term infants (Alin Akerman, 2001).

This prospective longitudinal study is focused on the mental health of ART mothers and fathers of twins. The occurrence of symptoms of depression and anxiety, sleeping difficulties and social dysfunction were investigated during the second trimester of pregnancy and when the children were 2 months and 1-year old, in four groups: in twin and singleton families in which conception was via ART or was spontaneous. Furthermore, the impacts of parity, prematurity and children’s health at birth and at 2 months of age on maternal and paternal mental health were evaluated in these four groups.

Materials and Methods

Participants and study procedure

In 1999, we recruited 572 Finnish couples who conceived by ART using their own gametes and 497 spontaneously conceiving control couples (Fig. 1). The study procedure has previously been described in detail as regards the singletons (Repokari et al., 2005; Poikkeus et al., 2006a, b). Briefly, Finnish-speaking couples with viable pregnancies as a result of fresh or frozen embryo transfer following IVF or ICSI in five infertility clinics (Helsinki University Central Hospital, the Family Federation of Finland in Helsinki, Turku and Oulu and the Deaconess Institute in
Helsinki) were asked to participate in the follow-up study. Spontaneously
conceiving Finnish-speaking control couples with no history of infertility
and with a maternal age above 25 years were recruited by consecutive
sampling from the patient list for screening ultrasonographic scans at
16–18 weeks of gestation weeks at Helsinki University Central Hospital.
All participants gave voluntary informed consent after receiving oral and
written information. The Ethics Committees of each participating clinic
approved the study.

Mothers and fathers were asked to fill in standardized questionnaires
separately, first during the second trimester at 18–20 weeks of gestation
(T1; mean weeks of gestation 19.7, SD 3.5), second when the children
were 2 months old (T2; mean age 2.3 months; SD 0.9) and third when
the children were 1-year old (T3; mean 14 months; SD 1.6). The first
questionnaire was given at recruitment but the second and the third ques-
tionnaires were mailed after the research nurse had confirmed the
couple’s willingness to continue in the study by a telephone call. The
response rates in the ART and control groups according to the number
of children born are presented in Fig. 1. The final study group consisted
of 458 ART couples and 399 control couples, with 91 pairs of twins
and 367 singletons in the ART group and 20 pairs of twins and 379 single-
tons in the control group. Two couples with triplets in the ART group and
1 couple with triplets in the control group were excluded. Data on the
mental health of mothers and fathers of singletons have been previously
published by our group (Repokari et al., 2005).

**Measures**

‘Mental health’ was assessed by means of a General Health Questionnaire
(GHQ-36), which gives an effective measure of psychiatric disorders
in the general population (Goldberg, 1972; Goldberg and Hillier, 1979;
Ferdinand and Verhulst, 1994), including that in Finland (Rantakallio,
1988). Participants used a scale to estimate how each of the 36
symptom descriptions matched his/her current state (1 = not at all,
4 = much more than usual). Averaged sum scores were created for symp-
toms of ‘depression’ (11 items) involving feelings of hopelessness and
suicidal ideation. The reliability (Cronbach α) varied between 0.77 and
0.85 for women and men across the time points T1–T3. The ‘anxiety’
scale (11 items) describes feelings of being under constant pressure, and
panic (Cronbach α: 0.88–0.92). The ‘sleeping difficulties’ scale (6 items)
referred to difficulties in falling asleep, and waking up in the night, for
example (Cronbach α: 0.75–0.81). Finally, the ‘social dysfunction’ scale
(8 items) describes feelings of inability to perform everyday tasks and to
take part in social activity (Cronbach α: 0.83–0.88).

‘Socio-economic status (SES)’ was assessed via education, profession
and jobs of both spouses in five categories, but because of small
numbers in categories 4 and 5 they were summed: (i) director,
manager, professional in leading position, (ii) entrepreneur, works
manager, trade, nurse, (iii) shop assistant, clerk, skilled worker, nursing
assistant, (4–5) shop trainee, unskilled worker, hospital orderly, unskilled
worker and no paid job outside the home, including students. The scale
relates to that of the Finnish Statistical Office and has been widely used
in Finnish epidemiological studies (Almqvist et al., 1999). Inter-rater
reliability of coding was calculated for 45 cases, and k values were 0.90
for women and 0.93 for men. The SES of the mothers and fathers of
singletons has been described earlier (Repokari et al., 2005).

**Medical and infertility history; obstetric
and perinatal outcome**

Data on medical and reproductive history of the study participants were
collected from the records of infertility and maternity clinics by the
recruiting doctors or by the research nurse. Information concerning the
course of pregnancy and delivery, and the perinatal data was requested
in the questionnaire at T2. Obstetric and perinatal data of T2 non-
responders were collected from the medical records.

Age, duration of marriage or cohabiting partnership and duration of
infertility are given as continuous variables (Table I) based on the partici-
pants’ information at T1. The couples’ children before the current preg-
nancy were scored no = 0 and yes = 1. Parity was scored primipara
(first time mother) = 0 and multipara = 1.

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**Figure 1** Formation of the study groups.

Numbers and percentages of couples returning questionnaires after achieving a pregnancy via ART group or spontaneously without infertility (control group). Assessments were at the second trimester (T1), 2 months post-partum (T2) and when the children were 1-year old (T3).
**Children-related factors**

The date of birth and birthweight of the infants were requested at T2. Factors concerning perinatal outcome are given in Table I, and some were dichotomized—prematurity (birth before 37 weeks of gestation, 0 = no; 1 = yes) and low birthweight (<2500 g, 0 = no; 1 = yes). Early separation (0 = no; 1 = yes) means immediate taking to a neonatal intensive care unit (NICU) or other observational ward.

**Statistics**

Statistical analyses were performed using Statistical Package for the Social Sciences -12.1 software. Bivariate analyses included $\chi^2$ tests and Fisher’s exact tests for categorical variables and Student’s t-tests or analysis of variance (ANOVA) with Bonferroni post hoc tests for continuous variables. A $P$-value < 0.05 was considered significant.

To compare the levels of mental health symptoms between the parents of twins and singletons in the ART and control groups, $2 \times 2$ analysis of covariance between the groups (ART/control) and parenthood status (twin/singleton) at T1, T2 and T3 was separately run for mothers and fathers. The dependent variables included the means of symptoms of depression, anxiety, sleeping difficulties and social dysfunction. The children’s birthweight was used as a covariant. Waller–Duncan post hoc analysis (because of different sample sizes) was applied to evaluate the differences between subgroups.

Three-way ANOVA, using Waller–Duncan post hoc analysis because of different sample sizes, was applied to examine the impact of children’s...
Results

Analysis of study sample

The characteristics of the study participants and obstetric and perinatal outcome of the pregnancy are summarized in Table I. As regards age, ART mothers of twins were younger than other mothers, but all fathers were of similar age. The ART couples had longer partnerships than the control couples, but the difference was not significant. The groups were similar as regards SES (data not shown). First-time motherhood was significantly more frequent in the ART couples than in the control couples. Duration of infertility was comparable in the ART couples as regards twins and singletons. The ART and control parents of twins faced prematurity, low birthweight, early separation from the mother and admittance to an NICU similarly, but more often than the ART or control parents of singletons.

The full response rate of the couples (return of T1, T2 and T3 questionnaires) was 68.6%. Drop-out analysis (attrition analysis) revealed that parents in the ART group showed a better full response rate than parents of the control group (71.2% versus 65.5%, \( P < 0.02 \)). Parents of twins returned questionnaires like parents of singletons (59.3% versus 70.3%, \( P = 0.057 \)). Participation rates among the four groups (Fig. 1) differed (\( P < 0.01 \)) : the control parents of twins showed the lowest full response rate (35%), and ART-parents of singletons the highest (73.6%). A low participation rate was associated with lower paternal SES (\( P < 0.03 \)), and prematurity of the child (\( P < 0.001 \)).

Maternal mental health

Table II presents the results of maternal mental health assessment (mean scores of symptoms of depression and anxiety, sleeping difficulties and social dysfunction with F-statistics) among ART and control mothers of twins and singletons at T1, T2 and T3. No significant interaction between the groups (ART/control) or parenthood status (twin/singleton) was found at any time point, so we focused on analysis of the main effects. The ART mothers had lower levels of symptoms of depression than their respective controls during pregnancy.

<table>
<thead>
<tr>
<th>Table II</th>
<th>Mental health of ART and control mothers of twins and singletons in the second trimester of pregnancy (T1), 2 months post-partum (T2) and when the children were 1-year old (T3)</th>
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<tr>
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<td>ART women</td>
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<td></td>
<td>Twins</td>
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<td>T1</td>
<td>Depression</td>
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<td>Anxiety</td>
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<td>Sleeping difficulties</td>
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</table>

Data are given as mean (M) and SE with analysis of covariance (ANCOVA) statistics.

Note 1. Child’s birthweight was a covariate in all analyses.

Note 2. Waller–Duncan post hoc analyses were conducted because of different sample sizes. The various superscripts indicate differences at \( P < 0.05 \).

\( ^{1} \text{ART mothers of twins } n = 91 \text{ and singletons } n = 367; \text{ control mothers of twins } n = 20 \text{ and singletons } n = 367.\)

\( ^{2} \text{ART mothers of twins } n = 70 \text{ and singletons } n = 324; \text{ control mothers of twins } n = 15 \text{ and singletons } n = 304.\)

\( ^{3} \text{ART mothers of twins } n = 54 \text{ and singletons } n = 265; \text{ control mothers of twins } n = 11 \text{ and singletons } n = 249.\)

\( ^{a} \text{P} < 0.05.\)

\( ^{b} \text{P} < 0.01.\)

\( ^{**} \text{P} < 0.001.\)
The ART mothers of twins had significantly fewer symptoms of depression than the control mothers of twins (1.18 versus 1.34), but the scores were comparable with those in the mothers of all singletons. The lower level of symptoms of depression in ART versus control mothers of singletons has been reported earlier (Repokari et al., 2005). At T2, the mothers of twins, independent of ART, had significantly higher levels of symptoms of depression and anxiety than ART or control mothers of singletons ($F = 5.20, P < 0.05$ and $F = 3.93, P < 0.05$, respectively). At T3, the mothers of twins in both groups continued to report more symptoms of depression than the mothers of singletons ($F = 10.01, P < 0.01$), but concerning anxiety symptoms, the difference between mothers of twins and singletons existed only in the control group ($F = 8.64, P < 0.01$ for parenthood and $F = 4.64, P < 0.05$ for group). Additionally, at T3, the ART mothers of twins reported significantly fewer anxiety symptoms than control mothers of twins (Fig. 2). No differences were found concerning sleeping difficulties and social dysfunction between the mothers of twins and singletons or between the ART and control groups at any time point.

**Paternal mental health**

Table III presents the results of paternal mental health (mean scores of symptoms of depression and anxiety, sleeping difficulties and social dysfunction with F-statistics) among ART and control fathers of twins and singletons. Similarly to mothers, the interaction effects were non-significant; thus, the focus was on the main effects. During the partner’s pregnancy, the mental health of fathers did not differ between the ART and control groups or between fathers of twins and singletons. At T2, the ART and control fathers of twins showed more symptoms of depression than the fathers of singletons ($F = 4.15, P < 0.05$) (Fig. 3). Symptoms of social dysfunction were more common in fathers of twins than in fathers of singletons ($F = 4.93, P < 0.05$). At T3, the ART and control fathers of twins continued to report more symptoms of depression than the ART or control fathers of singletons ($F = 4.29, P < 0.05$). In addition, fathers of twins, irrespective of ART, had more anxiety symptoms than fathers of singletons ($F = 5.40, P < 0.05$). Furthermore, sleeping difficulties were more common in fathers of twins than in fathers of singletons ($F = 6.66, P < 0.01$), significantly so between the control fathers of twins and singletons.

Clinically significant amounts of symptoms according to GHQ-36 total points (depression, anxiety, sleeping difficulties and social dysfunction) were found among 7.7% of all mothers of twins at T1 (5 ART versus 1 control; Fisher’s exact test $P = 1.00$), 4.9% at T2 (3 ART versus 1 control; $P = 1.00$) and 13.1% at T3 (6 ART versus 2 controls; $P = 0.63$), and among 3.9% of all fathers of twins at T1 (3 ART versus 0 control; $P = 1.00$), 5.3% at T2 (4 ART versus 0 control; $P = 1.00$) and 6.9% at T3 (3 ART versus 1 control; $P = 0.50$) using a threshold of nine as recommended when establishing a norm in Finland (Holi et al., 2003).

**The impact of parity and children’s health-related factors on maternal and paternal mental health post-partum**

The non-significant interactions (Table IV) indicate that parity had similar impact on the occurrence of maternal or paternal mental health symptoms in ART and control groups (twins and singletons) at T2. Neither was maternal mental health differently affected by children’s health-related factors in these groups. However, prematurity had a negative impact on social dysfunction in control fathers of twins but not in ART fathers of twins or in the ART or control fathers of singletons (Table IV, Fig 4.).

**Discussion**

Although infertile couples who prepare for twin parenthood after successful ART are considered to be at an increased risk of psychosocial problems (Klock, 2004), this is, to our knowledge, the first prospective study concerning assessment of mental health (symptoms of depression and anxiety, sleeping difficulties and social dysfunction) of both mothers and fathers of ART twins covering three stages of the transition to parenthood. Previous cross-sectional studies have shown either a negative or a neutral impact on mental health and on psychosocial well-being of parents of twins conceived by means of infertility treatment (Munro et al., 1990; Munro et al., 1992; Colpin et al., 1999; Pinborg et al., 2003b; Tully et al., 2003; Baor et al., 2004; Pinborg et al., 2004a, b; Ellison et al., 2005; Olivennes et al., 2005). However, research settings and the methods used in these studies vary and make it difficult to draw definite conclusions. For example, the studies have been performed at very different time points and they include various infertility treatments. In some studies, treatments with own and donated gametes have been combined, as well as the parents of twins and triplets (Glazebrook et al., 2004; Sheard et al., 2007). To keep the focus solely on the effect of twin parenthood on maternal and paternal mental health, we excluded couples with higher order multiple pregnancies, as well as couples treated with donated gametes.

Some limitations have to be considered. The results are based on self-reported mental health, not on more objective methods such as personal interviews or observations. Thus, the results reflect subjective well-being. Even though we sent the questionnaires in separate envelopes to the couples, we really do not know if they answered...

**Figure 2** Symptoms of depression and anxiety among ART and control mothers of twins and singletons at the second trimester (T1) and when the children were 2 months (T2) and 1-year old (T3). Analysis of covariance, Waller–Duncan post hoc analyses, adjusted for child’s birthweight. *$P < 0.05$.****

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individually or in cooperation. Further, participation rates in the groups were different. The ART groups showed higher full response rates than the control groups, and twin groups marginally lower response rates than singleton groups. The full response rate was lowest in the controls with twins. As the number of control couples with twins at the age of one year was low (11 couples), interpretation of the results at this time point must be cautious. In addition, we could not analyse the role of child health-related factors on psychological well-being over the first year in the ART and control groups, as we have previously reported for parents of singletons (Repokari et al., 2005). Our control group was gathered from one hospital, but we think that this narrow geographic distribution compared with that of the ART group is of minor importance, as the capital area accumulates couples from all over Finland and health and social services are similar all over the country. In Finland, accessibility to ART is good and the expenses of infertility treatments are covered by social security.

In the present study, analogous to our previous results with singletons (Repokari et al., 2005), ART mothers of twins reported fewer symptoms of depression than control mothers of twins during pregnancy. Long-term desire for a child/children and the different degrees of preparedness for a twin pregnancy may be associated with a difference in occurrence of psychological symptoms in previously infertile and fertile mothers expecting twins. The better psychological well-being of ART mothers of twins during pregnancy may be a result of the thorough counselling process, including information on the option of multiple gestation and its complications, before the couple’s decision to begin ART. Further, the ART mothers had an early pregnancy ultrasonographic examination to

<p>| Table III | Mental health of ART and control fathers of twins and singletons in the second trimester of pregnancy (T1), 2 months post-partum (T2) and when the children were 1-year old (T3) |
|---|---|---|---|---|---|---|---|
| ART father | Control father | Group main effects ART/control | Parenthood main effects twin/singleton | Interaction effects |
| Twins | Singletons | Twins | Singletons | Twins | Singletons | Twins | Singletons |
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<th>M</th>
<th>SE</th>
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<th>M</th>
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<tr>
<td>Depression</td>
<td>1.24</td>
<td>0.03</td>
<td>1.22</td>
<td>0.01</td>
<td>1.27</td>
<td>0.07</td>
<td>1.29</td>
</tr>
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<td>Anxiety</td>
<td>1.44</td>
<td>0.04</td>
<td>1.38</td>
<td>0.02</td>
<td>1.46</td>
<td>0.09</td>
<td>1.44</td>
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<td>Sleeping difficulties</td>
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<td>1.65</td>
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<td>1.72</td>
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<td>Social dysfunction</td>
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<td>1.88</td>
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<td>1.90</td>
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<tr>
<td>Depression</td>
<td>1.26a</td>
<td>0.03</td>
<td>1.22b</td>
<td>0.01</td>
<td>1.37a</td>
<td>0.07</td>
<td>1.26ab</td>
</tr>
<tr>
<td>Anxiety</td>
<td>1.38</td>
<td>0.05</td>
<td>1.34</td>
<td>0.02</td>
<td>1.53</td>
<td>0.11</td>
<td>1.39</td>
</tr>
<tr>
<td>Sleeping difficulties</td>
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<td>1.87</td>
<td>0.03</td>
<td>1.87</td>
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<td>1.89b</td>
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<td>2.03ab</td>
<td>0.08</td>
<td>1.91ab</td>
</tr>
<tr>
<td>T3</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Depression</td>
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<td>1.28b</td>
<td>0.01</td>
<td>1.41a</td>
<td>0.08</td>
<td>1.28b</td>
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<td>Anxiety</td>
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<td>1.59a</td>
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<td>Sleeping difficulties</td>
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<td>1.59b</td>
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<td>Social dysfunction</td>
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<td>0.04</td>
<td>1.87</td>
<td>0.02</td>
<td>2.04</td>
<td>0.11</td>
<td>1.97</td>
</tr>
</tbody>
</table>

Data are given as mean (M) and SE with ANCOVA statistics. 
Note 1. Child’s birthweight was a covariate in all analyses. 
Note 2. Waller–Duncan post hoc analyses were conducted because of different sample sizes. The various superscripts indicate differences at P < 0.05. 
ART fathers of twins n = 85 and singletons n = 352; control fathers of twins n = 14 and singletons n = 344. 
ART fathers of twins n = 60 and singletons n = 310; control fathers of twins n = 12 and singletons n = 277. 
ART fathers of twins n = 53 and singletons n = 256; control fathers of twins n = 9 and singletons n = 222. 
*P < 0.05. 
**P < 0.01. 

Figure 3 | Symptoms of depression and anxiety among ART and control fathers of twins and singletons at the second trimester (T1) and when the children were 2 months (T2) and 1-year old (T3). 
Analysis of covariance, Waller–Duncan post hoc analyses, adjusted for child’s birthweight. *P < 0.05.
pregnancy rate and medical and psychosocial consequences of singleton and multiple pregnancies, including child/ren’s health-related risks. The decision to perform eSET or double embryo transfer has been the responsibility of the IVF doctor in concord with the couple. Implementing eSET in clinical practice may be a complex issue, as also discussed by van Peperstraten et al. (2008). Reimbursement of infertility costs by social security, our own progressively accumulated data on the effectiveness of eSET and well-functioning cryopreservation system has contributed to the implementation of eSET in Finland. In the counselling process prior to ART and control mothers of twins than in mothers of singletons confirm previous findings of an increased risk of post-partum depression associated with spontaneously conceived multiple births (Thorpe et al., 1991; Fisher and Stocky, 2003). The post-natal mental health of ART mothers of twins, especially as regards depression, has been the focus of only one previous study (Sheard et al., 2007). Our results add to their finding of a more than 3-fold increased risk of clinically significant symptoms of depression in ART mothers of multiples compared with ART mothers of singletons at 6 weeks after delivery. A limitation of their study is that they included mothers with triplets and mothers treated with donated gametes, both factors which may have affected their results.

With 1-year-old children, the ART and control mothers of twins reported higher levels of depression than the mothers of singletons in any group. This finding is consistent with previous results on primiparous ART mothers of 1-year-old multiples (Baor et al., 2004; Glazebrook et al., 2004). Previous cross-sectional studies have shown that the risk of depression in ART mothers of twins still exists 2–4 years after delivery (Ellison et al., 2005; Olivennes et al., 2005). On the other hand, anxiety symptoms in all ART mothers were similar to those of control mothers of singletons and significantly fewer than those in control mothers of twins, thus further adding evidence that ART itself does not impair maternal mental health during the transition to parenthood.

By including a focus on the mental health of ART fathers of twins across the transition to parenthood, our study is unique. We found that across the transition to parenthood, twin birth, but not ART, had a negative impact on the mental health of fathers. This finding backs up the results of previous research, which has shown that the

Table IV Summary of group (ART/control) × parenthood (twin/singleton) × child-related factors on maternal and paternal mental health at two months post-partum (T2)

<table>
<thead>
<tr>
<th>Group × parenthood × parity</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Sleeping difficulties</th>
<th>Social dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.89</td>
<td>0.42</td>
<td>0.68</td>
<td>0.71</td>
<td>0.30</td>
</tr>
<tr>
<td>0.95</td>
<td>0.17</td>
<td>1.76</td>
<td>0.96</td>
<td>0.35</td>
</tr>
<tr>
<td>0.75</td>
<td>0.36</td>
<td>1.93</td>
<td>2.17</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Interaction ANOVA F*<sup>a</sup>

<table>
<thead>
<tr>
<th>Group × parenthood × prematurity</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Sleeping difficulties</th>
<th>Social dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.95</td>
<td>0.17</td>
<td>1.76</td>
<td>0.96</td>
<td>0.35</td>
</tr>
<tr>
<td>0.75</td>
<td>0.36</td>
<td>1.93</td>
<td>2.17</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Interaction ANOVA F*<sup>b</sup>

<table>
<thead>
<tr>
<th>Group × parenthood × birthweight</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Sleeping difficulties</th>
<th>Social dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.89</td>
<td>0.42</td>
<td>0.68</td>
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<tr>
<td>0.75</td>
<td>0.36</td>
<td>1.93</td>
<td>2.17</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Interaction ANOVA F*<sup>c</sup>

<sup>a</sup>Degrees of freedom (df) = 4, 695 for mothers; df = 4, 647 for fathers; interaction effects are based on three-way ANOVAs.

<sup>b</sup>P < 0.05.

confirm the viability and to investigate the plurality of the pregnancy, in contrast to the situation in follow-up after natural conception. Thus, the infertile couples expecting twins had been able to prepare themselves for twin pregnancy earlier than the fertile controls. Additionally, many studies have shown that attitudes of infertile and fertile mothers and fathers towards multiple pregnancies are different, infertile couples being more receptive to the option of multiple

In Finland, the IVF doctors started to perform eSET in 1996 in women who had a medical indication in order to minimize the obstetric and perinatal complications. An important initial stimulator to start eSET in Finland was the close cooperation between the infertility doctors, perinatologists and the neonatologists at the University Clinics. The patients for this study were recruited in 1999, when our own experimental data on the effect of eSET was available for counselling the patients (Vilska et al., 1999). In addition, a well-functioning cryopreservation system has contributed to the implementation of eSET in Finland. In the counselling process prior to ART treatment, the key points have included the pregnancy rate, multiple

Figure 4 The interaction effect of prematurity on symptoms of social dysfunction in ART and control fathers of twins and singletons 2 months post-partum (T2).

Analysis of variance (F = 3.34, P < 0.05).
mode of conception does not affect the psychological well-being of fathers of 1-year-old twins (Colpin et al., 1999; Baor et al., 2004).

We also studied the impact of parity on the post-partum mental health of parents of twins. As could be expected, first-time parenthood was significantly more common in the ART than in the control groups. In contrast to the results of previous studies, we did not find any correlation between parity and parental mental health in any of our ART or control groups. Higher parental stress among first-time ART mothers of twins compared with first-time mothers of naturally conceived twins has been reported (Gibson et al., 2000; Baor et al., 2004), but we found only two studies focusing on the impact of parity on parental psychosocial well-being (Colpin et al., 1999; Baor et al., 2004). Colpin et al. (1999) reported that first-time mothers of 1-year-old twins conceived by means of IVF or by artificial insemination had lower psychosocial well-being than naturally conceiving first-time mothers of twins and infertile mothers of twins who had older children. However, the presence of older children in the family had no impact on the fathers’ psychosocial well-being. Results reported by Baor et al. (2004) on ART mothers of twins support these findings.

Pregnancies after ART involve more risks than spontaneous pregnancies, e.g. complications during pregnancy, preterm birth and low birthweight of the child (Helmerhorst et al., 2004; Jackson et al., 2004). Increased morbidity, risk of cerebral palsy, disability and later behavioural problems of children have been shown to be associated with prematurity (Bhutta et al., 2002; O’Brien et al., 2004), the risks being even higher in low-birthweight preterm infants (Saigal et al., 2003). Parents of preterm infants are at risk of psychosocial stress, depression and anxiety disorders (Meyer et al., 1995; Singer et al., 1999). These risks are even greater if the child is born very preterm (Hagan et al., 1998). Our results showed that prematurity or low birthweight did not affect post-natal maternal mental health, but prematurity correlated with social dysfunction and sleeping difficulties in the control fathers of twins. These findings suggest that the mental health of ART parents of twins is resistant to child-related stressors, in a manner similar to that reported previously in ART parents of singletons as regards social and child-related stress (Repokari et al., 2005).

Our results should, however, be interpreted with caution, as the number of deliveries before 32 weeks of gestation was small. Additionally, attrition analysis showed that a low participation rate was associated with prematurity of the child, which may have biased the analyses. As the obstetric and perinatal data were based on self-reporting by the parents 2 months after delivery, the accuracy of the results may be restricted. However, the obstetric and perinatal characteristics of twins and singletons in both the ART and control groups are in good accordance with those previously reported (Pinborg et al., 2003b, 2004a).

In conclusion, during pregnancy, ART mothers of twins had fewer symptoms of depression than their controls. Twin parenthood, but not ART, was correlated with an increased amount of adverse mental health symptoms in mothers and fathers during their first year as parents. The ART parents of twins, compared with the parents of naturally conceived twins, were more resilient to stressors related to child health post-partum, most probably because of their positive attitude and preparedness for a twin pregnancy. Our results contribute to previous recommendations to strive to approach the natural twinning rate in ART. Counselling, as regards the option of a twin pregnancy, covering its medical and psychosocial risks before beginning ART, is of decisive importance in helping a couple to understand the consequences of twin pregnancy and birth, and to help them to adapt to twin parenthood.

**Author’s role**

S.V. and L.U.-K.: acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version; R.-L.P.: study design, acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version; P.P. and L.R.: acquisition of data, revising the article, final approval of the version; J.S.: study design, revising the article, final approval of the version; and A.T. and M.T.: study design, acquisition of data, revising the article, final approval of the version.

**Acknowledgements**

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**References**


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