

Changes in partnership quality after successful in-vitro fertilization and natural conception

Manuel Kiesswetter¹, Erik Danay¹ & Stefan Duschek¹

¹UMIT Tirol – University for Health Sciences and Health Technology

Address correspondence to: Manuel Kiesswetter, UMIT Tirol – University for Health Sciences and Health Technology, Institute of Psychology, Eduard Wallnöfer Zentrum 1, 6060 Hall in Tirol, (Austria). Email: manuel.kiesswetter@edu.umat-tirol.at

Abstract

Objective: This prospective study explored changes in self-reported partnership quality related to childbirth in couples after successful in-vitro fertilization (IVF), and in those experiencing spontaneous pregnancy.

Background: Previous research suggested decline in partnership satisfaction after childbirth in couples with spontaneous pregnancy. However, longitudinal studies on partnership quality in couples undergoing IVF are still scarce.

Method: Seventy-five couples with successful IVF, and seventy with spontaneous pregnancy, completed the Partnership Questionnaire; data were recorded before pregnancy (baseline) and 6, 12, 18 and 24 months after childbirth. Multi-level models were applied for data analysis.

Results: Reports of general partnership quality, feelings of togetherness and experience of tenderness increased, while reports of conflictive behaviors declined overall across the observation period in couples with IVF. Couples with spontaneous pregnancy indicated marked negative changes in these facets of partnership quality after childbirth (month 6); subsequently, partnership quality progressively improved, reaching a similar level to that of couples with IVF at month 24.

Conclusion: While couples with IVF reported an overall positive trend in partnership quality, in couples with spontaneous pregnancy partnership quality declined immediately after childbirth but improved again over time. The experiences of infertility and IVF treatment may promote the acquisition of dyadic coping strategies, which can buffer the negative effects of stressors characterizing the initial period of parenthood. Moreover, selection processes may be important for higher partnership quality in couples with successful IVF, where couples with abundant coping resources are more likely to stay together during infertility and the burdensome treatment.

Key words: infertility, in-vitro fertilization, partnership quality, pregnancy, childbirth



1. Introduction

The psychological impact of infertility has been widely reported; numerous studies documented reduced wellbeing and quality of life, and increased stress and symptoms of mental disorders in affected couples (Deka & Sarma, 2010; Domar et al., 1993; Fisher & Hammarberg, 2017; Greil, 1997; Kiesswetter et al., 2020). Between 10% and 15% of couples in the industrialized world experience infertility; depending on various individual and contextual factors, couples may make use of assisted reproductive techniques, in particular in-vitro fertilization (IVF), to fulfill their desire to have a child (Evers, 2002; Ragni et al., 2005; WHO, 2003). In Italy, where the accessibility of assisted reproduction is comparatively high, a large portion of couples chose this option. According to national health registers, approximately 50,000 couples per year are treated with these techniques in Italy; in contrast, there are only about 1,500 requests for adoption (CAI, 2019; Scaravelli et al., 2020). The success of IVF strongly depends on the couples' age; while the success rate has been estimated at 45% in couples younger than 35 years, it decreases with increasing age (SART, 2016). It has been extensively documented that infertility and its treatment can have a negative impact on a couple's relationship, reflected for example in more partnership conflicts and emotional and sexual problems, as well as generally reduced partnership satisfaction (Kiesswetter et al., 2020; Lowyck et al., 2009; Wischmann et al., 2014; Wischmann et al., 2001).

Similar to couples with spontaneous pregnancy, those with successful IVF experience major changes in most life areas after the birth of a child (Luhmann et al., 2012). In addition to changes in daily routines and professional and social life, the partnership substantially changes due to parenthood (Doss et al., 2009). Most studies conducted in couples with spontaneous pregnancy suggest a decline in partnership quality after childbirth, which may relate for example to partnership conflicts or reduced quality time together (Guttmann & Lazar, 2004; Roy et al., 2014). While changes in partnership quality are perceived by fathers and mothers, findings concerning gender differences are inconsistent (Nomaguchi & Milkie, 2020); a greater decrease in partnership satisfaction has been described in fathers (Don & Mickelson, 2014), but also in mothers (Keizer & Schenk, 2012). Other studies did not reveal gender differences in the changes (Figueiredo et al., 2008; Holmes et al., 2013).

Not much is known about changes in partnership quality during pregnancy and after childbirth in couples with IVF. In previous studies, couples who had a child through IVF reported less distress in the partnership (Benazon et al., 1992), greater marital cohesion (Slade et al., 1997), a strong working relationship (Allan et al., 2021) and generally more positive evaluations of their partnership (Strauss et al., 1992), than those where the intervention did not lead to a success. Studies where a comparison with controls was made, suggested greater partnership stability (Sydsjö et al., 2002) but also more conflicts in couples with successful IVF than in those with spontaneous pregnancy (Gibson et al., 2000); further studies did not find any difference in partnership satisfaction between these two groups (Colpin et al., 1995; Gibson et al., 2000; Hahn & DiPietro, 2001; McMahon et al., 1997). Moreover, infertility diagnosis and IVF treatment were associated with more sexual problems, leading to reduced partnership satisfaction (Kiesswetter et al., 2020; Ramezanzadeh et al., 2006).

The inconsistency of the results of the above-described studies may partly be due to various methodological restrictions. Most of the studies used cross-sectional designs, comparing couples with IVF and natural conception during pregnancy or shortly after childbirth (Colpin et al., 1995; Klock & Greenfeld, 2000; McMahon et al., 1997). Very few longitudinal studies have investigated changes in partnership quality after childbirth; however, these studies are limited by short observation intervals (not exceeding 1 year), beginning during the period of pregnancy. As such, no firm conclusions can be drawn regarding partnership quality before pregnancy onset.

From a theoretical perspective, the birth of a child constitutes a critical life event, requiring substantial readjustment by parents (Holmes & Rahe, 1967). Building on this, the adaptation of the Stress Process Model (SPM) to the transition to parenthood assumes that the birth of a child is a relevant stressor, where its negative impact on parents' wellbeing and partnership quality varies according to resources like social support and coping strategies (Milkie, 2009; Pearlin, 1989). Moreover, according to the SPM, successful readjustment and coping with the challenges of parenthood may ultimately improve partnership quality over time (Cast, 2004; Lawrence et al., 2008). Partnership quality after childbirth depends on numerous factors, which have been described under the so-called demands-rewards perspective (Nomaguchi & Milkie, 2020). While demands include psychosocial and physical stressors, rewards can refer to satisfaction due to parenthood and personal growth (Nomaguchi & Milkie, 2020).

Based on these theoretical frameworks, hypotheses concerning the different responses to childbirth of couples with IVF versus those with spontaneous pregnancy may be formulated. Considering the distress associated with the unfulfilled desire to have a child and the burdens imposed by treatment, couples with IVF might focus more on the positive aspects (rewards) of parenthood than those with spontaneous pregnancy. Various studies suggested that couples having children after IVF appraise parenting more positively than those with spontaneous pregnancy. For example, they reported being more emotionally involved with their children and feeling more competent in terms of educational issues (Golombok et al., 1995; Van Balen, 1996; Weaver et al., 1993). Moreover, these couples had a lower perceived stress burden and indicated that parenthood felt easier than they had expected, and that their children were essentially easy to handle (Hahn & DiPietro, 2001; Sydsjö et al., 2002). These positive experiences may ameliorate the negative aspects (demands) of parenthood and facilitate couples' readjustment to their new role. Further research suggested more positive self-perceptions of couples with successful IVF; for example, they claimed that due to the longer period of preparation for parenthood they may be more thoughtful and better adjusted overall to the task of raising a child (Allan et al., 2021; Sydsjö et al., 2002). In addition, overcoming the challenges of infertility and IVF together may promote the acquisition of coping skills by the couple, which may in turn help them deal with stressors related to the presence of a newborn baby. It was reported that parents with IVF spend more time talking about family and parenting issues than those with spontaneous pregnancy, such that they may be more likely to reach a consensus and identify efficient strategies to handle everyday problems (Sydsjö et al., 2002). Overall, in couples with IVF, greater perceived rewards, a more positive attitude regarding parenthood, and greater ability to meet demands may limit the negative impact of childbirth on partnership quality.

In addition, selection processes may play a role in partnership quality in couples with successful IVF. As noted previously, infertility and IVF constitute significant challenges for a couple (Fisher & Hammarberg, 2017; Greil, 1997; Kiesswetter et al., 2020; Wischmann et al., 2014). It is likely that only couples possessing abundant coping resources will stay together under these conditions. This also supports the hypothesis that couples who have gone through infertility and have a child after IVF experience higher partnership quality than those with natural pregnancy.

The present study was carried out in Trentino - South Tyrol in northern Italy; the specific situation regarding IVF treatment in Italy should be considered. Italian health legislation dictates which couples can undergo IVF, and these techniques may be used only based on the principles of staged application and minimal invasiveness. Six IVF treatment attempts and associated costs are covered by the public health care system and thus are free of charge for couples. Therefore, in contrast to many other countries, financial costs do not play a major role for most couples considering IVF, such that financial aspects are unlikely to contribute to conflicts or tension between partners.

The study investigated changes in the partnership quality of couples with successful IVF, and those with spontaneous pregnancy, between the time before pregnancy onset and the end of the second year of life of the child. For this purpose, questionnaire data on partnership quality were obtained from infertile couples before they underwent IVF treatment, and from couples with a desire to have a child expecting spontaneous pregnancy. Only couples who conceived a child were included in this study, all of whom completed the same questionnaires again 6, 12, 18 and 24 months after childbirth. We hypothesized that there would be a decline in partnership quality between the periods before pregnancy and after childbirth, followed by a gradual return to baseline satisfaction in the couples of both study groups. The literature did not allow for precise prediction of the time required for recovery of partnership quality (Kluwer & Johnson, 2007). While factors including initial partnership quality, relationship duration, and coping resources were suggested to affect the course of partnership quality after childbirth, there has been no research on the possible role of IVF (Bogdan et al., 2022; Twenge et al., 2003). However, according to the reasoning presented above, the initial decline was expected to be less pronounced in couples with successful IVF than in those with spontaneous pregnancy, indicating a more stable partnership overall.

Partnership quality is commonly regarded as a multidimensional construct comprising the couple's positive or negative appraisals of a variety of significant areas of the partnership and related behaviors (Fletcher et al., 2000; Hassebrauck & Fehr, 2002). Relevant dimensions include feelings of togetherness and positive interactions, intimacy and tenderness, as well as possible destructive communication. Therefore, multidimensional assessment of changes in partnership quality following childbirth was implemented in the study (Hahlweg, 1996). Cohesion and positive interactions of partners may be compromised by increased everyday stress due to childcare and reduced quality time together. Intimacy and sexuality may be

negatively affected by exhaustion, fatigue, and less privacy. Finally, diminished frustration tolerance, for example, due to sleep deprivation or less time available for recreation, may increase the risk of negative communication.

2. Methods

2.1 Study Design

This study is part of a larger project investigating changes in life satisfaction in couples with IVF and spontaneous pregnancy (Kiesswetter et al. 2020, Kiesswetter et al., 2022). Self-report data on partnership quality from couples who had a child through IVF treatment (IVF group) or spontaneous conception (spontaneous pregnancy group) were obtained. During this study, there were five measurement occasions: before pregnancy (T1), 6 months after birth of the child (T2), 12 months after birth (T3), 18 months after birth (T4) and 24 months after birth (T5).

2.2 Participants

In total, 145 couples participated: 75 in the IVF group and 70 in the spontaneous pregnancy group. The IVF group was recruited from three IVF centers in Trentino - South Tyrol (Italy): Reference Center for Reproductive Medicine, Hospital of Brunico; Fertility Clinic, Hospital of Merano; and Reference Center for Reproductive Medicine, Hospital of Arco. The distribution of the infertility factors was as follows: idiopathic infertility (30 couples, 40%), male infertility (10 couples, 13.3%), female infertility (21 couples, 28%), and female and male infertility (14 couples, 18.7%). The spontaneous pregnancy group was recruited from the Department of Gynecology of the Hospital of Merano, and through personal contacts. All participants were either bilingual or German-speaking Italians, since German is the most widely spoken language in this region of northern Italy. This allowed us to recruit couples with a relatively homogenous cultural background. Table 1 presents the demographic data of both groups at T1. While men and women in the spontaneous pregnancy group were younger than in the IVF group, there were no group differences in duration of education or income ($U = 9447$, $Z = -1.61$, $p = .11$).

The dropout rate was 3% (four couples). In the IVF group, one couple divorced after T2, one couple lost their child after T4, and one couple decided not to continue the study after T4; in the spontaneous pregnancy group, one couple lost their child after T3. The data of these couples are not included in the analysis.

2.3 Procedure

The IVF group was recruited in the reference centers by medical doctors who informed the couples about the procedure, collected the sociodemographic data, and presented them with the questionnaires for T1 before the beginning of the IVF treatment. A total of 237 couples were recruited at that point; they all underwent IVF. Among the couples, 154 were treated with conventional IVF and 83 were treated with IVF combined with intracytoplasmic sperm injection (ICSI). The treatment was successful in 78 couples (24 couples with ICSI). The success rate of 32.9 % was slightly higher than reported in the literature (SART, 2016; Scaravelli et al., 2020). In total, 136 couples who reported that they were planning to have a child, and expecting natural conception in the near future, were recruited to the spontaneous pregnancy group as prospective participants and completed the questionnaires for T1 before a possible pregnancy. Seventy of the couples in this group became parents.

The couples who participated in the IVF and spontaneous pregnancy groups were compared with those who were initially recruited but did not have a child at the beginning of the study in terms of self-reported partnership quality (see next paragraph for the questionnaire) and demographic characteristics. While no differences were seen in partnership quality, couples with successful IVF were younger than those with unsuccessful IVF (mean difference = 1.5 years for men and 2.1 years for women) (see [Appendices](#), Tables S1 and S2 for details of the comparisons).

Table 1: Demographic characteristics of the IVF group (n = 75) and the spontaneous pregnancy group (n = 70)

	IVF group			Spontaneous pregnancy group					
	n			n					
Marital status									
Married	20			22					
Living together	55			48					
Gender of the baby									
Boys	30			33					
Girls	45			37					
Parity									
Primipara	65			50					
Multipara	10			20					
	IVF group			Spontaneous pregnancy group			t[143]	p	d
	M	SD	SE	M	SD	SE			
Men: age (years)	37.07	5.40	0.62	33.71	4.88	0.58	3.92	<.001	-0.65
Women: age (years)	33.73	3.66	0.42	30.43	4.15	0.50	4.98	<.001	-.085
Men: duration of education (years)	14.88	4.55	0.53	14.33	3.67	0.44	0.80	.43	-0.13
Women: duration of education (years)	15.19	4.07	0.47	15.89	3.09	0.37	-1.16	.25	0.19
Duration T1 to birth (days)	480.83	190.05	21.95	555.65	152.13	18.18	-2.61	.01	0.43
Age Children (T2) (months)	6.08	0.49	0.06	6.03	0.48	0.06	0.64	.52	-0.10
Age Children (T3) (months)	12.03	0.49	0.06	12.03	0.17	0.02	-0.3	.98	0.00
Age Children (T4) (months)	18.00	0.16	0.01	17.99	0.21	0.02	0.65	.52	-0.05
Age Children (T5) (months)	24.00	0.23	0.02	23.99	0.22	0.02	0.27	.79	-0.04
	IVF group		Spontaneous pregnancy group						
	n	%	n	%					
Annual net income of individual partners									
<15,000	25	16.7	16	11.4					
15,000 - 30,000	63	42.0	88	62.9					
30,000 - 45,000	48	32.0	28	20.0					
45,000 - 70,000	11	7.3	7	5.0					
>70,000	3	2.0	1	0.7					

Note: M = mean, SD = standard deviation, SE = standard error, t = t-value, d = Cohen's d

The mean time between completion of the questionnaires at T1 and the birth of the child was longer for the spontaneous pregnancy group than the IVF group (see Table 1). Participating couples were contacted again 6 (T2), 12 (T3), 18 (T4), and 24 (T5) months after the birth, and asked to complete the same questionnaires as for T1. The participants completed the questionnaires in paper-pencil format on all five measurement occasions. The questionnaires were managed by the lead researcher (M.K.). In cases of missing responses to any questionnaire items, the questionnaires were handed back to the participants, and they were asked to complete them. This was necessary in relatively few cases (1.3 % of all completed questionnaires). All subjects provided written informed consent before participating and the study protocol was approved by the Ethics Committee of the Public Health Authorities of South Tyrol (Italy).

2.4 Questionnaire

Partnership quality was quantified using the Partnership Questionnaire (PQ) [Partnerschaftsfragebogen] (Hahlweg, 1996). The questionnaire includes 30 items describing typical communication and interaction behaviors of the couple. Behavior-oriented items were chosen based on research on psychological determinants of partnership quality, where transactions between partners, including expression of emotions and needs or conflict behaviors, explained the largest proportion of the variance (Ayub & Iqbal, 2012; Gottman, 1994; Hahlweg et al., 1984). The items were selected from a large pool of statements using methods from classical test theory; factor analysis revealed three subscales termed Togetherness, Tenderness, and Quarreling Behavior (Hahlweg, 1996). The PQ was cross-validated with other instruments assessing partnership quality, such as the Dyadic Adjustment Scale (Spanier, 1976) and the Marital Adjustment Test (Locke & Wallace, 1959). All items refer to the present time and are answered separately by both partners. In total, 25 of the items (scored on 4-point Likert scales) relate to behaviors of the partner (e.g., “He/she criticizes me in a sarcastic way”); the remaining items refer to the behavior of the couple (e.g., “We make plans for the future together”). The Togetherness subscale is concerned with togetherness and communication (e.g., “We plan together how we want to spend the weekend”), the Tenderness subscale covers tenderness and intimacy (e.g., “He/she tells me that he/she is happy when he is with me”), and the Quarreling Behavior subscale deals with aggressive or quarreling behavior (e.g., “He/she starts an argument about small things”). Higher values on the Tenderness and Togetherness subscales reflect higher partnership quality, while higher values on the Quarreling Behavior subscale reflect lower partnership quality. A sum score for partnership quality is also available. Nevertheless, the three subscales were additionally used, as changes in the different dimensions of partnership quality were expected after childbirth. The Cronbach's α values of the scales computed for the present sample are presented in Table 2.

Table 2: Cronbach's α values of the Partnership Questionnaire scales in the present sample

	T1	T2	T3	T4	T5
Sum score	.89	.89	.91	.91	.92
Togetherness	.78	.78	.80	.79	.82
Tenderness	.84	.84	.86	.86	.89
Quarreling Behavior	.85	.78	.84	.85	.88

Note: T1 = before pregnancy, T2 = 6 months after child birth, T3 = 12 months after child birth, T4 = 18 months after child birth, T5 = 24 months after child birth

2.5 Data Analysis

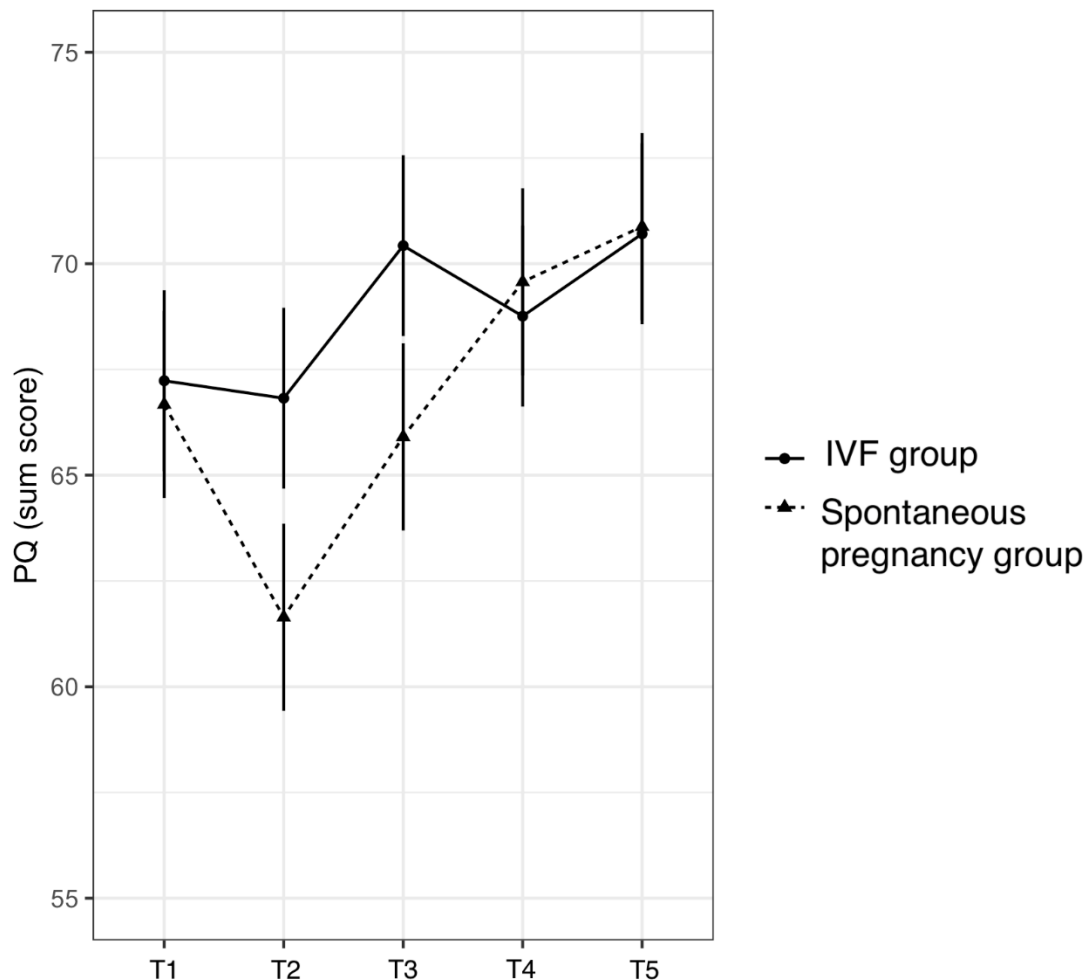
The data were analyzed using R 4.1.2 software (RCoreTeam, 2021). To take the nestedness of the data into account, multi-level models (hierarchical linear modeling, HLM) were computed using the lme4 package (Bates et al., 2015). The individuals (Level 1) were nested within the couple (Level 2). To test whether the questionnaire scale scores of the couples changed over time (i.e., across the five measurement occasions; T1 to T5) and whether the changes differed between the study groups (IVF group vs. spontaneous pregnancy group), we computed random-intercept models with Time and Group as Level 2 predictors. The PQ sum score and all PQ subscale scores were dependent variables.

In addition, the following analysis were conducted: For 12 couples in the spontaneous pregnancy group, T4 (month 18) and T5 (month 24) took place during the COVID-19 pandemic (March 2020 – March 2021). To account for possible distortion of the findings due to factors inherent to pandemics, the same analysis was also conducted without these 12 couples. Moreover, to explore possible gender differences in the course of partnership quality, the HLM analyses were also carried out separately for women and men. Finally, HLM models were computed, in which potential effects of age, gender, annual income, the time between T1 and childbirth, and the number of children that couples already had before enrolling in the study, were controlled for. These variables were included as further Level 1 predictors. The results of these additional analyses are presented in the [Appendices](#).

3. Results

The interclass correlations (ICCs) of the questionnaire scales were .51 (PQ sum score), .50 (Togetherness), .42 (Tenderness) and .47 (Quarreling Behavior), indicating that nearly half of the variance between individuals was explained by the couple, in turn indicating that the two members of the couple assessed their situation similarly. The random-intercept models for the PQ sum score and subscales are presented in Table 3. Note that T1 constitutes the reference for the Time effects and Time * Group interactions at each of the measurement occasions T2 to T5. Figure 1 depicts the changes in PQ sum score across the five measurement occasions in both groups; the changes in the three subscale scores are presented in Figure 2.

Figure 1: Changes in PQ sum score over time for the IVF group and the spontaneous pregnancy group



Note: T1: before pregnancy, T2: 6 months after birth, T3: 12 months after birth, T4: 18 months after birth, T5: 24 months after birth; bars denote 95% CI.

3.1 PC Sum Score

The PC sum score did not differ between the groups at T1 (before pregnancy). While it remained virtually unchanged in the IVF group at T2 (month 6), it markedly decreased in the spontaneous pregnancy group (Time * Group interaction at T2). The sum score increased in both groups between T2 and T3 (month 12) (Time effect at T3; Time * Group interaction at T3, reflecting a greater change from T1 in the IVF group). Between T3 and T4 (month 18), the sum score increased in the spontaneous pregnancy group and

decreased in the IVF group, such that the score was similar in both groups at T4. The score increased at T5 (month 24) in both groups (Time effect at T5).

3.2 Togetherness

The Togetherness score was higher in the IVF group than in the spontaneous pregnancy group at T1 (Group effect at T1). In both groups, this score decreased between T1 and T2 (month 6) (Time effect at T2), and increased between T2 (month 6) and T3 (month 12). A crossover interaction arose between T3 and T4 (month 18), where the Togetherness score of the spontaneous pregnancy group exceeded that of the IVF group at T4 and T5 (month 24) (Time effect at T4; Time * Group interactions at T4 and T5).

Table 3: Estimates (Est), Confidence Interval (CI), p values for the models for the PQ sum score, Togetherness, Tenderness and Quarreling Behavior

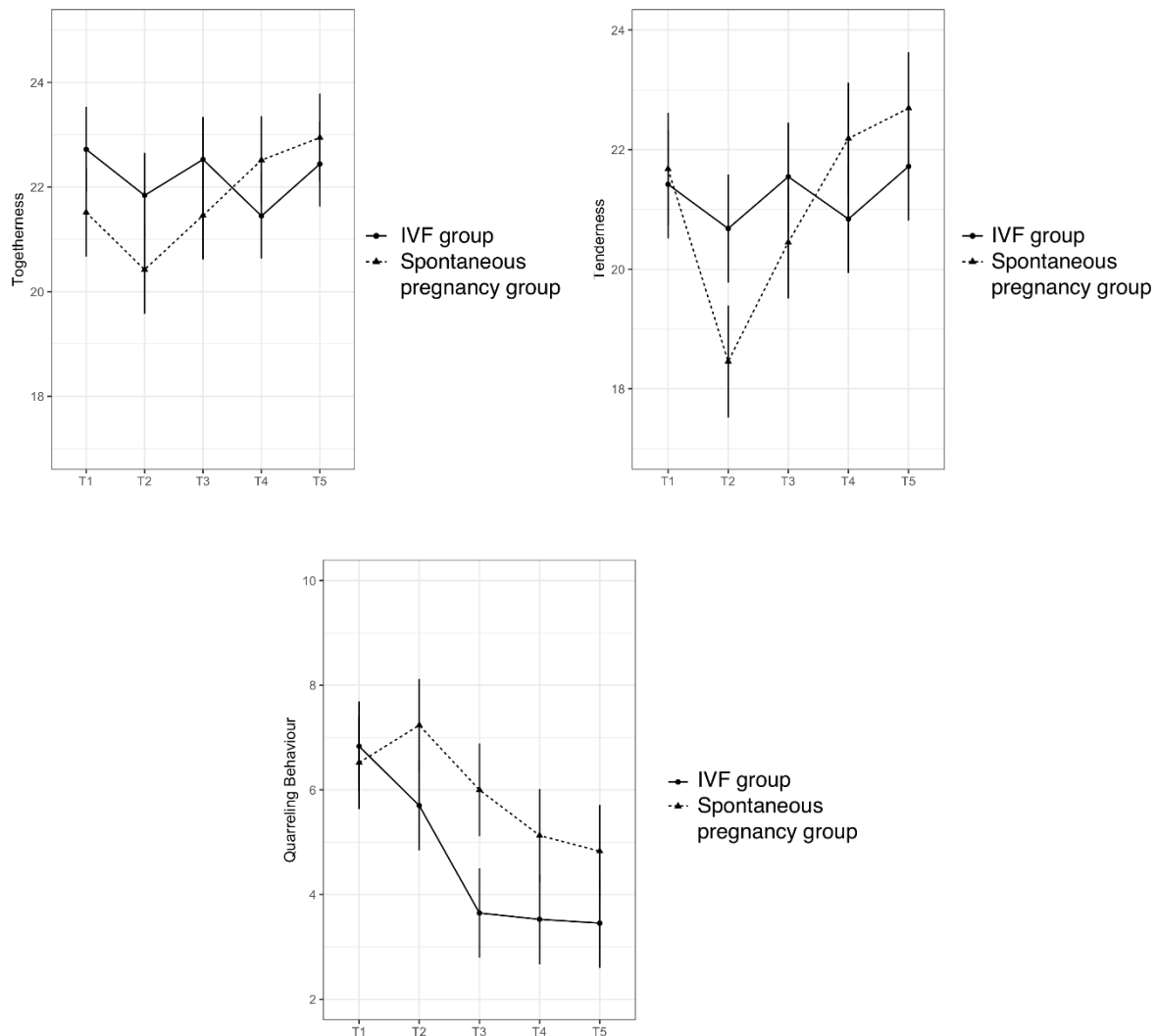
Predictors	PQ sum score			Togetherness			Tenderness			Quarreling Behavior		
	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p
(Intercept)	67.23	65.10 – 69.36	<.001	22.72	21.91 – 23.53	<.001	21.42	20.52 – 22.32	<.001	6.83	5.98 – 7.69	<.001
Time [T2]	-0.41	-2.13 – 1.31	.64	-0.88	-1.54 – -0.22	<.01	-0.74	-1.55 – 0.07	.07	-1.13	-1.86 – -0.41	<.01
Time [T3]	3.19	1.47 – 4.91	<.001	-0.19	-0.85 – 0.47	.57	0.13	-0.68 – 0.94	.76	-3.19	-3.91 – -2.46	<.001
Time [T4]	1.53	-0.19 – 3.25	.08	-1.27	-1.93 – -0.61	<.001	-0.58	-1.39 – 0.23	.16	-3.31	-4.03 – -2.58	<.001
Time [T5]	3.47	1.75 – 5.19	<.001	-0.28	-0.94 – 0.38	.41	0.30	-0.51 – 1.11	.47	-3.38	-4.11 – -2.65	<.001
Group [T1]	-0.56	-3.63 – 2.50	.72	-1.21	-2.37 – -0.04	.04	0.26	-1.04 – 1.56	.70	-0.31	-1.54 – 0.92	.62
Time [T2] * Group	-4.62	-7.09 – -2.14	<.001	-0.21	-1.16 – 0.74	.66	-2.48	-3.65 – -1.31	<.001	1.85	0.80 – 2.89	.001
Time [T3] * Group	-3.96	-6.43 – -1.48	.002	0.14	-0.82 – 1.09	.78	-1.36	-2.52 – -0.19	.02	2.67	1.62 – 3.71	<.001
Time [T4] * Group	1.37	-1.10 – 3.85	.28	2.27	1.32 – 3.23	<.001	1.09	-0.08 – 2.25	.07	1.91	0.87 – 2.96	<.001
Time [T5] * Group	0.73	-1.74 – 3.21	.56	1.71	0.76 – 2.66	<.001	0.71	-0.45 – 1.88	.23	1.69	0.64 – 2.73	<.01
Random Effects												
σ^2	57.77			8.54			12.84			10.31		
τ_{00}	59.55 Couple			8.56 Couple			9.44 Couple			9.04 Couple		
ICC	0.51			0.50			0.42			0.47		
n	145 Couple			145 Couple			145 Couple			145 Couple		
Observations	1450			1450			1450			1450		
Marginal R ² / Conditional R ²	0.058 / 0.536			0.031 / 0.516			0.051 / 0.453			0.085 / 0.513		

Note: T1 = before pregnancy, T2 = 6 months after child birth, T3 = 12 months after child birth, T4 = 18 months after child birth, T5 = 24 months after child birth

3.3 Tenderness

The Tenderness score did not differ between the groups at T1. This score remained relatively stable over time in the IVF group. In contrast, in the spontaneous pregnancy group it showed a steep decrease at T2 (month 6) and a progressive increase between T2 and T5 (month 24) (Time * Group interactions at T2 and T3). The score of the spontaneous pregnancy group exceeded that of the IVF group at T4 (month 18) and T5.

Figure 2: Changes in PQ subscale scores over time for the IVF group and the spontaneous pregnancy group



Note: T1: before pregnancy, T2: 6 months after birth, T3: 12 months after birth, T4: 18 months after birth, T5: 24 months after birth; bars denote 95% CI.

3.4 Quarreling Behavior

No group difference was seen in the Quarreling Behavior score at T1. Between T1 and T2 (month 6), this score decreased in the IVF group and increased in the spontaneous pregnancy group (Time effect and Time * Group interaction at T2). In both groups, it declined at T3 (month 12) (Time effect at T3; Time * Group

interaction at T3, reflecting a greater change from T1 in the IVF group). At T4 (month 18) and T5 (month 24) the score further decreased in the spontaneous pregnancy group and remained virtually constant in the IVF group (Time effects and Time * Group interactions at T4 and T5).

3.5 Additional Analyses

The additional analysis in which the couples affected by the COVID-19 pandemic were excluded is presented in Tables S3 and Figure S1 and S2 of the *Appendices*. The results were virtually the same as those obtained for the entire sample. The analysis carried out separately for both genders revealed a higher PQ sum score in women than men at all measurement occasions in both study groups. The Tenderness subscale score was higher, and the Quarreling behavior subscale score was lower in women; the gender differences were nearly constant over time (Figures S3 to S6 and Tables S4 to S7). The HLM models, in which the variables age, gender, annual income, the time between T1 and childbirth, and the number of children were included as additional Level 1 predictors, revealed nearly identical results as those without these control variables (Tables S8 to S11).

4. Discussion

This study investigated changes in self-reported partnership quality related to the birth of a child in couples with successful IVF treatment, and in those with spontaneous pregnancy. While couples preparing for IVF treatment and those awaiting spontaneous pregnancy did not differ in the PQ sum score or Tenderness and Quarreling Behavior subscale scores, those preparing for IVF scored higher on the Togetherness subscale. The PQ sum score was markedly decreased after childbirth in couples with spontaneous pregnancy at month 6 after birth, but progressively increased thereafter, exceeding the baseline level at month 24 after birth. In contrast, this score remained stable after childbirth in couples with IVF and increased between months 6 and 12, following a slight decrease at month 18, where it reached the same level as in couples with spontaneous pregnancy. Similar to the PQ sum score, the Tenderness score changed only slightly in couples with IVF; in those with spontaneous pregnancy, this score steeply decreased after childbirth and progressively increased thereafter. While the Togetherness score was higher in couples with IVF during the first year after childbirth, only a small group difference was seen during the final part of the observation period. The Quarrelling Behavior score increased after childbirth in couples with spontaneous pregnancy but decreased in those with IVF; subsequently, it decreased in both groups and remained at a lower level in couples with IVF.

The decline in partnership quality during the first 6 months after childbirth in couples with spontaneous pregnancy is in accordance with previous research (Ahlborg et al., 2009; Doss et al., 2009). It may relate to the challenges of adjustment during the transition to parenthood suggested by the adapted SPM (Milkie, 2009). Factors relevant to the changes may be classified according to the demands-rewards perspective (Nomaguchi & Milkie, 2020). While increasing burden with stress, for example due to overwhelming childcare demands, sleep deprivation, lack of opportunity for recreation constitute typical demands of the early phase of parenthood, less time for leisure and social activities imply loss of rewards (Cast, 2004; Clark et al., 2008; Doss & Rhoades, 2017; Wynter et al., 2019). Altogether, these factors may compromise communication between partners and promote negative interactions. This is reflected by the Quarreling Behavior score, which indicated that aggressive behaviors within the couples, like sarcastic or negative comments, increased after childbirth. Moreover, it has been claimed that the challenges characterizing this period may amplify pre-existing partnership problems (Otchet et al., 1999; Riggs et al., 2018). Changes in a couple's physical relationship may also lead to loss of rewards (Yeniel & Petri, 2014). Potential reasons for sexual problems include altered hormone balance, fear of pain during sexual intercourse, lack of privacy, and exhaustion and fatigue (Leeman & Rogers, 2012; Olsson et al., 2005; Williamson et al., 2008). These changes may be reflected in the steep decline in the Tenderness score seen in the spontaneous pregnancy group after childbirth. Importantly, the PQ sum score, and the Togetherness and Tenderness subscale scores, increased again at the measurement occasions starting 12 months after childbirth and reached levels above baseline at month 24; the Quarreling behaviors score decreased again and fell below baseline at month 24. In terms of the adapted SPM, this reflects the couples' successful readjustment, which may be

mediated by learning processes enabling dyadic reorganization and thus restoration of partnership quality (Cast, 2004; Lawrence et al., 2008).

Negative changes in partnership quality after childbirth were not seen in couples who underwent IVF. In terms of the demands-rewards perspective (Nomaguchi & Milkie, 2020), it is likely that these couples experience substantial rewards by achievement of the long awaited parenthood, which outweigh the demands associated with childbirth. This, in turn, may limit negative effects of the challenges of adjustment on partnership quality. Moreover, it may be hypothesized that effective coping plays a role, which, according to the adapted SPM, moderates the effects of childbirth on wellbeing and partnership (Milkie, 2009; Pearlin, 1989). Two forms of dyadic coping are commonly distinguished: supportive dyadic coping (supportive reactions to the partner's stress signals) and common dyadic coping (joint efforts to cope with adversities) (Falconier et al., 2015). Strong evidence supports that both strategies reduce the negative impact of stress on the partnership (Bodenmann, 2005). After successful IVF, couples are obviously faced with the same challenges as those with spontaneous pregnancy. However, the relief of the burden of infertility and the imminent IVF treatment (rewards), might promote positive dyadic coping, which buffers the impact of demands (Ying et al., 2018). While the PQ sum score and Tenderness score remained largely stable in couples with IVF, the Quarrelling Behavior score declined after childbirth, indicating that aggressive interactions within the couple actually decreased. It may be that, during the difficult time of infertility and IVF treatment, these couples acquire positive communication and conflict resolution strategies, which facilitate coping with the challenges of their new role as parents (Sydsjö et al., 2008).

The most important difference in the course of partnership quality between both study groups is the initial decline after childbirth, which was seen in couples with spontaneous pregnancy but not in those with IVF. This is in line with a previous follow-up study showing more stable levels of marital satisfaction in couples with IVF than in those with spontaneous pregnancy during the first year after childbirth (Sydsjö et al., 2002). Differences may relate to different impact of adjustment processes on partnership interaction (Milkie, 2009). Overcoming the burdens of infertility and IVF treatment and experience of the highly appreciated parenthood may lead to a shift of balance between demands and rewards towards rewards, and thus to better conditions for adjustment than in spontaneous pregnancy (Nomaguchi & Milkie, 2020). Moreover, going through infertility and IVF together as a couple may foster acquisition of more efficient coping strategies which in turn help dealing with stressors associated with a newborn child. Among the PQ scales, only the Togetherness score showed a group difference at baseline, with stronger feelings of togetherness and cohesion reported by couples with IVF. This confirms that, despite a significant psychological burden, IVF treatment has no negative influence on the partnership (Martins et al., 2018), and may even strengthen it because partners have to overcome emotional distress, and possible stigmatization and social exclusion, together (Kayabasi & Yaman Sözbir, 2020); they may also share positive and negative feelings (Ying et al., 2015).

In addition to the initially considered improvement in dyadic coping and communication and conflict resolution strategies during the infertility and IVF treatment, selection processes may explain the higher partnership quality of couples with successful IVF. The burdens of infertility may lead to separation in many couples, such that only those who have efficient coping strategies and experience overall high partnership stability may be able to maintain a functioning relationship. Due to this selection, couples with initially high partnership satisfaction may have been more likely to be included in the IVF group investigated in this study.

It is important to note that the PQ sum score at the last measurement occasion exceeded that before pregnancy in both groups, which suggests overall improvement of partnership quality during the first two years of parenthood. This supports the notion that in the longer term, positive experiences of parenthood can strengthen positive interaction within a couple and increase partnership satisfaction (Stertz & Wiese, 2020).

A relevant limitation of the study is that some constructs, which are taken into account in the interpretation of the findings (e.g., everyday stress, coping or sexuality), were not assessed; as such, the explanations provided must remain hypothetical. Another restriction pertains to the higher age of the IVF group than the spontaneous pregnancy group (average age difference more than 3 years), which also applies to previous studies comparing couples with IVF and those with spontaneous pregnancy (e.g., Gibson et al., 2000; Sydsjö et al., 2008; Sydsjö et al., 2002). In addition, the interval between the two first measurement occasions, i.e., before pregnancy and 6 months after childbirth, was longer in the spontaneous pregnancy group (79 vs. 69 weeks). However, the inclusion of age and the duration between the first two measurement

occasions as control variables in the statistical analysis did not change the results. The same applies to the variables gender, income, and the number of children that the couples already had before enrolling in the study. Moreover, the separate analysis for both gender groups indicated that, though women rated partnership quality overall higher than men, both genders reported a similar course of changes. By definition, not all potentially relevant variables could be included in the analysis. For example, the mental and physical health of the participants and the duration of infertility were not considered.

Follow-up data were collected in couples who had a child, but not in those who did not conceive. In further studies it will be of great interest to compare couples with successful IVF with those in which the procedure was unsuccessful. All couples were recruited through Italian public centers; in Italy, six IVF attempts are paid for by the public sector; thus, the generalizability to countries where couples have to bear the full costs of the treatment is certainly limited. It is feasible that in these countries, financial burden due to IVF treatment constitutes an additional stressor having a potential negative impact on partnership quality. Moreover, the relief experienced by couples after successful IVF may be even greater than in Italy. In turn, this might result in even stronger positive effects on partnership quality. Another regional aspect relevant to generalization is that the age at which couples become parents for the first time is higher in Italy than in most other countries (30.3 years in women and 33.8 years in men) (Mauceri & Valentini, 2010). Finally, for 12 couples in the spontaneous pregnancy group, the last two measurement occasions took place during the COVID-19 pandemic. However, the additional analysis excluding these couples yielded almost identical results to the analysis of the entire sample.

In conclusion, this study showed differences in partnership quality over time between couples with successful IVF and those who had a child after natural conception. While couples with IVF exhibited relatively stable indices of partnership quality, fluctuations were seen in couples with spontaneous pregnancy, particularly transient negative changes during the first 6 months after childbirth. While couples with IVF already experienced greater feelings of togetherness before pregnancy, the reported reduction in aggressive interactions persisted until 24 months after childbirth. The findings support the notion of a positive impact of successful IVF on the stability of the partnership (Slade et al., 1997). Moreover, it may predominantly be couples with abundant coping resources who remain stable and stay together during the burdensome period of infertility and IVF treatment. This is crucial as couple stability is regarded as an important factor in a child's mental health, promoting positive emotional and behavioral development (Bachman et al., 2011; Osborne & McLanahan, 2007).

Finally, the potential practical and clinical implications of the study should be considered. While preparation for a birth (e.g., through prenatal classes) is essential for good couple functioning (Nolan, 2012), it commonly focuses on medical aspects of the birth and care of the infant. In addition, psychoeducation of parents-to-be regarding possible challenges within the partnership during the first few months after childbirth may be advisable. The same applies to psychosocial counselling of couples during this period. Prevention and intervention measures may include techniques from classical couple therapy like communication training, conflict management, and strategies aiming to foster mutual support and expression of needs and feelings (Randall et al., 2010).

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Data availability statement

The research data of the study is available to the public via the repository Open Science Framework (OSF: <https://osf.io/8nd2s/>).

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Information in German

Deutscher Titel

Veränderungen in der Partnerschaftsqualität nach erfolgreicher In-vitro-Fertilisation und bei natürlicher Empfängnis

Zusammenfassung

Fragestellung: Diese Längsschnittstudie untersuchte Veränderungen in der Partnerschaftsqualität im Zusammenhang mit der Geburt eines Kindes bei Paaren nach erfolgreicher In-vitro Fertilisation (IVF) und natürlicher Empfängnis.

Hintergrund: Frühere Untersuchungen haben gezeigt, dass die Partnerschaftsqualität von Paaren mit spontaner Schwangerschaft nach der Geburt abnimmt. Jedoch gibt es nur wenige Längsschnittstudien zur Partnerschaftsqualität bei Paaren, die sich einer IVF unterziehen.

Methode: Fünfundsiebzig Paare mit erfolgreicher IVF und siebzig Paare mit spontaner Schwangerschaft bearbeiteten den Partnerschaftsfragebogen vor der Schwangerschaft (Baseline) und 6, 12, 18 und 24 Monate nach der Geburt des Kindes. Zur Datenanalyse wurden Mehrebenenmodelle verwendet..

Ergebnisse: Bei Paaren mit IVF nahm die allgemeine Partnerschaftsqualität, das Gefühl der Zusammengehörigkeit und das Erleben von Zärtlichkeit über die Zeit zu, während das konflikthafte Verhalten abnahm. Paare mit spontaner Schwangerschaft zeigten nach der Geburt (6. Monat) deutliche negative Veränderungen in diesen Aspekten der Partnerschaftsqualität; danach verbesserte sich die Partnerschaftsqualität sukzessive und erreichte zum 24. Monat ein ähnliches Niveau wie bei Paaren mit IVF.

Schlussfolgerung: Während Paare mit IVF eine insgesamt positive Entwicklung der Partnerschaftsqualität berichteten, nahm die Partnerschaftsqualität bei Paaren mit spontaner Schwangerschaft unmittelbar nach der Geburt ab, verbesserte sich jedoch im Laufe der Zeit. Die Erfahrungen der Unfruchtbarkeit und der IVF-Behandlung könnten den Erwerb von dyadischen Bewältigungsstrategien fördern, welche die negativen Auswirkungen der Stressbelastung in der Anfangsphase der Elternschaft ausgleichen.

Schlagwörter: Infertilität, In-vitro Fertilisation, Partnerschaftsqualität, Schwangerschaft, Geburt

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Manuel Kiesswetter: <https://orcid.org/0000-0003-1907-7123>

Erik Danay: <https://orcid.org/0009-0001-0241-0631>

Stefan Duschek: <https://orcid.org/0000-0002-9082-0154>



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