

Direct and indirect effects of perceived social support on women's infertility-related stress

Mariana V. Martins^{1,*}, Brennan D. Peterson², Vasco M. Almeida³,
and Maria E. Costa¹

¹Faculty of Psychology and Education Sciences, University of Porto, R. do Dr. Manuel Pereira da Silva, 4200-392 Porto, Portugal

²Faculty of Psychology, Chapman University, 92866 Orange, CA, USA ³Faculty of Sciences, University of Porto, 4169-007 Porto, Portugal

*Correspondence address. Tel: +351-226079705; Fax: +351-226079725; E-mail: mmartins@fpce.up.pt

Submitted on October 29, 2010; resubmitted on April 13, 2011; accepted on April 21, 2011

BACKGROUND: Social support can be a critical component of how a woman adjusts to infertility, yet few studies have investigated its impact on infertility-related coping and stress. We examined relationships between social support contexts and infertility stress domains, and tested if they were mediated by infertility-related coping strategies in a sample of infertile women.

METHODS: The Multidimensional Scale of Perceived Social Support, the Copenhagen Multi-centre Psychosocial Infertility coping scales and the Fertility Problem Inventory were completed by 252 women seeking treatment. Structural equation modeling analysis was used to test the hypothesized multiple mediation model.

RESULTS: The final model revealed negative effects from perceived partner support to relationship concern ($\beta = -0.47$), sexual concern ($\beta = -0.20$) and rejection of childfree lifestyle through meaning-based coping ($\beta = -0.04$). Perceived friend support had a negative effect on social concern through active-confronting coping ($\beta = -0.04$). Finally, besides a direct negative association with social concern ($\beta = -0.30$), perceived family support was indirectly and negatively related with all infertility stress domains (β from -0.04 to -0.13) through a positive effect of active-avoidance coping. The model explained between 12 and 66% of the variance of outcomes.

CONCLUSIONS: Despite being limited by a convenience sampling and cross-sectional design, results highlight the importance of social support contexts in helping women deal with infertility treatment. Health professionals should explore the quality of social networks and encourage seeking positive support from family and partners. Findings suggest it might prove useful for counselors to use coping skills training interventions, by retraining active-avoidance coping into meaning-based and active-confronting strategies.

Key words: infertility / social support / stress / coping / structural equation modeling

Introduction

As women continue delaying their decision of childbearing, more are being confronted with the possibility of not becoming biological mothers (Lunenfeld and Steirteghem, 2004). Infertility is a disease resulting in the inability to achieve pregnancy after 12 months of unprotected sexual intercourse, or 6 months for women over 35 years old (ASRM, 2008; Zegers-Hochschild *et al.*, 2009). Recent epidemiological data estimate that ~80 million people worldwide are struggling with the possibility of not becoming biological parents (Nachtigall, 2006). The experience of infertility is highly stressful for women (Abbey *et al.*, 1991; Greil, 1997; Peterson *et al.*, 2006; White and McQuillan, 2006). Those who seek treatment participate in physically demanding and emotionally taxing medical procedures in an effort to achieve pregnancy even if the cause is

attributed to their partner (Benyamini *et al.*, 2004; Drosdzol and Skrzypulec, 2009).

Because it is fundamental to one's physical and psychological well-being (Berkman *et al.*, 2000; Bolger and Amarel, 2007), social support can be a critical component of how a woman adjusts to the unexpected stress of infertility, especially since most women disclose their infertility to others, and in higher proportions than men (Schmidt *et al.*, 2005b; Peterson *et al.*, 2006; Slade *et al.*, 2007). Social support is defined as the perception that one has an available confidant (Cohen and Wills, 1985), or experiences caring attitudes displayed by a specific source (Walen and Lachman, 2000), and is commonly sought for and provided by partners, family and friends. Having social support from these sources can reduce the impact of a large number of life stressors, including myocardial infarction and cancer (for a review, see Schwarzer and Knoll, 2007).

Despite increasing calls that have been made to include social support as a variable in infertility studies (Verhaak et al., 2005a; Mahajan et al., 2009; Schmidt, 2009), there are relatively few studies examining the impact of social support on a woman's levels of infertility stress and psychological adjustment. While some studies have focused on the often unintentional negative impact that unsupportive responses have on generic adjustment and infertility stress (Mindes et al., 2003; Slade et al., 2007), support from social networks can also benefit a woman's adjustment when dealing with the stress of infertility. For example, social support has been associated with lower levels of depression and anxiety (Verhaak et al., 2005b; Lechner et al., 2007) and reductions in infertility stress (Gibson and Myers, 2002; Schmidt et al., 2005b). However, the influence of multiple social support sources on varying forms of infertility-specific stress (e.g. social stress, sexual stress) remains unclear.

In addition to social support, coping strategies are used to deal with infertility-related stress. Coping strategies refer to cognitive or behavioral efforts to manage a stressful event that is perceived to exceed an individual's personal resources (Lazarus and Folkman, 1984). Active and problem-focused coping strategies involve actions intended to resolve the stressor, and are typically more effective in dealing with a stressor than passive and emotion-focused strategies (Lechner et al., 2007). However, since infertility is a low-control stressor (Miller-Campbell et al., 1991; Benyamini et al., 2004), women can do little to nothing to actively change the nature of the situation (Terry and Hynes, 1998; Verhaak et al., 2005a). As a result, passive coping styles and emotion-focused strategies, which include efforts to focus on something other than the stressor and relieve anxiety, can also be adaptive (Terry and Hynes, 1998; Rapoport-Hubschman et al., 2009).

While coping strategies can in and of themselves directly impact infertility-related stress, they can also act as mediating variables between social support and stress. In accordance with the transactional stress theory (Lazarus and Folkman, 1984), social support from a given context, among other factors, can affect the cognitive appraisal of a stressful encounter and, coupled with a coping strategy, generate a stress response. Previous studies focusing on other low-control situations have confirmed this sequence in which the outcome is generated by the way one copes with the stressor, and the effectiveness of coping is increasingly facilitated when more support is available. For example, cardiac patients perceiving positive support had a greater use of approach-oriented coping strategies, leading to fewer depressive symptoms (Holahan et al., 1997). In human immunodeficiency virus-positive patients, social support had a negative effect on avoidant coping, which decreased medication adherence and consequently increased viral load (Weaver et al., 2005). For cancer patients, accommodative coping strategies can act as mediators between social support and some dimensions of personal growth (Luszczynska et al., 2005), and active coping can mediate the link between support and quality of life (Boehmer et al., 2007).

However, this transactional stress theory three-step approach has not been studied with a sample of women experiencing infertility. Knowing that social support can promote adaptive coping styles (Holahan et al., 1997), it is essential that studies include social support as a variable to further disentangle the complex relationship

between coping and infertility-related stress (Verhaak et al., 2005b; Mahajan et al., 2009; Schmidt, 2009).

The current study addresses the existing gap in the infertility literature base by testing a model that examines the effect of perceived social support and coping strategies on infertility-related stress in a sample of infertile women seeking treatment. More specifically, this study explores (i) whether specific social support has a differentiated impact on various infertility-related coping strategies and stress domains, and (ii) whether different coping strategies mediate the relationship between social support and infertility-related stress. In order to test this hypothesized multiple mediation model, structural equation modeling (SEM) was used to verify the impact of three social support sources on four infertility-specific coping subscales and five infertility-related stress dimensions (Fig. 1). To the authors' knowledge, this is the first study to use SEM analysis to examine the impact of social support on coping strategies and infertility-related stress.

Materials and Methods

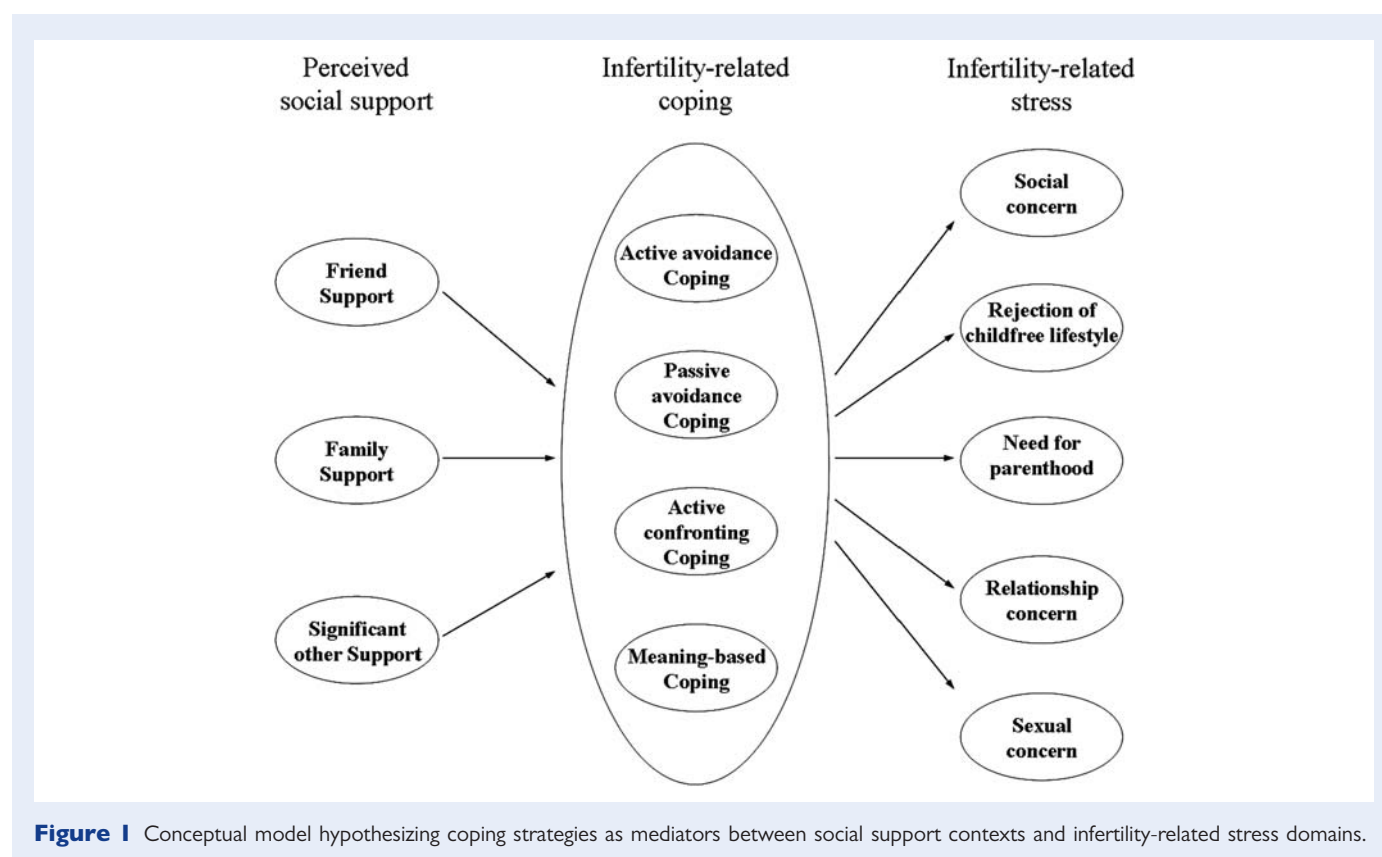
Participants

Participants were selected using two different non-representative data collection methods. The first method was based on a sample that included 112 childless women seeking fertility treatments at Centro Hospitalar do Porto, E.P.E., a large regional public hospital in Portugal, and the second included 200 women who completed an online survey through the Portuguese Fertility Association website. In order to match the characteristics of these patients, women who completed the online questionnaire were included in this study sample if at the time of completion they (i) met the medical definition of infertility (i.e. they had been trying to get pregnant for >1 year, or 6 months if older than 35 years), (ii) were childless and seeking treatment for primary infertility at the time, and (iii) were not receiving infertility treatments owing to a previous PGD. Participants responding to the online questionnaire could not go further in the questionnaire without selecting an option in every item, so there were no missing values. Participants who completed the paper version at the hospital were excluded if items left unanswered corresponded to >20% within a given study's dimension ($n = 12$). Then, missing values were replaced by respective scale mean. The final sample included 252 women.

Procedure

The Portuguese National Health Service partially reimburses infertility medication (69% of the total cost), and provides free access to infertility first-line treatments for women <42 years of age, and second-line treatments for women <40 years. All ovulation induction treatments are financed, as well as up to three intrauterine insemination (IUI) cycles and three *in vitro* fertilization (IVF) or intracytoplasmic injection (ICSI) cycles.

Women attending the public fertility center at the hospital were asked by their physician to participate in the study at the conclusion of their appointment. After reading the study information sheet and signing the consent form, participants completed their questionnaire booklet in a separate room. For women completing the online form, the Portuguese Fertility Association posted a request for participation on its internet forum. At the end of the invitation, a link conducted forum visitors to another website with the questionnaire. Before starting to answer, respondents were first presented with the study information and the first author's contact in case respondents had any doubts about participation. Data from the online and hospital samples were collected between January



and July 2010. Prior to data collection, the study was approved by the hospital Ethics Committee and by the Portuguese Data Protection Authority.

Measures

Socio-demographic and biomedical variables were obtained using a specifically designed questionnaire. Self-reported measures included perceived social support, infertility-related coping strategies and infertility-related stress. In order to ensure adaptation to the Portuguese language, and after permission for translation and use from the original authors, the psychometric instruments were submitted to the following steps: (i) translation; (ii) back-translation by an independent bilingual researcher; (iii) pretesting with infertile women; (iv) reliability analyses; and (v) confirmatory factor analyses.

Social support

The Multidimensional Scale of Perceived Social Support (MSPSS, Zimet *et al.*, 1988) measures the perceived adequacy of social support received from family (four items; e.g. 'I get the emotional help and support I need from my family'), friends (four items; e.g. 'I can count on my friends when things go wrong') and the significant other (four items; e.g. 'There is a special person with whom I can share joys and sorrows'). Because in our sample all subjects had a significant partner, in this study this dimension is designated as partner support for purposes of clarity. Respondents reported their agreement on a 6-point Likert-type scale (1 = very strongly disagree; 6 = very strongly agree). High internal consistency reliability estimates of 0.95, 0.93 and 0.91 were found for the Family, Friends and Partner dimensions of the Portuguese MSPSS (MSPSS-P). The confirmatory factor analysis (CFA) confirmed the original structure, revealing overall good fit indices [$\chi^2(51) = 161.32$; standardized root mean

square residual (SRMR) = 0.04; comparative fit index (CFI) = 0.96; root mean square error of approximation (RMSEA) = 0.09] for the MSPSS-P.

Infertility-related coping strategies

The Copenhagen Multi-centre Psychosocial Infertility (COMPI) coping strategy scales (Schmidt *et al.*, 2005a) were specifically developed to measure infertility-related coping strategies. The instrument is based on Lazarus and Folkman's Ways of Coping Questionnaire (Folkman and Lazarus, 1988), including a revised coping model that added meaning-based coping (Folkman, 1997) and specific items developed from a qualitative study (Schmidt, 1996). The original COMPI version has 29 items, with 17 representing four different coping strategies. The Portuguese version (COMPI Coping-P) has 26 items, scored from 1 ('not used') to 6 ('used a great deal'). COMPI Coping-P CFA procedures yielded a similar structure to the original conceptual model. Although some items were removed because of insufficient loading, the four original subscales were maintained: active-avoidance strategies (two items; e.g. 'I avoid being with pregnant women or children'; $\alpha = 0.88$); active-confronting strategies (six items; e.g. 'I ask other childless people for advice'; $\alpha = 0.74$); passive-avoidance strategies (three items; e.g. 'I try to forget everything about our childlessness'; $\alpha = 0.53$); and meaning-based coping (six items; e.g. 'I find other life goals'; $\alpha = 0.75$). The empirically derived COMPI Coping-P model showed moderate fit indices ($\chi^2(113) = 266.32$; SRMR = 0.08; CFI = 0.86; RMSEA = 0.07).

Infertility-related stress

Newton *et al.* (1999) developed the Fertility Problem Inventory (FPI) to measure perceived infertility-related stress. The 46 items are scored on a 6-point agreement scale. The CFA model for the Portuguese version (FPI-P) revealed acceptable fit indices ($\chi^2(769) = 1509.20$; SRMR =

0.08; CFI = 0.78; RMSEA = 0.07). While some items did not obtain enough saturation in local confirmatory analyses to be retained, the five original domains were maintained with good reliability indexes: social concern (10 items, e.g. 'When I see families with children I feel left out'; $\alpha = 0.88$), sexual concern (6 items, e.g. 'Having sex is difficult because I don't want another disappointment'; $\alpha = 0.77$), relationship concern (8 items, e.g. 'I can't show my partner how I feel because it will make him feel upset'; $\alpha = 0.84$), rejection of childfree lifestyle (7 items, e.g. 'There is a certain freedom without children that appeals to me' (reversed); $\alpha = 0.82$) and need for parenthood (10 items, e.g. 'I will do just about anything to have a child'; $\alpha = 0.82$).

Data analysis

First, in order to check for possible response bias in the online and hospital groups, statistical comparisons were conducted with socio-demographic and biomedical variables. Independent-samples *t* tests revealed no significant differences in both groups ($P > 0.05$) on age ($t = 0.89$), cohabitation time ($t = -0.66$), time attempting a pregnancy ($t = -1.43$), time to contact a physician ($t = 0.73$) and time until the first fertility medical appointment ($t = 1.58$). Chi-square tests revealed that the samples did not differ significantly on the stated cause for infertility ($\chi^2 = 7.37$, $P > 0.05$), type of infertility treatments ($\chi^2 = 0.153$, $P > 0.05$) or experiencing pregnancy ($\chi^2 = 2.71$, $P > 0.05$) but indicated that a greater proportion of online respondents had high school and university degrees ($\chi^2 = 7.37$, $P < 0.0005$). However, a multivariate analysis of variance showed no significant effect of education level on any of the dimensions used in the study ($F(12,251) = 1.31$, $P > 0.05$).

To test the hypothesized multiple mediation model, SEM analysis was used with EQS 6.1 (Bentler and Wu, 2004). Compared with separate simple mediation models, the relevant advantages of performing a single multiple mediation model include (i) the ability to ascertain the unique mediating effect of a specific variable controlling for the presence of other possible mediators and effect of predictors, (ii) reducing the likelihood of parameter bias related to potentially omitted variables, and (iii) the ability to test competing results between variables (Preacher and Hayes, 2008).

Prior to SEM analysis, all subscales from the MSPSS-P, COMPI Coping-P and FPI-P were parceled by averaging two or more items into aggregate-level indicators for each dimension or latent variable (Little et al., 2002). Because it requires fewer parameters to be tested, the parceling technique has the advantages of providing more parsimonious models compared with item-level data (MacCallum and Austin, 2000; Little et al., 2002), in addition to identifying more precisely the latent constructs, detecting fewer violations of normal distribution and providing greater reliability (Little et al., 2002; Kline, 2005). In our study, items were randomly assigned into two parcels for each construct.

In order to test the proposed model, we followed Baron and Kenny's (1986) guidelines for mediation by (i) testing the effect of perceived social support dimensions on infertility-related stress dimensions, (ii) testing the effect of perceived social support dimensions on infertility-related coping scales, (iii) testing the effect of coping scales on infertility stress domains controlling for the previous effect of perceived social support contexts found in step 2, and (iv) testing whether the significant effects found in step (i) decrease or cease when controlling for the coping effects. The same four fit indices examined in CFA were appraised to test the goodness of fit of the hypothesized models, namely the chi-square ratio ($\chi^2/\text{d.f.}$), the SRMR, the RMSEA and the CFI. Values closer to zero are demonstrative of better fit in the $\chi^2/\text{d.f.}$, SRMR and RMSEA. We considered the criteria of $\text{SRMR} \leq 0.10$ (Hu and Bentler, 1995) and $\text{RMSEA} \leq 0.06$ (Hu and Bentler, 1998) to be indicative of good fit. For the CFI, the closer to 1.0 the values are, the better the fit

of the data to the specified model. Good fitting models are expected to have values of ≥ 0.95 (Hu and Bentler, 1999). To measure mediation and significance of indirect effects, the Sobel test (Sobel, 1982) was used.

Results

Demographic and descriptive statistics

Participants had a mean age of 32 years ($M = 32.01$; $SD = 4.65$). The majority of these women had a university or higher education degree (53.4%). Participants were married or living together with their partners for an average of 6 years ($SD = 3.43$), and were attempting a pregnancy for an average of 4 years ($SD = 2.76$). Since attempting the pregnancy, women waited an average of 1.3 years ($SD = 1.69$) to search for a fertility physician, and 1.9 years ($SD = 2.20$) until their first fertility consult. The majority of the participants (80.9%) had received a diagnosis regarding the cause of infertility, with 30.9% of them reporting a female cause, 30.8% reporting a male factor, 19.7% a combined male–female causation and 8.3% idiopathic infertility. Fifty-eight percent of these women had already been submitted to infertility treatments, with 24.3% of them having only experienced hormonal treatment, 10.4% having also undergone IUI and 64.6% having reached a stage of IVF or ICSI. Eleven percent of participants had already been pregnant as a consequence of these treatments; 15.9% had already conceived spontaneously and 2.8% had a history of both types of pregnancies. All women that had previously been pregnant had suffered a miscarriage or stillbirth. Table 1 presents the mean levels and SDs for MSPSS-P, COMPI Coping-P and FPI-P subscales.

Associations between social support, coping and stress

Bivariate associations between the study dimensions were tested to determine the potential role of coping strategies as mediators and

Table 1 Descriptive statistics for dimensions of social support, coping and stress in women seeking infertility treatment ($N = 252$).

	Dimension	M	SD
MSPSS-P Perceived Social Support	Perceived partner support	5.46	0.92
	Perceived family support	4.91	1.24
	Perceived friends support	4.58	1.40
	Meaning-based coping	4.07	1.12
COMPI Coping-P Coping Strategies	Active-avoidance coping	2.33	1.52
	Active-confronting coping	3.91	1.13
	Passive-avoidance coping	4.20	1.27
	Relationship concern	2.29	1.03
	Sexual concern	2.30	1.07
FPI-P Infertility Stress	Rejection of childfree lifestyle	4.09	1.04
	Need for parenthood	4.37	0.96
	Social concern	3.09	1.19

All items were rated on a 6-point Likert scale. MSPSS-P: Portuguese version of the Multidimensional Scale of Perceived Social Support; FPI-P: Portuguese version of the Fertility Problem Inventory; COMPI Coping-P: Portuguese version of the COMPI coping strategy scales.

Table II Pearson's correlations between support, coping and stress dimensions.

	1	2	3	4	5	6	7	8	9	10	11	12
Perceived Social Support												
1. Perceived partner support	–											
2. Perceived family support	0.39**	–										
3. Perceived friends support	0.28**	0.44**	–									
4. Meaning-based coping	0.24**	0.11	0.15*	–								
Coping Strategies												
5. Active-avoidance coping	–0.09	–0.16*	–0.16*	–0.15*	–							
6. Active-confronting coping	0.23**	0.25**	0.32**	0.44**	0.03	–						
7. Passive-avoidance coping	0.15*	0.07	0.09	0.30**	0.21**	0.30**	–					
8. Relationship concern	–0.39**	–0.31**	–0.23**	–0.13*	0.27**	–0.02	0.18**	–				
Infertility Stress												
9. Sexual concern	–0.19**	–0.17**	–0.23**	–0.17**	0.41**	0.02	0.20**	0.54**	–			
10. Rejection of childfree lifestyle	–0.04	–0.10	–0.11	–0.19**	0.28**	0.12	0.13*	0.15*	0.31**	–		
11. Need for parenthood	0.03	–0.09	–0.14*	–0.07	0.29**	0.17**	0.32**	0.27**	0.48**	0.60**	–	
12. Social concern	–0.20**	–0.42**	–0.28**	–0.21**	0.63**	–0.11	0.17**	0.39**	0.46**	0.35**	0.42**	–

* $P < 0.05$; ** $P < 0.01$ (two-tailed).

assure they were not highly correlated (Baron and Kenny, 1986; Kenny *et al.*, 1998). Table II shows the correlation between MSPSS-P, COMPI Coping-P and FPI-P subscales. With the exception of active-avoidance coping (displaying small but statistically significant negative associations with family and friends support dimensions), coping and support variables were correlated in a positive direction. Results also indicated that increased levels of meaning-based coping were significantly associated with decreased infertility stress levels in all dimensions except for need for parenthood. While this stress domain was the only one to be significantly associated with active-confronting coping, both active- and passive-avoidance coping strategies were positively related with all infertility stress dimensions. Because each coping strategy was significantly associated with at least one of the hypothesized predictors and one of the outcome dimensions, all variables were included in the model.

Direct effects of social support contexts on infertility stress domains

In testing the first condition necessary for mediation, results revealed differentiated effects of perceived social support contexts in specific infertility stress domains, and good model fit indexes ($\chi^2(30) = 40.65$; SRMR = 0.05; CFI = 0.99; RMSEA = 0.04). Partner support was negatively associated with two infertility stress domains, namely relationship stress ($\beta = -0.47$) and sexual stress ($\beta = -0.20$). The analysis also indicated a negative relationship between family support and infertility social stress ($\beta = -0.43$). No significant relationships were revealed for the dimensions of friend support, rejection of childfree lifestyle and need for parenthood in this first model.

Mediating and indirect effects

Figure 2 shows the results of the final model, presenting the significant relationships between social support, coping and stress dimensions, as well as the magnitude of direct effects (magnitudes of indirect effects are omitted for clarity). The latent variable concerning passive-avoidance coping strategies ended up not contributing to the final model, and therefore was removed from it. The depicted model suggests a close fit for the data ($\chi^2(182) = 283.42$; SRMR = 0.05; CFI = 0.97; RMSEA = 0.05). The significant pathways leading to each infertility stress outcome variable in the model accounted for 66.0% of the variance in social stress, 31.7% in sexual stress, 31.4% in relationship stress, 11.8% in need for parenthood and 11.7% of the variance in rejection of childfree lifestyle.

Partner support

Partner support relationships found in the first model were maintained after the introduction of coping variables, as well as their magnitude. Perceived support from the partner had a strong direct and negative effect on relationship stress ($\beta = -0.47$) and sexual stress ($\beta = -0.20$). While these relationships were not mediated by any of the coping latent variables, an indirect negative mediating effect was revealed between partner support and rejection of childfree lifestyle through meaning-based coping ($\beta = -0.04$, $z = -2.00$, $P < 0.05$). Although there was a significant positive relationship between partner support and active-confronting coping ($\beta = 0.21$),

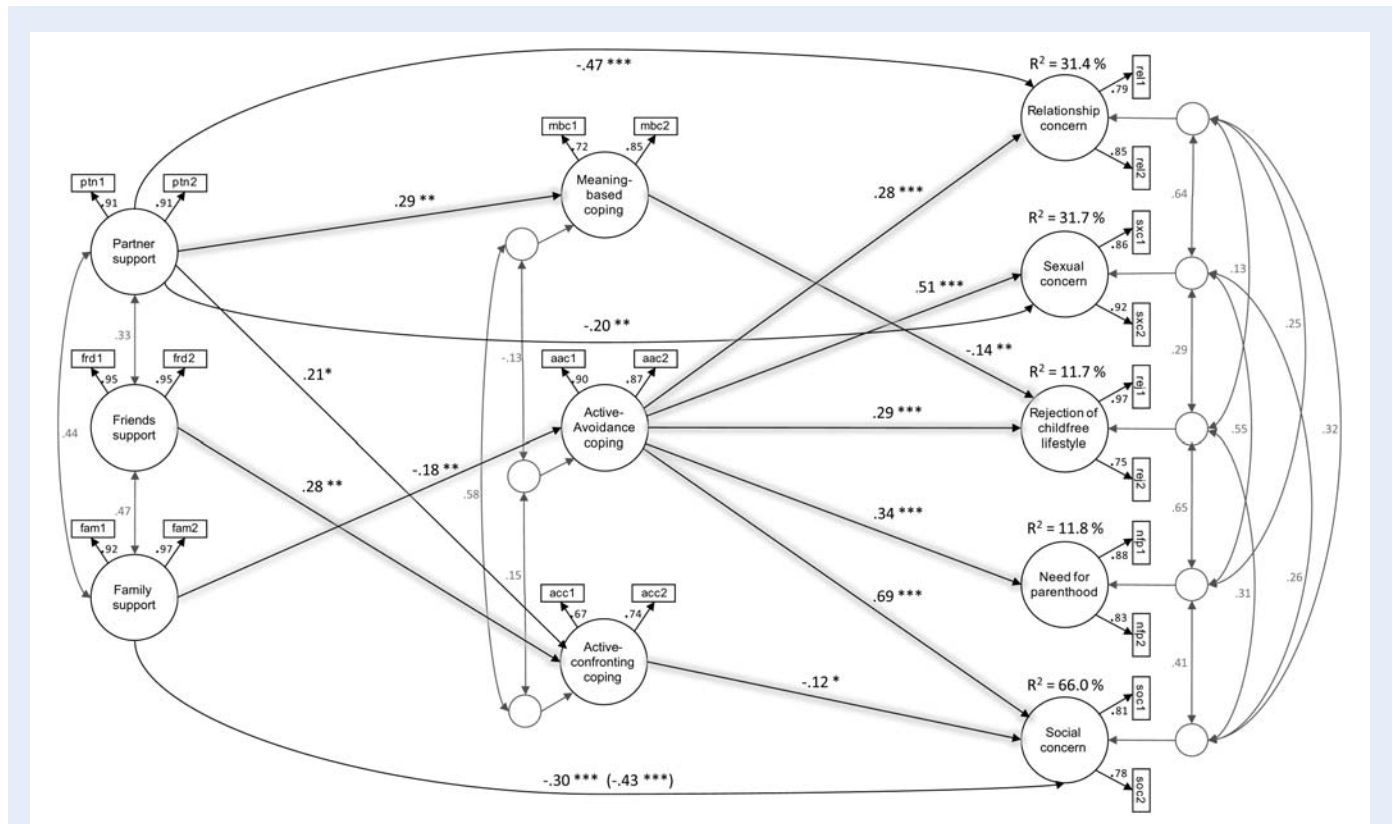


Figure 2 Final structural model and standardized estimates of factor loadings and regression coefficients. Shadowed arrows represent mediating effects. Latent constructs are shown within circles, parceled observed variables are shown within rectangles, and correlated error disturbance terms and standardized correlations are shown in gray. Only significant effects are shown in the picture. Signs of beta weights mark the direction of the effect. Indirect effects beta weights are not shown. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

and a negative relationship between this coping style and social stress ($\beta = -0.12$), the indirect path between partner support and social stress was not significant ($\beta = -0.03$, $z = -1.70$, n.s.).

Friends support

Regarding the perceived support from friends, only two significant relationships were revealed in this study. Besides a positive direct effect on active-confronting coping ($\beta = 0.28$), a negative indirect link was found with social stress ($\beta = -0.04$, $z = -1.96$, $P < 0.05$), via the decreasing effect of active-confronting coping ($\beta = -0.12$).

Family support

Perceived family support was negatively related with social infertility stress both directly ($\beta = -0.30$) and indirectly through active-avoidance coping ($\beta = -0.13$, $z = -2.54$, $P < 0.05$), indicating a partial mediation effect. Although the introduction of the coping variable reduced the strength of the previously found relationship between family support and social stress ($\beta = -0.43$ to $\beta = -0.30$), the direct effect remained and strongly contributed to reductions in the social stress domain. Family support was also related with active-avoidance coping ($\beta = -0.18$), which in turn had significant and strong direct effects on all infertility stress dimensions (β values ranging from 0.28 on relationship stress to 0.69 on social stress). Through active-avoidance coping, small but significant

indirect effects were found from family support to all infertility stress latent variables: relationship concern ($\beta = -0.04$, $z = -2.17$, $P < 0.05$), sexual concern ($\beta = -0.09$, $z = -2.44$, $P < 0.05$), rejection of childfree lifestyle ($\beta = -0.05$, $z = -2.22$, $P < 0.05$), need for parenthood ($\beta = -0.06$, $z = -2.28$, $P < 0.05$) and social concern ($\beta = -0.13$, $z = -2.54$, $P < 0.05$). Hence, while family support also had a direct effect on social stress, its effect on all other infertility stress domains occurred only through active-avoidance coping.

Discussion

The present study aimed to examine the relationships between perceived social support and infertility-related stress, and to test whether these links were mediated by infertility-specific coping strategies in a sample of infertile women seeking treatment. The tested SEM model represents a first step toward exploring the possible unique pathways by which different perceived sources of social support influence specific infertility stress domains.

The strong relationships found between a positive perception of partner support and low relationship and sexual infertility stress could not be explained by any of the accessed coping strategies. In fact, the strongest link found in the model was between partner support and relationship stress. This suggests that, no matter what coping strategy a woman adopts while pursuing a pregnancy through

treatment, the perception that one's husband is supportive might facilitate not only the couple's communication about the impact of infertility on the relationship, but also, for example, the scheduling of sexual relations. Given that the desire for a child is created within the marital relationship, and that a couple's difficulty in communicating can predict infertility stress (Schmidt *et al.*, 2005b), this evidence reinforces the importance of conceptualizing infertility as a shared couple's problem in clinical settings (Peterson *et al.*, 2008; Johnson and Johnson, 2009). Additionally, partner support was also related to decreases in rejection of a childfree lifestyle through meaning-based coping, suggesting that having a supportive partner can also facilitate the process of accepting a childfree lifestyle, if one views infertility in a positive light or focuses on new life goals.

Although few studies have examined the relationship between family support on infertility-related coping and stress, the current study demonstrates that perceived family support can have a powerful impact on how a woman experiences infertility stress, both directly and indirectly. For example, even though high levels of perceived support from friends (but not from a partner) can decrease women's social stress levels through the use of active-confronting coping strategies (e.g. reading about childlessness; finding a way to let feelings out), our findings imply that the support one perceives from family might assume a more direct role in alleviating social infertility stress (e.g. feeling more at ease when questioned about children).

Positive perceptions about the support provided by the family can not only diminish infertility-related social concerns but also indirectly benefit four infertility stress domains (relationship concern, sexual concern, rejection of childfree lifestyle and need for parenthood). Hence, even though family and friends are often considered unhelpful in their attempts to assist with infertility, these findings are consistent with the scarce evidence available on the benefit of familial support in infertility adjustment and are worthy of future study (Shiu-Neng and Pei-Fan, 2008; Mahajan *et al.*, 2009). While perceived family support acts directly to reduce social stress symptoms, such as sensitivity to comments and feelings of social isolation, results suggest that this potential benefit on other infertility stress domains can only help when women engage in active-avoidance coping strategies. This reinforces previous findings regarding the negative relationship between family support and avoidance coping (Holahan and Moos, 1987), and the power avoidance strategies have in increasing distress (Berghuis and Stanton, 2002; Schmidt *et al.*, 2005b). In fact, our model suggests that the use of infertility-related active-avoidance strategies, such as abandoning a conversation about children or pregnancies, can significantly raise infertility stress at all levels and be more directly powerful than positive strategies. While active-avoidance coping is primarily used as a defensive and protective reaction to the stress of infertility (Schmidt *et al.*, 2005a), its short-term reward actually ends up maintaining the problem. While the potential familial benefit on infertility stress through active-avoidance coping might seem paradoxical at first, given that avoidance-coping strategies are used when interpersonal resources are scarce, it is possible that women can be more at ease with feelings of discomfort when they turn to their own families, and therefore lower their propensity to retreat when perceiving their family as available to support them. Families might offer a secure haven where one can lower defenses and easily accept a higher vulnerability level. On the other hand, owing to the lack of prospective data, it could also be that high infertility stress levels in these

dimensions lead to a greater use of active-avoidance strategies, which could decrease perceived family support.

Findings from this study have implications for mental health practitioners working within infertility. Women displaying high infertility stress levels can benefit from interventions focused on reducing their reliance on active-avoidance coping strategies by retraining them to use more constructive coping behaviors. Coping skills training (CST) has been used successfully in other low-control situations, for example in patients waiting for a lung transplant (Blumenthal *et al.*, 2006) or with diabetes (Whittemore *et al.*, 2010). CST within the infertility context has been suggested before (Cousineau and Domar, 2007), and a review of psychosocial interventions in infertility (Boivin, 2003) indicates that the more successful interventions included the acquisition of coping techniques. More positive and adaptive strategies can include meaning-based and active-confronting coping strategies, especially in trying to lower social concerns and accepting a childfree lifestyle.

Because women have a greater propensity to seek social support than men (Thoits, 1995), the importance of evaluating adequacy of social support in the infertility context also becomes especially relevant. We know that infertility counseling should focus on both partners; it is probably no surprise to clinicians that our findings suggest that focusing on the importance of husband support can decrease the wife's relationship and/or sexual concern, and even potentially increase the use of meaning-based coping strategies. Because infertile women mobilize more social support than men (Cousineau and Domar, 2007), counselors can highlight the importance that the support of friends might have in encouraging confronting coping, and that family support can have in decreasing active-avoidance coping and social stress. These points become especially relevant in couples therapy if partners are not in agreement regarding how and when to disclose their infertility to others. In order to avoid encouraging support where none is available, counselors should conduct a thorough assessment of each partner's family dynamics as a support system before encouraging the woman to rely on her family.

It should be noted that the current study contains a number of limitations. First, because of the aforementioned cross-sectional study design, claims of directional influence cannot be made. Also, even though this study had solid theoretically driven hypotheses and good fit of the SEM model to the data, we did not consider other approaches. Testing alternative hypotheses beyond the scope of transactional stress theory could be valuable to rule out possible reverse causal effects. Second, another reason why this model should be considered exploratory is the fact that there are several and varied guidelines regarding the sample size in SEM analyses. Even though our sample had >100 subjects (Muthén and Muthén, 2002), following other suggestions as having an item:subject ratio of 5 subjects per free parameter (Bentler and Chou, 1987) or 5–10 responses per parameter (Muthén and Muthén, 2002) could enhance the stability and reliability of these estimates. Third, the measure of social support was a general measure, obtaining generalized perceptions of how women view social support in different contexts but not specifically regarding infertility. Even though it is common to inform family and close friends (Peronace *et al.*, 2007), we do not know whether the infertility condition was revealed in these contexts. And fourth, in addition to the fact that findings may be different for those who have given up treatment (Lechner *et al.*, 2007) or simply decided

not to pursue treatment, generalization of results to women seeking treatment must be made with caution. Because non-respondents' records at the hospital were not kept and there might be a bias inherent to a self-selected sample regarding online users, the study's external validity is limited.

Because the present study constitutes an exploratory analysis and no previous research has investigated the mediating effects of coping strategies on the association between perceived social support and infertility stress, future replication studies using larger samples and longitudinal data are warranted to verify the findings of this study. It would also be highly valuable to test for the possibility of different paths in a sample of men experiencing infertility since the experiences of infertile men are often underrepresented in the literature and increased calls have been made to include their voices in studies of this kind (Fisher et al., 2010; Greil et al., 2010; Keylor and Apfel, 2010). Once we know how these paths operate in men, couples going through a crisis over their infertility might be better counseled on how to accept gender-related ways of seeking social resources and adopting coping strategies in order to reduce stress (Wright et al., 1991). Because infertility is a shared stressor, it is also important to study the impact of a partner's use of social support resources and coping given recent evidence on the influence of a partner's coping strategies on infertility stress (Peterson et al., 2008). Additionally, further studies addressing the differences between infertility disclosure patterns (for example, using a latent class approach) in the relationship between social support, coping and infertility-related stress would also be useful.

In conclusion, the present study shows that social support from different sources can be related to specific coping strategies and different domains of infertility stress. The main findings demonstrate that while different coping strategies can mediate the process through which social support contexts influence infertility stress, social support through one's partner and family can directly reduce infertility-related stress in some of these domains. These findings highlight the importance of various social support contexts in helping women deal with the challenges of infertility, and can benefit mental health professionals and physicians as they work to help couples navigate this unexpected life stressor.

Authors' roles

M.M., B.P., M.C. and V.A. participated in the concept and design of the study. M.M. was responsible for data collection and analysis. M.M. and B.P. drafted the manuscript. M.M., B.P., M.C. and V.A. interpreted data, revised drafts and approved of the manuscript submission.

Acknowledgements

The authors wish to thank Dr Joana M. Guimarães and the Portuguese Fertility Association (APFertilidade) for the cooperation and guidance during data collection.

Funding

This research was supported by a PhD Scholarship from the Portuguese Foundation for Science and Technology granted to M.M. (FCT, SFRH/BD/44232/2008).

References

- Abbey A, Andrews FM, Halman J. Gender's role in responses to infertility. *Psychol Women Quart* 1991;**15**:295–316.
- American Society for Reproductive Medicine (ASRM) Practice Committee. Definitions of infertility and recurrent pregnancy loss. *Fertil Steril* 2008;**90**:S60.
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *J Pers Soc Psychol* 1986;**51**:1173–1182.
- Bentler PM, Chou C-P. Practical issues in structural modeling. *Sociol Method Res* 1987;**16**:78–117.
- Bentler PM, Wu E. *EQS for Windows*, 6.1 edn. Encino, CA: Multivariate Software, 2004.
- Benyamini Y, Gozlan M, Kokia E. On the self-regulation of a health threat: cognitions, coping, and emotions among women undergoing treatment for infertility. *Cognitive Ther Res* 2004;**28**:577–592.
- Berghuis JP, Stanton AL. Adjustment to a dyadic stressor: a longitudinal study of coping and depressive symptoms in infertile couples over an insemination attempt. *J Consult Clin Psychol* 2002;**70**:433–438.
- Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. *Soc Sci Med* 2000;**51**:843–857.
- Blumenthal JA, Babyak MA, Carney RM, Keefe FJ, Davis RD, LaCaille RA, Parekh PI, Freedland KE, Trulock E, Palmer SM. Telephone-based coping skills training for patients awaiting lung transplantation. *J Consult Clin Psych* 2006;**74**:535–544.
- Boehmer S, Luszczyńska A, Schwarzer R. Coping and quality of life after tumor surgery: personal and social resources promote different domains of quality of life. *Anxiety Stress Copin* 2007;**20**:61–75.
- Boivin J. A review of psychosocial interventions in infertility. *Soc Sci Med* 2003;**57**:2325–2341.
- Bolger N, Amarel D. Effects of social support visibility on adjustment to stress: experimental evidence. *J Pers Soc Psychol* 2007;**92**:458–475.
- Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull* 1985;**98**:310–357.
- Cousineau TM, Domar AD. Psychological impact of infertility. *Best Pract Res Cl Ob* 2007;**21**:293–308.
- Drosdzol A, Skrzypulec V. Depression and anxiety among Polish infertile couples—an evaluative prevalence study. *J Psychosom Obst Gyn* 2009;**30**:11–20.
- Fisher JRW, Baker GHW, Hammarberg K. Long-term health, well-being, life satisfaction, and attitudes toward parenthood in men diagnosed as infertile: challenges to gender stereotypes and implications for practice. *Fertil Steril* 2010;**94**:574–580.
- Folkman S. Positive psychological states and coping with severe stress. *Soc Sci Med* 1997;**45**:1207–1221.
- Folkman S, Lazarus RS. *Manual for the Ways of Coping Questionnaire*. Palo Alto, CA: Consulting Psychologists Press, 1988.
- Gibson DM, Myers JE. The effect of social coping resources and growth-fostering relationships on infertility stress in women. *J Ment Health Couns* 2002;**24**:68–80.
- Greil AL. Infertility and psychological distress: a critical review of the literature. *Soc Sci Med* 1997;**45**:1679–1704.
- Greil AL, Slauson-Blevins K, McQuillan J. The experience of infertility: a review of recent literature. *Sociol Health Ill* 2010;**32**:140–162.
- Holahan CJ, Moos RH. Personal and contextual determinants of coping strategies. *J Pers Soc Psychol* 1987;**52**:946–955.
- Holahan CJ, Moos RH, Holahan CK, Brennan PL. Social context, coping strategies, and depressive symptoms: an expanded model with cardiac patients. *J Pers Soc Psychol* 1997;**72**:918–928.

- Hu L, Bentler PM. Evaluating model fit. In: Hoyle RH (ed). *Structural Equation Modeling: Concepts, Issues, and Applications*. Thousand Oaks, CA: Sage, 1995, 96–99.
- Hu L, Bentler PM. Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification. *Psychol Methods* 1998; **3**:424–453.
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling* 1999; **6**:1–55.
- Johnson KM, Johnson DR. Partnered decisions? U.S. *Couples and Medical Help-Seeking for Infertility*. *Fam Relat* 2009; **58**:431–444.
- Kenny DA, Kashy DA, Bolger N. Data analysis in social psychology. In: Gilbert D, Fiske S, Lindzey G (eds). *Handbook of social psychology*. Boston, MA: McGraw-Hill, 1998, 233–265.
- Keylor R, Apfel R. Male infertility: integrating an old psychoanalytic story with the research literature. *Stud Gender Sex* 2010; **11**:60–77.
- Kline RB. *Principles and Practice of Structural Equation Modeling*, 2nd edn. New York: The Guildford Press, 2005.
- Lazarus RS, Folkman S. *Stress, Appraisal and Coping*. New York: Springer Publishing Company Inc, 1984.
- Lechner L, Bolman C, van Dalen A. Definite involuntary childlessness: associations between coping, social support and psychological distress. *Hum Reprod* 2007; **22**:288–294.
- Little TD, Cunningham WA, Shahar G, Widaman KF. To parcel or not to parcel: exploring the question, weighing the merits. *Struct Equ Modeling* 2002; **9**:151–173.
- Lunenfeld B, Van Steirteghem A. Infertility in the third millennium: implications for the individual, family and society: condensed meeting report from the Bertarelli Foundation's second global conference. Bertarelli Foundation. *Hum Reprod Update* 2004; **10**:317.
- Luszczynska A, Mohamed NE, Schwarzer R. Self-efficacy and social support predict benefit finding 12 months after cancer surgery: the mediating role of coping strategies. *Psychol Health Med* 2005; **10**:365–375.
- MacCallum RC, Austin JT. Applications of structural equation modeling in psychological research. *Annu Rev Psychol* 2000; **51**:201–226.
- Mahajan NN, Turnbull DA, Davies MJ, Jindal UN, Briggs NE, Taplin JE. Adjustment to infertility: the role of intrapersonal and interpersonal resources/vulnerabilities. *Hum Reprod* 2009; **24**:906–912.
- Miller-Campbell S, Dunkel-Schetter C, Peplau LA. Perceived control and adjustment to infertility among women undergoing in vitro fertilization. In: Stanton AL, Dunkel-Schetter C (eds). *Infertility: Perspectives from Stress and Coping Research*. New York: Plenum, 1991, 133–156.
- Mindes EJ, Ingram KM, Kliever W, James CA. Longitudinal analyses of the relationship between unsupportive social interactions and psychological adjustment between women with fertility problems. *Soc Sci Med* 2003; **56**:2165–2180.
- Muthén LK, Muthén BO. How to use a Monte Carlo study to decide on sample size and determine power. *Struct Equ Modeling* 2002; **9**:599–620.
- Nachtigall RD. International disparities in access to infertility services. *Fertil Steril* 2006; **85**:871–875.
- Newton CR, Sherrard W, Glavac I. The Fertility Problem Inventory: measuring perceived infertility-related stress. *Fertil Steril* 1999; **72**:54–62.
- Peronace LA, Boivin J, Schmidt L. Patterns of suffering and social interactions in infertile men: 12 months after unsuccessful treatment. *J Psychosom Obstet Gynaecol* 2007; **28**:105–114.
- Peterson BD, Newton CR, Rosen KH, Skaggs GE. Gender differences in how men and women who are referred for IVF cope with infertility stress. *Hum Reprod* 2006; **21**:2443–2449.
- Peterson BD, Pirritano M, Christensen U, Schmidt L. The impact of partner coping in couples experiencing infertility. *Hum Reprod* 2008; **23**:1128–1137.
- Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods* 2008; **40**:879–891.
- Rapoport-Hubschman N, Gidron Y, Reicher-Atir R, Sapir O, Fisch B. 'Letting go' coping is associated with successful IVF treatment outcome. *Fertil Steril* 2009; **92**:1384–1388.
- Schmidt L. *Psykosociale konsekvenser af infertilitet og behandling [Psychosocial Consequences of Infertility and Treatment]*. Copenhagen: FADL Press, 1996.
- Schmidt L. Social and psychological consequences of infertility and assisted reproduction-what are the research priorities? *Hum Fertil* 2009; **12**:14–20.
- Schmidt L, Christensen U, Holstein BE. The social epidemiology of coping with infertility. *Hum Reprod* 2005a; **20**:1044–1052.
- Schmidt L, Holstein BE, Christensen U, Boivin J. Communication and coping as predictors of fertility problem stress: cohort study of 816 participants who did not achieve a delivery after 12 months of fertility treatment. *Hum Reprod* 2005b; **20**:3248–3256.
- Schwarzer R, Knoll N. Functional roles of social support within the stress and coping process: a theoretical and empirical overview. *Int J Psychol* 2007; **42**:243–252.
- Shiu-Neng C, Pei-Fan M. Infertile couples' experience of family stress while women are hospitalized for Ovarian Hyperstimulation Syndrome during infertility treatment. *J Clin Nurs* 2008; **17**:531–538.
- Slade P, O'Neill C, Simpson AJ, Lashen H. The relationship between perceived stigma, disclosure patterns, support and distress in new attendees at an infertility clinic. *Hum Reprod* 2007; **22**:2309–2317.
- Sobel ME. Asymptotic intervals for indirect effects in structural equations models. In: Leinhardt S (ed). *Sociological Methodology*. San Francisco: Jossey-Bass, 1982, 290–312.
- Terry DJ, Hynes CJ. Adjustment to a low-control situation: reexamining the role of coping responses. *J Pers Soc Psychol* 1998; **74**:1078–1092.
- Thoits PA. Stress, coping, and social support processes: where are we? What next? *J Health Soc Behav* 1995; **36**:53–59.
- Verhaak CM, Smeenk JMJ, Evers AWM, van Minnen A, Kremer JAM, Kraaijmaat FW. Predicting emotional response to unsuccessful fertility treatment: a prospective study. *J Behav Med* 2005a; **28**:181–190.
- Verhaak CM, Smeenk JMJ, van Minnen A, Kremer JAM, Kraaijmaat FW. A longitudinal, prospective study on emotional adjustment before, during and after consecutive fertility treatment cycles. *Hum Reprod* 2005b; **20**:2253–2260.
- Walen HR, Lachman ME. Social support and strain from partner, family, and friends: costs and benefits for men and women in adulthood. *J Soc Pers Relat* 2000; **17**:5–30.
- Weaver KE, Llabre MM, Durán RE, Antoni MH, Ironson G, Penedo FJ, Schneiderman N. A stress and coping model of medication adherence and viral load in HIV-positive men and women on highly active antiretroviral therapy (HAART). *Health Psychol* 2005; **24**:385–392.
- White L, McQuillan J. No longer intending: the relationship between relinquished fertility intentions and distress. *J Marriage Fam* 2006; **68**:478–490.
- Whitemore R, Grey M, Lindemann E, Ambrosino J, Jaser S. Development of an internet coping skills training program for teenagers with type 1 diabetes. *Comput Inform Nurs* 2010; **28**:103–111.
- Wright J, Duchesne C, Sabourin S, Bissonnette F, Benoit J, Girard Y. Psychosocial distress and infertility: men and women respond differently. *Fertil Steril* 1991; **55**:100–108.
- Zegers-Hochschild F, Adamson GD, de Mouzon J, Ishihara O, Mansour R, Nygren K, Sullivan E, van der Poel S, on behalf of ICMART and WHO. The International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary on ART terminology. *Hum Reprod* 2009; **24**:2683–2687.
- Zimet GD, Dahlem NW, Zimet SG, Farley GK. The Multidimensional Scale of Perceived Social Support. *J Pers Assess* 1988; **52**:30–41.