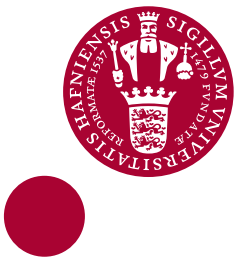

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Published in:
Reproductive BioMedicine Online

DOI:
10.1016/j.rbmo.2012.03.002

Publication date:
2012

Document version
Publisher's PDF, also known as Version of record

Reproductive BioMedicine Online (2012) **24**, 670–679

www.sciencedirect.com
www.rbmonline.com

ARTICLE

Perception of control, coping and psychological stress of infertile women undergoing IVF

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Kleanthi Gourounti is a lecturer in midwifery at the Technological Educational Institution of Athens, Greece. She received her PhD in psychology from the Panteion University in Athens, with a special focus on the impact of psychosocial factors on fertility-related stress and IVF outcome. She previously received her MSc in research on midwifery practice from King's College London and her MMedSc in environmental health from the University of Athens. She has served as a reviewer for several scientific publications and has authored or co-authored 26 manuscripts in peer-reviewed journals. She has a strong academic and professional interest in infertility counselling.

Abstract The study aimed to examine: (i) the association between perception of infertility controllability and coping strategies; and (ii) the association between perception of infertility controllability and coping strategies to psychological distress, applying multivariate statistical techniques to control for the effects of demographic variables. This cross-sectional study included 137 women with fertility problems undergoing IVF in a public hospital. All participants completed questionnaires that measured fertility-related stress, state anxiety, depressive symptomatology, perception of control and coping strategies. Pearson's correlation coefficients were calculated between all study variables, followed by hierarchical multiple linear regression. Low perception of personal and treatment controllability was associated with frequent use of avoidance coping and high perception of treatment controllability was positively associated with problem-focused coping. Multivariate analysis showed that, when controlling for demographic factors, low perception of personal control and avoidance coping were positively associated with fertility-related stress and state anxiety, and problem-appraisal coping was negatively and significantly associated with fertility-related stress and depressive symptomatology scores. The findings of this study merit the understanding of the role of control perception and coping in psychological stress of infertile women to identify beforehand those women who might be at risk of experiencing high stress and in need of support.

KEYWORDS: controllability, coping, infertility, IVF, psychological stress

1472-6483/$ - see front matter
doi:10.1016/j.rbmo.2012.03.002

Introduction

Infertility and its treatment are severe stressors and many women undergoing fertility treatment experience significant emotional distress (Verhaak et al., 2007). The existing literature indicates that several factors may influence emotional reactions to infertility and fertility treatment, including sociodemographic factors, cognitive perception (e.g. controllability) and coping strategies (e.g. avoidance coping) (Benyamini et al., 2009; Boivin and Schmidt, 2005; Gourounti et al., 2010b; Mahajan et al., 2009; Miles et al., 2008; Lord and Robertson, 2005; van den Broeck et al., 2010; Verhaak et al., 2005a,b). A selection of possible predictors of infertility-related stress can be based on stress vulnerability models (Lazarus and Folkman, 1984; Leventhal et al., 1980).

Lazarus and Folkman's (1984) theory of stress and coping posits that adjustment to stressful experiences (e.g. infertility) is determined by the interaction of situational variables, cognitions (e.g. controllability) and the selection of effective coping strategies. Studies examining infertility, stress and coping are commonly guided by Lazarus and Folkman's stress and coping theoretical perspective. According to the systematic review by Gourounti et al. (2010a) which assessed the impact of psychosocial variables on infertility-related stress, most of the included studies that explored the relationship between coping and emotional response to infertility and to a failed fertility treatment found a consistent negative effect of escape/avoidance, self-blame coping and accepting-responsibility coping and a consistent positive effect of active/problem-focused coping, positive re-appraisal coping and social support seeking coping. However, two studies, that were included in the systematic review, failed to support the predictive value of avoidance coping (Verhaak et al., 2005a,b) and three studies reported that problem management strategies were associated with higher levels of infertility stress and worse adjustment (Bayley et al., 2009; Benyamini et al., 2009; Terry and Hynes, 1998). For example, Benyamini et al. (2009) reported that problem management strategies were associated with higher levels of infertility distress and worse adjustment, while emotional approach and problem-appraisal strategies (positive re-interpretation) were associated with lower levels of infertility distress and better adjustment. A recent study by Lykeridou et al. (2011) revealed that avoidance and active confronting coping strategies were positively associated with higher levels of infertility distress.

A meta-analysis of empirical studies adopting the self-regulation model of Leventhal et al. (1980) concluded that the evidence supports significant relationships between illness cognition dimensions, coping strategies and psychological wellbeing (Hagger and Orbell, 2003). More specifically, the meta-analysis revealed that perceived controllability of the illness was significantly associated with cognitive reappraisal and problem-focused coping strategies. Furthermore, perceptions that the illness was controllable were significantly and positively associated with psychological wellbeing and negatively related to psychological distress.

Many infertility studies have explored the relationship between the perceived controllability of infertility and the levels of psychological distress (Abbey and Halman, 1995; Benyamini et al., 2009; Campbell et al., 1991; Litt et al., 1992; Lord and Robertson, 2005; Mahajan et al., 2009; Stanton et al., 1991). Four studies found a positive association between low perception of control and fertility related distress (Abbey and Halman, 1995; Campbell et al., 1991; Litt et al., 1992; Stanton et al., 1991). Stanton et al. (1991) found that women who felt greater control over the course of their fertility problem displayed higher emotional wellbeing and reported less distress. Campbell et al. (1991) revealed that low perception of controllability over infertility was significantly related to higher level of depression but was not significantly related to quality of life. Litt et al. (1992) found that a sense of loss of control over individuals' life because of infertility and fertility treatment was associated with increased levels of distress after a failed IVF attempt. Feelings of lost control explained 16% of the variance in post-IVF distress. Abbey and Halman (1995) found that high perception of general control was related to life quality. A study by Benyamini et al. (2009) revealed that low perception of controllability was related to lower psychological wellbeing. However, these authors concluded that perception of controllability was not related to psychological distress. In addition, the studies by Lord and Robertson (2005) and Mahajan et al. (2009) suggested that perceived controllability of infertility and fertility treatment was not associated with psychological distress. Therefore, it seems that there are discrepancies among previous findings and that the available evidence is still inconclusive. According to the authors' knowledge, only one study investigated the relationship between perception of controllability and coping strategies and found that a sense of loss of control over individuals' life because of infertility and fertility treatment was positively related to escape coping strategies (Litt et al., 1992). In addition, there is evidence that coping modes, such as emotionally expressive coping (Panagopoulou et al., 2007; Rapoport-Hubschman et al., 2009) statistically correlate with IVF outcome. However, very few studies have explored the impact of different coping styles on IVF outcome and, according to the author's knowledge, there is no study that has investigated the association between perception of infertility controllability and IVF outcome.

The aims of this study were to examine: (i) the association between perception of controllability of infertility and coping strategies, and (ii) the association between perception of infertility controllability, coping strategies and psychological distress, applying multivariate statistical techniques to control for the effects of demographic variables. The first hypothesis states that low perception of infertility controllability is associated with maladaptive coping strategies (e.g. avoidance/escape coping) and the second hypothesis states that low perception of infertility controllability and maladaptive coping strategies are positively associated with psychological stress after controlling for demographic variables.

Materials and methods

Sample and data collection

The study was conducted in one of the largest public fertility clinics in Greece to achieve a large database. Women with

fertility concerns come to this clinic, not only from the capital of Greece but also from rural areas of Greece. The questionnaires were administered to infertile women who were referred to a specialist for fertility treatment with IVF. Women were included if they were able to read and write in Greek to have the ability to complete the questionnaires and they had an infertility diagnosis. Screening for eligibility involved asking women whether they had a high fluency in Greek and an infertility diagnosis. If they answered affirmatively, they were invited to participate in the study. The eligibility rate was 85% (15% of women stated that they had low fluency in Greek). During the recruitment period (from November 2008 to July 2009), all eligible women who attended fertility treatment at the hospital ($n = 174$) were invited to participate in the study and 160 women agreed to participate and completed the questionnaires (response rate 92%). Non-participation was mainly due to time constraints. For this study, 23 women were excluded because they had secondary infertility (having already had a child). This resulted in a final sample of 137 women, which according to Green (1991), is considered adequate for testing the overall fit of a regression model with up to 10 independent variables. Using the G* Power program (Faul et al., 2007), both an a-priori and a post-hoc power analysis were employed. The a-priori power analysis for an alpha equal to 0.05, a power of 0.80, an effect size of 0.20 and 10 independent variables indicated that a sample size of at least 91 women would be required. In addition, the post-hoc analysis for computing retrospectively the achieved power (for an alpha of 0.05, an effect size of 0.20, seven predictors and a sample size of 130 women) showed that the achieved power of this study was 0.99.

Study instruments

Personal and treatment controllability were measured by the Controllability subscales (personal and treatment control) of Illness Perception Questionnaire-Revised (IPQ-R) (Moss-Morris et al., 2002). The personal control subscale included six items referring to perceived personal control or lack of control over the problem and over the improvement of the situation (e.g. 'nothing I do will affect my fertility problem'). The treatment control subscale included five items referring to perceptions about the effectiveness of any treatment or the effectiveness of medical personnel to control the illness (e.g. 'my fertility treatment can control my fertility problem'). Generally, in the IPQ-R, each item referred to 'my illness'. In this study, each item referred to 'fertility problem' to elicit the woman's cognitive perception of fertility problems. Items were rated on a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5). The personal control subscale score ranged from 6 to 30, the treatment control subscale score ranged from 5 to 25 and the higher the score, the higher the perceived control. The IPQ-R has been adapted to Greek and has been found to have satisfactory psychometric properties (Anagnostopoulos and Spanea, 2005). Cronbach's alpha for personal control of 0.70 and for treatment control of 0.72 were obtained in the present study.

The Fertility Problem Inventory (FPI) (Newton et al., 1999) is a 46-item self-administered, multidimensional measure that identifies infertility-related problems in five homogeneous domains: social concern, sexual concern, relationship concern, need for parenthood and rejection of childfree lifestyle. A composite score, derived by summing up all five domain scores, is interpreted as providing a global measure of perceived infertility-related stress. The FPI asks respondents to indicate the degree of their agreement with each item on a 6-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (6). The overall score ranged from 46 to 276, and the higher the score, the higher the infertility-related stress. The FPI has been adapted to Greek and has been found to have satisfactory psychometric properties (Gourounti et al., 2010c). Cronbach's alpha of 0.90 was obtained in the present study.

State anxiety was measured by the State Trait Anxiety Inventory (STAI)-State form developed by Spielberger (1972). State anxiety refers to the subjective and transitory feelings of tension, nervousness and worry and reflects how threatening a person perceives his environment. The STAI-State scale consists of 20 items that ask people to describe how they feel at a particular moment in time rated on a 4-point scale ranging from 'not at all' to 'very much so'. Total score for STAI-State ranged from 20 to 80. The STAI has been adapted to Greek and has been found to have satisfactory psychometric properties (Liakos and Gianitsi, 1984). Cronbach's alpha of 0.89 was obtained in the present study.

The Centre for Epidemiologic Studies-Depression (CES-D) was used to assess depressive symptoms (Radloff, 1977). The CES-D is a self-report 20-item scale that covers affective, psychological and somatic symptoms occurring during the past week. Responses to item statements are graded from 0 (rarely or none of the time) to 3 (most or all of the time). The overall score ranged from 0 to 60 and the higher the score, the more frequent the depressive symptoms. The CES-D has been adapted to Greek and has been found to have satisfactory psychometric properties (Madianos and Stefanis, 1992). Cronbach's alpha of 0.91 was obtained in this study.

Coping was assessed with Brief COPE (Carver, 1997). The brief COPE is a 28-item, multidimensional coping instrument designed to assess 14 conceptually distinct methods of coping. The 28 items represent a large number of coping responses including active coping, planning, positive reframing, acceptance, humour, using emotional support, using instrumental support, denial, self-distraction, behavioural disengagement, self blame, venting, religion and substance use. Participants are asked to refer to their experience of infertility within the past month. Items are rated on a 4-point scale ranging from 1 ('I don't do this at all') to 4 ('I do this a lot') and the score of each scale ranges from 2 to 8. The COPE factors were clustered in four groups: problem management (active coping, using instrumental support and planning), problem-appraisal (positive reframing and acceptance), avoidance or escapism (denial, self-distraction, behavioural disengagement, substance use) and seeking emotional support (using emotional support, religion, venting). The scores on subscales were summed up to yield the corresponding subscale. The COPE factors were clustered in four groups based on the exploratory factor analysis of COPE (by using parallel analysis for determining the number of factors to retain) that was conducted in this study. The four clusters of COPE subscales have also

been used in infertility studies by Lancastle and Boivin (2005) and Verhaak et al. (2005a) and agree with the theoretical approach described by Terry and Hynes (1998). The brief COPE has been adapted to Greek and has been found to have satisfactory psychometric properties (alpha ranges from 0.50 to 0.92) (Roussi and Vassilaki, 2001). Cronbach's alpha ranges from 0.51 to 0.89 in this study.

Basic demographic and medical information included: age, marital status, educational level, income level, cause of infertility, duration of infertility and fertility treatments received. The cause of infertility was categorized into female (tubal, hormonal, endometriosis), male infertility, mixed infertility (both female and male infertility) and idiopathic (unknown aetiology). The IVF outcome was categorized into positive pregnancy outcome and negative pregnancy outcome. The education level was categorized into low (elementary school), medium (high school) and high (university). The annual income level was categorized into low (9600–17,999 €), medium (18,000–35,999 €) and high (≥36,000 €).

Data analyses

The statistical analyses were conducted using Statistical Package for Social Sciences version 17.0 (SPSS, USA). Univariate frequency distributions, means and standard deviations were calculated for the variables (biological and demographic characteristics of participants). Distribution analysis was performed using SPSS Explore for evaluation of assumption of normality. Transformations (e.g. by taking the square root) of the problematic variables were applied to achieve normality, to stabilize the variance or to linearize relationships. In addition, bivariate analyses were conducted, comparing women who agreed to participate to the eligible women who did not agree to participate. Hierarchical multiple linear regression was performed to test the relationships between a set of independent variables (e.g. personal controllability, coping strategies) and a dependent variable (e.g. state anxiety or fertility-related stress), controlling for the effects of demographic variables to psychological distress. First, the relationships between individual independent variables (continuous and categorical) and dependent variables were explored by using independent *t*-test, chi-squared and one-way ANOVA. Then multiple regression analysis was performed with the independent variables that were significant in bivariate analyses at a 0.05 significance level. Three steps were conducted: the demographic variables were entered in the first step, while the controllability (personal and treatment control) variables were entered in the second step and the coping strategies were entered in the third step. To identify influential cases and outliers, Cook's distance (>1.0), Mahalanobis' distance (>15), standardized and Studentized residuals (>3.0 or <−3.0) were computed and examined. The presence of multicolinearity was assessed by inspecting the tolerance (<0.10) or the variance inflation factor (VIF > 10) associated with each independent variable (Field, 2009). Pearson's correlation was used to measure the associations between the independent variables that were entered in the regression analysis. Independence of error terms and sequential correlation of adjacent errors was tested through the Durbin–Watson statistic. This statistic can vary between 0 and 4, has an acceptable range of values from 1.50 to 2.50, with a value of 2 meaning that the residuals are uncorrelated. The criteria for assessing the overall fit of the model were the value of R^2 and the value of F-ratio and its associated *P*-value. R^2 is an indicator of how much variance was explained by the model compared with how much variance was not explained after the model has been fitted and big R^2 values indicated that the model explained high proportion of variance in the outcome variable. Big F-ratio values and significant *P*-values indicated a good model fit. All statistical tests were two-sided and performed at a significance level of 0.05.

Ethics

The Research and Ethics Committee of the Elena Benizelou hospital, approved this study protocol. All participants in this study were informed about the scope and the purpose of the study. Eligible women were also assured that the collected data would be used only for the purpose of the study. A signed informed consent was obtained from all study participants.

Results

Characteristics of participants

The age of participants was (mean ± SD) 36.1 ± 4.3 years (range 25–48 years). Forty-six percent had education beyond high-school, 49% had high school and 5% had less than a high school education. Most of the participants had a medium-income status. Seventy-five percent of women participated in the work-force, 98% were married and all of them were childless. Participants reported a mean duration of infertility of 4.0 ± 2.3 years and the average number of treatment cycles was 1.5. Forty-six percent of participants reported undergoing their first IVF cycle, 15% their second IVF cycle, 20% their third and 19% their fourth or greater IVF cycles. Women classified the cause of infertility as female factor (25%), male factor (37%), idiopathic (13%) and combined female and male factor (25%). Twenty-six percent of women had a positive pregnancy outcome, and 74% of women had a negative pregnancy outcome.

Non-respondents

Univariate independent *t*-tests and chi-squared test revealed that non-responders did not statistically differ from the respondents with regard to age, educational level, duration of infertility and number of fertility treatments.

Correlations between demographic/medical variables, controllability subscales and psychological stress

The mean score of personal controllability subscale was 15.9 ± 3.9 with a range of 6–30. The mean score of treatment controllability subscale was 16.8 ± 2.9 with a range 5–25. Pearson's correlation coefficients and one-way ANOVA revealed that personal control subscale was negatively and statistically significantly related to number of previous IVF trials ($r = -0.224$, $P < 0.001$) and treatment

control subscale was positively and statistically significantly related to income level ($F = 5.249$, $P = 0.007$). Therefore, women with a history of many previous IVF trials had lower perception of personal control than women with a history of fewer IVF trials. Women with high income had higher perception of treatment control than women with medium or low income. There was no significant relationship between controllability subscales and age, education level, duration of infertility and cause of infertility. In addition, age was positively and significantly related to fertility-related stress ($r = 0.264$, $P < 0.001$), state anxiety ($r = 0.314$, $P < 0.001$), and depressive symptoms ($r = 0.308$, $P < 0.001$). Measures of psychological stress were not significantly related to educational level, income level, infertility duration, aetiology of infertility and number of IVF trials. There was no significant relationship between controllability subscales and IVF outcome while there was a significant and positive relationship between problem-appraisal coping and positive pregnancy outcome ($r = 0.326$, $P = 0.001$).

Correlations between controllability, coping and psychological stress

Test of normality for the independent variable CES-D indicated that its distribution was not normal but positively skewed, and it was thus log transformed to better satisfy the normality assumptions of test statistics. Correlation between the personal controllability subscale and the treatment controllability subscales was explored. Correlation between the personal control subscale and the treatment control subscale was low, positive and statistically significant ($r = 0.335$, $p < 0.001$). The low correlations between the two subscales provided evidence that the subscales were indeed measuring a separate and unrelated dimension of controllability cognition. Intercorrelations among the independent variables (controllability subscales and coping subscales) and between the independent and dependent variables (fertility-related stress, state anxiety, depression) were explored (**Table 1**). Most of the correlations were statistically significant and in the expected direction. Findings suggested that controllability subscales of IPQ-R were negatively and statistically significantly correlated with state anxiety, depressive symptoms, fertility-related stress and avoidance coping. In addition, treatment control subscale was positively and significantly correlated with problem management coping. All the measures of psychological stress (fertility-related stress, state anxiety, depressive symptoms) were negatively and statistically significantly correlated with problem-appraisal coping strategies and positively and statistically significantly correlated with avoidance coping.

Multiple linear regression analysis

Hierarchical linear multiple regression analysis was conducted to identify variables that were significantly independently related to psychological stress. There were no cases with large standardized residuals, Studentized residuals or Cook's or Mahalanobis' distances. Significant correlations were observed among all the independent variables. However, multicollinearity was not detected, as none of the independent variables had a small tolerance value or a high VIF value. Therefore, all the independent variables that were significant in bivariate analyses were included in the multiple linear regression.

According to the standardized regression coefficient, age appeared to be the only demographic variable that was significantly related to infertility-related stress, state anxiety and depressive symptomatology ($\beta = 0.204$, $P = 0.004$; $\beta = 0.273$, $P < 0.001$; $\beta = 0.288$, $P < 0.001$, respectively) (**Tables 2—4**). The positive regression coefficient for age suggested that older women had higher levels of infertility-related stress, anxiety and depressive symptomatology than younger women. The model R^2 when only the age was in the first model was equal to 0.090, suggesting that approximately 9% of the variance in fertility-related stress was explained by age. The model R^2 when only the age was in the second model was equal to 0.113, suggesting that approximately 10% of the variance in state anxiety was explained by the age. In addition, the model R^2 when only the age was in the third model was equal to 0.131, suggesting that approximately 13% of the variance in depressive symptomatology was explained by the age. According to the standardized coefficient, personal control was significantly related to fertility-related stress ($\beta = 0.201$, $P = 0.004$) and to state anxiety ($\beta = 0.173$, $P = 0.017$) (**Tables 2 and 3**). Furthermore, according to the standardized coefficient, the controllability variables were not significantly related to the depressive symptoms (**Table 4**). When the controllability variables were added in the models, there was a small but significant improvement in the models of fertility-related stress, state anxiety and depressive symptomatology (R^2 change = 0.049, $F = 17.125$, $P = 0.048$; R^2 change = 0.082, $F = 24.010$, $P = 0.003$; R^2 change = 0.062, $F = 26.068$, $P = 0.014$, respectively). More specifically, only an additional 4.9% of the variance in fertility-related stress was explained by the controllability variables and 13.9% of the variance in fertility-related stress was explained by the age and the controllability variables. Furthermore, an additional 8.2% of the variance in state anxiety was explained by the controllability variables and 19.5% of the variance in state anxiety was explained by the age and the controllability variables. Furthermore, only an additional 6.2% of the variance in depressive symptomatology was explained by the controllability variables and 19.3% of the variance in depressive symptomatology was explained by the age and the controllability variables.

According to the standardized coefficients, the coping strategies were significantly related to fertility-related stress, state anxiety and depressive symptoms. The positive regression coefficient for avoidance coping suggested that women who more frequently used avoidance coping had significantly higher levels of fertility-related stress, anxiety and depressive symptomatology than women who less frequently employed avoidance coping strategies ($\beta = 0.357$, $P < 0.001$; $\beta = 0.297$, $P < 0.001$; $\beta = 0.414$, $P < 0.001$, respectively). The negative regression coefficient for problem-appraisal coping suggested that women who more frequently used appraisal coping had significantly lower levels of fertility-related stress and depressive symptomatology than women who less frequently employed appraisal coping strategies ($\beta = -0.242$, $P = 0.001$; $\beta = -0.211$, $P = 0.002$, respectively). It was also found that women who more frequently used emotion-focused coping had significantly higher levels

Table 1 Intercorrelations among independent and dependent variables.

Variables	*Personal control*	*Treatment control*	*Problem-appraisal coping*	*Problem management coping*	*Avoidance coping*	*Emotion-focused coping*
Treatment control	0.335**					
Problem-appraisal coping	0.129	0.145				
Problem management coping	0.169	0.250**	0.267**			
Avoidance coping	−0.256**	−0.331**	−0.049	−0.013		
Emotion focused coping	−0.011	0.109	0.095	0.486**	−0.210**	
State anxiety	−0.259**	−0.258**	−0.221*	−0.130	0.430**	0.014
Depressive symptoms	−0.201*	−0.259**	−0.296**	−0.060	0.454**	0.138
Fertility-related stress	−0.166*	−0.166*	−0.313**	0.015	0.385**	0.225**

*$P < 0.05$.
**$P < 0.001$.

Table 2 Results of multiple linear regression, including factors related to fertility-related stress.

Explanatory variables	*B*	*SE*	*Beta*	*t-value*	*P-value*	*Tolerance*	*Variance inflation factor*
Block 1: Model characteristics: $R^2 = 0.090$, F = 14.428, $P < 0.001$							
Age (years)	1.515	0.522.	0.204	2.900	0.004	0.940	1.064
Block 2: Model characteristics: $R^2 = 0.139$, R^2 change = 0.049, F = 17.125, $P = 0.048$							
Personal control (dummy 1 low)	36.002	12.437	0.201	2.895	0.004	0.964	1.037
Personal control (dummy 3 high)	−0.845	5.049	−0.013	−0.167	NS	0.831	1.204
Treatment control	−2.148	3.248	−0.052	−0.661	NS	0.747	1.339
Block 3: Model characteristics: $R^2 = 0.349$, R^2 change = 0.210, F = 32.224, $P < 0.001$							
Problem-appraisal coping	−2.221	0.647	−0.242	−3.433	0.001	0.937	1.067
Avoidance coping	2.854	0.606	0.357	4.708	<0.000	0.808	1.237
Emotion-focused coping	1.439	0.719	0.146	2.000	0.047	0.872	1.147

B = unstandardized coefficients, NS = not statistically significant, SE = standard error, Beta = standardized coefficients.

of fertility-related stress ($\beta = 0.146$, $P = 0.047$). When the coping variables were added in the models, there was a significant improvement in the model of fertility-related stress, state anxiety and depressive symptomatology (R^2 change = 0.210, F = 32.224, $P < 0.001$; R^2 change = 0.057, F = 32.715, $P < 0.001$; R^2 change = 0.190, F = 48.061, $P < 0.001$, respectively). More specifically, an additional 21% of the variance in fertility-related stress, an additional 8.7% of the variance in state anxiety and an additional 19% of the variance in depressive symptoms was explained by the coping strategies. The total proportion of variance explained in fertility-related stress, state anxiety and depressive symptoms explained by all the independent variables was 34.9%, 28.2% and 38.3% respectively.

Discussion

The authors of this study sought to examine the association between perception of infertility controllability and coping strategies, as well as the association between perception of infertility controllability and coping strategies to psychological distress, applying multivariate statistical techniques to control for the effects of demographic variables. According

Table 3 Results of multiple linear regression, including factors related to state anxiety.

Explanatory variables	*B*	*SE*	*Beta*	*t-value*	*P-value*	*Tolerance*	*Variance inflation factor*
Block 1: Model characteristics: $R^2 = 0.113$, F = 19.057, $P < 0.001$							
Age (years)	0.653	0.174	0.273	3.743	<0.000	0.937	1.067
Block 2 Model characteristics: $R^2 = 0.195$, R^2 change = 0.082, F = 24.010, $P = 0.003$							
Personal Control (Dummy 1 low)	10.043	4.165	0.173	2.411	0.017	0.967	1.034
Personal Control (Dummy 3 high)	−1.313	1.676	−0.060	−0.783	NS	0.840	1.191
Treatment control	−0.780	1.064	−0.059	−0.733	NS	0.776	1.289
Block 3: Model characteristics: $R^2 = 0.252$, R^2 change = 0.057, F = 32.715, $P < 0.001$							
Problem-appraisal coping	−0.293	0.215	−0.099	−1.361	NS	0.937	1.067
Avoidance coping	0.754	0.191	0.297	3.955	<0.000	0.886	1.128

B = unstandardized coefficients, NS = not statistically significant, SE = standard error, Beta = standardized coefficients.

Table 4 Results of multiple linear regression, including factors related to depressive symptomatology.

Explanatory variables	*B*	*SE*	*Beta*	*t-value*	*P-value*	*Tolerance*	*Variance inflation factor*
Block 1: Model characteristics: $R^2 = 0.131$, F = 22.393, $P < 0.001$							
Age (years)	0.589	0.139	0.288	4.241	<0.000	0.936	1.068
Block 2: Model characteristics: $R^2 = 0.193$, R^2 change = 0.062, F = 26.068, $P = 0.014$							
Personal Control (Dummy 1 low)	4.993	3.312	0.101	1.507	NS	0.967	1.034
Personal Control (Dummy 3 high)	−2.536	1.338	−0.136	−1.895	NS	0.836	1.197
Treatment control	−0.885	0.859	−0.077	−1.131	NS	0.763	1.310
Block 3: Model characteristics: $R^2 = 0.383$, R^2 change = 0.190, F = 48.061, $P < 0.001$							
Problem-appraisal coping	−0.538	0.173	−0.211	−3.108	0.002	0.932	1.072
Avoidance coping	0.899	0.152	0.414	5.916	<0.000	0.882	1.133

B = unstandardized coefficients, NS = not statistically significant, SE = standard error, Beta = standardized coefficients.

to the authors' knowledge, this study is the first one that examines the relationship between infertility controllability perception and coping strategies, after the study by Litt et al. (1992) conducted approximately 20 years ago. Results of this study confirm the study hypotheses.

The data confirmed a degree of congruence between coping strategies and secondary appraisals (controllability) of infertility. The study results clearly demonstrated that low perception of controllability was positively associated with avoidance coping. The study finding is consistent with findings of the previous study by Litt et al. (1992) and suggest that low perception of controllability is associated with frequent use of avoidance coping. The study findings also demonstrated that a high perception of infertility controllability was positively associated with problem-focused coping. Specifically, high perception of controllability treatment was positively associated with problem-management coping. It may be concluded that although infertility is a low control situation (Terry and Hynes, 1998), women's perception of treatment effectiveness (treatment controllability) may lead to adaptation of problem-focused coping.

Results of this study also indicated that perception of infertility controllability and coping strategies were significantly related to psychological stress. Importantly, these relationships remained significant even after controlling for demographic variables. More specifically, results obtained

from the multivariate analysis showed that when controlling for demographic factors, low perception of personal control was positively associated with fertility-related stress and state anxiety. In other words, women with higher levels of fertility-related stress and state anxiety had lower perception of personal control than women with lower levels of stress and anxiety. These findings are consistent with the findings of many previous studies (Benyamini et al., 2009; Litt et al., 1992; Stanton et al., 1991). It should be noted that while bivariate results showed that depressive symptoms were related to controllability variables, multivariate analyses showed that controllability variables were not significantly related to depressive symptoms. This could be attributed to the independent variables being correlated with each other (e.g. controllability variables with avoidance coping), making the unique contribution of each difficult to assess (Tabachnic and Fidell, 2007). Any statement about the magnitude of the regression coefficients or the relative importance of an independent variable is contingent upon the other variables in the regression equation. Thus, in the presence of other independent variables (e.g. coping strategies), controllability variables were not significantly related to depressive symptoms.

It is noteworthy, that according to the results of the multivariate analyses only perception of personal controllability was significantly related to fertility-related stress and state anxiety. Perception of treatment controllability proved to be a variable that was not significantly associated with levels of stress and anxiety of women undergoing fertility treatment. There is one possible explanation for this finding. The study sample consisted only of participants who had decided to seek assisted reproduction treatment and did not consist of infertile women who did not seek treatment. Therefore, it could be postulated that almost all study participants had decided to seek assisted reproduction treatment because they perceived fertility treatment as an effective way of dealing with infertility.

In addition, results from the multivariate analysis showed that when controlling for demographic and controllability variables, avoidance coping and emotional-focused coping were positively associated with fertility-related stress, state anxiety and depressive symptomatology while problem-appraisal coping was negatively and significantly associated with fertility-related stress and depressive symptomatology scores. In other words, women with higher levels of fertility-related stress, state anxiety and depressive symptoms more frequently employed avoidance and emotional-focused coping strategies and less frequently problem-appraisal coping. These findings are consistent with and confirm the findings of many previous studies (e.g. Bayley et al., 2009; Benyamini et al., 2009; Lechner et al., 2007; Litt et al., 1992; Mindes et al., 2003; Schmidt et al., 2005; Terry and Hynes, 1998). These findings also confirm the theory of stress and coping by Lazarus and Folkman (1984). More specifically, it seems that the negative impact of avoidance coping and emotion-focused coping strategies (e.g. praying, venting) on psychological status is attributed to the failure of such efforts to confront the event (Lazarus and Folkman, 1984; Folkman and Moskowitz, 2000) while the positive effect of problem-appraisal coping is attributed to the fact that appraisal-focused coping may engage women to focus their attention on specific goals and make them feel effective (Terry and Hynes, 1998). It is also interesting that women who became pregnant more frequently employed problem-appraisal coping. Therefore, the findings may suggest that cognitive coping interventions can be proved effective not only by reducing fertility-related stress but also by enhancing positive treatment outcomes (Boivin, 2003; Domar et al., 2011; Panagopoulou et al., 2009). Additionally, the study findings indicated that problem-management coping was not significantly associated with stress levels. Although typically there is a positive relationship between problem-management coping and better adjustment, it seems that in response to infertility, problem-management coping strategies do not have a predictive value. According to Terry and Hynes (1998) in response to low-control stressful situations, specific problem-focused coping strategies, such as problem-management coping, are likely to have deleterious effects presumably because such efforts engender feelings of frustration and disappointment.

Each of the variables significantly contributed to psychological stress. Of particular interest is the finding that coping strategies were the most powerful predictors of the models accounting for 21% of the total variance (35%) in fertility-related stress, 9% of the total variance (25%) in state anxiety and 19% of the total variance (38%) in depressive symptomatology. Controllability variables accounted for 5—8% of the total variance in models of psychological stress. Nevertheless, the findings indicated that age, controllability and coping variables explained less than 40% of the variance in psychological stress. Therefore, the potential importance of other variables remains to be explored. According to the literature, social support (Slade et al., 2007; Verhaak et al., 2005ab), financial concerns (Smeenk et al., 2004), stigma (Donkor and Sandall, 2007), career role salience, role failure and low self-esteem (Miles et al., 2008) could account for a significant amount of the variance in psychological stress of infertile women.

Results of this study need to be interpreted within the light of some limitations. First, the study design was cross-sectional, which precludes drawing definitive conclusions regarding the direction of relationships and the causal relationships between variables. Additionally, although the present study controlled for differences in age, it did not control for other potentially important psychosocial factors (e.g. social support). Thus, the results obtained may be influenced by uncontrolled confounding factors. Therefore, future studies should aim to investigate the relation between perception of infertility controllability and coping strategies to psychological distress after controlling for these additional psychosocial factors. In addition, the relatively small sample size might not have provided adequate statistical power for including these other variables and still being able to detect meaningful differences in fertility-related stress. Finally, the sample of women with fertility problems was drawn only from one public infertility clinic and not from many clinics, which may have introduced selection bias and produced a non-representative sample of women undergoing IVF. Nevertheless, the sample consisted of women with various medical and demographic characteristics and the study participants had demographic and medical characteristics (mean duration of infertility and average number of IVF treatments) similar to that of participants included in other relevant studies (Lykeridou et al., 2008;

Panagopoulou et al., 2009). Consequently, the sample of the present study is representative of the population of women undergoing fertility treatment in Greece.

Despite these limitations, this study had many strengths. First, the study included a sufficient sample size to provide sufficient statistical power (>80%) to detect an $R^2 = 0.2$ for a model with six or seven variables. Another advantage of the present study in relation to many previous studies is the statistical techniques employed (hierarchical regression analysis) which permitted assessment of the relation of controllability and coping variables to psychological stress after controlling for relevant demographic factors related to fertility-related stress. Moreover, both general and fertility-specific psychological stressors were assessed. In summary, an effort to overcome the methodological and statistical limitations of previous published studies, which might have led to inconclusive evidence regarding the relation between controllability, coping and fertility-related stress, was made.

In conclusion, the current study represents an attempt to understand how certain psychosocial factors make infertile women undergoing fertility treatment more vulnerable to stress. This study also contributes to the broader literature examining the relationships between psychosocial factors and fertility-related stress, as well as the mediators of these relationships. It is hoped that information acquired from this study will help to identify beforehand those women who might be at risk of experiencing high stress and in need of support. Therefore, healthcare professionals should enhance the implementation of interventions and support services for infertile women undergoing fertility treatment in order to enhance sense of control and alter coping skills of those women believed to be at risk.

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Declaration: The authors report no financial or commercial conflicts of interest.

Received 14 January 2012; refereed 29 February 2012; accepted 1 March 2012.