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## Predictors of psychological health in couples diagnosed with Male infertility: A dyadic approach

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### Abstract

**Background:** Research underlined that infertile men may experience sense of guilt and failure, loss of self-esteem, high psychosocial and marital stress, and psychological suffering, but little attention was given to individual and dyadic dynamics featuring both partners diagnosed with male infertility.

**Objective:** The study aimed to apply the Actor-Partner-Interdependence Model (APIM) to investigate actor and partner effects of infertility-related stressors (Social Concern, Need for Parenthood, Rejection of Childfree Lifestyle, Couple's Relationship Concern), coping strategies (Social Support, Avoiding, Positive Attitude, Problem-Solving, Turning to Religion) and dyadic adjustment dimensions (Consensus, Satisfaction, Cohesion, Affectional Expression) on perceived levels of state-anxiety and depression among both members of couples diagnosed with male infertility.

**Method:** Both members of 80 couples with male infertility diagnosis completed self-administered questionnaires.

**Results:** Perception of Social and Couple's Relationship Concerns and adoption of Avoiding and Turning to Religion coping emerged as risk factors for both partners. Adoption of Social Support and Problem-Solving coping and partners' perception of Rejection of Childfree Lifestyle emerged as risk factors, while the perception of dyadic adjustment and partners' adoption of Social Support coping, emerged as protective factors for men's psychological health. Perception of Need for Parenthood and partners' perception of Rejection of Childfree Lifestyle emerged as risk factors, while the perception of Cohesion, and partners' perception of Social and Couple's Relationship Concerns and adoption of Positive Attitude coping, emerged as protective factors for women's psychological health.

**Conclusions:** The study suggested specific individual and dyadic dynamics to be addressed for developing tailored interventions to promote psychological health in couples diagnosed with male infertility.

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### Keywords:

Male infertility; Infertility-related stress; Actor-Partner Interdependence Model (APIM); State-Anxiety; Depression.

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## 1. Introduction

Infertility diagnosis is an unexpected event that can entail a life crisis, and expose both members of infertile couples to the risk of reporting a loss of self-esteem, inability to plan the future, difficulties in social interactions, and adverse emotional outcomes (Luk & Loke, 2015; Ying et al., 2015).

In particular, several studies have underlined that infertility represents a distressing experience (Rooney & Domar, 2022), potentially featured by specific stressors, namely personal concerns linked to the perceived high need to achieve parenthood (i.e., parenthood is a leading life goal) and to perceived rejection/adjustment to a future without a child/another child. Moreover, although the key protective role the social/relational networks may have in effectively dealing with life stress (Flannery & Wieman, 1989; Hannigan et al., 2004), research also highlighted that infertility might even compromise relational and social life, entailing further specific stressors, namely concerns about the impact of infertility on the couple relationship (i.e., sexual and couple life) and social concerns (i.e., sensitivity to comments and reminders of infertility from family/friends; feelings of isolation and alienation) (Abbey et al., 1992; Newton et al., 1999).

Therefore, considering the well-known and consistent evidence of the detrimental effects of exposure to high and/or persistent stress on individuals' psychophysical health conditions (Frisone et al., 2021; Rooney & Domar, 2022), research in the field has spent increasing efforts to identify risk and protective factors significantly influencing infertile couples' wellbeing, highlighting not only the significant role of specific perceived infertility-related stressors (i.e., social and couple's relationship concerns, need for parenthood, rejection of childfree lifestyle), but also of individual and personality characteristics (e.g., coping strategies), and perceived couple's dyadic adjustment dimensions (i.e. Consensus, Satisfaction, Cohesion, Affectional-Expression) (Benyamini et al., 2008; Luk & Loke, 2015; Ying et al., 2015).

In this perspective, a valid and comprehensive predictive model was proposed by Zurlo et al. (2020a). It allows assessing predictors of psychological health outcomes (State-Anxiety and Depression) among both partners of infertile couples. The model enables to simultaneously account for the effect of a wide range of individual and situational characteristics. Individual characteristics comprise socio-demographics and coping strategies (i.e., Social Support, Avoiding, Positive Attitude, Problem Solving, Turning to Religion); situational characteristics include infertility-related parameters (i.e. Type of diagnosis; Duration of Infertility), perceived infertility-related stressors (i.e. Social Concern; Couple's Relationship Concern; Need for Parenthood; Rejection of Childfree Lifestyle) and couple's dyadic adjustment dimensions (i.e.

Dyadic Consensus; Affectional Expression; Dyadic Cohesion; Dyadic Satisfaction). Overall, the final predictive model accounted, respectively, for 63% of the variance in State-Anxiety and for 54% of the variance in Depression among male partners, and for 41% of the variance in State-Anxiety and for 47% of the variance in Depression among female partners. For both women and men, the infertility related-stress dimensions of Social Concern, Couple's Relationship Concern and Need for Parenthood, as well as the adoption of Social Support and Avoiding coping strategies emerged as risk factors, while higher educational level, employment status (Employed) and the adoption of Positive Attitude coping strategies emerged as protective factors. Specificities in risk and protective factors according to sex were also found. Indeed, for men only, the type of diagnosis (i.e., Male and Unexplained diagnoses) and the adoption of Problem Solving and Turning to Religion coping strategies emerged as specific risk factors, while the perceived level of the couple's Dyadic Consensus emerged as a specific protective factor. Differently, for women only, the high duration of infertility emerged as a specific risk factor, while the perceived level of the couple's Affectional Expression emerged as a specific protective factor (Zurlo et al., 2020a). By empirically identifying a wide set of significant predictors (risk and protective factors) of psychological health in infertile patients, this model provides researchers and practitioners with a valid and comprehensive framework to be used for the development of further research and tailored evidence-based interventions.

In this perspective, a growing body of research emphasised the necessity to further develop studies targeting couples facing a specific type of infertility diagnosis (Male, Female, Combined, Unexplained) since they are potentially featured by particular risks and resources (De et al., 2017). This research direction is, however, underdeveloped. Indeed, in high-income countries, approximately 15% of couples experience difficulties in conceiving, and, despite up to half of these couples are diagnosed with male infertility (Jungwirth et al., 2014), the majority of literature targeted female diagnosis (Hanson et al., 2017; Schweiger et al., 2018). In addition, less attention has been given to the impact of male diagnosis at the individual level, and even less at the couple level (Fisher & Hammarberg, 2012).

Overall, research targeting male diagnosis emphasised that men are less likely to accept and discuss infertility when aetiological factors lie with them (Fahami et al., 2010), since fertility is often perceived and socially confounded with virility and sexual adequacy (Jaoul, et al., 2014; Tüzer et al., 2010).

Accordingly, some studies targeting infertile men's experience highlighted the loss of self-esteem, sense of failure for themselves and guilt about the medical treatments their partner must

undergo (Reder et al., 2009), stigmatization (Dyer et al., 2004), significant levels of psychosocial and marital stress (Basu, 2014; Culley et al., 2013) and adverse emotional outcomes (De et al., 2017; Gamel et al., 2019). Moreover, considering the social roles of the western cultural context, men are also less allowed to freely express their feelings than women, particularly within intimate relationships, potentially exacerbating their individual and relational disease (Ghinassi et al., 2021).

However, whether male infertility may directly affect men's psychological health, little attention has been given to their partner's experience (De et al., 2017; Kowalcek et al., 2001; Samadaee-Gelehkolaee et al., 2016), raising the necessity to develop further research not only targeting male diagnosis, but also including both members of infertile couples.

Indeed, research has increasingly moved toward the examining infertility as a shared experience by adopting a dyadic approach, particularly using the Actor-Partner Interdependence Model (APIM; Kenny et al., 2006). The APIM is a model of dyadic relationships that integrates a theoretical view of interdependence in two-person relationships with the appropriate statistical techniques for measuring and testing it. A relationship is interdependent when one person's emotion, cognition, or behaviour affects another person's emotion, cognition, or behaviour. The consequence of interdependence is that observations of two individuals are linked such that one person's scores provide information about the other person's scores. Each couple co-creates a unique identity (i.e., "We" dimension; "third world") with its own complex emotional equilibrium (Iacone, 2019). For example, husbands' and wives' marital satisfaction scores tend to be positively correlated (Cook & Kenny, 2005). This model has been widely adopted in the study of close relationships and allows to simultaneously consider the reciprocal influence of each partner on their own (actor effect) and on their partner's outcome measure (partner effect). Therefore, the adoption of APIM was considered particularly appropriate given the shared nature of the infertility experience.

Previous research adopting APIM emphasised, beyond the specific type of diagnosis, the effects of the variables addressed within the abovementioned infertility-related theoretical framework (Zurlo et al., 2020a). Specifically, the role of infertility-related stressors emerged as key risk factors (both actor and partner effects) in influencing sexual satisfaction (Nakić Radoš et al., 2020) and quality of life (Casu et al., 2018; Kim et al., 2018), but it also emerged as having, even if with actor effects only, a protective role in promoting post-traumatic growth (Zhang et al., 2021). Considering coping strategies, mixed evidence was provided. On one side, research underlined that active and passive dyadic coping strategies (e.g., common, emotion-focused,

problem-focused, and delegated dyadic coping) might play a protective role in marital adjustment (both actor and partner effects) (Molgora et al., 2019). On the other side, the adoption of active coping strategies such as active-confronting and active-avoidance emerged as risk factors (both actor and partner effects), reciprocally exacerbating personal, marital, and social distress (Peterson et al., 2008), as well as anxiety and depression (Volmer et al., 2017).

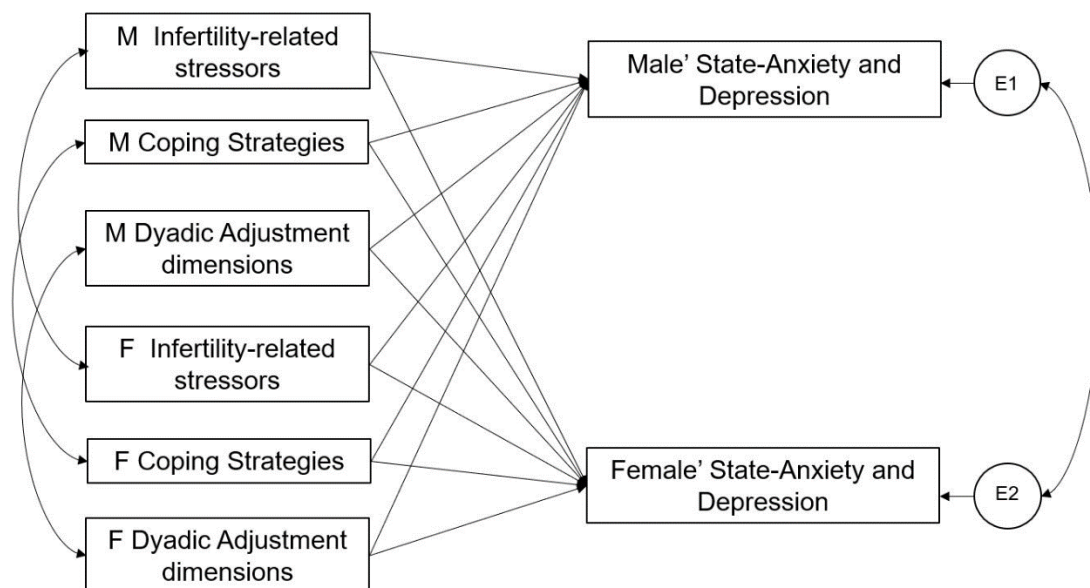
Finally, research also highlighted the protective role of dyadic adjustment dimensions, which foster quality of life (Kim et al., 2018) and reduce depressive symptoms (actor effects only) (Maroufizadeh et al., 2018).

Nonetheless, all these studies failed to provide a comprehensive view of multiple risks and protective factors (both actor and partner effects) that may simultaneously influence psychological health conditions in men and women facing infertility. In addition, these studies did not specifically target members of couples diagnosed with male infertility. Further research is, therefore, required to address the specificity of individual and dyadic dynamics featuring male infertility and, accordingly, to develop tailored evidence-based interventions.

### **1.1 The Current Study**

Based on the more updated and comprehensive multidimensional framework in the field of infertility research (Zurlo et al., 2020a), and in line with the growing body of studies adopting a dyadic approach (APIM; Kenny et al., 2006), the present study aimed at developing further research targeting both male and female partners of couples diagnosed with male infertility. In particular, the goal was to investigate the actor's and partner's effects of perceived infertility-related stressors (Social Concern, Need for Parenthood, Rejection of Childfree Lifestyle, Couple's Relationship Concern), coping strategies (Social Support, Avoiding, Positive Attitude, Problem Solving, Turning to Religion) and perceived couple's dyadic adjustment dimensions (Dyadic Consensus, Satisfaction, Cohesion, Affectional Expression) in predicting State-Anxiety and Depression. In addition, considering that research in the field also highlighted that the length of a couple's relationship (Sahin et al., 2017) and the duration of infertility (Abdishahshahani et al., 2020; Ramezanzadeh et al., 2004; Zurlo et al., 2018) might significantly influence infertile patients' experience, the study also aimed at controlling for their potential effects on the hypothesised associations.

Figure 1 summarises the conceptual framework and the APIM models we tested.



**Figure 1.**

Conceptual Framework: Actor and Partner Effects of Infertility-related stressors, Coping Strategies, and Dyadic Adjustment dimensions on State-Anxiety and Depression in both Partners of Infertile Couples.

*Notes.* The double-headed arrow between the independent variables represents its covariance. The double-headed arrow between the outcomes is the residual nonindependence in these outcome scores, which is represented by the covariance between their corresponding two error terms.

## Methods

### *Participants and Procedure*

Participants were recruited from nine Italian centres of assisted reproduction in Brescia, Naples, and Udine between May 2018 and October 2019. The Ethical Committee of Psychological Research of the University where the study took place approved the study (IRB:34/2019). The research was performed in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Chairpersons were asked to give the authorization for administering a questionnaire in their centres. All infertile patients were fully informed about the aims of the study, and they were also assured that data would be only used for research purposes and refusal to participate would not affect their treatments in any way. Every precaution was taken to protect the patients' privacy, and the questionnaires were anonymously completed. Informed consent was obtained from each of them prior to participating in the study. To be eligible for the study, participants had to meet the following criteria: (a) couples that had been diagnosed with male infertility; (b) willingness by both partners of the couple to

participate in the study. Overall, 100 couples were proposed to individually complete a questionnaire lasting 20-25 min (one session) in a quiet room setting in the medical centre. If one or both partners refused to complete the questionnaire they were not included in the final dataset. In total, both members of 80 infertile couples (80 male, 80 female) completed the questionnaire (response rate: 80%). There were no missing data. According to Kenny et al. (2006) a sample size of 80 dyads would have approximately 80% power in the standard APIM model. Therefore, our sample size (i.e.  $N = 160$ ; 80 Men and 80 Women) was considered large enough to provide satisfactory power and to decrease estimation error. All the couples included had a diagnosis of primary infertility i.e., at the moment of the data collection, they had never had a child, due to the inability to become pregnant or to carry a pregnancy to live birth.

## **2. Measures**

### **2.1 Background Information**

An information section containing questions on Sex, Age (in years), Educational Level (Less than College/College and higher), Length of Relationship (in years), and Duration of Infertility (in years) was administered.

### **2.2 Fertility Problem Inventory-Short Form**

The Fertility Problem Inventory-Short Form (FPI-SF; Zurlo et al., 2017) consists of 27 items on a 6-point Likert scale ranging from one (Strongly disagree) to six (Strongly agree) divided into four subscales: Social Concern (10 items; Cronbach's  $\alpha = .88$ ) assessing perceived stress related to comments and reminders of infertility, and to feelings of social isolation (e.g. "Family get-togethers are especially difficult for me"); Need for Parenthood (6 items; Cronbach's  $\alpha = .88$ ) assessing perceived stress related to viewing parenting as an essential life goal (e.g. "For me, being a parent is a more important goal than having a satisfying career"); Rejection of Childfree Lifestyle (6 items; Cronbach's  $\alpha = .77$ ) assessing perceived stress related to a negative view of living child-free/future happiness dependent on having a child (e.g. "Having a child/another child is not necessary for my happiness"); Couple's Relationship Concern (5 items; Cronbach's  $\alpha = .70$ ) assessing perceived stress related to decreased sexual enjoyment and to concerns about impact of infertility on quality of relationship (e.g. "My partner doesn't understand the way the fertility problem affects me"). The sum of all four domain scores provides a Global Stress score of perceived infertility-related stress ranging from 27 to 162 (Cronbach's  $\alpha = .85$ ).

### 2.3 Coping Orientation to Problem Experienced

The Coping Orientation to Problem Experienced-New Italian Version (COPE-NIV; Sica et al., 2008) consists of 60 items on a 5-point Likert scale ranging from one (I usually don't do this at all) to four (I usually do this a lot) divided into five subscales: Social Support (12 items; Cronbach's  $\alpha = .88$ ) evaluating coping strategies centred on seeking advice, assistance or information (e.g. "I talk to someone to find out more about the situation"); Avoiding (16 items; Cronbach's  $\alpha = .70$ ) evaluating coping strategies centred on denial, disengagement, and distracting from thinking about the problem (e.g. "I turn to work or other substitute activities to take my mind off things"); Positive Attitude (12 items; Cronbach's  $\alpha = .76$ ) evaluating coping strategies centred on acceptance and positive reinterpretation of the problem (e.g. "I try to see it in a different light, to make it seem more positive"); Problem Solving (12 items; Cronbach's  $\alpha = .83$ ) evaluating coping strategies centred on planning and actively facing the problem (e.g. "I focus on dealing with this problem, and if necessary let other things slide a little"); Turning to Religion (8 items; Cronbach's  $\alpha = .85$ ), evaluating coping strategies centred on seeking comfort and/or guidance from a divine being (e.g. "I put my trust in God").

### 2.4 Dyadic Adjustment Scale

The Dyadic Adjustment Scale (DAS; Gentili et al., 2002; Spanier, 1976) consists of 32 items divided into four subscales: Dyadic Consensus (13 items; Cronbach's  $\alpha = .90$ ), which measures the degree to which the couple agrees on matters of importance to the relationship (e.g. "Handling family finances"); Affectional Expression (4 items; Cronbach's  $\alpha = .73$ ) that measures the degree to which the couple agrees on the expressions of emotional affection and sex in the relationship (e.g. "Do you kiss your mate?"); Dyadic Cohesion (5 items; Cronbach's  $\alpha = .86$ ), that measures the degree of closeness and shared activities experienced by the couple (e.g. "Work together on a project"); Dyadic Satisfaction (10 items; Cronbach's  $\alpha = .94$ ), that measures the degree to which the couple is satisfied with the present state of own relationship and the commitment to its continuance (e.g. "How often did you discuss or have you considered divorce, separation or terminating your relationship?"). The sum of all four domain scores provides a total score of perceived Dyadic Adjustment ranging from 0 to 160 (Cronbach's  $\alpha = .93$ ).

### 2.5 State-Trait Anxiety Inventory

The State scale from the Italian version of the State-Trait Anxiety Inventory (STAI-Y; Pedrabissi & Santinello, 1989; Spielberger, 1972) consists of 20 items (e.g. "I am worried") on a 4-point Likert scale ranging from one (Not at all) to four (Very much). Total score ranges from 20 to



80 (Cronbach's  $\alpha = .91$ ). State-Anxiety scores were also converted into percentages and, according to the Italian validation study (Pedrabissi & Santinello, 1989), a score of 50.93 for female partners and 45.70 for male partners were considered to be the cut-off point to define the clinical cases.

## **2.6 Edinburgh Depression Scale**

The Edinburgh Depression Scale (EDS; Benvenuti et al., 1999; Murray & Cox, 1990) consists of 10 items (e.g. "I have blamed myself unnecessarily when things went wrong") on a 4-point Likert scale ranging from zero (Not at all) to three (Most of the time). Total score ranges from 0 to 30 (Cronbach's  $\alpha = .78$ ). Depression scores were also converted into percentages and, according to the Italian validation study (Benvenuti et al., 1999), a score of 9.00 was considered to be the cut-off point to define the clinical cases.

## **2.7 Statistical Analyses**

Data analyses were conducted using IBM SPSS Statistics, Version 21 and the Lavaan program. Firstly, descriptive statistics were conducted for socio-demographics. Secondly, preliminary to the APIM analyses, the database was restructured to consider each partner's score as a different variable, and Pearson's correlations were conducted within and between men's and women's independent variables and outcomes to account for the non-independence of partners' scores (Kenny et al., 2006). T-tests were also carried out to compare mean scores of study variables according to Sex. In order to check the normality of the data collected, descriptive statistics were produced. Skewness and Kurtosis were used to judge the normality of data, considering values between -2 to +2 as falling in the acceptable range (George & Mallery, 2019). In addition, State-Anxiety and Depression scores were converted into percentages referring to the cut-off points of the Italian validation studies reported in the Measures section to define clinical cases. Afterwards, APIM was used to test the actor effects (the degree to which a person's outcome is influenced by his/her own characteristics) and partner effects (the degree to which a person's outcome is influenced by his/her partner's characteristics) (Kenny et al., 2006). Structural equation modeling with maximum likelihood estimation was used (Lavaan program; Rosseel, 2012; Stas et al., 2018). In the present study, overall, 26 models were run, respectively 13 for State-Anxiety and 13 for Depression, which separately included each infertility-related stressor, coping strategy, and dyadic adjustment dimension as independent variable. Couples' length of relationship and duration of infertility were used as covariates, thus controlling statistically for their potential impact on model parameters.

In addition, according to the main premises of conducting APIM analyses, overall tests of distinguishability were preliminarily carried out to verify that the data were empirically and conceptually distinguishable based on the variable Sex. If the test of distinguishability is significant, treating the dyad as distinguishable improves the fit of the model. We, therefore, submitted the hypothesised models to the Laavan program (Stas et al., 2018) to compare distinguishable and indistinguishable versions of APIM models.

### 3. Results

Characteristics of study participants are displayed in Table 1.

**Table 1.** Characteristics of study participants

Characteristics	Value
Age in years [ <i>Mean</i> ± <i>SD</i> /(range)]	
Male	35.84±4.18 (24-48)
Female	34.04±3.96 (22-42)
Male Educational Level [ <i>n</i> (%)]	
Less than college	18 (22.5%)
College and higher	62 (75.5%)
Female Educational Level [ <i>n</i> (%)]	
Less than college	16 (20%)
College and higher	74 (80%)
Length of couple's relationship in years [ <i>Mean</i> ± <i>SD</i> /(range)]	3.82 (1-20)
Duration of infertility in years [ <i>Mean</i> ± <i>SD</i> /(range)]	3.78 (1-18)

Table 2 displays means, standard deviations and Pearson's correlations between study variables according to Sex. Findings revealed that the significant correlations between male and female partners indicated similarities and patterns of relationships within couples and, thus, the appropriateness of the APIM.

Moreover, skewness and kurtosis values for all the variables fall within the range of -2 to +2, indicating that the data are fairly normally distributed. Afterwards, *t*-test analyses were carried out to compare mean scores of study variables according to Sex. Firstly, data revealed that women perceived significantly higher levels of stress related to Couple's Relationship Concern than men (Women *M* = 13.94; *SD* = 5.26; Men *M* = 11.52; *SD* = 4.62; *t* = 2.96; *p* = .004), while no differences in perceived levels of all the other infertility-related stressors were found between women and men (i.e., Social Concern: Women *M* = 28.04; *SD* = 10.88; Men *M* = 25.27; *SD* = 11.04; *t* = 1.52; *p* = .129; Need for Parenthood: Women *M* = 26.93; *SD* = 7.14; Men *M* = 27.04; *SD* = 5.74; *t* = -.10; *p* = .919; Rejection of Childfree Lifestyle: Women *M* = 27.29; *SD* = 6.33; Men *M* = 27.30; *SD* = 6.02; *t* = -.01; *p* = .989). Secondly, with respect to coping strategies, data

showed a significantly higher recourse by women to strategies centred on Social Support (Women  $M = 28.01$ ;  $SD = 6.93$ ; Men  $M = 25.38$ ;  $SD = 7.33$ ;  $t = 2.23$ ;  $p = .027$ ) and Turning to Religion (Women  $M = 24.96$ ;  $SD = 4.14$ ; Men  $M = 23.26$ ;  $SD = 4.19$ ;  $t = 2.46$ ;  $p = .015$ ), while a similar recourse by men and women to coping strategies centred on Avoiding (Women  $M = 26.59$ ;  $SD = 7.18$ ; Men  $M = 25.70$ ;  $SD = 8.79$ ;  $t = .67$ ;  $p = .504$ ), Positive Attitude (Women  $M = 28.74$ ;  $SD = 6.51$ ; Men  $M = 28.20$ ;  $SD = 6.97$ ;  $t = .48$ ;  $p = .633$ ), and Problem Solving was found (Women  $M = 29.33$ ;  $SD = 6.39$ ; Men  $M = 29.85$ ;  $SD = 6.11$ ;  $t = -.50$ ;  $p = .616$ ). Differently, no significant differences emerged in perceived levels of Dyadic Adjustment dimensions reported by women and men (i.e., Dyadic Consensus: Women  $M = 65.14$ ;  $SD = 11.13$ ; Men  $M = 66.22$ ;  $SD = 9.93$ ;  $t = -.62$ ;  $p = .536$ ; Dyadic Satisfaction: Women  $M = 30.55$ ;  $SD = 4.75$ ; Men  $M = 30.29$ ;  $SD = 5.07$ ;  $t = .32$ ;  $p = .749$ ; Dyadic Cohesion: Women  $M = 16.20$ ;  $SD = 3.72$ ; Men  $M = 16.03$ ;  $SD = 2.85$ ;  $t = .32$ ;  $p = .746$ ; Affectional Expression: Women  $M = 10.04$ ;  $SD = 2.15$ ; Men  $M = 9.70$ ;  $SD = 2.00$ ;  $t = .99$ ;  $p = .320$ ). Finally, with respect to psychological health conditions, women reported significant higher levels of State-Anxiety than men (Women  $M = 45.55$ ;  $SD = 10.47$ ; Men  $M = 42.03$ ;  $SD = 8.95$ ;  $t = 2.18$ ;  $p = .031$ ), while no differences were found in perceived levels of Depression (Women  $M = 11.44$ ;  $SD = 5.27$ ; Men  $M = 10.10$ ;  $SD = 4.80$ ;  $t = 1.61$ ;  $p = .110$ ).

Moreover, according to the clinical cut-off scores for State-Anxiety (i.e., scores 50.93 for women and 45.70 for men; STA-Y; Pedrabissi & Santinello, 1989) and for Depression (score 9; EDS; Benvenuti et al., 1999), respectively, 26.25 % of female partners ( $n = 21$ ) and 30% of male partners ( $n = 24$ ) scored at a clinical threshold for State-Anxiety, whereas 65% of female ( $n = 52$ ) and 55% of male ( $n = 44$ ) scored at a clinical threshold for Depression.

**Table 2.** Bivariate correlations between study variables in male and female partners of infertile couples (N = 80 couples)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	<i>M</i>	<i>SD</i>
1 Social Concern	<b>.588**</b>	.113	.094	.467**	-.120	.245*	-.369**	.126	-.023	-.523**	-.437**	-.378**	-.363**	.412**	.200	25.27	11.04
2 Need for Parenthood	.480**	<b>.130</b>	.436**	.069	.033	-.322**	.128	.298*	.470**	.385**	.169	.225	.075	-.079	.055	27.04	5.74
3 Rejection of Childfree Lifestyle	.298*	.386**	<b>.297*</b>	.135	.111	-.137	.065	.149	.290*	.056	.049	-.013	.062	-.025	.216	27.30	6.02
4 Couple's Relationship Concern	.382**	.414**	.137	<b>.202</b>	.160	.333**	.017	.100	.047	-.489**	-.582**	-.329**	-.329**	.206	.286*	11.52	4.62
5 Social Support coping strategy	.006	.031	.193	.107	<b>.184</b>	.624**	.696**	.237*	.181	-.005	-.163	.274*	.210	.264*	.542**	25.38	7.33
6 Avoiding coping strategy	.049	-.217	-.072	.228	.331**	<b>.222</b>	.300**	.086	-.111	-.473**	-.446**	-.112	.073	.578**	.506**	25.70	8.79
7 Positive Attitude coping strategy	-.493**	.010	-.006	-.123	.449**	.312**	<b>.358**</b>	.227	.142	.292*	.215	.354**	.358**	-.139	.199	28.20	6.97
8 Problem Solving coping strategy	-.053	.126	.037	.127	.319**	.272*	.295*	<b>.246*</b>	.098	.134	-.029	.197	.046	.166	.396**	29.85	6.11
9 Turning to Religion coping strategy	-.009	.432**	.260*	.280*	.473**	.023	.258*	.085	<b>.191</b>	.188	.043	.137	.018	.119	.382**	23.26	4.19
10 Dyadic Consensus	-.246*	.084	.078	.068	.306**	-.243*	.241*	.062	.133	<b>.525**</b>	.750**	.758**	.466**	-.464**	-.282*	66.22	9.93
11 Dyadic Satisfaction	-.311**	-.019	.017	-.235*	.061	-.271*	.198	-.198	.162	.540**	<b>.451**</b>	.480**	.483**	-.399**	-.374**	30.29	5.07
12 Dyadic Cohesion	-.243*	-.135	.080	-.021	.201	-.078	.154	-.095	-.022	.704**	.390**	<b>.314**</b>	.458**	-.199	-.086	16.03	2.85
13 Affectional Expression	-.314**	-.185	-.087	.119	.144	.289*	.278*	.045	-.026	.513**	.312**	.519**	<b>.457**</b>	-.205	-.196	9.70	2.00
14 State-Anxiety	.485**	.273*	.130	.232*	.160	.282*	-.164	.043	.266*	-.139	.071	-.169	-.041	<b>.257*</b>	.622**	42.03	8.95
15 Depression	.209	.312**	.130	.472**	.152	.465**	.094	.200	.337**	-.073	-.127	-.203	.072	.512**	<b>.019</b>	10.10	4.80
<i>M</i>	28.04	26.93	27.29	13.94	28.01	26.59	28.74	29.33	24.96	65.14	30.55	16.20	10.04	45.55	11.44		
<i>SD</i>	10.88	7.14	6.33	5.26	6.93	7.18	6.51	6.39	4.14	11.13	4.75	3.72	2.15	10.47	5.27		

*M*, Mean values; *SD*, Standard Deviations.

Men' scores are reported above the diagonal, women' scores are reported below. Correlations between male and female partners' scores are reported on the diagonal.

\* $p < .05$ ; \*\* $p < .01$

Preliminary to APIM analyses, overall tests of distinguishability were carried out, yielding chi square values ranging from 108.726 to 126.816 (11 *df*). Because the tests of distinguishability were all significant ( $p < .001$ ), members can be statistically distinguished based on their Sex.

Afterwards, APIM analyses were carried out. Predictors of State-Anxiety and Depression among male and female partners (Actor and Partner effects), controlling for length of the couple's relationship and duration of infertility, are summarised in Table 3.

For male partners, concerning actor effects, and considering infertility-related stressors, perceived stress related to Social Concern and Couple's Relationship Concern was significantly associated with higher perceived levels of adverse emotional outcomes. Moreover, considering coping strategies, the recourse to Social Support, Avoiding, Problem Solving, and Turning to Religion was significantly associated with higher perceived levels of State-Anxiety and Depression. Finally, considering couples' dyadic adjustment dimensions, perceived Dyadic Consensus, Dyadic Satisfaction, and Affectional Expression were significantly associated with lower levels of adverse emotional outcomes.

Still considering male partners, concerning partner effects, women's perceived stress related to Rejection of Childfree Lifestyle was associated with perceived higher levels of Depression. Conversely, women's adoption of Social Support coping strategy was associated with significantly lower perceived levels of State-Anxiety. No significant partner effects for Dyadic Adjustment dimensions were found.

For female partners, concerning actor effects, considering infertility-related stressors, perceived Social Concern, Need for Parenthood and Couple's Relationship Concern were associated with higher perceived levels of State-Anxiety and Depression. Moreover, considering coping strategies, the recourse to Avoiding and Turning to Religion was significantly associated with higher perceived levels of adverse emotional outcomes. Finally, considering couples' dyadic adjustment dimensions, perceived Dyadic Cohesion was associated with significantly lower levels of adverse emotional outcomes.

Still considering female partners, concerning partner effects, men's perceived stress related to Social Concern and Couple's Relationship Concern was associated with lower perceived levels of Depression. Conversely, men's perceived Rejection of Childfree Lifestyle was associated with higher perceived levels of State-Anxiety. Furthermore, men's adoption of Positive Attitude was

associated with lower perceived levels of State-Anxiety. No significant partner effects for Dyadic Adjustment dimensions were found.

**Table 3.** Predictors of State-Anxiety and Depression among male and female partners of infertile couples diagnosed with Male Factor (*N* = 80 couples): Actor and Partner effects

	MALE PARTNERS					
	State-Anxiety			Depression		
	Estimate	95% confidence interval		Estimate	95% confidence interval	
	Lower	Upper		Lower	Upper	
<b>Actor Effects</b>						
M Social Concern	.31**	.10	.51	.12*	.00	.23
M Couple's Relationship Concern	.38	-.06	.81	.31**	.09	.54
M Social Support coping strategy	.33*	.06	.59	.33***	.20	.46
M Avoiding coping strategy	.57***	.37	.78	.27***	.13	.39
M Problem Solving coping strategy	.29	-.04	.62	.33***	.17	.49
M Turning to Religion coping strategy	.17	-.31	.64	.38**	.14	.62
M Dyadic Consensus	-.38***	-.60	-.16	-.15*	-.27	-.02
M Dyadic Satisfaction	-.58**	-1.01	-.16	-.40***	-.62	-.17
M Affectional Expression	-.94	-2.01	.14	-.55*	-1.14	-.04
<b>Partner Effects</b>						
F Rejection of Childfree Lifestyle	.16	-.17	.48	.17*	.01	.34
F Social Support coping strategy	-.30*	-.58	-.02	.01	-.13	.15
FEMALE PARTNERS						
	State-Anxiety			Depression		
	Estimate	95% confidence interval		Estimate	95% confidence interval	
		Lower	Upper		Lower	Upper
<b>Actor Effects</b>						
F Social Concern	.41***	.17	.65	.22***	.10	.34
F Need for Parenthood	.37*	.05	.69	.21**	.06	.36
F Couple's Relationship Concern	.43	-.02	.88	.47***	.28	.67
F Avoiding coping strategy	.36*	.02	.69	.32***	.17	.47
F Turning to Religion coping strategy	.62*	.04	1.20	.32*	.05	.58
F Dyadic Cohesion	-.68*	-1.34	-.02	-.31*	-.62	-.00
<b>Partner Effects</b>						
M Social Concern	.09	-.15	.32	-.16**	-.27	-.04
M Rejection of Childfree Lifestyle	.41*	.01	.81	.01	-.18	.21
M Couple's Relationship Concern	.14	-.38	.65	-.20*	-.42	-.02
M Positive Attitude coping strategy	-.37*	-.72	-.01	-.04	-.22	.13

Controlled by Length of Relationship and Duration of Infertility. Only significant associations were displayed.

\**p* < .05; \*\**p* < .01; \*\*\* *p* < .001

#### 4. Discussion

The present study targeted couples with male diagnoses and aimed to apply the APIM to explore the actor and partner's effects of infertility-related stressors, coping strategies, and couple's dyadic adjustment dimensions on men's and women's perceived levels of state-anxiety and depression.

Firstly, our data showed that 26.25% of female partners and 30% of male partners receiving male infertility diagnosis reported clinical levels of State-Anxiety, while, surprisingly, 65% of

female partners and 55% of male partners reported clinical levels of Depression. These data showed extremely higher levels of anxiety and depression than the general population (i.e., 5.1% suffering from clinical anxiety and 3% from Depression in Italy; de Girolamo et al. 2006).

Nonetheless, these remarkable findings support the compelling need to comprehensively identify those risks and protective factors influencing infertile patients' psychological health at individual and dyadic levels. This, indeed, may help to develop timely interventions.

#### **4.1 Predictors of Male's Psychological Health: Actor and Partner Effects**

As outlined by the actor effects, men's perceived stress related to social concerns (i.e., sensitivity to comments and reminders of infertility and feelings of social isolation) was associated with higher levels of State-Anxiety and Depression. This emphasises the potential burden related to the difficulties of handling their medical condition, in line with previous research underlining that fertility is often perceived and socially confounded with sexuality and virility (Hanna & Gough, 2015; Jaoul, et al., 2014). Furthermore, perceived couple's relationship concerns (i.e., concerns about the impact of infertility on the quality of the relationship and decreased sexual enjoyment) were associated with men's State-Anxiety, underlining how infertility experience may be perceived as undermining the couple's balance. This could also be interpreted in light of research suggesting that men's negative response to infertility may significantly impair their intimate experiences (Bechoua et al., 2016; Simionescu et al., 2021).

In addition, considering partner effects, female partner's perceived stress related to rejection of childfree lifestyle (i.e., a negative view of living child-free/future happiness depends on having a child) emerged as significantly associated with men's Depression. We hypothesised this could be linked to the idea that men may feel to be worthless due to the perceived lack of control over the possibility of fulfilling their partner's desire, whose happiness is strongly dependent on having a child. Moreover, these findings seem consistent with previous literature highlighting that men can feel shame and guilt about the medical treatments their partner must undergo (Reder et al., 2009). This complex dyadic dynamic, already emphasised by extremely high levels of depression in both male and female partners, should be carefully considered within counselling interventions.

Considering coping strategies, noteworthy, both passive and active coping strategies adopted by men were significantly associated with higher levels of State-Anxiety and Depression (actor effects). This suggests that trying to avoid or escape (e.g., recourse to avoiding coping strategies), engaging in faith (e.g., recourse to turning to religion coping strategies), and attempting to gain /re-establishing control/ rationalizing their condition (e.g., recourse to problem solving coping)

may be not adequate to deal with infertility diagnosis. It may potentially result in a vicious circle – already underlined by previous studies- that may produce a further burden (Benyamini et al., 2008; Zurlo et al., 2020b). However, while men’s coping strategies centred on seeking social support were associated with higher levels of psychological suffering (actor effect), the adoption of this strategy by female partners exerted, instead, a significant protective role for male partners. These latter data are in line not only with previous research emphasising the significant protective role of social support when dealing with stress (Flannery & Wieman, 1989; Hannigan et al., 2004), but also with research emphasising a higher tendency to recur to social support among infertile women (Berghuis & Stanton, 2002) than infertile men (Culley et al., 2013). Therefore, we hypothesised that these data might suggest a complex dynamic within the couple, in which women would safeguard their partners by attempting to fulfil the shared needs of social support. Nonetheless, this dyadic dynamic - despite being protective among men - could result in further burdens for women and need to be carefully considered in counselling interventions. From this perspective, research emphasised that infertile women showed a higher tendency to recur to social support (Berghuis & Stanton, 2002), while their male partners may feel ashamed, overwhelmed, and powerless (Culley et al., 2013). Accordingly, these data, which confirmed a complex dynamic within the couple (Iacone, 2019), showed how women would safeguard their partners by attempting to fulfil the shared needs of social support.

Finally, considering the couple’s dyadic adjustment, the protective role of dyadic satisfaction and consensus on the matter of importance revealed that even if infertility diagnosis may compromise a good couple’s balance (Samadaee-Gelehkolaee et al., 2016; Tao et al., 2012), maintaining couple’s satisfaction and high agreement may represent important resources for men dealing with their diagnosis.

#### **4.2 Predictors of Female’s Psychological Health: Actor and Partner Effects**

As outlined by both the actor and partner effects, all infertility-related stressors were directly or indirectly, *via* their partners, associated with women’s psychological health. This endorses the meaningfulness of exploring predictors of psychological burden also among women partners of infertile men as in previous studies (De et al., 2017; Kowalcek et al., 2001; Samadaee-Gelehkolaee et al., 2016). Indeed, data revealed that women’s perceived stress related to need for parenthood (i.e., parenting as an essential life goal), concerns in social life and in couple’s relationship, were associated with higher levels of adverse emotional outcomes. This emphasises, also among women, relevant individual and relational difficulties in dealing with infertility experience. Moreover, at the couple’s level, we can hypothesise women may



experience several difficulties in sharing and disclosing feelings with their partner, particularly about the impact of infertility on sexual life (Pozza et al., 2019).

From this perspective, interestingly, men's perceived levels of the same stressors (i.e., concerns about the impact of infertility on social life and the couples' relationship) that represent clear risk factors were, instead, associated with lower levels of Depression among women, revealing an unexpected protective partner effect in contrast with research on the detrimental role of infertility-related stressors (Abbey et al., 1992, Newton et al., 1999; Zurlo et al., 2020a). Our data, indeed, suggest that perceiving the partner is sharing the same concerns – mainly those regarding the safeguard of the couple relationship – may reduce women's feelings of loneliness, and elicit common attempts to find strategies to face discomfort.

Conversely, male partner's rejection of childfree lifestyle was associated with women's State-Anxiety that is probably due to the feelings of apprehension and a sense of powerlessness about the partner's negative view of childfree lifestyle.

Considering coping strategies, in line with previous studies, women's strategies centred on avoidance and on turning to religion were associated with increased levels of adverse emotional outcomes (Andrei et al., 2021; Berghuis & Stanton, 2002; Oti-Boadi & Asante, 2017), while men's strategies centred on positive attitude were associated with lower levels of State-Anxiety among women. This suggests carefully considering the pivotal role infertile men may play in fostering the partner's wellbeing through their capability to preserve an active and optimistic attitude.

Finally, in line with previous studies, the significant protective role of perceived dyadic cohesion for female partners further emphasised that the agreement between the couple on matters of importance to their relationship may represent an anchor point for infertile women (Durat et al., 2018; Zurlo et al., 2019).

## **5. Clinical Implications**

Overall, findings from the present study foster the development of tailored evidence-based interventions by addressing the specificity of individual and dyadic dynamics linked to male infertility through the application of the infertility-related stress model (Zurlo et al., 2020a) and of a dyadic approach (APIM; Kenny et al., 2006).

Our results bear clinical implications for mental health professionals working with individuals and couples undergoing infertility treatments (Patel et al., 2018). One of the principal aspects of clinical intervention is the relevance of taking a dyadic perspective on the infertility-related

process, thus viewing infertility as a shared experience, and treating the couple as a unit. In line with this, according to the Family Systems Theory (Bertalanffy et al., 1968; Van den Broeck et al., 2010), clinicians and practitioners working with infertile individuals and couples should carefully take into account these dyadic effects. Indeed, our findings provided evidence-based contribution to this theory, showing that partners may reciprocally influence each other, so that not only their own perception of infertility experience (actor effects), but also the feelings reported by the partner (partner effects) may have a deep impact, providing further suffering, but also additional resources.

In line with this, it's noteworthy that men's social and couple's relationship concerns may even alleviate women's infertility burden, probably by providing a sense of shared challenges and tools to deal with their medical condition. In the same direction, considering coping strategies, interventions should take into account not only the inefficacy and counter-productiveness of some active (i.e., problem solving) and passive (i.e., avoiding, turning to religion) coping strategies (actor effects), but also the dyadic dynamics. Indeed, within the couples, the partners may provide efficient resources to each other; regarding this, seeking social support (by women) and positive attitude (by men) may help disclose and reappraising their condition, promoting individual and couples' psychological health. Therefore, enhancing the awareness of the reciprocal impact on partner's psychological health can be essential to develop interventions aiming at promoting the couple as a key resource. This can be particularly useful when infertility diagnosis directly affects only one of the partners – as the male diagnosis is – which may elicit a sense of guilt and failure, and feelings of loneliness for their own medical condition, requiring tailored interventions also focused on effectively facing these feelings through acceptance strategies and value-directed actions (e.g., Acceptance and Commitment Therapy; Peterson & Eifert 2011).

In line with this, overall, evidence-based interventions are particularly required considering that infertility diagnosis may impact not only on individual, but also on couple's relationship, families of origin and individual's greater context (Van den Broeck et al., 2010). In particular, tailored therapeutic approaches, such as the Self-Regulation Couple Therapy (Heshmati et al., 2016) and Systemic Therapy (Iacone, 2019), have proven their validity in supporting couples in reflecting on their functional and dysfunctional dynamics, in sustaining cooperation and collaboration, as well as in fostering the re-configuration of the relationship.

## 6. Limitations and Future Research

Despite these clear findings, some limitations need to be mentioned. Firstly, this is a cross-sectional study, so the direction of the association we tested is theory-driven. Secondly, the measurement tools used were self-report, increasing the risk of social desirability bias. Thirdly, we controlled for the length of the relationship and the duration of infertility only. Further studies could be developed to also explore the potential impact of some medical variables linked to infertility (e.g., number of treatments, type of ART). Finally, future research targeting couples could also address the potential actor and partner effects of other key variables, such as the attachment styles (Craparo et al., 2018; Midolo et al., 2020), but also the potential presence of intimate partner violence within the relationship (Ghinassi et al., 2021).

However, although limited, the study provided, as far as we know, meaningful and original evidence that may enrich the scarce literature targeting male infertility both at individual and dyadic levels, offering information that may be used for promoting psychological health in men and women facing male infertility.

**Ethical Approval:** The study was approved by the Ethics Committee of Psychological Research of University of Naples Federico II (IRB:34/2019).

**Author Contributions:** MFCDV: acquisition of data, analysis and interpretation of data, drafting of manuscript. FV: analysis and interpretation of data, drafting of manuscript. MCZ: study design, drafting of manuscript, critical revision. All authors read and approved the final manuscript.

### Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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