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## Male Psychological Adaptation to Unsuccessful Medically Assisted Reproduction Treatments: A Systematic Review

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# Male Psychological Adaptation to Unsuccessful Medically Assisted Reproduction Treatments: A Systematic Review

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Male psychological adaptation to unsuccessful medically assisted reproduction  
treatments: a systematic review

Running title: Men's adaptation to unsuccessful MAR treatments

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## ABSTRACT

**BACKGROUND:** Similarly to women, men suffer from engaging in fertility treatments, both physically and psychologically. Although there is a vast body of evidence on the emotional adjustment of women to infertility, there are no systematic reviews focusing on men's psychological adaptation to infertility and related treatments. The main research questions addressed in this review were "Does male psychological adaptation to unsuccessful MAR treatments vary over time?" and "Which psychosocial variables act as protective or risk factors for psychological maladaptation?"

**METHODS:** A literature search was conducted from inception to September 2015 on five databases using combinations of MeSH terms and keywords. Eligible studies had to present quantitative prospective designs and samples including men who did not achieve pregnancy or parenthood at follow-up. A narrative synthesis approach was used to conduct the review.

**RESULTS:** Ten studies from 3 continents were eligible from 2,534 records identified in the search. The results revealed that psychological symptoms of maladjustment significantly increased in men one year after the first fertility evaluation. No significant differences were found two or more years after the initial consult. Evidence was found for active-avoidance coping, catastrophizing, difficulties in partner communication and the use of avoidance or religious coping from the wife as risk factors for psychological maladjustment. Protective factors were related to the use of coping strategies that involve seeking information and attribution of a positive meaning to infertility, having the support of others and of one's spouse, and engaging in open communication about the infertility problem.

**CONCLUSIONS:** Psychological adjustment in men seems to decrease in the year after the initial evaluation, and long-term adjustment does not seem to be affected. Our findings suggest an active involvement of men during the treatment process by health care professionals, and the inclusion of coping skills training and couple communication enhancement interventions in counselling. Further prospective large studies with high-quality design and power are warranted.

**Key Words:** Infertility; men; systematic review; adaptation, psychological; protective and risk factors; stress; depression; marital relationship; coping behaviour.

## Introduction

A Google search for ‘infertility in women’ retrieves approximately 24 million hits and ‘infertility in men’ approximately 20 million hits, with a difference of 17% in the number of hits presented. This difference increases to 44% when performing a search using the same terms in PubMed ( $\approx$  18,000 against 10,000 hits) and to 72% in a PsycInfo search ( $\approx$  43,000 against 12,000). These numbers reflect the way men have been underrepresented within the infertility literature by clinicians and researchers, especially concerning psychiatric and psychological research.

There are both historical and cultural reasons for this disproportion. While infertility was already established as a subspecialty in the first half of the twentieth century, the term andrology emerged for the first time in 1951 to draw attention to the equal importance of females and males in reproduction (Schirren, 1985). Until the 1980s, medical doctors and mental health professionals believed that idiopathic infertility affected women exclusively, with personalities characterized by unconscious conflict and traits such as neuroticism (see Stanton *et al.*, 2002; Van Balen, 2002; Wischmann, 2003). The introduction of intracytoplasmic sperm injection (ICSI) in the early 90s (Palermo *et al.*, 1992) allowed men with very low sperm counts to achieve parenthood. Despite being the most relevant therapeutic advance in male fertility treatment, this technique was announced as “a promising assisted-fertilisation technique that may benefit women who have not become pregnant by in-vitro fertilisation (IVF)” (Palermo *et al.*, 1992, p. 17).

As this and other sophisticated ART procedures evolved alongside diagnoses, the percentage of causation attributed to the male partner increased, while unexplained infertility decreased. It is now known that male factor contributes to infertility in 30-40% of diagnoses and is the sole cause in 20% of cases (Adamson and Baker, 2003).

1 Although more than half of infertility cases have male causation, 18% to 27% of  
2 couples still do not undergo male evaluation (Eisenberg *et al.*, 2013). Additionally,  
3 growing evidence indicates that men also have biological clocks and that advanced male  
4 age increases the time to pregnancy and decreases the likelihood of conception (Dunson  
5 *et al.*, 2004; Hassan and Killick, 2003; Louis *et al.*, 2013).

6 In a parallel manner, the field of reproductive health psychology has increasingly  
7 moved away from a belief that infertility stress primarily affects women towards a  
8 belief that infertility is a stressor shared by the couple, even when causation is attributed  
9 to only one of its members (Greil and McQuillan, 2010; Johnson and Johnson, 2009;  
10 Peterson *et al.*, 2008). It is also now recognized that the way that men and women  
11 experience medical and psychological circumstances related to infertility can vary based  
12 on biological, cultural, and social factors (Deka and Sarma, 2010; Nakamura *et al.*,  
13 2008). Hence, several articles are currently being published with the specific purpose of  
14 calling for greater recognition and focus on the male experience of infertility (Inhorn  
15 and Patrizio, 2015; Joja *et al.*, 2015; Petok, 2015). Although there has been an increase  
16 in recent studies focusing on men, the predominance of female samples in research  
17 continues under the argument that women suffer more than men with treatment and its  
18 failures, both physically and psychologically (Greil, 1997; Jordan and Revenson, 1999;  
19 Newton *et al.*, 1999). However, there is evidence that a) men are also subjected to  
20 embarrassing and painful procedures inherent to medically assisted reproduction  
21 (MAR), namely, the pressure to ejaculate through masturbation on demand and the pain  
22 that follows the use of testicular sperm extraction techniques (Inhorn, 2013), and b) the  
23 assumption that infertility causes more distress to women is based on outdated gender  
24 stereotyping, as all women report more distress in general psychological adjustment and  
25 health-related adjustment measures (Edelmann and Connolly, 2000). Infertility has even

1 been shown to cause more detrimental psychological effects for men than for women.  
2 For example, Fairweather-Schmidt and colleagues (2014) observed that infertility  
3 independently predicted depressive symptomatology in men but not in women.  
4 Additionally, Huijts and colleagues (2013) analysed more than twenty thousand subjects  
5 aged  $\geq 40$  and found an association between childlessness and poorer psychological  
6 well-being for men but not for women.

7 It is clear that men are emotionally affected by infertility (Culley *et al.* 2013).  
8 Although there is a vast body of evidence on the emotional adjustment of women to  
9 infertility (Gourounti *et al.*, 2010; Rockliff *et al.*, 2014; Verhaak *et al.*, 2007a), there are  
10 no systematic reviews focusing on the male psychological adaptation to infertility.

### 11 **Purpose of this review**

12 This study reviews empirical research on male psychological adaptation to  
13 unsuccessful fertility treatment. Psychological adaptation refers both to the processes  
14 and to the outcomes of attempting to respond efficiently to variations in the individual's  
15 environment, which here concerns the experience of fertility treatment. These  
16 adaptation processes include changes in behaviour in order to adjust to the environment  
17 effectively (e.g. coping) and the ability to relate to others and engage in social  
18 interactions and relationships (American Psychological Association, 2015). This review  
19 attempts to answer two questions: (i) Does male psychological adaptation to  
20 unsuccessful fertility treatment vary over time? and (ii) Which psychosocial variables  
21 can act as protective or risk factors for psychological maladaptation?

### 22 **Method**

#### 23 **Search strategy**

24 A literature search was performed independently by two researchers (J.P. and  
25 M.P.) using the ISI Web of Science, Medline, PsycArticles, Scielo and Scopus



1 electronic databases. There were no restrictions for the time of publication (from  
2 inception to September 2015). The following combinations of MeSH terms were used in  
3 the search strategy: [(‘male, infertility’) OR (‘infertility’ AND ‘male’)] AND  
4 (‘adaptation’ OR ‘stress’ OR ‘depression’ OR ‘anxiety’ OR ‘quality of life’ OR  
5 ‘adjustment’ OR ‘psycho\*’ OR ‘distress’ OR ‘coping’ OR ‘mental health’ OR ‘well-  
6 being’ OR ‘emotional adjustment’ OR ‘social support’). Additional studies were sought  
7 through snowball sampling. To be considered in this review, studies had to be published  
8 in English, Spanish, French or Portuguese.

### 9 **Study selection**

10 Data were analysed in accordance with the PRISMA checklist and the PRISMA  
11 flowchart. The search strategy yielded 2534 potentially relevant abstracts. After being  
12 transferred and stored, the reference database programme Endnote X6 identified 1243  
13 duplicates, leaving 1291 for a more rigorous assessment. Manual inspection of the titles  
14 and abstracts left 208 studies. Studies were further excluded if they did not meet the  
15 following criteria: a) a quantitative longitudinal design and b) a measure of  
16 psychological adaptation as a dependent variable. Disagreements were discussed and  
17 resolved by consensus among three reviewers (M.V.M., M.P., and J.P.). Next, 27 full  
18 texts were examined independently by these three researchers.

19 One study was excluded because baseline and follow-up data were collected  
20 simultaneously using a retrospective design (Wischmann *et al.* 2014). Ten studies were  
21 excluded for not allowing extraction of data pertaining exclusively to men who did not  
22 conceive or had not become parents at follow-up. In five of them, it was not possible to  
23 differentiate men who did not conceive from those who did conceive at follow-up  
24 measurement (Anderson *et al.* 2003; Benazon *et al.* 1992; Sydsjö, Lampic, *et al.* 2014;  
25 Sydsjö, Svanberg, *et al.* 2014; Sydsjö *et al.* 2011), and in one it was not possible to

1 differentiate male from female scores (Najafi *et al.* 2015). In four studies (Martins *et al.*  
2 2014b; Peterson *et al.* 2011; Peterson *et al.* 2009; Sydsjö *et al.* 2005), the outcome  
3 assessed accounted for several moments in time, and thus, conclusions regarding  
4 differences between baseline and follow-up could be biased compared with other  
5 studies. This decision was reinforced by the fact that the change measured in three of  
6 these studies (Martins *et al.* 2014b; Peterson *et al.* 2011; Peterson *et al.* 2009) included  
7 a one-year follow-up in regression analyses that overlapped with a previous study  
8 included in this review (Schmidt *et al.*, 2005a). Additionally, two studies were excluded  
9 because of the small sample size (< 30) of men facing infertility at follow-up  
10 (Fairweather-Schmidt *et al.* 2014; Verhaak *et al.* 2005b). Finally, one additional study  
11 was removed (Martins *et al.*, 2013) because of sample overlapping in regards to the  
12 dependent variable and follow-up measurement with a previous study (Schmidt *et al.*,  
13 2005a).

14 Next, reviewers independently performed a formal assessment of quality by  
15 adapting a standardized framework for non-intervention studies (Dancet *et al.* 2010;  
16 Shepherd *et al.* 2006). To be included, studies had to have an explicit and clear  
17 description of at least four of the following criteria i) a theoretical framework or an  
18 outlined rationale; ii) aims and objectives; iii) setting; iv) sample; v) methodology; and  
19 iv) sufficient original data to mediate between data and interpretation (see Appendix 1).  
20 One study (Dhaliwal *et al.*, 2004) was excluded at this stage.

21 Figure 1 depicts the study selection process. A narrative synthesis approach was  
22 used to conduct the review. This technique synthesizes evidence in a systematic way in  
23 order to develop an encompassing narrative (Mays *et al.* 2005).

## 24 Results

### 25 Study characteristics

1 A total of 12 studies were included in this review. All of these studies were peer-  
2 reviewed articles published in eight different journals between 1991 and 2015. Table 1  
3 presents the participants' characteristics. Data from these 12 studies were collected in  
4 seven countries, with the majority from Europe ( $n = 8$ ), three from America, and one  
5 from Asia. These studies had a large number of participants responding to both the  
6 baseline and follow-up assessments but the number of men included in the group whose  
7 treatments were unsuccessful and had not achieved spontaneous pregnancy or  
8 alternative fatherhood (e.g., adoption) was significantly lower, ranging from 45 to 375.  
9 Participants were predominantly in their early thirties, and they had been trying to  
10 conceive for three or four years. The study of Kraaij *et al.* (2008) was an exception,  
11 given that the sample consisted of men for whom the infertility was definite (had started  
12 trying to conceive 12 years on average before being recruited) and who had an  
13 unfulfilled child wish. Half of the selected studies evaluated participants at baseline  
14 before entering a new cycle of fertility treatment, and follow-ups ranged from four  
15 weeks to five years. With the exception of one study based on a structured interview  
16 (Holley *et al.* 2015), all variables related to psychological adaptation in the selected  
17 articles were based on self-report measures. The most studied psychological adaptation  
18 variables were depression (Bak *et al.* 2012; Berghuis and Stanton 2002; Holley *et al.*  
19 2015; Kraaij *et al.* 2008; Möller and Fällström 1991) and coping strategies using both  
20 general population self-report scales (Berghuis and Stanton, 2002; Kraaij *et al.*, 2008))  
21 and a scale specifically designed to assess specific coping strategies in an infertility  
22 context (Schmidt *et al.*, 2005a, Peronace *et al.*, 2007). Infertility-related stress was a  
23 dependent variable in four studies (Peronace *et al.*, 2007; Pook *et al.*, 2002; Schmidt *et*  
24 *al.*, 2005a; Schneider and Forthofer, 2005), but the study of Peronace *et al.* (2007) was  
25 removed when analysing the changes of infertility stress over time because of a sample

1 overlap with the Schmidt *et al.* (2005b) study. The quality of the marital relationship  
2 was assessed both by general population questionnaires (Möller and Fällström, 1991;  
3 Schanz *et al.*, 2013) and by an infertility-specific questionnaire (Schmidt *et al.*, 2005b)  
4 in three studies. Two studies focused on anxiety (Bak *et al.*, 2012; Möller and  
5 Fällström, 1991). Other psychological adaptation variables studied were aggression and  
6 hysteria (Möller and Fällström, 1991), mental health (Peronace *et al.*, 2007), the social  
7 environment (Peronace *et al.*, 2007), well-being (Schanz *et al.*, 2013), desire for a child  
8 (Schanz *et al.*, 2013), infertility-related communication strategies (Schmidt *et al.*  
9 2005a), and sexual functioning (Bayar *et al.* 2014).

#### 10 **Male psychological adaptation to unsuccessful MAR treatments over time**

11 Eight studies were identified as repeating assessments of men's psychological  
12 adaptation to unsuccessful treatments over time (Table 2). The majority of  
13 investigations set their baseline assessment before the onset of either the first cycle of  
14 fertility treatment or a subsequent cycle. Although it is the oldest study, Möller and  
15 Fällström's (1991) design was the only one assessing male patients visiting a fertility  
16 clinic for the first time before diagnosis. The chosen interval between measurements  
17 varied immensely, from four weeks to five years. Apart from the study by Berghuis and  
18 Stanton (2002), who evaluated depression one week after taking a pregnancy test  
19 following an assisted insemination (AI) cycle, follow-ups were based solely on the  
20 amount of time since baseline. Of the 14 instruments identified as assessing  
21 psychological adaptation over time in these studies, only seven reported psychometric  
22 properties within the corresponding samples (Berghuis and Stanton 2002; Holley *et al.*  
23 2015; Kraaij *et al.* 2008; Peronace *et al.* 2007; Schanz *et al.* 2013; Schmidt *et al.* 2005b;  
24 Schneider and Forthofer 2005).

1 Three studies repeated their assessment of depression over the course of fertility  
2 treatments in subsamples of men who did not succeed in achieving pregnancy or  
3 parenthood. Using the Beck Depression Inventory (BDI, Beck *et al.*, 1988b), both Bak  
4 *et al.* (2012) and Berghuis and Stanton (2002) found an increase in self-reported  
5 depression levels within a few weeks after baseline assessment (Bak *et al.*, 2012:  $W =$   
6  $11.72 \pm 2.76$ ,  $P < 0.0001$ ; Berghuis and Stanton: statistics not presented). Based on a  
7 two-year interval after the first infertility consultation, no significant differences were  
8 found in the depression index subscale of the Symptom Rating Scale developed by  
9 Möller and Fällstrom (1991: statistics not presented).

10 Anxiety was prospectively assessed by two studies. Using the Beck Anxiety  
11 Inventory (BAI, Beck *et al.*, 1988a), Bak *et al.* (2012) measured four anxiety subscales  
12 four weeks after a diagnosis of non-obstructive azoospermia (NOA) was given and then  
13 repeated the measure four weeks after the diagnosis of sertoli cell-only syndrome  
14 (SCO) or chromosomal anomalies. With the exception of panic anxiety ( $W = -0.19 \pm$   
15  $1.31$ , n.s.), all other subscale levels were lower at follow-up (subjective anxiety:  $W =$   
16  $3.56 \pm 2.705$ ,  $P < 0.0001$ ; neurophysical anxiety:  $W = 1.50 \pm 1.63$ ,  $P < 0.0001$ ;  
17 autonomic anxiety:  $W = 1.75 \pm 1.42$ ,  $P < 0.0001$ ). There were no significant differences  
18 in anxiety levels found two years after the initial measurement (Möller and Fällström,  
19 1991; statistics not presented).

20 Two studies assessed changes in the use of coping strategies before and after  
21 unsuccessful fertility treatments through ANOVAs. Peronace *et al.* (2007) found an  
22 increase in the use of coping strategies in general one year after having started a new  
23 cycle ( $F = 57.47$ ;  $P < 0.001$ ). Pook *et al.* (2002) analysed changes in five coping  
24 strategies over time. Although no significant differences were found in depressive  
25 coping ( $F = 0.13$ ), distraction ( $F = 0.89$ ), and minimizing and wishful thinking ( $F =$

1 0.21), the use of active coping strategies ( $F = 6.16$ ;  $P = 0.017$ ) decreased and the use of  
2 religiousness and seeking meaning ( $F = 4.49$ ;  $P = 0.040$ ) increased in men four months  
3 after the workup compared with the levels prior to the workup. These results did not  
4 interact with a previous fertility workup ( $F = 1.13$ ;  $P = 0.37$ ).

5 The amount of stress specifically related to the infertility problem was  
6 longitudinally assessed by three studies, with contradictory findings. Pook *et al.* (2002)  
7 found a significant decrease in male infertility-related stress four months after the  
8 workup ( $F = 18.04$ ;  $P = 0.001$ ). Although this effect remained significant ( $F = 24.03$ ;  $P$   
9  $= 0.001$ ) in the subsample of men for whom this was the first fertility workup ( $n = 16$ ),  
10 there were no significant differences in infertility stress levels ( $F = 1.70$ ) for those who  
11 had undergone previous workups ( $n = 28$ ). Schmidt *et al.* (2005a) analysed these  
12 differences with t-tests and found that the levels of reported male infertility stress before  
13 starting a new cycle were higher one year later ( $P < 0.001$ ). Compared with baseline  
14 levels, these men presented higher infertility-related stress levels in the social domain  
15 subscale but indicated less stress in the marital and personal domains (all  $P < 0.001$ ),  
16 thus suggesting that the stress associated with infertility can result from social pressure  
17 and a lack of social support.

18 Peronace *et al.* (2007) also focused on changes in relation to the social  
19 environment of men being treated for infertility. Compared with the moment before  
20 starting a new cycle, men reported less support and understanding ( $F = 20.58$ ;  $P <$   
21  $0.001$ ) and more negative reactions and comments ( $F = 21.53$ ;  $P < 0.001$ ) from family  
22 and friends one year later.

23 Regarding the marital relationship, despite the abovementioned significant  
24 decrease in marital stress levels one year after starting a new cycle (Schmidt *et al.*,  
25 2005a), no significant differences were found in two studies using longer follow-ups.

1 Specifically, Möller and Fällström (1991) found no differences in the marital  
2 relationship ratings of men between the first visit and two years later (statistics not  
3 presented). There were also no significant differences in the reported quality of life  
4 associated with partnership found by Schanz *et al.* (2013), who followed patients five  
5 years after a fertility consultation ( $W = -0.22 \pm 0.82$ ).

6 Bayar and colleagues (2014) found that men reported higher sexual functioning  
7 on the Arizona Sex Life Inventory (McGahuey *et al.* 2000) before entering a first  
8 treatment cycle than three months after ( $P < 0.001$ ). This decrease in the total score was  
9 also observed on the subscales drive ( $P < 0.001$ ), arousal ( $P = 0.005$ ), orgasm ( $P =$   
10  $0.001$ ) and satisfaction from orgasm ( $P < 0.001$ ), but no significant differences were  
11 found regarding erection ( $P = 0.216$ ).

12 Other psychological adaptation variables related to emotional needs were  
13 independently studied. Although there was a decrease in mental health and energy  
14 vitality at a one-year follow-up evaluation ( $F = 16.45$ ;  $P < 0.001$ ; Peronace *et al.*, 2007),  
15 there were no significant differences in psychosomatic symptomatology, aggression or  
16 hysteria at two-year follow-up (Möller and Fällström, 1991; statistics not presented) and  
17 no differences in psychological well-being ( $W = 0.03 \pm 0.57$ ) or desire for a child ( $W = -$   
18  $0.04 \pm 0.58$ ) at five-year follow-up (Schanz *et al.*, 2013).

## 19 **Protective and risk factors for male psychological maladaptation to unsuccessful** 20 **MAR treatments**

21 Table 3 summarizes the six studies that met this review's criteria for investigating  
22 the psychosocial determinants of psychological adjustment to infertility in men. The  
23 baseline for the analysed cohorts was stipulated as occurring at a random fertility  
24 consultation (Schneider and Forthofer, 2005), before the first cycle (Holley *et al.* 2015)  
25 or any cycle of treatments (Schmidt *et al.*, 2005a, 2005b), exactly one week before an

1 assisted insemination (AI) cycle occurred (Berghuis and Stanton, 2002), or after  
2 unsuccessful treatment (Kraaij *et al.*, 2008). Apart from the study of Berghuis and  
3 Stanton (2002), for which the outcome was measured one week after a pregnancy test  
4 was taken, follow-ups were conducted at 12 (Schmidt *et al.*, 2005a, 2005b), 18 (Holley  
5 *et al.* 2015), or 24 months (Kraaij *et al.*, 2008; Schneider and Forthofer, 2005) after  
6 baseline. All self-report scales containing continuous variables were analysed regarding  
7 internal consistency and/or factor structure, and all studies used regression techniques in  
8 their analysis.

9 Depression was chosen as a dependent variable by three studies, with two of them  
10 having used coping strategies as independent variables. Berghuis and Stanton (2002)  
11 analysed the effects of coping strategies on depression rated by both men and their  
12 wives one week before the AI and one week after a negative pregnancy test result  
13 following AI. These authors found that male depression symptoms can be reduced by  
14 using coping strategies that involve positive reinterpretation ( $\beta = -0.50$ ;  $P < 0.001$ ),  
15 emotional processing ( $\beta = -0.61$ ;  $P < 0.001$ ), or emotional expression ( $\beta = -0.41$ ;  $P <$   
16  $0.007$ ). The only positive predictors of depression were the partners' use of avoidance  
17 and religious coping ( $\beta = 0.60$ ;  $P < 0.001$  and  $\beta = 0.71$ ;  $P < 0.001$ , respectively). Using  
18 different measures, Kraaij *et al.* (2008) found that catastrophizing predicted depression  
19 two years after treatment ( $\beta = 0.26$ ;  $P < 0.05$ ). This was the only strategy out of 11  
20 cognitive coping strategies that had a significant effect (see table 3). While both  
21 Berghuis and Stanton (2002) and Kraaij *et al.* (2008) studies used self-report scales of  
22 depression, the study of Holley and colleagues (2015) used a structured interview to  
23 assess major depressive disorder (MDD). Patients were interviewed before entering the  
24 first fertility treatment cycle (baseline), and four, ten and eighteen months after.  
25 Individuals were considered depressed at follow-up if they had been diagnosed with



1 MDD at least one time after baseline and over the course of treatment. While partner  
2 support did not significantly predict MDD (OR 0.80, 95% CI 0.51–1.25), significant  
3 contributions were found from baseline MDD (OR 10.10, 95% CI 3.21–31.74), and  
4 self-reported depression (OR 2.27, 95% CI 1.40–3.70), and anxiety (OR 2.02, 95% CI  
5 1.23–3.31).

6 Three studies assessed infertility stress. In the study by Schneider and Forthofer  
7 (2005), participants rated their degree of infertility stress two years after a fertility  
8 consultation in which they responded to questions concerning social and spousal  
9 support, self-esteem, perceived health, the importance of having biological children, and  
10 attribution of responsibility for the fertility problem. The only variables that  
11 significantly contributed to male infertility stress were social support and spousal  
12 support (statistics not presented). Schmidt and colleagues (2005a) analysed the  
13 predictive power of infertility-related coping and communication in men before a new  
14 cycle of treatment in infertility stress one year later while controlling for age. Infertility  
15 stress was predicted by difficulties in partner communication (OR 3.69, 95% CI 2.09–  
16 6.43) and by the use of infertility-related active-avoidance coping (OR 2.41, 95% CI  
17 1.29–4.53). These two variables were also the only predictors of infertility stress in the  
18 personal (OR 3.56, 95% CI 1.38–4.74; OR 2.12, 95% CI 1.04–4.32, respectively) and  
19 social domains (OR 2.76, 95% CI 1.55–4.91; OR 2.58, 95% CI 1.34–4.96,  
20 respectively).

21 Regarding the impact on the couple relationship, the authors tested the described  
22 predictors in terms of the stress (Schmidt *et al.*, 2005a) as well as the strength and  
23 closeness (Schmidt *et al.*, 2005b) that infertility can cause in a relationship. The results  
24 revealed that difficulties in partner communication predicted high infertility-related  
25 marital stress levels (OR 2.27, 95% CI 1.22–4.22, Schmidt *et al.*, 2005a) and low

1 marital benefits (OR 0.52, 95% CI 0.26–1.03, Schmidt *et al.*, 2005b). Strategies for  
2 communicating with others did not influence the levels of marital stress (Schmidt *et al.*,  
3 2005a), but the use of open-minded strategies (i.e., discussing both factual and  
4 emotional issues related to infertility in both close and distant relationships) can bring  
5 marital benefit (Schmidt *et al.*, 2005b) when compared with the use of secrecy strategies  
6 (OR .35, 95% CI 0.14–0.86) but not with the use of formal strategies (i.e., discussing  
7 factual and no or only few emotional issues related to infertility in both close and distant  
8 relationships). In the study investigating marital benefit (Schmidt *et al.*, 2005b), coping  
9 strategies subscales were trichotomized into low, medium, and high use. While active-  
10 avoidance coping was found to be a significant risk factor (medium vs. low OR 0.56,  
11 95% CI 0.30–1.05; high vs. low OR 0.48, 95% CI 95% 0.24–0.96), meaning-based  
12 coping was a protective factor for marital benefit (medium vs. low OR 2.21, 95% CI  
13 1.06–4.66; high vs. low OR 6.31, 95% CI 2.93–13.57). Only the moderate use of active-  
14 confronting coping predicted marital benefit compared with low use (medium vs. low  
15 OR 1.66, 95% CI 0.91–3.03; high vs. low n.s.), and high levels of active-confronting  
16 coping were associated with greater marital stress (OR 0.53, 95% CI 0.28–1.00,  
17 Schmidt *et al.*, 2005a).

18 Table 4 encapsulates the findings and shows which factors can benefit or pose  
19 risks to men’s mental health when facing failed fertility treatments.

## 20 Discussion

21 This is the first systematic review to summarize the best available evidence  
22 analysing the psychological symptoms associated with men’s experience of  
23 unsuccessful fertility treatment. Following a rigorous sampling and assessment  
24 procedure, 12 studies were included for analysis in this review. Although the majority  
25 of these studies were published in the last decade, revealing the increasing interest in the

1 male experience of infertility, evidence concerning how men psychologically react to  
2 infertility, its treatments, and subsequent failures is far from solid.

### 3 **Summary of research synthesis**

#### 4 ***Male psychological adaptation to unsuccessful MAR treatments over time***

5       Although evidence is scarce, this review suggests a tendency towards poorer  
6 psychological adaptation to fertility treatments in the year following the initial  
7 evaluation. The gathered evidence suggests that infertility-related stress (Schmidt *et al.*,  
8 2005a) and depression increase (Bak *et al.*, 2012; Berghuis and Stanton, 2002), and  
9 dimensions of mental health (Peronace *et al.*, 2007) and sexual functioning (Bayar *et*  
10 *al.*, 2014) show decline. Men also feel less supported and have to increase their efforts  
11 to cope with this stressor (Peronace *et al.*, 2007), namely, by increasing seeking  
12 meaning and decreasing active coping (Pook *et al.*, 2002).

13       There were two exceptions to this pattern. The first exception is the study by Bak  
14 and colleagues (2012), who observed a decrease in subjective, neurophysical and  
15 autonomic anxiety and found no significant differences in panic anxiety. The sample  
16 used in this study was entirely composed of men who had a diagnosis of NOA.  
17 Although treatment with ICSI is possible, only 50% of men diagnosed with NOA have a  
18 successful testicular sperm recovery (Ald *et al.*, 2004; Chan and Schlegel, 2000).  
19 Receiving such a diagnosis means facing the much stronger risk of being unable to have  
20 biological children compared with the risk faced by other infertile men in treatment.  
21 Additionally, this group of men is more vulnerable to endure embarrassing and painful  
22 treatment procedures (Inhorn, 2013). This tendency might explain the high anxiety  
23 levels in the first month after receiving the diagnosis and the finding that depression  
24 increased while anxiety decreased. The second exception was in Pook *et al.*'s study  
25 (2002), in which male infertility stress decreased four months after treatment. However,

1 this decrease remained significant only for those who had never seen a fertility  
2 specialist, not for those who had already undergone fertility treatment before T1.  
3 Although conclusions from this study are limited by sample size restrictions, these  
4 findings suggest that men might suffer from anticipatory stress before the first  
5 consultation.

6 Men's long-term psychological adaptation to failed fertility treatments does not  
7 seem to be affected, as shown by longitudinal evidence with follow-ups at two (Möller  
8 and Fällström, 1991) and five years (Schanz *et al.*, 2013). These studies point towards  
9 stability regarding psychosomatic symptomatology (Möller and Fällström, 1991), well-  
10 being (Schanz *et al.*, 2013), and partnership quality (Möller and Fällström, 1991;  
11 Schanz *et al.*, 2013). Moreover, men's wish to have a child decreases five years after  
12 having received a diagnosis, even while they continue pursuing fertility treatment  
13 (Schanz *et al.*, 2013).

14 Together, findings related to male adaptation to unsuccessful treatments over time  
15 point to increased distress during the first year, followed by a return to initial  
16 psychological adjustment. The opposite pattern seems to occur with distress in the  
17 marital relationship, which decreases in the first year and returns to baseline distress  
18 levels in the following years. However, the limited number of studies increases the  
19 difficulty of making definite assumptions, particularly concerning long-term adjustment  
20 to treatments.

### 21 *Protective and risk factors for male psychological maladaptation to unsuccessful*

#### 22 *MAR treatments*

23 This review also allowed for the identification of risk and protective factors in  
24 male adjustment to MAR treatments. The few studies included in this review on the  
25 longitudinal associations found for male psychological adjustment to unsuccessful

1 treatments covered only three main dependent variables – depression, stress, and marital  
2 adjustment – and the predictors were coping strategies, communication, and social  
3 support. The majority of protective factors consist of coping strategies related to seeking  
4 social support, emotional expression and reconstruction of life goals. Men who adopt  
5 these coping strategies are protected against depression (Berghuis and Stanton, 2002)  
6 and disruption in the marital relationship (Schmidt *et al.*, 2005a, 2005b). The  
7 maintenance or development of good relationships within the social sphere seems to be  
8 a key protective factor. Besides seeking social support and express one's emotions,  
9 openly speaking about the infertility problem and feeling supported by others,  
10 particularly by one's wife, can improve marital adjustment (Schmidt *et al.*, 2005b) and  
11 decrease the distress brought by MAR treatments (Schneider and Forthofer, 2005),  
12 respectively.

13         Meanwhile, risk factors seem closely linked not only to feelings of isolation but  
14 also to the marital relationship. Initial anxiety and depression contribute to the onset of  
15 major depression during treatment (Holley *et al.*, 2015). Coping strategies that pose a  
16 risk to infertility adjustment might involve either cognitively emphasizing the fertility  
17 problem and its taxing nature, thus increasing depression (Kraaij *et al.*, 2008), or  
18 actively avoiding the problem, thus increasing stress and decreasing the quality of the  
19 marital relationship (Schmidt *et al.*, 2005b). Coping strategies adopted by these men's  
20 wives can also influence their adjustment to treatments. More specifically, women's use  
21 of religious or avoidance coping increases male depression after a failed cycle (Berghuis  
22 and Stanton, 2002). Adjustment to failed treatments is also compromised when men  
23 sense barriers to marital communication regarding the infertility problem, and this  
24 perception was found to be detrimental to both infertility stress and the relationship  
25 (Schmidt *et al.*, 2005a, 2005b).

1           Taken together, this review's findings help to refute the commonly held  
2   misperception that men, despite being disappointed with infertility, are not overly  
3   emotionally distressed as a result of such an experience.

#### 4 5 6   **Limitations and recommendations for future research**

7           The strengths of this review are its systematic review of all published studies to  
8   date from five databases, the a priori review protocol, and the fact that studies were  
9   selected both on the bases on eligibility and quality, with standard sheets used by three  
10   independent researchers. Nevertheless, there are limitations arising both from the  
11   studies and the complexity of the research questions involved. Because of the  
12   heterogeneity and introduction of bias, we made a rigorous assessment to ensure that all  
13   included subjects continued seeking treatment and had not achieved pregnancy or  
14   childbirth at follow-up. Thus, generalization to men who are not seeking treatment is  
15   not possible. Additionally, all samples included in this review were composed of  
16   heterosexual men in a relationship, and hence, conclusions on single and lesbian, gay,  
17   bisexual and transgender (LGBT) populations cannot be drawn. Finally, with the  
18   exception of one data collection from Asia, all research samples were from Europe and  
19   the United States, posing a high risk of cultural and demographic bias. Adding to this  
20   bias the fact that treatment seekers are more frequently Caucasian, highly educated and  
21   with high family incomes (White *et al.* 2006), another limitation of this review is that  
22   the relative contribution of demographic variables could not be considered

23           Although the included research constitutes the best available evidence, a cautious  
24   approach to data interpretation is required as a result of the studies' design. The  
25   strongest limitation is related to variations in baseline measurements and the subsequent

1 difficulty in comparing results. Having already received a diagnosis or experienced a  
2 previous failed cycle can represent an important bias regarding psychological adaptation  
3 over time. Of the 12 included studies, only one had a baseline measurement defined at  
4 the first consult at a fertility centre (Möller and Fällström, 1991). Interestingly, this was  
5 the only study published in the past century included in this review. Follow-up  
6 measurements also constitute a problem when reviewing the evidence. Berghuis and  
7 Stanton (2002) and Pook *et al.* (2002) were the only researchers to define a follow-up  
8 measure based on a specific moment in relation to treatment. Defining follow-ups based  
9 solely on months or years since baseline means that a subject can be reporting after only  
10 one cycle or after five cycles, either on the day of embryo transfer or when the couple  
11 has decided to take a pause from treatment even though they will continue pursuing it.  
12 These situations can be very particular in terms of anxiety, for example. We are all  
13 aware that in recent years, there have been progressively sophisticated methods of data  
14 analysis that demand increasing ratios of subjects per variable, making it difficult for  
15 research teams to spend time and resources on building a representative sample of men  
16 initiating fertility treatment. Nevertheless, research focusing on the impact of infertility  
17 at earlier stages is needed to understand how men react to the first consult or diagnosis  
18 and to test for the hypothesis of anticipatory treatment stress, in addition to research  
19 post-treatment with follow-ups based on the treatment process rather than merely based  
20 on time. It is also relevant to include dependent variables at baseline. We recommend  
21 that a priori power analyses be performed to determine the required number of subjects  
22 necessary for a given design. The potential relationship between non-participation and  
23 abandonment of treatment is also an important problem. For example, when focusing on  
24 marital adjustment to infertility, future studies should try to control for selection bias  
25 because non-participants might be the individuals who tend to divorce or exhibit weak

1 marital adjustment. Only then could we conclude that stress does not affect the marital  
2 relationship and that infertility can bring couples together (Martins *et al.*, 2014b).

3 Another issue raised during this investigation was the lack of reporting on  
4 validation and/or adaptation procedures for instruments and scale reliability. Although  
5 all studies included in this review make at least a mention to the original validity, only 7  
6 out of 10 studies reported validity procedures or internal consistency values regarding  
7 the actual samples (Berghuis and Stanton 2002; Holley *et al.* 2015; Kraaij *et al.* 2008;  
8 Peronace *et al.* 2007; Schanz *et al.* 2013; Schmidt *et al.* 2005b; Schneider and Forthofer  
9 2005). The testing of psychometric properties is necessary to prove the clinical  
10 usefulness of a given measure (Streiner *et al.*, 2014), and hence, these should be tested  
11 and reported at all times.

12 It should also be noted that most of the studies included in this review also included  
13 women. As far as we could ascertain, only one study treated data as nonindependent  
14 (Kraaij *et al.*, 2008), while others assumed nonindependence of data by not accounting  
15 for variation in the husband's adjustment that could be explained by the wife's  
16 adjustment or predictors (Kenny *et al.*, 2006). Future research using the dyad as a unit  
17 of analysis is needed not only to test whether effects remain after accounting for the  
18 partner's behaviour but also to differentiate genders in actor and partner effects as  
19 mentioned above.

20 To overcome these limitations, internal campaigns at fertility centres and  
21 associations targeting professionals and patients should be used to call attention to the  
22 lack of men in fertility research and to the need to increase knowledge on the male  
23 experience of infertility and its treatments in order to facilitate recruitment and avoid a  
24 great number of losses at follow-up. Although men have been more likely to be  
25 included in the designs of recent studies, women have been overrepresented in the



1 infertility literature because they are primarily handled as patients and participants  
2 typically selected among those attending treatment appointments. If men become more  
3 involved in treatment and participate more fully with their partners in fertility  
4 procedures, this involvement would have the added benefit of allowing researchers  
5 better opportunities to sample men and to study issues of importance related to their  
6 unique experiences regarding infertility and treatment. Only then will research within  
7 this field be able to move towards high-quality randomized controlled trials with men  
8 also participating in interventions.

9

### 10 **Clinical implications**

11 The current review provides a road map for understanding men's psychological  
12 and emotional reactions to unsuccessful fertility treatments. By better understanding the  
13 unique elements of men's experiences, we can build on existing knowledge as we seek  
14 to improve the delivery of support and mental health services for men as well as to  
15 identify additional areas of needed inquiry to strengthen the existing knowledge base.

16 We propose that medical and mental health professionals work together to  
17 develop and implement targeted clinical interventions by considering the unique  
18 elements of men's experience with infertility. Our first recommendation is that health  
19 care professionals work to identify ways in which men can be more directly involved in  
20 fertility treatments – in all diagnostic cases. If medical providers ensure an atmosphere  
21 that helps men move from the periphery of treatment towards the centre with increased  
22 involvement, this environment could reduce these feelings of marginalization. We  
23 support Malik and Coulson's (2008) recommendation to develop educational materials  
24 for men as well as offer increased resources such as support groups or online  
25 information detailing men's emotional reactions to the infertility journey – strategies

1 that have been effective in ensuring greater male involvement in the process.  
2 Furthermore, the inclusion of men more directly in the treatment process is valued by  
3 fertility patients (Dancet *et al.* 2010) and may benefit both men and their partners by  
4 easing the solitary burdens and isolation that each partner may feel.

5 The majority of risk factors for male psychological maladaptation in this review  
6 were closely linked to the marital relationship, which adds validity to the existing  
7 recommendations for couples counselling (Human Fertilisation and Embryology  
8 Authority (HFEA), 2008; National Institute for Clinical Excellence (NICE), 2013).  
9 Hence, we also recommend that men be educated regarding effective communication  
10 strategies that decrease marital stress related to fertility treatment, and be informed  
11 regarding effective coping strategies that can reduce the risk factors associated with  
12 psychological distress. Coping skills training (CST) has been successfully used in other  
13 health-related low-control situations (Blumenthal *et al.*, 2006; Whittemore *et al.*, 2010),  
14 and men may benefit from the acquisition of coping techniques that reduce both  
15 individual and relational stress related to infertility (Peterson *et al.*, 2009).

## 16 **Conclusion**

17 Although studies are increasing, there is little available prospective evidence on  
18 male psychological adjustment to MAR treatment. The findings from this review  
19 indicate that psychological adjustment in men decreases in the year after the initial  
20 evaluation and that long-term adjustment is not affected. Disclosure, social support, and  
21 coping strategies related to the reconstruction of life goals and seeking support were  
22 found to be protective of male maladjustment. Coping associated with isolation,  
23 difficulties in partner communication, and partner coping can pose risks to men's  
24 adjustment to fertility treatment. The findings highlight a key role of the spouse and  
25 marital adjustment in male mental health and well-being when facing infertility. Hence,

1 counselling should include interventions with coping skills training and couples  
2 communication enhancement strategies to deal with the challenge of infertility.  
3 Nevertheless, great efforts are needed to strengthen the methodologies of future studies  
4 to produce solid evidence on the course of male psychological adjustment not only  
5 during but also before and after fertility treatment. Further prospective large studies  
6 with high-quality design and power are warranted to perform a subsequent meta-  
7 analysis and compare results concerning diagnosis and treatment options. Education  
8 campaigns within fertility centres and public associations should be used to call  
9 attention to the importance of men's participation in reproductive health research.

10

11

#### **Authors' roles**

12 M.V.M.: protocol development, blind rating of final studies to include in review,  
13 review of literature and manuscript preparation; M.B-P.: protocol development,  
14 literature searches, blind rating of studies to include in review and manuscript  
15 preparation; J.P.: literature searches and blind rating of studies to include in review;  
16 B.P.: supervision of research and manuscript preparation; V.A.: expertise in clinical  
17 aspects of MAR and critical revision of manuscript; L.S.: supervision of research and  
18 critical revision of manuscript; and M.E.C. supervision of research and critical revision  
19 of manuscript.

20

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25

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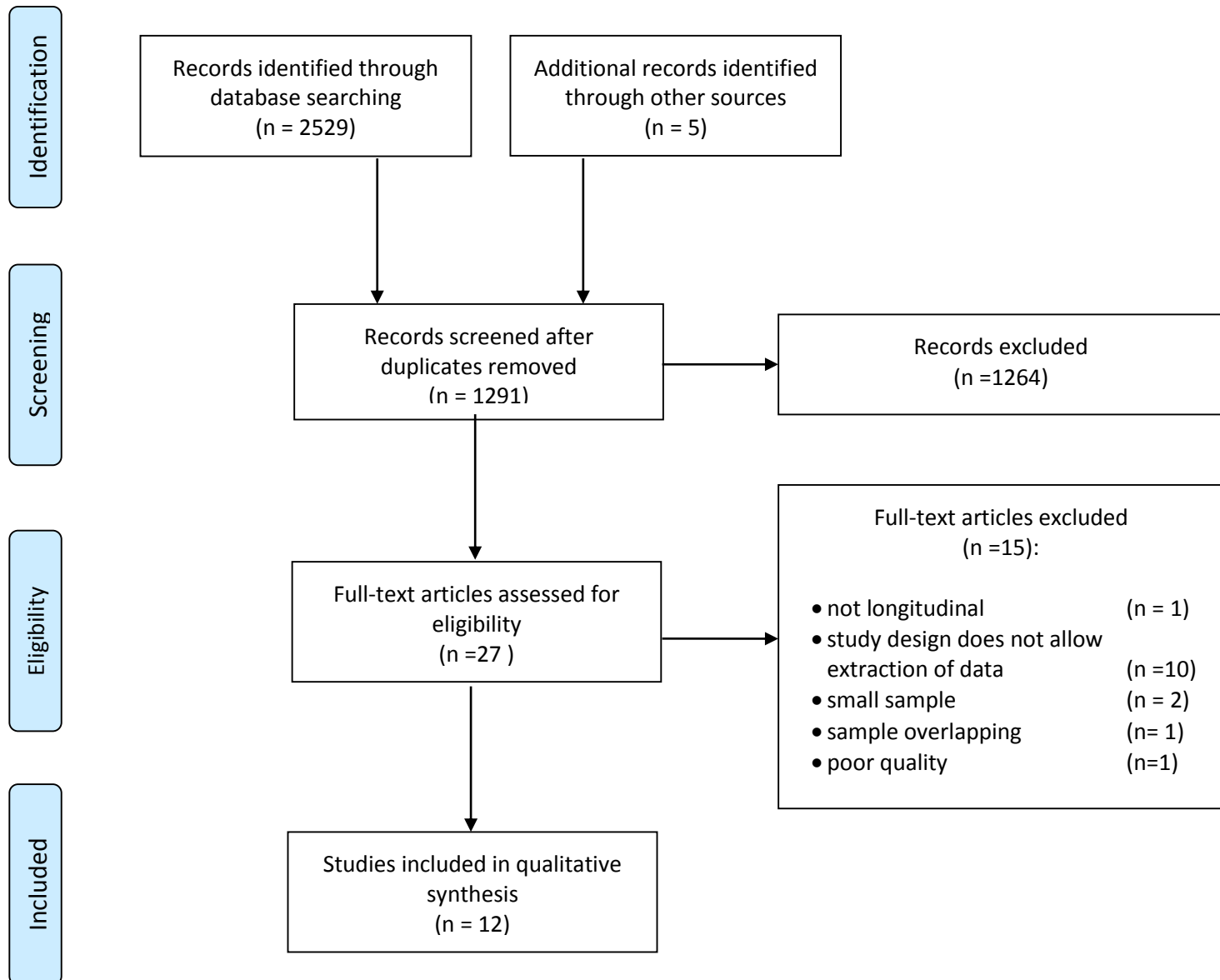
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Figure 1.



PRISMA flow diagram. From Moher *et al.*, 2009.



Table 1. Main characteristics of all studies included in this review.

Reference	Country where data were collected	Sample sizes	Mean male age	Infertility mean duration (years)	Moments of measurement		Longitudinal participation rate	Psychological adaptation outcome measure
					baseline (T1)	follow-up (T2)		
Bak <i>et al.</i> (2012)	Korea	N = 264 (132f, 132m) n = 72 men diagnosed with NOA	31.97		4 weeks after diagnosis	4 weeks after T1	96%	Anxiety Depression
Bayar <i>et al.</i> (2014)	Turkey	N = 110 (55f, 55m) n = 45 men, no pregnancy at T2	33.9	4	Before first cycle	3 months after T1	91%	Sexual functioning
Berghuis and Stanton (2002)	USA	N = 86 (43f, 43m) n = 43 men, no pregnancy at T2	34.7	2.8	1 week before AI	1 week after negative pregnancy test	85%	Depression Coping strategies
Kraaij <i>et al.</i> (2008)	Netherlands	N = 169 (105f, 64m) n = 20 men with definite infertility		12	Not defined	2 years after T1	89%	Depression Coping strategies
Holley <i>et al.</i> (2015)	USA	N = 834 (448f, 386m) n = 144 men, no pregnancy/child at T2	37.8	2.4	Before first cycle	4, 10 and 18 months after T1	59%	Major depressive disorder during treatment
Möller and Fällström (1991)	Sweden	N = 142 (71m, 71f) n = 35 men, no pregnancy/child at T2	30.6	3.3	First visit	2 years after T1	89%	Psychosomatic symptoms Marital relationship
Peronace <i>et al.</i> (2007)	Denmark	N = 256m n = 256 men, no pregnancy/child at T2	34	4.3	Before (new) cycle	1 year after T1	86%	Mental health Coping strategies Social environment
Pook <i>et al.</i> (2002)	Germany	N = 45m n = 45 men, no pregnancy/child at T2	33.4		Before (new) fertility workup	4 months after fertility workup	100%	Infertility-related stress Coping strategies
Schanz <i>et al.</i> (2013)	Germany	N = 275m n = 45 men, no pregnancy/child at T2	35.6	3.8	Fertility consultation	5 years after T1	37%	Well-being Desire for a child Partnership
Schmidt <i>et al.</i> (2005a)	Denmark	N = 816 (441f, 375m) n = 375 men, no pregnancy/child at T2			Before (new) cycle	1 year after T1	86%	Infertility-related stress Infertility-related communication strategies Infertility-related coping strategies
Schmidt <i>et al.</i> (2005b)	Denmark	N = 816 (441f, 375m) n = 375 men, no pregnancy/child at T2			Before (new) cycle	1 year after T1	86%	Infertility-related marital benefit
Schneider and Forthofer (2005)	USA	N = 128 (66f, 62m) n = 62 men, no pregnancy/child at T2	33	2.7	Fertility consultation	2 years after T1	82%	Infertility-related stress

N = total sample size of the study at baseline; n = number of male participants who at follow-up did not achieve pregnancy or parenthood: only statistics for these participants were included in the qualitative synthesis of results; NOA = non-obstructive azoospermia; AI = assisted insemination;

Table 2. Male psychological adjustment over time to unsuccessful infertility treatments.

Reference	Sample size	Moments of measurement		Measures	Results
		baseline (T1)	follow-up (T2)		
Bak <i>et al.</i> (2012), Korea	n = 72 men with non-obstructive azoospermia	4 weeks after diagnosis	4 weeks after T1	Anxiety: BAI Depression: BDI	Subjective anxiety: T1> T2; neurophysical anxiety: T1> T2; autonomic anxiety: T1> T2; panic anxiety: T1=T2; depression: T1<T2; Wilcoxon test
Bayar <i>et al.</i> (2014), Turkey	n = 45 men, no pregnancy at T2	Before first cycle	3 months after T1	Sexual Functioning: ASEX	Drive: T1> T2; arousal T1> T2; erection T1= T2; orgasm T1> T2; satisfaction from orgasm T1> T2; sexual functioning total score T1> T2; Wilcoxon test
Berghuis and Stanton (2002), USA	n = 43 men, no pregnancy at T2	1 week before AI	1 week after pregnancy test	Depression: BDI	Depression: T1< T2; ANOVA
Möller and Fällström (1991), Sweden	n = 35 men, no pregnancy/child at T2	First visit	2 years after T1	Psychosomatic symptoms: SRS Marital relationship: RRMW	Psychosomatic index: T1=T2; anxiety index: T1=T2; depression index: T1=T2; aggression index: T1=T2; hysteria index: T1=T2; marital relationship: T1=T2; Student's t-test
Peronace <i>et al.</i> (2007), UK	n = 256 men, no pregnancy/child at T2	Before (new) cycle	1 year after T1	Mental health: SF-36 Coping strategies: COMPI CSS Social environment: DLHBS	Mental health T1> T2; coping effort T1< T2; negative comments T1< T2; understanding T1> T2; ANOVA
Pook <i>et al.</i> (2002), Germany	n = 45 men, no pregnancy/child at T2	Before (new) fertility workup	4 months after fertility workup	Infertility-related stress: IDS Coping strategies: FQCI-SF	Infertility stress: T1> T2; depressive coping: T1=T2; active coping: T1> T2; distraction: T1=T2; religiousness and seeking meaning: T1< T2; minimizing and wishful thinking T1=T2; ANOVA
Schanz <i>et al.</i> (2013), Germany	n = 45 men, no pregnancy/child at T2	Fertility consultation	5 years after T1	Infertility-related quality of life: TLMK	Desire for a child: T1>T2; partnership: T1=T2; psychological well-being: T1=T2; Wilcoxon test

Schmidt <i>et al.</i> (2005a), Denmark	n = 375 men, no pregnancy/child at T2	Before (new) cycle	1 year after T1	Infertility-related stress: COMPI FPSS	Personal stress: T1> T2; marital stress: T1> T2; social stress: T1<T2; infertility stress: T1< T2 ; Student's t-test
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AI = assisted insemination; BAI, Beck Anxiety Inventory (Beck *et al.*, 1988a); BDI, Beck Depression Inventory (Beck *et al.*, 1988b); ASEX = Arizona Sex Life Inventory (McGahuey *et al.* 2000); SRS = Symptom Rating Scale (Moller & Fallstrom, 1991); RRMW = Ratings of relationship between man and woman (Moller & Fallstrom, 1991); SF-36, Short-Form-36 Inventory (Ware *et al.*, 1993); COMPI CSS, COMPI Coping Strategy Scales (Schmidt *et al.*, 2005a, 2005c); DLHBS, Danish Longitudinal Health Behavior Study (Due *et al.*, 1999); IDS, Infertility Distress Scale (Pook *et al.*, 1999); FQCI-SF, Freiburg Questionnaire of Coping with Illness – Short Form (Muthny, 1989); TLMK, Tubingen Quality of Life Questionnaire for men with involuntary childlessness (Schanz *et al.*, 2005); COMPI FPSS, COMPI Fertility Problem Stress Scales (Schmidt *et al.*, 2005a).

Table 3. Predictors of male psychological adjustment to unsuccessful infertility treatments.

Reference	Sample size	Predictors [T1]	Outcomes [T2]	Results
Berghuis and Stanton (2002), USA	n = 43 men, no pregnancy at T2	Coping strategies (seek social support; problem-focused coping; avoidance; positive reinterpretation and growth; religious coping): COPE Coping strategies (emotional processing; emotional expression): EACS [1 week before AI]	Depression: BDI [1 week after pregnancy test]	Positive reinterpretation, emotional expression, and emotional expression negatively predicted depression; partner avoidance and religious coping positively predicted depression. Hierarchical multiple regression
Holley <i>et al.</i> (2015)	n = 144 men, no pregnancy/child at T2	Depression: CESD Anxiety: STAI-State Partner support: PSSSC Past major depressive disorder: CIDI, depression module [before first cycle]	Major depressive disorder: CIDI, depression module [4, 10 and 18 months after T1]	Depression, anxiety, and partner support positively predicted major depressive disorder. Up points; Hierarchical multiple logistic regression
Kraaij <i>et al.</i> (2008), Netherlands	n = 20 men with definite infertility	Coping cognitive strategies (self-blame; acceptance; rumination; positive refocusing; refocus on planning; positive refocusing; refocus on planning; positive reappraisal; putting into perspective; catastrophizing; other-blame): CERQ [undefined]	Depressive symptoms: SCL-90 [2 years after T1]	Catastrophizing positively predicted depressive symptoms; Hierarchical multiple regression
Schmidt <i>et al.</i> (2005a), Denmark	n = 375 men, no pregnancy or child at T2	Infertility-related communication strategies (open-minded; formal; secrecy): COMPI ICS Infertility-related coping strategies (active-avoidance; active-confronting; passive-avoidance; meaning-based): COMPI CSS Difficulties in partner communication [Before (new) cycle]	Infertility-related stress (personal domain; marital domain; social domain): COMPI FPSS [1 year after T1]	Difficulties in partner communication positively predicted personal stress, marital stress, and total infertility stress; active-avoidance coping positively predicted personal stress, social stress, and total infertility stress; active-confronting coping positively predicted marital stress; Odds ratio
Schmidt <i>et al.</i> (2005b), Denmark	n = 375 men, no pregnancy or child at T2	Infertility-related communication strategies (open-minded; formal; secrecy): COMPI ICS Infertility-related coping strategies (active-avoidance; active-confronting; passive-avoidance; meaning-based): COMPI CSS Difficulties in partner communication [Before (new) cycle]	Infertility-related marital benefit: COMPI MS [1 year after T1]	Medium and high use of marital benefit strategies, medium use of active-avoidance coping, low use of active-confronting coping, and high use of open-minded communication strategies positively predicted high marital benefit. Odds ratio

Schneider and Forthofer (2005), USA	n = 62 men, no pregnancy or child at T2	Social support: SSQ Spousal support: SS Self-esteem: RSES Perceived health: HSCL Importance of biological children: ICS Attribution of responsibility for the fertility problem [Fertility consultation]	Infertility-related stress: FPS [2 years after T1]	Social support and spousal predicted infertility-related Hierarchical multiple regression
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COPE, Coping Orientations to Problems Experienced (Carver *et al.*, 1989); EACS, Emotional Approach Coping scales (Stanton *et al.*, 2000); AI = assisted insemination; BDI, Beck Depression Inventory (Beck *et al.*, 1988b); CESD, Center for Epidemiologic Study of Depression scale (Radloff 1977); STAI-State, State-Trait Anxiety Inventory, State anxiety subscale (Spielberger *et al.* 1983); PSSSC, perceived social support and social conflict scale (Abbey *et al.* 1985); CIDI, Composite International Diagnostic Interview (Kessler and Ustun 2004); CERQ, Cognitive Emotion Regulation Questionnaire (Garnefski *et al.*, 2001); SCL-90, Symptom Check List (Derogatis 1977); COMPI CSS, COMPI Coping Strategy scales (Schmidt *et al.*, 2005a, 2005c); COMPI FPSS, COMPI Fertility Problem Stress scales (Schmidt *et al.*, 2005a); COMPI MS, COMPI Marital benefit (Schmidt, 1996, Schmidt *et al.*, 2005b); COMPI ICS, COMPI infertility-related communication strategies (Schmidt *et al.*, 2005a); SSQ, Social Support questionnaire (Sarason *et al.*, 1987); SS, Spousal Support (Schneider & Forthofer, 2005); RSES, Rosenberg Self-Esteem Scale (Rosenberg *et al.*, 1965); HSCL, The Hopkins Symptom Checklist (Derogatis *et al.*, 1974); ICS, Importance of Biological Children (Abbey *et al.*, 1992); Attribution of responsibility for the fertility problem (Schneider & Forthofer, 2005); FPS, Fertility Problem Stress (Abbey *et al.*, 1992).

Table 4. Protective and risk factors of male psychological adjustment to unsuccessful infertility treatments.

Predictors	Moments of measure		Outcomes		
	Baseline	Follow-up	1. Depression	2. Stress	3. Marital adjustment *
Emotional processing <sup>1</sup>			(-)		
Emotional expression <sup>1</sup>		1 week after	(-)		
Positive reinterpretation <sup>1</sup>	1 week before AI	negative pregnancy test	(-)		
Partner religious coping <sup>1</sup>			(+)		
Partner avoidance coping <sup>1</sup>			(+)		
Difficulties in partner communication <sup>2,3</sup>				(+)	(-)
Active-confronting coping <sup>2,3</sup>	before			(-)	(+)
Active-avoidance coping <sup>2,3</sup>	(new)	1 year after		(+)	(-)
Open-minded communication strategies (vs. secrecy) <sup>3</sup>	cycle				(+)
Meaning-based coping <sup>3</sup>					(+)
Anxiety <sup>4</sup>	Before first	18 months	(+)		
Depression <sup>4</sup>	cycle	after	(+)		
Social support <sup>5</sup>				(-)	
Spousal support <sup>5</sup>	in treatment	2 years after		(-)	
Catastrophizing <sup>6</sup>	undefined		(+)		

<sup>1</sup> Berghuis and Stanton, 2002; <sup>2</sup> Schmidt *et al.*, 2005a; <sup>3</sup> Schmidt *et al.*, 2005b; <sup>4</sup> Holley *et al.*, 2015; <sup>5</sup> Schneider and Forthofer, 2005; <sup>6</sup> Kraaij *et al.*, 2008; AI = assisted insemination; (-) = negative predictors; (+) = positive predictors; green symbols represent protective factors, and red symbols represent risk factors.

\* Includes the outcomes marital benefit and marital stress

Appendix 1 Quality assessment of studies on the basis of Shepherd *et al.* (2006) and Dancet *et al.* (2010).

	Bak <i>et al.</i> (2012)	Bayar <i>et al.</i> (2014)	Berghuis and Stanton (2002)	Dhaliwal <i>et al.</i> (2004)	Holley <i>et al.</i> (2015)	Kraaij <i>et al.</i> (2008)	Möller and Fällström (1991)	Peronace <i>et al.</i> (2007)	Pook <i>et al.</i> (2002)	Schanz <i>et al.</i> (2013)	Schmidt <i>et al.</i> (2005a)	Schmidt <i>et al.</i> (2005b)	Schneider and Forthofer (2005)
i) an explicit account of theoretical framework and/or a literature review outlining a rationale	+	+	+	+	+	+	+	+	+	+	+	+	+
ii) clearly stated aims and objectives	+	+	+	+	+	+	-	+	+	-	+	+	+
iii) a clear description of context including who, where and how data was collected and/or assessed; ethical approval and consent	+	+	+	-	+	+	+	+	+	+	+	+	+
(iv) a clear description of the sample	+	+	+	-	+	+	+	+	+	+	+	+	+
v) a clear description of methodology, including questionnaire development, response categories (and possible aggregation/dichotomization), appropriate statistical tests for the used level of measurement, p-levels	+	+	+	-	+	+	-	+	+	+	+	+	+
vi) sufficient original data to mediate between data and interpretation, including appropriate measures of central tendency and indexes of variability	+	+	+	-	+	+	+	+	+	+	+	+	+
<b>Total</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>2</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>6</b>	<b>6</b>

\*(+) study fulfills criteria; (-) study does fulfill the criteria or it is unknown