

**Anxiety, Depression, Dyadic Adjustment and Attachment to the Fetus in Pregnancy:
Actor-partner Interdependence Mediation Analysis**

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Abstract

Perinatal research has focused essentially on maternal outcomes leaving paternal outcomes unexplored. This cross-sectional study aimed to explore the intrapersonal and interpersonal effects of mothers' and fathers' anxiety and depressive symptoms on their own and their partners' antenatal attachment to the fetus. Additionally, it aimed to explore the mediating role of dyadic adjustment on these associations. Participants, 320 pregnant women and their partners, completed the Hospital Anxiety and Depression Scale, the Dyadic Adjustment Scale and the Maternal and Paternal Antenatal Attachment Scale. Data were analyzed using the actor-partner interdependence mediation model. Mothers' ($\beta = -.16, p < .01$) and fathers' depressive symptoms ($\beta = -.38, p < .001$) were associated with their levels of antenatal attachment to the fetus. These relationships, however, were mediated by levels of dyadic adjustment ($\beta = -.08, p < .05$; $\beta = -.09, p < .05$, respectively). Fathers' anxiety symptoms were associated with their levels of antenatal attachment to the fetus ($\beta = .16, p < .05$). This relationship was partially mediated by their levels of dyadic adjustment ($\beta = -.05, p < .05$). Finally, fathers' depressive symptoms were associated with mothers' levels of antenatal attachment to the fetus through the mothers' dyadic adjustment levels ($\beta = -.06, p < .05$). Results indicated that anxiety and depressive symptoms as well as lower levels of dyadic adjustment during pregnancy seem to negatively impact the levels of antenatal attachment to the fetus, especially for fathers. Results highlight the need to adopt a dyadic perspective to understand mothers' and fathers' outcomes during pregnancy.

Keywords: anxiety, depression, dyadic adjustment, attachment to the fetus, dyadic study

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Anxiety, Depression, Dyadic Adjustment and Attachment to the Fetus in Pregnancy: Actor-partner Interdependence Mediation Analysis

Pregnancy is a normative life event but it is accompanied by profound biological, psychological, and social changes for both mothers and fathers (Figueiredo, 2014). Cowan and Cowan (2000) highlighted some strains faced by parents during this period, namely the anxiety related to becoming a parent, the need for greater involvement of fathers, combining work-family demands, and the negotiation of (new) roles and responsibilities. While some parents seem to adjust well to this demanding life transition, others have more difficulties, which turn pregnancy into a time of great vulnerability for the development of anxiety and depressive symptoms. Specifically, pregnant women, in comparison to non-pregnant women, present higher anxiety and depressive symptoms (e.g., Fatoye, Ademyemi, & Oladimeji, 2004). Moreover, reviews and studies indicate that, during pregnancy, about 18 to 25% of women experience clinically significant anxiety symptoms (i.e., scores above the cut-off points on symptoms scales) (Dennis, Falah-Hassani, & Shiri, 2017). Moreover, about 7 to 12% of women experience clinically significant depressive symptoms (Bennett, Einarson, Taddio, Koren, & Einarson, 2004).

For fathers, recent reviews have shown that, during pregnancy, about 4% to 16% reported an anxiety disorder (as defined by either diagnostic clinical interviews or above cut-off points on symptom scales) (Leach, Poyser, Cooklin, & Giallo, 2016), and about 8 to 10% reported clinically significant depressive symptoms (Cameron, Sedov, & Tomfohr-Madsen, 2016; Paulson & Bazemore, 2010).

One important indicator of successful mothers' and fathers' psychological adjustment during pregnancy is their *attachment* to the unborn child, also called *prenatal* or *antenatal attachment* to the fetus (Raphael-Leff, 2005). Antenatal attachment to the fetus refers to “an

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abstract concept, representing the affiliative relationship between a parent and a fetus, which is potentially present before pregnancy, is related to cognitive and emotional abilities to conceptualize another human being, and develops within an ecological system” (Doan & Zimmerman, 2003, p. 110). Condon and Corkindale (1997) defined antenatal attachment as the emotional tie or psychological bond developed during pregnancy between the mother/father and the unborn infant.

Antenatal attachment to the fetus is a highly important outcome during pregnancy because it has been found to be associated not only with intraindividual functioning but also with infant development outcomes. For instance, lower levels of antenatal attachment to the fetus have been linked to poor maternal-infant bonding (odds ratio = 1.17) and psychopathology post-partum (anxiety: odds ratio = 0.83; and depression: odds ratio = 0.88) (Petri et al., 2017). According to a meta-analysis conducted by Cannella, Yarcheski, and Mahon (2018), maternal antenatal attachment to the fetus was the predictor that had the largest effect (effect size $r = .56$) on health practices in pregnant women (health practices included prenatal care, good nutrition, and exercise). Moreover, levels of antenatal attachment to the fetus can also have a negative impact on neonatal outcomes (e.g., neonatal birth weight and gestational age) and infant development (e.g., communication, gross motor, fine motor) (Alhusen et al., 2012a; Alhusen, Hayat, & Gross, 2013).

In the last years, the reviews focused on this topic have evidenced that efforts have been made to identify predictors of antenatal attachment to the fetus (e.g., Yarcheski, Mahon, Yarcheski, Hanks, & Cannella, 2009). Clearly, mothers’ antenatal attachment to the fetus has been explored more than fathers’ antenatal attachment. Overall, for mothers, higher levels of family support, greater psychological well-being, higher self-esteem, and lower levels of anxiety and depressive symptoms are associated with higher levels of antenatal attachment to the fetus (Yarcheski et al., 2009). These results evidence the need to explore the processes

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and mechanisms underlying the development of antenatal attachment to the fetus for both mothers and fathers.

Anxiety and Depressive Symptoms and Antenatal Attachment to the Fetus

Besides other negative consequences for women and their infants such as obstetric complications, pregnancy symptoms, or even preterm labor (e.g., Alder, Fink, Bitzer, Hösli, & Holzgreve, 2007), antenatal anxiety and depressive symptoms have been found to be risk factors for the development of poor antenatal attachment levels (Alhusen, Gross, Hayat, Rose, & Sharps, 2012b; Condon & Corkindale, 1997; Goecke et al., 2012; Yarcheski et al., 2009). These associations remain significant even when the majority of participants experience normal to moderate anxiety and depressive symptoms (e.g., Condon & Corkindale, 1997).

It is important to highlight, however, that there has been less focus on the effect of anxiety symptoms as compared to the effect of depressive symptoms. Moreover, despite the recent proliferation of research on the consequences of antenatal anxiety and depressive symptoms for the mothers' and infants' outcomes, studies focused on fathers' outcomes have been relatively neglected. The few available studies found that when fathers experienced fewer anxiety and depressive symptoms, they experienced higher levels of antenatal attachment (Vreeswijk, Maas, Rijk, & van Bakel, 2014). Thus, anxiety and depressive symptoms may influence women's and men's response to pregnancy, specifically their abilities for bonding with their unborn baby.

Anxiety and Depressive Symptoms and Marital Adjustment

Overall, marital adjustment seems to play an important role in providing spouses with the emotional resources needed to create a warm and supportive family environment (Feldman et al., 1990). Marital adjustment, also designated as marital satisfaction, marital quality, or dyadic adjustment (Heyman, Sayers, & Bellack, 1999) can be defined as “the

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process by which married couples attain mutual gratification and achieve common goals while maintaining an appropriate degree of individuality” (American Psychologist Association (APA), 2015, p.623). We conceptualize marital adjustment as “a process, the outcome of which is determined by the degree of: (1) troublesome dyadic differences; (2) interpersonal tensions and personal anxiety; (3) dyadic satisfaction; (4) dyadic cohesion; and (5) consensus on matters of importance to dyadic functioning” (Spanier, 1976, p.17). It implies the existence of a continuum as well as a movement (back and forth) along this continuum as a consequence of events, circumstances and interactions (Spanier, 1976).

In this sense, marital adjustment may have an important role on providing couples with some resources to deal with pregnancy-related challenges (e.g., partner’s effective support). However, marital adjustment can be affected by anxiety and depressive symptoms that usually emerge as common responses during pregnancy (as presented at the beginning). Accordingly, several studies have shown that during pregnancy mothers’ anxiety and depressive symptoms are associated with poor marital adjustment (Figueiredo, Field, Diego, & Hernandez-Reif, Deeds, & Ascencio, 2010; Whisman, Davila, & Goodman, 2011). Fathers with more anxiety and depressive symptoms tend to report poor marital adjustment, lower proximity and communication, and higher conflict and ambivalence toward their pregnant partners (e.g., Gawlik, et al, 2014). Other studies point to the negative impact of depressive symptoms on perceived social support during pregnancy (e.g., Westdahl et al., 2007).

Based on previous studies with married couples, we did not expect gender differences in these associations since anxiety and depressive symptoms have been associated with marital adjustment for both men and women (Herr, Hammen, & Brennan, 2007; Whisman, Uebelacker, & Weinstock, 2004). However, it is possible that anxiety and depressive symptoms have similar detrimental effects on marital adjustment, but through different mechanisms. It is possible that anxiety may disrupt marital adjustment through feelings of

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fear or sense of failure that contribute to one's engagement in patterns of behaviors that elicit poor reactions from others or reduce opportunities for support and intimacy (e.g., strong demands for attention or controlling behaviors) (e.g., Whisman et al., 2004).

On the other hand, it is possible that depressive symptoms may disrupt marital adjustment through deficits in couple functioning, lack of support and availability, with more depressed individuals having a negative view not only of the self and the world, but also of their partner, which can contribute to spouse withdrawal (Fincham, Beach, Harold, & Osborne, 1997; Whisman et al., 2004). Using a qualitative study, Sharabi, Delaney, and Knobloch (2016) found that couples recognized that depressive symptoms may affect marital adjustment through different mechanisms such as negative emotional exchanges, diminished intimacy, communication difficulties, isolation, lack of energy/motivation, lack of understanding and uncertainty (Sharabi et al., 2016). For this reason, it is possible that depressive symptoms can have a stronger effect on marital adjustment than anxiety symptoms (Whisman et al., 2004).

Marital Adjustment and Antenatal Attachment to the Fetus

One important contributing factor for understanding levels of antenatal attachment to the fetus is related to levels of marital adjustment. As presented earlier, pregnancy is a time of profound changes capable of generating stress for both members of the couple. It is well-known that, during adulthood, romantic relationships are the main source of support to cope with stressful situations (e.g., Cutrona, 1996). The same seems to happen during pregnancy with most parents mentioning their partner as their greatest source of support (Widarsson, Kerstis, Sundquist, Engstrom & Sarkadi, 2012). As suggested by attachment theory, expectant mothers' feelings of being loved and supported by their partners increase their ability to love their child (Bowlby, 1980). In fact, some studies have shown that when one

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partner feels emotional distance and lacks support from the other partner, their adjustment to parenthood is negatively affected (Durkin, Morse, & Buist, 2001).

For this reason, several studies have explored the impact of marital adjustment on the development of antenatal attachment to the fetus. In this regard, mothers have been studied more often than fathers. Generally, studies have shown that lower levels of marital adjustment as well as lower levels of perceived support from partners are associated with lower levels of antenatal attachment to the fetus (Colpin, 1998; Condon & Corkindale, 1997; Figueiredo, 2014; Gomez & Leal, 2007; Karakoça & Ozkanb, 2017). Overall, results suggest that the establishment of a strong emotional bond with the fetus depends on a good relationship with the romantic partner characterized by feelings of closeness, support and satisfaction. Moreover, marital adjustment seems to be important in predicting antenatal attachment but not postnatal attachment to the baby. For instance, in one study, fathers who experienced better marital adjustment were more likely to be highly bonded to their unborn infant during pregnancy (Robson & Mandel, 1985). However, marital adjustment during pregnancy was not a significant predictor of attachment to the baby one year later (Robson & Mandel, 1985). The authors suggested that marital adjustment seems to have a greater effect on the relationship between the father and the unborn infant during pregnancy than on their relationship once the infant is born.

Other authors defended that the degree of marital adjustment may influence how husbands feel part of the pregnancy, influencing the father-child relationship more than the mother-child relationship (Slade, Cohen, Sadler, & Miller, 2009). As found in a previous study (Colpin, 1998), while mothers' antenatal attachment to the fetus was predicted by their marital adjustment as well as by their psychosocial well-being, for fathers their antenatal attachment to the fetus was predicted only by their marital adjustment. This seems to suggest that, contrary to mothers that are touched in a more personal way by pregnancy, fathers, in

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the absence of a real child, may be more directly involved with the fetus through their marital adjustment (Colpy, 1998). In sum, marital adjustment seems to have an important role on the process of adjustment to pregnancy in general, and to the bond established with the fetus during pregnancy in particular.

Marital Adjustment as a Mediator

This study goes beyond examining direct associations between anxiety and depressive symptoms and antenatal attachment to the fetus by trying to examine a potential mechanism through which these variables are related. In this study, marital adjustment is examined as a potential mechanism because it has been shown to be affected by pregnancy, an event that evokes changes and requires adaptation not only at the individual level but also in the relationship (Cowan & Cowan, 2000). As studies have shown, marital adjustment can decline not only after childbirth but also during pregnancy (e.g., Claxton & Jenkins, 2008), since pregnancy is already a demanding phase for both members of the couple.

Reasons for this decline can be of different nature. Two potential factors that contribute to this decline can be anxiety and depressive symptoms. Indeed, studies have shown that they are risk factors for poor marital relationship during pregnancy (e.g., Figueiredo et al., 2010; Whisman et al., 2011). Finally, studies have shown that marital adjustment can be a strong predictor of antenatal attachment to the fetus (e.g., Condon & Coarkindale, 1997; Figueiredo, 2014; Gomez & Leal, 2007; Karakoça & Ozkanb, 2017) which leads us to our final proposition that marital adjustment may act as a mechanism through which anxiety and depressive symptoms impact the development of the antenatal attachment to the fetus. To the best of our knowledge, no study has directly explored the mediating effects of marital adjustment.

The Present Study

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Having a child is a dyadic event since it involves both partners simultaneously and requires changes at both the individual and relational levels (Cowan & Cowan, 2000). Most studies have examined pregnancy-related variables from an individual perspective (especially from women). The objective of this study was to examine intrapersonal and interpersonal associations between antenatal anxiety and depressive symptoms and levels of antenatal attachment to the fetus during pregnancy. The mediating role of marital adjustment on these associations was also explored taking into account intrapersonal and interpersonal effects.

This study fills some gaps in the literature (1) by taking into account fathers' outcomes and their role on mothers' outcomes, since fathers have been relatively neglected by researchers (2) by testing the mediating role of marital adjustment as a potential explanatory mechanism through which anxiety and depressive symptoms are associated with levels of antenatal attachment to the fetus; and (3) by using the couple as the unit of analysis, which allows us to analyze these associations using a data analytic technique that takes into account the interdependence between the two members of the couple (i.e., the actor-partner interdependence model).

In terms of intrapersonal effects, we hypothesized that antenatal anxiety and depressive symptoms would be negatively associated with levels of antenatal attachment to the fetus for both mothers (Alhusen et al., 2012b; Condon & Corkindale, 1997; Goecke et al., 2012; Yarcheski et al., 2009) and fathers (Colpin, 1998; Vreeswijk et al., 2014) (H1). We also predicted that the link between antenatal anxiety and depressive symptoms and levels of antenatal attachment to the fetus would be mediated by levels of marital adjustment. Specifically, we expected that antenatal anxiety and depressive symptoms would be associated with poor marital adjustment (e.g., Gawlik, et al, 2014), which in turn would be associated with lower levels of antenatal attachment to the fetus for both members of the couple (Colpin, 1998; Condon & Carkindale, 1997; Figueiredo, 2014; Gomez & Leal, 2007)

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(H2). Based on previous studies exploring marital adjustment in married couples, we did not expect gender differences in these associations (Herr et al., 2007; Whisman et al., 2004).

To advance previous research, interpersonal effects were analyzed. There is a lack of empirical studies examining these effects. However, based on previous studies we expect that mothers' anxiety and depressive symptoms will be negatively associated with fathers' marital adjustment; and that fathers' anxiety and depressive symptoms will be negatively associated with mothers' marital adjustment (e.g., Whisman et al., 2004). Some cross-sectional and longitudinal studies have found interpersonal effects in which the presence of psychopathology in one partner was linked to poor marital satisfaction in the other partner. Moreover, in another recent study with couples expecting their first child, the dyadic coping of one partner influenced the marital adjustment of the other (Molgora, Acquati, Fenaroli, & Saita, 2018), supporting our expectation regarding the presence of interpersonal effects.

Because both partners are interconnected, interdependent and are involved in the pregnancy process, interpersonal effects are expected to exist. In fact, from a family system perspective, the family should be conceptualized as a dyad, in which its members are intensely connected (Kerr & Bowen, 1988). According to Bowen's theory, the unit of analysis should be the family system (or a family subsystem such as the couple), as one's thoughts, emotions and behaviors are often more determined by the involvement within the family (or couple) relationship system than by individual choices. For this reason, each member of the couple can only be understood in relation to the other (Kerr & Bowen, 1988).

Method

Participants

The participants were recruited between February 2015 and September 2017. Recruitment was done at different private and public clinics and hospitals in Lisbon and Oporto, the two greatest metropolitan areas of Portugal. Inclusion criteria for both partners

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were: to be at least 18 years old, to be expecting a baby, and to be involved in a romantic relationship. Same-sex couples were excluded.

A total of 320 heterosexual pregnant couples were recruited to participate in this study. The mean age for women was 31.35 ($SD = 5.52$; min 18, max 46) and the mean age for men was 33.28 ($SD = 5.76$; min 21, max 54). In terms of educational levels, 51% of women and 36% of men held a university degree, 37% of women and 37% of men had 12 years of education, and 12% of women and 27% of men had less than 12 years of education. The majority of women and men were first-time parents (58% and 57%, respectively). At the time of completing the questionnaire the mean gestation was 32.52 ($SD = 6.76$) weeks. Women and men had, on average, one child ($M = 1.29$; $SD = .64$, and $M = 1.41$; $SD = .72$, for mothers and fathers respectively).

Measures

All measures were completed in Portuguese. The demographic form included information regarding participants' age, gender, educational level, first-time pregnancy, and number of children.

Anxiety and depressive symptoms. Symptoms of anxiety and depression were assessed with the *Hospital Anxiety and Depression Scale* (HADS; Zigmond & Snaith, 1983; Portuguese version: Pais-Ribeiro et al., 2007), a 14-item questionnaire with scores for each item ranging from 0 to 3. Participants were asked to rate the frequency with which they had experienced symptoms of either anxiety (7 items; e.g., “I feel tense or ‘wound up’”; “I get a sort of frightened feeling as if something awful is about to happen”) or depression (7 items; e.g., “I still enjoy the things I used to enjoy”; “I feel as if I am slowed down”) over the past week. This scale has been used in hospitals and in the community. The cut-off points are the following: 0–7 normal, 8–10 mild, 11–14 moderate, and 15–21 severe symptoms (Zigmond & Snaith, 1983). The HADS has been correlated with quality of life dimensions, psychiatric

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morbidity and with physical symptoms (e.g., pain) in patients with different diseases (see Herrmann, 1997 for a review). The internal consistency of the scale has been high (especially, for the anxiety subscale), with Cronbach's alphas ranging from .67 to .93 (Bjelland, Dahl, Haug, & Neckelmann, 2002). The Cronbach's alpha for this sample was .78 for women and .77 for men (anxiety subscale) and .66 for women and .64 for men (depression subscale). Although acceptable, the internal consistency for the HADS depression subscale was not very high. This pattern was also found in other studies using HADS (e.g., Mihalca & Pilecka, 2015).

Marital adjustment. Marital adjustment was measured with the *Dyadic Adjustment Scale* (DAS; Spanier, 1976; Portuguese version: Gomez & Leal, 2008), a 32-item questionnaire scored on different Likert-type scales. It measures four dimensions of relationship adjustment: dyadic consensus (13 items; e.g., agreement in terms of family finances or major decisions), dyadic satisfaction (10 items; e.g., “How often do you discuss, or have you considered divorce, separation, or terminating your relationship?”), dyadic cohesion (5 items; e.g., “Do you and your mate engage in outside interests together?”), and dyadic affectional expression (4 items; e.g., “showing love”). The sum up of all items creates a total score of the relationship adjustment (ranging from 0 to 151). Higher scores indicate higher adjustment or less distress; the cut-off point for happily married couples is 114.8; the cut-off point for distressed couples is 98 (Spanier, 1976). The DAS has been associated with psychological distress, family functioning, and spousal support (e.g., Cano-Prous et al., 2014). The DAS was found to produce scores of good internal consistency with a mean of .92 from a pool of 403 studies (Graham, Liu, & Jeziorski, 2006). The alpha coefficient for this sample was .91 for women and .89 for men (total score).

Antenatal attachment to the fetus. Maternal and paternal antenatal bonding to the unborn baby was measured with the Maternal/Paternal Antenatal Attachment Scale (MAAS,

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PAAS; Condon, 2015; Portuguese versions: Gomez & Leal, 2007). The MAAS is composed of 19 items and the PAAS of 16 items scored on a 5-point Likert-scale. The items measured the participants' feelings, attitudes and behaviors towards the fetus. MAAS and PAAS assess two subscales: quality of attachment, including experiences of closeness, tenderness, pleasure in interaction and distress at hypothetical loss (e.g., *"when I think about the baby inside me I get feelings which are:"* from 1 (very sad) to 5 (very happy); *"I have felt"*: from 1 (very emotionally distant from my baby) to 5 (very emotionally close to my baby); and intensity of preoccupation, including amount of time spent thinking about, talking to, and dreaming about the fetus or caressing the belly (e.g., *"when I have spoken about, or thought about the baby inside me I got emotional feelings which were"*: from 1 (very weak or inexistent) to 5 (very strong); *"I have had dreams about the pregnancy or baby"*: from 1 (not at all) to 5 (almost every night). Because the Portuguese validation (through confirmatory factor analysis) did not find support for this multidimensional model, we used MAAS and PAAS as unidimensional scales, as suggested by the authors (Gomez & Leal, 2007). Antenatal attachment can be negatively affected by depressive and anxiety symptoms, and enhanced by marital relationship (Condon & Corkindale, Boyce & Gamble, 2013; Gomez & Leal, 2007). For fathers, it has been associated with greater infant involvement post-partum (Gomez & Leal, 2007). Good internal consistency for the total score has been found in several studies, ranging from .73 to .83 (e.g., Condon, 1993; Gomez & Leal, 2007). The alpha coefficient for this sample was .74 for women and .81 for men (total score).

Procedures

This study was approved by the Ethical Committee of the Center for Research in Psychology (CIP) from Universidade Autónoma de Lisboa Luís de Camões, by the Ethical Committees of the hospitals involved (public and private), and by the National Commission for Data Protection. Couples were given a written consent form and completed paper-and-

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pencil questionnaires in the presence of a researcher. Partners also completed paper-and-pencil questionnaires independently. The time required to complete the questionnaires varied between 15 to 30 minutes. Participants were volunteers and did not receive any kind of incentives or monetary compensation for their participation. Confidentiality was ensured.

Data Analytic Approach

SPSS and AMOS (version 23; IBM, SPSS Inc., Chicago, IL) were used to conduct the analysis. Prior to the main analyses, missing data were imputed through Expectation Maximization (EM), since none of the items had more than 5% of missing values and the missing pattern was completely at random (Little's MCAR tests $> .05$) (Tabachnick & Fidell, 2007).

The proposed mediational model was tested with the extended version of the Actor-Partner Interdependence Model with distinguishable dyads, the API Mediation Model (APIMeM) (Ledermann, Macho, & Kenny, 2011). This allows the estimation of actor and partner effects and assessing mediation in dyadic data. Our APIMeM was composed of eight variables and aimed to test the mediating role of relationship adjustment of both parents (two variables) on the association between mothers' and fathers' anxiety and depressive symptoms (4 variables) and mothers' and fathers' antenatal attachment (2 variables). Our model was tested with structural equation modelling (SEM) using the maximum likelihood robust estimation method. The overall fit of the model was assessed with the following goodness of fit indicators: the chi-square/df statistic (< 2.0), the Bentler comparative fit index (CFI), the goodness of fit index (GFI) ($> .90$), and the root mean square error of approximation (RMSEA; $< .07$) (Hooper, Coughlan, & Mullen, 2008). Finally, mediation was tested and quantified by estimating direct and indirect effects using bootstrap resampling procedures (MacKinnon, Lockwood, & Williams, 2004). Bias-corrected 95% confidence intervals (CI) for the unstandardized effects were obtained based on 5000 bootstrap samples (MacKinnon et

al., 2004). To examine whether the paths in the APIMeM model differed by gender, several equality constraint tests were conducted to compare actor and/or partner effects between women and men. For this purpose, the chi-square difference tests were examined. We set equal the corresponding paths for women and men (first actor and partner effects at the same time; then actor effects; and then partner effects). When a significant difference was found, we set equal the corresponding paths one pair at a time to identify which paths were equal and which paths were not equal.

Results

Preliminary Analysis

It is important to highlight that the majority of women and men in our sample did not meet criteria for a psychiatric disorder (Women: 8% experienced mild depressive symptoms, and 2% moderate depressive symptoms; none of them presented severe symptoms; 30% experienced moderate anxiety symptoms; 8% severe anxiety symptoms; and 2% severe anxiety symptoms; Men: 5% experienced mild depressive symptoms; and 1% moderate depressive symptoms; 16% experienced mild anxiety symptoms; 7% moderate anxiety symptoms; 2% severe anxiety symptoms).

The means, standard deviations and Pearson bivariate correlations of all variables for both women and men are presented in Table 1. The dependence of the partners' data were established by the significant correlations of parallel variables between mothers and fathers (i.e., within-dyad correlations). This means that the analytical strategy adopted should take into account the non-independence of the data. In terms of actor correlations, the same pattern was found for both mothers and fathers. Specifically, mothers' and fathers' anxiety symptoms were positively correlated with their depressive symptoms and negatively correlated with their dyadic adjustment levels. Mothers' and fathers' depressive symptoms were negatively correlated with their dyadic adjustment levels and their antenatal attachment

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levels. Mothers' and fathers' dyadic adjustment levels were positively correlated with their antenatal attachment levels.

(INSERT TABLE 1 AROUND HERE)

Regarding partner correlations, we found that mothers' anxiety symptoms were positively correlated with fathers' depressive symptoms and negatively correlated with fathers' dyadic adjustment levels. Mothers' depressive symptoms were positively correlated with fathers' depressive symptoms and negatively correlated with fathers' dyadic adjustment levels and fathers' antenatal attachment levels. Finally, mothers' dyadic adjustment levels were positively correlated with fathers' dyadic adjustment levels and fathers' antenatal attachment levels.

Actor and Partner Effects of Anxiety and Depressive Symptoms on Antenatal Attachment to the Fetus (APIM)

We fit an APIM model in which all the direct paths from partners' anxiety and depressive symptoms to levels of antenatal attachment to the fetus were tested. Several constraints were added among parallel actor and partner paths in order to test gender invariance. The results of chi-square difference tests showed that constraining the actor effects did not significantly worsen the model fit ($\chi^2(2) = 4.87; p = .09$) but constraining the partner effects did ($\chi^2(2) = 5.79; p = .05$). The final model with the actor paths constrained to make them equal for mothers and fathers (but not partner paths) showed a good fit to the data ($\chi^2/df = 2.44$; CFI = .995; GFI = .992; RMSEA = .067, 90% CI [.000, .145]). In terms of actor effects, we found a significant negative effect of mothers' and fathers' depressive symptoms on their own levels of antenatal attachment to the fetus. A significant positive effect of fathers' anxiety symptoms on their levels of antenatal attachment was also found. In terms of partner effects, mothers' anxiety and depressive symptoms were positively and negatively associated with their partners' levels of antenatal attachment to the fetus, respectively.

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Fathers' anxiety and depressive symptoms, however, were not associated with their partners' levels of antenatal attachment to the fetus.

Tests of Marital Adjustment as Mediator (APIMeM)

Next, the APIMeM model was tested. Again, for the APIMeM, several constraints were added among parallel actor and partner paths in order to test gender invariance (including paths to and from marital adjustment). The results of chi-square difference tests showed that constraining the actor effects to make them equal did significantly worsen the model fit ($\chi^2(5) = 19.72$; $p < .01$) but constraining the partner effects did not ($\chi^2(5) = 7.14$; $p = .13$), the exception being the constraining of one of the partner paths (from dyadic adjustment levels to antenatal attachment levels) that was not comparable for mothers and fathers and, for that reason, was freely estimated. In both models, the APIM and the APIMeM, the nonsignificant paths were retained in the model.

The significance of the indirect effects was tested using bootstrapping. Path coefficient estimates for this model (with actor effects freely estimated for all variables and partner effects constrained for all variables - exception being the path from dyadic adjustment to antenatal attachment levels) are presented in Figure 1. This final APIMeM showed a good fit to the data ($\chi^2/df = 1.79$; CFI = .994; GFI = .995; RMSEA = .050, 90% CI [.000, .108] and explained 8% of the variance in mothers' levels of antenatal attachment and 19% of the variance in fathers' levels of antenatal attachment. Based on bootstrap estimates, we identified two actor indirect effects and two partner indirect effects (See Table 2). Mothers' and fathers' depressive symptoms were associated with their own levels of antenatal attachment through their levels of dyadic adjustment, that is, more depressive symptoms were associated with lower levels of dyadic adjustment, which in turn were associated with lower levels of antenatal attachment to the fetus. Moreover, fathers' depressive symptoms were negatively associated with their partners' levels of antenatal attachment through their

partners' levels of dyadic adjustment. Specifically, fathers' depressive symptoms were associated with lower levels of dyadic adjustment for mothers, which in turn were associated with lower levels of antenatal attachment to the fetus. Finally, fathers' anxiety symptoms were negatively associated with their own levels of antenatal attachment through their own levels of dyadic adjustment¹.

Multigroup SEM tests showed that the mediational model did not differ across couples in their first vs subsequent pregnancy ($\chi^2(10) = 11.40; p = .327$) and across couples that faced vs did not face pregnancy complications ($\chi^2(10) = 14.04; p = .171$).

(INSERT TABLE 2 AROUND HERE)

(INSERT FIGURE 1 AROUND HERE)

Discussion

To our knowledge, the present study was the first to examine whether mothers' and fathers' antenatal anxiety and depressive symptoms were associated with their own and their partners' levels of antenatal attachment to the fetus; and whether this association was potentially mediated by marital adjustment. Despite its cross-sectional nature, this study has the advantage of gathering information from both mothers and fathers and of using a data analyzing technique that controlled for the non-independence of couple data (i.e., the APIMeM).

Consistent with the findings of prior studies that examined individual influences, depressive symptoms were negatively associated with levels of antenatal attachment to the

¹ A different model in which anxiety and depressive symptoms and dyadic adjustment was entered as correlated predictors of levels of antenatal attachment to the fetus was tested. Although the model also presented acceptable fit ($\chi^2/df = 1.73$; CFI = .99; GFI = .99; RMSEA = .05, 90% CI [.00, .13]), the use of the Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BI) to compare the models showed that our proposed model is more accurate in representing reality (Dziak, Coffman, Lanza, & Li, 2012). Although the AIC difference between the two models is weak (AIC difference = 0.32), the BIC difference is strong (BIC difference = 7) providing support for our proposed mediational model. An alternate model was also tested (i.e., anxiety and depressive symptoms as mediators of the link between dyadic adjustment and levels of antenatal attachment to the fetus). The lack of fit of the alternate model ($\chi^2/df = 26.06$; CFI = .66; GFI = .88; RMSEA = .28, 90% CI [.25, .32]) plus the AIC (193.33) and the BIC (178.258) strong difference between the two models provided evidence or supporting our proposed model as the most accurate model (Dziak et al., 2012).

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fetus for both mothers (Alhusen et al., 2012b; Condon & Corkindale, 1997; Goecke et al., 2012) and fathers (Vreeswijk et al., 2014). These results seem to suggest that depressive symptoms may be associated with mothers' and fathers' inability to experience positive bonding experiences with regards to the fetus. As Condon and Corkindale (1997) suggest, depressed people tend to feel detached from others, including from those for whom they feel affection.

For fathers, anxiety levels were also associated with their levels of antenatal attachment to the fetus but not in the expected direction (Vreeswijk et al., 2014). It is important to note, however, that at the bivariate levels this association was not significant. In the model, higher levels of anxiety were associated with higher levels of antenatal attachment to the fetus. Partner effects in the same direction were also observed. This is a surprising result since the majority of studies pointed to a detrimental effect of anxiety on the levels of antenatal attachment to the fetus (Condon & Corkindale, 1997; Vreeswijk et al., 2014). It is important to acknowledge that levels of anxiety are considered normal since the mean is below seven (Zigmond & Snaith, 1983); and the majority of mothers and fathers were first-time parents (58% and 57%, respectively), which means that these anxiety symptoms could be associated with parents' expectations regarding the baby and the parenthood. Yet, it is possible that higher levels of anxiety symptoms may serve as a warning sign that contributes to greater efforts and motivation to face pregnancy-demands, which may lead to a greater focus on the unborn baby and more efforts to keep their baby safe, cared for and protected. Moreover, anxiety is usually associated with higher levels of insecurity, which can contribute to constant worrying over the baby and the baby's health. This may have a stronger effect on fathers since they live the experience of pregnancy in a different way. Moreover, men usually feel excluded from antenatal care, which usually is focused on the pregnant women (Poh, Koh, Seow, & He, 2014). This can contribute to a lack of knowledge and, consequently,

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increase anxiety levels. It is important to note that both anxiety and depressive symptoms were low among this sample. For this reason, results should be interpreted with caution.

The results about the effects of anxiety and depressive symptoms on levels of antenatal attachment through marital adjustment give some support to our hypotheses. Specifically, antenatal anxiety (only in the case of fathers) and depressive symptoms were associated with lower levels of marital adjustment, which in turn were associated with lower levels of antenatal attachment for both mothers and fathers. As hypothesized, it seems that when antenatal anxiety (only for fathers) and depressive symptoms arise during pregnancy they may be negatively associated with couples' marital relationship (Figueiredo et al., 2010; Gawlik, et al, 2014; Whisman et al., 2011). In fact, it is possible that depressive symptoms may increase partner burden, generate stress in the marital relationship or even impair social support perceptions/provisions (e.g., Benazon & Coyne, 2000). Results seem to indicate that these problems in marital functioning appear to be negatively associated with the way mothers and fathers establish their bonds with their unborn child, which is in accordance with previous research (e.g., Condon & Carkindale, 1997, Karakoça & Ozkanb, 2017).

For fathers, it is important to note that when marital adjustment was introduced in the model, anxiety symptoms were negatively associated with antenatal attachment. It is possible that anxiety symptoms only produce negative effects on antenatal attachment levels when the symptoms impair their marital adjustment. In sum, our results seem to suggest that the marital relationship may have an important role in the way anxiety and depressive symptoms affect levels of antenatal attachment to the fetus. Especially for fathers who seem to live pregnancy in a different way possibly being more involved with the unborn baby through the relationship they have with their spouse (Colpy, 1998; Slade et al., 2009).

Also, it is important to note that, for women, not only their own depressive symptoms but also their partners' depressive symptoms were associated with their marital adjustment

and, consequently, with their levels of antenatal attachment to the fetus. Since during pregnancy women need more support, having a partner with more depressive symptoms and, consequently, less available to support them and less involved in the pregnancy (Sharabi et al., 2016), can contribute to decrease their marital adjustment, and, consequently, their levels of antenatal attachment to the fetus. These results also seem to suggest that, for women, depressive symptoms (not only their own symptoms but also their partners' symptoms) may have a stronger impact on marital adjustment than anxiety symptoms (Whisman et al., 2004); and, consequently, influence the relationship they establish with the unborn infant.

Limitations, Future Research and Implications

Findings should be interpreted with caution given some of the study's limitations. First, it is important to note that the couples' participation was voluntary, which means that those who accepted to participate were probably those who were more involved and/or satisfied with their pregnancy and/or marital relationship. It is possible that anxiety and depressive symptoms (that were not clinically significant - less than 7) are stronger and have more detrimental effects for those who are not satisfied or did not plan their pregnancy.

Second, despite the innovative focus using the dyad as the unit of analysis, the cross-sectional nature of this study does not allow to establish causal relations among the studied variables. This means that alternate models cannot be ruled out. Also, longitudinal studies should be conducted in order to explore directions of causality. Moreover, future studies should also explore the impact of anxiety and depressive symptoms on postnatal attachment levels using data from both mothers and fathers and testing the mediating effect of antenatal marital adjustment or other antenatal relational variables (e.g., social support) on these associations.

Third, we used self-report questionnaires, thus, answers could be influenced by social desirability or other forms of reporting bias. For this reason, other methods of data collection

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should be used in the future. Moreover, the internal consistency for the HADS depression subscale was not very high. The same pattern has been found in other studies. This may suggest that items from this subscale may not be capturing the real construct of depression. For this reason, results should be interpreted with caution. Indeed, researchers should further explore the role played by depressive symptoms using a more consistent instrument. Finally, levels of antenatal attachment to the fetus were assessed using MAAS and PAAS as unidimensional scales. However, it is important to acknowledge that the use of the two original dimensions could lead to some differences in the results.

Overall, our findings demonstrate that the implementation of a dyadic framework can bring a new level of understanding to complex associations among anxiety symptoms, depressive symptoms, marital adjustment and antenatal attachment in the context of pregnancy. Moreover, this study provides important contributions to clinical practice. Our results indicate that not only mothers but also fathers should be screened during pregnancy for levels of anxiety and depressive symptoms. Also, our results suggest that both members of the couple should be included in interventions offered during pregnancy, and marital relationship issues should be targeted in those interventions.

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