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**Erectile Dysfunction and Partner-Directed Behaviors in Romantic Relationships:
The Mediating Role of Suspicious Jealousy**

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Abstract

Erectile dysfunction (ED) has been shown to have a considerable impact on romantic relationships. The purpose of the present research was to examine whether the associations that ED had with men's mate retention behaviors, partner-directed insults, partner-directed violence, and injuries inflicted on the partner were mediated by suspicious jealousy but not reactive jealousy. These associations were examined using self-reports of men (Study 1) and partner-reports provided by women about their perceptions of their male partner (Study 2). The results of both studies indicated that suspicious jealousy (but not reactive jealousy) mediated the associations that ED had with the partner-directed behaviors of men in their romantic relationships. Specifically, higher levels of ED were associated with men experiencing (or being perceived to experience) more suspicious jealousy which, in turn, predicted their use of mate retention behaviors, partner-directed insults, and partner-directed violence as well as the infliction of injuries on their female partners. Discussion addresses the evolutionary implications of these associations, as well as limitations and directions for future research on ED.

Keywords: Erectile dysfunction; evolutionary psychology; jealousy; mate retention; partner-directed insults; intimate partner violence

Erectile Dysfunction and Partner-Directed Behaviors in Romantic Relationships: The Mediating Role of Suspicious Jealousy

Erectile dysfunction (ED) refers to the inability to maintain an erection sufficient for satisfactory sexual intercourse (NIH Consensus Development Panel on Impotence, 1993).

Although the risk of ED increases with age and is often comorbid with physical health problems (e.g., diabetes, heart disease; Nicolosi et al., 2003), it is not restricted to older men. For example, up to 10% of men under the age of 40 report ED (e.g., Lewis et al., 2010). ED is also often comorbid with psychological health problems in men (e.g., depression, anxiety) and with low sexual and emotional satisfaction in both men and their partners (Althof, 2002). In turn, sexual dissatisfaction is associated with overall relationship dissatisfaction (Young et al., 1998). Further, low relationship satisfaction is associated with infidelity (Pereira et al., 2014) as well as infidelity-related online behaviors (McDaniel et al., 2017).

Several theoretical perspectives have informed research on human sexual behavior and romantic relationships, including evolutionary psychology (Buss, 1989; Buss & Shackelford, 1997). From an evolutionary perspective, human sexual behavior is produced by adaptations designed to solve recurrent problems of reproduction faced by our ancestors (Buss & Schmitt, 1993). Sexual dysfunctions, including disorders such as ED, have likewise been addressed from several theoretical perspectives, including evolutionary psychology (Apostolou, 2015, 2016). In past research, evolutionary perspectives have motivated specific, novel hypotheses that may not have been developed otherwise. For instance, in an article exploring the causes of ED and sexual dysfunction, more generally, Apostolou (2015) uses an evolutionary perspective to argue that the modern prevalence of ED may be attributable to evolutionarily novel contexts, such as increased

average lifespan or environmental circumstances not faced by our ancestors. An evolutionary perspective may be similarly valuable for generating hypotheses about the causes and consequences of ED in modern romantic relationships.

ED is associated with issues such as hormonal imbalances (e.g., Lue, 2000) as well as psychological symptoms such as depression (e.g., Araujo, Durante, Feldman, Goldstein, & McKinlay, 1998) and anxiety (e.g., Hedon, 2003). ED also may be associated with jealousy (e.g., Cornwell & Laumann, 2011; Kingham & Gordon, 2004). For example, Kingham and Gordon (2004) argued that ED – along with other indicators of reduced sexual functioning – may be among the causes of “morbid jealousy” (i.e., irrational thoughts and emotions reflecting a preoccupation with the potential infidelity of one’s partner that are coupled with extreme and unacceptable behaviors motivated by the preoccupation). Easton and colleagues (2006) applied an evolutionary perspective to morbid jealousy, and argued that many features of normal jealousy overlap with features of morbid jealousy, which suggests that both may be evolved responses to suspected partner infidelity. This suggests that evolutionary perspectives may be able to provide insight into some of the psychological consequences of ED.

Sexual jealousy is an example of an evolved response to adaptive problems of reproduction faced by our ancestors. Specifically, men’s sexual jealousy may be an evolved response to the adaptive problems of partner infidelity and cuckoldry (i.e., unwitting investment in offspring to whom a man is genetically unrelated; Buss et al., 1992). Rydell and Bringle (2007) differentiated *reactive* jealousy from *suspicious* jealousy. Reactive jealousy occurs in response to incontrovertible evidence of betrayal, such as discovering a partner *in flagrante delicto*. Suspicious jealousy, in contrast, occurs in response to suspected infidelity without clear evidence. Suspicious jealousy is also associated with greater insecurity and lower self-esteem,

meaning that men may experience more suspicious jealousy if they perceive themselves to have lower mate value than their partner (Rydell & Bringle, 2007).

Although jealousy is believed to be an evolved response to infidelity, jealousy alone is unlikely to actually prevent partner infidelity. Rather, individuals often use “mate retention” behaviors in their intimate relationships, which function to prevent a partner from committing infidelity or leaving the relationship (Buss, 1988). For example, individuals engage in more mate retention behaviors when they are at greater risk of partner infidelity—such as when they perceive their partner to be highly attractive (e.g., Goetz et al., 2005; Starratt et al., 2007) or more attractive than themselves (Sela et al., 2017). Use of mate retention behaviors also may vary as a function of jealousy, with one study finding that anxious jealousy and preventative jealousy (which corresponds to suspicious jealousy in the Rydell and Bringle [2007] framework) but not reactive jealousy are associated with the use of cost-inflicting mate retention behaviors, such as guarding one’s partner and threatening same-sex rivals (Davis et al., 2018). Mate retention behaviors encompass a range of tactics that individuals use to prevent their partner’s infidelity, including threats, derogation of partner, and derogation of same-sex competitors (Buss, 1988; Buss & Shackelford, 1997).

One specific type of mate retention behavior explored from an evolutionary perspective is the use of verbal insults. For example, men may attempt to prevent infidelity by their partners through the use of verbal insults. Specifically, McKibbin and colleagues (2007) suggested that partner-directed insults function to lower the partner’s self-esteem, thereby reducing the likelihood that they will seek extra-pair sexual partners. Men’s use of partner-directed insults is positively correlated with their use of other mate retention behaviors (McKibbin et al., 2007) and sexual coercion (Lopes et al., 2019; Starratt et al., 2008). Additionally, a partner’s mate value is

associated with men's partner-directed insults such that women who indicate that their partners are lower in mate value also report that their partners inflict insults more frequently (Miner et al., 2008).

Another form of mate retention behavior that men sometimes use to prevent their partner's infidelity is physical violence or the threat of physical violence. Men's suspicion of partner infidelity is associated with their partner-directed violence (Kaighobadi & Shackelford, 2009). Further, in a study of morbidly jealous individuals, men were more likely than women to use violence against, attempt to murder, and actually murder their partners (Easton & Shackelford, 2009). Campbell and colleagues (2003) also found that women's risk of murder by an intimate partner increased when they left the relationship for another man, or when male sexual jealousy was otherwise evoked.

Men who suffer from ED report that the sexual dysfunction causes relationship problems (Althof, 2002), and such men may be at increased risk of a partner's infidelity and the associated adaptive costs (McDaniel et al., 2017; Pereira et al., 2014). In the present study, we sought to investigate whether men who experience ED do, in fact, perceive an increased risk of partner infidelity and, if so, whether and how men respond to this perceived risk. Regardless of whether ED was a recurrent adaptive problem for ancestral males, any detectable increase in risk of partner infidelity is expected to elicit a predictable set of evolved responses (e.g., mate retention behaviors; Buss, 1988; Buss & Shackelford, 1997). Further, ancestral males who performed a diverse range of behaviors to combat partner infidelity and cuckoldry risk likely achieved greater relative reproductive success as a consequence. For example, it is not possible to directly guard one's partner 100% of the time and, as a result, mate retention behaviors may not always be successful in preventing a partner's infidelity. Men also sometimes perform behaviors during

sexual intercourse that suggest the evolved function of “correcting” (rather than preventing) a partner’s infidelity by displacing the ejaculate of a potential rival, and via the strategic placement of one’s own, competing ejaculate (Shackelford, 2003). However, ED reduces (but does not entirely eliminate) a man’s ability to perform sexually and, in this way, compromises his ability to address the adaptive problem of cuckoldry that accompanies suspected partner infidelity (e.g., by having more consensual or coercive sex with a partner). This basic pattern is observed even among clinical samples (e.g., Carson et al., 2004) and older samples (50 to 75 years; e.g., Shiri et al., 2003) such that most men who experience ED do not report a complete inability to achieve erection. Thus, ED does not necessarily result in a total elimination of a man’s reproductive fitness. Still, men who suffer from even mild ED may be forced to rely more heavily on other means – such as mate retention behaviors – to prevent or discourage their partner’s infidelity.

Overview and Hypotheses

We conducted parallel multiple mediation analyses to determine the extent to which suspicious jealousy and reactive jealousy mediated the associations that ED had with several partner-directed behaviors. In Study 1, men completed self-report measures of ED, jealousy, mate retention behaviors, partner-directed insults, partner-directed violence, and injuries inflicted on their partner. In Study 2, women completed partner-report measures of these same variables (e.g., perceptions of their male partner’s ED). We expected that greater experience with ED would lead to greater feelings of suspicious jealousy for men which, in turn, would lead to more frequent use of mate retention behaviors, partner-directed insults, partner-directed violence, and injuries inflicted on their partner. Given that previous research has found suspicious jealousy (but not reactive jealousy) to be associated with lower self-esteem and greater frequency of mate retention behaviors, we did not expect reactive jealousy to mediate the associations that ED had

with mate retention behaviors, partner-directed insults, partner-directed violence, or injuries inflicted on their partner (Davis et al., 2018; Rydell & Bringle, 2007).

Our primary hypotheses for the present studies were that suspicious jealousy (but not reactive jealousy) would mediate the associations that ED had with men's partner-directed behaviors. That is, we expected the associations that ED had with many partner-directed behaviors – especially those that were aversive in nature such as cost-inflicting mate retention behaviors, partner-directed insults, partner-directed violence, and injuries inflicted on the partner – to be explained, at least in part, by suspicious jealousy. We did not have clear expectations regarding whether ED would have indirect associations with benefit-provisioning mate retention behaviors through either suspicious jealousy or reactive jealousy, but we examined these associations for exploratory purposes.

STUDY 1

The purpose of Study 1 was to examine whether the self-reported suspicious jealousy of men (but not their reactive jealousy) would mediate the associations that ED had with their self-reported partner-directed behaviors. More specifically, we expected that ED would lead men to report experiencing greater feelings of suspicious jealousy that, in turn, would promote more frequent use of mate retention behaviors, more frequent use of partner-directed insults, more frequent use of partner-directed violence, and more injuries inflicted on their partner. We focused only on the self-reported experiences of 18-45-year-old men in Study 1. Although the current average lifespan in the U.S. is approximately 78 years (World Development Indicators, 2021), archeological data suggests that the average lifespan of ancestral humans may have been around 30-40 years for those who survived past infancy (Finch, 2012). Therefore, the ability of selective forces to act on older men experiencing ED may have been limited over the course of

human evolutionary history. Our goal in focusing on the 18-45 age range was to assess the associations that ED had with jealousy and mate retention behaviors in men during their prime reproductive years, ideally obtaining the most accurate representations of evolved mechanisms.

Method

Participants and Procedure

Participants were 299 men recruited via Amazon's Mechanical Turk (MTurk) who participated in exchange for financial compensation (\$2.00 USD). In order to enhance the quality of our data, we restricted participation to those individuals who had successfully completed 90% or more of at least 100 previous MTurk jobs (see Peer, Vosgeru, & Acquisti, 2013, for the recommendation of similar MTurk filters). Participants were required to be heterosexual men between the ages of 18 and 45 years and currently in a romantic relationship of at least six months duration. Data were excluded for a total of 96 participants: 43 participants were excluded for reporting a sexual orientation other than "heterosexual," 2 participants were excluded for reporting they were not currently in a romantic relationship, 35 participants were excluded for reporting they were currently in a romantic relationship for less than 6 months, 2 participants were excluded for reporting they were over 45 years of age, and 62 participants were excluded for completing the survey in less than 10 minutes which suggested that they did not complete the survey with care (the average completion time was 30.96 minutes [$SD = 51.73$ minutes] after excluding participants who completed the survey in less than 10 minutes). We also examined the data for univariate outliers, multivariate outliers as assessed by Mahalanobis distance (De Maesschalck, Jouan-Rimbaud, & Massart, 2000), and inconsistent responding as assessed by inter-item standard deviation (Marjanovic, Holden, Struthers, Cribbie, & Greenglass, 2015) but no additional participants were excluded for those reasons (see Curran, 2016, for a review of

methods for detecting careless or inattentive responding). The final sample consisted of 203 heterosexual men from the United States with a mean age of 30.48 years ($SD = 5.03$) and a racial/ethnic composition as follows: 65.5% White, 12.8% Black, 6.4% Latino, 4.9% Asian, 7.4% Native American, 0.5% Middle Eastern, and 2.5% Biracial. Participants reported involvement in a romantic relationship lasting an average of 39.43 months ($SD = 47.54$).

Measures

Erectile Dysfunction. The International Index of Erectile Function (IIEF-5; Rosen et al., 1999) was used to assess erectile function over the past six months (5 items; e.g. “When you had erections with sexual stimulation, how often were your erections hard enough for penetration?” [$\alpha = 0.88$]). Participants were asked to respond to each question using a 5-point scale with specific anchors that differed across the items (e.g., 1 [*Almost never/never*] to 5 [*Almost always/always*]). Here and for all other measures used in the present studies, composite scores were created by calculating the average of the constituent items. Due to our interest in erectile dysfunction, we reverse-scored each of the IIEF-5 items so that higher scores for this measure indicated greater ED.

Jealousy. The Multidimensional Jealousy Scale (Pfeiffer & Wong, 1989; Rydell & Bringle, 2007) was used to assess *suspicious jealousy* (16 items; e.g., “I suspect that [my partner] may be attracted to someone else” [$\alpha = 0.98$]) and *reactive jealousy* (8 items; e.g., “[My partner] is flirting with someone of the opposite sex” [$\alpha = 0.92$]). Participants were asked to respond to each item using a 7-point scale with specific anchors that differed across the items (e.g., 1 [*never*] to 7 [*always*]).

Mate Retention Behaviors. Mate retention behaviors were measured using the Mate Retention Inventory-Short Form (MRI-SF; Buss, Shackelford, & McKibbin, 2008). The MRI-SF

assesses two types of mate retention: *cost-inflicting behaviors* (22 items; “Called to make sure my partner was where they said they would be” [$\alpha = 0.97$]) and *benefit-provisioning behaviors* (16 items; e.g. “Bought my partner an expensive gift” [$\alpha = 0.85$]). Participants were asked to report how frequently they had engaged in each behavior in the past year using a scale ranging from 1 (*never performed this act*) to 4 (*often performed this act*).

Partner-Directed Insults. The Partner-Directed Insult Scale (Goetz et al., 2006) was used to assess insults directed at a romantic partner (47 items; e.g. “I told my partner that she is fat” [$\alpha = 0.99$]). Participants were asked to report how frequently they had employed each insult using a scale ranging from 1 (*never*) to 6 (*25 or more times*).

Partner-Directed Violence. The Violence Assessment Index (Dobash et al., 1995, 1996) was used to assess how frequently participants reported using violence against their romantic partner (24 items; e.g. “Kicked partner in the body, arms, or legs” [$\alpha = 0.99$]). Participants were asked to report how frequently they had engaged in each behavior using a scale ranging from 1 (*Act NEVER occurred in this relationship*) to 6 (*Act occurred 11 OR MORE times in this relationship*).

Partner-Inflicted Injury. The Injury Assessment Index (Dobash et al., 1998) was used to assess how frequently participants had injured their romantic partner as a consequence of using violence against them (20 items; e.g. “Black eye” [$\alpha = 0.99$]). Participants were asked to report how frequently their partner had sustained various injuries using a scale ranging from 1 (*Partner NEVER sustained this injury as a result of my physical aggression*) to 6 (*Partner sustained this injury 11 OR MORE times as a result of my physical aggression*).

Results

Descriptive statistics and zero-order correlations are presented in Table 1. Given the present study's focus on ED, we thought it prudent to note that men's average self-reported levels of ED were relatively low ($M = 2.16$; $SD = 0.88$). We anticipated the possibility of low average levels of ED as a consequence of our upper age limit of 45 years, and indeed, previous work addressing sexual reproduction later in life has predicted a decline in male sexual function with increased age (e.g., Gray & Garcia, 2012). Still, the low average reported by our male participants should be highlighted in advance of the results of our statistical analyses. As the goal of the present study was to explore the associations that ED had with jealousy and mate retention behaviors, it is important that the subsequent discussion of our results is couched within the knowledge that our sample may not be representative of men who regularly experience ED.

ED had large positive correlations with suspicious jealousy, cost-inflicting behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury. In addition, ED had a small positive correlation with benefit-provisioning behaviors but it was not correlated with reactive jealousy. Suspicious jealousy had large positive correlations with cost-inflicting behaviors, benefit-provisioning behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury but it was not correlated with reactive jealousy. In contrast, reactive jealousy had a small negative correlation with cost-inflicting behaviors and a small positive correlation with benefit-provisioning behaviors but it was not correlated with partner-directed insults, partner-directed violence, or partner-inflicted injury.

Our hypotheses were consistent with an indirect effects model such that the associations that ED had with cost-inflicting behaviors, benefit-provisioning behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury were a function, at least in part, of suspicious jealousy but not reactive jealousy. This led us to conduct separate parallel multiple

mediation analyses for each partner-directed behavior in which ED served as the predictor with suspicious jealousy and reactive jealousy serving as the potential mediators. Direct and indirect effects were examined using model four of the PROCESS macro developed by Hayes (2018) which uses a bootstrap resampling process that is repeated 10,000 times to generate a 95% bootstrap confidence interval (CI). All the variables were standardized to aid with interpretation of the resulting coefficients. Although the parallel multiple mediation analyses were conducted separately for each partner-directed behavior, we present the results together in Figure 1 in the interest of parsimony. These analyses revealed that ED had a large positive association with suspicious jealousy ($a_1 = .63$, $SE = .06$, $t = 11.40$, $p < .001$, $CI_{95\%} [.52, .74]$) but was not associated with reactive jealousy ($a_2 = .14$, $SE = .07$, $t = 1.93$, $p = .06$, $CI_{95\%} [.52, .74]$).¹

Cost-Inflicting Behaviors

ED had a large positive association with cost-inflicting behaviors ($c_1 = .64$, $SE = .05$, $t = 11.95$, $p < .001$, $CI_{95\%} [.54, .75]$) that was reduced in magnitude – but still significant – when the mediators were included in the model ($c_1' = .12$, $SE = .04$, $t = 3.10$, $p = .002$, $CI_{95\%} [.04, .19]$). Suspicious jealousy had a large positive association with cost-inflicting behaviors ($b_1 = .83$, $SE = .04$, $t = 22.00$, $p < .001$, $CI_{95\%} [.75, .90]$), whereas reactive jealousy had a small negative association with cost-inflicting behaviors ($b_6 = -.06$, $SE = .05$, $t = -2.08$, $p = .04$, $CI_{95\%} [-.12, .00]$). ED had the expected indirect association with cost-inflicting behaviors through suspicious jealousy ($a_1b_1 = .52$, $SE = .05$, $z = 10.12$, $p < .001$, $CI_{95\%} [.42, .62]$) but not through reactive jealousy ($a_2b_6 = .01$, $SE = .01$, $z = 1.34$, $p = .18$, $CI_{95\%} [.00, .02]$).

¹ We conducted additional analyses in which we entered men's general physical health, heart health, and age as covariates. However, the inclusion of these covariates did not substantially alter the reported results. As a consequence, we reported the results of the analyses without these covariates in the interest of parsimony.

Benefit-Provisioning Behaviors

ED had a small positive association with benefit-provisioning behaviors ($c_2 = .27$, $SE = .07$, $t = 3.90$, $p < .001$, $CI_{95\%} [.13, .40]$) that did not persist when the mediators were included in the model ($c_2' = -.07$, $SE = .08$, $t = -0.88$, $p = .38$, $CI_{95\%} [-.22, .08]$). Suspicious jealousy had a large positive association with benefit-provisioning behaviors ($b_2 = .57$, $SE = .08$, $t = 7.42$, $p < .001$, $CI_{95\%} [.42, .72]$), whereas reactive jealousy had a small positive association with benefit-provisioning behaviors ($b_7 = .16$, $SE = .06$, $t = 2.66$, $p = .01$, $CI_{95\%} [.04, .28]$). ED had an indirect association with benefit-provisioning behaviors through suspicious jealousy ($a_1b_2 = .35$, $SE = .06$, $z = 6.20$, $p < .001$, $CI_{95\%} [.26, .47]$) but not through reactive jealousy ($a_2b_7 = -.02$, $SE = .01$, $z = -1.50$, $p = .13$, $CI_{95\%} [-.05, .00]$).

Partner-Directed Insults

ED had a large positive association with partner-directed insults ($c_3 = .56$, $SE = .06$, $t = 9.60$, $p < .001$, $CI_{95\%} [.45, .68]$) that was reduced in magnitude – but still significant – when the mediators were included in the model ($c_3' = .12$, $SE = .06$, $t = 2.09$, $p = .04$, $CI_{95\%} [.01, .24]$). Suspicious jealousy had a large positive association with partner-directed insults ($b_3 = .69$, $SE = .06$, $t = 12.06$, $p < .001$, $CI_{95\%} [.58, .81]$), whereas reactive jealousy was not associated with partner-directed insults ($b_8 = -.04$, $SE = .05$, $t = -0.98$, $p = .33$, $CI_{95\%} [-.13, .05]$). ED had the expected indirect association with partner-directed insults through suspicious jealousy ($a_1b_3 = .43$, $SE = .05$, $z = 8.27$, $p < .001$, $CI_{95\%} [.33, .56]$) but not through reactive jealousy ($a_2b_8 = .01$, $SE = .01$, $z = 0.79$, $p = .43$, $CI_{95\%} [-.01, .03]$).

Partner-Directed Violence

ED had a large positive association with partner-directed violence ($c_4 = .58$, $SE = .06$, $t = 10.15$, $p < .001$, $CI_{95\%} [.47, .70]$) that did not persist when the mediators were included in the

model ($c_4' = .09$, $SE = .05$, $t = 1.82$, $p = .07$, $CI_{95\%} [-.01, .19]$). Suspicious jealousy had a large positive association with partner-directed violence ($b_4 = .78$, $SE = .05$, $t = 15.59$, $p < .001$, $CI_{95\%} [.68, .87]$), whereas reactive jealousy was not associated with partner-directed violence ($b_9 = -.04$, $SE = .04$, $t = -0.93$, $p = .35$, $CI_{95\%} [-.11, .04]$). ED had the expected indirect association with partner-directed violence through suspicious jealousy ($a_1b_4 = .49$, $SE = .05$, $z = 9.19$, $p < .001$, $CI_{95\%} [.38, .61]$) but not through reactive jealousy ($a_2b_9 = .00$, $SE = .01$, $z = 0.76$, $p = .45$, $CI_{95\%} [-.01, .02]$).

Partner-Inflicted Injury

ED had a large positive association with partner-inflicted injury ($c_5 = .54$, $SE = .06$, $t = 9.08$, $p < .001$, $CI_{95\%} [.42, .66]$) that did not persist when the mediators were included in the model ($c_5' = .07$, $SE = .06$, $t = 1.30$, $p = .20$, $CI_{95\%} [-.04, .19]$). Suspicious jealousy had a large positive association with partner-inflicted injury ($b_5 = .74$, $SE = .06$, $t = 13.14$, $p < .001$, $CI_{95\%} [.63, .85]$), whereas reactive jealousy was not associated with partner-inflicted injury ($b_{10} = -.02$, $SE = .04$, $t = -0.51$, $p = .61$, $CI_{95\%} [-.11, .06]$). ED had the expected indirect association with partner-inflicted injury through suspicious jealousy ($a_1b_5 = .46$, $SE = .05$, $z = 8.60$, $p < .001$, $CI_{95\%} [.35, .60]$) but not through reactive jealousy ($a_2b_{10} = .00$, $SE = .01$, $z = 0.44$, $p = .66$, $CI_{95\%} [-.01, .02]$).

Discussion

The results of Study 1 supported the hypotheses that suspicious jealousy would mediate the associations that ED had with partner-directed behaviors. Greater self-reported experience with ED was associated with greater feelings of suspicious jealousy which, in turn, predicted the use of more mate retention behaviors, more frequent use of verbal insults directed towards one's partner, more frequent use of partner-directed violence, and more frequently inflicting injury on

one's partner. Although these results do not allow us to establish causal links between ED, suspicious jealousy, and partner-directed behaviors, these patterns do highlight the co-occurrence of these variables with one another.

STUDY 2

Study 2 was intended to replicate and extend the results of Study 1 by using women's *partner*-reports instead of men's *self*-reports. That is, Study 2 examined whether the perceived suspicious jealousy of men (but not their reactive jealousy) would mediate the associations that ED had with their partner-directed behaviors as reported by their female partners. Our decision to focus on the perceptions of women in Study 2 was an effort to increase the confidence in our findings from Study 1 by making certain they were not limited to the self-reported experiences of men.

Method

Participants and Procedure

Participants were 236 women recruited via MTurk who participated in exchange for financial compensation (\$2.00 USD). As in Study 1, we restricted participation to those individuals who had successfully completed 90% or more of at least 100 previous MTurk jobs (see Peer, Vosgeru, & Acquisti, 2013, for the recommendation of similar MTurk filters). Participants were required to be heterosexual women between the ages of 18 and 45 years currently in a romantic relationship of at least six months duration. Data were excluded for a total of 84 participants: 33 participants were excluded for reporting a sexual orientation other than "heterosexual," 8 participants were excluded for not completing the survey, 26 participants were excluded for reporting they were currently in a romantic relationship for less than 6 months, 1 participant was excluded for reporting she was over 45 years of age, 1 participant was excluded

for reporting she was under 18 years of age, and 15 participants were excluded for completing the survey in less than 10 minutes which suggested that they did not complete the survey with care (the average completion time was 27.69 minutes [$SD = 14.77$ minutes] after excluding participants who completed the survey in less than 10 minutes). As in Study 1, we also examined the data for univariate outliers, multivariate outliers, and inconsistent responding but no additional participants were excluded for those reasons. The final sample consisted of 152 heterosexual women from the United States with a mean age of 30.41 years ($SD = 4.77$) and a racial/ethnic composition as follows: 80.3% White, 11.8% Black, 1.3% Latino, 2.0% Asian, 2.6% Native American, and 2.0% Biracial. Participants reported involvement in a romantic relationship lasting an average of 50.52 months ($SD = 49.47$).

Measures

Erectile Dysfunction. A modified version of the IIEF-5 from Study 1 was used to assess the perceived ED of the male partner over the last six months ($\alpha = 0.87$). The modifications involved directing participants to consider their male partner. For example, the item “When you had erections with sexual stimulation, how often were your erections hard enough for penetration?” was replaced with “When your partner had erections with sexual stimulation, how often were your partner’s erections hard enough for penetration?” As in Study 1, we reverse-scored each of the items for the IIEF-5 so that higher scores for this measure indicated greater ED.

Jealousy. A modified version of the Multidimensional Jealousy Scale from Study 1 was used to assess perceptions of the male partner’s *suspicious jealousy* ($\alpha = 0.98$) and *reactive jealousy* ($\alpha = 0.91$). The modifications involved directing participants to consider the jealousy of their male partner rather than themselves. For example, the item “I suspect that [my partner] may

be attracted to someone else” was replaced with “[My partner] suspects that I may be attracted to someone else.”

Mate Retention Behaviors. A modified version of the MRI-SF from Study 1 was used to assess perceptions of the male partner’s *cost-inflicting behaviors* ($\alpha = 0.97$) and *benefit-provisioning behaviors* ($\alpha = 0.89$) over the past year. The modifications involved directing participants to consider the mate retention behaviors of their male partner rather than their own behaviors. For example, the item “Called to make sure my partner was where they said they would be” was replaced with “Called to make sure I was where I said I would be.”

Partner-Directed Insults. A modified version of the Partner-Directed Insult Scale from Study 1 was used to assess insults directed against the participant from the male partner ($\alpha = 0.99$). The modifications involved directing participants to consider the insults their male partner directed against them rather than the insults they directed against their partner. For example, the item “I told my partner that she is fat” was replaced with “My partner told me that I am fat.”

Partner-Directed Violence. A modified version of the Violence Assessment Index from Study 1 was used to assess perceptions of violence from the male partner ($\alpha = 0.99$). The modifications involved directing participants to consider the violence their male partner directed against them rather than the violence they directed against their partner. For example, the item “Kicked partner in the body, arms, or legs” was replaced with “Kicked me in the body, arms, or legs.”

Partner-Inflicted Injury. A modified version of the Injury Assessment Index from Study 1 was used to assess how frequently participants had been injured by their male partner as a consequence of having violence against them ($\alpha = 0.99$). The modifications involved directing

participants to consider the injuries they sustained by their partner rather than the injuries they inflicted on their partner (e.g., Black eye).

Results

Descriptive statistics and zero-order correlations are presented in Table 2. ED had large positive correlations with suspicious jealousy, cost-inflicting behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury. In addition, ED had a moderate positive correlation with benefit-provisioning behaviors but it was not correlated with reactive jealousy. Suspicious jealousy had large positive correlations with cost-inflicting behaviors, benefit-provisioning behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury as well as a small negative correlation with reactive jealousy. In contrast, reactive jealousy had a small negative correlation with cost-inflicting behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury, but was not correlated with benefit-provisioning behaviors.

As in Study 1, our hypotheses were consistent with an indirect effects model such that the associations that ED had with partner-directed behaviors were a function, at least in part, of suspicious jealousy but not reactive jealousy. To examine this possibility, we again examined direct and indirect effects using model four of the PROCESS macro. The results of these parallel multiple mediation analyses are presented together in Figure 2 even though the analyses were conducted separately for each outcome. These analyses revealed that ED had a large positive association with suspicious jealousy ($a_1 = .68$, $SE = .06$, $t = 11.36$, $p < .001$, $CI_{95\%} [.56, .80]$) but

was not associated with reactive jealousy ($a_2 = -.08$, $SE = .08$, $t = -0.99$, $p = .33$, $CI_{95\%} [-.24, .08]$).²

Cost-Inflicting Behaviors

ED had a large positive association with cost-inflicting behaviors ($c_1 = .66$, $SE = .06$, $t = 10.79$, $p < .001$, $CI_{95\%} [.54, .78]$) that was reduced in magnitude to non-significance when the mediators were included in the model ($c_1' = .08$, $SE = .05$, $t = 1.80$, $p = .07$, $CI_{95\%} [-.01, .17]$). Suspicious jealousy had a large positive association with cost-inflicting behaviors ($b_1 = .85$, $SE = .05$, $t = 18.17$, $p < .001$, $CI_{95\%} [.75, .94]$), whereas reactive jealousy was not associated with cost-inflicting behaviors ($b_6 = -.05$, $SE = .03$, $t = -1.36$, $p = .18$, $CI_{95\%} [-.11, .02]$). ED had the expected indirect association with cost-inflicting behaviors through suspicious jealousy ($a_1b_1 = .57$, $SE = .06$, $z = 9.62$, $p < .001$, $CI_{95\%} [.48, .67]$) but not through reactive jealousy ($a_2b_6 = .00$, $SE = .01$, $z = 0.69$, $p = .49$, $CI_{95\%} [.00, .02]$).

Benefit-Provisioning Behaviors

ED had a small positive association with benefit-provisioning behaviors ($c_2 = .28$, $SE = .08$, $t = 3.50$, $p < .001$, $CI_{95\%} [.12, .43]$) that did not persist when the mediators were included in the model ($c_2' = -.16$, $SE = .09$, $t = -1.65$, $p = .10$, $CI_{95\%} [-.34, .03]$). Suspicious jealousy had a large positive association with benefit-provisioning behaviors ($b_2 = .63$, $SE = .10$, $t = 6.61$, $p < .001$, $CI_{95\%} [.44, .82]$), whereas reactive jealousy was not associated with benefit-provisioning behaviors ($b_7 = -.04$, $SE = .07$, $t = -.53$, $p = .60$, $CI_{95\%} [-.18, .10]$). ED had an indirect association with benefit-provisioning behaviors through suspicious jealousy ($a_1b_2 = .43$, $SE = .08$, $z = 5.70$, p

² We conducted additional analyses in which we entered women's reports of their male partner's general physical health, heart health, and age as covariates. However, the inclusion of these covariates did not substantially alter the reported results. Similar to Study 1, we reported the results of the analyses without these covariates in the interest of parsimony.

< .001, $CI_{95\%}$ [.31, .56]) but not through reactive jealousy ($a_2b_7 = .00$, $SE = .01$, $z = 0.35$, $p = .35$, $CI_{95\%}$ [-0.01, .03]).

Partner-Directed Insults

ED had a large positive association with partner-directed insults ($c_3 = .61$, $SE = .06$, $t = 9.39$, $p < .001$, $CI_{95\%}$ [.48, .74]) that did not persist when the mediators were included in the model ($c_3' = .03$, $SE = .05$, $t = 0.48$, $p = .63$, $CI_{95\%}$ [-0.08, .13]). Suspicious jealousy had a large positive association with partner-directed insults ($b_3 = .85$, $SE = .06$, $t = 15.54$, $p < .001$, $CI_{95\%}$ [.75, .96]), whereas reactive jealousy was not associated with partner-directed insults ($b_8 = -.02$, $SE = .04$, $t = -0.40$, $p = .69$, $CI_{95\%}$ [-0.10, .06]). ED had the expected indirect association with partner-directed insults through suspicious jealousy ($a_1b_3 = .58$, $SE = .06$, $z = 9.16$, $p < .001$, $CI_{95\%}$ [.47, .70]) but not through reactive jealousy ($a_2b_8 = .00$, $SE = .00$, $z = 0.27$, $p = .79$, $CI_{95\%}$ [-0.01, .02]).

Partner-Directed Violence

ED had a large positive association with partner-directed violence ($c_4 = .65$, $SE = .06$, $t = 10.57$, $p < .001$, $CI_{95\%}$ [.53, .78]) that was reduced in magnitude – but still significant – when the mediators were included in the model ($c_4' = .13$, $SE = .06$, $t = 2.27$, $p = .02$, $CI_{95\%}$ [.05, .24]). Suspicious jealousy had a large positive association with partner-directed violence ($b_4 = .77$, $SE = .06$, $t = 13.64$, $p < .001$, $CI_{95\%}$ [.66, .88]), whereas reactive jealousy was not associated with partner-directed violence ($b_9 = -.03$, $SE = .04$, $t = -0.61$, $p = .54$, $CI_{95\%}$ [-0.12, .06]). ED had the expected indirect association with partner-directed violence through suspicious jealousy ($a_1b_4 = .52$, $SE = .06$, $z = 8.72$, $p < .001$, $CI_{95\%}$ [.41, .65]) but not through reactive jealousy ($a_2b_9 = .00$, $SE = .01$, $z = 0.39$, $p = .69$, $CI_{95\%}$ [-0.01, .01]).

Partner-Inflicted Injury

ED had a large positive association with partner-inflicted injury ($c_5 = .60$, $SE = .07$, $t = 9.18$, $p < .001$, $CI_{95\%} [.47, .73]$) that did not persist when the mediators were included in the model ($c_5' = .12$, $SE = .07$, $t = 1.60$, $p = .11$, $CI_{95\%} [-.03, .24]$). Suspicious jealousy had a large positive association with partner-inflicted injury ($b_5 = .72$, $SE = .07$, $t = 10.73$, $p < .001$, $CI_{95\%} [.59, .85]$), whereas reactive jealousy was not associated with partner-inflicted injury ($b_{10} = -.06$, $SE = .05$, $t = -1.13$, $p = .26$, $CI_{95\%} [-.15, .04]$). ED had the expected indirect association with partner-inflicted injury through suspicious jealousy ($a_1b_5 = .49$, $SE = .06$, $z = 7.79$, $p < .001$, $CI_{95\%} [.36, .62]$) but not through reactive jealousy ($a_2b_{10} = .00$, $SE = .01$, $z = 0.62$, $p = .54$, $CI_{95\%} [-.01, .02]$).

Discussion

The results of Study 2 were consistent with – but not identical to – those observed in Study 1. For example, the perceived suspicious jealousy of men (but not their reactive jealousy) consistently mediated the associations that ED had with their partner-directed behaviors. The consistency in the results between the two studies is notable because Study 1 focused on the self-reports of men, whereas Study 2 focused on the partner-reports provided by women about their perceptions of their male partners. However, there were also some differences between the results of the two studies. For example, ED had a direct association with partner-directed violence even when controlling for jealousy in Study 2 but this direct association did not emerge in Study 1. This suggests that there may be at least some differences in the perceptions of men and women with regard to the connections between ED, jealousy, and partner-directed behaviors.

GENERAL DISCUSSION

The purpose of the present research was to examine whether the suspicious jealousy of men (but not their reactive jealousy) mediated the associations that ED had with their partner-

directed behaviors in romantic relationships as reported by themselves (Study 1) and their female partners (Study 2). The results of the two studies firmly established the role that suspicious jealousy played in mediating the associations that ED had with mate retention behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injuries. Although there were some minor differences in the results between the two studies, the basic pattern that emerged suggests that suspicious jealousy plays an important role in the connections between ED and partner-directed behaviors in romantic relationships rather than merely being the result of biased reporting from either men or women.

Men who experienced more ED reported higher levels of suspicious jealousy which, in turn, was associated with more frequent use of cost-inflicting and benefit-provisioning behaviors, partner-directed insults, and partner-directed violence as well as the infliction of more injuries on their female partners. Women's partner-reports revealed a similar pattern. The pattern of results that emerged from the present studies suggests that men who experience ED may use a range of aversive partner-directed behaviors as a consequence of their suspicious jealousy. These partner-directed behaviors may serve to mitigate the disparity in mate value that men may perceive between themselves and their partners that may result from experience with ED. For example, partner-directed verbal insults may serve the specific function of reducing the self-perceived mate value of the female partner which may reduce her motivation for leaving the relationship or engaging in infidelity (McKibbin et al., 2007). Additionally, men may use violence – or the threat of violence – to discourage infidelity (Kaighobadi & Shackelford, 2009).

Previous research has documented that greater proportions of men than women are more upset when imagining their partner's sexual infidelity than when imagining their partner's emotional infidelity (e.g., Buss et al., 1992) and that men perform more mate retention behaviors

when they are at greater recurrent risk of experiencing sperm competition (due to partner infidelity; Starratt et al., 2007). Evolutionary theories posit that men perform these behaviors in order to reduce the risk that they will unwittingly invest time and resources in the offspring of other men. This explanation may also be applicable to the relationship between men's experience with ED and the suspicious jealousy they feel toward their partners. Although men who experience ED are not typically rendered entirely unable to have penile-vaginal intercourse with their partners, their ability to do so is certainly reduced. Any such reduction in a man's ability to have sex with his partner is a disadvantage in terms of sperm competition because he cannot successfully inseminate his partner with sperm to compete with rival male sperm, and because he also may experience a decline in mate value as a result of his inability to have sex. Mate retention behaviors such as partner-directed violence and insults may be some of the ways in which men manage the perceived increase in the risk of partner infidelity resulting from their experience with ED. A potential alternative explanation is that men feel threatened in their masculinity and relationship stability as a result of their experience with ED, and use mate retention behaviors to partially ameliorate these feelings. The connection between ED and low sexual satisfaction of partners (e.g., Althof, 2002) may explain why men who experience ED report elevated levels of suspicious jealousy and aversive partner-directed behaviors.

The hypotheses investigated in the present studies were informed by evolutionary psychological theory, and the results were interpreted using an adaptive lens. However, it is important to note that there are alternative theoretical perspectives which can be used to make sense of these results. For example, men's feelings of jealousy and their subsequent use of partner-directed behaviors may result from feelings of inadequacy following their experience with ED (Kingham & Gordon, 2004). Another possibility is that men may feel a sense of

threatened masculinity resulting from their experience with ED (as suggested by Carvalho et al., 2013) and use negative partner-directed behaviors as one strategy for mitigating those feelings. As is often the case with investigations of hypothesized adaptations, there is the possibility that the observed behaviors are the result of evolutionary byproducts, and should therefore be interpreted with caution.

Limitations and Future Directions

The present research has some notable strengths (e.g., captures the perspectives of both men and women) but it also has some important limitations. The first limitation is that we are unable to determine the direction of causality between ED, jealousy, and partner-directed behaviors due to the correlational nature of the present studies. The model that we adopted for our analyses was based on the assumption that the connections ED had with partner-directed behaviors would be explained, at least in part, by suspicious jealousy and the present results were consistent with these hypotheses. However, these results do not necessarily demonstrate the causal pattern that is implied by mediation because it is possible that other causal patterns could exist between these variables. For example, it is possible that suspicious jealousy could contribute to the development of ED rather than being a consequence of ED. It is also possible that one or more unexamined variables (e.g., perceived discrepancies between the mate value of men and their female partners) could play an important role in the connections between ED, jealousy, and partner-directed behaviors. Future research should focus on gaining a clearer understanding of the causal links between these variables by using experimental designs or longitudinal studies.

The second limitation of this research is that the levels of ED were relatively low in these studies, which is almost certainly a consequence of our decision to restrict the age range of our

participants to be between 18 and 45 years. More specifically, the average levels of ED were 2.16 in Study 1 and 2.02 in Study 2 with potential scores ranging from 1 to 5 (such that higher scores indicated more severe symptoms). It may be useful for future studies to examine whether similar patterns emerge in samples with more severe levels of ED and across a much wider range of ages. Research concerning the connections between ED, jealousy, and partner-directed behaviors in clinical samples of men who are seeking treatment for their ED symptoms may be particularly informative.

A third limitation of this research regards the instruments used to measure several of the constructs we investigated. For example, whereas all other partner-report measures used in the present study have been validated, and used in previous studies, the Multidimensional Jealousy Scale does not presently have a validated partner-report version. It is possible that this issue may partially account for the reduced efficacy of suspicious jealousy as a mediator in Study 2 (e.g., women may have had at least some difficulty recognizing the extent to which their male partners experienced suspicious jealousy). Further, the instruments used in the current study may not be the most comprehensive measures of the constructs they were intended to represent. Future research may wish to observe whether similar patterns of relationships emerge using alternate assessments of constructs such as jealousy and mate value.

The fourth limitation is that our sample sizes were modest and we relied on convenience samples recruited through MTurk. Researchers have expressed various concerns with the quality of data collected from MTurk in recent years (e.g., Chmielewski & Kucker, 2020; Hauser et al., 2018; Kennedy et al., 2020). Many of the instruments used in the present studies had high reliabilities (e.g., the internal consistency for the Partner-Directed Insult Scale was 0.99) and some of zero-order correlations were quite strong (e.g., ED had a strong positive association with

suspicious jealousy in both studies) which would be consistent with the concerns that have been raised about relying on data collected through MTurk. Although some of the internal consistency estimates for our instruments were high, it should be noted that previous research has sometimes found high internal consistencies for these instruments. For example, Goetz, Shackelford, Schipper, and Stewart-Williams (2006) observed internal consistencies of 0.91 for men and 0.93 for women on the Partner-Directed Insult Scale. Further, we screened the data using various criteria (e.g., we excluded participants who completed the study in less than 10 minutes) but it would have been useful for us to incorporate other indicators of fraudulent or inattentive responding (e.g., directed-response items such as “Select ‘2’ as your response if you are reading this item”). As a result, it would be beneficial for future research in this area to replicate and extend the present results using larger and more diverse samples that are recruited through means other than MTurk.

Future studies that involve a more diverse array of participants in terms of their age and relationship length would allow for a more nuanced understanding of whether the connections between ED, jealousy, and partner-directed behaviors depend on the ages of the people involved in the relationship or the stability of the relationship. For example, is there a stronger association between ED and suspicious jealousy for younger men than for older men? Does ED more readily lead to suspicious jealousy when men are paired with female partners who they perceive as being highly attractive to other men? Does being involved in a stable, committed relationship impact the likelihood that men experiencing ED will also experience suspicious jealousy or engage in aversive behaviors intended to prevent their female partners from engaging in infidelity (e.g., cost-inflicting mate retention behaviors)? These are questions that should be addressed in future studies. An additional complication of our sample is the possibility of differences across

populations. As our sample was primarily drawn from large, Western populations, our results may not be indicative of small-scale societies and their experience with ED. Indeed, there may be considerable factors such as access to medical care or dietary habits that could be responsible for differences in experience with ED across populations. Although empirical investigations of ED in small-scale societies have been conducted (e.g., Gray & Campbell, 2005), further investigation is needed to better understand the prevalence and correlates of ED in non-Western populations.

The fifth limitation is that we relied on independent samples of men and women in the present studies. That is, the male participants in Study 1 were not partnered with the female participants in Study 2. An avenue for future research would be to use a dyadic design (i.e. collect data from both members of the same romantic couple) because that approach may provide additional information about the connections between ED, jealousy, and partner-directed behaviors. For example, a dyadic design would allow researchers to investigate whether romantic partners had similar perceptions of the impact of ED on their relationship.

CONCLUSION

The results of the present research suggest that suspicious jealousy mediates the associations that ED has with several partner-directed behaviors in romantic relationships (e.g., the use of cost-inflicting mate retention behaviors). By applying an evolutionary perspective, we were able to generate hypotheses about the alternate strategies men who experience ED may use to prevent partner infidelity or desertion. The present research indicates that men's mate retention behaviors, partner-directed insults, and partner-directed violence may be aspects of evolved male psychology that have been co-opted to address the evolutionarily novel issue of ED.

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Table 1
Study 1 (Men's Self-Reports): Intercorrelations and Descriptive Statistics

	1	2	3	4	5	6	7	8
1. Erectile Dysfunction	—							
2. Suspicious Jealousy	.63***	—						
3. Reactive Jealousy	-.14	-.03	—					
4. Cost-Inflicting Behaviors	.65***	.90***	-.12***	—				
5. Benefit-Provisioning Behaviors	.27***	.52***	.15*	.65***	—			
6. Partner-Directed Insults	.56***	.77***	-.08	.76***	.45***	—		
7. Partner-Directed Violence	.58***	.83***	-.08	.80***	.47***	.86***	—	
8. Partner-Inflicted Injury	.54***	.79***	-.06	.75***	.45***	.88***	.92***	—
<i>Mean</i>	2.16	3.22	4.43	2.15	2.69	2.24	2.38	2.13
<i>Standard Deviation</i>	0.88	1.71	1.29	0.81	0.52	1.42	1.58	1.49

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

Note: $n = 203$ men.

Table 2
Study 2 (Women's Partner Reports): Intercorrelations and Descriptive Statistics

	1	2	3	4	5	6	7	8
1. Erectile Dysfunction	—							
2. Suspicious Jealousy	.68***	—						
3. Reactive Jealousy	-.08	-.17*	—					
4. Cost-Inflicting Behaviors	.66***	.91***	-.20*	—				
5. Benefit-Provisioning Behaviors	.28**	.53***	-.13	.66***	—			
6. Partner-Directed Insults	.61***	.88***	-.17*	.81***	.77***	—		
7. Partner-Directed Violence	.65***	.86***	-.17*	.80***	.44***	.91***	—	
8. Partner-Inflicted Injury	.60***	.80***	-.19*	.75***	.45***	.87***	.94***	—
<i>Mean</i>	2.02	2.90	4.64	2.00	2.52	2.19	2.22	1.99
<i>Standard Deviation</i>	0.84	1.76	1.21	0.86	0.60	1.41	1.48	1.43

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

Note: $n = 152$ women.

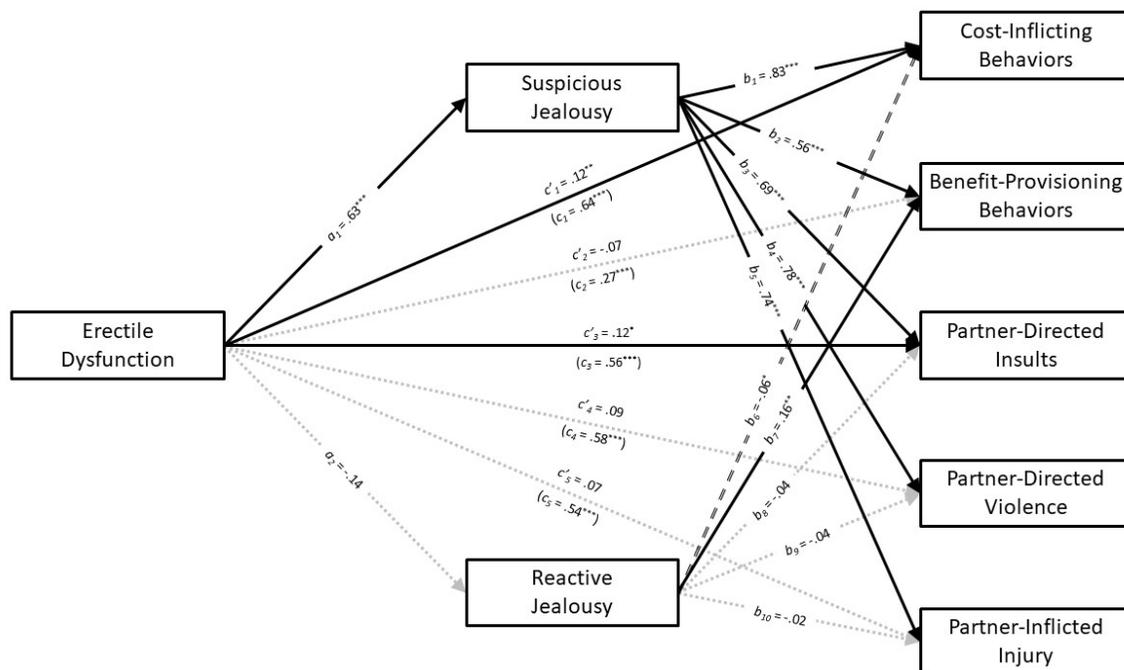


Figure 1. *Study 1 (Men's Self-Reports):* The results of the parallel multiple mediation analyses with suspicious jealousy and reactive jealousy mediating the associations that erectile dysfunction had with mate retention behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury. *Notes:* The significant positive associations are indicated by solid black arrows. The significant negative associations are indicated by dashed black arrows. The dotted gray lines represent nonsignificant associations. * $p < .05$; ** $p < .01$; *** $p < .001$; $n = 203$ men.

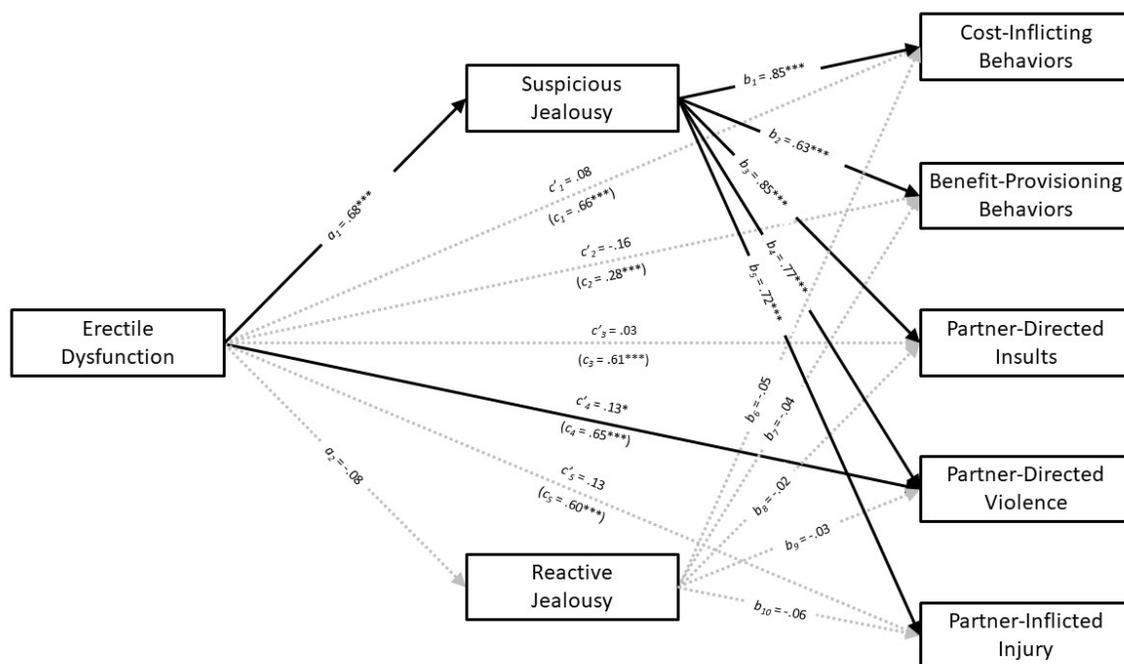


Figure 2. *Study 2 (Women's Partner Reports):* The results of the parallel multiple mediation analyses with suspicious jealousy and reactive jealousy mediating the associations that erectile dysfunction had with mate retention behaviors, partner-directed insults, partner-directed violence, and partner-inflicted injury. *Notes:* The significant positive associations are indicated by solid black arrows. The significant negative associations are indicated by dashed black arrows. The dotted gray lines represent nonsignificant associations. * $p < .05$; ** $p < .01$; *** $p < .001$; $n = 152$ women.