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Sperm Competition Risk: The Connections that Partner Attractiveness and Infidelity Risk have with Mate Retention Behaviors and Semen-Displacing Behaviors

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Abstract

The present studies investigated the relationships between men's perceived risk of experiencing sperm competition (i.e., when the ejaculates of two or more men simultaneously occupy the reproductive tract of a single woman), and their use of strategies to detect, prevent, and correct their partner's sexual infidelity. We investigated these associations using self-reports provided by men (Study 1, n = 113), partner-reports provided by women (Study 2, n = 136), and dyadic reports (Study 3, n = 103 couples). The results of these studies indicated that the attractiveness of women was consistently associated with men's use of benefit-provisioning mate retention behaviors (e.g., buying expensive gifts for one's partner, showing signs of physical affection) and semen-displacing behaviors (e.g., deeper copulatory thrusting, more thrusts during copulation), whereas the infidelity risk of women was often associated with men's use of cost-inflicting mate retention behaviors (e.g., threatening to end the relationship, monopolization of partner's free time). Discussion addresses the evolutionary implications of these results, including the possibility that men use both benefit-provisioning mate retention behaviors and semen displacing-behaviors when they perceive their partner to be more attractive, ostensibly as a way to mitigate their risk of sperm competition. Discussion also explores the extent to which these results extend those of previous studies concerning sperm competition risk.

Keywords: Sperm competition; semen displacement; extrapair copulation; evolutionary psychology; sexual psychology

Sperm Competition Risk: The Connections that Partner Attractiveness and Infidelity Risk have with Mate Retention Behaviors and Semen-Displacing Behaviors

Men in long-term heterosexual relationships historically faced the adaptive problem of avoiding cuckoldry, or the unwitting investment of resources into offspring to whom they are genetically unrelated (e.g., Symons, 1979). The selective pressures imposed by cuckoldry may have resulted in evolved psychological mechanisms that motivate behaviors intended to mitigate the risk of cuckoldry (e.g., Buss, 2002; Buss & Shackelford, 1997). Buss (1988) identified tactics that men use when they perceive an increased risk of their partner's infidelity or desertion, and these tactics can be categorized into benefit-provisioning and cost-inflicting behaviors. Whereas benefit-provisioning mate retention encompasses behaviors prospectively intended to prevent relationship infidelity or dissolution by improving relationship satisfaction (e.g., "Bought my partner an expensive gift"), cost-inflicting mate retention encompasses behaviors intended to reduce the likelihood of relationship infidelity or dissolution, even at the expense of relationship harmony (e.g., "Snooped through my partner's personal belongings").

Multiple studies have provided evidence for the association between men's perceived risk of partner infidelity and their use of mate retention behaviors, which is consistent with the hypothesis that mate retention behaviors are the result of evolved psychological mechanisms intended to prevent partner infidelity, and reduce the risk of cuckoldry. For example, men with younger, more attractive female partners, and who perceive themselves to be at increased risk of partner infidelity, report more frequent use of mate retention behaviors (Barbaro et al., 2019; Buss & Shackelford, 1997; Goetz et al., 2005). Because younger, more attractive women tend to be found more sexually desirable by men (e.g., Buss, 1989; Shackelford et al., 2005), men with younger, more attractive partners are predicted to be at increased risk of partner infidelity and

should be more motivated to deploy preventative measures against potential partner infidelity. Men's risk of partner infidelity also increases as the proportion of time spent apart from their partner since the couple's last in-pair copulation increases. The time that partners spend apart from each other may reasonably be categorized as distinct from other forms of sperm competition risk. Whereas female partner's attractiveness may constitute risk in the sense that they are more likely to be solicited by extra-pair men, time spent apart may constitute risk because it affords more opportunities for infidelity. Accordingly, men engage in more mate retention behaviors as the proportion of time away from their partner since their last in-pair copulation increases (Starratt et al., 2007). The evidence suggests not only that male sexual jealousy and suspicion are associated with increased perceived and actual risk of a female partner's infidelity, but also that these feelings of jealousy and suspicion motivate the use of mate retention behaviors.

Whether a female partner's infidelity is real or imagined, prevention tactics such as mate retention behaviors are not the only tools at men's disposal. Specifically, men may still "correct" their partner's infidelity with sexual behaviors that mitigate their risk of cuckoldry. Men's infidelity-correcting behaviors include displacing the semen of rival males from the reproductive tract of their female partner. Because semen displacement necessitates sexual intercourse, an important aspect of men's infidelity correction concerns their motivation to have sex with their partner. The likelihood of a female partner's infidelity increases as the proportion of time spent away from her increases (Baker & Bellis, 1995) and, accordingly, men who have spent a greater proportion of time away from their partner since their most recent in-pair copulation rate their partner as being more attractive, and express greater interest in copulating with their partner (Shackelford et al., 2002). Intimate partner sexual coercion and rape provides further evidence

for men's motivation to have sex with their partner following suspicions of her infidelity. Previous research has shown that men's use of sexually coercive behaviors is positively associated with their female partner's infidelity (measured as women's past infidelity and likelihood of future infidelity; Goetz & Shackelford, 2006, 2009). These studies provide evidence of psychological mechanisms that motivate a man to copulate with his partner as soon as possible following a period of separation, or when he suspects that his partner may have recently engaged in infidelity. By having sex with his partner following a period of separation, or a suspected infidelity, a man may mitigate his risk of cuckoldry in several important ways.

Having sex with one's female partner following infidelity is necessary but may not be sufficient for semen displacement, and some evidence has suggested that men perform specific behaviors during sex that function to facilitate semen displacement. For example, Gallup and colleagues observed that semen displacement varied as a function of thrusting depth (using artificial penises, vaginas, and semen), with more semen being displaced when the artificial penis was fully inserted (compared to 75% of the penis being inserted) and no semen displacement taking place when only 25% or 50% of the artificial penis was inserted. In the same study, Gallup and colleagues surveyed college students and found that, for couples who had sexual intercourse following accusations of female partner infidelity, both men and women reported that the male partner thrusted deeper and more quickly than was typical (compared to previous in-pair copulations). Additionally, Goetz and colleagues (2005) surveyed heterosexual men in committed, romantic relationships regarding their most recent in-pair copulation, and observed that the number of thrusts, depth of the deepest thrust, average depth of thrust, and duration of sexual intercourse were all positively associated with the female partner's risk of exposing her male partner to sperm competition (operationally defined as men's perceptions of their female

partner's physical and sexual attractiveness). Goetz and colleagues also provided evidence that men employ prevention and correction tactics simultaneously, showing that men's use of several mate retention tactics were positively associated with their performance of semen-displacing behaviors.

Goetz et al. (2005) provided preliminary evidence for the connection between perceived risk of sperm competition, and tactics to prevent or correct the female partner's infidelity. However, this study also had several limitations. One limitation is that Goetz and colleagues relied on men's perceived risk of experiencing sperm competition and men's self-reports of mate retention and semen-displacing behaviors. Additionally, rather than group mate retention behaviors into the two categories of benefit-provisioning and cost-inflicting, Goetz and colleagues analyzed associations between perceived risk of sperm competition and each of 19 tactics of mate retention. Although this approach provided valuable information regarding the associations between perceived risk of sperm competition and the individual tactics of mate retention, there may be merit in organizing these tactics into the two broader categories of mate retention. Arguably, the most notable limitation of the study conducted by Goetz and colleagues was reliance on a measure of sperm competition risk that included 4 items, each of which focused on men's perceptions of their female partner's attractiveness. This measure may be problematic because it focuses exclusively on men's perceptions of sperm competition risk, which may not reflect actual risk of experiencing sperm competition. Further, focusing on the attractiveness of the female partner captures just one aspect of sperm competition risk, and ignores the potential infidelity risk associated with, for example, a female partner's time spent with other men, previous sexual involvement with extra-pair men, and interest in future infidelity (Baker & Bellis, 1995; Goetz & Shackelford, 2006, 2009). Although the female partner's

attractiveness is an important aspect of sperm competition risk (at least, in terms of men's perceived risk), other correlates or indicators of risk should also be considered. The present research aimed to replicate the results of Goetz and colleagues, and address these limitations.

Overview and Hypotheses

The present research was intended to replicate and extend the work of Goetz and colleagues (2005) using improved methodologies and more representative samples. We expected to replicate the pattern of results reported by Goetz et al. such that risk of sperm competition would be positively associated with men's use of benefit-provisioning and cost-inflicting mate retention behaviors as well as their use of semen-displacing behaviors. Although one goal of the present research was to improve the methods used by Goetz and colleagues, it is important to note that in all three studies, our replication of Goetz et al. was largely conceptual. Specifically, we investigated benefit-provisioning and cost-inflicting mate retention behaviors, rather than the associations that sperm competition risk had with the 19 mate retention tactics. Additionally, we did not investigate the association between risk of sperm competition and individual semen-displacing behaviors, but rather, the association that sperm competition risk had with a composite measure of semen-displacing behaviors. Finally, we used a measure of sperm competition risk that was intended to be a more comprehensive measure of men's risk of experiencing sperm competition that included items concerning the female partner's attractiveness (similar to Goetz et al.) as well as the female partner's infidelity risk (e.g., her sexual and romantic interest in men outside of the committed relationship, the time she spends with male friends and coworkers).

STUDY 1: MEN'S REPORTS

The purpose of Study 1 was to examine whether men's risk of experiencing sperm competition was related to their use of mate retention behaviors and semen-displacing behaviors. Specifically, we expected that the perceived risk of sperm competition would predict men's use of benefit-provisioning behaviors, cost-inflicting behaviors, and semen-displacing behaviors.

Method

Participants and Procedure

Participants for each of the present studies were recruited from Prolific and participated in exchange for financial compensation ($10.00 USD). Our decision to use Prolific was partially motivated by previous experiences receiving lower-quality data from other online data collection platforms such as Amazon's Mechanical Turk. Other researchers have provided evidence that data collection via Prolific results in higher-quality data in terms of participant attention, honesty, and reliability (Palan & Schitter, 2018; Peer et al., 2022). The data reported in each of our studies were collected in September 2020 as part of a larger project concerning whether erectile dysfunction is associated with jealousy and partner-directed behaviors (e.g., partner-directed violence). Part of that larger project has been reported elsewhere (i.e., *BLINDED FOR REVIEW*), but the present studies are focused on sperm competition risk which was not included in the previous report. The initial sample for Study 1 included 375 male participants. However, 156 participants were excluded because they had a romantic partner who also participated in this study. In other words, these participants qualified for participation in Study 3, which focused on sperm competition risk and mate retention behaviors in romantic dyads. In addition, 17 participants were excluded for failing to complete the survey, 6 participants were excluded for reporting they were currently in a romantic relationship for less than 6 months, and 61 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 69.35 minutes [*SD* = 31.84 minutes] after excluding participants who completed the survey in less than 10 minutes). This resulted in a sample of 135 men. Data were excluded for 2 participants for failing to correctly complete two or more directed-response items that were included in the instruments to detect inattentive responding (e.g., "For this item, please select '1' as your response"). Data for 3 participants were removed for being univariate outliers, and 4 participants were excluded for inconsistent responding as assessed by inter-item standard deviation (Marjanovic et al., 2015). We also examined the data for multivariate outliers as assessed by Mahalanobis distance (De Maesschalck et al., 2000) but no additional participants were excluded for this reason. The final sample of 126 men had a mean relationship length of 3.63 years (*SD* = 4.29; *range* = 6 months-36 years; *Median* = 2.63 years). The mean age for men was 25.94 years (*SD* = 7.55; *range* = 18-65 years) and the racial/ethnic composition of the male participants was 80.2% White, 4.0% Asian, 7.1% Hispanic, 7.1% Black, and 1.6% multi-racial.

Measures

Sperm Competition Risk. Participants were asked to respond to 11 items regarding their female partners. We then conducted an exploratory factor analysis using principal components, varimax rotation, and fixing two factors for extraction (based on the assumption that perceptions of attractiveness would be distinct from other cues to potential infidelity). The first factor captured men's perceptions of their female partner's *attractiveness* (5 items; "Thinking about your partner at this moment in time, how physically attractive do you think she is?" "Thinking about your partner at this moment in time, how sexually attractive do you think she is?" "Thinking about your partner at this moment in time, how sexually attractive do other men think she is?" "Thinking about your partner at this moment in time, how sexually attracted is she to

you?" "At this moment in time, how interested are you in having sexual intercourse with your partner?" [α = .78]). The second factor captured men's suspicions of their female partner's *infidelity risk* (6 items; "As far as you know, has your current partner had sexual intercourse with someone other than you since you have been involved in a relationship together?" "As far as you know, has your current partner fallen in love with someone other than you since you have been involved in a relationship together?" "As far as you know, how much time does your partner currently spend with her male friends?" "As far as you know, how much time does your partner currently spend with her male coworkers?" "Thinking about your partner at this moment in time, how physically attractive do other men think she is?" "Thinking about your partner at this moment in time, how sexually attracted is she to other men?" [α = .50]). Participants were asked to respond using a 10-point scale with anchors that varied across items (e.g., 1 [*much less physically attractive than usual*] to 10 [*much more physically attractive than usual*]).

Mate Retention Behaviors. The self-reported mate retention behaviors of participants were measured using the Mate Retention Inventory-Short Form (MRI-SF; Buss et al., 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" [α = .85]) and *benefit-provisioning behaviors* (16 items; e.g., "Bought my partner an expensive gift" [α = .78]). 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*).

Semen-Displacing Behaviors. Participants were asked a series of questions regarding the semen-displacing behaviors they performed during their most recent sexual intercourse with their partner. Following Goetz et al. (2005), we calculated the aggregate of 4 items (i.e., "In comparison to what is typical for you, how many thrusts did you make during sexual

intercourse? That is, how many times did you push your penis into your partner's vagina?" "In comparison to what is typical for you, how deep was your deepest thrust of your penis into your partner's vagina?" "In comparison to what is typical for you, how deep were your thrusts of your penis into your partner's vagina, on average?" "In comparison to what is typical, how long did sexual intercourse with your partner last?" [α = .82]). Participants responded using a 10-point scale with anchors that varied across items (e.g., 1 [*many fewer thrusts than is typical for me*] to 10 [*many more thrusts than is typical for me*]).

Results

The zero-order correlations between the study variables are presented in Table 1. A series of multiple regression analyses were conducted to examine the unique associations that perceived attractiveness and perceived infidelity risk had with benefit-provisioning behaviors, cost-inflicting behaviors, and semen-displacing behaviors. The results of these analyses are presented in Table 1. Perceived attractiveness was positively associated with benefit-provisioning behaviors and semen-displacing behaviors, but it was not associated with cost-inflicting behaviors. In contrast, perceived infidelity risk was not associated with benefit-provisioning behaviors, cost-inflicting behaviors, or semen-displacing behaviors.

Discussion

The results of Study 1 partially corroborated the results of Goetz et al. (2005). Specifically, we observed that men's perceptions of their female partner's attractiveness predicted their use of benefit-provisioning behaviors and semen-displacing behaviors, but not cost-inflicting behaviors. Additionally, men's perceptions of their partner's infidelity risk was not associated with benefit-provisioning behaviors, cost-inflicting behaviors, or semen-displacing behaviors. This pattern of results provides preliminary evidence that certain cues

related to sperm competition risk (i.e., perceived attractiveness of the female partner) are more important for predicting benefit-provisioning behaviors and semen-displacement behaviors than other aspects of sperm competition risk (i.e., perceived infidelity risk). Here, it is also important to note that the items composing our measures of sperm competition risk are each, to some degree, based on men's perceptions of and inferences about their female partner's behaviors. In other words, these measures are not intended to assess "actual" sperm competition risk, and our results should be interpreted with this in mind. Nevertheless, we believe that our approach was appropriate for the present research as men's perceived risk of experiencing sperm competition should be more relevant to their use of mate retention behaviors and semen-displacement behaviors than is their "actual" risk.

STUDY 2: WOMEN'S REPORTS

The purpose of Study 2 was to replicate and extend the results of Study 1 using reports from an independent sample of women. Specifically, we expected that women's self-reports of their attractiveness and infidelity risk would predict their perceptions of their male partner's use of benefit-provisioning behaviors, cost-inflicting behaviors, and semen-displacing behaviors.

Method

Participants and Procedure

The initial sample for Study 2 included 368 female participants. However, 156 participants were excluded because they had a romantic partner who also participated in this study (i.e., those participants qualified for participation in Study 3, which focused on sperm competition risk and mate retention behaviors in romantic dyads). In addition, 17 participants were excluded for failing to complete the survey, 6 participants were excluded for reporting they were currently in a romantic relationship for less than 6 months, and 26 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 76.14 minutes [SD = 196.00 minutes] after excluding participants who completed the survey in less than 10 minutes). This resulted in a sample of 163 participants. Data were excluded for 8 additional participants for being univariate outliers, and 1 participant for inconsistent responding. We analyzed the data for multivariate outliers, but no participants were excluded for this reason. Data were excluded for 1 participant for failing to correctly complete two or more directed-response items that were included in the instruments to detect inattentive responding (e.g., "For this item, please select '1' as your response"). The final sample of 153 participants had a mean relationship length of 4.02 years (*SD* = 3.68; *range* = 6 months-25 years; *Median* = 2.67 years). The mean age for participants was 27.07 years (*SD* = 8.42; *range* = 18-61 years) and the racial/ethnic composition of the participants was 77.8% White, 5.9% Asian, 2.6% Hispanic, 9.8% Black, 3.3% multi-racial, and 0.7% other.

Measures

Sperm Competition Risk. A modified version of the sperm competition risk measure from Study 1 was used to assess sperm competition risk. The modifications involved directing female participants to report on their own attractiveness and infidelity risk. For example, the item "Thinking about your partner at this moment in time, how physically attractive do you think she is?" was replaced with "Thinking about yourself at this moment in time, how physically attractive does your partner think you are?" As in Study 1, we focused on attractiveness (α = .81) and infidelity risk (α = .57).

Mate Retention Behaviors. Participants reported the frequency of their male partner's use of mate retention behaviors using the partner-report version of the MRI-SF (Buss et al., 2008)

from Study 1. Participants reported the frequency of their male partner's *cost-inflicting behaviors* (22 items; "Called to make sure I was where I said I'd be" [$\alpha = .85$]) and *benefit-provisioning behaviors* (16 items; e.g. "Bought me an expensive gift" [$\alpha = .85$]). Participants were asked to report how frequently their male partner 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*).

Semen-Displacing Behaviors. A modified version of the semen-displacing behavior measure from Study 1 was used to assess women's perceptions of their male partner's semen-displacing behaviors. For example, the item "In comparison to what is typical for you, how many thrusts did you make during sexual intercourse? That is, how many times did you push your penis into your partner's vagina?" was replaced with "In comparison to what is typical for your partner, how many thrusts did your partner make during sexual intercourse? That is, how many times did your partner push his penis into your vagina?" Following Goetz et al. (2005), we calculated the aggregate of 3 items ($\alpha = .79$). This measure was originally intended to include 4 items, but one of these items had to be removed due to an error in the survey.

Results

The zero-order correlations and regression coefficients are presented in Table 2. The self-reported attractiveness of women was positively associated with perceptions of their male partner's benefit-provisioning behaviors and semen-displacing behaviors, but it was not associated with perceptions of their male partner's cost-inflicting behaviors. In contrast, the self-reported infidelity risk of women was positively associated with perceptions of their male partner's cost-inflicting behaviors, but it was not associated with perceptions of their male partner's benefit-provisioning behaviors or semen-displacing behaviors.

Discussion

The results of Study 2 were largely consistent with the results of Study 1, and with the results of Goetz et al. (2005). Notably, women's self-reports of their own attractiveness were associated with their perceptions of their partner's use of benefit-provisioning mate retention behaviors and semen-displacing behaviors, but not their partner's use of cost-inflicting mate retention behaviors. This pattern is similar to the results that emerged in Study 1 using men's reports. However, women's self-reports of their own infidelity risk were positively associated with their perceptions of their partner's use of cost-inflicting mate retention behaviors even though this association did not emerge using men's reports in Study 1. Taken together, these results show that women who perceive themselves as physically attractive view their male partners as using strategies that increase or maintain relationship harmony (e.g., benefit-provisioning behaviors), whereas women who perceive themselves to be more likely to engage in infidelity view their male partners as engaging in more cost-inflicting behaviors.

STUDY 3: DYADIC REPORTS

The purpose of Study 3 was to replicate and extend the results of Studies 1 and 2 using a sample of men and women in committed romantic relationships. Specifically, we expected that the risk of sperm competition would predict men's use of benefit-provisioning behaviors, cost-inflicting behaviors, and semen-displacing behaviors according to the reports of men and their female partners.

Method

Participants and Procedure

Participants were 300 community members (i.e., 150 heterosexual romantic couples) recruited from Prolific who participated in exchange for financial compensation ($10.00 USD). All participants reported that they were involved in a committed heterosexual relationship for a

minimum of 6 months. Participants completed measures of sperm competition risk, mate retention behaviors, and semen-displacing behaviors via a secure website. Participants were instructed to provide this information separately (i.e., one partner was not supposed to be aware of the specific responses provided by their partner). Data were excluded for 14 couples because at least one member of the couple failed to correctly complete two or more directed-response items that were included in the instruments to detect inattentive responding (e.g., "For this item, please select '1' as your response"). In addition, data were excluded for 13 other couples due to at least one member of the couple being a univariate outlier for at least one of the variables (i.e., more than three standard deviations above or below the mean for the sample), and data from 1 couple were excluded due to at least one member of the couple being a multivariate outlier. Data were excluded for 5 couples because at least one member of the couple was an inconsistent responder. Data were excluded for 10 couples because at least one member of the couple did not complete all items assessed for the present study. Data were excluded for 2 couples because both members of the couple reported the same sex (e.g., both members of the couple reported that they were male). Data were excluded for 2 couples because men reported that their partner was less than 18 years old. The final sample of 103 couples had a mean relationship length of 4.09 years (*SD* = 3.60; *range* = 6 months-19 years; *Median* = 3.33 years). The mean age for men was 27.17 years (*SD* = 7.75; *range* = 18-60 years) and the racial/ethnic composition of the male participants was 80.6% White, 4.9% Asian, 3.9% Hispanic, 3.9% Black, 1.9% Middle Eastern, and 4.9% multi-racial. The mean age for women was 26.22 years (*SD* = 7.45; *range* = 18-58 years) and the racial/ethnic composition of the female participants was 78.6% White, 4.9% Asian, 8.7% Hispanic, 2.9% Black, 1% Middle Eastern, and 3.9% multi-racial.

Measures

Sperm Competition Risk. Men completed the measures of perceived attractiveness (α = .75) and perceived infidelity risk (α = .63) from Study 1, whereas women completed the measures of self-reported attractiveness (α = .76) and self-reported infidelity risk (α = .62) from Study 2.

Mate Retention Behaviors. Men completed the measure of their use of cost-inflicting behaviors (α = .89) and benefit-provisioning behaviors (α = .83) from Study 1, whereas women completed the measure of their male partner's use of cost-inflicting behaviors (α = .86) and benefit-provisioning behaviors (α = .84) from Study 2.

Semen-Displacing Behaviors. Men completed the measure of their use of semen-displacing behaviors from Study 1 (α = .80), whereas women completed the measure of their male partner's use of semen-displacing behaviors from Study 2 (α = .77).

Results

The zero-order correlations and regression coefficients are presented in Table 3. Men's perceptions of their female partner's attractiveness were positively associated with their self-reported use of benefit-provisioning behaviors and semen-displacing behaviors as well as their female partner's perceptions of their use of benefit-provisioning behaviors, but it was not associated with their self-reported use of cost-inflicting behaviors or their female partner's perceptions of their use of cost-inflicting behaviors or semen-displacing behaviors. In contrast, men's perceptions of their female partner's infidelity risk were positively associated with their self-reported use of cost-inflicting behaviors, but it was not associated with their self-reported use of benefit-provisioning behaviors or semen-displacing behaviors nor was it associated with their female partner's perceptions of their use of benefit-provisioning behaviors, cost-inflicting behaviors, or semen-displacing behaviors.

Women's self-reported attractiveness was positively associated with their perceptions of their male partner's use of benefit-provisioning behaviors and semen-displacing behaviors, but it was not associated with their perceptions of their male partner's use of cost-inflicting behaviors or their male partner's self-reported use of benefit-provisioning behaviors, cost-inflicting behaviors, or semen-displacing behaviors. Women's self-reported infidelity risk was not associated with their male partner's use of benefit-provisioning behaviors, cost-inflicting behaviors, or semen-displacing behaviors according to the self-reports of the men or the perceptions of the women.

Discussion

The results of Study 3 partially corroborated the results of Goetz et al. (2005) and the results of Studies 1 and 2. Following the results of Study 1, men's perceptions of their female partner's attractiveness predicted men's self-reported use of benefit-provisioning mate retention and semen-displacing behaviors, whereas men's reports of their partner's infidelity risk predicted men's self-reported use of cost-inflicting mate retention behaviors. Following the results of Study 2, women's self-reports of their attractiveness were associated with their perceptions of their male partner's benefit-provisioning and semen-displacing behaviors.

GENERAL DISCUSSION

The goal of the present research was to replicate and extend the work of Goetz et al. (2005) using reports of men (Study 1), women (Study 2), and romantic dyads (Study 3). We extended previous work in this area by employing a more comprehensive assessment of perceived sperm competition risk than the assessment used in previous research. More specifically, we focused on both the perceived attractiveness of women as well as their perceived infidelity risk as distinguishable aspects of sperm competition risk. Men's perceptions of their

female partner's attractiveness predicted their self-reported use of benefit-provisioning and semen-displacing behaviors in Studies 1 and 3, whereas men's suspicion of their female partner's infidelity risk was associated with their self-reported use of cost-inflicting behaviors in Study 3 (but not Study 1). Similar patterns emerged for women such that their self-reported attractiveness was associated with their perceptions of their male partner's use of benefit-provisioning and semen-displacing behaviors (Studies 2 and 3), whereas their self-reported infidelity risk was associated with their perceptions of their male partner's use of cost-inflicting behaviors in Study 2, but not in Study 3. These results are largely consistent with the results of Goetz and colleagues, who surveyed samples of men from the United States and Germany and found that men's perceived risk of experiencing sperm competition had a positive association with men's use of several mate retention tactics and their use of certain semen-displacing behaviors (e.g., number of thrusts).

Taken together, the pattern of results that emerged from the present research supports evolutionary predictions regarding the link between perceived risk of sperm competition and men's use of strategies to mitigate this perceived risk. Specifically, sperm competition theory (e.g., Parker, 1970; Baker & Bellis, 1995) predicts that men will be more likely to employ these strategies when they perceive themselves to be at increased risk of experiencing sperm competition. However, the present research also adds important context to this relationship, showing that the type of strategies men employ may, at least in part, depend on the specific cues to potential sperm competition. In particular, our results showed that men's perceptions of their female partner's attractiveness predicted their use of benefit-provisioning and semen-displacing behaviors, whereas men's suspicions of their female partner's potential for infidelity sometimes predicted their use of cost-inflicting mate retention behaviors. Thus, the results of these studies

suggest that a multi-dimensional perspective of sperm competition risk may be useful for predicting the different types of strategies men sometimes use to mitigate their risk of experiencing sperm competition. However, the present research identified only two components of sperm competition risk (i.e., attractiveness and infidelity risk), and found inconsistent support for the relationship between infidelity risk and cost-inflicting mate retention behaviors. Future research should attempt to identify additional components of sperm competition risk, and the extent to which any such components are associated with relationship outcomes.

Overall, our results suggest that men with relatively more attractive partners are more likely to use strategies that mitigate their risk of experiencing sperm competition, without creating relationship disharmony, and that men who suspect their partners of being at greater risk for engaging in infidelity may be more willing to employ cost-inflicting strategies. This pattern of results suggests that men who perceive their partners to be higher in mate value are less likely to employ a cost-inflicting mate retention strategy, presumably because such partners would have more opportunities to desert the relationship or seek extra-pair mates if they become dissatisfied. Thus, men with more attractive partners opt to mitigate their risk of experiencing sperm competition via increased relationship harmony, rather than more aversive mate retention tactics. However, our results also provided preliminary evidence that infidelity risk is more predictive of men's use of cost-inflicting mate retention than is perceived attractiveness. This pattern suggests that, even for men who have attractive patterns, the presence of certain cues (e.g., the female partner's time spent with other men, suspicion of past infidelity) may influence men's use of more aversive mate retention tactics. These results are in line with previous research showing a link between suspicious jealousy, and men's use of aversive, partner-directed behaviors like physical and verbal aggression (*BLINDED FOR REVIEW*). Thus, the results of

the present research, and those of previous studies, indicate that men may escalate to more severe forms of mate guarding as their perceived risk of sperm competition increases.

The results of the present study should be interpreted with caution. Notably, our use of a factor analysis to identify different dimensions of perceived sperm competition risk was exploratory, and not theory-guided. This may explain the relatively low internal consistency for the infidelity risk measure across the present studies. Although the items that formed the infidelity risk factor seemed reasonable, additional research should examine whether there are better ways to assess infidelity risk (e.g., altering some of the items that we used) or even more specific components of infidelity risk (e.g., it may be advantageous to separate the items concerning the female partner's time spent with male friends and coworkers from those items concerning her previous infidelities or interest in future infidelities). These issues related to the measurement of infidelity risk may, at least in part, explain the inconsistent association that infidelity risk had with cost-inflicting behaviors across the present studies.

The present research also extended previous work by securing women's reports. Although there were some discrepancies in the results, the reports of women generally mirrored those of men. That the relationships observed in the present research emerged according to the reports of both men and women indicates that these relationships are not merely the result of male bias or underreporting. Indeed, our results highlight the importance of securing reports from both men and women when investigating behaviors in long-term, heterosexual relationships.

Limitations and Future Direction

The present research improved and extended the work of Goetz et al. (2005) in several notable ways. For example, the present research collected reports from men (Study 1), women

(Study 2), and romantic dyads (Study 3), whereas Goetz and colleagues relied exclusively on reports from men. Additionally, we used a more comprehensive measure of perceived sperm competition risk than the measure used by Goetz and colleagues which focused specifically on the perceived attractiveness of the female partner. We also collected data via Prolific, which has been shown to produce higher-quality data than other online data collection platforms (e.g., Palan & Schitter, 2018; Peer et al., 2022). Still, the present research also contained some important limitations. The first limitation is that we diverged considerably from the methodologies employed by Goetz et al. (2005). Notably, due to a mistake in our Qualtrics survey, we were unable to ask women about their partner's deepest copulatory thrust at their last in-pair copulation. As a result, our composite measure of semen-displacing behaviors reported by women diverged slightly from the measure used by Goetz and colleagues. Additionally, although our 2-factor measure of perceived risk of sperm competition was more comprehensive than the measure used by Goetz et al. and included all four of the items used in Goetz et al.'s measure, it is important to note that the measure used in the present research differed from the measure used by Goetz and colleagues. As a result, we cannot make definitive statements about the extent to which our results replicate those of Goetz and colleagues.

The second limitation is that our results may have been impacted by underreporting. Specifically, men in Studies 1 and 3 may have underreported the frequency with which they use certain mate retention behaviors, especially the more aversive, cost-inflicting behaviors, and women in Studies 2 and 3 may have underreported certain attitudes and behaviors (e.g., their extra-pair sexual involvement, their romantic interest in other men). Indeed, previous research has suggested that men underreport their use of certain partner-directed behaviors, such as partner-directed violence (e.g., Dobash et al., 1998). We attempted to mitigate the problems

associated with underreporting by collecting dyadic reports from men and women in romantic relationships, and the zero-order correlations in Study 3 suggest moderate to strong agreement between couples (see Table 4). However, because Studies 1 and 2 secured independent reports from men and women, we do not know the extent to which these reports matched the experiences of their romantic partners. Thus, underreporting of several behaviors by both men and women may have impacted the results of the present research, and future research should take steps to encourage accurate, honest reporting by participants.

Finally, our measure of perceived sperm competition risk has not been validated. Further, this was, to our knowledge, the first study to adopt a multi-dimensional approach to assessing aspects of sperm competition risk. This factor analysis was exploratory and, although the results of our analysis seem to have produced two distinct dimensions of sperm competition risk, this approach needs to be replicated because the evolutionary literature needs a valid and reliable measure of this construct.

CONCLUSION

We examined the associations that women's attractiveness and infidelity risk had with men's use of mate retention and semen-displacing behaviors. The results of the present research suggest that women's attractiveness and infidelity risk may be linked with divergent responses such that attractiveness is associated with men's use of benefit-provisioning and semen-displacing behaviors, whereas infidelity risk tends to be associated with men's use of cost-inflicting behaviors. Although sperm competition risk is often conceptualized as a unidimensional construct, these results suggest that it may actually be multi-dimensional and that the different components of sperm competition risk may have distinct implications for men's use of various behaviors in their romantic relationships.

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Table 1

Study 1 (Men's Reports): Zero-order correlations and standardized regression coefficients

	Benefit-Provisioning Behaviors		Cost-Inflicting Behaviors		Semen-Displacing Behaviors	
	r	*β*	*r*	*β*	*r*	*β*
Perceived Attractiveness	.38***	.36***	.08	.06	.34***	.35***
Perceived Infidelity Risk	.17	.11	.13	.12	.02	-.04
R^2		.16***		.02		.12***

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

Table 2

Study 2 (Women's Reports): Zero-order correlations and standardized regression coefficients

	Perceptions of Male Partner's Benefit-Provisioning Behaviors		Perceptions of Male Partner's Cost-Inflicting Behaviors		Perceptions of Male Partner's Semen-Displacing Behaviors	
	r	*β*	*r*	*β*	*r*	*β*
Self-Reported Attractiveness	.44***	.43***	.03	-.02	.43***	.43***
Self-Reported Infidelity Risk	.11	.02	.26***	.27***	.08	-.01
R^2		.19***		.07**		.19***

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

Table 3

Study 3 (Dyadic Reports): Zero-order correlations and standardized regression coefficients

	Men's Reports						Women's Reports					
	Self-Reported Benefit-Provisioning Behaviors		Self-Reported Cost-Inflicting Behaviors		Self-Reported Semen-Displacing Behaviors		Perceived Benefit-Provisioning Behaviors		Perceived Cost-Inflicting Behaviors		Perceived Semen-Displacing Behaviors	
	r	*β*	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Men's Reports												
Perceived Attractiveness	.44***	.37***	.10	.01	.37***	.27*	.32***	.21*	-.10	-.11	.12	.01
Perceived Infidelity Risk	-.04	-.03	.34***	.33***	.24*	.20	-.10	-.12	.11	.01	.07	.09
Women's Reports												
Self-Reported Attractiveness	.32***	.20	.10	.09	.27**	.15	.39***	.31***	-.02	-.03	.23*	.24*
Self-Reported Infidelity Risk	-.08	-.14	.21*	.03	.16	.00	.00	-.03	.22*	.23	.05	-.06
R^2		.49***		.13*		.19***		.44***		.06		.06

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

Table 4

Study 3 (Dyadic Reports): Intercorrelations between partnered men and women

	r
Attractiveness	.43***
Infidelity risk	.51***
Benefit-provisioning mate retention	.62***
Cost-inflicting mate retention	.54***
Semen-displacing behaviors	.30**

*p < 0.05. **p < 0.01. ***p < .001

Note: *n* = 103 dyads