



Sperm competition in marriage: Semen displacement, male rivals, and spousal discrepancy in sexual interest



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ABSTRACT

Non-human males attend to the presence of potential sexual rivals in the local environment to assess sperm competition risk, and adjust accordingly the deployment of sperm competition tactics (e.g., performing semen-displacing copulatory behaviors). We extend this research to humans using data from 45 married couples who completed questionnaires in a laboratory. We found that husbands whose wife spent more time with her male coworkers and male friends (i.e., potential sexual rivals) performed more semen-displacing copulatory behaviors at the couple's most recent copulation. We also found that performance of semen-displacing copulatory behaviors correlated with a novel cue to sperm competition risk: the discrepancy between the husband's sexual interest in his wife and her sexual interest in him. We also tested and refuted an alternative hypothesis that men adjust their copulatory thrusting to facilitate their partner's orgasm. Discussion highlights the novel contributions of the current research and notes limitations that can be addressed by future research.

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1. Introduction

Sperm competition occurs when a female copulates with two or more males within a sufficiently brief time period, resulting in the sperm of the different males simultaneously occupying the female's reproductive tract and competing to fertilize ova (Parker, 1970). In humans, female infidelity is the primary context for sperm competition (Baker & Bellis, 1993a; Shackelford, Goetz, McKibbin, & Starratt, 2007; Shackelford et al., 2002; Smith, 1984). Men whose regular partner engages in extra-pair copulation are at risk of cuckoldry—the unwitting investment of resources into genetically unrelated offspring. The reproductive costs of cuckoldry may have caused the evolution of male sperm competition tactics—adaptations that increase sperm competition success (Shackelford & Goetz, 2007).

Semen-displacing copulatory behaviors (e.g., deeper, more vigorous copulatory thrusts) may function as sperm competition tactics in humans (Gallup et al., 2003; Pham et al., 2013). Using artificial genitals, Gallup et al. (2003) found that the morphology of the human penis appears to be capable of displacing rival semen from the female reproductive tract. Additionally, the post-ejaculatory refractory period may function to prevent displacement of own recently-ejaculated semen (Gallup & Burch, 2004; Gallup, Burch, and Mitchell, 2006). Men perform more semen-displacing copulatory behaviors when they are at greater

sperm competition risk, such as when they are partnered to a more attractive woman (Goetz et al., 2005), accuse their partner of sexual infidelity (Gallup et al., 2003), and have spent more time apart from their partner since the couple's last copulation (Gallup et al., 2003). Semen-displacing copulatory behaviors also co-occur with the performance of other anti-cuckoldry tactics (e.g., non-sexual mate guarding behaviors; Goetz et al., 2005).

Another cue to sperm competition risk that may correlate with semen-displacing copulatory behavior is the presence of rival males. Research on non-humans documents that the presence of rival males causes the deployment of sperm competition tactics (Candolin & Reynolds, 2002; Gage & Barnard, 1996; Pizzari, Cornwallis, Lovlie, Jakobsson, & Birkhead, 2003). Two studies have investigated the presence of rival males as a cue to sperm competition risk in humans. Pham and Shackelford (2013) found that men who spent more time apart from their partner since the couple's last copulation also report greater interest in copulating with her and greater distress if she refused a request for copulation, but *only* if she recently spent more (versus less) time with male friends. Pham et al. (2014) found that men whose partner has more male coworkers and male friends (i.e., potential sexual rivals) also copulate more frequently with her. Frequent copulation may facilitate more semen-displacing copulatory behaviors, but also may serve other functions (e.g., sexually satisfying a partner). Following previous research (Pham & Shackelford, 2013; Pham et al., 2013), we hypothesize that men whose partner spends more time with male coworkers (Hypothesis 1) and male friends (Hypothesis 2) will perform more semen-displacing copulatory behaviors (e.g., deeper thrusting of penis into vagina) at the couple's most recent copulation.

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We also investigated in the current research a novel measure of sperm competition risk: the discrepancy in sexual interest between romantic partners. Men at greater risk of sperm competition report greater interest in copulating with their partner (Pham & Shackelford, 2013; Shackelford et al., 2002, 2007), and women who recently engaged in extra-pair copulation (i.e., presenting greater sperm competition risk) report attempting to delay copulation with their in-pair partner (Gallup, Burch, & Berens Mitchell, 2006). We therefore hypothesize that men who report greater interest in copulating with their partner—compared to their partner's interest in copulating with them—will perform more semen-displacing copulatory behaviors (Hypothesis 3).

An alternative (but not mutually exclusive) hypothesis is that men perform deeper copulatory thrusts to facilitate their partner's orgasm. Men may facilitate their partner's orgasm to increase her sexual satisfaction and, consequently, reduce her extra-pair copulatory desire (i.e., sperm competition risk). Additionally, Baker and Bellis (1993b) provided evidence that women who experience orgasm near the time of their partner's ejaculation retain more of his sperm in their reproductive tract, potentially increasing his chances of success in sperm competition. To test this alternative hypothesis, we secured wives' reports of their enjoyment of sex with their partner, in general, and their occurrence of orgasm, in particular.

Previous research on human sperm competition has secured data from university students (Shackelford et al., 2002, 2007), community members (Pham & Shackelford, 2013), and prisoners (Camilleri & Quinsey, 2009), demonstrating that putative adaptations to sperm competition are expressed in demographically diverse samples. We extend this line of research by securing data from legally married couples. Marriage is a universally-practiced, public declaration of commitment to a long-term romantic relationship (Nock, 1995). Because female extra-marital infidelity is the primary context for human sperm competition (Smith, 1984), and because marriage is ubiquitous across cultures (Betzig, 1989), it is important to investigate whether the putative adaptations to sperm competition manifest differently in marriages than in relationships for which the commitment is lower or has not been publicly declared and recognized.

2. Method

2.1 Participants and procedure

Forty-five heterosexual married couples ($n = 90$) arrived together to a university laboratory in the Southeastern region of the United States. This sample size was based on available funds. The average relationship length was 9.4 years ($SD = 12.5$). The average age was 36.3 years ($SD = 12.5$) for husbands and 34.5 years ($SD = 12.5$) for wives. Eligible participants reported being legally married. Participants were presented with a written consent form. Those who provided consent were provided with a survey, which each completed privately in a room separate from their spouse. Those who did not provide consent, or who reported that they were not legally married, were excluded from the study. Each participant was compensated US\$50 for participation.

2.2 Materials

Participants reported their age and current relationship length. Following Pham et al. (2014), husbands reported on several behaviors during the most recent copulation with their wife on 10-point scale, with reference to what is typical for them: number of copulatory thrusts (0 = fewer, 9 = more), depth of the deepest copulatory thrust (0 = less deep, 9 = more deep), and depth of the average copulatory thrust (0 = less deep, 9 = more deep). Husbands reported the amount of time their wife currently spends with her male co-workers and male friends on a 10-point scale (0 = no time spent, 9 = very much time spent). Husbands and wives self-reported their current sexual interest

in their spouse, compared to what is typical for them (0 = much less interested, 9 = much more interested). Husbands reported whether their wife achieved orgasm during the couple's last copulation (1 = yes, 2 = no, 3 = not sure). Wives reported whether they achieved orgasm during the couple's last copulation (1 = yes, 2 = no). Wives also reported their level of sexual excitement during the couple's last copulation (0 = much less sexually excited than is typical, 9 = much more sexually excited), how good it felt during their last copulation (0 = much worse than usual, 9 = much better), and how much relief they felt after intercourse (0 = much less than usual, 9 = much more).

3. Results

The Table 1 presents zero-order correlations among the target variables. Following Pham et al. (2014), we computed a composite semen-displacing copulatory behavior variable ($\alpha = 0.72$) as the mean of the husband's reports of his number of copulatory thrusts, and the depth of the deepest copulatory thrust and average copulatory thrust. To test Hypotheses 1 and 2, we correlated semen-displacing copulatory behavior with husband's reports of the amount of time his wife recently spent with her male co-workers (Hypothesis 1) and her male friends (Hypothesis 2). Consistent with Hypotheses 1 and 2, men married to women who recently spent more time with male coworkers and male friends performed more semen-displacing copulatory behavior at the couple's most recent copulation: $r(40) = 0.36, p < 0.05$ (male co-workers), $r(40) = 0.38, p < 0.05$ (male friends).

To test Hypothesis 3, we calculated the spousal discrepancy in current sexual interest by subtracting the wife's interest in copulating with her husband from the husband's interest in copulating with his wife. We then correlated scores on this variable with semen-displacing copulatory behavior. Consistent with Hypothesis 3, husbands who reported greater relative interest in copulating with their wife also reported performing more semen-displacing copulatory behavior at the couple's most recent copulation: $r(40) = 0.50, p < 0.01$.

To test an alternative hypothesis that men adjust their copulatory thrusting to increase their partner's sexual satisfaction and to facilitate their partner's orgasm, we conducted a logistic regression to predict the occurrence of the wife's orgasm (using husband's reports) from the husband's semen-displacing copulatory behavior. We excluded from analyses data from eight husbands because they reported uncertainty about whether their wife achieved orgasm. Inconsistent with the alternative hypothesis, husbands' semen-displacing copulatory behavior did not predict their wife's orgasm: $n = 36, \chi^2(1) = 0.94, p = 0.33$. Because women sometimes pretend orgasm (Kaighobadi, Shackelford, & Weekes-Shackelford, 2012), we conducted the same logistic regression, this time using wife's reports of the occurrence of their orgasm. The alternative hypothesis remained unsupported: $n = 44, \chi^2(1) = 0.93, p = 0.33$. Additionally, because some women experience greater difficulty achieving orgasm (Dunn, Cherkas, & Spector, 2005), we conducted zero-order correlations to investigate whether husbands' semen-displacing copulatory behaviors correlated with wives' enjoyment of sex as measured by feelings of excitement during

Table 1
Zero-order correlations among target variables.

	1.	2.	3.	4.	5.	6.
1. Number of thrust	X					
2. Deepest thrust	0.21	X				
3. Average thrust	0.21	0.86**	X			
4. Husband's sexual interest	0.18	0.27	0.26	X		
5. Wife's sexual interest	-0.35*	-0.33*	-0.34*	-0.02	X	
6. Time with male friends	0.23	0.39*	0.28	0.06	-0.19	X
7. Time with male co-workers	0.31*	0.26	0.28	-0.07	-0.22	0.65**

Note: $n = 42$.

* $p < 0.05$.

** $p < 0.01$.

intercourse, physical sensations of pleasure throughout the copulatory episode (and not just associated with orgasm), and feelings of relief experienced after the copulatory episode. The correlations between these variables and semen displacing behavior were not significant: $r(40) = -0.20, p = 0.39$; $r(40) = -0.16, p = 0.47$; $r(40) = -0.13, p = 0.55$, respectively. Therefore, the alternative hypothesis remained unsupported.

4. Discussion

The results of the current research support the hypotheses that men married to women who spend more time with male coworkers (Hypothesis 1) and male friends (Hypothesis 2) report performing more semen-displacing copulatory behavior at the couple's most recent copulation. In addition, the results support the hypothesis (Hypothesis 3) that men who report greater interest in sex with their wife than their wife reports in them perform more semen-displacing copulatory behavior during the couple's most recent copulation. We did not find support for an alternative hypothesis that husbands adjust their copulatory thrusting to increase their wife's sexual enjoyment or to facilitate her orgasm. Taken together, these results are consistent with the broader hypothesis that men attend to partner infidelity cues and adjust accordingly their deployment of sperm competition tactics.

The current research is the first to secure data from married couples to investigate hypothesized adaptations to human sperm competition. The results of this research replicate several findings identified in previous research with different samples, showcasing the robustness of the putative anti-cuckoldry adaptations in human male psychology. Despite the significant gesture of commitment marked by formal marriage, men continue to deploy sperm competition tactics because the reproductive costs of cuckoldry are severe. Indeed, Buss and Shackelford (1997) found that men commonly and often frequently perform multifarious behaviors to reduce the risk of their wife's infidelity.

The current research is also the first to integrate two concepts related to sperm competition risk: men's sexual interest in their partner in response to sperm competition risk (Shackelford et al., 2002) and women's sexual disinterest in their partner following an extra-pair copulation (Gallup et al., 2006). Previous research on human sperm competition has relied on men's self-reports of copulatory behaviors (e.g., Pham et al., 2013, 2014; Shackelford et al., 2002, 2007). Although men's self-reports are appropriate and defensible when investigating the functioning of male psychological mechanisms (i.e., men's self-reported perceptions are relevant inputs into these mechanisms), the current research highlights the importance of female psychology and the active role that women play in human sperm competition—phenomena that have received less attention in the literature (but see Baker & Bellis, 1993b; Gallup et al., 2006; Kaighobadi et al., 2012). In fact, in research on non-human sperm competition, there also is a much richer and more extensive literature addressing male adaptations than female adaptations—due, in part, to the greater methodological difficulty of investigating female adaptations, many of which are internal to females (e.g., females biasing the outcome of sperm competition in their reproductive tract: Birkhead, 1998).

Displacement of rival male semen from a partner's reproductive tract is a possible explanation for why men adjust their copulatory thrusting, and the results of the current research corroborate this hypothesis. However, men also may perform deeper copulatory thrusts to increase their own sexual arousal and consequent ejaculate quality. This could be related to individual difference factors such as whether a man's penis is intact or circumcised, as circumcised men tend to report deeper and more vigorous thrusting, possibly due to the loss of sensitivity associated with circumcision (O'Hara & O'Hara, 1999). However, another consequence of circumcision is enhanced semen-displacing properties of the penis compared to penises that are intact (Gallup & Burch, 2004). Future research might investigate such differences. Ejaculate adjustment is a widely-documented sperm competition tactic

across taxa (see Simmons & Fitzpatrick, 2012). Future research might also secure copulatory ejaculates to investigate whether self-reported semen-displacing copulatory behavior correlates with consequent ejaculate quality. A further limitation of the current research is the small sample due to the labor-intensive nature of the study and funds available for participant remuneration. Therefore, future research should replicate this study using larger sample size.

The current research adds to the growing empirical literature on human sperm competition, in general, and the ways in which men assess and respond to sperm competition risk, in particular. Men are at greater sperm competition risk when they spend more time apart from their partner since the couple's last copulation, when they are mated to more attractive women, and when they are mated to women with personality traits associated with female infidelity (see Pham & Shackelford, 2014). The current research documents that men attend to the presence of rival males in the local environment as a cue to sperm competition risk—a finding that has been previously documented (e.g., Pham & Shackelford, 2013; Pham et al., 2013). We also include a variable only recently identified as a cue to sperm competition risk: spousal discrepancy in sexual interest (Gallup et al., 2006), as measured in a novel way by subtracting the wife's interest in copulating with her husband from her husband's interest in copulating with her. Finally, despite the ubiquity of marriage across cultures, married couples have received no attention from research on human sperm competition. The current study is the first to extend previous research to a sample of legally married couples.

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