



Perceptions of Infectability to Disease Moderate the Association between Daily Concerns about Contracting COVID-19 and Satisfaction with Sex

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Abstract

The behavioral immune system is an evolved adaptation comprised of automatic behavioral, cognitive, and affective reactions that has allowed humans throughout evolutionary history to avoid situations that risk infection by pathogens (e.g., physical proximity to sick people). Although behavioral immune system activation may be functional by helping people avoid such situations, experiencing these automatic reactions during sexual interactions may undermine people's evaluations of those interactions because sex requires close physical contact. We examined whether two sources of behavioral immune system activation (daily concern over contracting COVID-19 and individual differences in infection concern) undermined satisfaction with sex among 318 partnered adults in the U.S. during the COVID-19 pandemic. Participants reported individual differences in perceived infectability and then, every night for two weeks, reported their (a) daily concern about contracting COVID-19, (b) daily stress, (c) whether they had sex with their partner, and (d) their satisfaction with sex when it occurred. People's perceived infectability moderated the association between their daily concern about contracting COVID-19 and the extent to which they enjoyed sex when it occurred, such that people higher, but not lower, in perceived infectability enjoyed sex less on days that they were more worried about contracting COVID-19 than usual. This effect was not moderated by biological sex and remained significant when controlling for biological sex, age, relationship length, and frequency of sex. Results highlight the importance of the behavioral immune system to sexual functioning and suggest a novel avenue through which the COVID-19 pandemic has disrupted relationships.

Keywords COVID-19 · Sex · Perceived infectability · Behavioral immune system

Introduction

Sex is crucial for human life. Not only is sex necessary for reproduction, it strengthens the bond between romantic partners (Meltzer et al., 2017) and thereby increases the likelihood of bi-parental care and offspring survival. It is thus important that people enjoy sex, because such sexual

enjoyment will motivate people to continue engaging in sex. Indeed, satisfaction with sex predicts both continued sex and relationship satisfaction (McNulty et al., 2016).

Nevertheless, maintaining a satisfying sexual relationship can be difficult. Although numerous factors impact people's satisfaction with sex (Butzer & Campbell, 2008; Young et al., 1998), one understudied yet perhaps particularly important factor is people's acute perceptions of disease or pathogen threat. Throughout evolutionary history, people have faced pervasive pathogenic threats that undermine their chances of survival and reproduction. To minimize such threats, humans evolved a behavioral immune system comprised of various affective, cognitive, and behavioral mechanisms that help them recognize the presence of threatening pathogens and avoid potential transmission (Ackerman et al., 2018). For example, when in the presence of someone with a runny nose, people tend to feel uncomfortable, attempt to keep their distance from the infected person, and wash their hands as soon

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as possible. Given that sex requires close physical contact and the exchange of bodily fluids, sex poses greater than normal risk of pathogen infection, which may activate the behavioral immune system. Experiencing such automatic avoidance during sexual interactions may lead to reduced enjoyment of those interactions.

Of course, human reproduction requires sex, and thus, it is common for sexual desire to suppress behavioral immune system activation. Indeed, prior experimental research provides evidence of such effects in a laboratory setting (Borg & de Jong, 2012; Stevenson et al., 2011). But there are situational and individual-difference variables associated with state and trait differences in behavioral immune system activation, and any such variables that increase the strength of behavioral immune system activation may minimize the extent to which the behavioral immune system can be suppressed during sex in real-world settings (Curtis et al., 2011). Indeed, previous research provides evidence that individual differences and situational variables can interact to predict sexual attitudes. For example, in a laboratory study of undergraduate students, Murray et al. (2013) found that women with higher chronic levels of germ aversion reported an increased desire for long-term relationships and a decreased preference for promiscuity after viewing photos of people with obvious indicators of infectious disease.

Both situational and individual-difference factors associated with behavioral immune system activation are relevant to understanding sexual satisfaction during the COVID-19 pandemic, a time in which global concern about infection has risen to a level that was previously unprecedented in the modern era. Notably, such concern has been linked to higher-than-normal behavioral immune system activation (Shook et al., 2020) that may lower individuals' satisfaction with sex when it occurs. With respect to situational factors, concern about threat from COVID-19 likely fluctuates from day-to-day depending on numerous environmental factors, such as people's daily activities, their contact with others, their exposure to news coverage, and local infection rates. People's satisfaction with sex may covary with such within-person fluctuations in COVID-19 concern, such that they experience lower satisfaction with sex on days in which they perceive greater (versus less) pathogen threat. With respect to individual-difference factors, people vary in their perceived infectability by pathogenic threats; some people perceive themselves to be particularly vulnerable to infection from pathogens, whereas other people perceive themselves to be relatively immune to infection even when pathogens are prevalent (Duncan et al., 2009). Indeed, recent research has already demonstrated that, during the COVID-19 pandemic, people who perceive themselves to be more vulnerable to infection experience greater anxiety and engage in greater social distancing measures (Makhanova & Shepherd, 2020). We predicted that such individual differences in perceived

infectability may moderate the impact of daily concerns over SARS-CoV-2 infection on satisfaction with sex that occurs on that day. That is, higher daily SARS-CoV-2 infection concern may more strongly influence satisfaction with sex that occurs among people who perceive higher (versus lower) susceptibility to infection. The goal of the current study was to test this possibility.

In pursuit of this goal, we analyzed a sample of participants in romantic relationships taken from an online, 14-day, daily diary study during the COVID-19 pandemic. At baseline, we assessed participants' perceived infectability; then, each evening for the next 14 evenings, we assessed participants' daily concerns about contracting COVID-19, whether they had sex with their romantic partners, and their satisfaction with any sex that occurred. Because previous research has shown that general stress (i.e., stress unrelated to infection concern) can negatively impact sexual satisfaction (Bodenmann et al., 2007), we also assessed and controlled for participants' daily general stress to ensure any associations were not caused by stress more generally. Moreover, given evidence suggesting that women tend to have stronger disgust responses (e.g., Al Shawaf & Lewis, 2013) and greater perceived infectability compared to men (Díaz et al., 2020), we explored possible sex differences in the interactive effect of daily concerns about contracting COVID-19 and perceived infectability to satisfaction with sex.

Method

Participants

We recruited 346 people via Prolific.com (an online platform for academic and market research) to participate in a broader study examining the effect of the COVID-19 pandemic on people's romantic relationships and parenting experiences. Comparisons between Prolific and other web-based data collection platforms (e.g., Amazon's Mechanical TURK) suggest Prolific users are typically more naïve about commonly used research goals and measures, less dishonest and provide higher quality data (Peer et al., 2017). Because of the broader goals of the study, which included examining parenting behaviors and child outcomes, eligibility required that all participants reside (a) in the U.S. with (b) at least one biological child who was 13 years of age or younger. The analyses presented here are based on a subsample of 318 participants (51.6% male) who reported being in an exclusive romantic relationship (89% married, 4.4% engaged, and 6.6% exclusively dating one person). We did not establish a minimum length of relationship for participants to be included in the current analyses, and participants reported being with their current partner for an average of 9.74 ($SD = 4.75$; range = 0.67–32.50)

years. Participants in this subsample on average were 33.62 ($SD = 6.24$) years of age, and the majority self-identified as White (77.4%, 7.9% Asian, 7.2% African American/Black, 5.7% Latinx/Hispanic, 1.3% American Indian/Alaska Native, and 0.6% Native Hawaiian or other Pacific Islander), heterosexual (92.5%), and college educated (77.9%). These participants reported a median household income that fell between US\$75,001 and US\$100,000 per year. Data were collected from May through July 2020, during the height of the COVID-19 shutdown in the U.S.

Procedure and Measures

Upon study enrollment, participants provided informed consent and then completed a baseline survey via Qualtrics.com that included questionnaires assessing demographic information, their perceived infectability, and several other measures beyond the scope of the current analyses. Then, every evening for the subsequent 14 evenings, participants completed a brief diary assessment. To maximize our chances of capturing as much of participants' daily experiences as possible, we instructed participants to complete these brief assessments each evening immediately before going to bed. Participants received US\$8 for completing the baseline assessment, US\$1 for completing each diary assessment, and a bonus of US\$4 if they completed all 14 diary entries. Participation also included a follow-up survey beyond the scope of the analyses presented here, for which they could earn US\$3. Participants who completed all phases of the study (i.e., baseline, all daily diaries, and the follow-up) were entered into a drawing to win one of five US\$25 bonuses. We did not establish a minimum number of diary entries that participants had to complete to be included in the current analyses, and thus, we included all diary entries that provided reports of sex, satisfaction with sex, COVID-19 concern, and stress. Participants in our sample completed on average 11.38 ($SD = 4.30$) diary entries, and 52.6% of the sample completed all 14 diary entries.

Perceived Infectability

At baseline, we measured people's beliefs about their personal susceptibility to the transmission of infectious diseases using the Perceived Infectability subscale of the Perceived Vulnerability to Disease Scale (Duncan et al., 2009). This subscale includes seven items such as "If an illness is 'going around,' I will get it," and "I am more likely than the people around me to catch an infectious disease." Participants rated their agreement to these items using a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Reliability of the subscale was high ($\alpha = 0.87$), and on average participants

reported moderate levels of perceived infectability ($M = 3.36$, $SD = 1.35$).

Daily Concern about Contracting COVID-19

Each evening, we assessed participants' concern about contracting COVID-19 with the following item: "Today, to what extent did you worry about contracting COVID-19?," using a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). Across the 14 days, participants on average reported moderate levels of perceived threat ($M = 3.31$) that varied substantially ($SD = 2.00$).

Satisfaction with Sex When It Occurred

Each evening, participants indicated whether they engaged in sex that day. If participants indicated having sex, they then reported their satisfaction with that sex by responding to the question, "How satisfied are you with the sex you had today?," using a 7-point Likert scale (1 = Not at all, 7 = Extremely). Across the 14 days, participants reported engaging in sex an average of 2.51 times, though there was variation in these reports ($SD = 2.54$, range = 0–13). Participants on average reported being highly satisfied with the sex that occurred ($M = 6.13$, $SD = 1.04$).

Covariates

To ensure associations were independent of general stress, we additionally assessed participants' daily general stress. Specifically, each evening, participants rated the extent to which they felt stressed about (a) money/finances, (b) work, (c) family, and (d) household chores, as well as the extent to which they felt (e) lonely, using a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree). We averaged participants' responses to these five items ($\alpha = 0.83$). Across the 14 days, participants on average reported moderate levels of stress ($M = 3.03$) that varied considerably ($SD = 1.46$). We also conducted supplemental analyses that controlled for participants' biological sex, age, relationship length, and frequency of sex across the diary to ensure our effects were independent of these variables.

Statistical analyses

Given the nested nature of the data (repeated daily assessments were nested within individuals), we tested our hypothesis by estimating a multilevel model using the MIXED procedure in SPSS. To isolate the effects of daily concern about contracting COVID-19 from between-person differences in such concern, we within-person centered daily COVID-19 concern and entered both within- and between-person

differences into the model, allowing both variables to interact with perceived infectability. Specifically, we regressed participants' reports of satisfaction with sex when it occurred onto their within- and between-person differences in daily concern about contracting COVID-19, their perceived infectability, and the Within-Person Differences in Daily COVID-19 Concern \times Perceived Infectability interaction, controlling for day of assessment, the Between-Person Differences in Daily COVID-19 Concern \times Perceived Infectability interaction, as well as within- and between-person differences in general stress and their interactions with perceived vulnerability to infection. To preserve their metric interpretation, satisfaction with sex was left unstandardized and day of assessment was mean centered. All other variables were standardized. Supplemental analyses controlled for participants' biological sex, age, relationship length, and frequency of sex across the diary.

Results

Consistent with predictions, the Within-Person Differences in Daily COVID-19 Concern \times Perceived Infectability interaction emerged as significant, $b = -0.08$, $CI_{95\%} [-0.16: -0.01]$, $t(666.62) = -2.27$, $p = .023$. This interaction also emerged controlling for participants' biological sex, age, relationship length, and frequency of sex across the diary, $b = -0.07$, $CI_{95\%} [-0.145: -0.001]$, $t(601.38) = -1.99$, $p = .048$ and was not moderated by participants' biological sex, $b = 0.07$, $CI_{95\%} [-0.01: 0.15]$, $t(625.00) = 1.63$, $p = .104$. (See Supplemental Materials.) The interaction is depicted in Fig. 1. Although daily concern about contracting COVID-19 was not significantly associated with satisfaction with sex among people relatively low (1 *SD* below the sample mean) in perceived infectability, $b = 0.03$, $CI_{95\%} [-0.06: 0.12]$, $t(620.74) = 0.67$, $p = .501$, it was negatively associated with satisfaction with

sex among people relatively high (1 *SD* above the sample mean) in perceived infectability, $b = -0.14$, $CI_{95\%} [-0.24: -0.03]$, $t(693.75) = -2.48$, $p = .013$. Likewise, although people's perceived infectability was not significantly associated with their satisfaction with sex on days when they were less (1 *SD* below their own mean) concerned about contracting COVID-19, $b = -0.002$, $CI_{95\%} [-0.15: 0.14]$, $t(306.04) = -0.03$, $p = .975$, it was negatively associated with their satisfaction with sex on days when they were more (1 *SD* above their own mean) concerned about contracting COVID-19, $b = -0.17$, $CI_{95\%} [-0.31: -0.03]$, $t(281.92) = -2.35$, $p = .019$. Notably, the Between-Person Differences in Daily COVID-19 Concern \times Perceived Infectability interaction was not significant, $b = 0.05$, $CI_{95\%} [-0.10: 0.20]$, $t(168.11) = 0.63$, $p = .530$.

Regarding general stress, within-person variability in general stress was negatively associated with participants' satisfaction with sex, $b = -0.08$, $CI_{95\%} [-0.15: -0.01]$, $t(637.04) = -2.13$, $p = .034$, but this association was not moderated by participants' perceived infectability, $b = 0.002$, $CI_{95\%} [-0.06: 0.06]$, $t(620.92) = 0.08$, $p = .938$. Between-person differences in general stress were not significantly associated with participants' satisfaction with sex, $b = -0.11$, $CI_{95\%} [-0.27: 0.04]$, $t(149.11) = -1.48$, $p = .141$, and this association was not significantly moderated by participants' perceived infectability, $b = -0.05$, $CI_{95\%} [-0.22: 0.11]$, $t(163.36) = -0.67$, $p = .504$.

We also explored whether participants' daily concern about contracting COVID-19 interacted with their perceived infectability to predict their (a) daily sexual desire or (b) whether sex occurred. The Within-Person Differences in Daily COVID-19 Concern \times Perceived Infectability interaction was not significant in either model, all $ps > 0.462$. Full results appear in Supplemental Materials.

Discussion

Sex and satisfaction with sex play a crucial role in relationships and the propagation of human life. Although many factors can influence sexual satisfaction, the COVID-19 pandemic has made the potential impact of the behavioral immune system particularly salient. Consistent with previous research demonstrating that individual and situational variables can interact to shape the consequences of the behavioral immune system for sexual attitudes (Murray et al., 2013), we found that people who perceived themselves to be especially vulnerable to infection experienced lower satisfaction with sex that occurred on days in which they were more concerned about contracting COVID-19 than usual. Among people who perceive themselves to be relatively less susceptible to infection, in contrast, daily fluctuations in concern about contracting COVID-19 were unrelated to satisfaction with sex when it occurred. Notably, this interactive effect was independent of

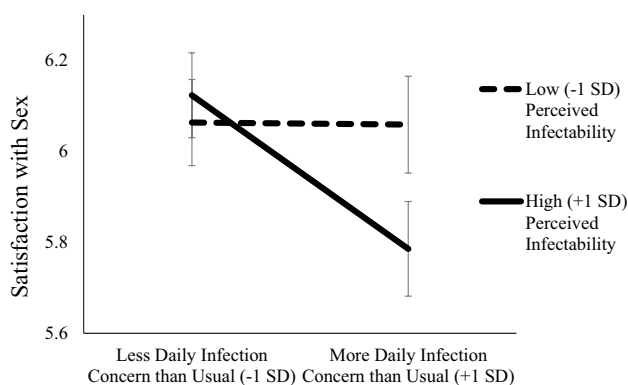


Fig. 1 The Interactive Effect of Within-Person Daily Fluctuations in COVID-19 Infection Concern and Perceived Infectability on Satisfaction with Sex

participants' daily reports of general stress, and the interactions between daily reports of general stress and perceived infectability did not predict participants' satisfaction with sex when it occurred. Further, these effects were not moderated by biological sex and held when controlling for participants' biological sex, age, relationship length, and frequency of sex across the study.

Several strengths of this work increase our confidence in the finding presented here. First, because our data were collected from a predominantly married sample during the COVID-19 pandemic in the U.S., our findings reflect the consequential outcome of very real infection concerns for romantic couples' sexual relationships. Second, because we utilized daily diaries rather than retrospective measures, we were able to capture reports of genuine fluctuations in infection concern and satisfaction with sex that were likely less susceptible to motivational biases or faulty memory. Furthermore, our use of daily diaries allowed us to isolate the effects of within-person differences in infection concern from between-person differences in infection concern. Finally, by controlling for general stress, we were able to provide stronger empirical support for our argument that behavioral immune system activation might interfere with people's sexual experiences over and above the effect of stress more generally.

Despite these strengths, several limitations of this work should be considered. First, the findings presented here are correlational and thus open to interpretations other than our proposed explanation. Although we controlled for participants' general stress, it remains possible that some other third variable accounts for the association presented here. Second, we did not gather data on the specific mechanism through which daily concerns about COVID-19 infection undermined satisfaction with sex for people high in perceived infectability. Future research may benefit from examining specific behaviors (e.g., less kissing, less face-to-face contact, less foreplay, less cuddling), cognitions (e.g., anxiety, preoccupation), or affect (e.g., disgust, fear) that could explain the effects that emerged here. Third, because this study was conducted for the purpose of examining parenting behaviors and child outcomes during the pandemic, participant recruitment was limited to people with a biological child. It is thus possible that our findings could be limited to people with children. Future research may benefit from exploring these effects among people without children. Finally, given that these data were collected during the global COVID-19 pandemic, the observed association between daily fluctuations in infection concern and satisfaction with sex might be specific to the novel SARS-CoV-2 outbreak. That is, specific qualities of the SARS-CoV-2 outbreak (e.g., early ambiguity surrounding the effects of SARS-CoV-2 and its transmission, the pervasiveness of SARS-CoV-2-related media messages) could have amplified behavioral immune system activation and thus made reduced sexual enjoyment more

likely. Nevertheless, although the infection concern experienced during the COVID-19 pandemic is unprecedented in recent history, activation of the behavioral immune system is not unique to COVID-19 concern. Other circumstances such as encountering sick people at work, having a sick partner or child, or concern over exposure to the common cold or flu may have similar effects. Future research may benefit from examining whether these and other pathogenic threats likely to activate the behavioral immune system have similar implications for people's sexual satisfaction.

These limitations notwithstanding, our findings have important implications for theory and future research. First, these findings add to a growing body of literature demonstrating effects of the behavioral immune system on people's romantic relationships (Borg & de Jong, 2012; Gangestad & Buss, 1993; Murray et al., 2013; Stevenson et al., 2011). Given that the physical closeness inherent to sex makes people particularly vulnerable to pathogen transmission, the behavioral immune system is likely to be particularly important during sexual encounters. Although sexual arousal may down-regulate the behavioral immune system in some circumstances (Borg & de Jong, 2012; Stevenson et al., 2011), thereby facilitating successful reproduction, examining these issues in the context of a global pandemic offered us the opportunity to examine the consequences of behavioral immune system activation for people's sexual satisfaction in a time of amplified infection concern and thus suggest a novel avenue through which the behavioral immune system may affect relationships. Second, these data speak to the myriad (and perhaps less obvious) ways that the COVID-19 pandemic has impacted people's social lives. Indeed, in addition to minimizing people's social contact with acquaintances, the COVID-19 pandemic may be undermining the quality of people's romantic relationships more directly. In this way, these results may inform potential recommendations to couples for sustaining sexual satisfaction during the pandemic. That is, for people who perceive themselves to be particularly vulnerable to infection, it may be prudent to reduce infection concerns by increasing social distancing or sanitization measures.

Authors' Contributions Andrea L. Meltzer, Juliana E. French, and Emma E. Altgelt designed the broader study, prepared materials and collected the data. Lindsey L. Hicks, Andrea L. Meltzer, Jordan A. Turner, and James K. McNulty formulated hypotheses. Lindsey L. Hicks and James K. McNulty performed data analyses. Lindsey L. Hicks drafted the manuscript. All authors commented on previous versions of the article. All authors read and approved the final article.

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Data Availability Data to reproduce the results are available upon request to the second author.

Declarations

Conflict of Interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

Ethical Approval Approval was granted by the Institutional Review Board at Florida State University. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent to participate Informed consent was obtained from all participants included in the study.

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