COVID-19 distress and interdependence of daily emotional intimacy, physical intimacy, and loneliness in cohabiting couples

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Abstract
Introduction: COVID-19 has had a profound impact on relationship functioning, though effects have been heterogeneous. Reasons for divergent effects on relationship functioning remain unclear. Theoretical models suggest that it is not just stress exposure that leads to adverse relationships outcomes, but also subjective response to these stressors. Using data from a 14-day intensive longitudinal study of romantic dyads, we hypothesized that COVID-19-related distress would adversely impact one’s own and one’s partner’s report of relationship functioning, on average. Interdependence at the trait level (random effects between couples) and day level (residuals within couples) was also examined.

Methods: Participants were 104 female-male romantic couples cohabiting the New York metropolitan area (Mage = 28.86, SDage = 7.69) between August 2020 – April 2021. Couples reported COVID-19 distress during a baseline interview and daily relationship functioning for 14 days. Multilevel models were specified for six outcomes simultaneously: female and male partner daily physical intimacy, emotional intimacy, and loneliness. Interrelationships of the intercepts of the six outcomes were specified, reflecting trait-level associations of each partner’s stable outcome tendencies. Interrelationships of the daily residuals of the six outcomes were also specified, reflecting within-couple associations at the daily level. Results: Female partner COVID-19 distress was inversely associated with her own emotional and physical intimacy and positively

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associated with her own and her partner’s loneliness. Male COVID-19 distress was associated with his own loneliness only. There was significant interdependence at both levels, such that greater loneliness in either partner was associated with less intimacy in each member of the couple. Discussion: Only one partner effect for COVID-19 distress emerged, such that female partner distress was associated with male partner loneliness; however, trait- and day-level interdependence suggested that distress may adversely impact relational well-being over time. Future studies should examine reciprocal relationships between COVID-19-related distress and relationship functioning.

Keywords
Couples, COVID-19, relationship functioning, intimacy, loneliness, daily diary methods, interdependence

Introduction
“Stay-home” and other distancing policies to slow the spread of COVID-19 have limited contact with friends and family outside the home, leaving many individuals with access only to cohabiting others, such as romantic partners. Due to this contraction of the social sphere, public health advocates have raised concerns about loneliness and social isolation, each of which has consistently been linked to mental and physical well-being (Courtin & Knapp, 2017; Holt-Lunstad et al., 2015). Surprisingly, research has not confirmed any notable increase in loneliness during the COVID-19 lockdowns (Luchetti et al., 2020; Prati & Mancini, 2021). Moreover, there have been mixed results regarding how the COVID-19 pandemic has affected relationship functioning. Specifically, a number of studies have documented both increases and decreases in relationship satisfaction during the pandemic (Schmid et al., 2021; Weber et al., 2021). We propose that subjective distress related to the COVID-19 pandemic, rather than mere exposure to the objective stressor itself, may underlie some of the divergence in relationship functioning. To test this hypothesis, we examined interdependence in couples’ reports of daily loneliness, emotional intimacy, and physical intimacy with one’s romantic partner as a function of each couple member’s COVID-19-related distress.

Understanding the mechanisms by which the COVID-19 pandemic has had differential impacts on relationship functioning is urgently needed. Certain theoretical models, for example, the Double ABCX Theory (McCubbin & Patterson, 1983) and Family Adjustment and Adaptation Response Theory (Patterson, 1988), suggest that it is not simply the presence of a stressor, but also subjective response to that stressor that determines subsequent changes – both adaptive and maladaptive – within close relationships. Thus, subjective response to COVID-19 (i.e., COVID-19-related distress) may help to explain differential impacts of stressor exposure on relationships. Prior work has shown that psychological distress adversely impacts relationship functioning, including aspects such as physical intimacy; specifically, self-reported subjective stress has been shown to be associated with less sexual activity, lower sexual satisfaction, and less overall relationship
satisfaction (Bodenmann et al., 2010). When thinking about distress in the context of COVID-19, we chose to specifically focus on relationship variables that incorporate aspects of closeness, including physical and emotional closeness, as well as loneliness broadly, because of mitigation policies that have reduced the ability to maintain social contact. Furthermore, it follows that decrements to relationship quality due to COVID-19-related distress could remove the ability of these relationships to buffer against further increases in distress (Kiecolt-Glaser & Newton, 2001; Kiecolt-Glaser & Wilson, 2017; Robles & Kiecolt-Glaser, 2003; Robles et al., 2014), thereby precipitating a self-reinforcing cascade of psychological distress and damage to the romantic relationship. A number of recent studies have shown a positive association of perceiving threat from COVID-19 or post-COVID-19 distress with decrements in relationship quality (Goodwin et al., 2020; Li & Samp, 2021; Pietromonaco & Overall, 2021; Randall et al., 2022) or increases in relationship instability (Ogan et al., 2021). Additionally, recent work has highlighted the positive association between psychological distress and loneliness (McCallum et al., 2021). Although these pathways between distress and different aspects of relationship functioning have been established broadly, much less explored is the relation between one’s own distress, specific to the COVID-19 pandemic, and romantic partners’ reports of relationship functioning, including physical intimacy, emotional intimacy, and loneliness (dyadic effects of COVID-19 related fear on depression and anxiety have been documented; Ahorsu et al., 2020). In line with the Conservation of Resources Theory (Hobfoll, 1989, 2001, 2011), it is plausible that, when individuals are distressed and preoccupied about COVID-19, that this will adversely impact relationships by distracting them from physical or emotional intimacy, or by increasing focus on lost social connections (Grandey & Cropanzano, 1999). (Although it is also possible that relationship functioning may buffer distress, this is not the pathway that we focused on in this model, because it seems less likely that lack of physical intimacy will increase distress about the COVID-19 pandemic.) In the current work, we aimed to expand our understanding of relationship functioning during COVID-19 by examining the relation between one’s own COVID-19 distress at baseline and their daily reports of relationship functioning over a 14-day span, as well as the relation between one’s own COVID-19 distress and partners’ reports of relationship functioning. We hypothesized that more COVID-19 distress at baseline will be associated with worse self- and partner-reported daily relationship functioning, on average, across the two-week monitoring period.

To get a true picture of the impact of COVID-19-related distress on couples’ relationship functioning, one must consider not only dyadic effects but also multiple aspects of the relationship simultaneously. In other words, it is not enough to understand impacts on physical intimacy alone, for example, as aspects of romantic relationships such as physical intimacy, emotional intimacy, and loneliness are inextricably linked (Acker & Davis, 1992; Baumeister & Bratslavsky, 1999; Rokach & Philibert-Lignières, 2015). Prior dyadic research has found increases in emotional closeness and intimacy to be associated with both own and partner-reported passion (Aykutoğlu & Üysal, 2017; Rubin & Campbell, 2012). Furthermore, own and partner relationship happiness and sexual satisfaction demonstrate bidirectional dyadic effects (Fisher et al., 2015), and intimacy, positive marital quality, and relationship satisfaction demonstrate inverse and
bidirectional dyadic associations with loneliness (Arpin et al., 2018; Mund & Johnson, 2021; Stokes, 2017), to name a few. Because cohabiting relationships ostensibly represent the primary source of closeness when maintaining social distancing and other COVID-19 mitigation practices – including emotional and physical contact during these isolating times – the current study examined how a baseline measure of COVID-19 distress is associated with three aspects of daily relationship functioning simultaneously: emotional intimacy, physical intimacy, and loneliness.

In addition to examining the association between baseline COVID-19 distress and daily relationship well-being, we also aimed to document both the stable association of emotional intimacy, physical intimacy, and loneliness within couples, as well as how these factors fluctuate from day-to-day within couples over time. These associations describe how one partner’s general tendency towards intimacy and loneliness covaries with their partner’s tendencies towards intimacy and loneliness (i.e., trait-level associations). For example, if Sam tends to report higher levels of emotional intimacy on average, does her partner report higher emotional intimacy on average? Or, how does Sam’s general reports of emotional intimacy covary with her partners’ general feelings of loneliness? Additionally, we sought to study how daily fluctuations in these factors covary within couples (i.e., residual associations that operate above and beyond stable tendencies). This could suggest an accumulation of “ripple” effects in couples from day to day that could strengthen or undermine the relationship as couples are facing COVID-19 (i.e., stress spills over from COVID-19 to a variety of relationship outcomes in each member of the couple, and that self-reinforces over time; Bolger et al., 1989) thereby contributing to heterogeneous relationship outcomes documented during the pandemic. Although this aim is exploratory and descriptive, furthering our understanding of the co-evolution of these factors in couples sheds light on fluctuations in relationship well-being in couples under duress. This highlights the ways in which dynamic and interdependent processes shape trajectories of relationship functioning.

**Methods**

**Participants**

Romantic couples living together in New York City and Hoboken, Newark, and Jersey City, New Jersey were invited to participate in the study, spanning August 2020 to April 2021. Eligibility criteria included: being 21 or older, in a romantic relationship, and currently cohabitating with their romantic partner in either New York City, Hoboken, Newark, or Jersey City. Exclusion criteria included living with anyone besides their partner such as a roommate or children. After screening couples through an eligibility survey, a Zoom call, and baseline survey responses, we were left with 126 eligible couples (252 individuals) who entered the daily diary stage (see DiGiovanni et al., 2022, for further details). For the baseline sample, mean age was 28.70 (SD = 7.85; Median 27; Range 21–71) and mean relationship length was 4.50 years (SD = 4.08; Range 0.08, 22.25). Most (109; 86.5%) were female sex and male sex couples, 12 comprised partners who both reported female sex (9.5%), and five comprised two male sex partners (4.0%).
Fifty one point two percent were White, 23.8% were Asian, 7.9% were Black or African American, 7.1% identified as Mixed, 9.9% identified as something else, and 16.7% of the sample were Hispanic/Latinx. The median income per participant was $48,000 US dollars (Range $0 – $400,000). Sample size was based on feasibility and on the fact that previous studies using sample sizes in this range were powerful enough to detect associations of interest (e.g., Bolger & Zuckerman, 1995; Bolger et al., 2000).

The analytical sample included 104 couples (208 individuals) comprising one partner who reported female biological sex and one reporting male biological sex (Table 1). This sample was arrived at by first excluding one couple who did not meet data quality checks, 18 couples comprising non-female sex/male sex partnerships, and three female-male couples who did not provide data necessary for analysis. The average age of participants was 28.86 (SD = 7.69; Median 28; Range 21–71) and couples had been together for an average of 4.53 years (SD = 3.98; Range 0.08–22.25). The racial breakdown was as follows: 51.0% were White, 26.0% were Asian, 6.3% were Black or African American, 6.7% identified as Mixed, and 9.1% identified as something else. Moreover, 16.4% of the sample were Hispanic/Latinx. The median income per participant was $48,000 US dollars (Range $0–$400,000).

**Procedures**

Couples were recruited through online postings (e.g., Facebook, Craigslist, Twitter, Honeybee Hub, University Listserv), word of mouth, and flyers around the New York City area to participate in a two-week daily diary study about the social and psychological impacts of the COVID-19 pandemic and social and political current events. Individuals first confirmed their eligibility in a Qualtrics screening survey, where only one partner was required to fill out the survey, but also provided their partner’s email address. Research assistants emailed couples to schedule a Zoom video call, to confirm eligibility and provide couples with more information regarding the study. After the Zoom call, research assistants sent eligible couples a baseline survey, where each member of the couple filled out the survey separately from their partner. All procedures were reviewed and approved by the Columbia University Institutional Review Board. Participants provided electronic consent during the baseline survey. Participants were only sent diaries if both partners completed the baseline survey.

Each daily diary cohort started on a Tuesday evening, and diaries were emailed to participants around 7 p.m. nightly. Participants were asked to fill out the diaries separately from their partners around the time they were going to sleep. If participants completed the baseline survey and 80% of the daily diaries (11 out of 14) on the correct day, they were paid either $20, $30, or $40 depending on when they participated in the study (payment was increased later in the study due to recruitment issues). Participants were paid via Venmo, and all participants were emailed a debriefing form at the end of the study.

We excluded diary entries that were completed outside of the hours of 6 p.m. and 3 a.m., as this was outside of the “bedtime” timeframe and entries were considered to be unreliable. We also excluded diary entries where the participant failed one or both attention checks or the participant responded in under two minutes (49 diary entries total).
Measures

Baseline COVID-19 psychological distress. Participants filled out a three-item questionnaire as part of the baseline survey indicating their coronavirus-related psychological distress (Conway III, Woodard, & Zubrod, 2020). Participants responded to how true the items were on a seven-point Likert scale ranging from 1, “Not true of me at all,” to 7, “Very true of me.” Items included, “I have become depressed because of the Coronavirus (COVID-19),” “the Coronavirus (COVID-19) outbreak has impacted my psychological health negatively,” and “the Coronavirus (COVID-19) pandemic has NOT made me feel any worse than I did [reverse coded].” Cronbach’s alpha was satisfactory ($\alpha = .85$), indicating good internal consistency.

COVID-19 status. Each day, participants were asked, “Do you currently have COVID-19 (coronavirus)?” Participants responded with either, “Yes,” “I think so,” “Maybe,” or “No.” This question was developed to assess suspected COVID-19 status even when testing access was limited (e.g., during surges, early in the pandemic). Any response other than, “No,” from either partner, was coded as a potential COVID-positive case within the couple.

Emotional and physical intimacy. Daily emotional and physical intimacy in the past 24 hours were each measured with a one-item face-valid question used in prior daily diary work (Gleason et al., 2003). Participants rated intimacy on a five-point Likert scale. For emotional intimacy, 1 indicated, “Emotionally distant,” and 5 indicated, “Emotionally close.” For physical intimacy, 1 indicated, “Not physically intimate,” and 5 indicated, “Physically intimate.”

Loneliness. Participants rated the extent to which they felt lonely “right now, in the evening,” on a nine-point Likert scale from 1, “Not at all,” to 9, “Extensively,” each day.

Data analysis strategy

These data require analytic strategies that can account for interdependence both between couple members and over time (Kenny et al., 2006). However, unlike the more traditional Actor-Partner Interdependence Model (APIM), which allows for the estimation of only one outcome within a couple over time (e.g., male partner loneliness and female partner loneliness), we extended the APIM to allow us to estimate three outcomes for each individual within the couple simultaneously (i.e., we estimated six outcomes at once). Without this extension to the APIM, it is not possible to examine the interdependence between all of these outcomes simultaneously. Data were restructured so that each couple-day had six rows, one for each outcome: physical intimacy (female partner report, male partner report), emotional intimacy (female partner report, male partner report), and loneliness (female partner report, male partner report). Each of these was denoted with a series of dummy indicators ($1 = a \text{ given outcome}, \ 0 = \text{not this outcome}$; see Supplementary Figure 1 for three days from an example dyad). With this data structure as input, we used
PROC MIXED in SAS v. 9.4 to estimate a dyadic multilevel model with the six outcomes of interest (two measures of intimacy and one of loneliness for each dyad partner) as a function of (i) each partner’s report of baseline psychological distress due to COVID-19, (ii) whether the diary day was a weekday or weekend (1 = weekend, 0 = weekday), and (iii) whether at least one member of the couple had current suspected or confirmed COVID-19 on that day (1 = yes, 0 = no). Each predictor was multiplied by each dummy indicator, such that each effect was allowed to differ for each outcome. For example, there was no overall intercept, but a separate intercept for each outcome, and the coefficient for baseline COVID-19 distress varied for each outcome (this equation represents fixed effects for the intercept and own and partner COVID-19-related distress and not the full model):

\[ Y = \text{Intercept} \times \text{Loneliness Male Dummy} + \text{Intercept} \times \text{Loneliness Female Dummy} + \]
\[ \text{Intercept} \times \text{Emotional Intimacy Male Dummy} + \text{Intercept} \times \text{Emotional Intimacy Female Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Loneliness Male Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Loneliness Female Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Emotional Intimacy Male Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Emotional Intimacy Female Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Physical Intimacy Male Dummy} + \]
\[ \text{Baseline COVID Distress Female} \times \text{Physical Intimacy Female Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Loneliness Male Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Loneliness Female Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Emotional Intimacy Male Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Emotional Intimacy Female Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Physical Intimacy Male Dummy} + \]
\[ \text{Baseline COVID Distress Male} \times \text{Physical Intimacy Female Dummy} + \]

We encourage the interested reader to examine the full model coding. All data and syntax are available on osf (https://osf.io/9crwh/?view_only=5c421e91d0b5405a999ce789836189a4).

At level two, the model contained all possible between-couple random effects (trait level interdependence): six random intercepts (one for each outcome) and an unstructured covariance structure among the intercepts. This resulted in six unique variances and all possible covariances between them (15), for a total of 21 level-two random effect estimates. From a substantive point of view, these random intercepts allow for an examination of correlation between each partner’s stable tendency on each outcome over the course of the assessment period (e.g., if Sam tends to report higher levels of emotional intimacy on average does her partner tend to report lower loneliness on average?).

For level one (within-couple day-level interdependence), we used a form of residual structure first proposed by Bolger and Shroot (2007) that simultaneously allows for two types of data nonindependence: (i) nonindependence due to having a pair of individuals with three outcomes for each (six outcomes in total) and (ii) nonindependence due to obtaining repeated measurements on each outcome over time. The first can be thought of as the residual correlations between the six outcomes measures within each day; the second can be thought of as first-order autocorrelation (AR1) for each of the six measures
|                                | Overall (N = 208) | Female (n = 104) | Male (n = 104) | Signed rank, paired T-Test, or McNemar’s test<sup>a</sup> |
|--------------------------------|-------------------|------------------|----------------|--------------------------------------------------------|
|                                | Mean (SD), Median [IQR], or N (%) | Mean (SD), Median [IQR], or N (%) | Mean (SD), Median [IQR], or N (%) | (N = 104) = −795, p = .002 |
| Age                            | 27 [25, 31]       | 27 [24, 30.5]    | 28 [25, 31]    | S (98) = −532, p = .015 | 3.99 (103), p < .001 |
| Income                         | $50,000 [$16,000, $76,000] | $40,000 [$10,000, $68,000] | $54,000 [$27,104, $99,000] | 0.39 (102), p = .69 |
| COVID-19 distress              | 13.61 (4.45)      | 14.64 (3.82)     | 12.57 (4.79)   | 0.84 (103), p = .41 |
| Emotional intimacy             | 3.85 (.80)        | 3.87 (0.71)      | 3.83 (0.89)    | 2.64 (103), p < .01 |
| Physical intimacy              | 3.21 (.96)        | 3.18 (0.93)      | 3.24 (0.99)    | 3.39 (102), p = .69 |
| Loneliness                      | 1.82 (1.12)       | 2.00 (1.19)      | 1.66 (1.01)    | 3.39 (102), p = .69 |
| Gender                         | 104 (50.0%)       | 0 (0.0%)         | 104 (100.0%)   | -- |
| Woman                          | 102 (49.0%)       | 102 (98.1%)      | 0 (0.0%)       | -- |
| Genderfluid/Genderqueer        | 2 (1.0%)          | 2 (1.9%)         | 0 (0.0%)       | -- |
| Relationship length (Years)    | 4.53 (3.98)       | --               | --             | -- |
| City<sup>b</sup>               | Manhattan: 48 (23.1%) | --               | --             | -- |
|                                | Brooklyn: 4 (1.9%) | --               | --             | -- |
|                                | Queens: 8 (3.8%)  | --               | --             | -- |
|                                | Bronx: 2 (1.0%)   | --               | --             | -- |
|                                | Long Island: 2 (1.0%) | --           | --             | -- |
|                                | Newark: 2 (1.0%)  | --               | --             | -- |
|                                | N/A<sup>c</sup>: 142 (68.3%) | --               | --             | -- |
| Work status                    | Currently working: 145 (69.7%) | 68 (65.4%)      | 77 (74.0%)     | 2.45 (1), p = .12 |

(continued)
Table 1. (continued)

| Overall (N = 208) | Female (n = 104) | Male (n = 104) | Signed rank, paired T-Test, or McNemar's test<sup>a</sup> |
|-------------------|------------------|---------------|--------------------------------------------------------|
| Mean (SD), Median [IQR], or N (%) | Mean (SD), Median [IQR], or N (%) | Mean (SD), Median [IQR], or N (%) |                                                      |
| Not currently working | 63 (30.3%) | 36 (34.6%) | 27 (26.0%) |                                                      |
| Race<sup>b</sup> | | | | 8.73 (15), p = .89 |
| American Indian | 2 (1.0%) | 1 (1.0%) | 1 (1.0%) |                                                      |
| Asian | 54 (26.0%) | 31 (29.8%) | 23 (22.1%) |                                                      |
| Black/African American | 13 (6.3%) | 4 (3.8%) | 9 (8.7%) |                                                      |
| Multiple | 14 (6.7%) | 6 (5.8%) | 8 (7.7%) |                                                      |
| Other | 19 (9.1%) | 8 (7.7%) | 11 (10.6%) |                                                      |
| White | 106 (51.0%) | 54 (51.9%) | 52 (50.0%) |                                                      |
| Ethnicity | | | | 2.25 (1), p = .13 |
| Hispanic/Latinx | 34 (16.4%) | 14 (13.5%) | 20 (19.2%) |                                                      |
| Non-Hispanic/Latinx | 173 (83.6%) | 90 (86.5%) | 83 (79.8%) |                                                      |

<sup>a</sup>Comparison between female and male participants.
<sup>b</sup>Does not sum to 100% due to rounding error.
<sup>c</sup>This variable was added partway through data collection when recruitment expanded to include cities New Jersey. All cities listed as N/A are in New York City, but the precise location is unknown.
across days (i.e., the autocorrelation for each outcome for each person). This resulted in a total of 22 estimates: six residual estimates, 15 residual correlations, and one estimate of serial autocorrelation. The level-one residual structure allows for the examination of how intimacy and loneliness were correlated within each couple on each day (e.g., if Sam feels less lonely on a given day, after accounting for her general tendency towards loneliness and all other predictors in the model, does her partner also feel less lonely than predicted on that same day?). The AR1 serial correlations allow for the tendency that levels of each outcome (e.g., female partner’s loneliness) are more similar on adjacent days than on days further apart. A conceptual diagram is shown in Figure 1, with level-two and level-one

| Outcome                  | Coefficient | B   | se  | t    | p      | 95% CI       |
|--------------------------|-------------|-----|-----|------|--------|--------------|
| Emotional Intimacy (F)   | Intercept   | 4.58| 0.26| 17.37| <.001  | 4.06, 5.10   |
|                          | Weekend     | 0.02| 0.06| 0.37 | .71    | −0.09, 0.14  |
|                          | COVID-19 Positive | 0.12| 0.18| 0.67 | .50    | −0.23, 0.47  |
|                          | COVID-19 Distress (F) | −0.06| 0.02| −3.53| <.001  | −0.09, −0.03 |
|                          | COVID-19 Distress (M) | 0.01| 0.01| 0.88 | .38    | −0.01, 0.04  |
| Emotional Intimacy (M)   | Intercept   | 4.29| 0.35| 12.40| <.001  | 3.61, 4.98   |
|                          | Weekend     | 0.03| 0.06| 0.56 | .58    | −0.09, 0.15  |
|                          | COVID-19 Positive | 0.12| 0.20| 0.58 | .56    | −0.28, 0.51  |
|                          | COVID-19 Distress (F) | 0.00| 0.02| −0.13| .90    | −0.05, 0.04  |
|                          | COVID-19 Distress (M) | −0.03| 0.02| −1.78| .08    | −0.07, 0.00  |
| Loneliness (F)           | Intercept   | 0.27| 0.48| 0.57 | .57    | −0.68, 1.23  |
|                          | Weekend     | −0.12| 0.09| −1.38| .17    | −0.30, 0.05  |
|                          | COVID-19 Positive | 0.11| 0.29| 0.38 | .70    | −0.46, 0.68  |
|                          | COVID-19 Distress (F) | 0.12| 0.03| 4.00 | <.001  | 0.06, 0.18   |
|                          | COVID-19 Distress (M) | 0.00| 0.02| 0.01 | .99    | −0.05, 0.05  |
| Loneliness (M)           | Intercept   | −0.07| 0.39| −0.19| .85    | −0.86, 0.71  |
|                          | Weekend     | 0.04| 0.07| 0.55 | .58    | −0.10, 0.17  |
|                          | COVID-19 Positive | −0.02| 0.23| −0.10| .92    | −0.47, 0.42  |
|                          | COVID-19 Distress (F) | 0.06| 0.02| 2.38 | .02    | 0.01, 0.11   |
|                          | COVID-19 Distress (M) | 0.07| 0.02| 3.46 | <.001  | 0.03, 0.11   |
| Physical Intimacy (F)    | Intercept   | 4.35| 0.37| 11.88| <.001  | 3.62, 5.08   |
|                          | Weekend     | 0.05| 0.07| 0.72 | .47    | −0.09, 0.20  |
|                          | COVID-19 Positive | −0.31| 0.23| −1.32| .19    | −0.77, 0.15  |
|                          | COVID-19 Distress (F) | −0.07| 0.02| −3.09| <.001  | −0.12, −0.03 |
|                          | COVID-19 Distress (M) | −0.01| 0.02| −0.50| .62    | −0.05, 0.03  |
| Physical Intimacy (M)    | Intercept   | 3.88| 0.40| 9.64 | <.001  | 3.08, 4.67   |
|                          | Weekend     | 0.09| 0.07| 1.29 | .20    | −0.05, 0.24  |
|                          | COVID-19 Positive | −0.20| 0.24| −0.85| .40    | −0.67, 0.27  |
|                          | COVID-19 Distress (F) | −0.01| 0.03| −0.56| .58    | −0.06, 0.04  |
|                          | COVID-19 Distress (M) | −0.03| 0.02| −1.64| .100   | −0.07, 0.01  |

Table 2. Association of each predictor variable with each outcome. Outcome is listed in the “outcome” column, and corresponding predictors are in the “coefficient” column.
Figure 1. Path diagram of the statistical model. Rectangles represent measured variables such as intimacy reports on a particular day. Ovals represent random intercepts, that is, between-person time-invariant latent variables, as well as within-person, day-level terms. These include serially correlated residuals, denoted by $r$, and non-serially correlated residuals, denoted by $e$, which are allowed to correlate between partners within dyads each day. Panel A shows the intercept-only model for only one outcome (emotional intimacy in female and male partners) with three days of data. There is a random intercept, defined by the daily measures of emotional intimacy. Errors exhibit serial autocorrelation within each person, and errors are allowed to correlate between partners each day. In the full model, baseline measures of psychological distress due to COVID-19 in female and male partners are included as predictors of each day’s emotional intimacy. Panel B shows correlations between random intercepts for all six outcome variables. Note that each random intercept is defined by 14 days of daily data, an expanded version of the model in Panel A. Panel C shows correlations between residuals for all six outcome variables for a given day, an expanded version of the model in Panel A.
paths separated out for clarity. Rows with missing data were excluded (n = 32 observations), resulting in 6,148 observations for analysis.

**Results**

**Fixed effects**

Full model results are detailed in Table 2. For female partners, her own distress due to the COVID-19 pandemic was negatively associated with her own reports of emotional intimacy over the 14-day monitoring period, $B = -0.06$, 95% CI $-0.09$, $-0.03$, $p < .001$. Her own distress was also associated with greater self-reported loneliness, $B = 0.12$, 95% CI $0.06$, $0.18$, $p < .001$, and lower physical intimacy, $B = -0.07$, 95% CI $-0.12$, $-0.03$, $p = .002$. Female partner distress was not associated with male partner reports of intimacy, $p_s > .57$; however, her distress was positively associated with his loneliness, $B = 0.06$, 95% CI $0.01$, $0.11$, $p = .018$.

For male partners, his own distress due to COVID-19 was not significantly associated with his own emotional intimacy, $p = .076$, or his own physical intimacy, $p = .100$, but was associated with his greater loneliness, $B = 0.07$, 95% CI $0.03$, $0.11$, $p < .001$. His COVID-19 distress was not associated with his female partner’s reports of emotional intimacy, physical intimacy, or loneliness.

**Random effects**

Correlations between random effects for the empty model and model including all predictors are displayed in Table 3. There were positive correlations between each partner’s tendency towards emotional intimacy (empty model, $r = 0.50$; full model, $r = 0.55$), loneliness (empty model, $r = 0.35$; full model, $r = 0.27$), and physical intimacy (empty model, $r = 0.74$; full model, $r = 0.76$) over the two-week monitoring period. In terms of trait-level associations for each individual, one’s own tendency towards loneliness was negatively correlated with emotional and physical intimacy, and physical and emotional intimacy were positively correlated (for female partners, the correlation between own loneliness and own physical intimacy was not significant). For trait-level associations between couple members, female partner’s tendency to report higher levels of emotional intimacy was associated with greater physical intimacy and less loneliness in male partners; male partner’s emotional intimacy was associated with greater physical intimacy in female partners, and male partner’s loneliness was associated with lower physical intimacy in female partners.

**Residual correlations**

Correlations between residuals for the empty model and model including all predictors are displayed in Table 4; these correlations were identical in these two models. There were positive correlations between residuals for emotional intimacy ($r = 0.24$), loneliness ($r = 0.15$), and physical intimacy ($r = 0.59$), suggesting additional interdependence between
couple members at the day-level. In terms of day-level residual associations for each individual, if one person reported greater loneliness than predicted on a given day, this was negatively correlated with their own reports of daily emotional and physical intimacy, and physical and emotional intimacy were positively correlated at the day-level. For day-level associations between couple members, female partner’s daily report of higher than
Table 4. Residual correlations between female and male partner reports of daily emotional intimacy, loneliness, and physical intimacy. The top panel shows correlations from the empty model, and the bottom panel shows correlations from the model including all predictors. Note that these correlations are quite similar because the predictor of interest was measured at baseline only, which cannot explain variance in day-level outcomes.

|                          | Emotional Intimacy (F) | Emotional Intimacy (M) | Loneliness (F) | Loneliness (M) | Physical Intimacy (F) | Physical Intimacy (M) |
|--------------------------|------------------------|------------------------|----------------|----------------|-----------------------|-----------------------|
| Emotional Intimacy (F)   | 1                      |                        |                |                |                       |                       |
| Emotional Intimacy (M)   | 0.24                   | 1                      |                |                |                       |                       |
| Loneliness (F)           |                        |                        | 0.26           | -0.10          |                       |                       |
| Loneliness (M)           |                        |                        | -0.11          | 0.23           | 0.15                  | 1                     |
| Physical Intimacy (F)    |                        |                        |                |                | 0.50                  | -0.17                 |
| Physical Intimacy (M)    |                        |                        |                |                | 0.32                  | -0.13                 |
| Emotional Intimacy (F)   | 1                      |                        |                |                |                       |                       |
| Emotional Intimacy (M)   | 0.24                   | 1                      |                |                |                       |                       |
| Loneliness (F)           |                        |                        | 0.26           | -0.10          |                       |                       |
| Loneliness (M)           |                        |                        | -0.11          | 0.24           | 0.15                  | 1                     |
| Physical Intimacy (F)    |                        |                        |                |                | 0.50                  | -0.17                 |
| Physical Intimacy (M)    |                        |                        |                |                | 0.32                  | -0.13                 |

predicted levels of emotional intimacy was associated with greater physical intimacy and less loneliness in male partners, and female partners report of greater loneliness than predicted was associated with less physical intimacy in male partners. Male partner’s emotional intimacy was associated with greater physical intimacy and less loneliness in
female partners, and male partner’s loneliness was associated with lower physical intimacy in female partners. The coefficient for serial autocorrelation was, $r = 0.16, p < .001$, in both models.

**Discussion**

Changes in relationship functioning during the COVID-19 pandemic are complex and varied, with heterogeneous effects across couples (Donato et al., 2021; Schmid et al., 2021; Weber et al., 2021). To unpack some of this variation, the present study explored whether a baseline measure of COVID-19-related distress was associated with daily relational outcomes in cohabiting couples living in the NYC metropolitan area, as well as within-couple associations of relationship factors over time. As hypothesized, female partners reporting higher levels of COVID-19 distress at baseline also reported less emotional and physical intimacy, as well as greater loneliness over the course of 14 days. For male partners, COVID-19 distress was associated with his own greater loneliness, but not with his reports of physical or emotional intimacy. There was only one significant partner association, such that female partners’ COVID-19 distress was also associated with greater loneliness in male partners (but not with his reports of physical or emotional intimacy). There was no association of male partners’ distress on female partners’ loneliness or emotional or physical intimacy.

The lack of within-person association between male partners’ COVID-19 distress and his own reports of emotional and physical intimacy was surprising. However, prior work has found that men, as compared to women, report fewer emotional and physical symptoms at times when they are stressed (American Psychological Association, 2012). This may account for why we did not find an association between COVID-19 distress and intimacy in male partners (i.e., female partners with higher levels of baseline distress reported significantly lower physical and emotional intimacy on average over the 14-day period, but male partners did not). Stated otherwise, even if male partners report similar levels of distress due to COVID-19 as their female partners, the manifestation of this of distress may look different. The sex-based differences uncovered in this study are also aligned with theories on gender/sex differences in the provision of social support during times of stress showing that female partners provide more skilled support when their male partners are distressed, whereas male partners tend to provide lower quality support (Bodenmann et al., 2015; Neff & Karney, 2005). It is possible that, in the current study, distressed males received more or higher quality support from their female partners and therefore did not report declines in intimacy. Future researchers should incorporate and test mechanisms (such as social support) that might explain why the association of distress with relational outcomes differs by sex and/or gender. Future researchers should also collect daily measurements of COVID-19-related distress, as this could uncover more nuanced effects that unfold on a shorter timescale. It is also important to note that, although not significant, the coefficients for the association of male partners’ COVID-19 distress with his own intimacy were negative and approached statistical significance, and differences between these coefficients for male and female partners were not formally tested.
Taken at face value, there seems to be very little influence occurring within the couple, such that there were few statistically significant partner associations found. That is, although there are significant within-person associations of baseline COVID-19 distress with one’s own outcomes, male partner distress at baseline was not associated with female partner outcomes over the following 2 weeks, and female partner distress was associated with male loneliness only. This seems at odds with dyadic literature demonstrating both actor and partner effects of distress in couples (Randall & Bodenmann, 2009). However, this is only a part of the picture. First, examining correlations at the upper level between partners’ time-invariant random effects and at the lower level between partners’ daily residual fluctuations uncovers positive associations of each partner’s physical intimacy, each partner’s emotional intimacy, and each partner’s loneliness, both overall and at the day-level. At the between-couple trait level, for example, if one partner is lonelier, on average, the other tends to be lonelier as well. Results are similar at the day level: if one partner is more (or less) lonely on any given day, the other partner tends to be more (or less) lonely as well, although this tendency is much weaker. This suggests the potential for indirect ripple effects within couples (e.g., if Sam reports high levels of COVID-19 distress at baseline, she is likely to report higher levels of loneliness on any given day [fixed effect]; in turn, the lonelier she is, the lonelier her partner is [level-two random covariance], and if she was particularly lonely on a given day, her partner was also particularly lonely [level-one residual correlation]). Other plausible correlations support this assertion: for example, when the female partner was lonelier than expected on a given day, both she and her male partner experienced lower levels of physical and emotional intimacy on that same day (Acker & Davis, 1992; Arpin et al., 2018; Aykutoğlu & Uysal, 2017; Baumeister & Bratslavsky, 1999; Fisher et al., 2015; Mund & Johnson, 2021; Rokach & Philibert-Lignières, 2015; Rubin & Campbell, 2012; Stokes, 2017). Although these are cross-sectional correlations only, given the interdependence in couples’ relationship functioning across multiple domains, future research may consider whether these small-to-medium effects (e.g., residual correlations between female and male partner outcomes) can accumulate as stressors within the relationship over time.

The dyadic longitudinal design is a major strength of this study, as was the statistical modeling technique. This method, which is similar to (and expands upon) the dyadic process model (Bolger & Shrout, 2007), allowed us to detect patterns of potential influence within couples, at multiple levels, that would have gone undetected had we simply looked at the association of each partner’s reported COVID-19 distress on relationship outcomes. Results confirmed that COVID-19 distress can be damaging for female partners, and, given the cross-sectional correlations in relationship functioning, that this may have indirect and negative effects on male partners and the couple relationship more broadly. This was true for more stable tendencies (i.e., relationship factors across the whole diary period) as well as at the day-level. It may be that female partner distress is one of the primary factors driving differences in the impact of COVID-19 on relationship functioning (given that male reported distress did not show consistent patterns of association). However, statistical differences between fixed effects for male and female partners were not formally tested, limiting study conclusions. It is also important to note that these correlational results showing interdependence in couples do not imply causality.
and influence effects should be examined directly in future research; thus, ripple effects are highly speculative. Because COVID-19 distress was measured at baseline only, it is also possible that more nuanced effects of distress on relationship functioning that occurred on the day-level were missed. Mechanisms that underlie the association of COVID-19-related distress with relationship outcomes, such as coping responses quality (Pietromonaco & Overall, 2021), could shed additional light on dyadic relationship dynamics; however, because very little research has examined how COVID-19 distress has impacted relationship functioning, this study represents an important first step in establishing this association.

Results may not generalize to romantic couples cohabitating outside of the New York metropolitan area (e.g., in other areas of the United States or different countries) or to couples who live with others in the home, such as roommates or children. These factors could change couple dynamics, including added stressors due to finding childcare or school closures and/or limiting opportunities for intimacy. This was also a convenience sample, and so results may not generalize to other couples living in the area. For example, couples who are more satisfied with their relationship are more likely to participate in research together. Finally, the current work only examined individuals in female—male sex relationships. We recognize that sex and gender go beyond a binary and that many romantic relationships include individuals of the same sex and/or gender. Research is needed to see whether results replicate in samples that differ (Rad et al., 2018), such as in queer couples, couples with children, those with different cultures or living in different geographic areas, and more. Disability status was not assessed and should be included in future studies. Although not a focus of this study, it is interesting that suspected COVID-19-positive status was not associated with relational well-being. Future research might explore reasons for this null effect; for example, it may not be relevant because the couple was already isolating together, or facing a stressor could be a challenge that the couple rises to face together.

Physical intimacy, emotional intimacy, and loneliness were measured using single item scales. Although these items were face-valid and have been used in prior work, more robust measures may have detected stronger associations. An important caveat of the present analysis is that baseline COVID-19 distress cannot explain fluctuations in daily outcomes, so it is unclear if daily changes in COVID-19 distress are associated with elevations (or reductions) in daily loneliness and intimacy within the couple. Future studies should examine time-varying distress as a predictor; examining changes in residual correlations in models including v. excluding time-varying distress would garner additional insights into mechanisms underlying interdependence in couples’ relationship functioning. Future research should also assess distress related to COVID-19 on a day level to test reverse directionality; in other words, to test whether own and partner reports of loneliness and intimacy are associated with fluctuations in COVID-19-related distress. This would also allow for a more thorough test of theoretical models of family adaptation to stressors (McCubbin & Patterson, 1983; Patterson, 1988) such as COVID-19 by allowing an incorporation of existing resources into the model, such as the reciprocal relationships between relationship functioning and distress outcomes, rather than simply looking at the associations of stressor presence (COVID-19, which was constant within
this sample) and subjective response (COVID-19 distress) with subsequent relationship variables. In other words, is positive relationship functioning a buffer against further distress, promoting positive adaptation?

**Conclusion**

This study implemented a longitudinal dyadic design to illuminate heterogeneous changes in relationship functioning amongst couples cohabiting together in the NYC metropolitan area during the COVID-19 pandemic. COVID-19-related distress, particularly in the female member of the couple, was associated with decrements in her own emotional and physical intimacy and increases in her own, and her partner’s, loneliness. Exploring covariation in each individual’s intimacy and loneliness, both at the trait-level and the day-level, suggested additional interdependence that could have ripple effects on couple functioning even when direct associations are not apparent. Further research should directly test mechanisms that underlie processes of influence in couples under stress, as well as individual and relational sequelae.

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**Open research statement**

As part of IARR’s encouragement of open research practices, the author(s) have provided the following information: This research was not pre-registered. The data used in the research can be publicly posted. The data can be obtained at: [https://osf.io/9crwh/](https://osf.io/9crwh/) or by emailing: tmc2184@cumc.columbia.edu. The materials used in the research can be publicly posted. The materials can be obtained at: [https://osf.io/9crwh/](https://osf.io/9crwh/) or by emailing: tmc2184@cumc.columbia.edu.

**Supplemental Material**

Supplemental material for this article is available online.
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