THESIS

ROMANTIC CONFLICT, INTERPERSONAL MINDFULNESS, AND CELLULAR AGING

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ABSTRACT

ROMANTIC CONFLICT, INTERPERSONAL MINDFULNESS, AND CELLULAR AGING

Interpersonal relationships can affect health (Ellison et al., 2016, Laurent et al., 2013) including biological and cellular aging processes measured through telomere length (Rentscher et al., 2020). Despite established associations between romantic conflict and health outcomes (Cummings et al., 2007), empirical evidence has yet to emerge supporting a link between romantic conflict and telomere length. Given the frequency with which adults may experience romantic conflict (Papp et al., 2002), it is important to understand how multi-faceted romantic conflict experiences impact health so that targeted interventions can be developed. Mindfulness has well-established benefits for health (Lucas-Thompson et al., 2019) and close personal relationships (Pratscher et al., 2018; Townshend et al., 2016), thus mindful partnering (Seiter et al., 2021) may be a fruitful avenue for such intervention. Using a community sample of 30 couples, this study explored hypothesized associations between romantic conflict and telomere length, as well as the moderating effects of mindful partnering, through self-reported and observational data. A small but non-significant association was found between romantic conflict and telomere length, and no significant moderating effect of mindful partnering emerged.

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INTRODUCTION

There is an established connection between quality of interpersonal relationships and health outcomes (Ellison et al., 2016; Kiecolt-Glaser et al., 1996; Laurent et al., 2013). Psychosocial stressors can impact not only mental health, but also physical health, including speeding (or slowing) the biological aging of cells (Rentscher et al., 2020), which is frequently measured via the length of noncoding DNA caps on the end of each chromosome known as telomeres. Telomeres become shorter with age, and almost disappear when a person is close to death. Telomere length (TL) is predictive of lifespan (Heidinger et al., 2012), susceptibility to disease (Fitzpatrick et al., 2007), death resulting from disease (Bakaysa et al., 2007; Rode et al., 2015), and premature mortality (Cawthon et al., 2003). TL itself is associated with psychosocial stressors like abuse, socioeconomic status, and early life adversity in childhood, as well as stressful life events such as divorce or illness, caregiving, financial strain, perceived discrimination, perceived stress, and threat appraisals in adulthood (Rentscher et al., 2020). There is also a well-established association between depression and TL (Schutte & Malouff, 2015).

Although the literature on TL and its relations to psychosocial stress and interpersonal relationship quality is expansive, researchers have yet to establish an association between TL and destructive romantic conflict (i.e., conflict that is frequent, intense, and hostile). Due simply to the number of daily interactions romantic partners generally have, romantic relationships have the potential to be either an epicenter for or an oasis from psychosocial stress. Destructive romantic conflict is consistently shown to be associated with negative physical and mental health outcomes (Cummings et al., 2007). There is reason to expect that destructive romantic conflict

also predicts shorter TL, but there is no evidence for this in the current literature. This study first seeks to provide that evidence. Then, it explores one potential moderator of that association: interpersonal mindfulness within the romantic context. This form of mindfulness will be explored through the novel construct of mindful partnering (Seiter et al., 2021).

Cellular Aging: The End-Replication Problem

As organisms age, their cells divide and replicate. Through this process, certain physical characteristics of cells and the DNA housed inside them begin to change. Because there is error in each replication, chromosomes become slightly shorter. When this happens, they may become instable and undergo structural changes such as loss of important coded genetic material (Greider & Blackburn, 1996). When new cells, known as daughter cells, receive inaccurate or incomplete genetic information, they may undergo a programmed cell death called "apoptosis" which, on a large scale, may become dangerous (Greider & Blackburn, 1996). Over time, organisms evolved noncoding end caps for their chromosomes, called telomeres, to protect coded genetic material, stored in chromosomes, and the cells that house that information, from this dangerous instability (Greider & Blackburn, 1996). Without telomeres, genetic material would disappear with each cell replication and lead to loss of important coded genetic information. These telomeres are crucial evolutionary developments because when telomeres shorten, important genetic information does not have to.

Through any life cycle, telomeres both grow, through the production of an enzyme known as telomerase, and shorten with each cell replication (Greider & Blackburn, 1996). Most cells, regardless of telomerase activity, eventually stop replicating and become "senescent," but most human cells have little to no telomerase activity (Greider & Blackburn, 1996). Because this is the case, cells lacking telomerase activity can only replicate a certain number of times. This is

known as the End-Replication Problem in biology; that is, as more and more cells become senescent, the organism becomes less capable of life. Conversely, excessive telomerase activity is hypothesized to lead to uncontrolled replication of cells, playing a role in the formation of tumors and the spread of cancer in the body (Greider & Blackburn, 1996).

Telomere Length

Telomeres are hypothesized to be a major part and potential cause of human aging (Greider & Blackburn, 1996). Research suggests that longer telomeres in early life are associated with a longer lifespan (Heidinger et al., 2012) because longer telomeres allow for more replications of cells. Even as an organism produces new cells, the average TL decreases with age (Monaghan & Haussmann, 2006). The shortening of telomeres removes layers of protection from genetic information (Rodier et al., 2005). When cells have shorter TL and, thus, fewer opportunities for replication, certain biological systems become vulnerable (Rodier et al., 2005). This concept is potentially grasped most easily through a look at the immune system, where the ability to replicate immune cells quickly is important for maintaining low morbidity. As a result of this and other vulnerabilities, it is important that individual cells maintain telomerase activity, thereby lengthening telomeres wherever possible. How then, though, do life experiences affect TL?

Rentscher and colleagues (2020) outlined substantial literature pointing toward psychosocial stressors as predictive of biological and cellular aging, which is measured primarily by TL. What they called “stressful life events” (SLEs) were linked to relatively shorter telomeres in 13 studies. SLEs included “diagnosis with a serious illness, job loss, divorce, and the death of a child or other close relative” (Rentscher et al., 2020, p. 228). These and other SLEs are also widely understood to increase risk of depression, which is negatively associated with TL

(Schutte & Malouff, 2015). Longitudinal studies have shown that not only are SLEs associated with shorter telomeres, but they may contribute to relatively faster rates of cellular aging (Rentscher et al., 2020). Thus, it seems plausible that developing resilience against SLEs and related psychosocial stressors, like destructive romantic conflict, may serve as a protective factor for maintaining TL and normative speeds of cellular aging.

Romantic Conflict

Romantic conflict is a particularly common stressor for adults in romantic relationships (Papp et al., 2002). In emerging adulthood and adulthood, romantic partners typically play a large role in attachment security (Diehl et al., 1998). During this stage of life, people generally become less reliant on their family of origin and may be relying on other relationships, like romantic relationships, to help form their identities (Diehl et al., 1998). Due to the large role romantic partners play in adult life, and because romantic conflict activates the attachment system (Feeney & Karantzas, 2017), conflict in romantic relationships may threaten attachment security. Destructive conflict—involving behaviors such as pushing, name calling, withdrawal, or threatening, for example—may be particularly threatening, and thereby increase risk of robust and long-term cognitive, physiological, emotional, and other consequences (Cassidy et al., 2013).

Given the variability of the many factors present in conflict, including the individual contexts each partner brings to the disagreement (Gottman & Notarius, 2002), conflict is multi-faceted and highly complex (Lucas-Thompson et al., 2016). Destructive romantic conflict behaviors are more damaging to relationships within the family system than constructive romantic conflict behaviors (e.g., calm discussion or negotiation; Lucas-Thompson & George, 2017). In fact, constructive conflict behaviors may benefit family dynamics. The literature

suggests that whether conflict is constructive or destructive is differentially predictive of outcomes like levels of distress, marital satisfaction, and depressive symptoms (Du Rocher Schudlich et al., 2004; Heene et al., 2005).

Mental Health Outcomes

As conflict between couples becomes more frequent, it also becomes less constructive and coupled with more negative emotionality (Cummings et al., 2007). Ellison and colleagues (2016) found that individual attributions about romantic conflict—that is, the way someone thinks about the causes, experiences, and effects of their romantic conflict—have long-term effects on an individual's mental health. Then, there is a robust and consistent association between destructive romantic conflict and mental health outcomes like depressive symptoms (Ellison et al., 2016; Kouros & Cummings, 2011; Whisman, 2001) and associated functional impairments (Choi & Marks, 2008).

Literature on activation of physiological stress responses within romantic contexts suggests a pathway from pair bonds to mental health outcomes. In relationships, individual partner stress responses become, in a way, synchronous (Liu et al., 2013), which can aid in repair of romantic relationships or, conversely, lead to escalation of arguments and prevent adaptive recovery (Mercado & Hibel, 2017). Repeated or long-term activation of the body's stress response system may result in a malfunction which is known as allostatic load: an inability for the system to return to "normal" (Juster et al., 2010). When physiological systems fail to return to baseline, various forms of dysregulation may occur across the spectrum from hyperreactivity to hyporeactivity (over-reactivity to under-reactivity; Juster et al., 2010; McEwen, 1998). Not only can these forms of dysregulation affect mental health (Beck, 1987), they can also lead to an array of physical health risks (Dowd et al., 2009).

Physical Health Outcomes

Beyond mental health outcomes, romantic conflict also affects physical health in several ways. In one study, conflict behaviors in newlywed couples were negatively associated with endocrine function (Kiecolt-Glaser et al., 1996). These findings were based on measures of hormones that indicate physiological stress response—cortisol, epinephrine, and norepinephrine—as well as three hormones related to cortisol when evaluated after a conflict interaction task (Kiecolt-Glaser et al., 1996). Cortisol, a robust indicator of hypothalamic-pituitary-adrenal (HPA) axis activity typically increases acutely in response to negative communication patterns (Laurent et al., 2013). Diurnal cortisol patterns (i.e., production of cortisol across the day) may also be altered in response to negative communication patterns (Barnett et al., 2005). These changes in HPA axis stress response and functioning—especially when sustained, as would be expected in high-conflict romantic relationships—are particularly concerning for long-term health outcomes (Pietromonaco & Beck, 2019). In women, findings suggest that marital dissatisfaction and romantic conflict involving hostility are associated with serious spikes in blood pressure during conflict, which also can be dangerous when frequent and sustained (Ewart et al., 1991). Given that better marital quality predicts lower risk for mortality (Robles et al., 2014) in addition to these health outcomes, it is prudent to explore links between direct romantic conflict and tangible health outcomes.

Potential Link Between Destructive Romantic Conflict and Telomere Length

Given the overlap in health problems associated with both romantic conflict and TL, establishing a link between TL and romantic conflict seems to be an appropriate next step in gathering a wholistic picture of romantic conflict's effects on health. Studies have already linked marital status and TL, with consistent findings showing that having a spouse or romantic partner

is associated with longer TL (Rentscher et al., 2020). In addition, Cabeza de Baca et al. (2017) found greater sexual intimacy in romantic relationships to be associated with longer TL and lower symptomatology from illness. When controlling for age, they found that more frequent sexual activity with a romantic partner was related to longer telomeres in blood samples. Effects were of moderate size in peripheral blood mononuclear cells, or leukocytes.

The established connections between stressful experiences (including divorce), depression, and TL present romantic conflict as a potentially fruitful area for research and intervention to prevent shortened TLs and increases in speed of cellular aging. Links between depressive symptoms and romantic relationship functioning have been well established (Proulx et al., 2007). Individuals with major depression are also reported to be around 70% more likely to have short telomeres (Schutte & Malouff, 2015). This overlap points to a likely association between TL and romantic conflict and opens the door for mental health interventions targeted at romantic relationships to also seek to slow cellular aging. Further supporting this line of intervention, relationship satisfaction is positively correlated with telomerase activity, which lengthens telomeres (Cabeza de Baca et al., 2017). Given the established connection between relationship processes and functioning, exploration of potential moderators for these and related connections becomes prudent.

A Potential Moderator: Interpersonal Mindfulness

Literature on mindfulness documents several mental and physical health benefits associated with mindfulness (Lucas-Thompson et al., 2019; Tomlinson et al., 2018). Mindfulness is defined as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994) (p. 4). According to the mindfulness stress buffering hypothesis (Creswell & Lindsay, 2014), mindfulness mitigates negative appraisals of potential

stressors, thereby reducing physiological responses to stressors. Given the frequency with which people may experience romantic partner conflict (Papp et al., 2002), the reduced reactivity and mitigation of negative appraisals that accompany interpersonal mindfulness likely serve as buffers between destructive partner conflict and negative health outcomes. Benefits to mental and physical health may, in turn, slow shortening of telomeres.

Dispositional mindfulness has a well-supported association with psychological health, such that greater mindfulness is linked to better psychological health (Tomlinson et al., 2018). A systematic review suggests that this association may be due to the fact that mindfulness is related to a decrease in negative cognitive patterns and rumination (Tomlinson et al., 2018), both of which contribute to reduced psychosocial stress. Due to the buffering effects of mindfulness (Creswell & Lindsay, 2014), mindfulness in emerging adults is negatively associated with depressive symptoms, anxiety, and several negative contributors to sleep quality (Bogusch et al., 2016). In addition to these mental health outcomes, studies have established mindfulness as a predictor of reduced cardiovascular and emotional stress responses as well (Lucas-Thompson et al., 2019). Thus, the potential exists for mindfulness to improve relationship quality simply by buffering the complications of poor mental and physical health that may stem from romantic conflict. Although the benefits of mindfulness are well-documented, research has primarily focused on intrapersonal mindfulness, or internalized mindfulness within-persons, as opposed to mindfulness in interpersonal relationships, or *interpersonal mindfulness.*

Interpersonal Mindfulness

Very little work has explored interpersonal mindfulness—a type of mindfulness between-persons. Interpersonal mindfulness was defined by Pratscher et al. (2018) as "awareness of self and others, accompanied with the qualities of nonjudgmental and nonreactive presence" (p.

1207). Literature has yet to explore in depth the levels of mindfulness present during interactions between romantic partners, and how mindfulness affects relationship satisfaction and romantic conflict. Existing research on interpersonal mindfulness has primarily focused on parent-child and friend relationships (Seiter et al., 2021). Findings in these areas suggest that exploring interpersonal mindfulness between romantic partners, dubbed "mindful partnering," may be a next step. To find empirical support for this idea, I look to literature on interpersonal mindfulness in other close relationships.

Mindfulness in Parent-Child Relationships. Mindful parenting is based on the idea that maintaining present moment awareness, attending to the needs of children, and exercising self-regulation are crucial for maintaining positive parent-child relationships (Duncan et al., 2009). Without this awareness, parents may be more prone to making rash, automatic, self-focused decisions that reduce the quality of interactions (Duncan et al., 2009). Conversely, more mindful parents report reduced stress, improved emotional awareness, and less likelihood of dismissing their child's emotions and needs (Townshend et al., 2016). Children with more mindful parents also show reduced externalizing symptoms (Townshend et al., 2016). Duncan et al. (2009) suggested that parents who remain mindful during interactions with their children create a family dynamic that supports mutual satisfaction within the parent-child relationship. These goals that theorists establish for parents to be more mindful in their relational interactions can be easily applied to relationships outside of parenting, such as relationships with friends or romantic partners.

Mindfulness in Friend Relationships. Theorists posit that, similar to actions in mindful parenting, interpersonal mindfulness within the context of adult friendships may foster more positive interactions with friends, particularly because mindfulness improves awareness of self

and personal experience as well as awareness of verbal and nonverbal cues from others (Pratscher et al., 2018). When fielding these incoming social signals in close relationships, empathic accuracy—the ability to accurately perceive the emotions of a social partner—is critical (Fruzzetti & Iverson, 2006), but could lead to co-rumination given stronger attunement even to negative emotions. Even when co-rumination is included as a control, though, interpersonal mindfulness is still positively associated with friendship quality (Pratscher et al., 2018).

Mindfulness in Romantic Relationships. Although there is much support for positive links between intrapersonal mindfulness and relationship quality (Carson et al., 2004; K. C. Jones et al., 2011; Khaddouma et al., 2015), past work examining associations between interpersonal mindfulness and romantic relationships has been extremely limited. Seiter et al. (2021) made the case that, due to the strong effects that romantic relationships have on mental and physical health, conceptualizing the novel interpersonal mindfulness construct "mindful partnering" further and exploring its associations with mental and physical health outcomes is of critical importance.

Of the work that does exist on interpersonal mindfulness within the context of romantic relationships, one team of researchers found their measure of mindful awareness in relationship contexts to be more strongly associated with romantic relationship quality than existing measures of intrapersonal mindfulness (Kimmes et al., 2018). This finding is particularly interesting given the vast literature suggesting that intrapersonal mindfulness is already positive for romantic relationships (Carson et al., 2004; K. C. Jones et al., 2011; Khaddouma et al., 2015). Seiter et al. (2021) argued, though, that even this finding paints an incomplete picture of the potential benefits of mindful partnering because Kimmes et al. (2018) only measured a single aspect of

mindful partnering: mindful awareness. Seiter et al. (2021) reported indicators that dimensions of their five-factor model of mindful partnering—including compassion/acceptance, nonreactivity, mindful awareness, emotional awareness, and self-compassion—were positively associated with outcomes like marital satisfaction, emotional stability, and agreeableness. Given the ability of mindfulness to buffer stress responses (Creswell & Lindsay, 2014) and these findings by Seiter et al. (2021), it seems likely that mindful partnering could buffer not only immediate stress responses, but also long-term effects that relationship stress can have on physical health and aging.

Mindfulness and Cellular Aging

Theorists have proposed that mindfulness, through its ability to reduce responses to stress (Creswell & Lindsay, 2014), may be able to slow cellular aging and the shortening of telomeres (Epel et al., 2009). More specifically, these researchers posited that mindfulness may be positively associated with positive cognition states and positive arousal while negatively associated with stress cognition and stress arousal. According to their model, threat appraisals are the specific type of stressor linked to cellular aging. In an empirical test, three items related to cognitive appraisals of stress and the perception of stress at face value were negatively associated with TL in support of their hypothesis (Epel et al., 2009). Data also suggested that appraising a stressor as "challenging" rather than "threatening" is related to longer TL (Epel et al., 2009).

In the context of romantic conflict, mindfulness moderates associations between negative partner behaviors and cortisol response such that partners with more state mindfulness following conflict—measured through curiosity and decentering—tend to display more-rapid cortisol recovery from destructive partner behaviors during conflict, whereas less mindful partners

showed an inhibited post-conflict cortisol recovery in response to negative partner behaviors (Laurent et al., 2016). This finding is promising, suggesting that mindfulness improves overall stress regulation within romantic conflict. Thus, it may similarly moderate links between romantic conflict and TL, given the established association between TL and stress (Rentscher et al., 2020).

Present Study

The purpose of this study is first to test associations between romantic conflict and TL. Past studies have linked stressors related to romantic conflict to TL but stopped short of establishing a direct negative association between these variables (Cabeza de Baca et al., 2017; Rentscher et al., 2020). I hypothesize that this study will establish this negative association between destructive romantic conflict and TL, showing that higher levels of destructive conflict are associated with shorter TL. Second, the present study seeks to establish mindful partnering as a moderator of this association. There are theorized links between intrapersonal mindfulness and TL (Epel et al., 2009), and the literature suggests that interpersonal mindfulness may have even stronger associations with predictors of TL, given the findings by Kimmes and colleagues (2018). Creswell and Lindsay (2014) also suggested that mindfulness serves as a stronger buffer for stress in people who experience stronger stressors. Given this suggestion related to intrapersonal mindfulness and the overall threatening nature of romantic partner conflict, I hypothesize that high levels of mindful partnering buffer stress from destructive conflict and reduce the strength of its negative association with TL.

METHODS

Participants

Participants were 60 individuals (53.3% Female, M_{age} = 35.92 years, SD_{age} = 15.29 years) nested within 30 couples (56.7% married) recruited from the community to participate in a larger study about stress, its biomarkers, families, and romantic relationships. Subjects were recruited nationally through various mailing and emailing lists, internet groups, online platforms, and flyers. To be eligible to participate, participants had to be at least 18 years old, currently in a serious committed relationship, and currently cohabitating. All participants had to be able to complete measures and tasks in English. Couples were not required to be heterosexual, and eight participants identified as lesbian or bisexual. Participants in the sample were allowed to select all racial backgrounds they identify with. The sample was 85.00% Caucasian, 11.70% Hispanic/Latinx, 6.70% Asian/Pacific Islander, 1.70% Black, and 6.70% identified as another race. Based on self-reports, the median yearly household income for this sample is between $50,000 and $100,000 and participants were educated, on average, to between a bachelor's and a graduate degree level (M = 6.23, SD = 1.19).

Procedure

Data for this study were collected remotely before and during the COVID-19 pandemic. Couples completed questionnaires to provide demographic information and self-reports of relationship-related variables: conflict and mindful partnering. Couples then recorded themselves engaging in a 10-minute conflict discussion task. Couples were prompted to discuss areas of disagreement in their relationship while working toward mutually satisfying solutions. Discussion topics were assigned by the researcher based on areas of highest disagreement in the

relationship that were self-reported via the questionnaire. Following the completion of these tasks, couples provided saliva samples via oral swab which were assayed for telomere length. All procedures were approved by the Colorado State University Institutional Review Board.

Measures

Destructive Romantic Conflict

Observer-rated conflict behavior. Three trained coders used an adaptation of the marital conflict coding system developed by Mangelsdorf and colleagues (Frosch et al., 2000) to rate conflict behaviors during the videotaped 10-minute conflict discussion task. The scale includes eight dyad-level codes (e.g., engagement between the partners) and four individual-level codes (e.g., positive affect of each individual partner). All dimensions were rated on a scale ranging between 1 (very low) and 7 (very high). Destructive conflict behaviors were captured primarily through the system's "irritation/antagonism," "individual negative affect," "sensitivity/support," and "conflict resolution/satisfaction" dimensions. As an example of types of behaviors observed, the irritation/antagonism scale captures overall negative tones within an interaction, with a score of 1 representing a positive or neutral interaction with no marked instance of irritation, antagonism, anger, or hostility, and a score of 7 representing personally-directed extreme irritation, antagonism, anger, or hostility that are likely common within the relationship. Appropriate scales were reverse scored so that lower scores reflected more destructive conflict. Raters overlapped on 30% of observations and reached high levels of reliability, as measured by intra-class correlations, for all individual dimensions of the coding system (α ranging .750 to .973). Ratings were averaged to compute an overall observed conflict behavior score, and coders were highly reliable on the ratings in this average score (α = .970).

Self-reported destructive conflict. Given that constructive conflict behaviors may benefit relationships within the family system (Lucas-Thompson & George, 2017), it is critical that researchers clearly define the dimensions of conflict they are particularly interested in studying and how they are operationalizing those dimensions. In the present study, we measured frequency of destructive romantic conflict behaviors via the psychological aggression (M = 21.27, SD = 34.02), physical assault (M = 2.50, SD = 8.30), sexual coercion (M = 3.43, SD = 13.73), and injury (M = 1.17, SD = 4.98) subscales of the Revised Conflict Tactics Scales (CTS2; Straus et al., 1996), which were then summed to create a composite score of destructive conflict behaviors. Subscale means for this sample were different from published norms: psychological aggression (norm range 15.1-17.2), physical assault (norm range 9.3-15.9) sexual coercion (norm range 11.8-19.9), and injury (norm range 3.6-25.1).

Subjects reported the frequency of destructive behaviors during conflict within the past year from 0 = "This has never happened" to 6 = "More than 20 times in the past year." The scale also includes options for 7 = "Not in the past year, but it did happen before." For consistency in my analyses, 7 was recoded to 0 (Straus et al., 1996). Examples of items for each subscale include "I insulted or swore at my partner" (psychological aggression), "I pushed or shoved my partner" (physical assault), "I insisted on sex when my partner did not want to" (sexual coercion), and "I had a broken bone from a fight with my partner" (injury). Subjects also reported the frequency with which their partner exhibited each behavior toward them. Sum scores for frequency of dyadic destructive conflict behaviors in the last year were calculated following guidelines outlined by the scale creators (Straus et al., 1996).

Telomere Length

Participants provided 200 ul saliva samples to be assayed for telomere length, which is an indicator of biological and cellular aging. Samples were assayed at Colorado State University. Using the DNeasy Blood and Tissue Kit (QIAGEN®, Valencia, CA), DNA was isolated from each saliva sample and multiplexed quantitative polymerase chain reaction measurements of telomere length were performed using a Bio-Rad CFX96 Real-Time PCR analysis machine (Hercules, CA).

Interpersonal Mindfulness in Romantic Relationships

Couples completed the Mindful Partnering Measure (MPM; Seiter et al., 2021), a reliable and valid scale consisting of 22 items related to interpersonal mindfulness within romantic relationships. All items on the MPM are rated based on a 5-point Likert-type scale ranging from 1 (Never true) to 5 (Always true). An example item is "I listen carefully to my partner's ideas, even when I disagree with them." Negatively worded items were reverse scored. This measure includes 5 sub-scales related to compassion/acceptance, nonreactivity, mindful awareness, emotional awareness, and self-compassion. After reverse scoring appropriate items, scores for each item were summed to generate sub-scale scores, and sub-scales were summed to create a total mindful partnering score. For the purposes of this study, only the total mindful partnering score was used.

Control Variables

In an effort to rule out confounds, I took an empirical approach to examine potential control variables. Basic demographics (e.g., age, sex) and the following possible controls were included in preliminary bivariate correlations. I first examined bivariate correlations between these variables and key study variables; only potential control variables that were significantly

correlated with both the independent and dependent variables were to be included in subsequent analyses as control variables.

Physical health. Participants were asked to report on their own and their partner's physical health using items from the RAND Health Survey (Ware & Sherbourne, 1992). The items read "In general, would you say your (partner's) health is:" Options ranged from 1 = "Poor" to 5 = "Excellent."

Financial stress. Participants were asked "How stressful is your current financial situation?" Options ranged from 1 (Not at all) to 10 (Extremely stressful).

Sexual satisfaction. Participants were asked to report on sexual satisfaction using the five-item sexual-satisfaction subscale of the Multidimensional Sexuality Questionnaire (Snell et al., 1993). An example item from this scale is "My sexual relationship meets my original expectations." Choices range from 0 (Not at all characteristic of me) to 4 (Very characteristic of me). Responses will be averaged to create one "sexual satisfaction" score for use in analyses.

Data Analysis Plan

Preliminary analyses were completed to compute descriptive statistics (*M*, *SD*) for each study variable. Q-Q plots were used to visually inspect skewness of variables that could affect models. Bivariate correlations were used to check for significant associations between romantic conflict, TL, mindful partnering, and all possible control variables: age, sex, physical health, financial stress, and sexual satisfaction.

For my main analyses, generalized estimating equations (GEE) were used in the R package *gee* (Højsgaard et al., 2006) to account for clustering of subjects within romantic partnerships in all models (Matson et al., 2021). To examine moderation, multiplicative interactions between destructive conflict and mindful partnering were created after centering and

tested in separate models, controlling for lower-order terms. Significant interactions were interpreted following guidelines for multiple regression (Aiken et al., 1991).

I also utilized the actor-partner interdependence model (Kashy & Kenny, 2000; Kenny, 1996) to evaluate *partner* effects (not possible in GEE, which focuses on individual-level effects) while continuing to control for nesting and interdependence within the data. Prior to conducting APIM analyses, observer-rated conflict was re-calculated for each individual to focus on individual contributions to the couple-level average of observer-rated and self-reported conflict behaviors. Thus, APIM analyses accounted for conflict behaviors that were *experienced* by each actor (actor effects) or partner (partner effects) rather than conflict behaviors *perpetrated* by the individual. In the absence of hypotheses about gender effects and with no salient distinguishing variable through which to systematically distinguish partners within each dyad (e.g., binary sex), dyads were treated as indistinguishable. Methods of "creating" distinguishability are problematic (Smith et al., 2013) and may lead to erroneous findings (Kenny et al., 2006). Following recommendations for smaller samples with indistinguishable dyads (Ledermann & Kenny, 2017), I took a multilevel modeling (MLM) approach to APIM. Skewed variables (observer-rated conflict and self-reported destructive conflict behaviors, telomere length) were log-transformed prior to inclusion in these models.

RESULTS

Preliminary Analyses

Descriptive statistics and bivariate correlations for all key variables and possible controls are presented in Table 1. Non-significant associations between key variables and TL were trivial to small: observer-rated conflict behavior (r = 0.08), self-reported destructive conflict behavior (r = 0.13), TL (r = -0.10). No potential control variables were found to be significantly correlated with both the independent and dependent variables. The outcome variable, TL, was significantly associated only with age (r = -0.30, p = .011). Thus, no variables were included in primary analyses as controls other than the key variables of interest.

Association Between Romantic Conflict and Telomere Length

The GEE model designed to test the hypothesized association between romantic conflict and TL revealed that neither observer-rated conflict behavior (b = 0.06, SE = 0.07, p = .289) nor self-reported destructive conflict behavior (b = 0.00, SE = 0.00, p = .152) were significantly associated with TL.

Moderating Effects of Mindful Partnering

Next, to investigate main effects of mindful partnering, I used a GEE model that included mindful partnering, observer-rated conflict behavior, and self-reported destructive conflict behavior as predictors of TL. There was a trend-level association between observer-rated conflict behavior and TL (b = 0.10, SE = 0.08, p = .079), but there were no significant associations between self-reported destructive conflict behavior (b = 0.00, SE = 0.00, p = .466) or mindful partnering (b = -0.01, SE = 0.00, p = .185) and TL. In GEE models testing interaction effects, mindful partnering did not significantly moderate associations between observer-rated conflict

behavior (b = -0.00, SE = 0.01, p = .417; Table 2) or self-reported destructive conflict behavior (b = -0.00, SE = 0.00, p = .257; Table 3) and TL.

To evaluate potential partner effects, I used an APIM to again test main effects of mindful partnering. There were no significant actor or partner effects of mindful partnering, observer-rated conflict behavior, or self-reported destructive conflict on TL (Table 4). Testing interaction effects, the APIM testing mindful partnering as a moderator of associations between observer-rated conflict behavior and TL revealed no significant moderating effect of mindful partnering (b = -0.01, SE = 0.03, p = .751; Table 5). Similarly, the APIM testing mindful partnering as a moderator of associations between self-reported destructive conflict behavior and TL revealed no significant moderating effect of mindful partnering (b = -0.00, SE = 0.00, p = .704; Table 6).

DISCUSSION

The goals of this study were to examine associations between TL and romantic conflict and evaluate whether mindful partnering, or interpersonal mindfulness in romantic dyads, moderates that association. Despite past findings linking romantic relationship variables and mindfulness with TL (Epel et al., 2009; Rentscher et al., 2020), this study did not find evidence for significant associations between these constructs. There was also no evidence that mindful partnering moderates associations between romantic conflict and TL. Further, correlational analyses failed to find significant associations between TL and any relationship factors. These findings suggest that romantic conflict, as well as other relationship factors, may not be robust predictors of cellular aging, and mindful partnering may not interact with romantic conflict to impact cellular aging. Perhaps most surprisingly, physical health was not associated with TL despite a large and robust literature linking physical health to cellular aging (Bakaysa et al., 2007; Fitzpatrick et al., 2007; Heidinger et al., 2012; Rode et al., 2015). Age was the only variable I included that was significantly associated with TL, which is expected given that TL shortens naturally over time (Greider & Blackburn, 1996).

Based on findings that factors like adult stress exposure (e.g., divorce, caregiving) and adult social stress (e.g., social strain, interpersonal conflict, relationship status) meaningfully impact TL (Rentscher et al., 2020), I hypothesized that romantic conflict, particularly conflict behaviors that are destructive, would be significantly and negatively associated with TL. This hypothesis was not supported by my findings. However, the present study had only 30 dyads, and effect sizes for adult stress effects on TL have been small (Rentscher et al., 2020). In the absence of effect size estimates in GEE models, bivariate correlations provide some indication of

associational strength. In this study, the association between observed conflict behavior and TL was trivial and the association between self-reported destructive conflict behavior and TL was small (Table 1). In particular, the magnitude of association found between self-reported destructive conflict behavior and TL is consistent with past literature, despite the fact that the association was non-significant in the present study.

In reviewing the literature, Rentscher et al. (2020) concluded that factors related to romantic conflict have meaningful effects on TL. However, the studies reviewed for each individual factor were limited in both quantity and scope. In combination, there were only 34 studies testing a link between relationship factors and TL by the time of the review in 2020. Although a broad array of variables was explored within those studies, providing a strong theoretical basis on which to study relationship factors in relation to TL, empirical support is lacking, and it seems possible that non-significant findings are rampant in unpublished literature. In short, my findings are not entirely consistent with the body of published empirical research, but they may be consistent with unpublished studies. These possible associations between stress/relational factors and TL merit further empirical attention in order to evaluate the robustness of the association between relationship characteristics and TL.

Although couples may find these results and this possible explanation comforting in light of the fact that conflict is relatively frequent (Papp et al., 2002) and normative in romantic relationships, self-reports of destructive conflict in this sample were not consistent with norms for the CTS2 (R. T. Jones et al., 2017; Straus et al., 2003) such that this sample scored higher for psychological aggression than published norms, but lower than norms for physical assault, sexual coercion, and injury. It is possible, then, that psychological aggression—characterized by behaviors ranging from swearing or yelling to destruction of important belongings and threats of

physical violence—has impacts on TL that are distinct from physical assault, sexual coercion, and injury, and that such effects were attenuated when combined with low scores on these subscales. It is also possible that conflict in this sample was not severe enough or long-lasting enough to affect TL. Overall, the sum score of destructive conflict in this sample (M = 28.19) was below even the most conservative estimate of a summed norm for these subscales (summed norm range 39.80-78.1). Thus, a limitation of the current study was restricted range of conflict severity, and analyses in a sample with a broader range of conflict severity (e.g., in a sample of clinical couples) might yield significant results.

Beyond potential statistical and power errors, measurement of TL was conducted through assays of saliva samples. Recent research found intra-individual differences in TL depending on the specimen type (saliva, dried blood, or fresh blood) in a sample of women (Geronimus et al., 2021). Associations with social variables, such as education and race, were significantly different in magnitude and, in some cases, direction, based on whether TL was measured from saliva, dried blood, or fresh blood. Thus, the authors suggested that these systematic differences may affect the validity of TL as an indicator of biopsychosocial processes. A methodological review found significant and impactful inconsistencies in the process of conducting quantitative PCR TL assays, and suggested that preanalytical factors, like sample storage procedures, are likely responsible for the majority of variance in TL introduced by an experiment (Lin et al., 2019). Samples for this study were collected during the COVID-19 pandemic and mailed to the research team. Although empirical research suggests that saliva samples can be stored at room temperature for years (Lin et al., 2019), samples sent via mail in our national study may have undergone significant temperature differences during transit. Additionally, Lin et al. (2019) recommended that the length of time specimens are stored should be recorded and controlled for

statistically. The present study did not record nor control for specimen storage time, but future research should do so.

Another measurement-based limitation of the present study involves relationship length. When asked to report length of relationship in an open response format, a large number of participants in the present study failed to report units of time (e.g., weeks, months, years). Thus, the relationship length variable was rendered unusable. Despite the fact that I could not control for length of relationship, in light of these findings it seems that it would have been more helpful to measure length of ongoing major conflicts throughout the relationship than length of the relationship itself. Cummings et al. (2007) found that longer-term conflict becomes less constructive over time, which suggests that short-term conflicts are unlikely to rise to the level of stressful life events studied by Rentscher et al. (2020).

Additionally, although having a romantic partner is associated with longer TL (Rentscher et al., 2020) and length of relationship likely affects the magnitude of that association, romantic conflict is not likely to be consistent over time. My study was likely affected by indirect selection bias given that longer-lasting relationships with substantial ongoing conflict are more likely to dissolve. Destructive conflict in dissolved relationships could be a productive focus of future empirical research, especially given the established association between divorce and TL (Rentscher et al., 2020) and the fact that a trend-level association between observed conflict behaviors that are more constructive and TL was found in the present study.

CONCLUSION

This study found evidence for a small, but non-significant, association between destructive romantic conflict and TL. Further, mindful partnering did not interact with destructive romantic conflict in relation to TL. Romantic relationships are an important facet of adult life, and style of conflict management within such relationships is critical for mental and physical health outcomes (Cassidy et al., 2013; Ellison et al., 2016; Kouros & Cummings, 2011; Lucas-Thompson & George, 2017). The literature suggests that the cumulative presence, absence, or loss of romantic relationships in adulthood is powerful enough to impact the process of cellular aging (Rentscher et al., 2020). However, conflict in romantic relationships might not stand alone as a predictor of this important outcome.

TABLES

Table 1

Descriptive Statistics and Bivariate Correlations of Key Variables

	1.	2.	3.	4.	5.	6.	7.	8.
1. CTS2	-							
2. OC	-0.25*	-						
3. MP	-0.36***	0.32**	-					
4. TL	0.13	0.08	-0.10	-				
5. Age	-0.06	-0.13	0.04	-0.30*	-			
6. MSQ	-0.26**	0.17	0.43***	0.17	0.01	-		
7. RAND	-0.10	0.03	0.22**	0.07	0.12	0.13^{+}	-	
8. FinStress	0.21**	0.16	-0.13^{+}	0.16	-0.38***	0.05	-0.11	-
M	28.19	5.67	82.88	1.29	33.46	19.11	3.85	4.69
SD	44.51	0.71	9.78	0.32	11.38	5.52	0.81	2.66

Notes: CTS2 = Self-reports of destructive conflict behaviors; OC = Observer-rated conflict behaviors; MP = Mindful partnering; TL = Telomere length; MSQ = Self-reported sexual satisfaction; RAND = Self-reported physical health; FinStress = Self-reported financial stress; * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2

GEE Predicting Telomere Length with Interaction of Mindful Partnering and Observed Conflict

	Intercept			**CTS2**			**OC**			**MP**			**OC*MP**		
	b	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
TL	1.32	0.05	<.001	0.00	0.00	.348	0.11	0.06	.059	-0.00	0.00	.307	-0.00	0.01	.417

Notes: CTS2 = Self-reports of destructive conflict behaviors; OC = Observer-rated conflict behaviors; MP = Mindful partnering

Table 3

GEE Predicting Telomere Length with Interaction of Mindful Partnering and Self-Reports of Destructive Conflict

	Intercept			**CTS2**			**OC**			**MP**			**CTS2*MP**		
	b	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
TL	1.29	0.05	<.001	0.00	0.00	.958	0.10	0.06	.084	-0.00	0.00	.143	-0.00	0.00	.257

Notes: CTS2 = Self-reports of destructive conflict behaviors; OC = Observer-rated conflict behaviors; MP = Mindful partnering

Table 4

APIM for Indistinguishable Dyads Testing Main Effects of Mindful Partnering on Telomere Length

	Telomere Length		
	b	*SE*	*p*
Intercept	-0.36	0.68	.604
A-CTS2[a]	0.01	0.04	.814
P-CTS2[a]	0.01	0.04	.760
A-OC[a]	0.41	1.40	.771
P-OC[a]	-0.07	1.42	.962
A-MP	-0.01	0.00	.206
P-MP	0.00	0.00	.185

Notes: A-OC = Actor's experience of observer-rated conflict behaviors; P-OC = Partner's experience of observer-rated conflict behaviors; A-CTS2 = Self-report of actor's experienced destructive conflict behaviors; P-CTS2 = Self-report of partner's experienced destructive conflict behaviors; A-MP = Actor's mindful partnering; P-MP = Partner's mindful partnering; [a]Log-transformed

Table 5

APIM for Indistinguishable Dyads Testing Moderating Effects of Mindful Partnering with Observer-Rated Conflict Behavior

	Telomere Length		
	b	*SE*	*p*
Intercept	-2.87	4.00	.476
A-OC[a]	1.21	2.46	.624
A-MP	0.02	0.05	.603
P-OC[a]	0.57	1.44	.694
A-CTS2[a]	0.02	0.04	.713
P-CTS2[a]	0.01	0.04	.858
P-MP	0.00	0.00	.171
A-OCC[a]*A-MP	-0.02	0.03	.526

Notes: A-OC = Actor's experience of observer-rated conflict behaviors; P-OC = Partner's experience of observer-rated conflict behaviors; A-CTS2 = Self-report of actor's experienced destructive conflict behaviors; P-CTS2 = Self-report of partner's experienced destructive conflict behaviors; A-MP = Actor's mindful partnering; P-MP = Partner's mindful partnering; [a]Log-transformed

Table 6

APIM for Indistinguishable Dyads Testing Moderating Effects of Mindful Partnering with Self-Reported Destructive Conflict Behavior

	Telomere Length		
	b	*SE*	*p*
Intercept	-0.37	0.74	.621
A-CTS2[a]	0.02	0.19	.927
A-MP	-0.01	0.01	.331
P-CTS2[a]	0.01	0.04	.763
A-OC[a]	-0.06	1.45	.968
P-OC[a]	0.40	1.47	.780
P-MP	0.00	0.00	.190
A-CTS2[a]*A-MP	-0.00	0.00	.966

Notes: A-CTS2 = Self-report of actor's experienced destructive conflict behaviors; A-MP = Actor's mindful partnering; P-CTS2 = Self-report of partner's experienced destructive conflict behaviors; A-OC = Actor's experience of observer-rated conflict behaviors; P-OC = Partner's experience of observer-rated conflict behaviors; P-MP = Partner's mindful partnering; [a]Log-transformed

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