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Intimate Partner Violence and Inflammaging: Conflict Tactics Predict Inflammation Among Middle-Aged and Older Adults

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Abstract

Objective: In long-term relationships, conflict is inevitable, but physical and psychological aggression is not. Intimate partner violence (IPV) is a known risk factor for age-related disease onset, and inflammation likely links the two. This study explores relationships between frequency of constructive (i.e., negotiation) and destructive (i.e., aggression) conflict tactics with inflammation in both younger and older adulthood. Based on the theory of inflammaging, the study investigates whether these associations were stronger in mid-to-late adulthood.

Methods: At one visit, 214 participants in long-term romantic relationships had their blood drawn to assess six inflammatory markers (interleukin-6, IL-6; tumor necrosis factor-alpha, TNF-α; c-reactive protein, CRP; serum amyloid A, SAA; soluble intercellular adhesion molecule, sICAM; soluble vascular cell adhesion molecule, sVCAM) and reported frequency of destructive and constructive conflict tactics with their partner in the past year on the Revised Conflict Tactics Scale short form.

Results: Age interacted with number of destructive conflicts per year to predict serum IL-6 ($F(1, 200)=5.3$, $p=.022$), TNF-α ($F(1, 180)=4.2$, $p=.043$), sICAM ($F(1, 193)=7.0$, $p=.008$), and marginally SAA ($F(1, 199)=3.7$, $p=.055$), such that middle-aged and older adults who reported more destructive tactics had higher inflammation. Also, the relationship between constructive conflict frequency and TNF-α also depended on age ($F(1, 177)=4.9$, $p=.029$), in that older adults who reported a greater number of constructive tactics had lower TNF-α.

Conclusion: Couples' conflict tactics may influence levels of inflammation, and, therefore, aging rate, in mid-to-late life. Middle-aged and older adults may disproportionately benefit from a healthy partnership and suffer from an unhealthy partnership.

Keywords: Conflict, Conflict Tactics, Intimate Partner Violence, Inflammation, Inflammaging, Aging

Introduction

In long-term relationships, conflict is inevitable. However, couples approach conflict differently. Healthy relationships do not involve destructive tactics like psychological and physical aggression, both aspects of intimate partner violence (IPV). IPV is problematic due to its cyclical nature (1). It is a destabilizing influence on the relationship that can create feelings of unsafety (2). IPV can occur in current or former partners regardless of culture, socioeconomic status, gender identity, or sexual orientation. Even so, it is most common among those struggling with high levels of chronic stress, and it is most often perpetrated against women (3,4). In fact, it affects nearly one in three women at some point in their lives (5). Moreover, IPV may be on the rise (3). It has received additional attention in the Diagnostic and Statistical Manual of Mental Disorders - 5, including expanded criteria (6).

Those who experience IPV have poorer health. IPV is a repeated and chronic stressor that drives hypervigilance and can ultimately lead to chronic pain, gastrointestinal symptoms and disorders, depression, and post-traumatic stress disorder (6,7). These symptoms share a proinflammatory profile (8,9). Indeed, systemic inflammation may be one physiological mechanism connecting conflict tactics with health outcomes.

Only a handful of studies have investigated relationships between IPV and inflammatory markers, with mixed results. Among 75 Canadian female university students in different-sex relationships, those who reported at least six instances of psychological aggression or any instance of physical aggression in the past three months, as indexed by the Conflict Tactics Scale, did not have significantly different levels of IL-6 or IL-10 than their peers who reported

less or no aggression (10). In contrast, these associations have emerged among older women (11,12). For example, in a study of 67 postmenopausal women, those who reported at least one case of severe physical assault or sexual coercion in their lifetime (again reported on the Conflict Tactics Scale), but were not currently in an abusive relationship and had not been abused within the past year, had higher levels of plasma CRP, but not IL-6, compared to those who had no or minor instances of abuse(11). In fact, the mean CRP for those with an IPV history was clinically elevated (>3.0 mg/L). Other research has connected IPV to elevations of the proinflammatory cytokine tumor necrosis factor-alpha (TNF-α) (13). In contrast, salivary inflammatory markers have not shown such IPV-related differences (11,14), perhaps because oral hygiene is a glaring confound. In sum, past findings demonstrate: (1) Plasma or serum inflammatory markers may reveal IPV-related effects that salivary markers obscure; (2) Prior work in this area almost exclusively measured IL-6, CRP, and/or TNF-α; (3) IPV's effect can endure long after the abusive relationship ends; and (4) IPV's relationship with inflammation may be most evident in mid-to-late adulthood.

A recent systematic review highlighted the inadequacies of the current IPV-inflammation literature (1). They documented the need for larger sample sizes and a wider variety of inflammatory markers. Here we also note that differences in sample characteristics, such as age, or type of inflammatory marker (e.g., salivary, plasma, serum) may help to explain prior mixed findings. Also, a major limitation of past work is that it only included female participants, even though males also experience IPV. Lastly, the current body of evidence suggests that there might be an amplifying effect of age, but it has not been systematically tested. The current study addresses these issues.

Conflict in Mid-to-Late Life

The above literature suggests that IPV's relationship with inflammation may be most obvious among middle-aged and older adults. Older adults' social networks and immune systems functionally diverge from younger adults', rendering them more vulnerable to the physiological effects of conflict. Compared to younger adults, older adults have smaller social networks and prioritize their closest, personally-meaningful relationships, such that their partners assume an ever-increasing role (15). Accordingly, older adults have stronger immune responsivity to laboratory-based conflicts with their partner compared to younger adults' (16,17). Changes in neuroendocrine functioning may help to explain differences in immune responsivity. The older HPA axis is less responsive to social stress (18,19) – potentially due to hippocampal volume loss (20) – and the sympathetic nervous system may become more reactive in later life (21,22). Ultimately, this pattern of dysregulation can promote chronic systemic inflammation, thereby burdening the immune system. Systemic inflammation naturally increases throughout the lifespan, and repetitive stressors can compound these age-related increases (23–25). Further, older adults may not have robust anti-inflammatory compensatory mechanisms to combat strong stress-induced pro-inflammatory signaling, and therefore they may not recover (i.e., return to baseline levels of inflammation) as well as their younger counterparts (26).

Past research has revealed that age modulates the association between couples' dynamic during a single conflict and acute physiological responses. Less satisfied older couples who received poorer quality support from their partners had greater acute inflammatory increases (27). However, younger people were protected from this effect regardless of marital satisfaction (27). Similarly, self-reported wife-demand/husband withdraw conflict pattern predicted greater

cortisol responses to a conflict, but only among older adults (28), which over time may promote glucocorticoid resistance. In essence, older adults may not handle or recover from stress's onslaught as well as younger adults, and, therefore, they may have greater risk for destructive conflict's physiological toll over time.

The Current Study

The current study examines whether the frequency of destructive conflict tactics in the past year predicts inflammation in an age-dependent manner among a large, age-diverse, physically healthy sample. We looked at six inflammatory markers: Two proinflammatory cytokines that are relevant for accelerated biological aging and mortality (TNF-α, IL-6) (29,30); two acute phase proteins produced by the liver (CRP, also an aging-related biomarker; serum amyloid A, SAA); and two adhesion molecules that facilitate attachment of immune cells to endothelial cells, fueling cardiovascular disease risk (soluble intercellular adhesion molecule, sICAM; soluble vascular cell adhesion molecule, sVCAM). We expected that more frequent use of destructive conflict tactics would track with higher inflammation among middle-aged and older participants. Couples also use constructive tactics during conflict, but less is known about their relationship with inflammation. Our lab has shown that couples who had healthier communication patterns (i.e., used cognitive processing words) during conflict had smaller increases in inflammation over the subsequent 24 hours (31). Also, couples who engaged in constructive conflict tactics slept better over time (32). Thus, we predicted that greater use of constructive conflict tactics would track with lower levels of inflammation among middle-aged and older adults.

Methods

For a parent study examining longitudinal relationships among marital satisfaction, gastrointestinal microbiota, and depressive symptoms (33), we used print- and web-based announcements to recruit 286 people (143 couples), 232 of which completed both study visits which were an average of 90 days apart. Visits occurred between January 2017 and September 2019. Only data from the second visit, which was when conflict tactics were assessed, are included in the current analyses. Partners must have cohabited for six months to be included. Exclusions included recent antibiotic use, pregnancy, breastfeeding, malignancies, stroke, heart attack, immune disorders, and acute medical issues. Of the 116 couples who completed the second visit, seven were same-sex couples (six lesbian couples and one gay couple). At the second visit, non-fasting blood samples were collected to index the inflammatory biomarkers of interest, and participants also completed the questionnaires described below. The Ohio State University Institutional Review Board approved this study, and all participants provided informed consent.

Conflict Tactics

The 20-item Revised Conflict Tactics Scale short form (CTS2S) measured how often in the past year couples engaged in a certain conflict tactics and violence (34). The short form has comparable validity to the full scale and is a useful screening instrument for IPV (34). Half of the items assessed the individual's own behavior during conflicts, and the other half assessed their partner's behavior toward them. Destructive conflict was assessed using the Psychological Aggression (four items; e.g., "My partner insulted or swore or shouted or yelled at me"; "I destroyed something belonging to my partner or threatened to hit my partner") and Physical

Aggression (four items; e.g., “I pushed, shoved, or slapped my partner”; “My partner punched or kicked or beat me up”) subscales. Constructive conflict was measured using the Cognitive Negotiation and Emotional Negotiation subscales (four items; e.g., “My partner explained his or her side or suggested a compromise for a disagreement with me”; “I showed respect for, or showed that I cared about my partner’s feelings about an issue we disagreed on”). Participants selected one of the following eight possible answers: ‘once in the past year’, ‘Twice in the past year’, ‘3-5 times in the past year,’ ‘6-10 times in the past year,’ ’11-20 times in the past year,’ ‘more than 20 times in the past year’, ‘Not in the past year, but it has happened before’, ‘This has never happened.’ To index past year frequency, answers were scored via their midpoint if there was a range (e.g., 4 for 3-5 times in the past year); if participants reported that it had never happened or had not happened in the past year, they received a score of zero; if participants reported that it occurred more than 20 times in the past year, they received a score of 25 in line with convention (35). For each subscale, items were aggregated such that higher total scores reflected greater occurrence of the conflict tactic in the past year. The ceiling score for the eight-item destructive conflict aggregate was 200, whereas the highest possible score for the four-item constructive conflict aggregate was 100. Cronbach’s alpha is not computed for this scale, given that there is no total score, and each subscale consists of two items assessing own behavior and two items assessing partner behavior (34). We created separate composite scores for couples’ destructive and constructive conflict, each including individuals’ rating of themselves and their partners, due to the high correlations between these ratings (*r*s>.77). This composite is in line with prior studies that have used a composite of self and partner hostile behavior, for example (35).

Covariates

Participants reported their height and weight, which were used to calculate BMI. They also indicated how many years they had been with their partner and completed the 32-item Couples Satisfaction Index, which was developed using item response theory and discerns satisfied and dissatisfied couples with more precision and power than other common indices (CSI; Cronbach's α=.97) (37). Depressive symptoms were measured with the Center for Epidemiological Depressive Scale, which is widely-used to index depressive symptoms on a scale of 0 to 60; scores of 16 and above are considered clinically significant (CES-D; Cronbach's α=.90) (38,39). The Charlson Comorbidity Index assessed participants' number of chronic medical conditions (40). Participants also reported their pre-tax annual household income, which we used as a proxy of socioeconomic status.

Inflammatory Markers

Non-fasting blood samples were collected during the study visit between 7 and 11am to limit diurnal variability. Blood samples provided data on serum TNF-α, IL-6, CRP, SAA, sICAM, sVCAM. An electrochemiluminescence method with Meso Scale Discovery Kits (Rockville, MD) was used to measure all biomarkers except IL-6, which was assayed with R&D Systems (Minneapolis, MN) Quantikine ELISA kits following kit instructions. The intra- and inter-assay coefficients of variation (CVs) and sensitivities are shown in Table S1, Supplemental Digital Content, http://links.lww.com/PSYMED/A959.

Analytical Strategy

Participants reported conflict tactics at Visit 2, so all analyses used Visit 2 data, which included 232 people (116 couples). Due to blood draw difficulties, we did not have inflammatory markers for nine individuals. Ten women had a history of breast cancer, including one who did not have inflammatory data, and were excluded from analyses because initial t-tests revealed that they had higher levels of SAA, sICAM, and sVCAM (*p*s<.046), but not CRP, IL-6, or TNF-α (*p*s>.23) than women without a history of cancer. Therefore, 214 individuals were included in primary models.

All analyses were conducted in SAS version 9.4 (Cary, NC). Because participants were clustered into couples, linear mixed effects regression models (i.e., SAS PROC MIXED statement) with a random couple-level intercept and Kenward-Rogers degrees of freedom adjustment were used to account for the within-couple clustering. Plate random effects were also included in the model. For the primary analyses, we tested the two-way interactions of age and number of times each conflict tactic was used in the past year to predict inflammatory markers. Each inflammatory marker was modeled separately, and the interactions of age with destructive and constructive conflict tactics were the simultaneous predictors of interest in all models. Couples use multiple conflict tactics during disagreements, so it is important to model these tactics simultaneously (i.e., within the same model), in line with prior research (32). All models adjusted for BMI, sex (‘1’ male, ‘2’ female), comorbidities, and depressive symptoms, due to their established relationships with inflammation (9,41–43). We also adjusted for relationship length (years) and marital satisfaction to test whether the age-dependent associations between

conflict tactics and inflammatory markers were over and above these important relationship factors. We conducted sensitivity analyses additionally controlling for pre-tax annual household income, but results were unchanged. Residuals for models of IL-6, TNF-α, CRP, and SAA were skewed; thus, these inflammatory markers were log-transformed to better approximate normality of residuals. Figures present back-transformed means of these variables to aid interpretability. Although neither destructive nor constructive conflict tactics were normally distributed, a visual inspection of residuals revealed no influential outliers.

Significant interactions were probed at the 25th and 75th percentiles for destructive conflicts (0.0, 8.0) and for constructive conflicts (24.0, 69.5), and at ages commonly used to represent younger, middle, and older adulthood (30, 50, 70 years old) (27). To obtain a measure of effect size, we standardized the effect of conflict tactics on inflammatory markers at these ages by dividing the predictor's standard deviation by the outcome's standard deviation and multiplying the quotient by the raw slope estimate that was unique to that specific age. We corrected for multiple testing via the Benjamini-Hochberg False Discovery Rate (FDR) procedure with an FDR of 0.25 (44); we chose this liberal correction due to the exploratory nature of these moderation analyses. As an initial foray into this domain, we wanted to report all signals with the understanding that replication is needed in other samples. Note that even though the outcomes (i.e., inflammatory markers) are positively related, the FDR method remains a valid approach (45). Below we report which results were significant before and after multiple test correction. Hypotheses were not pre-registered. Relevant data and code are available upon reasonable written request to the corresponding author.

Results

Demographic Information

Participants were 21 to 77 years old, with a mean age of 41.0 (13.6). On average, participants were overweight with an average BMI of 26.9 (*SD*=5.6). Their depressive symptoms were not clinically elevated, on average (*M*=7.7, *SD*=7.5), although there was a wide range (0-42). Most participants were White (86.0%), with 7% Asian, 4% Black and 2% multiracial participants. Participants reported high socioeconomic status, as the modal response was more than $100,000 of pretax household income in the past year (41%), and less than 6% reported having a pretax household income of less than $25,000. Overall, 89% of couples were married, 8% were not married, and 3% were in a common law marriage or domestic partnership. For most participants (74%), this marriage was their first. See Table 1 for further demographic information and Table S2, Supplemental Digital Content, http://links.lww.com/PSYMED/A959, for zero-order correlations.

Conflict Statistics

As described above, destructive conflict tactics included psychological aggression and physical assault, while constructive conflict tactics included emotional and cognitive negotiation. Overall, 66% of participants reported that conflicts included psychological aggression in the past year; the corresponding percentages were 5% for physical assault, 99% for emotional negotiation, and 98% for cognitive negotiation. Concerning whether these behaviors had ever occurred in the history of the relationship, 84% reported that psychological aggression had occurred; the corresponding percentages were 13% for physical assault, and 100% for negotiation. Among those who reported that these tactics occurred in the past year, the average

number of times conflicts with their partner included: psychological aggression was 9.3(10.0), physical assault was 4.6(6.5), emotional negotiation was 26.0(16.7), and cognitive negotiation was 24.6(15.7).

Primary Analyses

Age interacted with number of destructive conflicts per year to predict both proinflammatory cytokines – IL-6 ($F(1, 200)=5.3$, $p=.022$) and TNF-α ($F(1, 180)=4.2$, $p=.043$), to marginally predict one acute phase protein – SAA ($F(1, 199)=3.7$, $p=.055$), but not CRP ($p=.83$) – and to predict one adhesion molecule – sICAM ($F(1, 193)=7.0$, $p=.008$), but not sVCAM ($p=.16$). When probing the significant interactions, middle-aged and older adults who reported more conflicts that included destructive elements (i.e., psychological aggression, physical assault) had higher IL-6 (middle-age: $p=.002$; older age: $p=.003$), TNF-α (middle-age: $p=.009$; older-age: $p=0.010$), SAA (middle-age: $p=.024$, older-age: $p=.020$), and sICAM (middle-age: $p=.012$; older-age: $p=0.004$). See Table S3, Supplemental Digital Content, http://links.lww.com/PSYMED/A959, for results from primary models. Standardized regression coefficients (i.e., effect sizes) were small (.19<ES<.28) for middle-aged adults and medium for older adults (.38<ES<.50) (Supplemental Figure S1A, Supplemental Digital Content, http://links.lww.com/PSYMED/A959). However, these associations were not significant among younger adults (*p*s>.50). After FDR multiple test correction, destructive conflicts had significant age-graded relationships with sICAM, IL-6, TNF-α, SAA, and sVCAM, but not CRP (Table S4A, Supplemental Digital Content, http://links.lww.com/PSYMED/A959).

Age interacted with number of constructive conflicts in the past year to predict TNF-α ($F(1, 177)=4.9$, $p=.029$), in that middle-aged and older adults who reported a greater number of conflicts that included constructive elements (i.e., cognitive or emotional negotiation) in the past year had lower TNF-α (middle-age: $p=.037$; older-age: $p=.017$), but this relationship did not hold true among younger adults ($p=.54$). The standardized regression coefficient was small for middle-aged adults (ES=-.18) and medium for older adults (ES-.41) (Figure S1B, Supplemental Digital Content, http://links.lww.com/PSYMED/A959). The effect of constructive conflicts did not depend on age for any of the other inflammatory markers (ps>.23). After multiple test correction via FDR estimation, constructive conflicts maintained a significant age-dependent association with TNF-α, but not with any other inflammatory marker (Table S4B, Supplemental Digital Content, http://links.lww.com/PSYMED/A959).

In terms of covariates, number of comorbidities ($p=.024$) and BMI ($p<.001$) were positively related to IL-6; women ($p=.042$) and those with higher BMIs ($p=.002$) had higher TNF-α; women ($p=.040$), people with higher BMIs ($p<.001$), and those with more comorbidities ($p=.028$) had higher levels of CRP; women ($p<.001$), those with higher BMIs ($p=.016$), and those who had more depressive symptoms ($p=.026$) had higher levels of SAA; and BMI was positively associated with sICAM ($p=.006$).

Discussion

In this large age-diverse sample, we found that a greater number of destructive conflicts in the past year predicted higher levels of two proinflammatory cytokines (TNF-α, IL-6), one acute phase protein (SAA), and one vascular adhesion molecule (sICAM) only among middle-

aged and older adults. As expected, and in line with most prior work (10), there were no such associations in younger adults. Significant results survived FDR multiple test correction, and in fact, destructive conflict tactics had an additional age-dependent relationship with sVCAM under this method. This is the first report showing IPV's connections to SAA, sICAM, and vCAM among middle-aged and older adults. Also, there was some evidence that older adults uniquely reaped the benefits of constructive conflict. Older adults who reported more frequent emotional and cognitive negotiation had lower TNF-α levels than their peers. This effect also held after FDR multiple test correction. Compared to constructive conflict, destructive conflict's age-dependent link to inflammation was more reliable, demonstrating consistent associations across several different inflammatory markers, including some that are especially relevant to cardiovascular disease risk (SAA, sICAM) (46,47) and aging (TNF-α, IL-6) (48). Because psychological aggression was the most frequently reported destructive conflict tactic, these findings show that destructive conflict does not need to be physical in nature to compound age-related increases in low-grade inflammation. Overall, our findings are some of the first to connect IPV to several inflammatory markers in a large sample of both males and females – a potential mechanism for accelerated aging and chronic disease risk.

Conflict and Inflammaging

Inflammation rises with age, yet the rate of increase differs between individuals (30,49–51). Therefore, it is somewhat surprising that the main effect of chronological age was not significant in any of our primary models, although we did observe a significant zero-order correlation between IL-6 and age as would be expected (r=.24). Age-related IL-6 increases may

be especially relevant to disease development and frailty (30,52). One possible reason for null relationships between age and other inflammatory markers is that these were cross-sectional, between-subjects analyses. It is likely that within-subjects, longitudinal analyses would have greater power to detect age-related inflammation increases. Also, our exclusionary criteria yielded a healthy sample, which no doubt minimized variability in inflammation.

Biological age and chronological age increasingly diverge across the lifespan, and therefore, some middle-aged and older adults may have steeper increases in inflammation. In older adulthood, psychosocial factors – both negative and positive – may have more influence and predictive power. Termed inflammaging, an imbalance between pro- and anti-inflammatory mechanisms can propagate chronic, age-related diseases and speed up the aging process at a cellular level; this process leads to a build-up of damaged and exhausted, non-replicating (i.e., senescent) cells (26,53). In turn, damaged and senescent cells promote more inflammation and the onset of age-associated diseases (54,55). Thus, a vicious cycle can occur whereby chronic inflammation can damage tissues, for instance through oxidative stress, resulting in even more inflammation in response to the damage. Results from our primary models suggest that regardless of relationship length and marital satisfaction (as well as other demographic and health-related covariates), IPV may result in a pro-inflammatory phenotype in mid-to-late adulthood that aligns with inflammaging. Conversely, a supportive partnership in which partners work to resolve conflicts via constructive tactics may serve a rejuvenating function in the biological aging process.

Effect Size Comparison

The effect sizes we observed in this study, especially among older adults, point to IPV's distinctively potent effects, compared to other social stressors. Among middle-aged individuals, the effect sizes of destructive conflict (.19<ES<.28), and constructive conflict (ES=-.18) on inflammatory markers were small. Among older adults, the effect sizes of destructive conflict (.38<ES<.50) and constructive conflict (ES=-.41) on inflammatory markers were medium. When situated in the context of meta-analytic evidence concerning other relationship and stress-related variables, IPV's effect stands out. For example, one meta-analysis showed that social isolation was unrelated to IL-6 levels, but it had a small effect on CRP (r=0.19) (56). Also, loneliness was only marginally related to IL-6 (r=.08), but there was no association between loneliness and CRP (56). This meta-analysis was based primarily on studies of older individuals, so these effect sizes can be compared to ours. In a meta-analysis that examined the relationship between social support and inflammation (primarily IL-6 and CRP), the effect size was also small (Zr=-.07) (57); however, this effect was across all ages, and therefore, it is not as comparable to our effect sizes. Similarly, in people of all ages, victimization (a category that encompasses abuse from many different sources) predicted greater CRP (r=0.08), IL-6 (r=0.12), and TNF-α (r=0.15) (58). When compared to unemployment-related stress, IPV's relationship with inflammation in middle-age and older adulthood are also notable: One meta-analysis found that unemployment's effect size on CRP was 0.20 across all ages, but it was stronger among older workers (aged 45-54; ES=0.27)(59) . Here, too, we observed a similar but even stronger age-dependent effect. Overall, results from our study suggest that among middle-aged and older adults, IPV may have an especially strong effect on inflammation, compared to other social and stress-related variables.

Other Considerations

Couples may use multiple conflict tactics simultaneously; therefore, it is important that we included both constructive and destructive conflict tactics in the same model, as they are not necessarily related, competing, overlapping, or mutually exclusive variables. In fact, our zero-order correlations table depicts their weak yet positive relationship, meaning that those who reported more frequent destructive conflict tactics also reported more frequent constructive conflict tactics. Of course, couples who have more frequent conflicts have more of an opportunity to use both constructive and destructive conflict tactics. From this perspective, it is particularly noteworthy that greater constructive tactic frequency predicted *lower* inflammation among older adults. Also, among older adults, more destructive conflict tactic usage predicted heightened inflammation regardless of how often individuals engaged in constructive conflict tactics. Our models adjusted for marital satisfaction, which itself was negatively related to destructive and constructive conflict tactic usage; thus, it was a particularly stringent test. Independent of marital satisfaction, constructively working through problems together and refraining from psychological or physical aggression may be key to healthier biological aging.

Two features of this sample are salient to interpreting these results: (1) their high frequency of conflict tactic usage; (2) their physical health. The high frequency of constructive and destructive conflict tactics in this sample was on par with other samples (32), and nevertheless, it is disturbing. Two-thirds of our sample indicated that their conflicts included psychological aggression in the past year, and the mean frequency was nine times. On the other hand, almost all participants reported that their conflicts had included constructive tactics, such as showing respect for one another's feelings. Another feature of our sample was that they were

physically healthier than the general population due to our strict exclusionary criteria. Low Charlson Comorbidity Index scores corroborate this assertion. Therefore, the observed relationships between conflict tactics and inflammatory biomarkers among older adults may be accentuated in the general population. Chronic disease tracks with inflammaging, and both age and ongoing pathophysiology can reduce compensatory anti-inflammatory mechanisms, leading to a pro-inflammatory environment that furthers disease processes, aging, and cellular senescence (60).

Strengths and Limitations

A major strength of the current work is the sample's wide age range, making it ideal to examine age-dependent effects. Even so, the age-dependent effect may be even more pronounced in a sample that includes the oldest-old, as our sample's oldest participant was 77 years old. Also, unlike prior work in this domain, we included both sexes. Another strength is that we measured multiple inflammatory markers, including three that had not been previously tested in relation to IPV (SAA, sICAM, sVCAM). A primary limitation is that the sample was primarily White and affluent, and IPV is likely even more common among those who have high levels of chronic stress, including the impoverished and marginalized (3). That said, participants reported a range in frequency of conflict tactic usage, which is also a strength of the sample. Also, our scale did not measure the total number of conflicts in the prior year, and so we were unable to adjust for it. The CTS2S was validated on a younger college-aged sample (61), and even though it has been used with older samples, its psychometric properties among older samples are unknown. Another limitation is that our findings are cross-sectional. Therefore, it is impossible to tease out the time-course or nature of these associations (e.g., cumulative, cohort-specific).

Also, because the predictor of interest was a self-report measure rather than an experimental manipulation, causal claims are unwarranted.

Clinical Implications and Conclusion

Middle-aged and older adults who experience IPV may be at risk for elevated inflammation, potentially contributing to accelerated aging. Cognitive and emotional negotiation may have a protective effect, as these constructive tactics were related to lower levels of inflammation but only among older adults. This work is the first to connect the CTS2S, a widely-used screening instrument for IPV, to several inflammatory markers in a large, age diverse sample with both sexes – elucidating a potential mechanism that may help to explain why IPV predicts chronic disease onset (7). These results demonstrate the importance of fostering conflict resolution skills earlier in the lifespan to increase longevity and decrease inflammation-associated disease development in late life. Given that harmful relationship dynamics can pose similar if not stronger health risks as poor health behaviors, such as cigarette smoking (62), strengthening relationships is a public health imperative. Some experts believe that IPV increased during the COVID-19 pandemic (3,4) – the hidden "pandemic within the pandemic" – as people were shut in with their abusers. Therefore, in the pandemic's aftermath, interventions to reduce destructive conflicts should be a primary focus with the goal of promoting health and longevity.

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Figure Captions:

Figure 1. More Frequent Destructive Conflict Predicts Heightened Inflammation Only in Mid-to-Late Life. Number of destructive conflicts in the past year interacted with age to predict tumor necrosis factor-alpha (TNF-α; p=.043), interleukin-6 (IL-6; p=.022), soluble intercellular adhesion molecule (sICAM; p=.008), and to marginally predict serum amyloid A (SAA; p=.055). Middle-aged and older adults who reported more conflicts that included psychological aggression or physical assault had higher TNF-α, IL-6, sICAM, and SAA (ps<.025). There was no relationship between destructive conflict frequency and these inflammatory markers among younger adults (ps>.50). Models adjusted for BMI, sex, comorbidities, depressive symptoms, relationship length, and marital satisfaction. *p<.05 for slope.

Figure 2. More Frequent Constructive Conflict Predicts Lower Inflammation Only in Mid-to-Late Life. Number of constructive conflicts in the past year interacted with age to predict tumor necrosis factor-alpha (TNF-α; p=.029). Middle-aged and older adults who reported more conflicts that included cognitive or emotional negotiation in the past year had lower TNF-α (ps<.038), but this relationship did not exist among younger adults (p=.54). *p<.05 for slope.

Figure 1

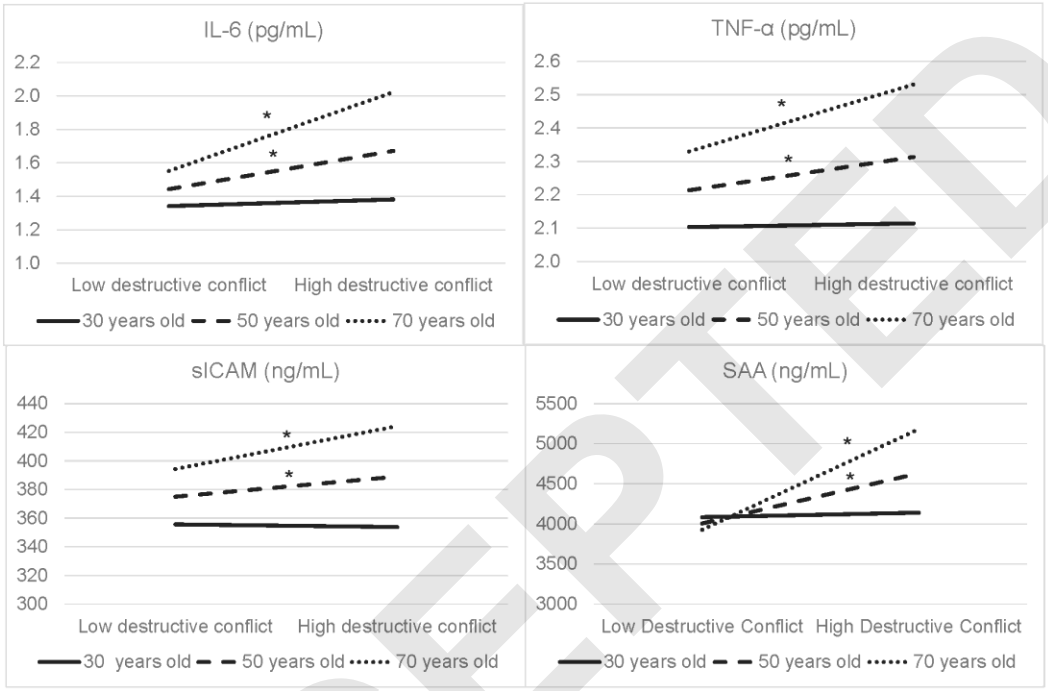

Figure 2

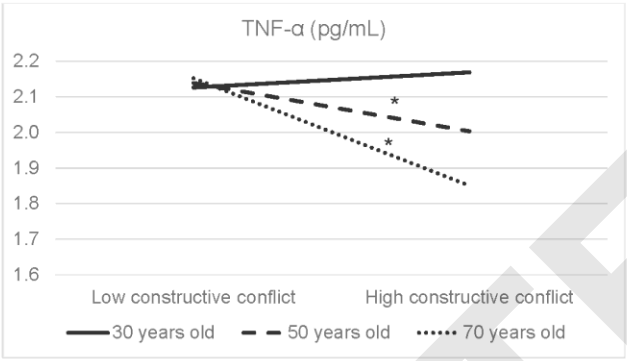

Table 1. Sample Demographic Information at Visit 2

	N	Mean (SD) or N (%)	Range
Sex (% Female)	214	108(50%)	
Age	214	41.0(13.6)	21.0 - 77.0
Race (% White)	214	184 (86%)	
BMI	214	26.9(5.6)	18.2 - 51.7
Comorbidities	214	0.2(0.5)	0.0 - 3.0
Depressive Symptoms (CES-D)	214	7.7(7.5)	0.0 - 42.0
Destructive conflicts in past year	214	6.3(10.2)	0.0 - 73.0
Constructive conflicts in past year	214	49.6(29.6)	0.0 - 100.0
CSI	214	134.0(22.3)	65.0 – 161.0
Relationship Length (Years)	214	13.9(10.6)	1.0 – 46.0
Pre-tax Household Income	208		
<$24,999		12 (6%)	
$25,000 – 49,999		37 (18%)	
$50,000 – 74,999		42(20%)	
$75,000 – 99,999		29(14%)	
>$100,000		88(42%)	
IL-6 (pg/mL)	214	2.0(3.4)	0.3 - 44.6
CRP (mg/L)	213	2.6(4.8)	0.0 - 44.2
TNF-α (pg/mL)	198	2.3(0.5)	1.0 - 4.4
ICAM (ng/mL)	213	360.9(82.8)	191.4 – 701.0
VCAM (pg/mL)	213	26.9(5.6)	18.2 - 51.7
SAA (ng/mL)	214	5659.1 (12674.5)	450.0 – 154457.5

BMI = body mass index; CES-D= Center for Epidemiological Studies Depression Scale; CSI = Couples Satisfaction Index; IL-6 = interleukin-6; TNF- α = tumor necrosis factor – alpha; CRP = C-reactive protein; SAA = serum amyloid A; sICAM = soluble intercellular adhesion molecule; sVCAM = soluble vascular cell adhesion molecule