

**Spinning Your Wheels: Psychological Overinvolvement and Actigraphy-assessed Sleep
Efficiency Following Marital Separation**

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Abstract

Background: This study investigated the ways in which adults reflect over their psychological experiences amid a recent marital separation and how these patterns of thought, manifest in language, are associated with self-reported negative affect and actigraphy-assessed sleep disturbance.

Methods: In a sample of 138 recently separated adults assessed three times over five months, we examined within- and between-person associations among psychological overinvolvement (operationalized using verbal immediacy derived as a function of the language participants used to discuss their relationship history and divorce experience), continued attachment to an ex-partner, negative affect, and sleep efficiency.

Results: The association between psychological overinvolvement and negative affect operated at the within-person level whereas the associations between psychological overinvolvement and sleep disturbance, as well as negative affect and sleep disturbance, operated at the between-person level.

Conclusions: These findings shed light on the intraindividual processes that may explain why some people are more susceptible to poor outcomes after separation/divorce than others. Our findings suggest that individuals who express their divorce-related thoughts and feelings in a psychologically overinvolved manner may be at greatest risk for sleep disturbances after marital separation/divorce.

Keywords: actigraphy; sleep efficiency; divorce; marital separation; psychological overinvolvement; negative affect

Spinning Your Wheels: Psychological Overinvolvement and Actigraphy-assessed Sleep Efficiency Following Marital Separation

Marital separation and the subsequent experience of divorce are significant and common life stressors that are associated with adults' health and well-being. Decades of research on divorce indicate that although most adults fare well after separation/divorce, being separated or divorced is associated with increased risk for several negative health outcomes, including mental health problems [1], physical health problems [2,3], and early death [4]. Sleep is a critical health behavior, and sleep disturbance may explain at least some of the effects of separation/divorce on these distal health outcomes, including in relationship contexts and following a range of stressful life experiences [5–9]. This may be especially true for individuals prone to experiencing high negative affectivity following stressful events [10]. In the context of separation/divorce, sleep disturbance is an established as a critical variable, both a predictor and outcome, related to adults' psychological and physiological health over time [11–14]. In one of the earliest process-focused investigations of sleep disturbance after marital separation/divorce, researchers found that sleep complaints predicted significant increases in blood pressure three months later, especially for those who were still experiencing sleep disturbance ten or more weeks after their marital separation [13]. New work using actigraphy-based assessments of sleep disturbance across a 5-month period after a recent marital separation finds that although adults do not evidence systematic increases in sleep efficiency over time, there is significant variability in the course of adults' sleep trajectories over time [15]. When it comes to divorce and sleep disturbances, understanding the predictors that help explain or account for these patterns of variability is an important next step in this overall research agenda.

The variability in health outcomes following separation/divorce has led some investigators to suggest that the course of adaptation to marital dissolution rests heavily on individual

differences in emotional experience, attachment orientations, and social circumstances [16]. For example, people with a history of depression are more likely to experience a subsequent depressive episode following their divorce [17]. Within this broad framework of studying individual differences following marital separation, as well as in the study of relationships and health more generally, there is a growing need for research to focus on the mechanistic processes through which these risks are conveyed [18]. Of particular importance is understanding the *intraindividual processes* that occur after the separation/divorce that predict who will fare better or worse over time; studying how adults relate to and make sense of their divorce experience may elucidate the processes that lead to disruption in sleep and in turn, confer risk for maladjustment across domains of functioning.

Psychological Immersion and the Language of Loss

What does it mean to *relate to* a psychological experience? A considerable literature has emerged documenting that the extent to which people are psychologically overinvolved with (immersed in) or distanced from their experiences is associated with their adaptation to difficult experiences [19–21]. Being overinvolved is generally conceptualized as a repetitive and ruminative focus on one's thoughts and feelings, often with a high degree of negative self-focus [22,23]. Not surprisingly, it is associated in the short- and long-term with day-to-day affective experiences such as sadness and happiness and broader indices of psychological distress after relationship dissolution [21]. It is plausible that psychological overinvolvement operates to disrupt emotional functioning and sleep through mechanisms similar to those shared with rumination—both constructs reflect a repetitive or perseverative thought process that may become so consuming that it interferes with sleep. (Operationally, we view rumination as the trait-like tendency to become overinvolved in your own psychological experiences, and from this perspective, the latter construct represents a behavioral manifestation of rumination—that is, being overinvolved in your

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own psychological experiences is how people “do” rumination.) In contrast, a more distanced perspective can involve seeing yourself and your experiences from the outside (often as a neutral 3rd-party might view the situation; see [24]) and recognizing that your individual psychological experiences are part of the universal human experience (see [25]). Frequently, too, people who are immersed in their experiences appear to reflect on difficult events in a repetitive manner without reaching useful or satisfying conclusions, a process that is referred to as recounting (versus reconstruing) an experience [26]. Empirical support for the adaptive value of being distanced vs. immersed is strong [27], and in this report, we seek to extend this literature by developing a better understanding of how the affective experiences that follow from these self-reflective styles may be associated with sleep disturbances after marital separation. In this way, the work described here adds mechanistic focus to the affective and sleep disturbance correlates, and perhaps putative consequences, of how adults internally relate to their thoughts about the end of their marriage.

One of the main approaches to studying the process of relating to a psychological experience is to study the language people use to describe their thoughts and feelings about difficult events [28]. Indeed, a large literature indicates that how people talk about difficult experiences can index both general and relationship-specific psychosocial coping and adjustment processes [29–33]). Sbarra and colleagues designed a laboratory paradigm to discern these linguistic cues in a stream-of-consciousness (SOC; see [34] task in which adults are asked to describe their thoughts and feelings about their separation/divorce experience. The divorce-experience SOC task can be thought of as a “stress test” of the attachment system. Language use during this SOC task can be used as a behavioral index of attachment-related emotion regulation, a key process that is related to psychological adjustment after relationship dissolution [20].

Talking about the Divorce – Linguistic Indicators of Adjustment

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In this study, we focus on two language use categories, verbal immediacy (e.g., first-person singular, present-oriented, short words; experiential here-and-now language) and first-person plural words use (e.g., we, us, ours), to operationalize psychological overinvolvement and continued attachment to one's former partner, respectively [32]). Individual differences in psychological overinvolvement predicts emotional recovery after separation/divorce [19,21], and recent evidence from an experimental study finds that this construct impedes adult's ability to create meaning (i.e., a coherent narrative) from their separation/divorce experience, which in turn, places them at higher risk for psychological distress, including negative affect [19,21]. Psychological overinvolvement is a marker of risk that can be measured via self-report (e.g., rumination; [21], independent coders (e.g., recounting and reconstruing, searching for meaning; [21,35], and language use (e.g., [30,36]. Verbal immediacy, our index of overinvolvement, is negatively associated with multiple and diverse markers of successful adaptation to separation/divorce [19–21,37].

Continued attachment is another marker of psychological recovery after divorce that reflects the way one relates to internal experiences through the lens of their former relationship. Adults who remain psychologically interdependent on their former spouse instead of rediscovering themselves as an independent person evidence poorer post-divorce adjustment [20,31,38]. Indeed, reestablishing an independent sense of self is a critical task of healthy adjustment after separation/divorce [39,40]. Illustratively, one study found that a positive association between continued attachment and psychological distress nearly five years later was driven by individual differences in self-concept disturbances [20]. Like psychological overinvolvement, continued attachment is an established marker of risk via self-report [41], observer ratings [31], behavior (e.g., continued contact with an ex-partner; e.g., [42,43]), and language use [20]. In the current report, we operationalize the construct via first-person plural pronouns (we, us, our; often referred

to colloquially as *we-talk*); relatively greater *we-talk* when discussing one's separation experience is associated with poorer psychological adjustment to the separation [19,31,44].

The Current Study

The current study investigates the association between actigraphy-assessed sleep efficiency, linguistic behaviors, and self-report indicators of psychological distress. We adopt a process-oriented view on how overinvolvement, continued attachment, negative affect, and sleep disturbances unfold together in the months following marital separation. We examined within- and between-person associations among these constructs using a 1-1-1 mediational design [45], and we also explored whether attachment orientations moderate the associations in a sample of 138 recently separated/divorced adults assessed three times over five months. As part of a preregistered analytic plan (osf.io/g9w5x), we predicted positive within-person indirect effects of observed psychological overinvolvement and continued attachment on nightly sleep disturbance through daily negative affect. In the preregistered plan, we also hypothesized that the effects of psychological overinvolvement and continued attachment on negative affect would be stronger for individuals higher in attachment anxiety. Individuals high in attachment anxiety are more likely to engage in hyperactivating emotion regulation strategies, which may intensify their emotional distress after reflecting on their separation/divorce experience [37].

Method

Participants

We conducted secondary data analysis using data from a study of 140 adults who had recently experienced marital separation or divorce. The institutional review board at the University of Arizona approved all study protocols before data collection. The current sample comprises the 138 adults (70% women; ages 21 – 65, $M = 43.2$, $SD = 10.8$) who provided data on at least one study variable. According to a simulation study conducted by Pan et al. [46], with three repeated

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measures, our sample was adequately powered (i.e., 80%) to detect mediational effect sizes based on the distribution of product method [47] of approximately $\beta_A = .26$ and $\beta_B = .26$ given that our dependent variable ICCs were moderate (.5 - .8).¹

Participants had been married for an average of 14.83 years (SD = 9.36) and separated for an average of 3.73 months (SD = 2.08). Forty-two percent were physically separated with no legal action filed, 16% were legally separated, and 12% were legally divorced. One participant was emotionally separated but still living together and 29% did not report their relationship status. The slight majority (55%) had children with their ex-spouse. Participants identified their race and ethnicity as follows: 62% White, non-Hispanic, 21% Hispanic, 5% Black or African American, 4% biracial or multiethnic, 2% Native American, 2% Asian, and <1% Polynesian (2% did not disclose their race or ethnicity). Reported annual income was as follows: 36% earned less than \$15,999, 54% earned \$16,000 – 49,999, 14% earned \$50,000 – 99,999, and 4% earned more than \$100,000 (7% did not disclose their income).

Study Procedures

Participants were recruited via the family court, online and newspaper advertisements, and divorce support groups in a large southwestern metropolitan area of the United States. They were invited to enroll in a study about adults' adjustment after marital separation/divorce. To be eligible, participants had to have cohabited with their ex-spouse for at least two years and been married for at least three years. Participants completed five consecutive monthly visits; this report describes data from the 1st, 3rd, and 5th study visits, which were completed in-home or in the lab, according to participants' preferences.² Procedures relevant to the current study included collection of previously-mailed self-report measures, a 4-minute stream-of-consciousness recorded divorce-

¹ ICC of negative affect = .56; ICC of sleep efficiency = .71

² The 2nd and 4th visit procedures consisted only of mailed self-report measures, which were returned by mail or collected by research assistants; these data were not used in the current study.

experience task, instructions to complete daily diaries over the following seven days, and delivery of actigraphy equipment to be worn over the next seven nights, each is discussed below. See Figure 1 for an illustration of the study procedures relevant to this report.

Measures

Psychological Overinvolvement (Verbal Immediacy) and Continued Attachment (We-talk)

Psychological overinvolvement was assessed using a stream-of-conscious (SOC) talk-about-your-divorce-experience task designed as a stress test of the attachment system following separation/divorce and was conducted at the 1st, 3rd, and 5th study visits. Research assistants transcribed the verbal SOC recordings and analyzed the transcripts using the Linguistic Inquiry Word Count (LIWC) [48]. Based on prior research, we used the linguistic composite of verbal immediacy as an indicator of psychological overinvolvement [21]. Verbal immediacy is operationalized as a composite of five linguistic categories: first-person singular pronouns (e.g., I, me, my), discrepancy words (e.g., should, would, could), and present focus words, and inverse scores for articles (e.g., a, an, the), and words with more than six letters. The verbal immediacy score comprises an average of the five standardized categories. Standardization was computed based on baseline mean and standard deviation for all time points to preserve change over time [49]. Verbal immediacy has been used to assess psychological overinvolvement in prior studies of separation/divorce [21,37,50]. The internal reliability was $\alpha = .64$ at T1, $\alpha = .64$ at T3, and $\alpha = .61$ at T5. The reliability of change in verbal immediacy was calculated according to the application of the generalizability theory method [51,52]. The reliability estimate was fair within persons ($R_C = .41$) and substantial between persons ($R_{KF} = .85$), according to guidelines by Shrout [53]. Continued attachment was also assessed during the stream-of-conscious (SOC) divorce-experience task conducted at the 1st, 3rd, and 5th study visits. We used we-talk as an indicator of continued attachment, based on prior research [31]. We-talk is operationalized as the use of first-person

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plural pronouns (e.g., we, us, our; [54]). The bivariate test-retest associations ranged from .44 - .56, with an intraclass correlation coefficient of .72 (95% CI: .62 - .80). We-talk has been shown to correlate strongly with self-reported and observer-rated attachment to a former partner, including meta-analytic evidence that it indexes interdependence in romantic relationships, and predict post-separation/divorce psychological adjustment [20,31,54].

Negative Affect

End-of-day self-report ratings of affect were assessed for seven days after the 1st, 3rd, and 5th study visits. Negative affect scores comprised a composite of participants' responses to daily ratings of sadness, anger, and stress (i.e., "How sad were you today?" "How stressed were you today?" "How angry were you today?") on a 5-point scale (*not at all* [1], *extremely* [5]), averaged across the week. The negative affect score is a mean composite of sadness, anger, and stress ($\alpha = .78 - .85$ across assessment occasions). The reliability of change estimate for negative affect was moderate within persons ($R_C = .76$) and substantial between persons ($R_{KF} = .94$), according to guidelines by Shrout [53]. ***Separation-related psychological distress (SRPD)***

SRPD is a composite of four self-report questionnaires measuring depressive symptoms and emotional distress, grief, and perceived loss and rediscovery of self, related to relationship dissolution: Beck Depression Inventory (BDI), Impact of Events Scale-Revised (IES-R), Loss-of-Self/Rediscovery-of-Self (LOSROS), and Inventory of Complicated Grief (ICG). The measures were rescaled using linear transformations to Percentage of Maximum Possible (POMP) scores on a scale of 0 to 100 [55], and then combined into a standardized mean composite of SRPD. This composite has been used in previous studies of divorced and separated adults (e.g., [21]).

Actigraphy-assessed Sleep Disturbance

We used sleep efficiency as an indicator of sleep disturbance. Sleep efficiency was calculated from actigraphy data and averaged across a 7-day assessment period following the 1st,

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3rd, and 5th study visits. Sleep onset was defined as the beginning of the first five minutes of contiguous quiescence with less than 30 seconds of any recorded activity counts that occur after lights-off time. Once lights off, lights on, sleep onset, and sleep offset were established, these four values were entered into a sleep-scoring algorithm. Sleep diaries were used to determine sleep onset and offset time. A member of the research team reviewed sleep diaries by hand and visually inspected actigraphy data to enhance precision. This algorithm was used to analyze sleep within the rest intervals, from which sleep parameters were calculated. Sleep efficiency (i.e., percentage of time asleep while trying to sleep) was calculated as total sleep time divided by the total time in bed. We multiplied all sleep efficiency scores by 100 to yield a percentage. As reported in our descriptive study of sleep disturbances in this sample [15], average sleep efficiency was 81.91% at occasion 1 (SD = 7.84), 81.61% at occasion 3 (SD = 8.90), and 82.34% at occasion 5 (SD = 7.97), and we found no evidence for significant improvements in sleep efficiency over time.

Anxious Attachment

The 6-item anxiety subscale of the short version of the Experiences in Close Relationships Scale (ECR [56]) assessed attachment anxiety on a 7-point scale from *strongly disagree* (1) to *strongly agree* (7) with higher scores indicating greater anxious attachment (e.g., “I need a lot of reassurance that I am loved by my partner”). Anxious attachment is a predictor of post-separation/divorce adjustment in prior studies [37,40]. The scale’s internal reliability was $\alpha = .76$.

Demographic and Relationship Covariates

We included age, gender, time since separation (in months), length of relationship (in months), and leaver status (4-point Likert scale) as covariates in all models.

Data Analysis Approach

Full code of statistical modeling in Rmarkdown is available at <https://osf.io/g9w5x/>. We first tested a within-person (i.e., 1-1-1) multilevel mediation model to examine effects of *verbal*

immediacy (X_1) and *we-talk* (X_2) on *negative affect* (M_1), and in turn, *sleep efficiency* (Y). We then added a Level 2 moderator, *anxious attachment*, on the paths between *verbal immediacy* (X_1) and *we-talk* (X_2) to *negative affect* (M_1). We added exploratory analyses to examine disaggregated (between-person [person-mean variable] and within-person [person mean-centered variable] [see 54]; concurrent, lagged, and moderated (by anxious attachment) effects of *verbal immediacy* and *we-talk* on *negative affect* and *verbal immediacy*, *we-talk*, and *negative affect* on sleep efficiency. We also tested an alternative theoretical mediation model in which we examined effects of *negative affect* on *verbal immediacy*, and in turn, *verbal immediacy*, and *sleep efficiency*. Finally, we replaced negative affect with the broader construct of separation-related psychological distress.

Our preregistered and exploratory analyses were conducted in a multilevel mediation modeling framework.³ Full information maximum likelihood estimation (FIML) handled missing data (12.4% on psychological overinvolvement and continued attachment; 9.8% on negative affect; 21.9% on sleep disturbance). We used the R packages *nmle* and *lme4* to fit multilevel mediation models. We used the *reshape2* package and *melt* function to restructure the data to have a single stacked outcome variable (i.e., mediator and dependent variables) with dummy-coded indicators, which allowed us to estimate mediational paths (i.e., A, B, C' paths) simultaneously in a single model [58]. We examined total effects (i.e., C paths) in a separate model. We estimated confidence intervals based on the distribution-of-the-product method to assess the significance of the indirect effects, using the RMediation package [59].

Results

³ We conceptualized our theoretical model as mediational associations; however, for each study occasion (i.e., 1st, 3rd, 5th visit), verbal immediacy and we-talk were collected during the study visit, but negative affect and sleep efficiency were composites of data collected on the seven days/nights following the study visit. Thus, negative affect and sleep efficiency were collected simultaneously with no temporal precedence established.

Table 1 displays descriptive statistics and correlations among all study variables.

Analysis of Preregistered Hypotheses

Within-Person Associations

We first examined within-person total effects of verbal immediacy on sleep efficiency (C_1), and we-talk on sleep efficiency (C_2) (Table 2; Model 1). We then examined within-person effects of verbal immediacy on negative affect (A_1), we-talk on negative affect (A_2), and negative affect on sleep efficiency (B), as well as direct effects of verbal immediacy and we-talk on sleep efficiency (C'_1 and C'_2 , respectively) and change over time in negative affect and sleep efficiency (Table 2; Model 2). Negative affect declined significantly across time; as reported elsewhere [15], sleep efficiency remained stable across time. We observed no significant effects associated with the B, C, or C' paths. However, after accounting for demographic (i.e., age, sex) and relationship-specific (i.e., relationship length, separation length, perceived responsibility for relationship dissolution) covariates, we observed a significant association between within-person verbal immediacy and within-person negative affect (A_1), $b = .12$, 95% CI = .01 – .22, $p = .030$). This model indicated support for the A path in our theoretical model: On study occasions when verbal immediacy was higher than one's average, (within-person) negative affect was relatively higher as well.

Next, we examined whether the associations between verbal immediacy and negative affect (A_1 path) and we-talk and negative affect (A_2 path) were moderated by attachment anxiety. Attachment anxiety did not moderate the effect of verbal immediacy or we-talk on negative affect ($p = .072$ and $.998$, respectively).

Exploratory Analyses

After initiating data analysis, we realized that the preregistered proposal of our theoretical mediation model (see Figure 2) failed to consider that the hypothesized effects would operate at the

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between-person level instead of the within-person level. Thus, we examined disaggregated within- and between-person total effects for verbal immediacy and we-talk on sleep efficiency (C paths) (Table 3; Model 1). We observed a significant total effect of between-person verbal immediacy on sleep efficiency, $b = -2.95$, 95% CI = $-4.22 - -1.67$, $p < .001$ (see Figure 3). Adults who exhibited higher verbal immediacy (relative to the grand mean of the sample and regardless of the occasion) evidenced lower sleep efficiency. We did not observe significant within- or between-person effects of verbal immediacy or we-talk on negative affect (A paths) (Table 3; Model 2). There was a significant between-person effect of negative affect on sleep efficiency (B_b path; $b = -1.77$, 95% CI = $-2.93 - -.61$, $p = .003$) and a direct effect of between-person verbal immediacy on sleep efficiency (C1'_b path; $b = -2.66$, 95% CI = $-4.01 - -1.32$, $p < .001$).

We also explored potential lagged within-person effects of verbal immediacy and we-talk on negative affect two months later, and of verbal immediacy, we-talk, and negative affect on sleep efficiency two months later (Table 4). When we added lagged within-person effects, the between-person effect of negative affect on sleep efficiency and the direct and total effect of between-person verbal immediacy on sleep efficiency remained significant. We observed no significant lagged effects.

Because prior models indicated no significant effects of we-talk, we focused our final exploratory analyses on better understanding the effects of verbal immediacy. First, we tested an alternative mediation model by switching the predictor and mediator variables; negative affect predicted verbal immediacy (A path), and verbal immediacy predicted sleep efficiency (B path). In support of the B path, we observed a significant between-person effect of verbal immediacy on sleep efficiency ($b = -3.35$, 95% CI = $-4.59 - -1.11$, $p < .001$; note that this is the same association as the C and C' paths in Table 3; Model 1: between-person immediacy predicted sleep efficiency). Results also indicated support for the C' path; there was a significant between-person effect of

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negative affect on sleep efficiency ($b = -1.34$, 95% CI = $-2.55 - -0.14$, $p = .029$; note that this is the same association as the B path in Table 3; Model 1: between-person negative affect predicted sleep efficiency). Given the lack of a significant A path, we did not assess the indirect effect of negative affect on sleep efficiency through verbal immediacy.

Next, we replaced negative affect with SRPD. Results indicated support for the A path ($b = 4.74$, 95% CI = $0.21 - 9.27$, $p = .040$); between-person verbal immediacy was associated with SRPD. We also found support for the B path ($b = -.96$, 95% CI = $-1.04 - -.87$, $p < .001$); a significant between-person effect of SRPD on sleep efficiency. There was a significant total effect of between-person verbal immediacy on sleep efficiency (C path; $b = -6.48$, 95% CI = $-9.48 - -3.48$, $p < .001$; note that this is the same association as the C path in Table 3; Model 1: between-person verbal immediacy predicted sleep efficiency). The direct effect of between-person verbal immediacy on sleep efficiency was not significant, after accounting for the effects of SRPD (C' path; $p = .496$). The indirect effect of between-person verbal immediacy on sleep efficiency, through SPRD, was significant ($ab = -4.55$; 95% CI [$-8.942, -.204$]).

Discussion

One of the main challenges in the study of divorce and health is to investigate mechanisms of action and the bio-psycho-social process that conveys risk over time. In this report, we examined a series of preregistered confirmatory hypotheses that focused on the ways in which psychological overinvolvement, continued attachment to an ex-partner, subjective negative affect, and actigraphy-assessed sleep disturbances may unfold together in the months following a marital separation. Central to our hypotheses was the idea that *being* overinvolved or *remaining* attached to an ex-partner is manifested behaviorally as participants' language when they describe their separation experience; we hypothesized that these behaviors, when manifest, would be associated with increased negative affect, which in turn, would operate indirectly to link greater

overinvolvement and continued attachment to increased sleep disturbances. We collected the data at three occasions over five months using three different methods—linguistic behavior, subjective experience, and actigraphy-assessed sleep disturbance—and we partitioned the variance in our outcome and predictor variables to determine whether the processes operate within- or between-persons over time.

The findings revealed partial support for the preregistered hypotheses. We found no evidence that continued attachment, at least operationalized as *we-talk*, was associated with either self-reported negative affect or actigraphy-assessed sleep disturbance. However, we observed a significant A path in our 1-1-1 mediation model; in this model, greater relative within-person verbal immediacy was associated with greater relative within-person negative affect. We are aware of no other studies that have portioned variance in repeated language use in this way, and the finding is substantively meaningful: On occasions when separated and divorcing adults were more overinvolved than their typical or average-level experience, they also reported relatively greater negative affect (compared to their own average scores on negative affect). We found no evidence of a lagged effect and the within-person association is correctly interpreted as a cross-sectional effect. The extent to which overinvolvement predicts negative affect, or vice versa, cannot be disentangled in our analyses. Nevertheless, we view this finding as contributing to the growing body of research on the construct validity of verbal immediacy as reflective of overinvolvement or distressing psychological immersion following the end of marriage [see 18–20,35].

One limitation of our preregistered plan is that we viewed the processes of interest from an entirely within-person perspective. In retrospect, this was short-sighted, especially considering our infrequent measurement resolution. In this sense, if we assessed verbal immediacy, negative affect, and sleep disturbance on a daily or weekly basis, we may have had a sensitive enough measurement resolution to capture within-person and perhaps even lagged processes unfolding.

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Alternatively, it is possible that some variables, like sleep efficiency (averaged over seven days) are relatively insensitive to daily fluctuations in emotion regulation strategies and more heavily influenced by an individual's global coping regulation style (i.e., the “go-to” strategy that persists across time and situation).

In our study, with just three assessments over five months, the primary predictor of sleep disturbance operated as an individual difference: between-person immediacy was significantly associated with poor sleep efficiency. Participants who evidenced verbal immediacy scores one standard deviation above the mean had a predicted 1.40% decrease in sleep efficiency, which is roughly .17 a *SD* unit difference in the outcome. Prior work on sleep and divorce showed that adults who reported greater sleep disturbances in the wake of their separation evidenced increases in resting blood pressure three months later [13]. The current study, using sleep actigraphy as an outcome, provides an illustration of who may be at greater risk for persistent sleep disturbances—people with a greater tendency to reflect on their experiences in a first-person, present-oriented, highly experiential way were more likely to exhibit diminished sleep efficiency over time. In our studies on divorce and health, we have argued that some people—especially those who get stuck on their experience and have difficulty creating distance from their psychological pain [16]—are more susceptible to poor outcomes than others. The findings reported here provide clues about how this process may unfold after a separation. Adults who *generally* spoke in a highly psychologically overinvolved manner across the study period were more likely to show diminished sleep efficiency. Psychological overinvolvement may disrupt sleep because of its repetitive, perseverative, self-focused, and/or experientially consuming nature; many people have had the experience of “thinking too much” when they try to get to sleep [60]. Sleep is a critical salubrious health behavior [61–63] and these findings shed light on who is most vulnerable for sleep disturbance after marital separation.

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In our exploratory analyses, we found no evidence for the association of between-person verbal immediacy and between-person negative affect, but we did observe a significant association between between-person verbal immediacy and between-person separation-related psychological distress. And we observed between-person associations between both negative affect and decreased sleep efficiency as well as separation-related psychological distress and decreased sleep efficiency. The exploratory findings provide partial support for our hypothesis that psychological overinvolvement would be associated with increased negative affect (i.e., evident in either proximal affective experiences or broader indices of psychological distress), which in turn, would operate indirectly to link greater overinvolvement to increased sleep disturbances; however, because immediacy and separation-related distress are both measured at the between person level in this model, we are not able to discern specificity in the predictor-mediator association. Although we theorized immediacy drives negative affect, the reverse association is equally plausible. These effects may be understood in terms of the broader association between negative affectivity and sleep disturbance and require careful consideration about the timing of measurement. This basic idea is consistent with other findings in the field. For example, across a two-week diary study of sleep in daily life, the association between neuroticism and sleep disturbances was reduced to zero when average-level negative affect was entered into the model [64]. The Slavish et al. [64] study also found that daily fluctuations in rumination and negative affect were most highly associated with self-reported sleep disturbances. As we intimated above, these within-person processes may be most evident at the daily level whereas our assessment at three times across five months in the current study may be most suited to understanding person-level risk factors (e.g., more global psychological distress) for poor sleep rather than process-level risk factors (e.g., daily negative affect). Indeed, the reliability of change indices yielded higher estimates between persons than within persons (see Method section). This may also explain the observed null effects for

attachment anxiety; if attachment orientations give rise to emotion regulatory strategies that unfold on a moment, hourly, or daily basis (e.g., see [37], we may be missing the “causal window” for assessing these processes).

We did not observe a significant association between the use of first-person plural words (*we-talk*) and sleep efficiency, which is inconsistent with our preregistered hypothesis. In other analyses from this data set, *we-talk* was associated with self-reported self-concept disruptions—that is, an inability to reestablish an independent identity in the wake of the separation [31], and we expected to observe a similar association between this verbal marker of continued attachment to an ex-partner and sleep disturbance. One explanation for this dissociation (where *we-talk* predicts self-concept disruptions but not sleep disturbance) is that continued attachment may not have the perseverative or ruminative qualities of overinvolvement, and it is these qualities that are more highly associated with sleep disturbance. Continued attachment may not be immediately distressing or consuming as it may reflect a “carrying-on” with life as usual. Thus, experiencing and reflecting on these emotions may not be as pernicious as being overinvolved, which has a ruminative quality that is likely emotionally resource-intensive, disrupting important adaptive regulatory processes, such as sleep. Only in the long-term, through its negative effects on issues such as self-concept [20], may continued attachment exert its deleterious effects on adjustment. These ideas, however, require empirical examination in future studies.

Although this work is the first to show that between-person verbal immediacy is associated with actigraphy-assessed sleep efficiency, the results of this study should be interpreted in terms of its limitations. In addition to the broad assessment windows used in this study (when more frequent assessments would have been ideal), the sample consisted of largely women, which precluded any gender-based moderation analyses in the study of sleep disturbance. We regret not specifying the between-person immediacy to sleep efficiency effect in our preregistered plan. This renders our

findings ultimately exploratory rather than confirmatory, and it would be ideal to confirm the effect in a future, pre-registered replication study. This oversight notwithstanding, the immediacy-sleep efficiency finding is consistent with the confirmatory hypotheses we used to organize this study. We note that we have no objective criteria to indicate that *immediacy* and *we-talk* are mapping directly on to the constructs we believe they are tapping; we made an argument for their utility by virtue of the extant literature, but we caution against a one-to-one mapping of the linguistic behaviors onto the psychological processes. Although we believe the literature *and* the current findings, at least with respect to verbal immediacy, accurately reflect the logic of our operationalization of psychological overinvolvement, we should focus our attention on the explicit linguistic behaviors (in the case of immediacy: 1st-person, present-oriented, short words; here-and-now language) versus the psychological processes we believe they represent.

Clinical Implications

Understanding the underlying links between individual differences in emotion regulation and health behaviors is critical to developing targeted, theory-driven, and effective prevention and intervention strategies following marital separation and divorce. Individuals who express their thoughts and feelings in a psychologically overinvolved manner may benefit from interventions that teach linguistic self-distancing (e.g., describing the situation as a third-party observer), as an emotion regulation strategy [26,65]. For example, learning and practicing subtle shifts in self-talk language when thinking about difficult situations may reduce the intensity of negative affect those thoughts provoke. In fact, a recent naturalistic study with over 6,000 participants engaged in text-message-based therapy demonstrated that self-distancing is a replicable marker of reduced internalizing problems and response to treatment [27]. Although the clinical implications of self-distancing emotion regulation strategies have not yet been studied in the context of sleep, there is preliminary evidence that self-distancing attenuates other adverse

health outcomes, such as autonomic reactivity [22,66–68]. For example, researchers found that veterans diagnosed with posttraumatic stress disorder who were randomized to analyze their trauma memories from a self-distanced perspective showed significantly higher heart rate and skin conductance reactivity than those who were randomized to analyze their trauma memories from a self-immersed perspective.

Conclusion

In this study, we found that people with a greater tendency to express their thoughts and feelings in a linguistic manner that is putatively overinvolved are at greatest risk for sleep disturbances. Our findings are not directional, thus it is possible that sleep disturbances impair emotion regulation, and there's ample evidence in support of this direction as well [69,70]. This study extends prior research documenting the critical link between sleep disturbances and emotion regulation difficulties to the context of marital separation and divorce, a stressful life experience that is experienced by many adults and associated with increased risk for a range of negative outcomes, including clinically-significant mood disturbance, suicidal ideation, and suicide attempts [17,71].

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Statement Regarding Informed Consent: Informed consent was obtained from all individual participants included in the study.

Statement Regarding Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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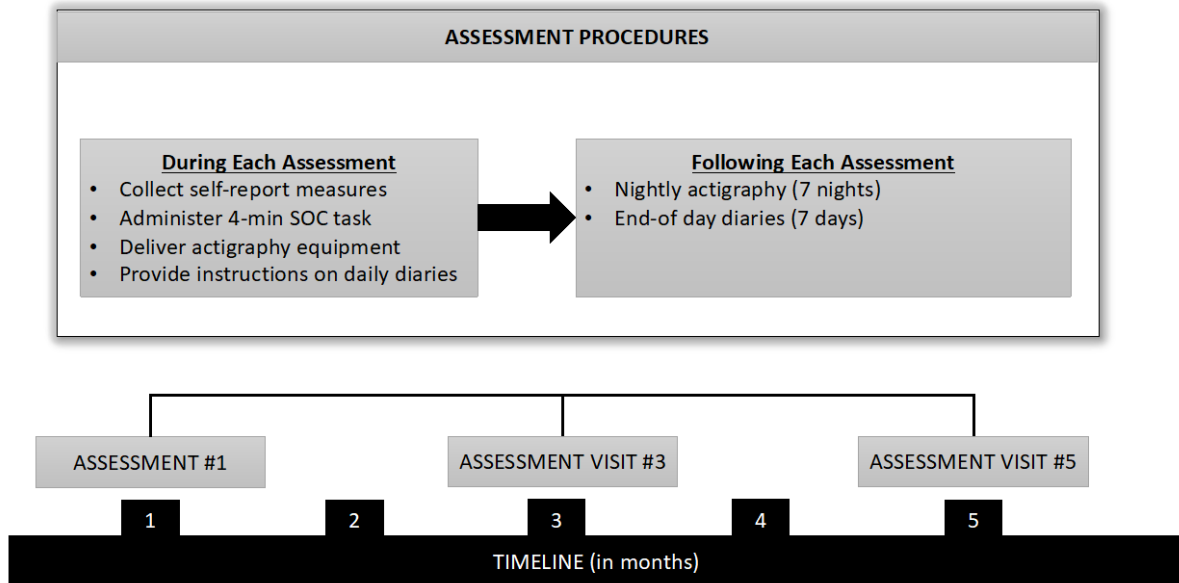
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Figure 1

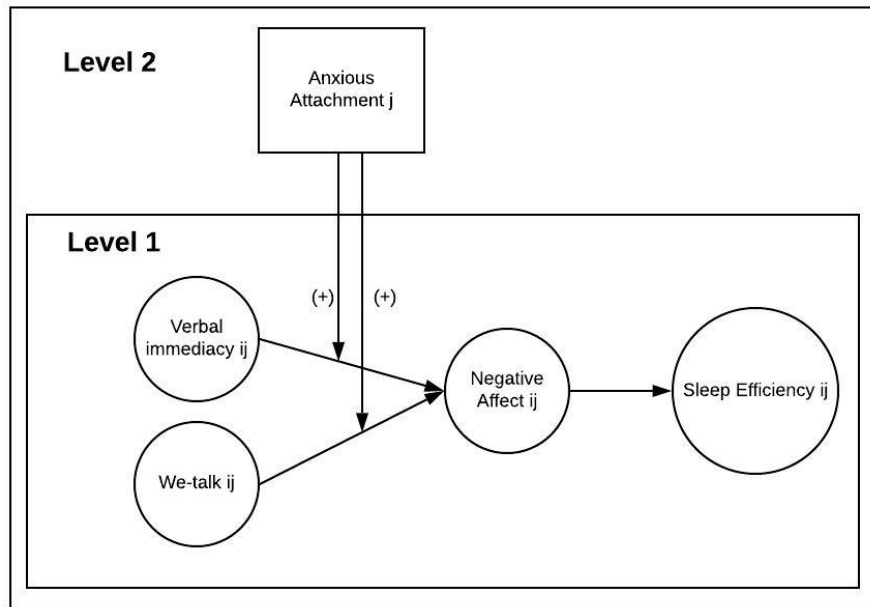
Illustration of study procedures



Note. Participants completed five consecutive monthly visits; this report describes data from the 1st, 3rd, and 5th study visits; the 2nd and 4th visit procedures consisted only of mailed self-report measures, not actigraphy and daily diary measures on which this secondary data analysis focuses.

Figure 2

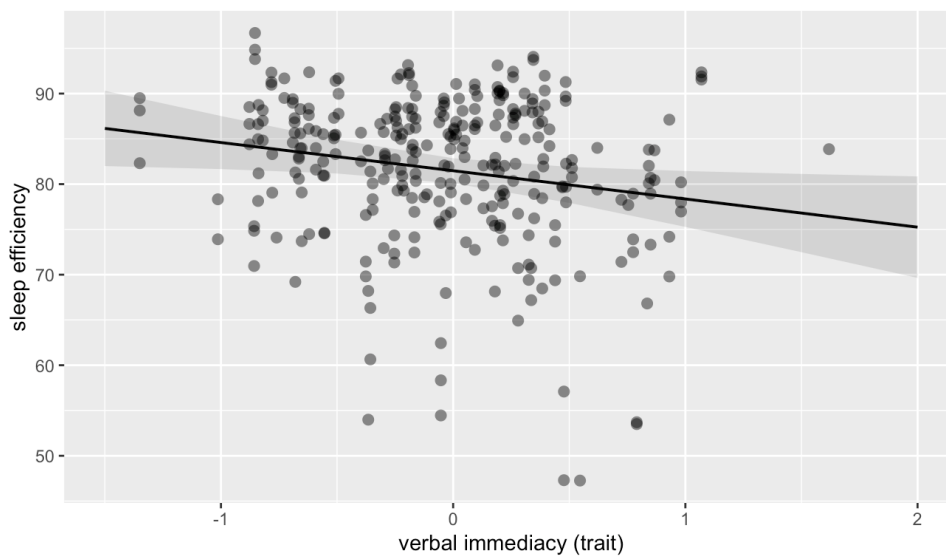
Theoretical 1-1-1 moderated mediation model



Note. Within-person variables are measured at Level 1 and between-person variables are measured at Level 2.

Figure 3

Expected values with observed data for total effect of verbal immediacy (trait) on sleep efficiency



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Table 1

Means, standard deviations, and correlations with confidence intervals

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. imm_1	0.00	0.64												
2. imm_2	0.27	0.63	.53**											
			[.39, .65]											
3. imm_3	0.35	0.61	.46**	.61**										
			[.31, .60]	[.48, .72]										
4. we_1	2.27	1.67	-.25**	-.16	-.30**									
			[-.40, -.08]	[-.33, .02]	[-.45, -.12]									
5. we_2	1.69	1.37	-.10	-.31**	-.21*	.46**								
			[-.27, .09]	[-.46, -.13]	[-.38, -.02]	[.30, .59]								
6. we_3	1.62	1.13	-.00	-.04	-.23*	.44**	.56**							
			[-.18, .18]	[-.23, .14]	[-.40, -.05]	[.27, .57]	[.42, .68]							
7. neg_1	2.15	0.70	.27**	.01	.21*	-.08	-.01	-.05						
			[.10, .42]	[-.17, .19]	[.03, .38]	[-.25, .10]	[-.19, .18]	[-.23, .13]						
8. neg_2	1.99	0.62	.17	-.03	.08	-.01	.04	.06	.67**					
			[-.01, .34]	[-.22, .15]	[-.11, .26]	[-.19, .17]	[-.14, .22]	[-.12, .24]	[.56, .76]					
9. neg_3	1.90	0.63	.17	.04	.23*	.06	.05	.05	.50**	.56**				
			[-.01, .35]	[-.15, .22]	[.05, .40]	[-.12, .24]	[-.14, .23]	[-.14, .23]	[.36, .63]	[.42, .67]				
10. SE_1	81.91	7.84	-.18	-.04	-.13	.14	-.13	.08	-.09	-.16	.03			
			[-.35, .00]	[-.23, .15]	[-.31, .06]	[-.04, .31]	[-.31, .06]	[-.11, .27]	[-.27, .09]	[-.34, .02]	[-.16, .21]			
11. SE_2	81.61	8.90	-.16	-.13	-.26**	.26**	-.03	.13	-.13	-.11	-.12	.75**		
			[-.34, .03]	[-.32, .06]	[-.43, -.07]	[.07, .43]	[-.22, .16]	[-.06, .32]	[-.31, .06]	[-.30, .08]	[-.31, .07]	[.65, .82]		
12. SE_3	82.34	7.97	-.04	-.05	-.12	.05	-.03	.12	-.23*	-.18	-.08	.66**	.64**	
			[-.24, .17]	[-.26, .15]	[-.32, .09]	[-.15, .25]	[-.24, .17]	[-.09, .32]	[-.41, -.04]	[-.37, .02]	[-.27, .12]	[.53, .76]	[.50, .75]	
13. ECRS	3.87	1.25	.02	-.10	.06	-.02	.01	-.11	.23**	.16	.24**	-.12	-.26**	-.13
			[-.15, .20]	[-.28, .08]	[-.13, .24]	[-.19, .15]	[-.17, .19]	[-.28, .08]	[.06, .38]	[-.02, .33]	[.07, .40]	[-.29, .06]	[-.42, -.07]	[-.32, .08]

Note. M and SD are used to represent mean and standard deviation, respectively. imm = verbal immediacy; we = we-talk; neg = negative affect; SE = sleep efficiency; ECRS = anxious attachment; _1 = at first visit; _2 = at second visit; _3 = at third visit. CI = 95% confidence

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interval. Bolded paths are statistically significant. Values in square brackets indicate the 95% confidence interval for each correlation. $p < .05$. ** indicates $p < .01$.

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Table 2

Unstandardized Regression Coefficients from Within-person Mediation Model

Path	<i>Estimate</i>	CI	<i>p</i>
Model 1			
C ₁ (verbal immediacy → SE)	-0.75	-1.86 – 0.35	0.180
C ₂ (we → SE)	0.07	-0.36 – 0.51	0.734
Model 2			
A₁ (verbal immediacy → neg affect)	0.12	0.01 – 0.22	0.030
A ₂ (we → neg affect)	-0.00	-0.05 – 0.04	0.857
B (neg affect → SE)	0.43	-0.66 – 1.51	0.440
C' ₁ (verbal immediacy → SE)	-0.81	-1.89 – 0.28	0.144
C' ₂ (we → SE)	0.13	-0.29 – 0.55	0.556
time trend: neg affect	-0.11	-0.15 – -0.06	<0.001
time trend: SE	-0.10	-0.59 – 0.38	0.684

Note. we = we-talk; SE = sleep efficiency; neg affect = negative affect; CI = 95% confidence interval. Bolded paths are statistically significant.

Table 3

Unstandardized Regression Coefficients from Within- and Between-person Mediation Model

Path	<i>Estimate</i>	CI	<i>p</i>
Model 1			
C1 _w (imm_w → SE)	-1.06	-2.73 – 0.62	0.217
C1_b (imm_b → SE)	-2.95	-4.22 – -1.67	<0.001
C2 _w (we_w → SE)	0.37	-0.28 – 1.03	0.261
C2 _b (we_b → SE)	0.34	-0.25 – 0.93	0.260
Model 2			
A1 _w (imm_w → neg affect)	0.11	-1.03 – 1.26	0.845
A1 _b (imm_b → neg affect)	0.13	-0.87 – 1.12	0.802
A2 _w (we_w → neg affect)	-0.02	-0.49 – 0.45	0.942
A2 _b (we_b → neg affect)	0.01	-0.46 – 0.48	0.966
B _w (neg_w → SE)	0.16	-1.61 – 1.92	0.862
B_b (neg_b → SE)	-1.77	-2.93 – -0.61	0.003
C1' _w (imm_w → SE)	-0.80	-2.49 – 0.89	0.354
C1'_b (imm_b → SE)	-2.66	-4.01 – -1.32	<0.001
C2' _w (we_w → SE)	0.33	-0.32 – 0.98	0.318
C2' _b (we_b → SE)	0.37	-0.25 – 0.99	0.238
time trend: neg affect	-0.13	-0.63 – 0.38	0.624
time trend: SE	0.25	-0.70 – 1.20	0.607

Note. C = total C path; A = A path; B = B path; C' = direct C path; imm_w = verbal immediacy within-person effect; imm_b = verbal immediacy between-person effect; neg_w = negative affect within-person effect; neg_b = negative affect between-person effect; SE = sleep efficiency; neg affect = negative affect; CI = 95% confidence interval. Bolded paths are statistically significant.

Table 4

Unstandardized Regression Coefficients from Lagged Mediation Model

Path	<i>Estimate</i>	CI	<i>p</i>
Model 1			
C1 _w (imm_w → SE)	3.81	-0.69 – 8.32	0.097
C1 _{wL} (imm_wL → SE)	2.35	-1.45 – 6.16	0.225
C1_b (imm_b → SE)	-3.24	-5.65 – -0.83	0.008
C2 _w (we_w → SE)	-1.34	-3.25 – 0.58	0.171
C2 _{wL} (we_wL → SE)	0.34	-1.27 – 1.94	0.681
C2 _b (we_b → SE)	0.64	-0.50 – 1.78	0.270
Model 2			
A1 _w (imm_w → neg affect)	0.06	-0.15 – 0.27	0.580
A1 _{wL} (imm_wL → neg affect)	0.01	-0.17 – 0.19	0.934
A1 _b (imm_b → neg affect)	0.14	-0.06 – 0.35	0.169
A2 _w (we_w → neg affect)	-0.02	-0.11 – 0.07	0.604
A2 _{wL} (we_wL → neg affect)	-0.06	-0.13 – 0.01	0.089
A2 _b (we_b → neg affect)	0.04	-0.06 – 0.13	0.474
B _w (neg_w → SE)	1.43	-3.11 – 5.97	0.536
B _{wL} (neg_wL → SE)	1.49	-2.44 – 5.43	0.458
B_b (neg_b → SE)	-2.44	-4.79 – -0.09	0.042
C1' _w (imm_w → SE)	2.50	-2.42 – 7.43	0.319
C1' _{wL} (imm_wL → SE)	1.97	-2.01 – 5.94	0.332
C1'_b (imm_b → SE)	-3.12	-5.66 – -0.58	0.016
C2' _w (we_w → SE)	-1.41	-3.32 – 0.50	0.148
C2' _{wL} (we_wL → SE)	0.47	-1.15 – 2.10	0.568
C2' _b (we_b → SE)	0.61	-0.52 – 1.75	0.291
time trend: neg affect	-0.12	-0.23 – -0.00	0.043
time trend: SE	1.79	-1.57 – 5.16	0.296

Note. C = total C path; A = A path; B = B path; C' = direct C path; imm_w = verbal immediacy within-person effect; imm_wL = verbal immediacy within-person lagged effect; imm_b = verbal immediacy between-person effect; neg_w = negative affect within-person effect; neg_wL = negative affect within-person lagged effect; neg_b = negative affect between-person effect; SE = sleep efficiency; neg affect = negative affect; CI = 95% confidence interval. Bolded paths are statistically significant.