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Department of Psychology
The University of British Columbia
Vancouver, Canada

Date 9/9/97
Abstract

The current study addresses recent calls in the literature to examine both within- and between-person variability in the unfolding of the coping process over time. Twice daily for one week, 74 respondents coping with Rheumatoid Arthritis (RA) pain reported on their pain severity, mood, coping efforts and coping efficacy. As hypothesized, coping efforts, mood, and perceptions of coping efficacy were associated with both between- and within-person differences in daily pain fluctuations. More importantly, greater use of cognitive reframing and lower use of planful problem-solving were associated with reductions in RA pain within days, over and above individual differences in general coping style. The implications of these findings for daily coping and pain outcomes among persons with RA are reviewed. Results provide support for the inclusion of specific cognitive-behavioral interventions for individuals coping with RA.
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Introduction

During the last three decades, researchers have made substantial progress in determining the ways in which individuals cope with stress (for reviews, see Aldwin, 1994; DeLongis & Newth, in press; Zeidner & Endler, 1996). Researchers examining the effects of coping have done so within the context of a variety of stressors such as family, interpersonal, work, financial, and health problems (e.g., Affleck, Urrows, Tennen, & Higgins, 1992; Bolger, DeLongis, Kessler, & Schilling, 1989; Bolger & Zuckerman, 1995; Parkes, 1986). Empirical evidence suggests that the use of both problem- and emotion-focused coping is related to important outcomes such as psychological and physical well-being (for reviews, see Aldwin, 1994; DeLongis & Newth, in press). General trends in the use of specific strategies and their impact upon health variables have emerged. First, the use of emotion-focused strategies that promote less negative construals of the problem (e.g., positive reappraisal, downward social comparison) tend to relate to more adaptive outcomes such as positive psychosocial adjustment or positive affect (e.g., Affleck, Tennen, Pfieffer, & Fifield, 1988-a; Folkman & Lazarus, 1988). Such strategies have also been described as "cognitive approach" coping (Holahan, Moos, & Schaefer, 1996). In comparison, the use of emotion-focused coping that prevents or interferes with constructive action or positive reframing (e.g., wishful thinking, distancing) tends to result in more negative outcomes such as increased levels of distress (e.g., Folkman & Lazarus, 1988; McCrae & Costa, 1986). This second set of strategies have also been referred to as "cognitive avoidance" coping (Holahan et al., 1996). Third, the use of problem-focused efforts that interfere with constructive action or appraisal (e.g., confronting others) are also related to negative outcomes such as increased psychological symptoms (e.g., Folkman, Lazarus, Gruen, & DeLongis, 1986-a). Finally, the use of problem-focused efforts that promote active attempts to change the situation (e.g., seeking more information, formulating a plan) are generally related to more positive outcomes such as satisfactory resolution of a stressful encounter or lower levels of psychological symptoms (e.g., Folkman et
Therefore it appears that there are both adaptive and maladaptive strategies within the more general categories of problem- and emotion-focused coping.

Situational factors in the coping process

A central tenet of a transactional model of stress and coping (e.g., DeLongis et al., 1988; O'Brien & DeLongis, 1996) is the dynamic interplay between the person coping with the stressor and the context in which the stressor occurs. Researchers examining the role of situational factors have determined at least two ways in which context contributes to the coping process. First, situational factors account for cross-situational variability in the types of coping strategies individuals use to cope with stress (for reviews, see Aldwin, 1994; Eckonrode, 1991; Lazarus & Folkman, 1984; Wethington & Kessler, 1991). To illustrate, Mattlin and his colleagues (1990) found that individuals coping with the death of a loved one were significantly less likely to cope by doing things to improve the situation (an example of planful-problem solving) than were individuals coping with a practical problem such as job loss or financial difficulties. Second, despite limited empirical attention, there is evidence that contextual factors account for cross-situational variability in the effectiveness of coping strategies (Aldwin, 1994; Lazarus, 1993; Mattlin, et al., 1990).

Such findings indicate that any one type of coping strategy cannot be accurately labelled “maladaptive” vs. “adaptive”. Instead, the impact and effectiveness of any one strategy depends upon the context or situation in which the individual encounters and copes with the stressor. Therefore, as Lazarus (1993) argues, coping and outcome variables should always be assessed independently of each other. In this way, empirical findings will not be biased by a priori assumptions regarding the effectiveness of any particular strategy. In addition to separating assessments of coping and outcome variables, individuals should be asked to report on their coping efforts in relation to a specific stressor rather than their general
tendencies. In this way, the fluctuating context-dependent relations between coping and outcomes may be identified.

The present study

In order to reduce the variability between individuals that was due to differences in situational factors (i.e., the stressful situation), respondents (R's) in the current study were asked to indicate how they coped with one particular stressor. Specifically, R's reported on coping with Rheumatoid Arthritis pain within the context of their normal everyday lives. Rheumatoid Arthritis (RA) is a chronic auto-immune disease that is associated with a variety of distressing and debilitating symptoms including pain, stiffness, inflammation of the joints, fatigue, and mood changes (Grennan & Jayson, 1989; Rodnan & Schumacher, 1983). In one study, 30% of individuals with RA reported pain as a major stressor (Affleck, Pfeiffer, Tennen, & Fifield, 1988-b). As a result of this pain and related distress, RA sufferers experience a wide range of daily stressors such as difficulties performing household chores, impaired ability to work or hold a job, difficulties engaging in leisure or social activities, and interpersonal tensions resulting from added burdens for friends and family members (e.g., Affleck et al., 1988-a; Anderson, Bradley, Young, McDaniel, & Wise, 1985; Blalock, McEvoy Devellis, Holt, & Hahn, 1993; Moldofsky, 1981; Parker, McCrae, Smarr, Beck, Frank, Anderson, & Walker, 1988-a; Stenstrom, Lindell, Swanberg, Nordemar, & Harms-Ringdahl, 1992). Affleck and his colleagues (1988-b) found these types of difficulties to be a major source of stress for 48% of their sample. However, evidence also suggests that RA pain and functional disability vary substantially both across time and between individuals in accordance with the fluctuating cycles of RA-related symptomatology and varying levels of disease severity (Affleck, Tennen, Urrows, & Higgins, 1991; Grennan & Jayson, 1989). Due to the within- and between-person variability that exists in RA symptomatology and its consequences, this disease provides a suitable context in which to investigate the idiographic-nomothetic approach to stress and coping (e.g., Tennen & Affleck, 1996; Keefe et al., 1997).
Coping and chronic pain

Previous research indicates that when coping with chronic pain, several ways of coping are significantly related to important outcome variables such as functional ability, pain severity, and psychological well-being (for reviews, see Jensen, Turner, Romano, & Karoly, 1991; Zautra & Manne, 1992). However, identifying general trends in the relations between specific coping strategies and chronic pain outcomes is made difficult due to the wide range of coping inventories utilized in previous research, variance in factor structures identified using the same inventories with different samples, and diverse conceptualizations of core coping constructs (for reviews, see Jensen et al., 1991; Zautra & Manne, 1992).

In general, research indicates that the use of several types of emotion-focused coping results in less adaptive outcomes for individuals coping with RA pain. For example, the use of catastrophizing, threat minimization, self-blame, and wishful thinking have been found to result in more negative outcomes such as higher levels of both psychological distress and pain severity (e.g., Felton & Revenson, 1984; Flor & Turk, 1988; Manne & Zautra, 1990; Parker et al., 1988-a). However, empirical evidence suggests that certain forms of emotion-focused coping may be adaptive under circumstances in which the individual has little or no control over a stressor (e.g., Mattlin, et al., 1990). RA is an example of a stressor over which an individual has limited control in that no clear etiology had been established, there is no current cure, and many individuals do not respond positively to conventional medical treatment (Arnett et al., 1988; Grennan & Jayson, 1989; Parker et al., 1988-b; Rodnan & Schumacher, 1983). Consistent with this line of reasoning, greater use of emotion-focused strategies such as positive reappraisal, downward social comparison, and rational thinking have been related to more positive outcomes such as less pain, lower levels of distress, and less functional disability (e.g., Affleck, Tennen, Pfeiffer, Fifield, & Rowe, 1987; Affleck et al., 1988-a; Beckham, Keefe, Caldwell, & Roodman, 1991; Keefe, et al., 1991; Parker et al., 1988-a).
Effects of problem-focused coping and health outcomes among individuals suffering from RA pain are less clear. For example, Parker and his colleagues (1988-a) found that use of information seeking as a means of coping with RA did not relate to psychological well-being or functional status. Likewise, Felton and Revenson (1984) found small and inconsistent relations between information seeking and psychological adjustment. In contrast, researchers have found that the use of palliative forms of problem-focused coping such as relaxation techniques are associated with lower levels of pain (e.g., Affleck et al., 1992). Many individuals with RA engage in a variety of self-care regimens such as therapeutic exercise and medication for inflammation, stiffness, and pain. Unfortunately, adverse side effects often occur when attempting to alleviate RA symptoms via pharmacological treatment (Parker et al., 1988-b), making mainstream palliative ways of coping ineffective for certain individuals. The lack of clear, consistent, and significant relations between problem-focused strategies and adjustment among RA patients has led some researchers to conclude that problem-focused coping is not related to health outcomes for this particular illness. Instead, it has been suggested that adaptive outcomes among individuals coping with chronic pain are largely a function of the degree to which an individual can minimize the use of maladaptive emotion-focused strategies such as catastrophizing (Rosenstiel & Keefe, 1983).

It has also been noted that pain severity may confound or constrain the effectiveness of coping across time in that the impact of coping can vary as a function of pain severity (Brown, Nicassio, & Wallston, 1989). Brown and his colleagues (1989) found that the use of strategies such as suppressing one's feelings and depending upon others were positively related to depression. However, the relation between these types of strategies and depression was stronger under conditions of higher pain than lower pain. It should be noted that diverse coping strategies were included within one general "passive" coping factor in Brown and his colleagues' study (1989), so the interactions between specific ways of coping and pain severity remain unclear.
Mood and coping with chronic pain

It has been argued that the relations between mood and pain remain inconclusive due to limited research, inconsistencies in findings, variability in the types of pain or mood measures utilized, and heavy reliance upon cross-sectional designs (Brown, 1990; Kuch, Cox, Evans, Watson, & Bubela, 1993; Romano & Turner, 1985). For example, some researchers have examined the relation between major depression and chronic pain (for a review, see Romano & Turner, 1985), while others have examined the contribution of temporary mood states to the pain experience. Furthermore, some researchers have assessed specific components of mood (e.g., anxious, depressed; Gaskin, Greene, Robinson, & Geisser, 1992; Linton & Götestam, 1985), while others have utilized more global indices of negative versus positive affect (e.g., Keefe et al., 1997).

Researchers have found positive relations between depressed or anxious mood states and subjective pain (e.g., Gaskin et al., 1992; Linton & Götestam, 1985) as well as significant positive relations between clinical measures of depression or anxiety (e.g., Beck Depression Inventory; Center for Epidemiologic Studies - Depression Scale; Hamilton Anxiety and Depression Scales) and pain ratings (e.g., Brown et al., 1989; Gaskin et al., 1992). However, some researchers have found no relation between anxiety or depression and pain intensity (e.g., Cruise, Broderick, Porter, Kaell, & Stone, 1996; Kuch et al., 1993), and at least one study has found between-person variability in the direction and magnitude of the relations between depressed mood and subjective pain (Linton & Götestam, 1985). The overlapping somatic items frequently used in both mood and pain assessment may have created a confound between mood and pain. However, at least one study has found pain and depression to be significantly related even when controlling for somatic symptoms as possible confounds (Brown, 1990). Research also indicates that the cognitive-affective components of depression play a more central role than somatic components in the psychological adjustment to chronic illness or disability (Frank et al., 1992). Overall, the evidence to date suggests that mood
states or disorders characterized by anxiety or depression may play a substantial role in the pain experience for at least some individuals.

Very few researchers have examined the contribution of mood states other than depressed and/or anxious mood. An exception is the recent examination of the degree to which hostility or anger impact pain experience. Evidence to date suggests that hostility is associated with both pain (e.g., Burns, Johnson, Mahoney, Devine, & Pawl, 1996; Gaskin et al., 1992) and the depressed mood sometimes experienced by individuals coping with chronic pain (e.g., Wade, Price, Hamer, Schwartz, & Hart, 1990). However, at least one study failed to find a relation between anger/hostility and pain (Cruise et al., 1996) and instead found higher levels of energy and alertness, and lower levels of fatigue to be associated with lower levels of pain.

Conclusions regarding the relative contributions of various mood states to pain experience are further complicated given that the majority of research in this area has been cross-sectional (for an exception, see Brown, 1990). Reliance upon such designs has prevented researchers from addressing causal issues among mood and pain (Romano & Turner, 1985).

Coping efficacy and coping with pain

Research also suggests that cognitive appraisals affect the ability to cope with stressful experiences and contribute to health outcomes such as psychological and physical well-being (Aldwin & Revenson, 1987; Keefe et al., 1997; Young, 1992). For example, the impact of a particular coping strategy upon psychological symptoms has been found to interact with perceptions of coping efficacy (i.e., how well one feels they have coped; Aldwin & Revenson, 1987). Coping efficacy appraisals have also been found to have a direct impact upon RA specific health outcomes. Keefe and his colleagues (1997) found that coping efficacy among individuals with RA related to subsequent changes in both mood and pain severity.
Summary and Hypotheses

Research to date has demonstrated the significant relations between coping strategies, mood states, coping efficacy and pain among individuals with RA. As a result, there is substantial empirical evidence that suggests individuals differ in their typical ways of coping with RA, and that these differences relate significantly to additional elements of the coping process and health outcomes. However, little is known about the degree to which fluctuations in ways of coping relate to variance in pain outcomes among individuals with RA. Few studies have examined the relations between elements of the coping process and RA as they unfold over time (for notable exceptions, see Tennen & Affleck, 1996; Keefe et al., 1997). Furthermore, despite calls in the literature (Tennen & Affleck, 1996), no research to date has examined the temporal relations between these variables within the timeframe of a single day. As Tennen and Affleck (1996) argue, multiple measurements within days allow stronger inferences regarding the temporal relations among variables. Therefore, the primary purpose of the current study was to examine the temporal relations between coping efforts, mood, coping efficacy, and pain severity in the process of coping as it unfolds across a single day.

First, it was expected that morning pain would be positively associated with evening pain. Second, it was hypothesized that use of emotion-focused coping that involves viewing the stressful situation more positively would be associated with lower pain severity at the end of each day. In comparison, it was hypothesized that the use of emotion-focused coping that involves ignoring the stressor or viewing the stressful situation negatively would be associated with higher pain severity at the end of each day. Exploratory analyses in regards to problem-focused coping, and the interactions between each form of coping and pain severity were conducted as well. Third, it was hypothesized that higher levels of depressed, anxious, and hostile mood would be related to higher levels of evening pain. The relations between energetic mood state and pain severity was examined for exploratory purposes in order to assess the relations between positive mood and pain experience. Finally, it was hypothesized
that higher coping efficacy would be associated with lower evening pain. The interaction between coping efforts and appraisals of coping efficacy were also examined for exploratory purposes, as it was suspected that the relations between specific coping strategies and pain experience may vary depending upon how well individuals thought they had coped.

In addition to these specific hypotheses, three general issues were also addressed in the current research. First, to what degree do individuals vary across time and from one another in health outcome variables? Second, to what degree do components of the coping process account for these distinct yet related sources of variability in outcome? Finally, do these relations continue to be significant when controlling for possible confounding variables?

Method

Methodological issues in the study of the coping process

In order to effectively address the issues outlined above, several methodological concerns were addressed in the current research. First, it has been noted that stress and coping researchers have tended to focus their efforts on the process of coping among individuals dealing with extreme events such as breast cancer or other life-threatening illnesses (e.g., Wood, Taylor, & Lichtman, 1985), earthquakes and other natural disasters (e.g., Lehman & Taylor, 1988), or death of a loved one (e.g., Nolen-Hoeksema, Parker, & Larson, 1994). Between person variability in coping may be reduced when facing extreme stressors or circumstances (Lazarus, 1990; Parker & Endler, 1996). Contextual factors under extreme circumstances may override individual differences in coping tendencies or demand responses that are less variable among individuals. For this reason, the current study examined the process of coping with RA pain within the context of respondents' (R's) everyday lives.

Second, due to lack of options, many researchers examining the coping process have utilized designs and statistical tools that limit the types of relations among variables that can be examined. As noted by many in the field, cross-sectional designs have a number of
limitations. First, as Epstein (1983) points out, stable trends may not become apparent using one time-point measures of dependent variables. That is, individual tendencies may only become apparent over several similar situations as they occur over time. Therefore, Epstein argues that multiple time-points are often necessary to create an appropriate test of the stability and magnitude of the relation between variables.

Cross-sectional designs also limit the ability of researchers to explore the process of coping as it occurs over time, and therefore preclude the exploration of causal relations among variables (Lazarus & DeLongis, 1983). However it is the constantly changing interplay between the person and the environment as it unfolds across time that is of primary interest to researchers investigating a process-oriented model of coping. In order to address issues of process and causality, multiple time points of both independent and outcome variables are necessary (DeLongis, Hemphill, & Lehman, 1992). It has also been noted that multiple measurements can result in greater reliability of estimates in comparison to single timepoint assessments (Jensen & McFarland, 1993). In addition, multiple measurements reduce the risk of retrospective contamination (DeLongis et al., 1992) which has been found among chronic pain patients in the form of overestimation and underestimation of pain intensity or negative mood states (Bryant, 1993). It should be noted that multiple daily measurements have not been found to significantly impact the experience of chronic pain or mood via reactivity effects (Cruise et al., 1996; von Baeyer, 1994). Therefore, multiple measurements of both dependent and independent variables were utilized in the present study.

Unfortunately, most of the existing multi-time point studies have relied upon aggregational analyses. Although such analyses may be more likely to identify stable individual trends over time (Epstein, 1983), such analyses do not allow exploration of the process/causal relations between variables (DeLongis et al., 1992; Lazarus, 1990). In addition, such an approach to data analysis ignores the within-person variability often present in time series data by basing data analyses solely upon means. Aggregation of variables can
also result in misleading results via overestimations of the magnitude of relations between variables, or identification of relations that vary from those revealed in non-aggregated data (Bryk and Raudenbush, 1992; Epstein, 1983; Kreft, 1994; Lazarus, 1990). Therefore, it is important that researchers make use of developments in research designs and statistical tools that avoid these problems while maximizing analysis of the rich information available within non-aggregated time series data. However, until recently, few statistical tools existed that would allow researchers to do so.

Hierarchical Linear Modeling

Current developments in statistical tools make it possible to address the key methodological and conceptual issues described above. Before such developments, researchers were frequently able to explore only one of the sources of variability in the ways in which individuals cope: (a) within-person variability in the degree to which individuals vary their coping from timepoint to timepoint (i.e., the idiographic approach) versus (b) between-person variability in coping from one individual to another (i.e., the nomothetic approach). To date few studies have examined both intraindividual and interindividual differences in the coping process (for exceptions, see Keefe et al., 1997 and Tennen & Affleck, 1996) despite calls in the literature for such an approach (Affleck et al., 1991; Parker & Endler, 1996; Tennen & Affleck, 1996). There is an even greater deficiency of research that has simultaneously examined both between- and within- person variance in coping within the one statistical model.

The most obvious reason for this deficiency has been lack of statistical tools suitable for combining intraindividual and interindividual data. Hierarchical Linear Modeling (HLM; Bryk & Raudenbush, 1992) is a recently developed statistical technique recommended for use with data collected across time that allows simultaneous exploration of these two sources of variability (Bolger & Zuckerman, 1995; West & Hepworth, 1991). The use of HLM analyses allows one to determine the specific relations between variables as they occur over time for each individual (idiographic trends) as well as overall patterns across individuals in these
relations (nomothetic trends). That is, HLM identifies whether general effects (i.e., intercepts and slopes) are significant, and whether significant variability exists in these values across individuals. Using this multi-level model, researchers are able to assess the degree to which normative trends can be generalized to all individuals or alternatively, whether one must qualify general conclusions. This concurrent examination of both within- and between-subject variability is the most valuable contribution that HLM affords stress and coping researchers.

In the current study, a process model that simultaneously explores both intraindividual and interindividual variability in coping process was assessed. Within this multi-level model, the effects of time variant variables such as coping efforts, mood states, and coping efficacy upon subsequent pain severity were examined. The degree to which these variables contribute to within- versus between-person variability in pain was also evaluated. Furthermore, the use of HLM allowed for control of other confounding variables such as time since onset of the disease.

**Procedure**

**Participant Recruitment**

Respondents (R’s) were recruited via the British Columbia Rheumatoid Arthritis Registry and the Provincial Department of Vital Statistics. Of the 327 potentially eligible individuals, 230 were identified who met the following criteria: (1) diagnosed with probable, definite, or classical RA as defined by the American Rheumatism Association criteria (Arnett et al., 1988), (2) nonhospitalized and had utilized outpatient services during the previous three years, (3) did not meet criteria for major comorbidity (e.g., life-threatening illness, major heart disease, stroke complications), (4) had clearance from their primary physician, (5) lived within the Greater Vancouver Region and (6) spoke English. Of these 230 eligible R’s, 200 gave consent via mail to be reached by telephone. One hundred and forty-nine individuals agreed via telephone to participate in the current study and were mailed study materials. In total, 126 study material packages were returned (although 12 of these were left uncompleted by the
R's). We were able to contact 25 of the R's who had not returned the study materials in order to establish reasons for their withdrawal. Reasons for withdrawal included unexpected illness (both RA related or other types of illness), leaving town, or reluctance to complete study materials twice daily.

Of the 114 R's who had completed and returned their study materials, 14 R's were dropped from the study as they had completed less than 50% of the 14 timepoints within the structured diary. An additional 23 R's indicated they had absolutely no RA related pain during the course of the study. Given the focus of the current analyses (i.e., the process of coping with RA pain), these individuals were excluded from the current analyses. Similarly, 3 R's who indicated they had done nothing at all over the course of the study to cope with their RA pain were also excluded from the current analyses.

Analyses indicated that dropped R's were not significantly different from the final sample in educational status, t (92) = -.27, p = n.s., years since diagnosis of RA, t (93) = -.68, p = n.s., or age, t (81) = .29, p = n.s.. However, the final sample reported more frequent morning stiffness, t (92) = -3.12, p < .01, longer lasting morning stiffness, t (92) = -4.46, p <.001, more frequent general pain, t (93) = -4.25, p <.001, and greater difficulties in daily living activities, t (93) = -3.67, p <.001, in comparison to those dropped from the current analyses. These findings suggest that some of the R's who were omitted from the current analyses may have been experiencing lower levels of disease activity and were potentially less motivated to participate in a study regarding coping with RA. The final sample included 74 RA patients.

Background Questionnaire

R's completed a questionnaire before beginning the diary phase of the study in order to obtain background information including age, sex, education level, marital status, work status, general health status, year of RA diagnosis, pain frequency, morning stiffness frequency, morning stiffness duration, and treatment status. Functional disability was operationalized as difficulties performing 16 daily activities (e.g., climbing stairs, getting in and out of bed, writing
with a pen or pencil) on a four point scale ranging from 0 (without any difficulty) to 3 (unable to do). These items were drawn from the Difficulty in Mobility Subscale of the Stanford Health Assessment Questionnaire (HAQ; Fries, Spitz, & Kraines, 1980).

Sample Characteristics

The R’s ranged from 24 to 81 years in age, with a mean age of 56 years (SD = 13.79). Seventy-seven percent of the R’s were women, 69% were currently married, 3% reported grade school as the highest level of education obtained, 59% high school, and 38% college or university. Regarding work status, 29% were currently working at their place of employment, 38% were retired, 15% were on sick-leave, 7% were unemployed, 10% worked in the home, and 1 person had been laid off. Time since the diagnosis of RA ranged from less than one year to 41 years, with a mean of 10.91 years since disease diagnosis (SD = 9.81). Additional information regarding the health status of the R’s is reviewed in the results section.

Structured Diary

R’s then completed a structured diary twice a day for one week resulting in 14 timepoints of data. The diary was completed at or after lunch, and again before going to bed each day. At each timepoint, R’s would report their coping since the last entry in the diary. R’s were encouraged to seal the diaries after each completion using stickers provided by the researchers. In this way, the period of cued recall was limited to no more than half a day.

Measures

R’s were asked to complete the following measures in the structured diary for each of the 14 time periods (7 morning timepoints and 7 evening timepoints over one week).

Pain Severity

R’s indicated severity of pain on a 10 cm visual analogue scale (VAS) with possible scores ranging from 0 (no pain) to 100 (severe pain) (Huskisson, 1974). In the absence of concurrent objective measures of pain, subjective measures of pain do have limitations (for a review, see Craig 1992). However, despite their problems, VAS measures of pain are the
current "gold standard" among pain researchers (Craig, 1992). Therefore, within the current
model, subjective pain severity represents the health outcome used as the dependent variable.

**Appraisals of Coping Efficacy**

R's reported their perceived efficacy in coping with their arthritis pain. R's indicated
how well they had managed or coped with their arthritis pain on a five point scale ranging from
not well (0) to extremely well (4) (Aldwin & Revenson, 1987).¹

**Mood States**

Four subscales assessing depressed, anxious, hostile, and energetic mood were drawn
from the Affects Balance Scale (ABS; Derogatis, 1975) for use in the current study. The ABS
subscales have demonstrated good reliability (Northouse & Swain, 1987). R's indicated the
degree to which 20 descriptors reflected the way in which they had felt during a given time
period on a scale ranging from 0 (never) to 4 (always). Each of the four mood subscales were
computed as the average of five items. Higher scores on all of these scales indicate a higher
level of the particular mood state.

**Coping Strategies**

Coping was assessed with a brief Ways of Coping inventory derived from the Revised
Ways of Coping (WOC-R; Folkman & Lazarus, 1985). The three highest loading items that
were relevant to coping with chronic pain were drawn from each of the following WOC-R
subscales: planful-problem solving, confrontation, distancing, self-control, escape-avoidance,
accepting responsibility, positive reappraisal and seeking social support. In addition, based
upon previous literature suggesting the important role of downward social comparison in
promoting adjustment (e.g., Affleck et al., 1987; Affleck et al., 1988-a; Wood, et al., 1985),
three items assessing this specific form of coping were also included.

In total, 27 coping items reflecting nine distinct forms of coping were assessed in the
current coping measure. R's indicated the degree to which they had utilized each strategy
specifically to cope with RA pain on a three point scale labelled 0 (not at all), 1 (some) and 2 (a lot).

Due to low endorsement by R's in the current sample, both escape avoidance (e.g., ate, drank, or smoked to feel better) and accepting responsibility (e.g., realized I had brought the problem upon myself) were dropped from the current analyses (used in less than 18% and 11% of all timepoints respectively). One additional social support item was also dropped due to low endorsement (sought professional help was endorsed in fewer than 8% of all timepoints). Factor analyses were conducted using the remaining 20 items. A Maximum Likelihood extraction and oblique rotation was used. Oblique rotation is most appropriate for coping data given evidence that people often engage in multiple ways of coping when facing a single stressor (Folkman et al., 1986-b). Based upon the initial factor analysis, two items that failed to load higher than .30 on any factor were dropped. In total, 18 items were retained in the final factor analyses.

The final factor analysis yielded four factors based upon these 18 items. The construction of the coping scales according to the factor analysis and the psychometric properties of these four scales are reported in Table 1. Item loadings for each of the factors ranged from .45 to .77, with no item loading higher than .20 on an alternative factor. The reliability estimates for each coping scale were calculated at each of the 14 timepoints. The average alphas across all 14 timepoints for the four coping scales ranged from .72 to .80, indicating moderately high levels of scale reliability across the course of the study. Both item loadings and alphas are comparable with empirically derived coping scales previously reported in the literature (e.g., Carver, Scheier, & Weintraub, 1989; Folkman et al., 1986-b).

*Cognitive Reframing* (Factor 1) represents efforts to perceive one's current situation positively. Items reflect both positive reappraisal and downward social comparison. Therefore, this scale includes strategies that enable the individual to see themselves as better off than others (e.g., "Realized how, in some ways, I'm more fortunate than others") in addition to
efforts to see positive elements within one’s current situation (e.g., “Changed or grew as a person in a good way”).

*Distancing* (Factor 2) represents attempts to avoid acknowledging or expressing the extent of the pain and its associated distress. This scale includes elements of distancing both oneself and others from the pain and pain-related distress as a means of coping (e.g., “Went on as if nothing had happened” or “Tried to keep pain to myself”).

*Emotional Expression* (Factor 3) represents efforts to express the pain-related distress within an interpersonal context. This scale includes items reflecting both the expression of pain-related emotions (e.g., “Expressed anger”) as well as efforts to obtain social support for such feelings (e.g., “Accepted sympathy and understanding from someone”).

*Planful Problem Solving* (Factor 4) represents efforts to engage oneself cognitively and behaviorally in order to directly impact the source of stress as a means of coping. Items on this scale reflect attempts to develop and execute such a course of action (e.g., “Made a plan of action and followed it”).

**Overview**

First, descriptive and bivariate statistics are reported. Both time invariant variables (obtained from the questionnaire) and time variant variables (obtained from the 14 structured diary timepoints) are examined. Consistent with common usage of the multivariate analyses reported subsequently, time variant data are referred as Level I variables, whereas time invariant data are referred to as Level II variables. Multivariate relations were examined using Hierarchical Linear Models (HLM: Bryk & Raudenbush, 1992). As previously described, by using both time variant and invariant data, HLM can identify multi-level relations among elements of the coping process. The degree to which these multi-level variables contribute to within- and between-person variance in outcomes can also be assessed within the same model. In this way, HLM allowed examination of the interrelated roles of both process
variables and person factors within one statistical model. Most importantly, this multi-level model allowed causal issues to be addressed by examining the process of coping across time.

Descriptives

Demographic and Disease Status

Level II variables from the questionnaire indicated variability among R's. First, R's were asked how often they had felt pain from arthritis during the last month on a 5 point scale ranging from never to all of the time. Responses indicated that 25% of the sample reported that they had pain from RA some of the time, 11% about half the time, 40% most of the time, and 24% all of the time. Second, R's were asked how often they get morning stiffness on a 6 point scale ranging from never to all of the time. Responses indicated that 19% of R's experienced morning stiffness all of the time, 28% most of the time, 15% more often than not, 22% occasionally, 7% rarely, and 9% never. R's were also asked how long their morning stiffness usually lasts each day on a 5 point scale ranging from no lasting stiffness to more than four hours of morning stiffness. Reports of morning stiffness duration ranged from no lasting stiffness to stiffness remaining for more than four hours, with a mean duration of approximately one hour. Third, R's were asked to report the degree to which they experience difficulties completing 16 daily activities (e.g., dressing, getting out of bed, doing chores, and climbing stairs) on a 4 point scale ranging from no difficulty to unable to do. R's' reports of disability ranged from 0 to 2.88 (M = .89, SD = .55). Finally, when asked if they had any other medical condition, ailment, or impairment other than arthritis, 43% of R's reported comorbid medical conditions (e.g., thyroidism, cataracts, high blood pressure) that did not meet criteria for major comorbidity. Ninety-one percent of the R's reported the use of prescribed medication for RA related symptoms during the previous month, including anti-inflammatories, gold therapy, and corticosteroids.
**Bivariates**

The correlations among both Level I (time variant) and Level II (time invariant) variables are presented in Tables 2 through 5. Table 2 reports the correlations among Level II variables. Results indicate that frequency of general pain, frequency of morning stiffness, duration of morning stiffness, and functional disability were all positively related to each other. In addition, older R's were more likely to have comorbid medical conditions in addition to their RA.

Table 3 reports the correlations among the Level II variables and coping strategies. Results suggest that age was negatively related to use of distancing. In addition, use of emotional expression was positively associated at the bivariate level with pain frequency, morning stiffness duration, and functional disability.

Table 4 reports the correlations among Level I and Level II variables. First, results indicate that frequency of pain was negatively related to perceptions of coping efficacy and positively related to pain severity. There was also a trend for frequency of pain to be positively related to anxious, depressed, and hostile mood. Second, both frequency of morning stiffness and duration of morning stiffness were positively related to pain severity. Duration of morning stiffness was also positively related at the bivariate level to depressed and hostile mood, but negatively related to perceptions of coping efficacy. There was also a trend for morning stiffness duration to be negatively related to energetic mood. Third, functional disability was negatively associated with perceptions of coping efficacy, but positively associated with pain severity. There was also a trend for functional disability to be negatively related to energetic mood and positively related to hostile mood. Finally, there was a trend for age to be negatively related to both depressed and hostile mood.

Table 5 presents the interrelations among the time variant data (i.e., coping strategies, mood states, perceptions of coping efficacy and pain severity). The pattern of correlations suggest that significant bivariate relations exist among most of these variables. First, the use
of cognitive reframing, distancing, emotional expression, and planful problem-solving were all positively associated with one another at the bivariate level. Second, the use of cognitive reframing, emotional expression, and planful problem-solving were all positively associated with energetic, anxious, depressed, and hostile mood. The use of distancing was positively associated with anxious mood. Third, the use of emotional expression and planful problem-solving were positively related to pain severity, but negatively related to perceptions of coping efficacy. Fourth, anxious, depressed, and hostile mood states were all positively related at the bivariate level. In addition, energetic mood was positively associated with anxious and hostile mood. Fifth, anxious, depressed, and hostile mood were positively associated with pain severity, but negatively associated with perceptions of coping efficacy. Finally, pain severity was negatively related to perceptions of coping efficacy at the bivariate level.

Hierarchical Linear Models

A model incorporating both within- and between-person variance in these variables was constructed and tested via HLM. For the current analyses, evening pain severity was the dependent variable. Pain severity, coping strategies, mood states, and coping efficacy were divided into morning timepoints versus evening timepoints in order to examine the process of coping as it occurs throughout the course of a day. Relations among morning variables and evening pain were assessed across a one week period. Evening variables were also entered as covariates or controls where appropriate. In the current model, evening variables are referred to as “PM” variables, whereas morning variables are referred to as “AM” variables.

In the HLM analyses, pain (0-100) was standardized. First, for ease of interpretation, it was preferable to have the intercepts and slopes in standard units. Second, RA pain cycles and fluctuates unpredictably (Rodnan & Schumacher, 1983). As a result, certain R’s may have been in the study during a less acute phase of their disease, whereas others may have participated during a particularly acute phase. However, when the sample mean was calculated, it was assumed that the R’s experiencing a relatively dormant phase of their
disease were counterbalanced by those R's experiencing a relatively active phase of their illness. Therefore, standardizing the pain severity variable utilized the most reliable estimate of average pain severity by setting the grand sample mean as the point of comparison for "above average" versus "below average" levels of pain severity. In the current analyses, the intercept represents the average level of pain (in standardized units) controlling for all other variables in the model. Slopes reflect the average increase (or decrease) in pain severity for every one unit change in the independent variables.

**Null Model**

The following null model was analyzed in order to determine the amount of between- and within-person variability in evening pain severity.

\[ Y_{ij}(PM \text{ PAIN}) = \beta_{0j} + \epsilon_{ij} \]

\[ \beta_{0j} = \phi_{00} + u_{0j} \]

With substitution, the overall null model for evening pain was represented by the following equation:

\[ Y_{ij}(PM \text{ PAIN}) = \phi_{00} + u_{0j} + \epsilon_{ij} \]

This equation was used to predict evening pain for each individual at each of the fourteen timepoints. The average intercept estimate (\( \phi_{00} \)) represents the grand sample mean of evening pain severity across all R's and timepoints. Two sources of variance are then added to obtain time specific pain severity estimates for each individual at each specific timepoint. First, the between-person residual parameter, \( u_{0j} \) (i.e., the difference between the grand sample mean and the individual's own mean across all timepoints) is added. This value contributes between-person variance. Second, the within-person residual parameter, \( \epsilon_{ij} \) (i.e., the difference between the individual's own mean pain severity across all timepoints and their pain severity score for any one particular timepoint) is added. This value contributes within-person variance.
Results of the null model for evening pain are presented in Table 6. Due to standardization of pain severity, $\phi_{00}$ is zero. A chi-square test, $\chi^2(71, N=72) = 1002.92, p < .000$, indicated that significant between-person variability existed among the intercepts ($\beta_{01}$'s) in evening pain. That is, R's varied significantly from one another in their average pain severity reported at the end of each day. The HLM reliability estimates also indicate whether substantial random variance lies between individuals, with smaller values on a scale ranging from 0 to 1.0 indicating less substantial variance among the intercepts than higher values (Bryk & Raudenbush, 1992). The reliability estimate within the current model (evening pain = .93) indicated that highly reliable variance existed between R's in average levels of pain severity across the course of the study.

Before proceeding to predict both within- and between-person variability in pain severity, two additional issues were addressed. First, a key assumption underlying data analysis within HLM was tested. Specifically, HLM analyses assume homogeneity of Level I variance across individuals (i.e., assumes that individuals are not statistically different from one another in their within-person variance in pain). A chi-square test, $\chi^2(70, N=72) = 70.57, p = .46$, revealed that heterogeneity of level I variance did not exist in the current data, and therefore HLM analyses were appropriate.

Second, the intra-class coefficient enables determination of the degree to which variability in pain severity lies within persons (i.e., across days) versus between persons (see Table 6 for calculation details). As reported in Table 6, the intra-class correlation reveals that 66% of the variance in evening pain severity is between-persons, while 34% of the variance is within-persons. These values are useful in evaluating the variance accounted for by subsequent models. Models containing predictors can be compared to the null model in order to estimate the overall effect of included variables on both between- and within-variability in pain severity.
Level I Model

The primary purpose of the analyses was to explore the process of coping as it occurs across time. Of particular interest was the degree to which mood states, coping strategies, and coping efficacy are associated with changes in pain severity throughout the day. With morning pain as an independent variable, changes in pain severity from morning to evening were examined and modelled as follows:

\[ Y_{ij}(PM\ PAIN) = \beta_{0j} + \beta_{1j}(AM\ PAIN) + \epsilon_{ij} \]

\[ \beta_{0j} = \phi_{00} + \nu_{0j} \]

\[ \beta_{1j} = \phi_{10} + \nu_{1j} \]

The morning pain slope (\( \beta_{1j} \)) is composed of the average degree of change in pain severity from morning to night for the entire sample (\( \phi_{10} \)), in addition to the degree to which the daily pain change for an individual varies from the sample mean (\( \nu_{1j} \)). With morning pain severity controlled for in this manner, the coefficients for mood states, coping efforts, and coping efficacy represent the changes in pain from morning to evening that are associated with each one unit of change in an independent variable.

In order to explore the relations between each of the coping strategies and pain severity, morning measures of coping were entered as predictors of evening pain severity. All four coping scales were included in the current model. As a result, the coefficients for each coping strategy are estimates of the impact of a particular way of coping independent of the other forms of coping in the current model. Dropping one or more related variables from an HLM model can result in biased coefficient and variance estimates (Bryk & Raudenbush, 1992). This occurs due to inappropriate allocation of shared variance to a variable maintained in the model upon removal of a second variable with which the first is interrelated (Bryk & Raudenbush, 1992). Therefore, all four forms of coping were included in the following model:
Note that the effects of morning coping upon pain severity are fixed in the current model. That is, there is no between-person residual added to the average effect of each coping strategy upon evening pain by fixing this residual to zero.

In order to assess the role of mood in pain fluctuations, evening mood states were entered in the model. Due to high correlations among anxious, depressed, and hostile mood, these subscales were collapsed into a general negative mood scale. As with coping, the effects of both positive and negative mood were fixed across persons and added to the model as follows:

\[ Y_{ij}(PM\ PAIN) = \beta_{0j} + \beta_{1j}(AM\ Pain) + \beta_{2j}(AM\ Cognitive\ Reframing) + \beta_{3j}(AM\ Distancing) + \beta_{4j}(AM\ Emotional\ Expression) + \beta_{5j}(AM\ Problem\ Solving) + \beta_{6j}(PM\ Positive\ Mood) + \beta_{7j}(PM\ Negative\ Mood) + \epsilon_{ij} \]

\[ \beta_{0j} = \phi_{00} + \nu_{0j} \]
\[ \beta_{1j} = \phi_{10} + \nu_{1j} \]
\[ \beta_{2j} = \phi_{00} \]
\[ \beta_{3j} = \phi_{10} \]
\[ \beta_{4j} = \phi_{10} \]
\[ \beta_{5j} = \phi_{10} \]
\[ \beta_{6j} = \phi_{00} \]
\[ \beta_{7j} = \phi_{10} \]
Finally, evening coping efficacy was added to the model as a fixed effect as follows:

\[ Y_{ij}(PM \text{ PAIN}) = \beta_{0j} + \beta_{1j}(AM \text{ Pain}) + \beta_{2j}(AM \text{ Cognitive Reframing}) + \beta_{3j}(AM \text{ Distancing}) + \beta_{4j}(AM \text{ Emotional Expression}) + \beta_{5j}(AM \text{ Problem Solving}) + \beta_{6j}(PM \text{ Positive Mood}) + \beta_{7j}(PM \text{ Negative Mood}) + \beta_{8j}(PM \text{ Efficacy}) + \varepsilon_{ij} \]

\[
\begin{align*}
\beta_{0j} &= \phi_{00} + \nu_{0j} \\
\beta_{1j} &= \phi_{10} + \nu_{1j} \\
\beta_{2j} &= \phi_{00} \\
\beta_{3j} &= \phi_{10} \\
\beta_{4j} &= \phi_{10} \\
\beta_{5j} &= \phi_{10} \\
\beta_{6j} &= \phi_{00} \\
\beta_{7j} &= \phi_{10} \\
\beta_{8j} &= \phi_{10}
\end{align*}
\]

**Level I Analyses**

The results for this model as analyzed via HLM are reported in Table 7. Morning pain had a significant relation to subsequent evening pain. The morning pain coefficient indicates that on average, evening pain severity increased .47 standard deviations for every standard unit that morning severity was above the grand sample mean. In addition, a chi-square test of the between-person variance in this effect, \( \chi^2(66, N=70) = 90.38, p < .05 \), indicated significant interindividual variability in the relation between morning pain and evening pain severity. The reliability estimate within the current model (morning pain = .17) also indicates that the remaining between-person variance in the relation between morning and evening pain severity is unlikely to be zero (i.e., it remains greater than .05; Bryk & Raudenbush, 1992).

As reported in Table 7, several of the independent variables had significant relations to evening pain severity even after controlling for the influence of morning pain on evening pain. As hypothesized, cognitive reframing in the morning was negatively related to evening pain severity (standardized beta = -.23). For example, the predicted evening pain severity for an individual who reported using this form of coping "a lot" in the morning (score of 2) is .46
standard deviations lower than an individual who did not use this strategy at all (score of 0). Although no hypotheses were made regarding the effects of planful problem solving upon pain severity, use of this strategy in the morning was positively related to evening pain severity (standardized beta = .30). For example, the predicted evening pain severity for a participant who reported using this strategy “a lot” (score of 2) would be .60 standard deviations higher than a participant who did not use this strategy at all (score of 0). The effects for both cognitive reframing and planful problem solving were significant despite controlling for morning pain severity, other forms of coping, evening mood states, and evening coping efficacy. The general relations between distancing or emotional expression and pain severity were nonsignificant.

As reported in Table 7, evening mood was associated with evening pain severity. Consistent with the hypotheses, evening negative mood was positively associated with evening pain severity (standardized beta = .22). To illustrate, the predicted evening pain severity for a participant who reported they “always” felt negative mood (i.e., anxious, depressed, and hostile) within a given timepoint (score of 4) would be .88 standard deviations higher in evening pain severity than someone who experienced no negative mood (score of 0). This effect is significant despite controlling for the effects of morning pain severity, coping efforts, coping efficacy, and other mood states. Positive mood was not significantly related to evening pain severity.

Finally, examination of the results suggests that coping efficacy was significantly related to evening pain severity, even when controlling for the independent variables previously described. As hypothesized, coping efficacy was negatively related to evening pain severity (standardized beta = -.19). For example, the predicted evening pain severity for an individual who reported coping extremely well (score of 4) is expected to be .76 standard deviations lower than someone who reported they were not coping well at all (score of 0).
A chi-square test of the between-person variance in evening pain intercepts, \( \chi^2(66, N=70) = 200.00, p < .000 \), revealed that even after controlling for morning pain, morning coping, evening mood, and evening efficacy, significant variability in pain severity continues to exist across individuals. The reliability estimate within the current model (evening pain = .52) also indicated that this between-person variability is unlikely to be zero. As reported in Table 7, the independent variables tested in the current model account for 75% of the original between-person variability in evening pain severity when compared to the null model. The current model also accounts for 27% of the original within-person variability in pain severity when compared to the null model.

It is important to model all relevant Level I variables before proceeding to the next level in order to avoid biased estimates for the Level II variables (Bryk & Raudenbush, 1992). Before entering Level II variables, Level I interactions between morning pain and morning coping, morning coping and morning coping efficacy, or morning coping and evening efficacy were all tested within the current model. Results indicated no significant Level I interaction effects.

**Level II Model**

Level II variables (i.e., time invariant predictors) were tested for their contribution to variability in evening pain severity. Sex, years since diagnosis, morning stiffness frequency, morning stiffness duration, general pain frequency, presence of an additional medical condition, and functional disability were entered as predictors by modelling them onto the evening pain severity intercept. Results of the final model that incorporates both Level I and Level II variables is presented in Table 8. Sex, morning stiffness measures, general pain frequency, and the presence of an additional medical condition all resulted in small and nonsignificant effects, and therefore were dropped from the model and are not reported.

In comparison, functional disability was positively related to evening pain severity (standardized beta = .35). To illustrate, the predicted score for an individual who reported
“much difficulty” (score of 2) in completing basic daily living activities during the previous month would be .70 standard deviations higher than the sample mean for pain severity when controlling for morning pain severity, morning coping, evening mood, evening efficacy, years since diagnosis and sex. Likewise, there was a small but significant positive relation between years since diagnosis and evening pain severity (standardized beta = .01). For example, the predicted evening pain severity for an individual who has been living with RA for 25 years would be .25 standard deviations higher than the sample average when controlling for all of the independent variables in the current model.

Comparison of the multi-level model (i.e., both Level I and Level II) to the null model revealed that it is able to account for 77% of the original between-person variability in evening pain and 29% of the original within-person variance. In comparison to the single level model (i.e., Level I only), the inclusion of Level II variables (years since diagnosis and functional disability) to the model accounts for a significant additional two percent of between-person variability in pain severity. As reported in Table 8, the effects of coping, mood, or coping efficacy on pain remain significant even after controlling for duration of illness and degree of functional disability.

Discussion

The central purpose of the current study was to examine variations in the process of coping with RA pain as it unfolds across a single day. The relations between coping, mood, coping efficacy and pain severity were examined within a multi-level model that utilized the rich process information available within repeated measures data collected twice daily. It should be noted that only one group of researchers have examined the temporal relations between these specific elements of the coping process between days (Keefe et al., 1997). As far as the author is aware, this is the first study to address calls in the literature to explore the temporal relations between elements of the coping process as they unfold across a single day among individuals with RA pain (e.g., Tennen & Affleck, 1996). The current findings suggest that
coping efforts, mood, and coping efficacy all relate to pain experience within a matter of hours. Such within-day relations between the coping process and pain changes have important implications for researchers, healthcare professionals in the area of chronic pain, and most importantly, those individuals who cope with RA on a daily basis.

First, the findings provide evidence that cognitive and behavioral strategies have an impact upon pain experience. Specifically, both problem- and emotion-focused coping efforts play a significant and substantial role in relatively immediate changes in RA pain that occur from morning to evening. The use of cognitive reframing (seeing oneself or the situation positively) appears to be an adaptive way of coping with RA, in that greater use of this strategy related to higher pain at the end of each day. This finding is consistent with current theory on pain (Wall & Melzack, 1989) which suggests that psychological factors play a significant role in the sensory experience of pain. Thinking positively may also relate to biochemical elements related to RA symptomology. For example, recent research has provided evidence that cognitive and affective variables are related to potential biochemical correlates of RA symptomology (e.g., Zautra, Burleson, Matt, Roth, & Burrows, 1994).

Prior suggestions in the literature that adaptive outcomes are largely a function of the degree to which an individual avoids utilizing maladaptive emotion-focused coping such as catastrophizing (Rosenstiel & Keefe, 1983) are consistent with the relations we found between cognitive reframing and pain as they unfold within a day. However, our findings suggest that the degree to which an individual can see themselves or the current situation positively may be just as critical to well-being as the degree to which an individual can minimize use of coping strategies that prevent acceptance of the stressful situation and/or perpetuate emotional distress. This is evidence that active coping attempts should be considered in addition to avoidant coping efforts in evaluating and promoting well-being among individuals with RA.

Our results also indicate that planful problem-solving (active attempts to resolve the stressful situation) relates to pain across the day. Overall, the use of planful problem-solving
was maladaptive in its relation to subsequent pain, in that greater use of this strategy was associated with higher levels of evening pain. Although previous research suggests that planful problem-solving is a highly adaptive way of coping with certain types of stressors, the current findings are consistent with research demonstrating the maladaptive effects of problem-focused coping when managing a stressor over which one has limited control (for a review, see Aldwin, 1994). However, given that participants did not report upon the specific details of their planful problem-solving, the current study does not address the possibility of differential effects of palliative forms of problem-focused coping (e.g., forming a physiotherapy plan and following it) versus non-palliative forms of problem-focused coping that may interfere with more adaptive forms of coping (e.g., excessive rumination regarding possible courses of action). Further research that delineates adaptive versus maladaptive subtypes of planful-problem solving and their specific cognitive and behavioral components is needed in order to draw more specific conclusions. However, the current findings do indicate that certain forms of cognitive-behavioral attempts to impact the stressor itself may predispose individuals to experience higher levels of RA pain at the end of the day. In the case of painful chronic illness, ongoing attempts to engage in futile problem-focused coping efforts may also increase awareness of pain, thereby elevating negative mood, lowering perceptions of coping efficacy and interfering with the ability to engage in the adaptive strategy of cognitive reframing.

Consistent with the transactional model of coping with stress, the overall findings do not support the global description of passive vs. active forms of coping as maladaptive vs. adaptive in their relation to outcome. Instead, the current study provides evidence that relatively immediate relief from pain among individuals with RA is associated with decreases in active attempts to change their current situation and increases in active attempts to view their situation as optimistically as possible. Therefore, active attempts to cope with RA pain are associated with both adaptive and maladaptive changes in pain. The significant relations between cognitive-behavioural ways of coping and pain fluctuations within a day also support...
the inclusion of cognitive-behavioral strategies in chronic pain management programs offered to individuals with RA (e.g., Bradley et al., 1984).

The current study also suggests that certain forms of coping may not relate to changes in pain from morning to evening. Distancing (avoidance of the acknowledgment or expression of pain-related distress) and emotional expression (expressing pain-related distress to another person) did not relate significantly to changes in pain after controlling for other forms of coping, mood states, and perceptions of coping efficacy. Furthermore, the impact of all forms of coping examined in the current model did not vary as a function of pain severity.

Results do suggest that mood is an important correlate of pain change. First, negative mood was a significant correlate of changes in pain from morning to evening even after controlling for ways of coping, positive mood, and perceptions of coping efficacy. The findings indicate that negative mood characterized by anxiety, depression, and hostility is associated with pain fluctuations. Further process-oriented research is needed to identify the mechanisms by which negative mood relates to pain fluctuations.

It remains a possibility that the relations between mood states, emotional expression and pain fluctuation is moderated by other people's reactions to the expressed emotions. That is, those individuals who receive social support when expressing emotions to others may experience larger decreases in pain across days than those individuals who do not receive social support. Preliminary evidence also suggests that the association between negative mood and pain is moderated by the ways in which emotions are expressed interpersonally (Burns et al., 1996). Burns and his colleagues (1996) found that the relation between hostility and pain was moderated by the ways in which anger was expressed to others. Therefore, some individuals with RA and high levels of negative mood may benefit from mood interventions such as anger management training. Interaction effects between negative mood and emotional expression could not be tested within the current model as the colinearity/multicolinearity created by including their interaction term exceeded the limits of the HLM program.
It also remains unclear whether the expression of negative mood is a cause or consequence of increases in pain severity, and if additional components of positive or negative mood (e.g., joy, contentment, or frustration; Derogatis, 1975) play a significant role in within day fluctuations in pain severity.

Consistent with previous research (e.g., Aldwin & Revenson, 1987; Keefe et al., 1997) coping efficacy (the appraisal of how well one coped) was also a significant correlate of pain fluctuations. More positive perceptions of how one had coped with the RA pain appear to be associated with decreases in pain severity from morning to evening. This finding suggests that individuals coping with RA may benefit from positive thinking at multiple stages of the coping process as it unfolds across each day. That is, thinking positively at the end of each day about how well one coped is associated with added reductions in pain across a day, even after controlling for thinking positively as a way of coping throughout the day. However, the interactions among coping and coping efficacy were nonsignificant in their relations to pain fluctuations. This finding suggests that the associations between certain forms of coping and subsequent pain change do not vary as a function of how well an individual feels they are managing their pain. It should be noted that interpretation of this finding is limited given that individuals reported upon coping efficacy in regards to their overall set of coping efforts. Interactions between specific forms of coping and strategy-specific perceptions of coping efficacy may relate significantly to changes in pain throughout the day. It also remains unclear whether perceptions of coping efficacy are causes and/or consequences of either pain fluctuations or coping efforts.

In addition to the relations of coping, mood and coping efficacy, several disease variables were significantly related to pain experience. More importantly, these variables were related to significant changes in pain occurring throughout the day. Specifically, the present findings suggest that individuals with longer disease duration (i.e., years since diagnosis) and greater degree of functional disability experience smaller decreases in RA pain from morning
to evening in comparison to their counterparts. This suggests that over the years and with increasing degrees of disability, individuals with RA pain are at risk to experience less relief from pain throughout the day even after controlling for coping, mood, and coping efficacy. Lower levels of within day pain relief may increase the risk of psychosocial maladjustment due to added pain-related distress.

A valuable focus of future research will be the exploration of the role of additional person factors such as personality traits in the process of coping with RA pain within days. Research suggests that the impact of coping strategies upon outcome can vary between individuals as a function of person factors (e.g., Bolger & Zuckerman, 1995). To illustrate, Bolger and Zuckerman (1995) found the impact of self-control upon depression varied as a function of neuroticism (tendency to experience negative affect) in that use of this strategy was adaptive for individuals low in neuroticism but maladaptive for individuals high in neuroticism. Similar relations between coping, person factors, and pain as they unfold within a single day have yet to be explored.

Conclusion

The present study demonstrates the rich information available to stress and coping researchers in multi-level models that maximize the use of time series data. The model tested allowed examination of the coping process within days, and exploration of the specific relations between elements of this process and daily health outcomes. The model tested in the present study suggests that disease status, coping efforts, mood states, and perceptions of coping efficacy relate significantly to daily changes in RA pain. Most importantly, the findings indicate that specific cognitive-behavioral efforts (cognitive reframing and planful problem solving) relate significantly to fluctuations in pain occurring only hours after these forms of coping are utilized. Negative mood and perceptions of coping efficacy also appear to be significant correlates of this process.
The current study seeks to add to existing stress and coping research by providing the first empirical demonstration of the significant role played by ways of coping, mood, and perceptions of coping efficacy in changes in RA health outcomes within days. The present findings provide evidence that individuals with RA can significantly impact their relief from pain across the course of a day by increasing or decreasing their use of various cognitive-behavioral strategies. This suggests that although the onset and overall progression of RA is relatively uncontrollable, clinicians and researchers can help RA patients identify cognitive and behavioral efforts that can be utilized on a daily basis in order to impact the pain experience. The current research indicates that it is possible for persons with RA to gain some relatively immediate control over the degree to which they experience relief from morning to night (i.e., pain change within hours) by using cognitive strategies that promote positive construal of the stressful situation, and avoiding use of futile cognitive-behavioral efforts to eliminate RA and its psychosocial consequences. These findings are promising for individuals seeking relief from this stressful and painful disease, and provide rich support for current process-oriented models of stress and coping.


Footnotes

1 The term "coping efficacy" is used to be consistent with the original description of the item used in the current study (Aldwin & Revenson, 1987). However, the construct assessed is distinct from and should not be confused with the more traditional sense of self-efficacy as outlined by Bandura (1977). That is, while the Bandurian sense of efficacy refers to prospective evaluations of one's own ability to perform a specific task, the current conceptualization of coping efficacy refers to retrospective evaluations of how well one was able to perform a specific task (i.e., coping with RA pain).

2 When relating Level I variables to Level II variables, the time variant data was aggregated so that each contribution of Level II data could be matched to a single contribution of Level I data for each participant. In this way, general bivariate trends between multi-level variables can be assessed. However, when examining the bivariate relations of the Level I variables with each other, the data was not aggregated and thus includes up to 14 timepoints of data per person. Because the calculation of the significance levels assumes that each of the 14 timepoints is an independent contribution, the use of standard p values would result in Type I error. In order to reduce the probability of Type I error given violation of the independence assumption and the number of correlations examined, a conservative level of significance was chosen (i.e., p < .01). Those correlations with p < .05 are treated as trends, and should be interpreted with caution.

3 There was insufficient power in the current study to reliably assess between-person variability in the effects of the independent variables upon pain via HLM. Therefore, the relations between coping, mood states, or coping efficacy with pain severity were fixed in the current model.
Table 1
Coping Scales, Item Loadings and Reliability Estimates

<table>
<thead>
<tr>
<th>Scale</th>
<th>Factor Loadinga</th>
</tr>
</thead>
</table>

**Scale 1: COGNITIVE REFRAMING** (alpha\(^b\) = .78 [ .63 to .86]; n = 65\(^d\) [61 to 68])

- Reminded myself how much worse things could be. \(.73\)
- I thought about someone I know who is in a worse situation. \(.73\)
- Realized how, in some ways, I'm more fortunate than others. \(.72\)
- Rediscovered what is important in life. \(.55\)
- Changed or grew as a person in a good way. \(.45\)

**Scale 2: DISTANCING** (alpha \(= .80\) [ .77 to .86]; n = 66 [63 to 69])

- Kept others from knowing how bad it was. \(.77\)
- Tried to keep my pain to myself. \(.77\)
- Didn't let it get to me; refused to think about it too much. \(.55\)
- Went on as if nothing had happened. \(.55\)
- Made light of the situation; refused to be upset. \(.54\)
- Tried to keep my pain from interfering with other things too much. \(.50\)

**Scale 3: EMOTIONAL EXPRESSION** (alpha \(= .72\) [ .62 to .82]; n = 67 [60 to 69])

- Talked to someone about how I was feeling. \(.73\)
- Expressed anger. \(.61\)
- I let my feelings out somehow. \(.58\)
- Accepted sympathy and understanding from someone. \(.55\)

**Scale 4: PLANFUL PROBLEM SOLVING** (alpha \(= .79\) [ .59 to .87]; n = 65 [62 to 68])

- Made a plan of action and followed it. \(.77\)
- Concentrated on what I had to do - the next step. \(.72\)
- I knew what I had to do so increased my efforts to make things work. \(.53\)

\(^a\) No coping item loads higher than .20 on the alternative factors (i.e., coping scales).
\(^b\) The alphas for the coping scales were calculated at each of the 14 timepoints. A mean alpha for each coping scale was then computed from these 14 alpha estimates and is the value reported here. This was done in order to avoid the potentially misleading relations between variables that can occur when one aggregates data across time prior to statistical procedures such as factor analysis. The range of alphas across all 14 timepoints is reported in brackets.
\(^c\) Alpha estimates for each timepoint include only those participants with complete data for the particular coping scale in question. The average n is reported, with the range across all 14 timepoints reported in brackets.
Table 2

Correlations among Level II Variables

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</tr>
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<td>.59***</td>
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<td>8. Additional Medical</td>
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<td>-.03</td>
<td>.07</td>
<td>-.02</td>
<td>-.14</td>
<td>.33**</td>
<td>.00</td>
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<td>Condition</td>
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<td>9. Sex&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>.01</td>
<td>-.02</td>
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<td>.13</td>
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<td>.89</td>
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</table>

*p<.05. **p<.01. ***p<.001.

<sup>a</sup> Means and standard deviations are not reported for dichotomous variables.

<sup>b</sup> Males = 1; Females = 0.
Table 3

Correlations among Level II Variables and Coping Strategies

<table>
<thead>
<tr>
<th>Level II Variables</th>
<th>Cognitive Reframing</th>
<th>Distancing</th>
<th>Emotional Expression</th>
<th>Planful-Problem Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Years Since Diagnosis</td>
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<td>.06</td>
<td>-.10</td>
<td>.08</td>
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<tr>
<td>2. General Pain Frequency</td>
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<td>.11</td>
<td>.35**</td>
<td>.12</td>
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<tr>
<td>3. Arthritis Medication</td>
<td>-.08</td>
<td>.22</td>
<td>-.07</td>
<td>.11</td>
</tr>
<tr>
<td>4. Additional Medical Condition</td>
<td>.06</td>
<td>-.10</td>
<td>.03</td>
<td>.04</td>
</tr>
<tr>
<td>5. Morning Stiffness Frequency</td>
<td>.01</td>
<td>.20</td>
<td>.23†</td>
<td>.18</td>
</tr>
<tr>
<td>6. Morning Stiffness Duration</td>
<td>.10</td>
<td>.16</td>
<td>.44***</td>
<td>.24*</td>
</tr>
<tr>
<td>7. Functional Disability</td>
<td>.19</td>
<td>.13</td>
<td>.31**</td>
<td>.09</td>
</tr>
<tr>
<td>8. Age</td>
<td>-.09</td>
<td>-.45***</td>
<td>-.25*</td>
<td>-.27*</td>
</tr>
<tr>
<td>9. Sex</td>
<td>-.05</td>
<td>-.07</td>
<td>-.09</td>
<td>-.03</td>
</tr>
</tbody>
</table>

M                      | .40                 | .70        | .27                  | .51                    |
SD                     | .43                 | .44        | .28                  | .51                    |

† p=.05. *p<.05. ** p<.01. ***p<.001.
a Correlations are based upon coping scales aggregated across all 14 timepoints.
b Males = 1; Females = 0.
Table 4

Correlations among Level II Variables and Coping Efficacy, Mood, and Pain Severity\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>Coping Efficacy</th>
<th>Energetic Mood</th>
<th>Anxious Mood</th>
<th>Depressed Mood</th>
<th>Hostile Mood</th>
<th>Pain Severity</th>
</tr>
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<tbody>
<tr>
<td>1. Years Since Diagnosis</td>
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<td>-.11</td>
<td>.06</td>
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<td>-.14</td>
<td>.27\textsuperscript{*}</td>
<td>.24\textsuperscript{†}</td>
<td>.25\textsuperscript{*}</td>
<td>.47\textsuperscript{***}</td>
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<td>3. Arthritis Medication</td>
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<td>.02</td>
<td>.02</td>
<td>.03</td>
<td>.09</td>
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<td>4. Additional Medical Condition</td>
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<td>.11</td>
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<tr>
<td>5. Morning Stiffness Frequency</td>
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<td>-.24\textsuperscript{†}</td>
<td>.06</td>
<td>.22</td>
<td>.19</td>
<td>.44\textsuperscript{***}</td>
</tr>
<tr>
<td>6. Morning Stiffness Duration</td>
<td>-.42\textsuperscript{***}</td>
<td>-.24\textsuperscript{†}</td>
<td>.10</td>
<td>.41\textsuperscript{***}</td>
<td>.44\textsuperscript{***}</td>
<td>.38\textsuperscript{**}</td>
</tr>
<tr>
<td>7. Functional Disability</td>
<td>-.33\textsuperscript{**}</td>
<td>-.26\textsuperscript{*}</td>
<td>.09</td>
<td>.19</td>
<td>.24\textsuperscript{†}</td>
<td>.49\textsuperscript{***}</td>
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<td>8. Age</td>
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<td>.04</td>
<td>-.24\textsuperscript{†}</td>
<td>-.30\textsuperscript{*}</td>
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<td>-.10</td>
<td>-.03</td>
<td>.07</td>
<td>-.16</td>
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<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>Years Since Diagnosis</td>
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<tr>
<td>General Pain Frequency</td>
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<td>.62</td>
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<tr>
<td>Morning Stiffness Duration</td>
<td>40.27</td>
<td>18.73</td>
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</table>

\textsuperscript{†} p=.05. \textsuperscript{*}p<.05. \textsuperscript{**}p<.01. \textsuperscript{***}p<.001.

\textsuperscript{a} Correlations are based upon coping efficacy, mood, and pain severity aggregated across all 14 timepoints.

\textsuperscript{b} Males = 1; Females = 0.
Table 5
Correlations among Coping, Mood, Coping Efficacy, and Pain Severity

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>1. Cognitive Reframing</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Distancing</td>
<td>.29(^a)</td>
<td>-</td>
<td></td>
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<tr>
<td>3. Emotional Expression</td>
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<td>-</td>
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<td></td>
</tr>
<tr>
<td>4. Planful Problem Solving</td>
<td>.49</td>
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<td>.41</td>
<td>-</td>
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<td>5. Energy</td>
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<td>.18</td>
<td>.21</td>
<td>.34</td>
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<td>6. Anxiety</td>
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<td>.46</td>
<td>.24</td>
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<td>7. Depression</td>
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<td>.10</td>
<td>.41</td>
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<td>.13</td>
<td>.76</td>
<td>-</td>
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<td>8. Hostility</td>
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<td>.77</td>
<td>.83</td>
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<tr>
<td>9. Pain Severity</td>
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<td>.07</td>
<td>.26</td>
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<td>-.12</td>
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<td>.34</td>
<td>.30</td>
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<td>-.32</td>
<td>-.36</td>
<td>-.39</td>
<td>-.46</td>
<td>-</td>
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</tbody>
</table>

\(^a\) Correlations are based upon all valid timepoints contributed by the 74 participants for the two variables in question. The number of available timepoints used to calculate each correlation coefficient ranges from 924 to 998 due to sporadic missing data for certain variables at some of timepoints.

\(^b\) If we were to assume the degrees of freedom equals the number of timepoints minus 2, (i.e., df = 1034), then all of the correlations greater than or equal to .07 are significant at p<.05. However, we conservatively assumed the degrees of freedom equaled the number of participants minus 2 (i.e., df = 72). Given this, only those correlations greater than or equal to .20 are significant at p<.10, those greater than or equal to .23 are significant at p<.05, those greater than or equal to .28 are significant at p<.01, and those greater than or equal to .37 are significant at p<.001.
<table>
<thead>
<tr>
<th>Sources of PM Pain Variability (p)</th>
<th>Between-Person</th>
<th>Within-Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between-Person</td>
<td>.66</td>
<td>.34</td>
</tr>
<tr>
<td>Within-Person</td>
<td>.35</td>
<td></td>
</tr>
</tbody>
</table>

***p<.001.

a The intercept refers to the average value of evening pain across all timepoints and all individuals (i.e., the grand sample mean). Due to standardization this value is equal to zero.

b The statistic computed is the Intraclass Correlation Coefficient which reflects the proportion of variance in the outcome variable that is between persons. This statistic is calculated by dividing the between-person variance by the total variance (i.e., between- and within-variance).
Table 7
Hierarchical Linear Model (HLM) Analysis: Level I (Time Variant) Predictors of Evening Pain

<table>
<thead>
<tr>
<th>Standardized Coefficient</th>
<th>Between-Person Variance (χ² test)</th>
<th>Reliability of the Estimate</th>
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<tbody>
<tr>
<td>N=70^a</td>
<td>SE</td>
<td>df^b</td>
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</table>

**Intercept**

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<td>Z PM Pain^a</td>
<td>.30</td>
<td>.15</td>
<td>.17***</td>
<td>66</td>
<td>.518</td>
<td></td>
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<tr>
<td>(Null Model)</td>
<td>(.00)</td>
<td>(.10)</td>
<td>(.66***)</td>
<td>(71)</td>
<td>(.929)</td>
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**Level I Slopes^c**

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<td>Z AM Pain^a</td>
<td>.47***</td>
<td>.05</td>
<td>.03*</td>
<td>66</td>
<td>.174</td>
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<td>AM C.R.</td>
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<td>.09</td>
<td>.03</td>
<td>66</td>
<td>.174</td>
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<td>AM DST.</td>
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<td>AM E.E.</td>
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<td>AM P.P.S.</td>
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<td>.08</td>
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<td>PM Efficacy</td>
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<td>.04</td>
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<td>.07</td>
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**Within-Person Residual Variance (Null Model)**

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<tbody>
<tr>
<td>PM Pain Variability</td>
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</table>

**PM Pain Variability Accounted for**

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<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Between-Person</td>
<td>74%</td>
<td></td>
</tr>
<tr>
<td>Within-Person</td>
<td>27%</td>
<td></td>
</tr>
</tbody>
</table>

*p<.05. **p<.01. ***p<.001.

^a HLM drops those individuals who are missing at least one variable at all 14 timepoints. 2 participants were dropped from the current analyses for this reason.

^b The chi-square test of between-person variance among the intercepts or slopes are calculated on those individuals who have complete data for for all variables included in the model at all timepoints. This results in lowered degrees of freedom for the variance estimates in the current model.

^c Z AM Pain = standardized morning pain; AM C.R. = morning cognitive reframing; AM DST. = morning distancing; AM E.E. = morning emotional expression; AM P.P.S. = morning planful problem-solving; PM Efficacy = evening coping efficacy; PM Pos Mood = evening positive mood; PM Neg Mood = evening Negative Mood.

^d Between-person variance estimates and significant tests are not computed for fixed effects.

^e Variables with this superscript have been standardized in order to interpret pain severity increases or decreases in standard units.
### Table 8
Hierarchical Linear Model (HLM) Analysis: Level I (Time Variant) and Level II (Time Invariant) Predictors of Evening Pain

<table>
<thead>
<tr>
<th>Standardized Coefficient</th>
<th>Between-Person Variance</th>
<th>Reliability of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=70(^a) SE</td>
<td>(\chi^2) test</td>
<td>df(^b)</td>
</tr>
<tr>
<td><strong>Intercept</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z PM Pain(^c)</td>
<td>-.15</td>
<td>.18</td>
</tr>
<tr>
<td>(Null Model)</td>
<td>(.00)</td>
<td>(.10)</td>
</tr>
<tr>
<td><strong>Intercept Predictors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Level II Slopes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis.</td>
<td>.01*</td>
<td>.01</td>
</tr>
<tr>
<td>Disability</td>
<td>.35***</td>
<td>.10</td>
</tr>
<tr>
<td><strong>Level I Slopes(^c)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z AM Pain(^d)</td>
<td>.45***</td>
<td>.05</td>
</tr>
<tr>
<td>AM C.R.</td>
<td>-.24*</td>
<td>.09</td>
</tr>
<tr>
<td>AM DST.</td>
<td>-.09</td>
<td>.07</td>
</tr>
<tr>
<td>AM E.E.</td>
<td>-.03</td>
<td>.09</td>
</tr>
<tr>
<td>AM P.P.S.</td>
<td>.29***</td>
<td>.08</td>
</tr>
<tr>
<td>PM Efficacy</td>
<td>-.19***</td>
<td>.04</td>
</tr>
<tr>
<td>PM Pos Mood</td>
<td>.06</td>
<td>.04</td>
</tr>
<tr>
<td>PM Neg Mood</td>
<td>.20**</td>
<td>.07</td>
</tr>
</tbody>
</table>

| Within-Person Residual Variance | | | |
| Residual Variance | .25 | | |
| (Null Model) | (.35) | | |
| PM Pain Variability | | | |
| Accounted for | | | |
| Between-Person | 77% | | |
| Within-Person | 29% | | |

\(^a\) HLM drops those individuals who are missing at least one variable at all 14 timepoints. 2 participants were dropped from the current analyses for this reason.

\(^b\) The chi-square test of between-person variance among the intercepts or slopes are calculated on those individuals who have complete data for all variables included in the model at all timepoints. This results in lowered degrees of freedom for the variance estimates in the current model.

\(^c\) Z AM Pain = standardized morning pain; AM C.R. = morning cognitive reframing; AM DST. = morning distancing; AM E.E. = morning emotional expression; AM P.P.S. = morning planful problem-solving; PM Efficacy = evening coping efficacy; PM Pos Mood = evening positive mood; PM Neg Mood = evening negative mood.

\(^d\) Between-person variance estimates and significant tests are not computed for fixed effects.

\(^e\) Variables with this superscript have been standardized in order to interpret pain severity increases or decreases in standard units.