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Social Support and Cognitive Functioning as Resources for Elderly Persons with Chronic Arthritis Pain

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Abstract

Objective—Arthritis pain and depression are prevalent physical and psychological disorders in late life and co-occur frequently. We explored the stability and co-variation of arthritis pain and depressive symptoms. We also addressed the influence of cognitive functioning and social support on the relationship between pain and depressive symptoms among community dwelling older individuals.

Method—This longitudinal study utilized a sample of 299 residents of Florida retirement communities who participated in a long term panel study using yearly assessments across 4 years. Using multilevel modeling, we modeled the individual differences as well as stability in arthritis pain and depressive symptoms simultaneously. Further, we tested the role of cognitive functioning and social support in the association between arthritis pain and depressive symptoms.

Results—We found substantial within-person variation in both pain and depressive symptoms (between 58 and 65 %) across 4 years even after controlling for a time effect. After controlling for arthritis pain, persons with higher social support and higher cognitive functioning reported lower levels of depressive symptoms.

Discussion—Findings suggest that fluctuations in pain and depressive symptoms are common for older adults. Furthermore, social support and intact cognitive functioning may serve as useful resources, as they buffer the negative impact of arthritis pain on depressive symptoms.

Keywords

Arthritis pain; Depressive symptoms; Social Support; Cognitive Functioning

Extensive research has documented that the persistent pain resulting from arthritis often produces substantial physical disability as well as social and psychological consequences (Thomas, Peat, Harris, Wilkie, & Croft, 2004; Yelin & Callahan, 2005). In particular, the linkage between arthritis pain and depressive symptoms has been consistently found, with co-occurrence rates of 30-50% (Arnstein, Caudill, Mandle, Norris et al., 1999; Keefe et al., 2002; Mavandadi et al., 2007). Furthermore, co-morbidity of these two common chronic conditions has been consistently observed among elderly adults in community settings (Conner et al., 2006; Hilderlink et al., 2012).

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The Association between Pain and Depressive Symptoms

Theoretical models are useful in contextualizing the linkages between physical illness, such as arthritis, attendant physical impairment of pain and functional disability and further negative sequelae manifested in depressive symptoms. The theory of the disability cascade put forth by Verbrugge and Jette (1994) posits that physical disability and negative quality of life outcomes (e.g., depressive symptoms) often result from functional impairment following natural sequences of disease related events. A similar theoretical formulation is offered in Lewinsohn's behavioral model (1974), Based on this formulation researchers noted that individuals with chronic pain often restrict their range of activities due to pain or fear of pain, leading to inactivity and withdrawal (Williamson & Schulz, 1992; Kahana, Kahana, Namazi, Kercher, & Stange, 1997). This lack of positive reinforcement for staying active is sequentially related to increase in negative affect and depressive symptoms (Williamson & Shaffer, 2000). Both of these models are centered on disease-disability pathways from pathology, joint impairment including pain, and functional limitations (Verbrugge & Jette, 1994).

Empirical findings have supported bidirectional association between pain and depression, but longitudinal studies among older people consistently show that pain precedes depressive symptoms (Arola, Nocholls, Mallen, & Thomas, 2010; Chou, 2007; Dickens, McGowan, Clark-Carter, & Creed, 2002; Hawker et al., 2011; Meyer Cooper, & Raspe, 2007). For example, a longitudinal study using over 12 years of follow up interviews examined the temporal relationships between pain and depression (Hilderink et al., 2012) and found that pain precedes the onset of depression. Furthermore, no effects of depression on the development of subsequent pain were found when adjusting for covariates.

Fluctuations in Pain and Depressive Symptoms

The literature on pain and depressive symptoms has been focusing on patient's average or usual symptoms levels (Schneider et al., 2012). However, the focus on mean level of pain at one time point does not capture the disablement process related to pain symptoms. Indeed, the literature on affectivity highlights an important distinction between average levels of mood and intra-individual variability (Nesselroade, 2001) and further suggests that variability in psychosocial measures is linked to long-term outcomes (Eizenmann, Nesselroade, Fingerman, & Rowe, 1997). For example, greater fluctuation in affective states, such as negative mood or depressive symptoms in short periods of time, is also known to reflect neurological or physiological disturbances (Kolanowski, Hoffman, & Hofer, 2007).

Similarly, fluctuations in arthritis pain severity have been also observed among older individuals using daily diary methods (Beekman et al., 2002; Chibnall & Tait, 2001). Past studies have indicated that variability of symptoms is of interest for better understanding the course of knee OA (Allen, 2007). Greater within person variability in symptoms has been found to be predictive of neurological integrity (Strauss, MacDonald, Hnter, Moll & Hultsch, 2002). Prior studies have also addressed the issues of arthritis pain variability

among elderly adults and suggest that large variations in pain often indicate worse prognosis with increasing pain over two years (Paradowski, Englund, Lohmander, & Roos, 2005).

Continuing this line of inquiry, in this paper, our study examines the extent to which important psychosocial variables are simultaneously associated with both the level and fluctuations in pain and with depressive symptoms among community dwelling older adults across 4 years. Specifically, we examine the stability of measures of emotional well-being by using statistical models that address both inter-individual differences (i.e., a between person model) and intra-individual change or variation over time (i.e., a within-person model).

Cognitive Functioning, Social Support and Pain and Depressive Symptoms

We follow the disablement process in arthritis (AR) (Escalante & Rincón, 2002) that is derived from the general disablement process model of Verbrugge and Jette (1994).We thus postulate that disablement in AR starts from pathology, defined as any diagnosed disease or abnormal condition that interrupts with normal bodily processes or structures. Although this disease-disability pathway seems straightforward, clinicians and investigators have argued that there is permeability between the stages of disablement process. They propose that psychosocial, factors may play a greater role in contributing to the disablement process of AR patients relative to,, biological or medical reasons (Reid, Williams, & Gill, 2003; Escalante &Rincon, 2002).

Despite this recognition, psychosocial factors have been rarely addressed to explain individual differences in pain adaptation and depressive symptoms (Schneider, Junghaenel, Keefe, Schwartz, Stone, & Broderick, 2012). Emerging empirical evidence as well as theoretical frameworks point to the potential role of social support as a moderator between arthritis pain and depressive symptoms (Holtzman, Newth, Delongis, 2004; Thoits, 2011). Social support is defined as the resources perceived as available from others in an individual's social network (Antonucci & Johnson, 1994; Bisconti & Bergeman, 1999). Support usually includes the receipt of provisions of tangible or emotional aid. The associations among social support, pain and depressive symptoms are well-known (Ferreira & Sherman, 2007). Especially among older adults, social support is associated with better adaptation to arthritis pain (Evers, Kraaimatt, Greenen, & Bijlsma, 1998) and lower depressive symptoms (Holtzman et al., 2004; Sherman, 2003).

In terms of personal resources, prior studies have focused on the role of coping strategies as the main sources of resilience for older adults dealing with arthritis pain (Sullivan et al., 2001; Turk & Rudy, 1992). However, relatively less is known about the role of intact cognitive functioning that may potentially buffer the effect of arthritis pain on depressive symptoms. Better cognitive functioning is known to buffer the effect of stressors on depressive symptoms in late life (Blazer, 2003; Kraaij, Arensman, & Spinhoven, 2002). Thus, we will examine whether intact cognitive functioning will help older individuals to experience less negative affect as a response to arthritis pain.

Furthermore, it is useful to explore not only factors contributing to the level of pain and depressive symptoms, but also the variation in pain and depressive symptoms within

individuals. Although it is expected that elderly persons with low social support and low cognitive functioning will be particularly vulnerable to depressive symptoms while coping with chronic stressors such as pain (Keefe & Somers, 2010; Sullivan et al., 2001), it is not known, whether there will be greater within-person variability in pain and depressive symptoms among elderly persons with lower social support and lower cognitive functioning when compared to their counterparts who are high on these resources. Given their protective roles in buffering the negative effect of pain, it is possible that within-person variability in pain may be differentially related to depressive symptoms among older persons depending on their level of social support and cognitive functioning.

Hypothesis and research questions

Our first research question sought to examine the fluctuations of arthritis pain and depressive symptoms across 4 years. Our second research question was to examine whether the level and fluctuations in pain and depressive symptoms differ as a function of cognitive functioning and social support. Our final research question was to examine the extent which pain and depressive symptoms are related to (a) between persons and within persons and (b) do these relationship differ as a function of cognitive functioning and social support.

Methods

Sample

The data for this study were collected by second and third author of the paper as part of a larger research panel study which focuses on late life adaptation of retirement community-dwelling elderly individuals. Participants were selected from a large, age-segregated, older adult community located in central Florida, where residents live independently and provide for their own care (Borawski, Kinney, & Kahana, 1996; Kahana, Kahana, & Zhang, 2005; Kahana, Kelley-Moore, & Kahana, 2012; Kelly-Moore, Schumacher, Kahana, & Kahana, 2006). Baseline data collection started in 1989, and respondents were interviewed annually for a 20 year follow up period. To be eligible for this study, participants had to be (1) age 72 years or older, (2) living in Florida at least 9 months of the year, and (3) healthy enough to complete a 90 minute face to face interview. With computerized resident listings provided by the managers of the retirement communities, households were randomly contacted by telephone to determine whether a member of the household met the eligibility criteria. The total resident population of community was 5,204 households, in which 3,905 households were randomly selected before the 1,000 study sample was reached. The final sample for the first wave of the study comprised 1,000 respondents, who completed face-to-face interviews. As part of the longitudinal project, respondents were contacted and interviewed annually with face-to-face interviews. Death is the main source of attrition. Based on careful sample maintenance, loss to follow-up accounted for only 7% of annual attrition.

The current study used data from Waves 8 to 11 of our panel study (N=299). These study waves were chosen because measurement of arthritis pain and report of diagnosis of arthritis by a clinician was introduced in the 8th study wave until 11th wave. In the selected waves, participants were asked more specific questions regarding to their arthritis pain and functioning resulting from arthritis pain. Of the eligible 373 participants, we narrowed the

sample down to 299 participants who reported that they have been diagnosed with arthritis by clinicians. At the time of Wave 8, the average age of participants was 83.78 (*SD*=4.55). There were 76 (25%) men and 223 (75%) women in the sample.

Measures

Depressive symptoms—Depressive symptoms were assessed with a 10-item version of the Centers for Epidemiologic Studies—Depression scale (CES–D; Radloff, 1977), a widely used self-report depression measure in community studies (Andresen, Malmgren, Carter, & Patrick, 1994). Shortened versions of the CES-D have been found to be internally reliable, valid, and highly correlated with the full scale version (r = 0.96) in previous studies (Andresen et al., 1994; Shrout & Yager, 1989). In this study, participants reported how often they experienced specific symptoms during the past week, on a scale from 1 (never/rarely) to 5 (all of the time). Given that usual CES-D scale has a scale from 0 to 3; our shortened measure provided more variation in depressive symptoms. We summed the scores to indicate that higher scores reflected more depressive symptoms. The average of the scores ranged from 19.57 to 21.10 (*SD* =5.76 - 6.43) across 4 years. Cronbach's alpha ranged from . 847 to .882.

Arthritis Pain—Pain severity during the past month was assessed with the subscale of the arthritis Impact Measurement Scale (AIMS2; Meenan, Mason, Anderson, Guccione, & Kazis, 1992). Among the subscales, we included five items regarding the severity of pain as well as morning stiffness, and sleeplessness due to arthritis. Ratings were made on a 5-point Likert Scale ranging from 1 (none or no days) to 5 (severe or all days). The average of the scores ranged from 10.02 to 10.8(*SD*=4.96-5.6), and Cronbach's alpha for this scale ranged from .84 to .87 across 4 years.

Social Support—Tangible social support was assessed with the social support scale developed by co-authors of the paper. We asked participants how much help they received from spouse, family members or friends/neighbors during the past year. Total 15 questions asked addressing the area of transportation, cooking, aid during sickness, and personal help (5 items per spouse, family and friends/neighbors). For example, participants were asked, “How much help did you receive from other people in the following areas?” Participants answered using a 5-point scale, ranging from 1 (*none*) to 5 (*very much*). An exploratory factor analysis using the principal components procedure and a varimax rotation was conducted using 15 items collapsing areas of support and the person who provided the support. Only one factor was obtained with Eigen values greater than 1. Thus, we summed the scores for all types of tangible support. A higher score means more tangible support received from spouse, family members and friends/neighbors. The Cronbach's alpha for this scale ranged from .7 to .78 across 4 years.

Cognitive functioning—Cognitive functioning was measured by The Short Portable Mental Status Questionnaire (SPMSQ; Pfeiffer, 1975). This questionnaire is often used to measure the presence and the degree of cognitive impairment in the elderly adults. The categories measured include; orientation, memory functioning, and the capacity to perform several mental operations. Prior studies have shown that there is a 92% agreement between

SPMSQ score and a clinical diagnosis of cognitive impairment (Erkinjuntti, Sulkava, Wikstrom, &Autio, 1987; Stump, Monahan, & Mchorney, 2005). This scale was validated with large community samples. The standards of performance were established as: 0-2 errors (score 8-10) as intact mental functioning, 3-4 errors (score 6-7) as borderline or mild impairment, 5-7 errors (score 3-5) as moderate impairment, and 8-10 errors (score 0-2) as severe impairment (Stump et al., 2005). The mean for our sample ranged from 8.74 to 9.22 (See Table 1), indicating generally intact cognitive functioning in this sample.

Control variables

Several measures that could confound the relationship between pain and depressive symptoms were considered. Demographic characteristics such as age, gender, health conditions, and education were included (See Table 1). Chronic health conditions were measured by a modified version of the OARS (Fillenbaum & Smyer, 1981) summing the prevalence of 20 health conditions, including heart trouble, cancer, and diabetes. The potential range of the variable was from 0 to 20, although the maximum number of conditions in this sample was 18 (See Table 1).

Prior to analyses, we estimated bivariate associations between potential control variables and dependent variables (i.e., arthritis pain and depressive symptoms). Control variables included: age, gender, education, and health problems. Inclusion of control variables that are not associated with a dependent variable may generate spurious associations. Given that the age of participants and their education did not show a significant association with depressive symptoms, age and education were not included in our analyses.

Analysis plan

Before the model testing, a series of univariate ANOVAS were used to assess if the cognitive functioning, social support, AR pain and depressive symptoms were related to time. We found that time has significant linear effects on depressive symptoms [F (3, 1002) =2.77, p<.05]. *Tukey's post hoc* test showed that the significance lay in the difference between wave 1 and wave 4. In terms of cognitive functioning, we also found a similar trend. Time has significant linear effects on the depressive symptoms [F (3, 1001) =4.19, p<.01]. *Tukey's post hoc* test showed that the significance lay in the difference between wave 1 and wave 4. AR pain and social support shows more stable pattern and overall increase over time, but not statistically significant (See Table 1).

The multilevel linear mixed model is a well-known analytic strategy for examining individual differences in between and within person co-variation of time-dependent processes. In contrast to approaches such as repeated measures of analysis of variance, multilevel modeling is helpful for analyzing change using longitudinal data as it makes use of all available data from individual and emphasize individual trajectories rather than average value at each occasion (Krueger & Tian, 2004; Singer & Willett, 2003).

Furthermore, using the multilevel model for heterogeneous variances allows us to examine between and within person sources of variance simultaneously. These models can be used to assess variability in the magnitude of depressive symptoms and AR pain severity between

individuals (i.e., inter-individual variability), as well as yearly fluctuations across time (i.e., intra-individual variability). Often times, such models are employed to specifically consider individual differences or heterogeneity in mean levels of some variable, such as whether the magnitude of the pain and depressive symptoms differs by social support or cognitive functioning. However, these models can be extended to consider individual differences or heterogeneity in intra-individual variability.

Thus, we could estimate the effect of predictors on within-person variability while simultaneously acknowledging the effect of these predictors on individuals' mean levels of pain and depressive symptoms across all 4 years. This modeling approach has been referred to as dispersion models in the literature (Hoffman, 2007).

In testing our first hypothesis to examine the fluctuations of arthritis pain and depressive symptoms over 4 years, we calculated an unconditional means model with the *time variable included* to determine if it needed to be included in model as fixed effects. Because the time effect was significant, it was included in the subsequent analyses. Given that we can expect changes in pain and depressive symptoms from the yearly assessments, controlling the effect of time could provide us with a better estimate of the stability of pain and depressive symptoms. Based on the random intercept variance and residual variance from the unconditional means model, we calculated an intraclass correlation (ICC) as the magnitude of between person versus within person variation in arthritis pain and depressive symptoms. An intraclass correlation (ICC) is often calculated to examine stability of pain and depressive symptoms as the relative magnitude of between person versus within person variation (Hoffman, 2007).

Next, to examine our second hypothesis, we tested whether the stability of depressive symptoms and pain were related to cognitive functioning and social support in separate models for each predictor. We included each predictor as a fixed effect (i.e., as a predictor of between-person differences) and also in a log-linear model for the residual variance (i.e., as a predictor of the magnitude of within-person variation).

Given that people differ in arthritis pain and depressive symptoms both from each other and from their usual levels over time, co-variation of pain and depressive symptoms was examined at both the between-and within-person levels. In order to examine co-variation in each model, we separated time-varying pain severity into two variables: the person's mean pain severity across the years and the person's deviation from his or her mean pain severity. The latter represents within-person variation.

Finally, to address our research question, we examined whether between- and within-person covariation of arthritis pain differs by social support and cognitive functioning. We included social support and cognitive functioning scores and their interactions with the between-person and within-person predictors of pain in order to examine the extent to which the magnitude of co-variation was moderated by cognitive functioning and social support. In addition, gender and number of health problems were added as between-person covariates. The multiple equation form of the model follows:

Level 1: $y_{ij} = \beta_{0j} + \beta_{1j}\ Time_{ij} + r_{ij}$, where $\gamma_{ij}=N\left(0,\sigma_j^2\right)$

Level 1 residual variance: $\sigma^2 = \alpha_0\ [\exp(\alpha_1 Cog)]$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}\ Cog_j + u_{0_j}$

$\beta_{ij} = \gamma_{10} + u_{1j}$

In the level 1 model for within person variation, the score on a given outcome variable (depressive symptoms) of person *j* on year *i* (y_{ij}) is a function of an intercept (β_{0j}). which represents the year mean for person *j*. As shown in the level 1 model for residuals of equation 1, the residual within person variance (σ^2_j) is explicated expressed for person *j* and can be modeled as a function of person characteristics such as cognitive function. All the analyses were conducted using the MIXED procedure in SAS (Littell, Milliken, Stroup, Wolfinger, & Schabenberber, 1996).

Results

Table 1 displays the means and standard deviations among the key study variables over 4 years. We first present findings regarding stability of pain and depressive symptoms. Then, we present models examining individual differences in the stability of pain and depressive symptoms. Next, we present multilevel models examining individual differences in the co-variation between arthritis pain severity and depressive symptoms.

Unconditional models of stability of pain and depressive symptoms

We examined the stability of pain and depressive symptoms across 4 years by calculating intraclass correlation (ICC) from a multilevel model including a time term. By including a time term, we could separate within individual variability from the variability of the linear time trend. The time effect was significant only for depressive symptoms (β=.49, p<.001). Tested models indicate that there was substantial within-person variation in depressive symptoms (ICC=.66; 66% variance between persons, 34% variance within persons) and more in pain (ICC=.54, 54% variance between persons, 46% variance within persons). Thus, for both depressive symptoms and pain symptoms, individuals differed in terms of their level of pain and depressive symptoms over time as much as they differed from each other.

Individual Differences in Level and Stability of Pain and Depressive Symptoms

Our second research questions addressed whether the level and fluctuations in pain and depressive symptoms differs as a function of cognitive functioning and social support. For depressive symptoms, we found a significant negative effect of overall level of cognitive functioning on the between person means (β=−.57, p<.01), indicating that overall level of cognitive functioning was negatively related to depressive symptoms (See Model 1 in Table 2). In addition, the significant negative effect of cognitive functioning on the residual variance in depressive symptoms indicates that persons with better cognitive functioning reported less-within person variation in depressive symptoms (β=−.13, p<.001; See Model 1 in Table 2). In contrast, social support did not have any significant association with between-person means of depressive symptoms or the residual variance of depressive symptoms.

In terms of predicting arthritis pain, we found that individuals with better cognitive functioning reported lower levels of pain (β=−.23, p<.001, See Model 2 in Table 2). The effect of social support on the between person means of arthritis pain was also significant (β=.40, p<.001, See Model 2 in Table 3), but not on the residual variance (See Model 2 in Table 3). This indicates that persons with better cognitive functioning and with lower social support reported lower levels of overall pain symptoms. In sum, cognitive functioning has a significant negative linear effect on depressive symptoms and AR pain, but social support has a negative linear effect on AR pain only.

Individual differences in co-variation of pain and depressive symptoms

Our final research questions aimed to examine the extent to which pain and depressive symptoms are related to between-person and within person level and also the extent to which these relationships depend on intact cognitive functioning and social support. In the model predicting depressive symptoms, including arthritis pain, both the between person and within-person effects of pain were positive (See Model 3 in Table 2). The interaction with between person and within person pain was also significant (β=.03, p<.05). After controlling for arthritis pain severity, we found significant interaction between cognitive functioning and between-person pain severity (β=− .02, p<.05, See Model 3 in Table 2), indicating that co-variation of pain severity with depressive symptoms was stronger in persons with lower cognitive functioning. In addition, there is a significant negative linear effect of cognitive functioning on the residual variance in depressive symptoms (β=−.15, p<.001; See Model 3 in Table 2). However, the interaction between cognitive functioning and within person pain severity was not significant.

Similarly, the interactions of social support with between-person pain was significant (β= −. 04, p<.05, See Model 3 in Table 3). That is, after controlling for AR pain, persons with higher social support reported lower levels of depressive symptoms (See Table 3). However, the interaction between social support and within person pain severity and the linear effect of social support on the residual variance in depressive symptoms were not significant (See Model 3 in Table 3).

Discussion

In this study, we sought to further specify tenets of Verbrugge and Jette's disablement model relevant to AR in late life. To do so we examined the between- and within-person levels among pain and depressive symptoms of elderly community residents over a 4 year period. In addition, we examined the role of psychosocial resources, such as social support and intact cognitive functioning in predicting levels and intra-individual variation in pain and depressive symptoms. Finally, we sought to expand on previous work on the co-variation between pain and depressive symptoms by examining the role of social support and cognitive functioning in response to arthritis pain. Several results are noteworthy.

Fluctuations in pain and depressive symptoms

First, we found significant within person fluctuation in both pain and depressive symptoms, such that between 35-42% of total variation in AR pain and depressive symptoms is due to

sources of intra individual variation, across 4 years. Given that these findings were found even after we controlled for time effects, our results offer several important insights into the disablement process.

Our findings extend prior studies that have documented fluctuations in pain and depressive symptoms using daily measures or weekly measures (Allen et al., 2009; Hutchings et al., 2007). Given that older individuals reported substantial variation in their AR pain severity and depressive mood over a 4 year period, our finding suggest that pain and depressive symptoms show substantial fluctuation despite a much longer interval in late life beyond their overall increase in AR pain and depressive symptoms.

Reporting of depressive symptoms appears to be more situation specific, rather than trait like, offering hope of some reprieve to sufferers. Our findings help explicate the disablement process occurring in late life and further demonstrate that AR pain severity and depressive symptoms are considerably more labile phenomena than traditional individual differences notions have implied (Verbrugge & Jette, 1994).

Psychosocial Factors Contributing to Pain and Depressive Symptoms

In this study, we also examined two psychosocial resources contributing to the levels in pain and depressive symptoms. We found that individuals with better cognitive functioning reported lower levels of depressive symptoms and greater stability in depressive symptoms. Significant fixed effects of cognitive functioning pointed out the importance of cognitive functioning in contributing to better mental health. Given that greater fluctuation in affective states indicate neurological or physiological disturbances (Eizenmann et al., 1997; Strauss et al., 2002), our finding supports the idea that intact cognitive functioning can be an important resource for older adults who experience fluctuations in negative affect and AR pain.

In additions, findings that individuals with higher cognitive functioning reported lower mean level of pain and depressive symptoms and also less within person variation in pain and depressive symptoms are in line with prior studies showing that greater stability in mood and AR pain are signs of better prognosis (Strauss et al., 2002).

The role of social support on AR pain is also noteworthy. Our findings that higher tangible social support is associated with higher levels of arthritis pain confirm observations from prior studies indicating that social support has positive association with high levels of pain and disability among patients with arthritis (Savelkoul, Post, de Witte, & Van den Borne, 2000). Thus, the significant association between tangible support and pain indicates higher need of these older patients with arthritis pain. Indeed, tangible support is likely to be elicited by perceived needs of the recipient (Holtzman et al., 2004).

Co-variations between Pain and Depressive Symptoms and Psychosocial Moderators

Findings regarding the co-variation between pain and depressive symptoms confirm previous research on this topic, but the role of cognitive functioning and social support in the co-variation between pain and depressive symptoms extend previous literature. Our findings suggest that social support could serve as a useful resource for those individuals with higher pain. This finding is also consistent with a buffering hypothesis. Thus,

individuals who receive more social support are resistant to stressful events such as pain and thus more resilient than those older adults with lower social support (Thoits, 2011). Perhaps, older adults with higher tangible support are more likely to adopt a proactive approach toward managing pain, thus allowing them to maintain their functional abilities that are essential for independent living and for maintenance of good quality of life.

Cognitive functioning was found in our study to buffer the levels of pain on depressive symptoms. This indicates that intact cognitive functioning is particularly beneficial for individuals with higher levels of arthritis pain. Relatedly, the cognitive behavioral model acknowledged the role of cognitive functioning in adaptations to pain (Meichenbaum, Turk, & Genest, 1983). Older adults who maintain high levels of cognitive functioning may cope better with arthritis pain by reappraising their pain experiences, which reduces their negative affect. Indeed, cognitive resources have been a target of psychological interventions (Ball et al., 2002; Pincus & Morley, 2001; Willis et al., 2006). Thus, clinicians might consider offering help to older patients with arthritis to maintain higher cognitive functioning in an effort to minimize the effect of overall arthritis pain on levels and fluctuations in depressive symptoms.

In sum, diverse coping resources, including tangible social support and cognitive functioning serve useful functions and may be viewed as a unifying concept for coping dispositions that serve protective roles in the presence of stressors (Pearlin, 1999; Kahana & Kahana, 2003). Our findings further illustrate the need to seek various ways to improve social support and cognitive functioning of older adults as a means of reducing adverse effects of pain and depression on their quality of life.

Limitations

The initial sample selection and subsequent attrition could have limited the representativeness of the study population and generalizabiltiy of findings. However, a large proportion of the losses to follow up are due to death. As high mortality is a characteristic of older populations, losses to follow-up for these specific reasons will not necessarily affect the representativeness of the study population or bias the results. The sample drawn for this study included primarily Caucasian respondents with slightly higher than average income and education. Thus, the results may not be generalizable to other demographic groups.

Our cognitive measure was less sensitive to cognitive status. Our findings about the value of intact memory as a cognitive resource offers the expectation that more refined measures of cognitive functioning could have an even greater impact. Although we found evidence of specific psychological resources for older individuals, there is a clear need for further research to investigate other important factors accounting for the impact of arthritis pain on depression. Thus, future studies should examine other social and environmental factors (e.g., activity level) that may be important for evaluating the association between arthritis pain and depressive symptoms.

Significance and practice implications

The findings of our study are valuable from several perspectives. First, we found that fluctuations in arthritis pain are a common experience for older adults. This phenomenon

has not been extensively studied, particularly over a long period of time in a large number of individuals, yet is of great importance if we are to provide individuals with relevant information about the prognosis of pain and offer effective medical interventions for them in the longer term. Thus, to best capture how older adults are adjusting to arthritis pain, clinical assessments for older adults should include multiple assessments of how their pain varies and how this variability impacts well-being over time.

In addition, clinicians might also consider variability in AR pain and depressive symptoms as a risk identification indicator for elderly patients in community setting. The significant variability in the linkage between pain and depression also suggests that these linkages might be malleable and open to interventions. These results urge further inquiry into predictions of depressive symptoms among older persons regarding social support as a source of resilience in the face of chronic stressors such as arthritis pain. If social support protects against increases in depressive symptoms among people experiencing pain, further research is needed to examine whether any interventions that address the needs of older individuals with arthritis pain for obtaining social support or the ways in which support networks encourage and respond to patients' adaptive ways to cope with pain and disability.

In sum, the results support a model in which tangible social support and cognitive functioning influence the relationship of both pain and depressive symptoms. Positive outcomes among older adults who live with chronic pain may be enhanced by building resources through increasing tangible social support or by reappraisals of stressors.

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References

Allen KD. The value of measuring variability in osteoarthritis pain. Journal of Rheumatology. 2007; 34(11):2132–2133. [PubMed: 17985413]

Allen KD, Coffman CJ, Golightly Y,M, Stechuchak KM, Keefe FJ. Daily pain variations among patients with hand, hip, and knee osteoarthritis. Osteoarthritis Cartilage. 2009; 17:1275–1282. [PubMed: 19410670]

Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults – Evaluation of a short-form of the CES-D. American Journal of Preventive Medicine. 1994; 10:77–84. [PubMed: 8037935]

Antonucci, TC.; Johnson, EH. Conceptualization and methods in social support theory and research as related to cardiovascular disease.. In: Schumaker, SA.; Czajkowski, SM., editors. Social support and cardiovascular disease. Plenum Press; New York: 1994. p. 21-39.

Arnstein P, Caudill M, Mandle CL, Norris A, Beasley R. Self-efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. Pain. 1999; 80(3):483–491. [PubMed: 10342410]

Arola HM, Nicholls E, Mallen C, Thomas E. Self-reported pain interference and symptoms of anxiety and depression in community-dwelling older adults: Can a temporal relationship be determined? European Journal of Pain. 2010; 14(9):966–971. [PubMed: 20381389]

Ball K, Berch DB, Helmers KF, Jobe JB, Leveck MD, Marsiske M, ACTIVE Study Group. Effects of cognitive training interventions with older adults: a randomized controlled trial. Jama. 2002; 288(18):2271–2281. [PubMed: 12425704]

Beekman AT, Geerlings SW, Deeg DJ, et al. The natural history of late-life depression: a 6-year prospective study in the community. Archives of General Psychiatry. 2002; 59:605–611. [PubMed: 12090813]

Bisconti TL, Bergeman CS. Perceived Social Control as a Mediator of the Relationships Among Social Support, Psychological Weil-Being and Perceived Health. The Gerontologist. 1999; 39(1):94–104. [PubMed: 10028775]

Blazer DG. Depression in late life: review and commentary. Journal of Gerontology. 2003; 58(3):249–265.

Borawski EA, Kinney JM, Kahana E. The meaning of older adults' health appraisals: Congruence with health status and determinant of mortality. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 1996; 51(3):S157–S170.

Chibnall JT, Tait RC. Pain assessment in cognitively impaired and unimpaired older adults: a comparison of four scales. Pain. 2001; 92:173–186. [PubMed: 11323138]

Chou K. Reciprocal relationship between pain and depression in older adults: Evidence from the English Longitudinal Study of Ageing. Journal of Affective Disorders. 2007; 102:115–123. [PubMed: 17240455]

Conner TS, Tennen H, Zautra AJ, Affleck G, Armeli S, Fifield J. Coping with rheumatoid arthritis pain in daily life: within-person analyses reveal hidden vulnerability for the formerly depressed. Pain. 2006; 126:198–209. [PubMed: 16904829]

Dickens C, McGowan L, Clark-Carter D, Creed F. Depression in rheumatoid arthritis: a systematic review of the literature with meta-analysis. Psychosomatic Medicine. 2002; 64(1):52–60. [PubMed: 11818586]

Eizenman DR, Nesselroade JR, Featherman DL, Rowe JW. Intraindividual variability in perceived control in a older sample: The MacArthur successful aging studies. Psychology and aging. 1997; 12(3):489. [PubMed: 9308096]

Erkinjuntti T, Sulkava R, Wikstrom J, et al. Short portable mental status questionnaire as a screening test for dementia and delirium among the elderly. Journal of American Geriatric Society. 1987; 35:412–416.

Escalante A, Del Rincón I. The disablement process in rheumatoid arthritis. Arthritis Care & Research. 2002; 47(3):333–342. [PubMed: 12115165]

Evers AW, Kraaimaat FW, Geenen R, Bijlsma JW. Psychosocial predictors of functional change in recently diagnosed rheumatoid arthritis patients. Behaviour Research and Therapy. 1998; 36(2): 179–193. [PubMed: 9613024]

Ferreira VM, Sherman AM. The relationship of optimism, pain and social support to well-being in older adults with osteoarthritis. Aging and Mental Health. 2007; 11(1):89–98. [PubMed: 17164163]

Fillenbaum GG, Smyer MA. The development, validity, and reliability of the OARS multidimensional functional assessment questionnaire. Journal of Gerontology. 1981; 36(4):428–434. [PubMed: 7252074]

Hawker GA, Gignac MA, Badley E, Davis AM, French MR, Li Y, Lou W. A longitudinal study to explain the pain-depression link in older adults with osteoarthritis. Arthritis care & research. 2011; 63(10):1382–1390. [PubMed: 20662042]

Hilderink PH, Burger H, Deeg DJ, Beekman AT, Voshaar RCO. The temporal relation between pain and depression: results from the longitudinal aging study amsterdam. Psychosomatic medicine. 2012; 74(9):945–951. [PubMed: 23115345]

Hoffman L. Multilevel models for examining individual differences in within-person variation and covariation over time. Multivariate Behavioral Research. 2007; 42(4):609–629.

Holtzman S, Newth S, Delongis A. The role of social support in coping with daily pain among patients with rheumatoid arthritis. Journal of Health Psychology. 2004; 9(5):677–695. [PubMed: 15310421]

Hutchings A, Calloway M, Choy E, Hooper M, Hunter DJ, Jordan JM, et al. “The Longitudinal Examination of Arthritis Pain (LEAP) study: relationships between weekly fluctuations in patient-rated joint pain and other health outcomes. Journal of rheumatology. 2007; 34:2291–2300. [PubMed: 17937461]

Kahana, B.; Kahana, E.; Namazi, K.; Kercher, K.; Stange, K. Handbook of pain and aging. Springer; US: 1997. The role of pain in the cascade from chronic illness to social disability and psychological distress in late life.; p. 185-206.

Kahana E, Kelley-Moore J, Kahana B. Proactive aging: A longitudinal study of stress, resources, agency, and well-being in late life. Aging and Mental Health. 2012:1–14.

Kahana E, Kahana B, Zhang J. Motivational antecedents of preventive proactivity in late life: Linking future orientation and exercise. Motivation and emotion. 2005; 29(4):438–459. [PubMed: 18080009]

Kahana, E.; Kahana, B. Contextualizing successful aging: New directions in age-old search.. In: Settersten, RA., editor. Invitation to the life course: A new look at old age. Baywood Publishing Company; Amityville, NY: 2003. p. 225-255.

Keefe FJ, Somers TJ. Psychological approaches to understanding and treating arthritis pain. Nature Reviews Rheumatology. 2010; 6(4):210–216. [PubMed: 20357790]

Keefe FJ, Smith SJ, Buffington ALH, Gibson J, Studts JL, Caldwell DS. Recent advances and future directions in the biopsychosocial assessment and treatment of arthritis. Journal of Consulting and Clinical Psychology. 2002; 70:640–655. [PubMed: 12090374]

Kelley-Moore JA, Schumacher JG, Kahana E, Kahana B. When do older adults become “disabled”? Social and health antecedents of perceived disability in a panel study of the oldest old. Journal of health and social behavior. 2006; 47(2):126–141. [PubMed: 16821507]

Kolanowski A, Hoffman L, Hofer SM. Concordance of self-report and informant assessment of emotional well-being in nursing home residents with dementia. Journal of Gerontology: Psychological Sciences. 2007; 62(1):20–27.

Kraaij V, Arensman E, Spinhoven P. Negative Life Events and Depression in Elderly Persons A Meta-Analysis. The Journals of Gerontology. 2002; 57:87–94.

Krueger C, Tian L. A comparison of the general linear mixed model and repeated measures ANOVA using a dataset with multiple missing data points. Biological Research for Nursing. 2004; 6(2): 151–157. [PubMed: 15388912]

Lewinsohn PM. The behavioral study and treatment of depression. Progress in behavior modification. 1975; 1:19–64.

Littell, RC.; Milliken, GA.; Stroup, WW.; Wolfinger, RD.; Schabenberber, O. SAS system for linear mixed models. SAS Institute; 1996.

Mavandadi S, Sorkin DH, Rook KS, Newsom JT. Pain, positive and negative social exchanges, and depressive symptomatology in later life. Journal of Aging and Health. 2007; 19:813–830. [PubMed: 17690337]

Meenan RF, Mason JH, Anderson JJ, Guccione AA, Kazis LE. AIMS2-The content and properties of a revised and expanded arthritis impact measurement scales health-status questionnaire. Arthritis and Rheumatism. 1992; 35:1–10. [PubMed: 1731806]

Meichenbaum, DH.; Turk, DC.; Genest, M. Pain and Behavioral Medicine: A Cognitive-Behavioral Perspective. Guilford Press; New York: 1983.

Meyer T, Cooper J, Raspe H. Disabling low back pain and depressive symptoms in the community-dwelling elderly: a prospective study. Spine. 2007; 32(21):2380–2386. [PubMed: 17906583]

Nesselroade JR. Intraindividual variability in development within and between individuals. European Psychologist. 2001; 6:187–193.

Paradowski PT, Englund M, Lohmander LS, Roos EM. The effect of patient characteristics on variability in pain and function over two years in early knee osteoarthritis. Health and quality of life outcomes. 2005; 3(1):59. [PubMed: 16188034]

Pearlin, L. The stress process revisited.. In: Aneshensel, CS.; Phelan, JC., editors. Handbook of the Sociology of Mental Health. Springer US; New York, NY: 1999. p. 395-415.

Pincus T, Morley S. Cognitive-processing bias in chronic pain: a review and integration. Pain. 2001; 127:599–617.

Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. Journal of the American Geriatrics Society. 1975; 23:433. [PubMed: 1159263]

Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. Applied Psychological Measurement. 1977; 1:385–401.

Reid MC, Williams CS, Gill TM. The Relationship Between Psychological Factors and Disabling Musculoskeletal Pain in Community-Dwelling Older Persons. Journal of the American Geriatrics Society. 2003; 51(8):1092–1098. [PubMed: 12890071]

Savelkoul M, Post MWM, De Witte LP, Van Den Borne HB. Social support, coping and subjective well-being in patients with rheumatic diseases. Patient Education and Counseling. 2000; 39(2): 205–218. [PubMed: 11040720]

Schneider S, Junghaenel DU, Keefe FJ, Schwartz JE, Stone AA, Broderick JE. Individual differences in the day-to-day variability of pain, fatigue, and well-being in patients with rheumatic disease: associations with psychological variables. Pain. 2012; 153(4):813–822. [PubMed: 22349917]

Sherman AM. Social relations and depressive symptoms in older adults with knee osteoarthritis. Social Science & Medicine. 2003; 56(2):247–257. [PubMed: 12473311]

Shrout PE, Yager TJ. Reliability and validity of screening scales – Effect of reducing scale length. Journal of Clinical Epidemiology. 1989; 42:69–78. [PubMed: 2913189]

Singer, JD.; Willett, JB. Applied longitudinal data analysis: Modeling change and event occurrence. Oxford university press; 2003.

Strauss E, MacDonald SWS, Hunter MA, Moll A, Hultsch DF. Intraindividual variability in cognitive performance in three groups of older adults: cross-domain links to physical status and self-perceived affect and beliefs. Journal of International Neuropsychological Society. 2002; 8:893–906.

Stump TE, Monahan P, Mchorney CA. Differential item functioning in the short portable mental status questionnaire. Research on Aging. 2005; 27:355–384.

Sullivan MJL, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA, Lefebvre JC. Theoretical perspectives on the relation between catastrophizing and pain. Clinical Journal of Pain. 2001; 17:52–64. [PubMed: 11289089]

Thoits PA. Mechanisms linking social ties and support to physical and mental health. Journal of Health and Social Behavior. 2011; 52(2):145–161. [PubMed: 21673143]

Thomas E, Peat G, Harris L, Wilkie R, Croft PR. The prevalence of pain and pain interference in a general population of older adults: cross-sectional findings from the North Staffordshire Osteoarthritis Project (NorStOP). Pain. 2004; 110(1):361–368. [PubMed: 15275787]

Turk DC, Rudy TE. Cognitive factors and persistent pain: A glimpse into Pandora's Box. Cognitive Therapy and Research. 1992; 16(2):99–122.

Verbrugge LM, Jette AM. The disablement process. Social Science and Medicine. 1994; 38:1–14. [PubMed: 8146699]

Williamson GM, Schulz R. Pain, activity restriction, and symptoms of depression among community-residing elderly adults. Journal of Gerontology. 1992; 47(6):P367–P372. [PubMed: 1430858]

Williamson, GM.; Shaffer, DR. Physical illness and depression in older adults. Springer; US: 2000. The activity restriction model of depressed affect.; p. 173-200.

Willis SL, Tennstedt SL, Marsiske M, Ball K, Elias J, Koepke KM, ACTIVE Study Group. Long-term effects of cognitive training on everyday functional outcomes in older adults. Jama. 2006; 296(23): 2805–2814. [PubMed: 17179457]

Yelin E, Callahan FL. The economic cost and social and psychological impact of musculoskeletal conditions. Arthritis and Rheumatism. 2005; 38:1351–1362. [PubMed: 7575685]

Table 1

Mean and Standard Deviation of Key variables (1 year apart)

Variable	T1	T2	T3	T4
	M (SD)	*M(SD)*	*M(SD)*	*M(SD)*
Age	83.78 (4.55)			
Education	12.52(2.54)			
Health problems	13.7(6.31)			
Cognitive functioning	9.22 (1.54)[a]	9.17 (1.71)	9.18 (1.52)	8.74 (1.98)[a]
Social Support	3.87 (1.7)	3.55 (1.56)	3.72 (1.58)	3.79 (1.62)
Arthritis Pain	10.2 (5.0)	10.02(4.96)	10.2 (5.3)	10.8 (5.6)
Depressive symptoms	19.57 (5.73)[b]	20.03 (6.1)	20.33 (6.14)	21.10 (6.51)[b]
Total	*N*=299	*N*=263	*N*=224	*N*=219

Notes:

[a] Tukey's post hoc test showed a significant differences ($p<.05$) between T1 and T4.

[b] Tukey's post hoc test showed a significant differences ($p<.01$) between T1 and T4.

Table 2

Parameter Estimates for MLM for stability and co-variation of pain and depressive symptoms by cognitive functioning

	Model 1 Depressive Symptoms		Model 2 AR Pain		Model 3 Covariation	
Parameter	**Beta**	**SE**	**Beta**	**SE**	**Beta**	**SE**
Fixed Effects						
Intercept	11.69***	1.18	4.52	1.02	9.86	1.17
BP Pain	–		–		.35***	.05
WP Pain	–		–		−.2**	.13
BP Pain× WP Pain					.03*	.01
COG fixed effect	−.57*	.11	−.23*	0.09	.−34*	.12
BP pain× COG					−.02*	.01
Time fixed effect	.38***	.11	.02	.10	.36***	.11
Covariates						
Health	.39***	.07	.39***	.06	.24***	.07
Gender	2.81***	.59	1.62**	.51	1.69***	.49
Random Effects						
Residual variance	19.98***	1.91	10.89***	.62	8.73***	1.20
Intercept variance	12.05***	0.68	13.65***	1.42	17.96***	.99
COG linear effect on residual	−.13***	.03	−.02	.04	−.15***	.03
Model Fit						
−2 Res Log Likelihood	5964.6		5784.6		5933.0	
AIC	5970.6		5790.6		5939.0	
BIC	5982.4		5784.6		5933.0	

Note. COG: Cognitive function, BP: between person, WP: within person

* $p<.05$

** $p<.01$

*** $p<.001$.

Table 3

Parameter Estimates for MLM for stability and co-variation of pain and depressive symptoms by social support

	Model 1 Depressive		Model 2 AR Pain		Model 3 Co-variation	
Fixed Effects Parameter	**Beta**	**SE**	**Beta**	**SE**	**Beta**	**SE**
Intercept	11.02		3.94***	1.02	9.23***	1.29
BP pain					.37***	.05
WP pain					−.14	.13
BP pain × WP pain					.02*	.01
SS fixed effect	.17	.04	.40***	.10	.57*	.27
BP pain×SS					−.04*	.02
Time fixed effect	.53***	.10	.09	.10	.49***	.10
Covariates						
Health	.41***	.07	.37***	.07	.30***	.07
Gender	2.96***	.62	1.92***	.51	2.33***	.60
Random Effects						
Residual variance	12.37***	1.44	10.90***	.61	12.11***	.68
Residual Intercept variance	21.94***	1.04	13.18***	1.36	19.51***	1.85
SS linear effect on residual	.002	.03	.04	.03	−.01	.03
Model Fit						
−2 Res Log Likelihood	6016.4		5781.3		5984.8	
AIC	6022.4		5787.3		5990.8	
BIC	6016.4		5781.3		5984.8	

Note. SS: Social Support, BP: between person, WP: within person

**p<.01

*p<.05

***p<.001.