

## The Association of Greater Dispositional Optimism With Less Endogenous Pain Facilitation Is Indirectly Transmitted Through Lower Levels of Pain Catastrophizing

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**Abstract:** Dispositional optimism has been shown to beneficially influence various experimental and clinical pain experiences. One possibility that may account for decreased pain sensitivity among individuals who report greater dispositional optimism is less use of maladaptive coping strategies such as pain catastrophizing, a negative cognitive/affective response to pain. An association between dispositional optimism and conditioned pain modulation, a measure of endogenous pain inhibition, has previously been reported. However, it remains to be determined whether dispositional optimism is also associated with temporal summation (TS), a measure of endogenous pain facilitation. The current study examined whether pain catastrophizing mediated the association between dispositional optimism and TS among 140 older, community-dwelling adults with symptomatic knee osteoarthritis. Individuals completed measures of dispositional optimism and pain catastrophizing. TS was then assessed using a tailored heat pain stimulus on the forearm. Greater dispositional optimism was significantly related to lower levels of pain catastrophizing and TS. Bootstrapped confidence intervals revealed that less pain catastrophizing was a significant mediator of the relation between greater dispositional optimism and diminished TS. These findings support the primary role of personality characteristics such as dispositional optimism in the modulation of pain outcomes by abatement of endogenous pain facilitation and less use of catastrophizing.

**Perspective:** Results from this study further support the body of evidence that attests to the beneficial effects of positive personality traits on pain sensitivity and pain processing. Further, this study identified diminished pain catastrophizing as an important mechanism explaining the inverse relation between dispositional optimism and endogenous pain facilitation.

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**Key words:** Optimism, catastrophizing, pain facilitation, temporal summation, osteoarthritis.

**A** growing literature supports the health promoting effects of positive personality traits and emotions.<sup>20,42,46,51</sup> Over the past decade, researchers

have begun to examine the important role of positive personality traits and emotions in explaining individual differences in the experience of acute and chronic

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pain.<sup>22,34,35,67</sup> In particular, dispositional optimism, described as a generalized expectancy of positive outcomes, has been linked with lower reports of clinical pain and less pain-related interference as well as less severe pain elicited in laboratory settings.<sup>9,27,30,39</sup> It has been shown that greater dispositional optimism is associated with higher levels of positive daily mood and fewer pain-related activity limitations in a sample of patients with rheumatoid arthritis.<sup>60</sup> Likewise, studies of psychophysical pain testing have shown that higher levels of dispositional optimism are related to decreased pain severity and distress as well as greater placebo analgesia.<sup>23,24</sup>

It may be that dispositional optimism influences pain responses by altering endogenous pain processing. Conditioned pain modulation (CPM), a measure of central pain inhibition,<sup>15,28,29</sup> and temporal summation (TS) of pain, a measure of central pain facilitation,<sup>54,55,57</sup> are methods frequently incorporated into studies of endogenous pain processing. We recently reported that healthy young adults with higher levels of dispositional optimism demonstrated greater CPM.<sup>27</sup> This suggests that dispositional optimism may attenuate pain severity by engaging endogenous pain inhibition. However, to further test this possibility, it was suggested that future studies examine other endogenous pain processes such as TS. TS results in the perception of increased pain despite constant or even reduced peripheral afferent input and is considered a perceptual manifestation of enhanced central excitability.<sup>57</sup>

Hood et al<sup>30</sup> have reported that pain catastrophizing, an exaggerated negative response to actual or anticipated pain,<sup>58,59</sup> mediated the association between dispositional optimism and reports of cold pressor pain severity. More specifically, greater dispositional optimism was associated with lower levels of pain catastrophizing, which, in turn, was associated with lower pain severity. Moreover, pain catastrophizing has also been shown to be related to endogenous pain processing, such that pain catastrophizing was predictive of lower pain inhibitory<sup>28</sup> and greater pain facilitatory<sup>16,44</sup> processes in the laboratory. Taken together, it appears that pain catastrophizing may be a viable factor linking dispositional optimism with endogenous pain processes, yet this also remains to be tested. The current study will expand upon the work of Hood et al by examining whether pain catastrophizing also mediates the relationship between dispositional optimism and TS.

The vast majority of studies that have examined the associations between dispositional optimism and pain responses,<sup>23,24,27,30</sup> as well as those studies that examined the associations between pain catastrophizing and endogenous pain processing,<sup>16,28,44</sup> all used young, healthy volunteers. It is unclear whether the findings reported by these studies generalize to populations of older adult with persistent or recurrent pain conditions. If future research reveals similar patterns of associations among dispositional optimism, pain catastrophizing, and endogenous pain processing in older samples of adults with chronic pain, it would be important for validating the clinical relevance of these psychosocial constructs.

The goal of the current study was to test the associations among dispositional optimism, pain catastrophizing, and endogenous pain facilitation (ie, TS) in a sample of older, community-dwelling adults with symptomatic osteoarthritis (OA) of the knee. We tested the following hypotheses: 1) dispositional optimism is significantly and inversely related to pain catastrophizing and TS; 2) pain catastrophizing is significantly and positively associated with TS; 3) pain catastrophizing mediates the association between dispositional optimism and TS; and 4) although not the primary criterion measure in the current study, it was also hypothesized that clinical OA pain severity is significantly related to greater dispositional optimism and lower levels of pain catastrophizing.

## Methods

### Participants

The current study is part of a larger ongoing project (Understanding Pain and Limitations in Osteoarthritic Disease; UPLoad) that aims to enhance the understanding of racial/ethnic differences in pain and limitations among individuals with knee OA. The UPLoad study is a multisite investigation that recruits participants at the University of Florida and the University of Alabama-Birmingham. The individuals described in the current substudy were recruited at both study sites between January 2010 and April 2012. The measures and procedures described below are limited to those involved in the current study. All procedures were reviewed and approved by the University of Florida and University of Alabama-Birmingham Institutional Review Boards. All participants provided informed consent and were compensated for their participation. A portion of this study has previously been presented in abstract form at the 31st annual meeting of the American Pain Society in May 2012.<sup>26</sup>

Participants were 140 older, community-dwelling adults recruited via posted fliers, radio and print media advertisements, orthopedic clinic recruitment, and word-of-mouth referral. Criteria for inclusion into the study were as follows: 1) between 45 and 85 years of age; 2) unilateral or bilateral symptomatic knee OA based upon American College of Rheumatology criteria<sup>1</sup>; and 3) availability to complete the 2-session protocol. Individuals were excluded from participation if they met any of the following criteria: 1) prosthetic knee replacement or other clinically significant surgery to the affected knee; 2) uncontrolled hypertension, heart failure, or history of acute myocardial infarction; 3) peripheral neuropathy; 4) systemic rheumatic disorders including rheumatoid arthritis, systemic lupus erythematosus, and fibromyalgia; 5) chronic daily opioid use; 6) cognitive impairment (Mini-Mental Status Exam [MMSE] score  $\leq 22$ ); 7) excessive anxiety regarding protocol procedures (eg, refusal to complete controlled noxious stimulation procedures); and 8) hospitalization within the preceding year for psychiatric illness. The 140 participants in the current study represent the entire sample of adults with knee OA who met inclusion criteria and were enrolled into the UPLoad study as of April

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