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Smoking Cigarettes as a Coping Strategy for Chronic Pain is Associated with Greater Pain Intensity and Poorer Pain-Related Function

Alexander L. Patterson, Psy.D.¹, Susan Gritzner, M.S.^{2,3}, Michael P. Resnick, M.D.^{1,2}, Steven K. Dobscha, M.D.^{1,2,4}, Dennis C. Turk, Ph.D.⁵, and Benjamin J. Morasco, Ph.D.^{1,2}

¹Mental Health and Clinical Neurosciences Division, Portland VA Medical Center, Portland, Oregon

²Department of Psychiatry, Oregon Health & Science University, Portland, Oregon

³School of Professional Psychology, Pacific University, Hillsboro, Oregon

⁴Center for the Study of Chronic Comorbid Medical and Psychiatric Disorders, Portland VA Medical Center, Portland, Oregon

⁵Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, Washington

Abstract

Smoking cigarettes is prevalent among individuals with chronic pain. Some studies indicate nicotine reduces pain and others suggest it may cause or exacerbate pain. Participants in this cross-sectional study were 151 chronic pain patients from a large, urban VA medical center. Patients were divided into 3 groups: (1) non-smokers, (2) smokers who deny using cigarettes to cope with pain, and (3) smokers who report using cigarettes to cope with pain. Patients who reported smoking as a coping strategy for chronic pain scored significantly worse compared to the other 2 groups on the majority of measures of pain-related outcome. Non-smokers and smokers who denied smoking to cope did not differ on any variable examined. After controlling for the effects of demographic and clinical factors, smoking cigarettes as a coping strategy for pain was significantly and positively associated with pain intensity ($p=0.04$), pain interference ($p=0.005$), and fear of pain ($p=0.04$). In addition to the assessment of general smoking status, a more specific assessment of the chronic pain patient's reasons for smoking may be an important consideration as part of interdisciplinary pain treatment.

Keywords

Smoking; Cigarettes; Chronic Pain; Coping

Correspondence regarding this manuscript may be addressed to: Benjamin Morasco, Ph.D., Portland VA Medical Center, 3710 SW US Veterans Hospital Road, Portland, OR 07239, benjamin.morasco@va.gov.

Disclosures

No other author reports having any potential conflict of interest with this study.

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Introduction

Individuals with chronic pain have high rates of cigarette smoking.^{41,50,52} Some studies estimate the odds of smoking cigarettes among chronic pain patients as more than double compared to the general population.^{31,34,59} The nature of the relationship between nicotine and chronic pain is complex. Smoking cigarettes may serve as a coping strategy to reduce pain, as nicotine has analgesic properties through its action on nicotinic cholinergic receptors that activate inhibitory pain pathways in the central nervous system.³ Nicotine has been demonstrated to have a direct analgesic affect in rodents.^{1,7} Among humans, laboratory studies have found evidence for decreased pain sensitivity among active smokers^{19,47} and among non-smokers who are administered nicotine prior to a painful stimuli.^{32,45} Smoking cigarettes may also reduce the emotional distress associated with chronic pain by shifting attention away from pain sensations.^{10,20}

However, if nicotine use is a coping strategy for chronic pain, the positive benefits appear to be illusory. Smokers with chronic pain report higher pain intensity,^{9,27,30,51,56} increased rates of depression,^{27,28,56} greater interference with life activities due to pain,^{12,56,57} have increased likelihood of pain-related disability,^{22,51} increased opioid use,^{27,34} are at greater risk for suicidal ideation,¹⁴ and have poorer outcome after a pain treatment program,^{13,28} compared to non-smokers with chronic pain.

There are several theories regarding the relationship between cigarette smoking, prevalence of back pain, greater pain-related problems, and poorer chronic pain treatment outcomes. Several large, prospective, epidemiological studies have demonstrated an association between smoking cigarettes in adolescence and the development of low-back pain in adulthood.^{25,38,40,48} Smoking cigarettes is associated with intervertebral disc degeneration through vasoconstriction and increased proteolytic enzyme activity in the vertebral discs,¹⁵ leading to an increased likelihood of chronic low back injury and chronic pain. Coughing associated with persistent smoking may increase the risk of musculoskeletal injury leading to increased pain.^{15,16} Thus, consumption of nicotine may be a predisposing factor contributing to the development of chronic back pain following an initial injury. Also, long-term nicotine use may attenuate the effect of some opioid medications by increasing metabolism and reducing blood levels, leading to less effective analgesia and increased pain.^{2,58} Overall, smoking cigarettes may contribute to the evolution, exacerbation, or maintenance of chronic pain.

The purpose of this study is to explore an additional but not necessarily competitive explanation for the relationship between cigarette smoking and chronic pain. Some patients may use common non-prescribed chemicals, such as alcohol and tobacco, to reduce their pain intensity or temper the emotional distress associated with chronic pain. The term chemical coping has been used to describe the use of medications or substances in nonprescribed ways as a mechanism of coping with stress.⁴³ Although general coping styles are strongly associated with pain-related variables,^{4,8,12,49} little is known about variables associated with chemical coping in particular, and how they may influence pain-related functioning. To shed light on these questions, we sought to examine the relationship between smoking cigarettes to cope with pain and pain-related variables. In this paper we explored three research questions: (1) Is there a significant proportion of chronic pain patients who consciously use cigarettes as a mechanism to cope with pain; (2) Are there significant differences on measures of pain-related outcome between chronic pain patients who use cigarettes to cope with pain and other chronic pain patients; and (3) Can the use of cigarettes to cope with pain predict meaningful aspects of pain-related functioning. Investigation of these research questions will help clarify the extent to which coping with cigarettes is associated with pain-related variables.

Materials and Methods

This study was approved by the Institutional Review Board at the Portland VA Medical Center, and all participants provided written informed consent.

Participants

This cross-sectional study was conducted at a large, urban, Department of Veterans Affairs Medical Center. Data were collected as part of a larger research study investigating the relationship between chronic pain, hepatitis C virus (HCV) infection, and substance use disorders. Participants were recruited into the study by means of posted advertisements in the hospital, letters sent to patients who had a pending appointment in primary care, announcements made in mental health classes, and referral from patients being seen in a hepatology clinic. Inclusion criteria for the study were at least 18 years of age, English-speaking, and current diagnosis of a chronic non-cancer pain condition per patient self-report (and confirmed using diagnoses from the electronic medical record). As noted, this study was part of a larger study examining chronic pain in patients with HCV; therefore, to be included patients must have a history of being tested for HCV, and both HCV positive and HCV negative patients were included. Exclusion criteria were over 70 years of age, pending litigation or disability compensation for pain, severe liver disease, current suicidal ideation, or other serious psychiatric conditions such as untreated schizophrenia or bipolar disorder.

Data Collection

Participants completed a packet of measures including demographic and self-report questionnaires. Pain, substance use, and psychiatric diagnoses were identified in the electronic medical record using ICD-9-CM codes recorded in the Veterans Integrated Service Network-20 Data Warehouse over a period of five years prior to the study assessment. The Data Warehouse is a centralized database that retrieves clinical data from several regional VA medical facilities and two national VA databases. The database is updated on a nightly basis and studies of the VA databases have found good reliability for diagnostic information.⁴⁶

Measures

Current smoking status was assessed through a single self-report question (yes/no). Participants who endorsed this item were asked how many cigarettes they currently smoke per day. Smoking to cope with chronic pain was assessed through a yes/no response to the question: "Have you ever smoked cigarettes to help cope with pain?" We also used 1 item from the Fagerstrom Test of Nicotine Dependence²³ to assess tobacco dependence: "How soon after waking do you have your first cigarette" (yes/no within 30 minutes). Individuals who smoke within 30 minutes of waking have higher general blood levels of carbon monoxide, cotinine and nicotine, and positive endorsement of this item is associated with greater nicotine dependence.²⁴

The Multidimensional Pain Inventory (MPI)³⁶ is a frequently used measure in research on chronic pain. Its reliability and validity has been supported in a large number of studies. The MPI includes subscales measuring subjective pain intensity (Pain Severity), interference of pain with day-to-day activities (Interference), influence of pain over the patient's sense of control over life events (Life Control), negative emotions as a result of pain (Affective Distress), and degree of involvement in pain-related problems by the patients spouse or significant other (Support). The measure also provides subscales measuring responses to pain provided by significant others and the patient's ability to engage in a variety of specific

activities of daily living (these latter scales were excluded from the present analysis for parsimony).

The Pain Anxiety Symptoms Scale (PASS-20)³⁹ is a brief, valid, and reliable questionnaire designed to assess the degree of anxiety and fear experienced by chronic pain patients because of pain. It includes subscales measuring cognitive, behavioral, and emotional symptoms, and a total score measuring overall pain-related anxiety and fear.

The Chronic Pain Coping Inventory (CPCI)³³ is a reliable and valid self-report questionnaire designed to measure aspects of pain-related coping. It yields 7 subscale scores, each corresponding with a distinct coping strategy. Three scales are “illness-focused” (Guarding, Resting, Asking for Assistance), 3 are “wellness-focused” (Relaxation, Task Persistence, Exercise/Stretch), and 1 “other” (Seeking Social Support). The illness-focused scales are associated with less activity and more pain-related dysfunction, while the wellness-focused scales are associated with greater activity and less dysfunction.³²

The Beck Depression Inventory, Second Edition (BDI-II)⁵ is a self-report questionnaire designed to measure depression symptoms. Higher scores indicate more severe symptoms. Studies support the validity and reliability of the BDI-II for use with chronic pain patients.^{18,22}

The Generalized Anxiety Disorder Scale (GAD-7)⁵⁴ is a reliable and valid measure that assesses for the presence of generalized anxiety disorder, with higher scores indicating more severe symptoms. Scores on the GAD-7 are also strongly correlated with measures of other anxiety disorders including posttraumatic stress disorder, panic disorder, and social anxiety disorder.³⁷

The TimeLine Follow-Back (TLFB)⁵³ was used to assess use of prescription opioids in the 30 days prior to the study assessment. The TLFB is a reliable, valid, and standardized tool that uses calendar prompts to track the frequency of self-reported use of different substances.²⁵

Data Analysis

Participants were divided into 3 groups based upon their response to the smoking items on the demographic questionnaire: (1) non-Smokers, (2) smokers who denied using cigarettes to cope with pain (Smoke No-Cope), and (3) smokers who reported using cigarettes to cope with pain (Smoke-Cope). Self-report demographic and psychiatric/substance use data were analyzed and the 3 groups were compared using analysis of variance (ANOVA) for linear variables and chi-square tests for categorical variables. A series of ANOVAs were used to analyze between group differences on measures of pain and psychiatric functioning. When significant differences were found, Tukey post-hoc tests were conducted to determine directionality.

Linear regression analyses were conducted to evaluate which variables were associated with specific dimensions of pain and pain-related functioning. Separate models were conducted to examine pain intensity, pain interference, and fear of pain. The dependent variables chosen to represent these dimensions were the Pain Severity subscale from the MPI (pain intensity), Interference subscale from the MPI (pain interference), and total score from the PASS-20 (fear of pain). Independent variables were selected for inclusion in the 3 regression models based upon their relationship with pain-related outcomes; they included age, gender, pain severity (only included for the pain interference and fear of pain models), prescription opioid use in previous 30 days, depressive symptoms, and whether participants smoked cigarettes to cope with pain. Non-Smokers and Smoke No-Cope were combined into 1

group for these analyses and compared to the Smoke-Cope group. This aggregation was done because Non-Smokers and Smoke No-Cope did not significantly differ on any demographic characteristics, pain outcome measures, or psychiatric symptom severity; and to obtain a binary variable that directly measures cigarettes to cope with pain without excluding Non-Smokers from the analysis. The Cigarettes to Cope with Pain variable was entered last into the equations to model the amount of variance in pain-related functioning associated with coping with cigarettes after controlling for the other variables. All analyses were conducted with the Statistical Package for the Social Sciences (SPSS, version 17.0). In order to control for multiple comparisons, results were considered statistically significant when $p \leq 0.01$.

Results

Participants

A total of 151 chronic non-cancer pain patients met inclusion criteria and participated in the study. Participants were predominantly male (92.1%), Caucasian (74.8%), divorced/separated (51.0%), unemployed (33.8%) or receiving disability (40.4%), and middle-aged ($M = 54.2$, $SD = 8.8$). Of those who were self-reported smokers ($n = 79$, 52.3%), 40 (50.6%) denied using cigarettes to cope with pain, and 39 (49.4%) reported using cigarettes to cope with pain. No significant differences were found between the 3 groups on demographic characteristics with the exception of marital status ($\chi^2(6) = 15.67$, $p = 0.02$), and Non-Smokers were less likely to have a substance use disorder in the 5 years prior to the study evaluation ($\chi^2(2) = 6.30$, $p = 0.04$). All participants self-reported a pain diagnosis, and review of the medical records confirmed that all had one or more pain diagnoses. The most common diagnoses in the medical record were chronic neck or joint pain (72.8%), chronic low-back (58.9%), and rheumatism/arthritis (54.3%). There were no significant differences between groups on pain diagnoses. Detailed demographic and clinical diagnostic data are displayed in Table 1.

Between Group Differences on Smoking, Pain, and Psychiatric Data

The Smoke-Cope group did not differ from the Smoke No-Cope group on the estimated mean number of cigarettes smoked per day (12.7 versus 13.5, $p = 0.63$) or percentage who smoked within 30 minutes of waking (78.9% versus 59.3%, $p = 0.09$). Statistically significant differences were found between the 3 groups on the pain interference and support subscales of the MPI. Post-hoc testing revealed that the Smoke-Cope group scored significantly worse than the other 2 groups on both of these subscales. The Smoke No-Cope group did not differ from Non-Smokers on any subscale score of the MPI (Table 2).

The 3 groups also had statistically significant differences on 3 of the 4 subscales and Total Score of the PASS-20. Post-hoc testing revealed that the Smoke-Cope group scored significantly worse than the other 2 groups on Cognitive, Fear, and Physiological subscales, and on the Total Score. Smoke No-Cope did not differ from Non-Smokers on any subscale score of the PASS-20 (Table 2).

Statistically significant between-group differences were detected on 2 of the subscales of the CPCI. Post-hoc testing revealed that participants in the Smoke-Cope group endorsed more use of Coping Self-Statements compared to the other 2 groups, and more use of Relaxation than participants in the Smoke No-Cope group (Table 3).

There were no significant differences between the 3 groups on current symptoms of depression or anxiety, as assessed by the BDI-II and GAD-7.

Factors associated with Pain Intensity, Pain Interference, and Fear of Pain

Table 4 displays the results of the linear regression analyses modeling the relationship between demographic, clinical, and psychosocial variables and pain outcome variables. In the first model, which examined factors associated with pain intensity, the overall model was significant, $F(1,146) = 7.68, p < 0.001$, and accounted for 20% of the variance in the pain intensity. Statistically significant variables included prescription opioid use in the previous 30 days, depressive symptoms, and smoking cigarettes to cope with pain. In the second model, which examined factors associated with pain interference, the overall model was significant, $F(1,145) = 36.05, p < 0.001$, and accounted for 62% of the variance in pain interference. Statistically significant variables included age, pain severity, prescription opioid use in the previous 30 days, depressive symptoms, and smoking cigarettes to cope with pain. In the third model, which examined factors associated with fear of pain, the overall model was significant, $F(1,145) = 12.36, p < 0.001$, and accounted for 34% of the variance in fear of pain. Statistically significant variables included pain severity, depressive symptoms, and smoking cigarettes to cope with pain.

Discussion

In this study we examined the associations between cigarette use and chronic pain by assessing whether smoking cigarettes as a method for coping with pain is associated with pain-related variables. We analyzed 3 groups of patients with chronic pain (non-smokers, smokers who deny using cigarettes to cope with pain, and smokers who report using cigarettes to cope with pain) and found that the purposeful use of smoking cigarettes as a coping strategy for chronic pain was associated with greater pain intensity and poorer pain-related functioning. Participants who denied smoking cigarettes as a strategy to cope with pain had similar pain-related outcomes as non-smokers. Regression analyses revealed that endorsing the use of cigarettes as a coping strategy for pain was significantly and positively associated with more pain intensity, poorer pain-related function, and more fear of pain. These associations were found even after controlling for relevant demographic characteristics, pain-related variables, depressive symptoms, and prescription opioid use. Overall, our findings suggest that the use of smoking cigarettes to cope with chronic pain is associated with a constellation of pain-related problems.

Parrott (1999)⁴² suggested that increased psychological and physiological pain symptoms among persistent smokers may be caused by the experience of frequent withdrawal symptoms. Therefore, poorer pain-related outcome among individuals who smoke cigarettes to cope with pain could be a reflection of greater underlying nicotine dependence. However, in our sample there were no significant differences between the 2 smoking groups in their frequency of nicotine consumption or severity of nicotine dependence. Therefore, the differences in pain-related outcome between the 2 smoking groups were likely not related to the frequency of withdrawal symptoms. It has also been suggested that differences in pain-related outcome between smokers and non-smokers could be explained by the higher prevalence of depression among smokers.²⁷ In our sample there were no significant differences between groups on self-report measures of depression or anxiety, or in terms of clinical diagnoses. Last, it is important to note that smokers who denied using cigarettes to cope with pain did not differ from non-smokers on measures of pain-related outcome, psychiatric symptoms, or opioid use. Therefore, among the patients in our sample, as long as the smoker was not consciously using cigarettes to cope with pain, no significant relationship existed between smoking status and pain-related variables.

Significant differences were found between the two cigarette smoking groups on measures of pain-related outcome, despite the fact that no significant differences were found in opioid use or patterns of nicotine consumption. Therefore, nicotine-induced attenuation of opioid

analgesia was likely not the cause of poorer pain-related outcome in our sample, as has been suggested in prior studies.^{2,58} The rewarding properties of nicotine may be related to the stimulation of endogenous opioids,⁴⁴ and it is possible that smoking to manage stress is more prevalent among individuals who build tolerance to this effect. Although we did not measure endogenous opioids in this study, the lack of significant differences in prescription opioid use between all three groups (both smoking and non-smoking) suggests that, in our sample, opioid-related variables may not be related to smoking status or coping with cigarettes. However, a systematic investigation controlling for opioid dose and endogenous opioid levels is needed to confirm this supposition.

The use of nicotine to cope with a distressing state has been studied and described in various terms in the scientific literature. Individuals with depression, anxiety, and particularly attention-deficit hyperactivity disorder may smoke cigarettes as a means of symptom reduction or stabilization, e.g. “self-medication.”¹⁷ A longitudinal study of 662 adolescents attempted to directly investigate self-medication of depression with cigarettes through use of a self-medication scale.⁶ The study found that smokers with higher self-medication scores had increased depression symptom severity, but more symptom stability, as compared to both non-smokers and smokers with low self-medication scores. The authors theorized that self-medication with cigarettes may be a trade-off between overall increased depression severity but greater long-term symptom stability. The findings of this study have similarities with the current study, and although we were not able to measure variation in pain severity over time, it is possible that smoking cigarettes may produce a similar trade-off when used to self-medicate symptoms of chronic pain.

Analyses of the different coping styles between the 3 groups provided mixed results. Although our findings suggest that smoking cigarettes to cope with pain is associated with poorer pain-related outcomes, we also found that smokers who used cigarettes to cope with pain endorsed higher scores on CPCI wellness-focused subscales assessing the use of relaxation and coping self-statements. It is possible that individuals who smoke cigarettes to help cope with chronic pain view smoking cigarettes as an active, purposeful coping mechanism that can provide relaxation and decrease pain-related anxiety. However, in the context of our study findings, this may be a misconception, or at least a fleeting phenomenon.

Individuals who are more pre-occupied with pain may have been more likely to report using cigarettes to cope with pain, and also may have scored worse on the pain measures. Therefore, the lower scores on pain-related function in the smoke-cope group may be less related to the conscious use of cigarettes to cope with pain, and more related to the mediating effect of preoccupation with pain. Although a causal relationship cannot be proven using our study design, smoking cigarettes as a mechanism to cope with pain appears to be associated with greater pain intensity and impairment. Longitudinal research is needed to clarify the interrelationships between cigarette use, coping, and pain-related function.

There are several limitations to this study. The cross-sectional design prevented us from determining causality. We used a single item self-report question to assess coping with pain with cigarettes, which has face validity, but may be only a gross proxy. To follow up on our results, studies should use more comprehensive self-report measures and biological markers of smoking status and behaviors (e.g., expired carbon monoxide). Studies that measure biological variables, such as endogenous opioid levels, may also help determine whether membership in a certain smoking group is associated with a particular chronic pain-smoking phenotype. Also, rather than relying on self-report measures of pain intensity, it may be valuable to measure this variable via quantitative sensory testing. Other limitations relate to the generalizability of our sample. All participants were veterans recruited from a single VA

medical center, were predominantly male, middle to older age, and overrepresented by individuals who have the hepatitis C virus and a history of psychiatric and substance use disorders. Our sample also had average pain severity scores in the mild-to-moderate range, so the results may not generalize to those with severe pain.

Despite these limitations, the results of this study may have important clinical implications. Coping strategies for pain are a common focus of interdisciplinary pain treatment programs. However, it is doubtful if much attention is given to the use of smoking cigarettes as a coping strategy for pain and how this may be associated with pain-related function. Our results suggest that smoking cigarettes to cope with pain is associated with poorer pain-related outcome. Therefore, as part of a multidisciplinary pain treatment approach it may be important to assess if a patient is using cigarettes as a coping strategy for pain (in addition to assessing smoking status more generally). Patients who answer in the affirmative may benefit from interventions focused on reducing the use of cigarettes as a coping mechanism and increasing the use of alternative positive, effortful, self-initiated coping strategies (e.g., cognitive self-talk, exercise, relaxation).

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References

1. Aceto MD, Bagley RS, Dewey WL, Martin BR. The spinal cord as a major site for the antinociceptive action of nicotine in the rat. *Neuropharmacology*. 1986; 25:1031–1036. [PubMed: 3774124]
2. Ackerman WE, Ahmad M. Effect of cigarette smoking on serum hydrocodone levels in chronic pain patients. *J Ark Med So*. 2007; 104:19–21.
3. Benowitz NL. Nicotine and postoperative management of pain. *Anesth Analg*. 2007; 107:739–741. [PubMed: 18713874]
4. Brown GK, Nicassio PM. Development of a questionnaire for the assessment of active and passive coping strategies in chronic pain patients. *Pain*. 1987; 31:53–64. [PubMed: 3696743]
5. Beck, AT.; Steer, RA.; Brown, GK. Manual for the Beck Depression Inventory-II. Psychological Corp; San Antonio: 1996.
6. Chaiton M, Cohen J, O'Loughlin J, Rehm J. Use of cigarettes to improve affect and depressive symptoms in a longitudinal study of adolescents. *Addict Behav*. 2010; 35:1054–1060. [PubMed: 20691543]
7. Cooley JE, Villarosa GA, Lombardo TW, Moss RA, Fowler SC, Sult S. Effect of pCPA on nicotine-induced analgesia. *Pharmac Biochem Behav*. 1985; 36:413–415.
8. Covic T, Adamson B, Hough M. The impact of passive coping on rheumatoid arthritis pain. *Rheumatology*. 2000; 39:1027–1030. [PubMed: 10986310]
9. Daniel M, Keefe FJ, Lyna P, Peterson C, Garst J, Kelley M, Bepko G, Bastian LA. Persistent smoking after a diagnosis of lung cancer is associated with higher reported pain levels. *J Pain*. 2009; 10:323–328. [PubMed: 19254679]
10. Ditte JW, Brandon TH. Pain as a motivator of smoking: effects of pain induction on smoking urge and behavior. *J Abnorm Psychol*. 2008; 117:467–472. [PubMed: 18489224]

11. Erikson W, Natvig B, Rutle O, Bruusgaard D. Smoking and the functional status of young adults. *Scand J Prim Health Care*. 1998; 17:174–179.
12. Ersek M, Turner JA, Kemp CA. Use of the chronic pain coping inventory to assess older adults' pain coping strategies. *J Pain*. 2006; 7:833–842. [PubMed: 17074625]
13. Fishbain DA, Lewis JE, Cutler R, Cole B, Rosomoff RS, Rosomoff HL. Does smoking status affect multidisciplinary pain facility treatment outcome? *Pain Med*. 2008; 9:1081–1090. [PubMed: 19067831]
14. Fishbain DA, Lewis JE, Gao J, Cole B, Steele Rosomoff R. Are chronic low back pain patients who smoke at greater risk for suicide ideation? *Pain Med*. 2009; 10:340–346. [PubMed: 19254332]
15. Fogelholm RR, Alho AV. Smoking and intervertebral disc degeneration. *Med Hypotheses*. 2001; 56:537–539. [PubMed: 11339862]
16. Frymoyer JW, Pope MH, Costanza MC, Rosen JC, Goggin JE, Wilder DG. Epidemiologic studies of low-back pain. *Spine*. 1980; 5:419–423. [PubMed: 6450452]
17. Gehricke JG, Loughlin SE, Whalen CK, Potkin SG, Fallon JH, Jamner LD, Belluzzi JD, Leslie FM. Smoking to self-medicate attentional and emotional dysfunctions. *Nicotine Tob Res*. 2007; 9:S523–536. [PubMed: 18067030]
18. Giesser ME, Roth RS, Robinson ME. Assessing depression among persons with chronic pain using the Center for Epidemiological Studies-Depression Scale and the Beck Depression Inventory: a comparative analysis. *Clin J Pain*. 1997; 13:163–170. [PubMed: 9186024]
19. Girdler SS, Maixner W, Naftel HA, Stewart PW, Moretz RL, Light KC. Cigarette smoking, stress-induced analgesia, and pain perception in men and women. *Pain*. 2005; 114:372–385. [PubMed: 15777863]
20. Gonzalez A, Hogan J, McLeish AC, Zvolensky MJ. An evaluation of pain-related anxiety among daily cigarette smokers in terms of negative and positive reinforcement smoking outcome expectancies. *Addict Behav*. 2010; 35:553–557. [PubMed: 20153120]
21. Hagen KB, Tambs K, Bjerkedal T. A prospective cohort study of risk factors for disability retirement because of back pain in the general working population. *Spine*. 2002; 27:1790–1796. [PubMed: 12195073]
22. Harris CA, D'Eon JL. Psychometric properties of the Beck Depression Inventory--second edition (BDI-II) in individuals with chronic pain. *Pain*. 2008; 137:609–622. [PubMed: 18079063]
23. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. *Br J Addict*. 1991; 86:1119–1127. [PubMed: 1932883]
24. Heatherton TF, Kozlowski LT, Frecker RC, Rickert W, Robinson J. Measuring the heaviness of smoking: using self-reported time to the first cigarette of the day and number of cigarettes smoked per day. *Br J Addict*. 1989; 84:791–799. [PubMed: 2758152]
25. Hellsing A, Bryngelsson I. Predictors of musculoskeletal pain in men: a twenty-year follow-up from examination at enlistment. *Spine*. 2000; 25:3080–3086. [PubMed: 11145820]
26. Hersh D, Mulgrew CL, Van Kirk J, Kranzler HR. The validity of self-reported cocaine use in two groups of cocaine abusers. *J Consult Clin Psychol*. 1999; 67:37–42. [PubMed: 10028207]
27. Hooten WM, Shi Y, Gazelka HM, Warnder DO. The effects of depression and smoking on pain severity and opioid use in patients with chronic pain. *Pain*. 2011; 152:223–229. [PubMed: 21126821]
28. Hooten WM, Townsend CO, Bruce BK, Warner DO. The effects of smoking status on opioid tapering among patients with chronic pain. *Anesth Analg*. 2009; 108:308–15. [PubMed: 19095867]
29. Hooten WM, Townsend CO, Bruce BK, Schmidt JE, Kerkvliet JL, Patten CA, Warner DO. Effects of smoking status on immediate treatment outcomes of multidisciplinary pain rehabilitation. *Pain Med*. 2009; 10:347–355. [PubMed: 18721171]
30. Jakobsson U. Tobacco use in relation to chronic pain: results from a Swedish population survey. *Pain Med*. 2008; 9:1091–1097. [PubMed: 18565000]
31. Jamison RN, Stetson BA, Parris WC. The relationship between cigarette smoking and chronic low back pain. *Addict Behav*. 1991; 16:103–110. [PubMed: 1829566]

32. Jamner LD, Girdler SS, Shapiro D, Jarvik ME. Pain inhibition, nicotine, and gender. *Exp Clin Psychopharmacol.* 1998; 6:96–106. [PubMed: 9526150]
33. Jensen MP, Turner JA, Romano JM, Strom SE. The Chronic Pain Coping Inventory: development and preliminary validation. *Pain.* 1995; 60:203–216. [PubMed: 7784106]
34. John U, Alte D, Hanke M, Meyer C, Volzke J, Schumann A. Tobacco smoking in relation to analgesic drug use in a national adult population sample. *Drug Alcohol Depend.* 2006; 85:49–55. [PubMed: 16675161]
35. John U, Meyer C, Rumpf H, Hapke U. Nicotine dependence criteria and nicotine withdrawal symptoms in relation to pain among an adult general population sample. *Eur J Pain.* 2009; 13:82–88. [PubMed: 18436459]
36. Kerns RD, Turk DC, Rudy TE. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). *Pain.* 1985; 23:345–356. [PubMed: 4088697]
37. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med.* 2007; 146:317–327. [PubMed: 17339617]
38. Mattila VM, Saarni L, Parkkari J, Koivusilta L, Rimpela A. Predictors of low back pain hospitalization – a prospective follow-up of 57,408 adolescents. *Pain.* 2008; 139:209–217. [PubMed: 18472217]
39. McCracken LM, Dhingra L. A short version of the Pain Anxiety Symptoms Scale (PASS-20): preliminary development and validity. *Pain Res Manage.* 2002; 7:45–50.
40. Mikkonen P, Leino-Arjas P, Remes J, Zitting P, Taimela S, Karppinen J. Is smoking a risk factor for low back pain in adolescents? A prospective cohort study. *Spine.* 2008; 33:527–32. [PubMed: 18317198]
41. Palmer KT, Syddall H, Cooper C, Coggon D. Smoking and musculoskeletal disorders: findings from a British national survey. *Ann Rheum Dis.* 2011; 62:33–36. [PubMed: 12480666]
42. Parrott AC. Does cigarette smoking cause stress? *Am Psychol.* 1999; 54:817–820. [PubMed: 10540594]
43. Passik, SD.; Kirsh, KL. Chemical coping: the clinical middle ground. In: Smith, HS.; Passik, SD., editors. *Pain and Chemical Dependency.* Oxford University Press; New York: 2008. p. 299–302.
44. Pomerleau OF. Endogenous opioids and smoking: a review of progress and problems. *Psychoneuroendocrinology.* 1998; 23:115–30. [PubMed: 9621393]
45. Perkins KA, Grobe JE, Stiller RL, Scierka A, Goettler J, Reynolds W, Jennings JR. Effects of nicotine on thermal pain detection in humans. *Exp Clin Psychopharmacol.* 1994; 2:95–106.
46. Petersen LA, Wright S, Normand SL, Daley J. Positive predictive value of the diagnosis of acute myocardial infarction in an administrative database. *J Gen Intern Med.* 1999; 14:555–558. [PubMed: 10491245]
47. Pomerleau OF, Turk DC, Fertig JB. The effects of cigarette smoking on pain and anxiety. *Addict Behav.* 1984; 9:265–271. [PubMed: 6496202]
48. Power C, Frank J, Hertzman C, Schierhout G, Li L. Predictors of low back pain onset in a prospective British study. *Am J Public Health.* 2001; 91:1671–1678. [PubMed: 11574334]
49. Samwel HJ, Evers AW, Crul BJ, Kraaimaat FW. The role of helplessness, fear of pain, and passive pain-coping in chronic pain patients. *Clin J Pain.* 2006; 22:245–251. [PubMed: 16514324]
50. Scott SC, Goldberg MS, Mayo NE, Stock SR, Poitras B. The association between cigarette smoking and back pain in adults. *Spine.* 1999; 24:1090–1098. [PubMed: 10361658]
51. Shi Y, Weingarten TN, Mantilla CB, Hooten WM, Warner DO. Smoking and pain: pathophysiology and clinical implications. *Anesthesiology.* 2010; 113:977–992. [PubMed: 20864835]
52. Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between smoking and low back pain: a meta-analysis. *Am J Med.* 2010; 123:E7–E35. [PubMed: 20102998]
53. Sobell, LC.; Sobell, MB. Timeline follow-back: a technique for assessing self-reported alcohol consumption. In: Litton, RZ.; Allen, JP., editors. *Measuring alcohol consumption: Psychosocial and biochemical methods.* Human Press; New Jersey: 1992. p. 41–42.

54. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* 2006; 166:1092–1097. [PubMed: 16717171]
55. Steer RA, Ball R, Ranieri WF. Further evidence for the construct validity of the Beck Depression Inventory-II with psychiatric outpatients. *Psychol Rep.* 1997; 80:443–446. [PubMed: 9129364]
56. Weingarten TN, Moeschler SM, Ptaszynski AE, Hooten WM, Beebe TJ, Warner DO. An assessment of the association between smoking status, pain intensity, and functional interference in patients with chronic pain. *Pain Physician.* 2008; 11:643–653. [PubMed: 18850028]
57. Yunus MB, Arslan S, Aldag JC. Relationship between fibromyalgia features and smoking. *Scand J Rheumatol.* 2002; 31:301–305. [PubMed: 12455822]
58. Zarrindast MR, Khoshayand MR, Shafaghi B. The development of cross-tolerance between morphine and nicotine in mice. *Eur Neuropsychopharmacol.* 1999; 9:227–233. [PubMed: 10208292]
59. Zvolensky MJ, McMillan K, Gonzalez A, Asmundson GJ. Chronic musculoskeletal pain and cigarette smoking among a representative sample of Canadian adolescents and adults. *Addict Behav.* 2010; 35:1008–1012. [PubMed: 20621422]

Perspective

This paper describes the relationship between smoking cigarettes as a mechanism to cope with chronic pain and pain-related outcome. Understanding this relationship may illuminate the broader relationship between smoking and chronic pain and provide new directions for effective interdisciplinary pain treatment.

Table 1

Demographic characteristics and clinical factors of chronic pain patients based on smoking status (n=151).

Variable	Non-Smoker (n=72)	Smoke-No Cope (n=40)	Smoke-Cope (n=39)	p-value
	Mean (SD)			
Age	54.2 (10.3)	53.1 (8.4)	55.4 (5.4)	
Years of Education	13.6 (2.6)	13.8 (3.1)	13.4 (2.9)	0.84
	Number (%)			
Male Gender	67 (93.1)	36 (90.0)	36 (92.3)	0.85
Marital Status				0.02
Single	11 (15.3)	4 (10.0)	11 (28.9)	
Married	26 (36.1)	8 (20.0)	6 (15.0)	
Divorced/Separated	33 (45.8)	27 (67.5)	17 (44.7)	
Widowed	2 (2.8)	1 (2.5)	4 (10.5)	
Ethnicity – Caucasian	53 (73.6)	33 (82.5)	27 (69.2)	0.38
Employment Status				0.36
Employed	16 (22.2)	8 (20.0)	3 (7.7)	
Unemployed	21 (29.2)	14 (35.0)	16 (41.0)	
Disability/Other	35 (48.6)	18 (45.0)	20 (51.3)	
Income less than \$25k	53 (73.6)	28 (70.0)	33 (84.6)	0.28
Pain Diagnoses				
Chronic Neck/Joint	50 (71.4)	31 (81.6)	29 (82.9)	0.31
Chronic Low-Back	40 (57.2)	22 (57.9)	27 (77.1)	0.11
Rheumatism/Arthritis	42 (60.0)	19 (50.0)	21 (60.0)	0.57
Migraine Headache	10 (14.3)	4 (10.5)	9 (25.7)	0.18
Fibromyalgia	8 (11.4)	3 (7.9)	4 (11.4)	0.83
Neuropathy	4 (5.7)	6 (15.8)	1 (2.9)	0.08
Current disability due to pain	26 (36.1)	15 (37.5)	20 (51.3)	0.27
Used prescription opiates in past 30 days	37 (51.4)	16 (40.0)	18 (46.2)	0.51
Mental Health Diagnoses				
Major Depressive Disorder	52 (74.3)	25 (65.8)	29 (82.9)	0.25
Post Traumatic Stress Disorder	20 (28.6)	17 (44.7)	54 (37.8)	0.08
Panic Disorder	7 (10.0)	3 (7.9)	1 (2.9)	0.43
Other Anxiety Disorder	27 (38.6)	15 (39.5)	12 (34.3)	0.88
Dysthymic Disorder	15 (21.4)	7 (18.4)	7 (20.0)	0.93
Bipolar Disorder	13 (18.6)	4 (10.5)	8 (22.9)	0.36
Schizophrenia	3 (4.3)	3 (7.9)	4 (11.4)	0.39
Substance Use Disorder	45 (64.3)	30 (78.9)	30 (85.7)	0.04

Table 2

Comparisons on pain measures, psychiatric measures, and smoking variables based on smoking status (n = 151).

Measure	Non-Smoker (n=72)	Smoke-No Cope (n=40)	Smoke-Cope (n=39)	p-value
Mean (SD)				
Multidimensional Pain Inventory				
Pain severity	3.3 (1.4)	3.5 (1.0) ^a	3.9 (1.1)	0.05
Pain interference	3.8 (1.7) ^a	3.4 (1.4) ^a	4.7 (1.0) ^b	<0.001
Life control	3.3 (1.2)	3.6 (1.1)	2.9 (1.0)	0.03
Affective distress	2.8 (1.2)	2.7 (1.2)	3.4 (1.1)	0.03
Support	4.4 (2.6) ^a	4.2 (2.7) ^a	6.1 (2.5) ^b	0.003
Pain Anxiety Symptoms Scale – 20				
Cognitive	2.6 (1.2) ^a	2.6 (1.3) ^a	3.4 (1.1) ^b	0.001
Escape/avoidance	2.6 (1.5)	2.6 (1.6)	3.1 (0.8)	0.10
Fear	1.5 (1.1) ^a	1.6 (1.3) ^a	2.3 (1.1) ^b	0.01
Physiological	1.6 (1.1) ^a	1.7 (1.3) ^a	2.5 (1.6) ^b	0.003
Total score	2.1 (1.0) ^a	2.1 (1.1) ^a	2.8 (1.0) ^b	0.006
Beck Depression Inventory – II	16.0 (12.4)	15.9 (13.0)	20.4 (11.9)	0.19
Generalized Anxiety Disorder Scale – 7	7.2 (5.9)	7.4 (5.9)	9.8 (6.1)	0.07
Smoking variables				
# Cigarettes per Day	n/a	13.5 (9.1)	12.7 (6.6)	0.63
Smoke first cigarette within 30 minutes of waking	n/a	59.3%	78.9%	0.09

Note. Means with different superscripts differed significantly ($p < 0.05$) in post-hoc testing.

Table 3

Comparisons on methods for coping with pain as measured by the Chronic Pain Coping Inventory (CPCI).

CPCI Subscales	Non-Smoker (n=72)	Smoke-No Cope (n=40)	Smoke-Cope (n=39)	p-value
	Mean (SD)			
Guarding	3.6 (1.9)	3.1 (1.7)	4.0 (1.7)	0.09
Resting	3.7 (1.5)	3.2 (1.2)	4.2 (1.4)	0.02
Asking for Assistance	1.8 (1.8)	1.5 (1.7)	1.8 (1.8)	0.62
Relaxation	2.0 (1.3) ^{a,b}	1.6 (1.2) ^a	2.6 (1.6) ^b	0.01
Task Persistence	3.5 (1.7)	3.9 (1.8)	4.0 (1.5)	0.17
Exercise/Stretch	2.5 (1.9)	2.6 (1.8)	2.5 (1.8)	0.88
Coping Self-Statements	3.0 (2.0) ^a	2.6 (1.6) ^a	3.9 (1.9) ^b	0.01

Note. Means with different superscripts differed significantly ($p < 0.05$) in post-hoc testing.

Table 4

Linear regression analyses examining demographic and clinical factors associated with pain-related variables (n=151).

Variable	Pain Severity Subscale of MPI				Pain Interference Subscale of MPI				PASS-20 total score			
	Beta	R ² change	p-value	Beta	R ² change	p-value	Beta	R ² change	p-value	Beta	R ² change	p-value
Gender	.00	.00	0.93	.00	.00	0.90	-.11	.01	0.19			
Age	.06	.01	0.17	.06	.03	0.04	-.06	.00	0.77			
Pain Severity	N/A	N/A	N/A	.51	.48	<0.001	.35	.24	<0.001			
Prescription Opioid Use in Previous 30 Days	.28	.08	0.004	.24	.04	0.001	-.01	.00	0.61			
Depressive Symptoms	.30	.11	<0.001	.24	.06	<0.001	.32	.10	<0.001			
Cigarettes to Cope with Pain	.16	.03	0.04	.16	.02	0.005	.15	.02	0.04			
Total R ²	.20				.62				<0.001			

Note. MPI = Multidimensional Pain Inventory. PASS-20 = Pain Anxiety Symptom Scale.