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BRIEF REPORT

Associations Between Chronic Pain Status, Attempts to Quit Smoking, and Use of Pharmacotherapy for Smoking Cessation

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Chronic pain and tobacco dependence are two highly prevalent and comorbid conditions, and there is mounting evidence that smokers with comorbid pain may experience greater difficulty when attempting to quit smoking. The main goal of the current study was to examine cross-sectional relations between lifetime chronic pain status, number of past attempts to quit smoking, and past use of pharmacotherapy for smoking cessation. Data were derived from a large, nationally representative survey of households in the continental United States. After adjusting for relevant third variables, analyses revealed that smokers who endorsed lifetime chronic pain were more likely to report having used pharmacotherapy for smoking cessation. Chronic pain status was not associated with number of past attempts to quit smoking. Thus, smokers with chronic pain appear motivated to quit smoking, and may be particularly amenable to pharmacologic intervention.

Keywords: smoking, pharmacotherapy, pain, nicotine, tobacco

Tobacco dependence and chronic pain are two highly prevalent and comorbid conditions that engender substantial burdens upon individuals and health care systems. Although smoking remains the leading preventable cause of morbidity and mortality in the United States, nearly 20% of American adults continue to smoke tobacco (CDC, 2011). Like smoking, chronic pain is a critical national health problem that affects more than 100 million adults (IOM, 2011). Clinical and epidemiological data indicate that the prevalence of smoking among persons in pain may be greater than twice the rate observed in the general population (Ditre, Brandon, Zale, & Meagher, 2011).

Tobacco smoking has been identified as a unique risk factor in the onset and progression of chronic pain (e.g., Shiri, Karppinen, Leino-Arjas, Solovieva, & Vikkari-Juntura, 2010; Sugiyama et al., 2010). Smokers (relative to nonsmokers) also tend to report more severe pain (Ditre, Gonzalez, et al., 2011; Weingarten et al., 2008) and poorer pain-treatment outcomes (Fishbain et al., 2008; Glassman et al., 2007). In addition, pain has been shown to increase desire to smoke (Ditre & Brandon, 2008; Ditre, Heckman, Butts, & Brandon, 2010), greater pain has been associated with increased cigarette consumption (Hahn, Rayens, Kirsh, & Passik, 2006; Riley, Tomar, & Gilbert, 2004; Saag et al., 1997), and pain patients have endorsed tobacco smoking as a means of coping with pain (Hooten et al., 2011; Patterson et al., 2012). To integrate these findings, Ditre, Brandon, Zale, & Meagher (2011) proposed a reciprocal model of pain and smoking, which is hypothesized to act in the manner of a positive feedback loop, resulting in greater pain and the maintenance of tobacco dependence.

Consistent with a reciprocal model of pain and smoking, there is reason to believe that recurring pain may impede smoking cessation. Although there is some evidence that smokers in pain may be willing to consider smoking abstinence (Hahn et al., 2006; Hooten et al., 2009), they also tend to endorse less confidence in quitting (Hooten et al., 2011), greater difficulty when attempting to quit smoking (Waldie, McGee, Reeder, & Poulton, 2008), and poorer abstinence-related outcomes (Waldie et al., 2008). Therefore, smokers with comorbid pain disorders may be hesitant to engage a serious quit attempt, possibly because they anticipate that quitting smoking will be especially difficult.

According to the Clinical Practice Guidelines for Treating Tobacco Use and Dependence, all persons who are attempting to quit smoking should be encouraged to use one or more FDA-approved medications (Fiore et al., 2008). Current first-line pharmacotherapies for smoking cessation include five forms of nicotine replacement therapy (NRT), the antidepressant bupropion (*Zyban*), and the partial nicotine agonist/antagonist varenicline tartrate (*Chantix*). Although these agents tend to be underutilized in the general population (Cokkinides, Ward, Jemal, & Thun, 2005), researchers have suggested that smokers may be more likely to use pharmacotherapy if they anticipate greater difficulty quitting (Shiffman, Di Marino, & Sweeney, 2005). Thus, smokers with chronic pain may be more likely to use pharmacotherapy during a quit attempt, possibly because they anticipate greater difficulty abstaining from tobacco.

Given evidence of complex interactions and significant comorbidity between pain and smoking, it is important to examine how persons with and without a history of comorbid pain may differ in

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their approach to quitting. The main goal of the current study was to examine cross-sectional relations between lifetime chronic pain status (yes/no) and (a) previous attempts to quit smoking, and (b) past use of pharmacotherapy for smoking cessation. Specifically, we hypothesized that persons who endorsed lifetime chronic pain would be (a) less likely to engage in a serious quit attempt, and (b) more likely to use pharmacologic aids for smoking cessation.

Method

Data

Data were derived from the National Comorbidity Survey-Replication (NCS-R), a large-scale and nationally representative field survey of mental health in the United States. Face-to-face diagnostic interviews were conducted with 9,282 English-speaking adults between 2001 and 2003. For a detailed description of survey administration and weighting procedures, see Kessler et al. (2004). The following analyses were restricted to current smokers (n = 1,636).

Measures

Chronic pain. Lifetime chronic pain status was assessed by asking participants whether they ever had any of the following: (1) arthritis/rheumatism, (2) chronic neck or back problems, (3) frequent or severe headaches, and (4) any other chronic pain. Participants were also asked whether they ever had medically unexplained chronic pain (defined as pain lasting at least six months that interfered with daily activities, caused emotional distress, and for which there was no apparent physical cause). Individual responses were condensed into a dichotomous measure of lifetime chronic pain status (0 = *no chronic pain*; 1 = *yes to one or more conditions*).

Attempts to quit smoking. Participants were asked the following: "how many different times did you ever make a serious attempt to quit smoking?" Responses were recorded as a continuous variable.

Use of pharmacotherapy for smoking cessation. Past use of pharmacotherapy for smoking cessation was assessed by asking participants whether they ever used any of the following to help them cut down or quit smoking: (1) nicotine patch or nicotine gum, (2) prescription medication. Responses were dichotomized (0 = *never used pharmacotherapy*; 1 = *used one or more pharmacotherapies*).

Substance use and mood disorders. Both substance use and mood disorders are highly prevalent among both smokers and persons with chronic pain (Ditre, Brandon et al., 2011). Thus, it is important to account for these disorders when examining relations between pain and smoking. The World Health Organization's Composite International Diagnostic Interview (WHO-CIDI; Kessler & Ustun, 2004) was used to assess *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM–IV*) criteria for lifetime Alcohol Abuse/Dependence, Drug Abuse/Dependence, Major Depressive Disorder, Dysthymia, and Generalized Anxiety Disorder. Alcohol and Drug diagnoses were combined into a dichotomous measure of lifetime Substance Use Disorder, and Major Depressive Disorder and Dysthymia diagnoses were combined into a dichotomous measure of lifetime Depressive Disorder.

Data Analytic Approach

All analyses used NCS-R weighting procedures, and Taylor series linearization to adjust for the complex sampling design (Wolter, 1985). All analyses also controlled for potential confounding factors, including relevant sociodemographic variables (age, gender, race/ethnicity, education, income, and marital status), and the presence of lifetime substance use and mood disorders. Linear regression was conducted to test the association between lifetime chronic pain status and number of serious attempts to quit smoking. Multiple logistic regression (further controlling for relevant smoking variables) was conducted to test the association between chronic pain status and past use of pharmacotherapy for smoking cessation. Given that varying degrees of association between pain and smoking have been observed across chronic pain conditions (Ditre, Brandon et al., 2011), we also conducted exploratory follow-up analyses to test relations between chronic pain subtypes and past use of either NRT or prescription cessation medications.

Results

Sample Characteristics

Participants were predominantly white (73%), with a mean age of 41 years (SD = 15.99), and reported smoking an average of 16 cigarettes per day (SD = 12.03) for a mean duration of 20 years (SD = 15.18). As seen in Table 1, smokers who endorsed lifetime chronic pain (vs. no chronic pain) were older ($p < .001$), more likely to be married ($p < .01$), and more likely to meet diagnostic criteria for a mood disorder (ps $< .001$). Current smokers also reported having made an average of 3.54 (SD = 6.87) serious attempts to quit smoking in their lifetime.

Attempts to Quit Smoking

Linear regression revealed that the hypothesized association between chronic pain status and number of serious attempts to quit smoking was not significant, $b = -0.13$, $t(1067) = -0.16$, $p = .75$. This finding indicates that smokers with and without a lifetime history of chronic pain were equally likely to have engaged in a serious quit attempt. Follow-up analyses revealed similar null findings for each chronic pain subtype, including arthritis/rheumatism ($p = .19$), chronic back/neck pain ($p = .55$), frequent/severe headaches ($p = .91$), other chronic pain ($p = .33$), and medically unexplained chronic pain ($p = .36$).

Use of Pharmacotherapy for Smoking Cessation

Consistent with our hypothesis, multiple logistic regression revealed a positive association between chronic pain status and past use of pharmacotherapy for smoking cessation, even after controlling for relevant sociodemographic factors, lifetime substance use and mood disorders, and number of past attempts to quit smoking. As seen in Table 2, smokers who endorsed lifetime chronic pain (vs. no chronic pain) were 57% more likely to have used pharmacotherapy for smoking cessation (95% CI = 1.16–2.14, $p < .01$). Follow-up analyses revealed that smokers who endorsed lifetime chronic pain were more likely to have used nicotine patch or gum

Table 1
Sociodemographic Characteristics, Substance Use and Mood Disorders, Smoking History, and Use of Pharmacotherapy for Smoking Cessation by Lifetime Chronic Pain Status

	No chronic pain *n* (%)	Chronic pain *n* (%)	Total sample *n* (%)
Gender**			
Male	311 (56.6%)	451 (48.4%)	762 (51.8%)
Race/Ethnicity***			
White*	428 (69.6%)	769 (75.2%)	1197 (72.9%)
Black	70 (9.5%)	136 (4.3%)	206 (11.2%)
Hispanic***	57 (15.9%)	57 (8.3%)	114 (11.4%)
Other	35 (5.1%)	73 (4.2%)	108 (4.5%)
Education			
0–11 years	122 (24.7%)	244 (25.7%)	366 (25.3%)
12 years	115 (39.4%)	383 (38.7%)	609 (39.0%)
12–15 years	169 (25.2%)	279 (24.9%)	448 (25.0%)
≥16 years	73 (10.8%)	129 (10.7%)	202 (10.7%)
Marital Status***			
Married/cohabitating**	283 (45.4%)	547 (52.6%)	830 (49.6%)
Divorced/separated/widowed*	113 (20.8%)	289 (26.7%)	402 (24.3%)
Never married*	194 (33.8%)	199 (20.6%)	393 (26.1%)
Substance use disorder	211 (28.4%)	385 (31.0%)	596 (29.9%)
Depressive disorder***	158 (15.7%)	325 (23.4%)	483 (20.2%)
Generalized anxiety disorder***	69 (6.2%)	198 (14.4%)	267 (11%)
Use of pharmacotherapy			
Any pharmacotherapy***	122 (31.8%)	329 (46.0%)	451 (40.6%)
Nicotine patch/gum***	108 (28.6%)	296 (41.2%)	404 (36.4%)
Prescription	570 (13.4%)	130 (17.8%)	179 (16.1%)
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Age***	38.22 (15.72)	43.48 (15.84)	41.30 (15.99)
Income	50,497 (43,426)	49,217 (44,035)	49,908 (43,748)
Cigarettes per day***	14.25 (12.44)	16.80 (11.57)	15.78 (12.03)
Years daily smoking***	18.22 (15.15)	22.69 (14.98)	20.86 (15.18)

Note. Inconsistencies between *n* and % are attributable to effects of the weighting procedure. All *n*s were unweighted. All %s were weighted. Significant differences between lifetime chronic pain vs. no chronic pain: * $p < .05$. ** $p < .01$. *** $p < .001$.

(Adjust Odds Ratio [AOR] = 1.47, 95% CI = 1.09–1.98, $p < .01$), but not prescription cessation medications (AOR = 1.13, 95% CI = 0.74–1.72, $p = .58$). As seen in Table 3, follow-up analyses also revealed that arthritis/rheumatism and frequent/severe headaches were each individually associated with a greater likelihood of having utilized pharmacotherapy to cut down or quit smoking (all *p*s $< .05$). Again, these relations appear to be driven by past use of nicotine patch or gum (all *p*s $< .05$), but not prescription cessation medications (all *p*s $> .17$).

Discussion

Results indicated that current tobacco smokers reported making the same number of serious attempts to quit smoking, regardless of their chronic pain history. However, smokers with a history of lifetime chronic pain (relative to those with no chronic pain) were more likely to have used pharmacotherapy to cut down or quit smoking. Exploratory follow-up analyses revealed significant associations between past use of pharmacotherapy and most chronic pain subtypes (i.e., arthritis/rheumatism, chronic back/neck pain, frequent/severe headaches). Observed associations between chronic pain subtypes and use of pharmacotherapy were primarily attributable to past use of nicotine patch or gum, perhaps because past use of nicotine patch or gum was more common (29%), relative to past use of prescription medication (13%).

With regard to number of past quit attempts, our null finding is somewhat consistent with a previous report that past-week pain symptoms did not influence readiness to quit smoking (Hahn et al., 2006). Importantly, frequency of previous attempts to quit smoking has been shown to predict the likelihood of initiating a future quit attempt (Vangeli, Stapleton, Smit, Borland & West, 2011). Thus, although recurring pain may serve as a barrier to smoking cessation (Ditre, Brandon et al., 2011), there is currently no evidence to suggest that comorbid pain disorders (either current or historical) serve to inhibit readiness to quit smoking or the likelihood of engaging in a serious quit attempt.

With regard to our observed association between lifetime chronic pain status and past use of pharmacotherapy for smoking cessation, it is worth noting that persons who use pharmacotherapies tend to endorse greater nicotine dependence, more severe withdrawal from smoking, and expectations for greater difficulty quitting (Shiffman, Brockwell, Pillitteri, & Gitchell, 2008; Shiffman et al., 2005). There is also evidence that smokers with comorbid pain disorders may be more likely to meet criteria for nicotine dependence (Zvolensky et al., 2009), and

Table 2
Multiple Logistic Regression Analysis of the Association Between Lifetime Chronic Pain and Past Use of Any Pharmacotherapy to Cut Down or Quit Smoking

	Past use of any pharmacotherapy					
	b	*SE*	Wald's χ^2	OR	95% CI	*p*
Primary predictor						
Lifetime chronic pain	0.46	0.16	8.66	1.57	1.16–2.14	.003
Covariates						
Gender (male)	−0.38	0.18	4.44	0.68	0.48–0.97	.04
Race/ethnicity						
Other	—	—	—	—	—	—
White	−0.27	0.41	0.43	0.77	0.34–1.70	.51
Black	−1.03	0.49	4.50	0.36	0.14–0.97	.03
Hispanic	−1.19	0.49	5.87	0.31	0.12–0.80	.02
Education						
0–11 years	—	—	—	—	—	—
12 years	0.32	0.20	2.41	1.37	0.92–2.04	.12
13–15 years	0.23	0.25	0.81	1.26	0.76–2.07	.37
≥ 16 Years	0.56	0.27	4.42	1.76	1.04–2.97	.04
Marital status						
Married	—	—	—	—	—	—
Divorced/widowed/separated	0.05	0.26	0.04	1.05	0.62–1.76	.85
Never married	−0.19	0.27	0.53	0.82	0.49–1.39	.46
Substance use disorder	0.37	0.16	5.32	1.45	1.06–1.99	.02
Depressive disorder	−0.09	0.23	0.15	0.92	0.58–1.44	.70
Generalized anxiety disorder	0.10	0.20	0.24	1.10	0.74–1.64	.62
Age	0.00	0.01	0.03	1.00	0.98–1.03	.87
Income	0.00	0.00	1.92	1.00	1.00–1.00	.17
Number of past quit attempts	0.02	0.01	3.60	1.02	0.99–1.04	.06
Cigarettes per day	0.04	0.01	29.55	1.04	1.03–1.06	<.001
Years daily smoking	0.01	0.01	1.59	1.01	.99–1.03	.21
Overall model evaluation	χ^2	*df*	*p*			
Likelihood ratio test	125.08	18	<.001			
Score test	115.06	18	<.001			
Wald test	417.15	18	<.001			

Note. All degrees of freedom (*df*) = 1, unless otherwise noted. CI = confidence interval; OR = odds ratio; *SE* = standard error.

are less confident in their ability to abstain from smoking (Hooten et al., 2011). Thus, smokers with comorbid pain disorders may be more likely to use pharmacological interventions, possibly because they anticipate greater difficulty abstaining. It may also be possible that smokers with chronic pain are simply more likely to encounter health care providers who recommend or prescribe pharmacotherapies for smoking cessation. Indeed, pain motivates about half of all annual physician visits in the United States (Mayo Clinic, 2001; Turk & Melzack, 2011), and Clinical Practice Guidelines recommend that all persons who are attempting to quit smoking should be encouraged to use one or more FDA-approved pharmacologic aids (Fiore et al., 2008).

To our knowledge, this is the first study to investigate how lifetime chronic pain status may be associated with historical attempts to quit smoking, or past use of pharmacotherapy for

Table 3
Odds of Past Use of Pharmacotherapy to Cut Down or Quit Smoking by Chronic Pain Sub-Type

	Past use of pharmacotherapy		
	Any pharmacotherapy AOR (95% CI)	Nicotine patch/gum AOR (95% CI)	Prescription AOR (95% CI)
Any chronic pain	1.57 (1.16–2.14)**	1.47 (1.09–1.98)**	1.13 (0.74–1.72)
Arthritis/rheumatism	1.50 (1.00–2.26)*	1.55 (1.06–2.27)*	1.32 (0.83–2.09)
Back/neck	1.38 (0.99–1.90)	1.43 (1.08–1.19)**	0.81 (0.61–1.09)
Headaches	1.58 (1.11–2.24)**	1.51 (1.04–2.20)*	1.21 (0.77–1.90)
Medically-unexplained	1.26 (0.63–2.52)	1.40 (0.67–2.92)	1.32 (0.54–2.07)
Other	0.96 (0.59–1.57)	1.03 (0.62–1.69)	1.30 (0.72–2.36)

Note. AOR = odds ratio adjusted for age, gender, race/ethnicity, education, income, marital status, past quit attempts, cigarettes per day, years daily smoking, and substance use, depressive and generalized anxiety disorders; CI = confidence interval.
* $p < .05$. ** $p < .01$.

smoking cessation. Strengths of the current study include the use of data derived from a large, nationally representative sample, and the capacity to account for highly relevant third variables (e.g., co-occurring substance use and mood disorders). However, several limitations bear noting. First, given that both chronic pain and smoking cessation variables were endorsed with regard to lifetime incidence, we are not able to draw inferences regarding temporal precedence. In other words, it is possible that duration of the chronic pain condition did not overlap with either quit attempts or use of pharmacotherapy for smoking cessation. However, because both pain and smoking are generally conceptualized as chronic, relapsing disorders (e.g., Fiore et al., 2008; Von Korff & Simon, 1996), at least some degree of overlap between the two conditions seems likely. Second, because respondents were not asked to report duration of abstinence achieved when using pharmacotherapy, these data cannot speak to the efficacy of cessation medications among persons with a history of chronic pain. Third, our ability to distinguish between pain and medication subtypes may have been hampered by the proportion of respondents who endorsed more than one type of chronic pain (55%), and use of both nicotine patch/gum and prescription medications (30%).

Although these data are cross-sectional and thus preclude inferences regarding causality, nascent findings like these are necessary to guide future research in the emerging area of pain and smoking. It is encouraging to note that a subpopulation of smokers who may be expected to have greater difficulty quitting (i.e., those with chronic pain) appear highly receptive to using first-line agents for smoking cessation. Indeed, these individuals may be receptive to a variety of treatment modalities (Hooten et al., 2009), especially if they come to understand that continued smoking may serve to exacerbate or maintain their pain (Ditre, Brandon et al., 2011). Future research should use a prospective analysis of how persons with chronic pain approach smoking cessation (inclusive of both behavioral and pharmacological interventions) and how chronic pain status/severity may predict cessation-related outcomes.

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