

# Effects of Smoking, Distraction, and Gender on Pain Perception

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*Whereas research on the antinociceptive effects of cigarette smoking has produced inconsistent findings, certain aspects of attentional processing repeatedly have been found to have an impact on pain perception. In an effort to delineate the relation between smoking and pain, the present study tested the attentional mediation model of smoking in pain perception. The authors hypothesized that by narrowing attentional focus, smoking in the presence of a distractor would facilitate distraction from painful stimuli, producing the most pronounced antinociceptive effect, compared with smoking or distraction alone. On the basis of previous findings of gender differences in pain, the authors hypothesized that the effects would vary by gender. The authors used the cold pressor test to assess pain threshold and tolerance in 76 smokers. A 2 (smoking/not smoking) × 2 (distraction/no distraction) × 2 (male/female) between-subjects analysis of variance (ANOVA) yielded Distraction × Gender interactions for pain threshold and pain tolerance. Pain sensitivity was lower in the distraction condition for men only. Whereas the results did not support the attentional mediation model of smoking in pain perception, they highlight the importance of distraction and gender differences in experimental pain.*

**Index Terms:** distraction, gender, pain perception, smoking

A preponderance of evidence from numerous sources, including anecdotal reports, biobehavioral research, and epidemiological data, indicates that there is an association between smoking and pain.<sup>1-3</sup> However, controlled laboratory investigations of the effect of smoking on pain have yielded mixed findings. Although consistently observed in animal research,<sup>4-6</sup> demonstration of nicotine's antinociceptive effect in humans has proven elusive.<sup>7</sup> In a review examining the effect of smoking on pain perception, we found that in approximately two thirds of the studies across a variety of pain-induction procedures,<sup>8-13</sup> the researchers observed a pain-inhibitory effect of nicotine.<sup>7</sup> There are, however, a significant number of studies that failed to observe nicotine-related antinociceptive effects.<sup>14-18</sup>

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In light of these inconsistencies, it has been proposed that the antinociceptive effects of smoking may be achieved indirectly, via its action on other interacting psychological or physiological factors. One factor that has been shown to play a significant role in pain modulation is attention.<sup>19</sup> Based on the information-processing model of scarce attentional resources, distraction-based coping strategies can alter pain perception by "competing for limited attentional resources with nociceptive input."<sup>20-22</sup> Numerous studies support the notion that attentional focus is an important factor in pain perception, with distraction leading to diminished pain.<sup>23-26</sup>

Given the significant role of attention in the mediation of pain perception, examination of nicotine's effects on attentional processes may help elucidate mechanisms underlying smoking's impact on pain. Cigarette smoking may be reinforcing, in part, because of nicotine's ability to enhance cognitive performance.<sup>27-29</sup> In a recent comprehensive review of the literature on smoking and attention, Kassel<sup>29</sup> concluded that nicotine both increases attentional resources and leads to attentional narrowing. Attentional narrowing is

thought to restrict attention to a smaller number of the most immediate cues in the environment. Potential implications of this effect are that distractibility is reduced and selective attention is enhanced.

Kassel and Shiffman<sup>30</sup> and Kassel and Unrod<sup>31</sup> proposed and tested the theory that nicotine's ability to narrow attentional focus may help explain nicotine's inconsistent anxiety-reducing effects. The model proposed that smoking reduces anxiety by constraining smokers' attention to distracting environmental stimuli, thereby diverting smokers' attention away from distressing thoughts. They compared the effect of smoking versus not smoking under conditions of distraction versus no distraction on experimentally stressed smokers in 2 independent studies.<sup>31</sup> Findings in both studies were consistent with the proposed model, such that smoking reduced anxiety only in conjunction with distraction.

Stepped within a theoretical framework previously examined in the context of the smoking and anxiety relationship, our purpose in the present study was to clarify the extent to which smoking, distraction, and the combination of the two, influence pain perception. We tested the hypothesis that nicotine will reduce pain perception through its ability to constrain smokers' attention to a distractor, thereby more effectively diverting attention away from a pain stimulus. More specifically, we hypothesized that smokers who smoke and are distracted will exhibit the least pain sensitivity relative to smokers in all other conditions.

Another important factor in the discussion of pain perception is gender. Gender differences in experimental nociception have been well documented.<sup>7,32-34</sup> However, few studies have examined gender differences in the effect of attentional focus on pain. In one study, men reported less sensory pain when they attended the pain than when they avoided it.<sup>35</sup> This effect was not found in women. The role of gender in the area of smoking and pain is also unknown. The current study sought to examine gender differences in the effect of smoking and attentional focus on pain.

## METHOD

### Participants

We recruited 80 smokers from the introductory psychology subject pool at the University of Florida and the community at large. The Institutional Review Board approved the study, and we collected informed consent from each participant at the outset of participation. Student participants earned class credit, and we paid participants from the community \$15 for their participation. All participants were at least 18 years old and were required to have smoked at least 10 cigarettes a day for a minimum of 1 year and to have smoked regularly (1 or

more cigarettes a day) for at least 2 years. Exclusion criteria to screen for factors that may affect participants' response to the cold pressor test included: (1) history of chronic pain, (2) diabetes mellitus, (3) systemic diseases, and (4) regular use of prescription pain medication.

### Setting and Apparatus

We conducted the experimental sessions between 8:00 AM and 2:00 PM to minimize the nicotine exposure and accumulation that occurs over the course of a day. Sessions took place in a 2.5-m × 3-m room with the participant seated in a comfortable recliner chair. Experimenters were an advanced clinical psychology graduate student and an undergraduate psychology research assistant, both women. The experimenter sat to the left of the participant and moved out of the participant's view during completion of questionnaires. The experimenter escorted participants to a smoking area, where the participants smoked one of their own cigarettes *ad libitum*.

We induced experimental pain using a cold pressor test. The cold pressor is a standardized pain induction technique, commonly used in pain research. We chose this method of pain stimulation because it appears to share some subjective qualities frequently observed in clinical pain patients.<sup>35</sup> Moreover, the cold pressor is more conducive to measuring pain tolerance than thermal stimulation, because there is minimal risk of tissue damage with the former. The apparatus consisted of a cooler fitted with a screened divider separating ice and water. A de bilge pump circulated water in the cooler and maintained the water at a constant temperature of 1 to 3 degrees Celsius.<sup>36</sup>

Modeled after procedures previously employed,<sup>30,37</sup> we also asked half the participants to view a series of art slides and answer the same 4 questions per slide (eg, "What do you think of the use of colors in this painting?"). This constituted the distraction condition. The other half of the participants did not rate art slides, representing the no-distraction condition. We placed the slide projector screen 3 ft in front of the participants, and the participants determined the rate of the slide presentation. The slide rating task has been viewed as "moderately" distracting.<sup>37-38</sup> Indeed, because of the behavioral nature of the task (viewing, processing, and writing), it clearly places some demands upon attentional processing capacity, yet is not so attentionally demanding that participants cannot also attend to other salient stimuli (eg, pain; see also Kassel and Unrod<sup>31</sup> for a discussion of these issues).

### Measures

*Fagerstrom Test of Nicotine Dependence (FTND)*. The FTND<sup>39</sup> is a 6-item questionnaire that measures the

degree of nicotine dependence. The measure has good psychometric properties<sup>40</sup> and has been correlated with the biochemical index of smoking behavior, including expired CO and cotinine levels.<sup>41</sup>

*Shiffman-Jarvik Smoking Withdrawal Questionnaire (SJWQ).* The SJWQ is a 25-item questionnaire that assesses withdrawal symptomatology in cigarette smokers.<sup>42</sup> Individuals are asked to respond to questions using a 7-point Likert-type scale from “very definitely” (7) to “very definitely not” (1), with respect to how they feel at that moment. We used the SJWQ total score to examine whether smokers in the no-smoking condition experienced more withdrawal symptomatology relative to smokers in the smoking condition.

*Pain threshold and tolerance.* We measured pain *threshold* as the amount of time it takes to report onset of pain during the cold pressor test. We measured pain *tolerance* as the total amount of time participants kept their hands immersed in the ice water. We asked those participants who kept their hand in the water for 300 s to remove it. We modeled these instructions on those used in previous pain studies.<sup>36</sup>

### Procedure

We randomly assigned all smokers to 1 of 4 experimental conditions: (1) smoking/distraction, (2) smoking/no distraction, (3) no smoking/distraction, and (4) no smoking/no distraction. We asked all participants to abstain from caffeine consumption for a minimum of 4 hours and to abstain from pain medication use (ie, ibuprofen) for at least 24 hours prior to the experimental session.

All participants smoked 1 of their own cigarettes (ad libitum) upon arrival at the laboratory and completed an informed consent form and a battery of questionnaires. To ensure that all participants have undergone equal periods of smoking deprivation, participants watched a cartoon film, *The Lion King*, for the balance of a 50-minute baseline waiting period. We chose a 50-minute period because typical pack-a-day smokers go approximately 45–60 minutes between cigarettes. All participants provided an expired air breath sample that was assessed for CO levels using a Vitalograph EC 50 Carbon Monoxide Monitor (Vitalograph, Inc., Lenexa, KS). Participants then completed the FTND. We asked half the smokers to smoke another cigarette (their own brand) ad libitum. We asked the other participants to wait in the same area for 10 minutes without smoking. We then provided participants with the cold pressor instructions and gave reassurance concerning the safety of the procedure to minimize anxiety.

We then asked half the participants to view and rate a series of art slides during the cold pressor test, while their hand was immersed in the ice water. All participants com-

pleted the cold pressor test using their nondominant hand. Upon withdrawal of the participants' hand from the ice water, they completed the SJWQ.

## RESULTS

### Descriptive Statistics

Participants were predominantly Caucasian (78.8%); the remainder were 6.3% African Americans, 6.3% Hispanics, 6.3% Asians, and 2.5% other. The average age of the sample was 28.78 ( $SD = 12.4$ ), and 50% were women. The average number of years of education completed was 14.19 ( $SD = 2.2$ ). College students made up 57.5% of the sample; the remaining participants (42.5%) came from the community at large. No differences emerged across the 4 experimental cells on gender,  $F(3, 79) = 1.0$ ; education,  $F(3, 79) = .306$ ; or age,  $F(3, 79) = .189$  (all  $ps > .10$ ).

Participants smoked an average of almost 1 pack a day ( $M = 19.06$  cigarettes,  $SD = 8.21$ ), had smoked their current amount for an average of almost 9 years ( $M = 8.91$ ,  $SD = 9.78$ ), and had been smoking with some degree of regularity for more than 12 years ( $M = 12.91$ ,  $SD = 12.04$ ). The average age of smoking initiation was 15.93 years ( $SD = 2.86$ ). The average score on the FTND was 3.77 on a scale of 0 to 10 ( $SD = 2.38$ ), indicating a mild-to-moderate level of nicotine dependence. Across the 4 cells of smokers, we did not find any differences in number of cigarettes smoked per day,  $F(3, 79) = .875$ , how long they had been smoking their current amount,  $F(3, 79) = .991$ , how long they had smoked regularly,  $F(3, 79) = .213$ , or age of smoking onset,  $F(3, 79) = 2.570$  (all  $ps > .05$ ).

### Preliminary Data Analyses

Because pain threshold and pain tolerance variables were significantly positively skewed (pain threshold skewness = 1.94, pain tolerance skewness = 2.89), we performed and used logarithmic transformations in all analyses.

Four participants obtained tolerance scores of 300 s, which is greater than 2.8 standard deviations from the mean. Therefore, we treated them as outliers and excluded them from all the primary analyses. These participants were evenly distributed among the experimental conditions.

### Withdrawal Measure

To examine differences on withdrawal symptomatology among smokers who smoked and smokers who did not smoke, we conducted a 2 (smoking/not smoking)  $\times$  2 (Time 2/Time 3) mixed model repeated measures ANOVA. Results revealed a significant Group  $\times$  Time interaction,  $F(2, 76) = 18.901$ ,  $p = .002$ . Withdrawal scores were higher at Time 3 for

smokers in the nonsmoking condition. Time 3 withdrawal was not related to the dependent variables and was not used as a covariate in the primary analyses. Moreover, controlling for Time 3 withdrawal scores did not produce significant differences in the results of the primary ANOVA.

**Primary Hypotheses**

The primary hypotheses concerned the effect of smoking and distraction on pain perception. Pain threshold and pain tolerance served as dependent variables in 2 separate ANOVAs (see Table 1). We used gender as a third factor in the primary analyses.

*Pain threshold.* In a 2 (smoking/not smoking) × 2 (distraction/no distraction) × 2 (male/female) ANOVA with pain threshold as the dependent variable, the predicted Smoking × Distraction interaction was not significant  $F(1, 76) = .737, p > .05$ . This analysis did yield a significant Distraction × Gender interaction,  $F(1, 76) = 4.75, p = .033$ . As can be seen in Figure 1, examination of the means by gender indicated that pain threshold was significantly higher in

the distraction condition than the no distraction condition, but only among men. (See Table 2 for means and standard deviations.)

*Pain tolerance.* A 2 × 2 × 2 ANOVA with pain tolerance as the dependent variable revealed a significant Distraction × Gender interaction,  $F(1, 76) = 4.215, p = .044$ . As shown in Figure 2, pain tolerance was significantly higher in the distraction condition than the no distraction condition among men, but not among women. (See Table 2 for means and standard deviations.) The predicted Smoking × Distraction interaction was not significant,  $F(1, 76) = 2.268, p > .05$ .

**COMMENT**

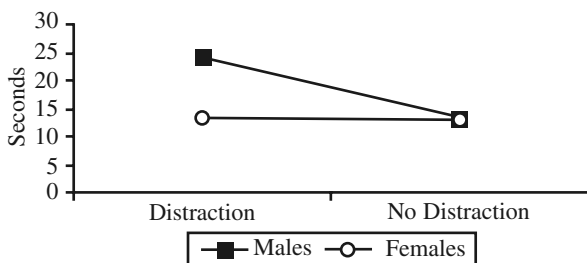
In the present study, we examined the extent to which the reputed antinociceptive effects of smoking may be mediated by distraction. In addition, we examined gender differences in conjunction with the smoking and distraction factors to assess potential main and interaction effects. Results of the current study revealed interactions between distraction and gender, indicating that men, but not women, exhibited pain reduction in the distraction condition as compared with no distraction. Whether participants smoked prior to the pain stimulus had no impact on their pain sensitivity. This finding is consistent with a number of past studies that failed to observe antinociceptive effects of smoking.<sup>14-18</sup> We did not find the predicted interaction between smoking and distraction and, therefore, these results did not support the attentional mediation model of smoking in pain perception.

The differential effect of distraction on pain among men and women is a notable finding given the paucity of research in this area. Although previous studies have shown that attentional focus mediates experimental pain,<sup>20-23</sup> few have examined or noted gender differences in this relationship. Keogh and colleagues<sup>35</sup> compared the effects of attentional focusing with attentional avoidance on experimental pain among men and women. Although there was no interaction effect

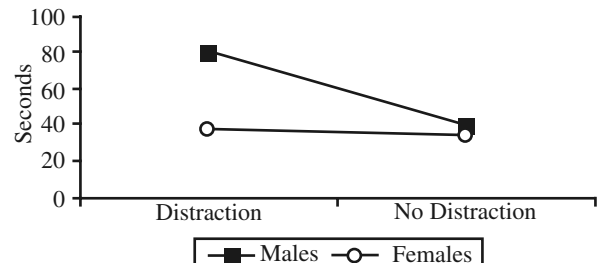
**TABLE 1. Analyses of Variance and Effect Sizes /  $\eta^2$**

Effect	Pain threshold		Pain tolerance	
	$F(1, 75)$	Effect size	$F(1, 75)$	Effect size
Smoke (S)	.16	.002	.04	.001
Distraction (D)	5.08*	.070	7.23*	.096
Gender (G)	7.07*	.094	5.13*	.070
S × D	.74	.011	2.27	.032
D × G	4.75*	.065	4.22*	.058

\* $p < .05$ .



**FIGURE 1. Pain threshold means. Males:  $t(1,34) = 3.28, p = .002$ ; Females:  $t(1,38) = .05, p > .05$ .**



**FIGURE 2. Pain tolerance means. Males:  $t(1,34) = 2.94, p = .006$ ; Females:  $t(1,38) = .51, p > .05$ .**

**TABLE 2. Pain Threshold and Tolerance Means and Standard Deviations**

	Distraction				No distraction			
	Male		Female		Male		Female	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pain-T	24.3	14.1	13.2	8.7	13.1	7.1	12.9	10.2
Pain-E	82.3	64.9	37.3	23.9	40.0	40.2	34.2	23.2

*Note.* Threshold and tolerance presented in seconds.

between type of attentional focus and gender on pain threshold or pain tolerance, men who were instructed to focus on their pain had lower sensory pain ratings relative to those who were instructed to avoid focusing on pain. This effect was not observed among women. In the current study, active attentional distraction had a significant effect on pain threshold and tolerance among men but not among women. Although the attentional focus task and instructions in the current study differed from those of the Keogh et al<sup>35</sup> study, both findings suggest that the use of attention-based strategies for pain reduction may be more effective in men than in women.

The interaction between distraction and gender is also intriguing in light of results from previous research by Jamner and colleagues.<sup>7</sup> They observed increases in pain threshold and tolerance among men but not among women who were administered nicotine patches. Although in the current study we did not observe smoking-related differences, results suggest that there may be important gender differences among smokers' responses to painful stimulation. Relative to female smokers, male smokers' pain perceptions may be more conducive to change or more responsive to external stimuli. Further research exploring gender differences in pain perception among smokers needs to be conducted to begin to formulate more definitive conclusions. Effects found in the current study should be examined in a clinical population, which, if replicated, can have important implications for therapeutic pain interventions. For example, attention-based techniques for chronic pain among smokers may be more effective for men than for women. Smoking prevalence among chronic pain patients is higher than that of the general population, indicating that more than half of chronic pain patients are smokers.<sup>1,3,43-44</sup> Therefore, the current findings and their potential implications can be particularly relevant to the area of chronic pain treatment.

Although the failure to observe an effect of smoking on pain in the current study is consistent with several previous findings, a number of limitations may have, in part,

contributed to the null result. The median age of participants was below that of the general population of smokers, and participants were mildly to moderately dependent on nicotine. Review of the studies that have observed antinociception effects attributable to smoking indicates that the majority of these studies contained older and heavier smokers. Therefore, it is questionable to generalize the current findings to older, more nicotine-dependent smokers. Another potential limitation of applying the attention allocation model to pain is that, unlike the construct of anxiety, pain may emerge as a more salient stimulus, regardless of the distraction, thus failing to yield a smoking by distraction interaction.

Another notable aspect of the current study is associated with nicotine dosing. The current study failed to control for cigarette brand and the amount of nicotine delivered per cigarette smoked. Therefore, there may have been significant variability between participants in the amount of nicotine derived from their cigarettes, potentially obscuring the smoking effect. At the same time, however, allowing participants to smoke their own brand of cigarette in an ad libitum manner increases the external, or ecological, validity of the procedure and is preferable to "controlled" smoking manipulations that more precisely control nicotine dose. Furthermore, previous studies using ad libitum nicotine administration have demonstrated a significant effect of smoking on pain.<sup>10,12-13</sup>

A number of strengths of the current study should be noted. Throughout the smoking and pain literature, control of withdrawal effects has been cited as essential in distinguishing between genuine antinociception, as opposed to effects related to withdrawal reduction. In the current study, we used minimally deprived smokers to minimize the onset of withdrawal. Additionally, we measured withdrawal symptoms throughout the experimental session. Withdrawal scores indicated that, at the end of the session, smokers who did not smoke experienced significantly stronger with-

drawal symptoms than smokers who smoked. Nonetheless, controlling for withdrawal did not have an impact on the overall pain measures, suggesting that mild withdrawal does not necessarily result in heightened pain sensitivity.

In conclusion, although the data did not support the attentional mediation model of smoking, the findings emphasize the importance of distraction and gender differences in the area of experimental pain. The differential effects of distraction on pain among men and women begin to shed light on the potential factors that mediate the effectiveness of distraction-based techniques for the management of pain. Future research should more closely examine gender differences, distraction, and pain in older and heavier smokers. Support for and replication of current findings in clinical populations can have important implications for the area of smoking and pain.

#### NOTE

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#### REFERENCES

- Louis Harris and Associates. *Nuprin Pain Report*. New York: Louis Harris and Associates; 1985:161–162.
- Biering-Sorensen F, Thomsen C. Medical, social and occupational history as risk indicators for low-back trouble in a general population. *Spine*. 1986;11:720–725.
- Jamison RN, Stetson BA, Parris WCV. The relationship between cigarette smoking and chronic low back pain. *Addict Behav*. 1991;16:103–110.
- Sahley TL, Berntson GG. Antinociceptive effects of central and systemic administrations of nicotine in the rat. *Psychopharmacology (Berl)*. 1979;65:279–283.
- Aceto MD, Bagley RS, Dewey WL, Fu TC, Martin BR. The spinal cord as a major site for the antinociceptive action of nicotine in the rat. *Neuropharmacology*. 1986;25:1031–1036.
- Mousa SA, Aloyo VJ, Van Loon GR. Tolerance to tobacco smoke and nicotine-induced analgesia in rats. *Pharmacol Biochem Behav*. 1988;31:265–268.
- Jamner LD, Girdler SS, Shapiro D, Jarvik ME. Pain inhibition, nicotine, and gender. *Exp Clin Psychopharmacol*. 1998;6(1):96–106.
- Nesbitt PD. Smoking, physiological arousal, and emotional response. *J Pers Soc Psychol*. 1973;25(1):137–144.
- Silverstein B. Cigarette smoking, nicotine addiction, and relaxation. *J Pers Soc Psychol*. 1982;42(5):946–950.
- Pomerleau OF, Turk DC, Fertig JB. The effects of cigarette smoking on pain and anxiety. *Addict Behav*. 1984;9:265–271.
- Fertig JB, Pomerleau OF, Sanders B. Nicotine-produced antinociception in minimally deprived smokers and ex-smokers. *Addict Behav*. 1986;11:239–248.
- Pauli P, Rau H, Zhuang P, Brody S, Birbaumer N. Effects of smoking on thermal pain threshold in deprived and minimally-deprived habitual smokers. *Psychopharmacology (Berl)*. 1993;111:472–476.
- Lane JD, Lefebvre JC, Rose JE, Keefe FJ. Effects of cigarette smoking on perception of thermal pain. *Exp Clin Psychopharmacol*. 1995;3(2):140–147.
- Waller D, Schalling D, Levander S, Edman G. Smoking, pain tolerance, and physiological activation. *Psychopharmacology (Berl)*. 1983;79:193–198.
- Shiffman S, Jarvik ME. Cigarette smoking, physiological arousal, and emotional response: Nesbitt's paradox re-examined. *Addict Behav*. 1984;9:95–98.
- Sult SC, Moss RA. The effects of cigarette smoking on the perception of electrical stimulation and cold pressor pain. *Addict Behav*. 1986;11:447–451.
- Jarvik ME, Caskey NH, Rose JE, Herskovic JE, Sadeghpour M. Anxiolytic effects of smoking associated with four stressors. *Addict Behav*. 1989;14:379–386.
- Knott VJ. Effects of cigarette smoking on subjective and brain evoked responses to electrical pain stimulation. *Pharmacol Biochem Behav*. 1990;35:341–346.
- Eccleston C. The attentional control of pain: Methodological and theoretical concerns. *Pain*. 1995;63:3–10.
- Miron D, Duncan GH, Bushnell MC. Effects of attention on the intensity and unpleasantness of thermal pain. *Pain*. 1989;39:345–352.
- Arntz A, Dreessen L, Merckelbach H. Attention, not anxiety, influences pain. *Behav Res Ther*. 1991;29(1):41–50.
- Williams SL, Kinney PJ. Performance and nonperformance strategies for coping with acute pain: the role of perceived self-efficacy, expected outcomes, and attention. *Cognit Ther Res*. 1991;15(1):1–19.
- Arntz A, De Jong P. Anxiety, attention and pain. *J Psychosom Res*. 1993;37(4):423–432.
- Ahles TA, Blanchard EB, Leventhal H. Cognitive control of pain: Attention to the sensory aspects of the cold pressor stimulus. *Cognit Ther Res*. 1983;7(2):159–177.
- McCaul KD, Monson N, Maki RH. Does distraction reduce pain-produced distress among college students? *Health Psychol*. 1992;11(4):210–217.
- Eccleston C, Crombez G. Pain demands attention: A cognitive-affective model of the interruptive function of pain. *Psychol Bull*. 1999;125(3):356–366.
- Wesnes K, Warburton DM. Smoking, nicotine and human performance. *Pharmacol Ther*. 1983;21:189–208.
- Warburton DM and Walters AC. Attentional processing. In T. Ney and A. Gales eds. *Smoking and Human Behavior*. New York: John Wiley, 1989:223–237.
- Kassel JD. Smoking attention: A review and reformulation of the stimulus-filter hypothesis. *Clin Psychol Rev*. 1997;17(5):451–478.
- Kassel JD, Shiffman S. Attentional mediation of cigarette smoking's effect on anxiety. *Health Psychol*. 1997;16(4):359–368.

31. Kassel JD, Unrod M. Smoking, anxiety, and attention: support for the role of nicotine in attentionally mediated anxiety. *J Abnorm Psychol.* 2000;109(1):161–166.
32. Fillingim RB, Maixner W. Gender differences in the response to noxious stimuli. *Pain Forum.* 1995;4:209–221.
33. Riley JL, Robinson ME, Wise EA, Myers CD, Fillingim RB. Sex differences in the perception of noxious experimental stimuli: a meta-analysis. *Pain.* 1998;74:181–187.
34. Robinson ME, Riley JL, Myers CD. Psychosocial contributions to sex related differences in pain responses. In: Fillingim R, ed. *Sex, Gender, and Pain.* Seattle, WA: IASP Press; 2000: 41–67.
35. Keogh E, Hatton K, Ellery D. Avoidance versus focused attention and the perception of pain: differential effects for men and women. *Pain.* 2000;85(1–2):225–230.
36. Geisser ME, Robinson ME, Pickren WE. Differences in cognitive coping strategies among pain-sensitive and pain-tolerant individuals on the cold-pressor test. *Behav Ther.* 1992;23:31–41.
37. Steele CM, Josephs RA. Drinking your troubles away II: An attention-allocation model of alcohol's effect on psychological stress. *J Abnorm Psychol.* 1988;97:196–205.
38. Josephs RA, Steele CM. The two faces of alcohol myopia: attentional mediation of psychological stress. *J Abnorm Psychol.* 1990;99:115–126.
39. Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The Fagerstrom Test of Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *Br J Addict.* 1991;86:1119–1127.
40. Pomerleau CS, Carton SM, Lutzke ML, Flessland KA, Pomerleau OF. Reliability of the Fagerstrom Tolerance Questionnaire and the Fagerstrom Test for Nicotine Dependence. *Addict Behav.* 1994;19(1):33–39.
41. Payne TJ, Smith PO, McCracken LM, McSherry WC, Antony MM. Assessing nicotine dependence: a comparison of the Fagerstrom Tolerance Questionnaire (FTQ) with the Fagerstrom Test for Nicotine Dependence (FTND) in a clinical sample. *Addict Behav.* 1994;19(3):307–317.
42. Shiffman S, Jarvik ME. Smoking withdrawal symptoms in two weeks of abstinence. *Psychopharmacology (Berl).* 1976;50: 35–39.
43. Brage S, Bjerkedal T. Musculoskeletal pain and smoking in Norway. *J Epidemiol Community Health.* 1996;50(2):166–169.
44. Hagg O, Fritzell P, Nordwall A. Characteristics of patients with chronic low back pain selected for surgery: a comparison with the general population reported from the Swedish lumbar spine study. *Spine.* 2002;27(11):1223–1231.

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