TOBACCO SMOKING AND CHRONIC PAIN: COMPLEX INTERACTIONS AND NOVEL TREATMENT CONSIDERATIONS

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Overview of pain and smoking

- **Chronic pain** *(APS, 2003; IASP, 2008; IOM, 2011)*
  - Critical national health problem
  - 25-43% of U.S. adults (up to 116 M)
  - $125-635 B annual health care costs/lost productivity

- **Tobacco smoking** *(CDC, 2010)*
  - 443,000 U.S. deaths annually
  - 21% of U.S. adults (46 M)
  - $193 B annual health care costs/lost productivity
Prevalence of smoking among persons in pain

- **Epidemiological data** (e.g., Zvolensky et al., 2009)
  - 42% past year medically unexplained chronic pain
  - 30% past year or lifetime chronic neck or back pain
    - Up to twice rate observed in general population (21%)
      - After adjusting for sociodemographic, medical, and psychiatric features

- **Clinical data** (e.g., Hooten et al., 2011)
  - 49-68% of treatment-seeking pain patients
    - Greater with more severe pain/functional impairment
      - Smokers: greater pain/emotional distress and decreased activity
Prevalence of smoking among persons in pain

![Chart showing prevalence of smoking]

- General Pop
- Chronic Pain
- Clinical Pain

Prevalence of Tobacco Smoking
Pain and tobacco smoking

- Highly prevalent comorbid conditions that:
  - Generate substantial challenges across domains/disciplines (e.g., psychology, medicine, public health)
  - Engender significant burdens upon patients/systems
  - Attracted the attention of researchers and clinicians within the medical and behavioral sciences
Research on pain and smoking

Published Studies

PsycINFO  PubMed

~40% past 5 years

(Ditre et al., in press; Psychological Bulletin)
Interaction of pain and smoking

- Can be conceptualized as a prototypical example of the biopsychosocial model
  - Complex interplay of biomedical, behavioral, cognitive, affective, neurobiological, and social phenomena
- Studies can be usefully dichotomized:

(Ditre et al., in press; Psychological Bulletin)
Effects of smoking on pain
Effects of smoking on pain

- Smoking as a risk factor for chronic pain
  - Numerous studies demonstrate evidence of covariation between smoking and the prevalence of a variety of chronically painful conditions
  - Recent meta-analytic support for smoking as a causal factor in the development of chronic LBP & RA (Shiri et al., 2010; Sugiyama et al., 2010)
Effects of smoking on pain

- Acute effects of smoking and nicotine on pain
  - Nicotine may have short-acting analgesic effects
    - Animal vs. Human Models
  - Meta-Analysis of Human Studies
    - Antinociceptive effects of nicotine/tobacco were observed to be "small" (Hedge’s $g = .26$, $p < .001$)

(Ditre et al., in preparation)
Effects of smoking on pain

- Smoking and pain intensity
  - Smokers report greater pain and functional impairment than nonsmokers (e.g., Weingarten et al., 2008)
  - Smokers use substantially more analgesic medication (e.g., opioids) than nonsmokers (e.g., Broekmans et al., 2010)
  - Chronic exposure to nicotine/tobacco smoke (e.g., Woodside, 2000)
Effects of pain on smoking
Effects of pain on smoking

- Covariation between pain and smoking behavior
  - Smoking associated with greater pain intensity
    - Chronic pain (e.g., Weingarten et al., 2008)
    - Cancer pain (Ditre et al., 2011)
  - Dose-response: pain intensity/cigarette consumption

- Stress/negative affect as motivator of smoking
  - Smokers consistently endorse increased smoking in response to stress and/or NA (e.g., Kassel et al., 2003)
  - Manifestations of NA often precede smoking lapses and relapse to regular smoking (e.g., Brandon et al., 1990)
Effects of pain on smoking

- Pain as a motivator of smoking
  - Cross-sectional & qualitative evidence (pain patients):
    - Reported increased smoking in response to pain (Jamison et al., 1991)
    - Endorsed pain-induce desire to smoke (Hooten et al., 2011)
      - “My smoking is extremely related to my pain...instead of rubbing my knee I’ll go smoke a cigarette”; “If I have a flare-up...I’ll...go for a cigarette”
    - Endorsed smoking for pain-coping (e.g., via distraction)
      - “I’m thinking of the cigarette...puffing it, and lighting it, and holding it...so it diverts me away from the pain”; “Smoking is a great distraction tool”
    - Reported that opioid use increased urge to smoke
      - “When I was on...opioids it would make me a chain smoker”
  - Experimental evidence
    - Ditre and Brandon, 2008; Ditre et al., 2010
Effects of pain on smoking

- Pain as a motivator of smoking

  Urge to Smoke (0 – 60)
  \[ F(4, 124) = 18.75, \ p < .001, \ f = .39 \]

  Latency to Smoke (in seconds)
  \[ F(4, 115) = 4.60, \ p = .03, \ f = .20 \]

(Ditre & Brandon, 2008; Journal of Abnormal Psychology)
Effects of pain on smoking

- Pain as a motivator of smoking
  - Ditre et al., 2010

(Ditre et al., 2010; Journal of Abnormal Psychology)
Effects of pain on smoking

- Pain as a motivator of smoking
  - Ditre et al., 2010

Urge to Smoke (0 – 60)

No-Expectancy Challenge vs. Expectancy Challenge

(Ditre et al., 2010; Journal of Abnormal Psychology)
Effects of pain on smoking

- Pain as a motivator of smoking
  - Pain may be a powerful reinforcer in the maintenance of tobacco smoking and nicotine dependence
  - In the absence of more adaptive coping responses, persons with chronic pain may learn to rely on smoking to manage noxious internal states (Zvolensky et al., 2010)
Integrative reciprocal model of pain & smoking

- Positive feedback loop: increased pain and the maintenance of tobacco dependence

(Ditre et al., in press; Psychological Bulletin)
Integrative reciprocal model of pain & smoking

**Psychosocial Factors**
- Sociodemographic
- Comorbid medical and psychiatric conditions

**Smoking-Related Outcome Expectancies**
- For pain coping
- For affect regulation

**Negative/Positive Reinforcement**
- Self-medication
- Conditioning of pain as an interoceptive cue

**Neurobiological Processes**
- Activation of dopamine reward system and neural stress system

**Other Pain-Related Factors**
- Pain-copying outcomes
- Catastrophizing
- Opioid use/misuse

**Immediate Affective Response**
- Unpleasantness, distress
- Physiological arousal

**Extended Pain Affect**
- Pain-related suffering
- E.g., depression, anxiety

**Tobacco Smoking**
- Behavioral pain response
- Efforts to cope with pain

**Risk Factor Interactions**
- Systemic inflammation
- Gene expression
- Basal metabolic rate
- Opioid pharmacology

**Tissue Damage**
- Cell/vascular damage
- Alterations of bone microarchitecture
- Carboxy-hemoglobin-induced anoxia

**Neurological Pain Processing**
- nAChR activity
- Endogenous opioid system activity
- HPA axis activity

**Other Effects on Pain Processing**
- Cardiovascular actions
- Attentional narrowing
- Nicotine withdrawal

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(Ditre et al., in press; Psychological Bulletin)
Pain as a barrier to smoking cessation

- Smokers in pain report greater difficulty and less confidence in quitting (e.g., Waldie et al., 2008; Hooten et al., 2011)

- Pain may precipitate relapse to smoking
  - Smoking-related outcome expectancies (pain/mood coping)
  - Negative reinforcement (smoking for stress-coping/self-medication)
    - Conditioning of pain as an interoceptive smoking cue
  - Positive reinforcement (unemployment, loneliness, low social support)
    - Smoking to maintain stable rates of positive reinforcement when other environmental reinforcers have been removed

- Neurobiological processes
  - Pain may activate overlapping neural substrates (i.e., reward and stress systems) that act synergistically to motivate smoking

(Ditre et al., in preparation)
Pain as a barrier to smoking cessation

- **Novel treatment considerations**
  - **Pain factors** (pain severity, functional impairment, disability status, pain-coping outcomes)
  - **Psychiatric comorbidity** (depression/anxiety, substance use, personality disorders)
  - **Medication interactions** (effects of increasing/decreasing opioid use)
  - **Pain-induced relapse** (painful stressors can reinstate extinguished drug-seeking)
  - **Smoking abstinence-induced hyperalgesia**
    - “I’d be afraid of the pain getting worse if I quit smoking” (Hooten et al., 2011)
Future research

- Identify common factors and elucidate causality
  - Test clinical and theoretical mechanisms

- Develop and refine targeted interventions

- Conduct randomized clinical trials
  - Tailored smoking cessation/relapse prevention
  - Integrated treatments for pain and smoking
Conclusions

- Examination of interrelations between pain and smoking represents a burgeoning but complex area of clinical and experimental research.
  - Pain and smoking may interact to synergistically influence their respective trajectories and outcomes.
    - Tobacco dependence may provide an invaluable model for research on other addictive behaviors in pain populations.
Thank you