

**ADVERSE EFFECTS OF NICOTINE
ON HEALING:
NEW NICOTINE AND SMOKING
PRODUCTS**

Janice Cooke Feigenbaum, RN, Ph.D., Clinical Professor
University at Buffalo School of Nursing
September 10, 2011

Objectives

- Identify current smoking products, trends, and smoking cessation methods;
- Analyze the effects of smoking and smoking cessation efforts on healing and recovery from surgery;
- Analyze the relationship of smoking and smoking cessation on individuals' experiences of pain;
- Analyze barriers to the promotion of smoking cessation;
- Analyze key principles of promoting smoking cessation, especially for individuals experiencing pain.

**Nicotine Addiction
is a Chronic Brain Disorder**

"Addiction is a complex neurobiobehavioral disorder characterized by impaired control, compulsive use, dependency, and craving for the activity, substance or food. Relapses are possible even after long periods of abstinence (National Institute on Drug Abuse [NIDA], 2002b; Wilson & Erickson, 2000). Addiction is often (but not always) accompanied by physiological dependence, consisting of a withdrawal syndrome and or tolerance (NIDA, 2002a)."

(Armstrong, Feigenbaum, Savage & Vourakis, 2006, p. iii)

CRAVING

- “Conscious awareness of the desire to ingest a substance or engage in a specific activity. It is a complex neurobiobehavioral phenomenon based on previous experiences with addictive substances or activities (Drummon, 2001; Goldstein, 1994; Ruden & Byalick, 1997).”

• (Armstrong, Feigenbaum, Savage & Vourakis, 2006, p. iii)

COMPOUNDS in TOBACCO SMOKE

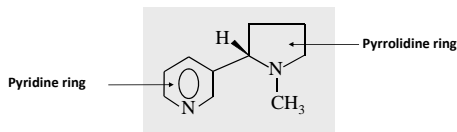
Approximately 4,800 compounds identified in tobacco smoke, including 11 proven human carcinogens

- | Gases | Particles |
|--------------------|----------------|
| ■ Carbon monoxide | ■ Nicotine |
| ■ Hydrogen cyanide | ■ Nitrosamines |
| ■ Ammonia | ■ Lead |
| ■ Benzene | ■ Cadmium |
| ■ Formaldehyde | ■ Polonium-210 |

Nicotine is the addictive component of tobacco products, but it does NOT cause the ill health effects of tobacco use.

(Rx for CHANGE--Clinician-Assisted Tobacco Cessation, <http://rxforchange.ucsf.edu>)

Nicotine is the Drug in Tobacco that Causes Addiction



Nicotiana tabacum

*Natural liquid alkaloid

*Colorless, volatile base $pK_a = 8.0$

*Nicotine mimics the effects of acetylcholine at the acetylcholine receptor site

Nicotine dependence is a chronic brain disorder

(Rx for CHANGE--Nicotine and principles of addiction, <http://rxforchange.ucsf.edu>)

Nicotine Products

- Cigarettes
- Smokeless Tobacco (chewing, oral snuff)
- Pipes
- Cigars
- Kreteks
- Bidis
- Hookah
- Electronic Cigarettes
- Oral Noncombustible Tobacco Products
- “Green” Cigarettes

Key Points Regarding Nicotine*

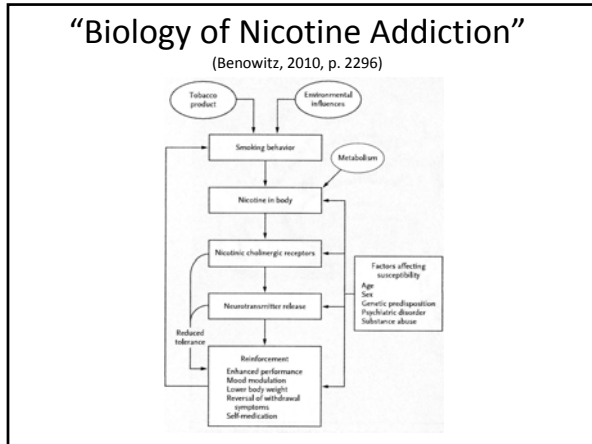
- Alkaloid derived from the tobacco plant
- Cigarettes sold in the United States contain 10 milligrams or more of nicotine
- When smoking a cigarette, the person will inhale 1-2 milligrams of nicotine
- Takes approximately 7-15 seconds for the effects of a puff of nicotine to reach the reward center of the brain

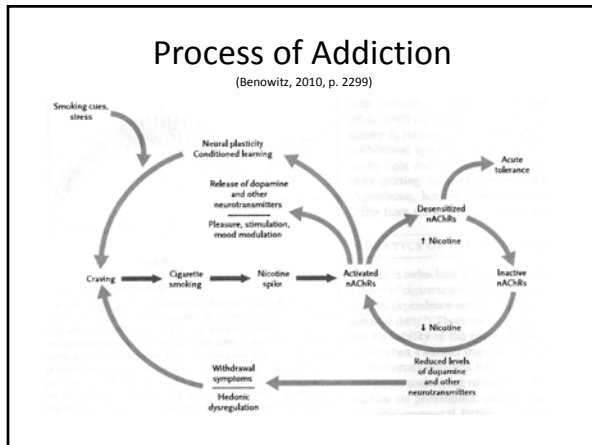
*National African American Tobacco Prevention Network (<http://www.naatpn.org>)

Persons Who Smoke

- tend to take 10 or more puffs on a cigarette over a 5 minute period
- 1.5 packs (30 cigarettes) daily, get approximately 300 hits of nicotine –per day

*National African American Tobacco Prevention Network (<http://www.naatpn.org>)





- ### Neurotransmitter Effects of Nicotine
- Dopamine Pleasure, appetite suppression
 - Norepinephrine Arousal, appetite suppression
 - Acetylcholine Arousal, cognitive enhancement
 - Glutamate Learning, memory enhancement
 - Serotonin Mood modulation, appetite suppression
 - β-Endorphin Reduction of anxiety and tension
 - GABA Reduction of anxiety and tension
- (Rx for CHANGE--Nicotine and principles of addiction, <http://rxforchange.ucsf.edu>)

Routine/Chronic Use of Nicotine

Results in an increased number of CNS nicotine receptors in persons who use nicotine compared to persons who do not use nicotine

(Rx for CHANGE--Nicotine and principles of addiction, <http://rxforchange.ucsf.edu>)

Process of Addiction Requires People Who Use Nicotine to Maintain Serum Levels of Nicotine

- Prevent withdrawal symptoms
- Maintain sense of pleasure and arousal
- Maintain mood
- Accomplish this through
 - *Using/smoking nicotine more frequently
 - *Increasing intensity of using/smoking nicotine
 - *Blocking vents on low nicotine brand cigarettes

(Rx for CHANGE--Nicotine and principles of addiction, <http://rxforchange.ucsf.edu>)

NICOTINE EXCRETION

- Half-life
 - Nicotine $t_{1/2} = 2$ hr
 - Cotinine $t_{1/2} = 16$ hr
- Excretion
 - Occurs through kidneys (pH dependent; \uparrow with acidic pH)
 - Through breast milk

(Rx for CHANGE--Nicotine and principles of addiction, <http://rxforchange.ucsf.edu>)

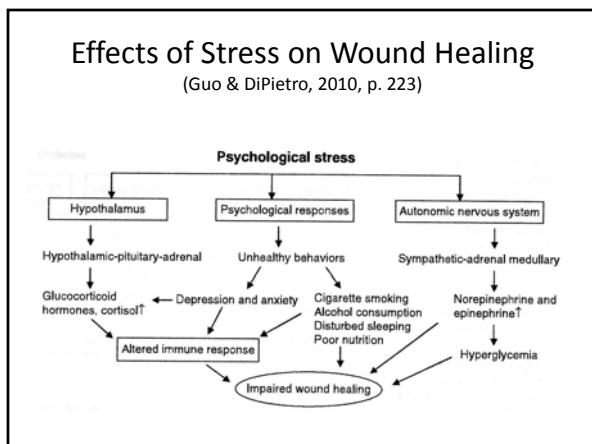
Experiences that Increase Levels of Stress For People Who Use/Smoke Nicotine

- Unintended consequences of prevention and treatment approaches
- Attempting to quit smoking/using nicotine products
- Withdrawal from nicotine
- Craving
- Pain/Symptoms
- Diagnosis of an illness
- Treatment of an illness (Surgery)

Withdrawal Symptoms

- peak within 24 to 48 hours after last use of nicotine
- may persist for weeks to months
- Cravings
- Anxiety
- Irritability
- Headache
- Difficulty Concentrating
- Restlessness
- Constipation
- Hunger
- Depression
- Insomnia/Fatigue

(Fiore et al., 2000a; Rx for CHANGE—Clinician Assisted Tobacco Cessation, <http://rxforchange.ucsf.edu>; Todd et al., 2001)

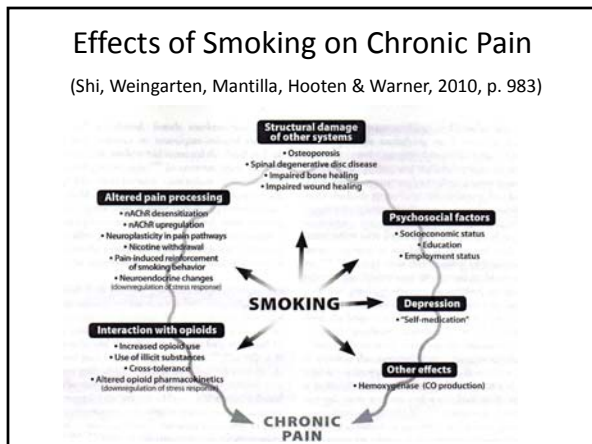


Effects of Nicotine on Phases of Wound Healing

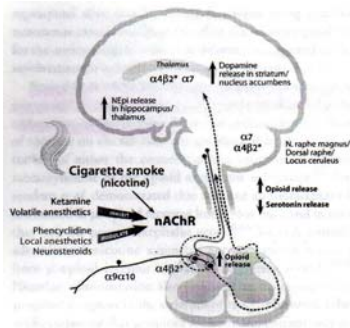
- “Post-operatively, patients who smoke show a delay in wound healing and an increase in a variety of complications such as infection, wound rupture, anastomotic leakage, wound and flap necrosis, epidermolysis, and a decrease in the tensile strength of wounds” (Guo & DiPietro, 2010, p. 225)

Phases of Wound Healing

- Hemostasis
- Inflammation
- Proliferation
- Remodeling



“Potential Sites of Analgesic Action of Nicotine”
 (Shi, Weingarten, Mantilla, Hooten & Warner, 2010, p. 978)



Hypotheses—
 Interaction Between Pain and Nicotine

- Pain may reinforce use of nicotine by “increasing the threshold for pain perception”
- Pain may promote the use of nicotine as a way to cope with the pain
- Withdrawal from nicotine may increase the sensitivity to pain
- Nicotine “causes changes in the neuroendocrine system that could modulate pain perception”
- Smoking causes physiological changes that increase the risk for persons developing illnesses, such as osteoporosis, that are painful
- Relationship between use of nicotine, depression and pain may result in all three factors reinforcing each other
- “Opioid pathways may modulate both the analgesic effects of nicotine . . . [and] “exposure to cigarette smoke may alter the pharmacokinetics of opioids”

(Shi, Weingarten, Mantilla, Hooten & Warner, 2010, pp. 225-226)

CLINICAL PRACTICE GUIDELINE for TREATING
 TOBACCO USE and DEPENDENCE

- Update released May 2008
- Sponsored by the U.S. Department of Health and Human Services, Public Health Service with support from:
 - Agency for Healthcare Research and Quality
 - National Heart, Lung, & Blood Institute
 - National Institute on Drug Abuse
 - Centers for Disease Control and Prevention
 - National Cancer Institute

Fiore, M. C., Jaen, C. R., Baker, T. B., et al. (2008). *Treating tobacco use and dependence—2008 update*. Rockville, MD: U. S. Department of Health and Human Services, Public Health Services.

<http://www.surgeongeneral.gov/tobacco/>

What Is Your Level of Self-Efficacy to Implement The Recommended 5 Steps to Promote Smoking Cessation?

Advise to quit
Ask about willingness to quit
Assist

Ask about use of tobacco

- Assess history of the use of tobacco products
- Assess level of dependence
- Assess suicide potential
- Assess prior attempts to quit
- Set quit date
- Discuss use of medications
- Options (pros and cons)
- Give specific instructions on how to use the medication effectively and safely
- Offer ongoing support throughout the process

Arrange follow-up support

Assess Level of Dependence

- Fagerstrom Test for Nicotine Dependence
- Modified Fagerstrom Tolerance Questionnaire
- Smokeless Tobacco Dependence Scale

(Rx for CHANGE--Clinician-Assisted Tobacco Cessation, <http://rxforchange.ucsf.edu>)

First Line of Recommended Medications

- | | |
|--|--|
| <p>Non-Nicotine Based</p> <ul style="list-style-type: none">• Bupropion SR• Varenicline | <p>Nicotine Replacement Therapies</p> <ul style="list-style-type: none">• Nicotine Gum• Nicotine Inhaler• Nicotine Nasal Spray• Nicotine Patch• --Nicotine Lozenge |
|--|--|

(Feigenbaum, 2010)

Second Line of Recommended Medications~

Clonidine Hydrochloride (A)	alpha(2) adrenergic agonist	Reduces intensity of withdrawal
Nortriptyline (B)	tricyclic antidepressant	May reduce intensity of cravings and decrease comorbid depression****

Medications Being Investigated~

Mecamylamine	Ganglionic blocker (May block nicotine receptors and limit the reinforcing effects of nicotine**)	
Moclobemide***	Reversible MAO-A inhibitor	
Selegiline***	Irreversible MAO-B inhibitor	
Naltrexone Hydrochloride***	Narcotic antagonist	
Buspirone Hydrochloride***	Anxiolytic	
Topiramate	Anti-convulsant	
Rimonabant	Cannabinoid *CB-1) receptor antagonist--	

Andrews & Tingen, 1999, p. 9; *George & O'Malley, 2004, p. 44; ****US DEPT. HHS, 2000; ^Urso, 2003; ^^Ward, 1999; ++Lehne, 2001; +++Fiore et al., 2001b; ^^ Benowitz, 2008;

Time Line of Health Benefits From Time of Smoking Cessation—30 Minutes to 9 Months**

Length of Time From Last Cigarette	Benefit
30 minutes	Blood pressure decreases; Pulse decreases Body temperature of feet and hands increases
8 hours	Level of carbon monoxide in blood decreases Level of oxygen in blood increases
24 hours	Risk for heart attack decreases
48 hours	Nerve endings begin to regenerate Abilities to taste and smell improve
72 hours	Bronchial tubes relax to promote easier breathing Lung capacity increases
3 months	Circulation of blood improves; Walking is easier Lung capacity increases significantly Ability to fight infection increases

Recommended References

- Cahill, K., Stead, L. F., & Lancaster, T. (2007). Nicotine receptor partial agonists for smoking cessation. *Cochrane Database of Systematic Reviews*, 1, Article No.: CD006103. DOI: 10.1002/14651858.CD006103.pub2.
- Feigenbaum, J. C. (2010). Pharmacological aids to promote smoking cessation. *Journal of Addictions Nursing*, 21, 87-97.
- Fiore, M. C., Jaen, C. R., Baker, T. B., et al. (2008). *Treating tobacco use and dependence—2008 update*. Rockville, MD: U. S. Department of Health and Human Services, Public Health Services.
- Guo, S., & DiPietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89, 219-229.
- Hughes, J. R. (2008). An Algorithm for choosing among smoking cessation treatments. *Journal of Substance Abuse Treatment*, 34, 426-432.
- Shi, Y., Weingarten, T. N., Mantilla, C. B., Hooten, W. M., & Warner, D. O. (2010). Smoking and pain: Pathophysiology and clinical implications. *Anesthesiology*, 113, 977-992.
