

## **Tobacco Addiction: What do we know, and where do we go?**

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While these experts have screened the report for accuracy, neither they nor their current or former organizations necessarily endorse its findings or conclusions.

### **Introduction:**

Tobacco addiction is a prevalent condition, affecting almost 20% of the Canadian population (CTUMS, 2008), costing the economy an estimated \$17 billion annually (CCSA, 2007), and killing about 5.4 million people worldwide every year. Dealing with this preventable epidemic requires a comprehensive and evidence-based approach. Such an approach requires an understanding of the nature of tobacco addiction as a chronic, relapsing medical condition.

Addiction to tobacco products is the leading preventable cause of death and disease in Canada and worldwide. But, their consumption has traditionally been viewed a matter of personal choice, a “lifestyle decision” – not as a significant chronic relapsing, yet treatable medical condition. This narrow “de-medicalized” view of nicotine addiction as a “choice,” which can be addressed primarily through behavioral approaches, has profoundly shaped society’s response to the epidemic of tobacco-initiated disease. This perspective has regrettably precluded the delivery of safe and effective evidence-based interventions to assist in the management of nicotine dependence. Failure to recognize the true nature of addiction as a chronic medical condition has conceivably

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perpetuated the epidemic, has contributed to innumerable deaths, and added significant cost to the Canadian economy.

Tobacco dependence is a condition, which is amenable to treatment. But, despite the accumulated evidence regarding the addictive nature of tobacco use, the systematic implementation of comprehensive evidence-based approaches to the prevention and treatment of tobacco addiction has been slow. This paper will discuss the tobacco addiction from a medical perspective and propose a more evidence-based and comprehensive approach to the management of this ultimately lethal, yet treatable, condition.

### **What is addiction?**

Addiction may be viewed as a chronic, relapsing brain disorder that results from the distinct effects of a specific drug on the brain, its structure and function. In addition, behaviors associated with drug consumption, and the social context in which drug taking occurs, serves to accentuate the drug's activity in the brain and further embed the addictive behavior. This is quickly manifested by the continued use of the drug despite the knowledge of harm, the rapid development of tolerance, the appearance of signs and symptoms of withdrawal when abstinence is attempted, and loss of control over the use of the drug. The conventional view of addiction has been described as "impaired control over a reward-seeking behavior from which harm ensues" (West, 2006).

Addiction, has been further defined as "repeated failures to refrain from drug use despite prior resolutions to do so" (Heather, 1998), reflecting the view that aspects of decision-making, ambivalence, and conflict, are central features of an addicted individual's behavior and experience. Addiction refers to a syndrome, induced by exposure to a particular drug, which produces chronic changes in the brain's "motivational system", as a consequence of which "a reward-seeking behavior has become out of control" (West, 2006).

### **Tobacco Dependence is 'Addiction by design'.**

Although the tobacco epidemic is a 20<sup>th</sup> century phenomenon, the contemporary presence of tobacco on the Canadian market is a historical anomaly. Because tobacco delivers thousands of chemicals to the user's body with every inhalation, it can be considered a "dirty" nicotine delivery device. If tobacco products were introduced to the market for the first time today, they would be rejected as unfit for human consumption and hence it would not be a legal product. Yet tobacco continues to escape most of the governmental regulatory mechanisms developed to protect the Canadian public and its health from dangerous consumer products and medications.

Tobacco, though legal, remains the only consumer product that will kill at least one out of every two of its regular users when used exactly as intended by the manufacturer. Tobacco has been proven to have no sustenance value; it serves only to addict. Cigarettes are highly engineered drug delivery devices aimed exclusively at achieving "nicotine addiction by design"<sup>2</sup>, resulting in profits for the tobacco industry and its shareholders. Over the past 50 years the tobacco industry has strenuously rejected any responsibility for the devastating health consequences of its products. It has been characteristic of the industry to consistently seek to subvert, distort, and denigrate all of the evidence that has accumulated regarding the lethal nature of its products. Its tactics are by now well known. They have frequently conspired with tobacco industry-friendly scientists and physicians

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<sup>2</sup> This is a term borrowed from the authors: Jeff Fowles and Dennis Shusterman in "Cigarettes science: Addiction by Design", in Tobacco: Science, policy, and public health. Eds: Boyle P, Gray N, Henningfield J, Seffrin J, and Zatonski W. Oxford Press. 2004.

with the sole aim to cast doubt on the link between smoking and the array of resulting disease states, the risks of second-hand smoke, and even on the addictive nature of nicotine. This collaboration has sabotaged public health on many occasions and continues to do so.

### **Tobacco addiction is a vector-driven disease.**

Tobacco addiction is perhaps one of the most important illnesses of our time. It remains the leading preventable cause of death and disease, and this pandemic of tobacco diseases is transmitted by an industry, which serves as its vector. The vector is maintained as a consequence of the greed of an industry unparalleled in its capacity to induce disease and suffering and unrivaled in its amoral and duplicitous conduct as it seeks to maintain profits of billions of dollars. David Kessler, a former Commissioner of the US Food and Drug Administration (1990-1997) aptly suggested, that, the tobacco industry ought to be dismantled.<sup>3</sup> The World Health Organization's Framework Convention on Tobacco Control<sup>4</sup> urges the need for denormalization of the tobacco industry, while defining the critical need to reduce the demand for tobacco through measures of education, communication, and enhanced public awareness, and the training of health professionals so as to facilitate the effective treatment of tobacco addiction on a wide scale.

### **What's in tobacco smoke, and why is it addictive?**

Tobacco smoke contains over 4000 chemicals, of which there are at least 172 toxic substances (Repace, 2006), including three regulated outdoor air pollutants, 33 hazardous air pollutants, 47 chemicals restricted as hazardous waste, and 67 known human or animal carcinogens. Commenting on this unparalleled toxicity, Stan Glantz (1997), a distinguished tobacco researcher, observed: "Each cigarette is like a little toxic waste dump on fire."

Nicotine, although safe in pharmaceutical doses, is considered the fundamental 'driver' of the process of addiction in the brain. Cigarettes without nicotine are not addictive. Repeated exposure to nicotine from tobacco smoke leads to complex neurophysiological transformations, resulting in disordered brain structure and function. Following inhalation, nicotine is rapidly delivered in the arterial system to the brain where it binds primarily to alpha-4 beta-2 ( $\alpha 4 \beta 2$ ) nicotinic receptors, structures central to the initiation and maintenance of the addictive state. These receptors are a natural ligand for acetylcholine. When chronically stimulated by nicotine, upregulation and desensitization of these receptors follow. Stimulation of these nicotinic receptors causes the generation of an action potential whose transmission stimulates other brain centers, resulting in the release of dopamine in the "pleasure center" of the brain. The reward pathway also becomes desensitized as a result of chronic exposure to the drug nicotine, and represents a second major maladaptive change in brain function that follows tobacco administration. It is further suggested that 40-60% of the syndrome of tobacco addiction is genetically modulated.

These changes in a smoker's brain are the neurological underpinnings of the syndrome of tobacco addiction, or nicotine dependence, a syndrome carefully described in global clinical classification systems like the ICD-10<sup>5</sup> and the DSM IV-TR<sup>6</sup>, and recognized as a chronic, relapsing medical condition by countless health authorities, including Health Canada, the Canadian Medical Association, and the World Health Organization. An overwhelming body of clinical and scientific evidence supports the view that tobacco use, far from being a "bad habit" or a "lifestyle choice," is

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<sup>3</sup> D. Kessler. A Question of Intent: A Great American Battle with a Deadly industry. New York: Public Affairs, 2001, p 392.

<sup>4</sup> <http://www.who.int/fctc>

<sup>5</sup> International Classification of Diseases and Health-Related Problems. (World Health Organization).

<sup>6</sup> Diagnostic and Statistical Manual of Mental Disorders. (American Psychiatric Association.)

a pervasive and persistent addictive condition. This addiction is perpetuated by the ability of cigarettes, in reality sophisticated drug delivery devices, to rapidly introduce nicotine and a host of other chemicals to the addiction centers of the brain. The prevalence of this addiction in our communities, and the burdens of the disease imposed on society, poses significant challenges to health professionals, policy makers, and governments. It is clear that there is an urgent need for a comprehensive national response to this modern pandemic.

### **Treatment for tobacco addiction does work.**

It is hopelessly outdated to suggest: “willpower alone is enough to quit”. Such a view betrays a pronounced misunderstanding of the mechanisms inducing and maintaining addiction. Quitting “cold turkey” does not generally translate into sustained abstinence from tobacco, and results in unnecessarily low rates of success for most smokers. It is also important to recognize that today’s smokers may be more addicted than many of their predecessors for whom cessation may have been relatively easier. In an age of smoking restrictions and the growing denormalization of tobacco use, those who continue to smoke are likely those for whom cessation is much more difficult. These individuals may have genomic predispositions which make the task of cessation much harder; a topic beyond discussion in this document. Only 3%–5% of smokers who try to quit without treatment achieve prolonged abstinence for 6–12 months after a given quit attempt, with most relapsing within the first 8 days of attempting to quit. This is in stark contrast to the significantly higher likelihood of sustained abstinence when individuals receive multimodal treatment for their addiction in accordance to internationally promulgated clinical guidelines.

Smoking cessation is considered the ‘gold standard’ of preventive clinical interventions. Only nine smokers need to be successfully assisted with cessation in order to prevent one premature tobacco-related death. No other preventive interventions are as robust; many of the classical preventive strategies, e.g. control of hypertension, treatment of dyslipidemia require the treatment of vastly more patients to show a similar effect. Evidence-based treatments of nicotine addiction are considered safe, effective and remarkably cost-effective.

### **An opportunity for health promotion.**

Despite the existence of internationally recognized treatment guidelines, an array of highly effective therapies, and the recognition of the need for concerted attempts to assist smokers, this addiction remains largely untreated. This represents one of the most significant missed opportunities in public health. It is perhaps best explained as reflecting outdated concepts regarding the underlying mechanism, which perpetuates smoking and is in part a legacy of the tobacco industries’ lavish and longstanding efforts to portray smoking purely as a matter of individual choice.

There are abundant opportunities for us to dramatically improve the health of Canadians. As our population ages, and as the burden of chronic disease (many caused or accentuated by tobacco addiction) increases in our communities, the argument for the development of new strategies becomes all the more compelling. It is important to ensure the availability, affordability, and accessibility of integrated behavioural and pharmacological treatment in every community. Cessation interventions must be delivered, as part of standard care, in every health institution and setting. Provision of pharmacotherapy for cessation must be standard practice in every jurisdiction. The screening for tobacco addiction and the provision of cessation treatment must be seen as part of a duty-of-care and a standard-of-practice for every health professional, like is the case with other medical conditions.

### **What is a rational approach to the treatment?**

As addiction is a chronic condition, the use of a short-term, acute care paradigm for the treatment of a chronic condition like tobacco addiction is illogical and compromises the chances of cessation success. Such practices are themselves an unfortunate legacy of the “just be strong” perspective that guided cessation attempts in the past and which maintained that a “little bit of help is all you should need” given that “moral fiber” was seen as the ultimate determinant of cessation success. Fortunately, contemporary best practices reflect a far more realistic understanding of the nature of tobacco addiction and the processes required to successfully combat it. A short-term focus on “curing” an addictive disorder will be unsuccessful in a large number of cases. The most rational approach to the management of this disorder is reflected in a dovetailing of behavioural and pharmaceutical cessation interventions. Such strategies can be developed and implemented in a highly time-efficient manner and have demonstrated clinical effectiveness, and the details are described below.

### **Recommendations:**

For primary care physicians and other health professionals, the current evidence-based guidelines suggest: consistent screening for, and documentation of, tobacco use; the provision of specific advice regarding the benefits of cessation; an offer of particular assistance with a cessation attempt; and arrangements for appropriate follow-up. This “5-A Approach” is considered standard: Ask, Advise, Assess, Assist, and Arrange follow-up. The consistent application of such a strategy is consistent with a longitudinal approach to the management of this chronic disease. Clinical evidence supports the offer, and provision, of safe and effective treatment to every person addicted to tobacco. A combination of simple, strategic behavioural counseling and pharmacotherapy should be offered to every smoker interested in quitting – and will dramatically enhance the likelihood of a successful quit attempt. Those who are not ready to make an attempt at cessation should be offered simple, sympathetic counseling designed to permit a reassessment of their reasons for continued smoking and an invitation to seek assistance with cessation at any time. Several levels of evidence support the use of the following modalities:

#### **A. Pharmacological interventions:**

- **Nicotine replacement therapy (NRT)** is available in four forms (transdermal patch, chewing ‘gum’, inhaler/vaporizer, and lozenge). All smokers seek to maintain a certain, individualized level of nicotine; and when nicotine levels fall, distinct and usually significant discomfort occurs (withdrawal symptoms) serving to overturn any conscious decisions to stop smoking. The provision of nicotine (delivered via the venous system following its administration to the skin or mucous membranes of the mouth and throat) stimulates nicotine receptors and extinguishes the symptoms of withdrawal permitting a would-be non-smoker to go about normal activities free of the discomfort that normally occurs with cessation attempts. The appropriate use of NRT (particularly when titrated to reflect a person’s individual need for a certain level of nicotine) is efficacious and usually doubles success rates. Combinations of NRT (i.e. use of the patch and the inhaler) are associated with increased levels of success. The scientific evidence does not support the use of alternative tobacco-based nicotine delivery systems, e.g. smokeless tobacco, or ‘snus’ as an aid to smoking cessation. Despite claims to the contrary, these are not considered to serve as a “harm reduction” measure, and may discourage or postpone cessation efforts in smokers who would otherwise have quit, or may induce another form of tobacco dependency with associated health consequences, e.g. pancreatic cancer.

- **Bupropion** is a medication initially used as an anti-depressant; it was subsequently, and serendipitously, found to be effective in producing cessation. However, its mechanism of action for smoking cessation is largely unknown. It is now understood that bupropion maintains levels of dopamine in the reward centers of the brain while affects levels of norepinephrine, a chemical known to be associated with the development of the symptoms of withdrawal. It's use has been shown to double the success rates in those attempting to quit smoking.
- **Varenicline**, a third-generation smoking cessation pharmacotherapy, directly and distinctly binds to the  $\alpha 4\beta 2$  nicotinic receptors (the brain receptors normally stimulated by nicotine). The receptor sites are completely blocked (in exactly the same way that a key in a lock prevents the insertion of another key) but are only partially stimulated. Thus there is a transmitted neurological impulse that, while reduced in intensity, still causes the release of dopamine, in reduced amounts, in the reward centers of the brain. As a result the smoker experiences little to no withdrawal symptoms and if a cigarette is smoked, no pleasurable sensation is experienced (the 'key in the lock' prevents the nicotine 'key' from being inserted). Varenicline has been shown to be the most superior pharmacotherapy for cessation when compared with NRT and bupropion. The odds ratio of quitting with varenicline is approximately 3:1, and current evidence suggests that it is not associated with a higher rate of neuropsychiatric adverse effects than placebo or bupropion, with the exception of the symptom of insomnia (Tonstad, 2008).

**B. Psychosocial interventions**, or counseling (group or individual; office-based, telephone, or web-based) should be routinely offered in combination with medication in order to yield enhanced success in cessation outcomes. The provision of simple, strategic advice regarding the avoidance of high risk situations for relapse, the recognition of settings or circumstances in which smoking has been particularly common; the management of acute cravings, and the development of family smoking guidelines for home and car are all important in accentuating the likelihood of cessation success.

#### **Towards Canadian Guidelines for Tobacco Addiction Treatment:**

At the 58<sup>th</sup> Annual Meeting of the Canadian Psychiatric Association, the Addiction Section of the CPA adopted the USDHHS<sup>7</sup> Clinical Practice Guidelines as a template for the guidance of their members as they deliver smoking cessation treatments to their patients and communities. Members of the Addiction Section noted:

1. "It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.
2. Tobacco dependence (TD) is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.
3. Tobacco Dependence treatment (TDRx) is effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counseling treatments and medications recommended in this Guideline (see #6).

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<sup>7</sup> United States Department of Health and Human Services, Public Health Service.

4. Brief TDRx is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in this section.
5. Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Two components of counseling are especially effective, and clinicians should use these when counseling patients making a quit attempt: Practical counseling (problem solving/skills training), social support delivered as part of treatment.
6. Effective medications are available for TD, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). Six (in Canada) first-line medications reliably increase sustained abstinence.
7. Counseling and medication are effective when used by themselves for treating TD. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication.
8. Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, both clinicians and health care delivery systems should ensure patient access to quitlines and promote quitline use.
9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use motivational treatments in increasing future quit attempts.
10. TDRx is both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counseling and medication identified as effective as covered benefits”.

Although the evidence suggests that interventions are effective across a broad range of populations, tailored interventions may be advised for selected sub-populations, e.g. incarcerated individuals, the mentally ill, pregnant smokers, smokeless tobacco users, and those belonging to minority ethnic groups. Persons with mental illness and chemical dependence also predominantly die of tobacco-related illnesses, and have been shown to also be interested and able to quit smoking when offered appropriate interventions.

Optimal tobacco control programs require an array of integrated strategies and interventions. Appropriate levels of taxation will have a significant impact on deterring smoking (particularly among adolescents) while reinforcing commitments to cessation. Legislation to protect against exposure to second-hand smoke serves to minimize the significant risks of exposure, denormalize smoking, induces quit attempts, and reinforces the commitment to cessation.

### **Conclusions:**

Tobacco addiction is a vector-driven chronic disease, which is prevalent, lethal, treatable, but yet undertreated. The development of comprehensive approaches to tobacco control will save lives and dollars. It is of fundamental importance that policy makers are made aware that assistance with cessation will be more effective and more cost efficient than programmes designed to ensure that smoking is never commenced – both are obviously important, but the magnitude of the health and economic benefits of cessation programmes delivered to the current cohort of smokers make the

former strategy an important, and heretofore largely neglected, element of a contemporary approach to the tobacco disease epidemic.

It is paramount that in the 21<sup>st</sup> century that the Canadian health system develops, and delivers a state-of-the-art smoking cessation programme. At a time of heightened economic pressure, such an approach will produce significant savings in reduced re-admissions, recurrences of illness, and progression of disease than any other preventive intervention. Such interventions are markedly cheaper than virtually all other preventive treatments or intercessions. It is no longer acceptable to use outdated techniques, or permit antiquated attitudes preclude the development and implementation of best practice solutions to the management of the leading cause of preventable disease, disability, and premature death in Canada. The identification and treatment of tobacco addiction is now seen as a standard-of-care in Canada; more importantly there is an emerging consensus that all health professionals have a duty-of-care when tobacco addiction is identified.

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