

Nicotine and addiction

What does the term addiction mean?

Addiction is defined by the World Health Organization as “repeated use of a psychoactive substance or substances, to the extent that the user is:

- periodically or chronically intoxicated,
- shows a compulsion to take the preferred substance(s),
- has great difficulty in voluntarily ceasing or modifying substance use,
- exhibits determination to obtain psychoactive substances by almost any means, and
- tolerance is prominent and a withdrawal syndrome frequently occurs when substance use is interrupted.”¹

The Royal College of Physicians lists the following criteria for addiction:

- a strong desire to take the drug
- substance is taken in larger amounts or longer than intended
- difficulty in controlling use
- a great deal of time is spent in obtaining, using or recovering from the effects of the substance
- a higher priority is given to drug use than to other activities and obligations
- continued use despite harmful consequences
- tolerance
- withdrawal.²

Is nicotine addictive?

Tobacco addiction (like all drug addictions) is a complex combination of pharmacology, learned behaviour, genetics, and social and environmental factors (including tobacco product design and marketing).³

The US Surgeon General acknowledges that “there is no established consensus on criteria for diagnosing nicotine addiction” but asserts that a number of symptoms can be cited as indicators of addiction. These include:

- drug use that is highly controlled or compulsive with psychoactive effects,
- stereotypical patterns of use
- continued use despite harmful effects, and
- relapse following abstinence accompanied by recurrent cravings.

The Surgeon General concludes that “*nicotine is the key chemical compound that causes and sustains the powerful addicting effects of commercial tobacco products.*”⁴ This report follows a landmark review published in 1988 which had also concluded that cigarettes and other forms of tobacco are addictive and nicotine is the drug in tobacco that causes addiction.⁵

A report by the Royal College of Physicians on nicotine addiction agrees that nicotine fulfils criteria for defining an addictive substance.

The report states that *“it is reasonable to conclude that nicotine delivered through tobacco smoke should be regarded as an addictive drug, and tobacco use as the means of self-administration”* and concludes that: *“Cigarettes are highly efficient nicotine delivery devices and are as addictive as drugs such as heroin or cocaine.”*²

There is some evidence to suggest that smokers can become addicted to nicotine very quickly. A study from the United States found that adolescent smokers displayed symptoms of nicotine withdrawal within the first few weeks of commencing smoking.⁶

Properties of nicotine

Nicotine induces pleasure and reduces stress and anxiety. Smokers use it to modulate levels of arousal and to control mood.⁷ Paradoxically, while nicotine is a stimulant drug, effects of both stimulation and relaxation may be felt. The mental and physical state of the smoker, and the situation in which smoking occurs, can influence the way in which a particular cigarette will affect psychological perceptions.⁸ The addictive effect of nicotine is linked to its capacity to trigger the release of dopamine - a chemical in the brain that is associated with feelings of pleasure.⁷

However, research has suggested that in the long term, nicotine depresses the ability of the brain to experience pleasure.⁹ Thus, smokers need greater amounts of the drug to achieve the same levels of satisfaction. Smoking is therefore a form of self-medication: further smoking alleviates the withdrawal symptoms which set in soon after the effects of nicotine wear off.

Difficulty in quitting

Possibly one of the strongest indicators of the effect of nicotine is the discrepancy between the desire to quit and quitting success rates. Surveys consistently show that the majority of smokers (around two-thirds) want to stop smoking¹⁰ yet the successful quit rate remains very low.

The 2008/09 “Smoking-related Behaviour and Attitudes” survey found that 26% of smokers had attempted to quit in the previous year and as many as 21% of smokers had made three attempts in the previous year alone.¹¹ However, only eight per cent of smokers succeeded in quitting for two or more years. Similarly, figures from the United States show that each year only 3 per cent of smokers succeed in quitting. Most smokers take several attempts to quit before they finally succeed.^{12,13}

The power of addiction is further demonstrated by the fact that some smokers are unable to stop smoking even after undergoing surgery for smoking-related illnesses. A 1995 study found that around forty per cent of those who had a laryngectomy resumed smoking soon after surgery, while about 50 per cent of lung cancer patients resumed smoking after undergoing surgery.¹⁴ Among smokers who have had a heart attack, as many as 70% take up smoking again within a year.¹⁵ More recent studies confirm the difficulties faced by smokers in quitting even following the diagnosis of a life threatening illness.^{16,17}

Other measures of dependence

There are a number of markers which can measure dependence on a substance. A key factor is the degree of compulsion to take the drug experienced by the user. Most smokers smoke on a daily basis. In Britain, the average self-reported consumption of cigarettes is 13 per day.¹⁸ Other indicators of dependence include the time from waking to first cigarette. In 2010, among smokers of all ages, 14 per cent reported lighting up within five minutes of waking. Heavy smokers are much more likely than light smokers to smoke immediately on waking: 32% of those smoking more than 20 cigarettes a day light up within five minutes of waking, compared to just 4% of those smoking fewer than 10 a day.¹⁹

The Fagerström Test for nicotine dependence

A widely used tool for measuring nicotine addiction is the [Fagerstrom test for nicotine dependence](#).¹⁹

The questionnaire determines the degree of dependence by measuring the extent of nicotine exposure, impaired control over use and urgency for use. A key question about time from waking to first cigarette is used as a strong predictor of relapse following a quit attempt.

Nicotine withdrawal symptoms

Another marker for addiction is the occurrence of withdrawal symptoms following cessation of drug use. For smokers, typical physical symptoms following cessation or reduction of nicotine intake include craving for nicotine, irritability, anxiety, difficulty concentrating, restlessness, sleep disturbances, decreased heart rate, and increased appetite or weight gain.²⁰ These symptoms can be alleviated by using Nicotine Replacement Therapy products, such as patches, gum, nasal spray and lozenges or other medication such as varenicline (Champix) or bupropion (Zyban).

For further information about using nicotine as an aid to stopping smoking download ASH Fact Sheet: [Benefits and aids to quitting](#).

Genetic influence

Research suggests that certain smokers may be predisposed to nicotine addiction through the effects of a gene responsible for metabolising nicotine. Scientists have found that non-smokers are twice as likely to carry a mutation in a gene that helps to rid the body of nicotine.²¹ Researchers in the United States found that smokers who carried a genetic variant were more likely than non-carriers to be heavy smokers, more heavily dependent on nicotine, and less likely to quit smoking. Carrying the variant did not make a person more likely to be a smoker, but smokers who carried the variant were more likely to be addicted to nicotine.²² In addition, smokers who carry mutations in the gene CYP2A6 are likely to smoke less because nicotine is not rapidly removed from the brain and bloodstream.²³ By contrast, smokers with the efficient version of the gene will tend to smoke more heavily to compensate for nicotine being removed more rapidly.

Nicotine and harm reduction

Although nicotine is the addictive component of tobacco products it is the toxins and carcinogens in tobacco smoke that cause most of the harm from using tobacco.²⁴ Pure or 'clean' nicotine extracted from tobacco can be used to help people overcome their addiction as demonstrated through the use of nicotine replacement therapies (NRT). For more information on ways to stop smoking download the ASH fact sheet: [Stopping smoking - the benefits and aids to quitting](#).

NRT can also be used to help smokers cut down the number of cigarettes smoked or as an aid to temporary abstinence, that is, when a smoker is required to go without smoking for a long period of time, for example, on a long flight or during a stay in hospital.²⁵ The National Institute for health and Care Excellence (NICE) has now published guidance on tobacco harm reduction.²⁶ While recognising that quitting smoking is always the best option for smokers, the NICE guidance supports the use of licensed nicotine containing products to help smokers not currently able to quit to cut down and as a substitute for smoking, where necessary indefinitely. The Medicines and Healthcare products Regulatory Agency (MHRA) has also announced that non-tobacco nicotine products (for example electronic cigarettes) will be regulated as medicines.²⁷ For further information download the ASH policy on [Regulating nicotine products](#).

Tobacco industry recognition of the importance of nicotine

Tobacco industry documents dating from the 1960s have shown that tobacco companies recognised that the main reason that people continue smoking is nicotine addiction. A lawyer acting for Brown & Williamson said: “*Nicotine is addictive. We are, then, in the business of selling nicotine, an addictive drug.*”²⁸ Publicly, however, tobacco companies denied that nicotine was addictive, because such an admission would have undermined their stance that smoking is a matter of personal choice. As the US Tobacco Institute put it in 1980: “*We can’t defend continued smoking as ‘free choice’ if the person was ‘addicted’.*”²⁹ The industry was also quick to realise that selling an addictive product is good for business: as a British American Tobacco memo said in 1979: “*We also think that consideration should be given to the hypothesis that the high profits additionally associated with the tobacco industry are directly related to the fact that the customer is dependent on the product.*”³⁰ In March 1997, Liggett Group, the smallest of the five major US tobacco companies, became the first to admit that smoking is addictive as part of a deal to settle legal claims against the company.³¹ Subsequently the tobacco companies tried to cast doubt over the meaning of addiction by comparing smoking with other common pursuits such as shopping or eating chocolate.³²

For further examples of the tobacco industry’s position on addiction see [chapter 2](#) of ‘Tobacco Explained’. Other examples can be found in “[Trust Us, We’re the Tobacco Industry](#)”.

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