

Fact sheet no. 8

Nicotine and Addiction

A comprehensive look at why and how nicotine is so addictive. This fact sheet examines the mental and physical aspects of nicotine addiction. August 2018.

HARM TO HEALTH FROM NICOTINE

Almost all of the harm from smoking comes from the inhalation of tobacco smoke rather than nicotine.⁵ There are some risks to health from nicotine but overall they are relatively minor. Nicotine increases heart rate and blood pressure and can also increase gastric acid secretion leading to peptic ulcers. Smoking during pregnancy is associated with a number of disorders and nicotine is believed to be a factor in adversely affecting fetal brain and lung development.⁶ The extent of harm from use of nicotine from other sources, notably nicotine replacement therapy, is less clear but the evidence to date suggests that medicinal nicotine does not reduce birth weight and is not a cause of serious developmental abnormalities.⁵ In fact, the only study that compared fetal and maternal outcomes in pregnant women who used nicotine and placebo patches reported better outcomes with nicotine patches.⁷

Children are also at risk of nicotine poisoning through accidental ingestion of tobacco or liquid nicotine. However, serious poisoning is usually prevented by the fact that even relatively small doses cause nausea and vomiting which stops users from further intake.⁸

IS NICOTINE ADDICTIVE?

While some smokers can stop smoking without any great problems, others continue to smoke despite a strong desire to stop and multiple attempts to do so. The addictive potential of smoking is linked closely to the tobacco alkaloid nicotine.

The Royal College of Physicians' 2000 report on nicotine addiction 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

It is important to note that it is the delivery of nicotine through tobacco smoke which makes it potentially addictive as this is the fastest way of delivering nicotine to the bloodstream.¹ Tobacco smoke may also include chemicals that make nicotine more potent because nicotine separated from tobacco is not particularly addictive. Studies have shown that animals do not self-administer nicotine readily even if provided rapidly, and nicotine replacement treatments have virtually no addictive potential for non-smokers and only limited appeal to smokers.²

There is some evidence to suggest that some smokers can become addicted to smoking very quickly. This can be especially true of young people, since 40% of regular smokers start before the age of 16²; recent research has shown that in England, almost one in five children had smoked.⁸ 60% of regular smokers reported that they would find it very or fairly difficult to not smoke for a week, while 74% reported that they would find it very or fairly difficult to give up smoking altogether.³ Just over a half (51%) of regular smokers reported that they had tried to give up smoking.⁴

PROPERTIES OF NICOTINE

When a person smokes, nicotine is distilled from burning tobacco and small droplets of tar containing nicotine are inhaled and deposited in the lungs. Nicotine can be absorbed quickly or slowly depending on the route of administration and how the drug is formulated. During smoking, nicotine enters the bloodstream rapidly, peaking approximately 20 seconds after inhalation.⁵ By contrast, the various types of nicotine replacement therapy including electronic cigarettes deliver nicotine much more slowly.

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. 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.

However, when people who have never smoked are given nicotine they do not experience the mood-enhancing benefits reported by smokers, suggesting that the feelings of pleasure derived from smoking are largely due to the alleviation of cravings for nicotine after periods of abstinence.²

DIFFICULTY IN QUITTING

Possibly one of the strongest indicators of the effect of nicotine inhaled through tobacco smoke is the discrepancy between the desire to quit and quitting success rates. Surveys consistently show that a majority of smokers want to stop smoking yet the successful quit rate remains low.¹⁰

A smoker will typically make several failed quit attempts before they manage to quit smoking successfully.¹¹ Data from the English Smoking Toolkit Study has shown that in 2017, 34.3% of people had attempted to quit within the previous 12 months, while 17.8% of those who attempted to quit had succeeded.¹²

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. One study found that around 40% of those who had a laryngectomy resumed smoking soon after surgery, while about 50% of lung cancer patients resumed smoking after undergoing surgery.¹³ Among smokers who have had a heart attack, as many as 70% take up smoking again within a year.¹⁴ More recent studies confirm the difficulties faced by smokers in quitting even following the diagnosis of a life-threatening illness.^{15 16}

OTHER MEASURES OF DEPENDENCE

A widely used tool for measuring cigarette addiction is the Fagerström test for cigarette dependence.¹⁷ The questionnaire determines the degree of dependence by measuring the extent of cigarette exposure, impaired control over use and urgency for use. A key question is about time from waking to first cigarette, and can predict how difficult quitting smoking is likely to be. In 2016, ONS statistics found that among smokers aged 16 and over, 44.2% reported lighting up within half an hour of waking including 14% who had their first cigarette of the day within five minutes of waking.¹⁸

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 smoking include urge to smoke, irritability, anxiety, difficulty concentrating, restlessness, sleep disturbances, decreased heart rate, and increased appetite or weight gain.¹⁹ These symptoms can be alleviated by using Nicotine Replacement Therapy products including e-cigarettes or other medication such as varenicline (Champix) or bupropion (Zyban).

GENETIC INFLUENCE

An individual's likelihood of becoming addicted to nicotine may be influenced by their genetic make-up. Twin and family studies have shown that there is not one specific gene that determines who will develop a smoking addiction but rather several genes that cause an individual to become more susceptible to being addicted to smoking.²⁰ These genes are responsible for how certain neurotransmitters are produced and metabolised, the number of receptors that are available to act on and how rapidly nicotine is metabolised by the individual. A New Zealand longitudinal study measuring smoking initiation, conversion to daily smoking, nicotine dependence and cessation difficulties found that the genetic risk score was unrelated to smoking initiation. However, individuals at higher genetic risk were more likely to become daily smokers as teenagers, progressed more rapidly to heavy smoking, developed nicotine dependence more frequently and were more likely to fail in their cessation attempts.²¹

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.²² Nicotine extracted from tobacco can be used to help people overcome their compulsion to smoke as demonstrated through the use of nicotine replacement therapies (NRT) and consumer nicotine products including electronic cigarettes.

NICOTINE REPLACEMENT THERAPY

Nicotine Replacement Therapy (NRT) works by providing smokers with nicotine to help them deal with withdrawal symptoms after quitting smoking. NRT is much safer than smoking because it does not contain the tar and other toxic chemicals contained in tobacco smoke. NRT is available in many forms including chewing gum, lozenges, patches, inhalers and a nasal spray.²³ Using NRT can roughly double a person's chances of successfully stopping smoking compared to someone trying to quit unaided.⁶

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."²⁷ 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.²⁸ 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.²⁹

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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NON-MEDICAL NICOTINE PRODUCTS

Aside from medicinal NRT, currently the main alternative source of nicotine available to consumers is from electronic cigarettes, also known as vapes. These devices have risen in popularity in recent years and are used by smokers and ex-smokers to cut down, quit or prevent relapse to smoking.²⁴ Electronic cigarettes act in a similar way to other forms of nicotine replacement therapy.

For further information on tobacco harm reduction and e-cigarettes see the ASH fact sheets:

[Use of electronic cigarettes among adults in Great Britain](#)

[Use of electronic cigarettes among children in Great Britain](#)

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."²⁵ 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'".²⁶ The industry was also quick to realise that selling

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