

# Nicotine Addiction

## Making a Difference Today

Nicotine, one of the most heavily used addictive drugs in the United States, comes with high costs to those addicted to it, to those breathing in their smoke, and to the economy.

Long-term smoking can lead to fatal heart attacks, strokes, emphysema, and cancer. Secondhand smoke is associated with lung cancer and heart attacks in adults and greatly increases the risk of respiratory illnesses in children. According to the 2000 Centers for Disease Control and Prevention estimates, tobacco topped the leading, preventable causes of death, resulting in 18 percent of total U.S. deaths. And, nicotine addiction is costly, reaching more than \$138 billion a year in direct medical costs and in indirect costs, such as perinatal care for low-birth-weight infants of mothers who smoke.

Despite the known health risks of nicotine addiction, numerous people still smoke cigarettes and use other forms of tobacco, and many have difficulty quitting. Nearly 35 million smokers make a serious attempt to quit each year, but less than 7 percent who try to quit on their own remain tobacco-free more than a year, due to nicotine's highly addictive nature. Nicotine is readily absorbed from tobacco, resulting in an almost immediate "kick" from the chemical epinephrine released from the adrenal cortex and from the chemical dopamine, and other chemicals, released in the brain's pleasure and reward systems. Withdrawal symptoms such as depressed mood, fatigue, increased appetite, and irritability usually follow, and are common when smokers try to quit. Creating a strong desire to repeat the pleasurable feelings and to decrease the withdrawal symptoms, nicotine drives the person to use more and more of it.

### Research Leads to Improved Treatment

Fortunately, due to research partly funded by the National Institutes of Health (NIH), discoveries on the chemistry of tobacco's effects have led to some biology-based treatments for nicotine addiction.

One major step in treatment development occurred when researchers determined that the chemical nicotine is the key addictive component of tobacco. Based on this finding, scientists developed "nicotine replacement strategies," including the nicotine patch, the nicotine inhaler, and nicotine gum—nicotine gum was already available, since its invention in the 1970s, but these findings further advanced this strategy. These treatments help wean people off tobacco by providing low concentrations of nicotine without the other toxins found in tobacco. This strategy reduces withdrawal symptoms and cravings for cigarettes and other tobacco products, decreasing the motivation to resume using tobacco.

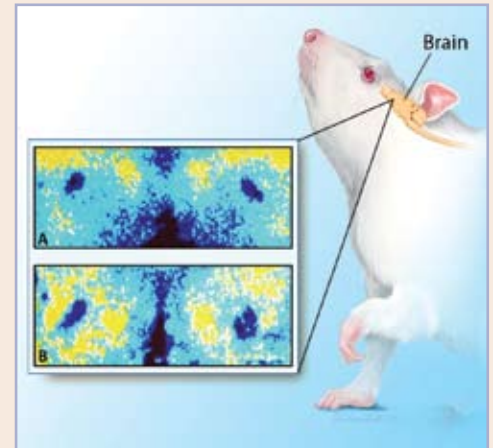
In 1997, bupropion became the first non-nicotine medication to gain approval by the Federal Drug Administration for the treatment of nicotine addiction. Researchers suspect that bupropion works by targeting the reward and pleasure pathways in the brain. Bupropion decreases nicotine's withdrawal symptoms and aids in smoking cessation.

### Continued Advances in Treatment

Although nicotine replacement strategies and bupropion help many, they do not lead to quitting in every person addicted to nicotine.

Thanks to support from NIH, researchers are getting closer to finding more treatments and combinations of strategies that work. Already they have discovered much about the brain pathways involved in nicotine addiction. With continued funding from NIH, scientists could translate these findings into better treatments that would help more people quit tobacco.

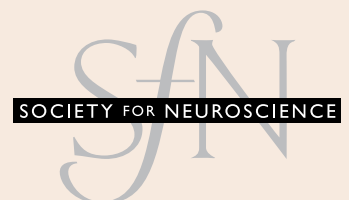
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In one study depicted above, researchers examined a brain section, termed the nucleus accumbens, which is a critical target of addictive drugs and thought to be part of a pathway that produces pleasure, reward, and desirable mood states. Image A shows the nucleus accumbens taken from a rat that had no nicotine. Image B shows the effects of an injection of nicotine. The increase in yellow shading indicates that nicotine boosts activity of the area. This and other findings suggest that the nicotine in tobacco products, like other addictive drugs, creates its alluring effects by activating rewarding pathways in the brain.

### Continued funding for research could lead to:

- The development of new medical treatments, such as a vaccine for tobacco users and combined strategies of counseling and medicines that target diverse brain mechanisms and account for differences between tobacco users.
- A greater understanding of how nicotine affects the brain and its role in addiction.
- A greater understanding of other drug addictions that share common brain pathways with nicotine addiction.
- A reduction in the number of people addicted to nicotine, resulting in decreased costs to society.



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# Nicotine Addiction

## Making a Difference Tomorrow

Research has come a long way in helping to combat nicotine addiction, but more is needed. Current strategies do not adequately treat everyone.

As a result, nicotine addiction continues to cause a host of health problems.

Did you know that:

- Nicotine is one of the most heavily used addictive drugs in the United States.
- Nearly 35 million smokers make a serious attempt to quit each year, but less than 7 percent who try to quit on their own remain tobacco-free more than a year.
- Tobacco topped the leading, preventable causes of death, resulting in 18 percent of total U.S. deaths, or approximately 440,000 people, in 2000.
- Economic costs of nicotine addiction reach more than \$138 billion in direct and indirect medical costs annually.

### Research Brings Hope for the Future

With increased funding for scientific studies, researchers can gain a greater understanding of how nicotine affects the brain and of how the addiction process works, leading to better treatments and even prevention of nicotine addiction.

Several new promising strategies are in development, including a vaccine for tobacco users. The tobacco vaccine may be effective in both the treatment and prevention of nicotine addiction, as well as in the prevention of relapse. The vaccine is designed to bind to nicotine in the body and prevent it from reaching the brain's reward pathways. This interception could block the pleasurable effects that make a person want to continue to use tobacco.

Following encouraging animal research, scientists have started testing nicotine vaccines in people. Early results from one group, funded by the National Institutes of Health, indicate that its vaccine is safe. Larger studies specifically designed to test the vaccine's effectiveness as a treatment are being planned.

Researchers believe that a wider range of treatment options are needed to better battle tobacco addiction. Although successful for some, currently available treatments including nicotine replacement strategies and bupropion do not work for everyone. For many, ideal therapy will likely involve combination techniques that include counseling and a variety of medicines that target diverse brain mechanisms and account for differences between tobacco users.

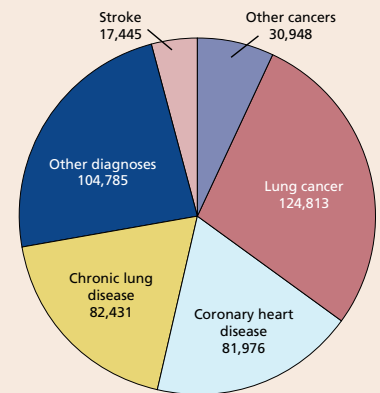
With continued funding for scientific research, advances in nicotine addiction could provide more people with access to improved treatment regimens.

### Hope for Other Addictions

Many pathways and chemicals in the brain that are affected by nicotine addiction are affected in similar ways by other addictive drugs. Researchers think that study of the pleasure and reward pathways and of dopamine in the brain, for example, will not only increase understanding of nicotine addiction, but of other drugs of abuse as well.

With continued funding for research, scientists can know more about these pathways and chemicals, which brings researchers closer to finding successful treatments for many of these addictions.

Average Annual Number of U.S. Deaths Attributed to Cigarette Smoking



According to the 2000 Centers for Disease Control and Prevention estimates, tobacco topped the leading, preventable causes of death, resulting in 18 percent (approximately 440,000 people) of total U.S. deaths.

### Already research has led to:

- An increased understanding of tobacco addiction, including the discovery that nicotine is the key addictive component of tobacco.
- A better understanding of the brain's pathways and chemicals that are affected by nicotine addiction.
- Increased treatment options for individuals hooked on cigarettes or other tobacco products.

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