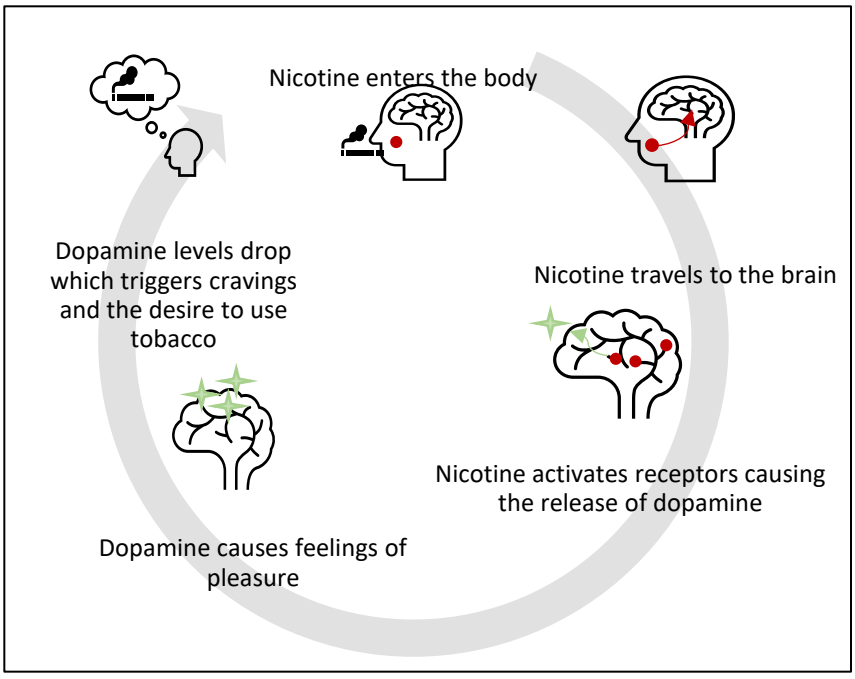
How Tobacco Use Disorder Develops in the Brain

Tobacco use disorder (TUD) is a chronic relapsing condition characterized by dependence on nicotine. It includes periods of withdrawal and behavioral patterns of continued use despite known harms. **Nicotine** is a naturally occurring substance in tobacco plants and is the primary substance that makes tobacco addictive. The most immediate risk of using tobacco products is becoming addicted to nicotine because it leads to addiction to tobacco products, which in turn causes premature morbidity and mortality.

What happens in the brain when someone uses tobacco?

Nicotine travels through the bloodstream to the brain in 7-10 seconds, where it binds to nicotinic receptors. This binding releases chemicals in the brain, including dopamine, to activate the reward pathway and lead to feelings of pleasure. The reward system in the brain is necessary for survival as it reinforces behaviors to natural rewards, such as eating food. However, nicotine floods the brain with ten times more dopamine than a natural reward. This encourages someone to use tobacco again and again in the future.



Within a few hours, nicotine levels in the bloodstream drop and dopamine levels in the brain decrease. This withdrawal process triggers the desire to use tobacco again.

What happens in the brain with continued tobacco use?

Regular tobacco use changes the structure and function of the brain and leads to dependence or TUD. Over time the brain relies on having nicotine present and develops extra nicotine receptors. The receptors become desensitized, so a person needs to consume a greater amount of nicotine to feel the same effects. This is known as tolerance. People initially smoke for the positive or pleasurable feelings, eventually this shifts to smoking largely to avoid negative experiences like nicotine withdrawal.

Behaviors or situations, such as waking up, eating a meal or driving, and time of day can become associated with tobacco use and can reinforce dependence. For many people, tobacco use is combined with other substance use and has been shown to have reinforcing effects in the brain due to overlapping reward and stress pathways. Tobacco use can impede recovery of brain function from other substance use and make recovery from all substances more challenging. Smoking may lead to cravings for other substances, whereas quitting smoking may enhance recovery from substances.

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Clinician Talking Points About Tobacco Dependence and Nicotine Addiction

Strategy	Talking Points
Discuss what happens in the brain in the presence and absence of nicotine	• "Quitting smoking is beneficial regardless of age and the health benefits start almost immediately." • "Changes to the brain from tobacco use are reversible, and, over time, receptors will return to normal levels making cravings less strong or frequent."
Explain tobacco use as an addiction, not a habit	• "Tobacco activates the reward pathway in the brain. Over time, the brain learns to need nicotine. When the nicotine metabolizes and levels are low enough, people experience withdrawal symptoms and have cravings." ***TIP:*** Use the Fagerström Test for Cigarette Dependence to measure severity of nicotine dependence.
Explore how tobacco use is related to the use of other substances	• "Being tobacco-free will decrease likelihood of using other substances, so I highly recommend we add that to your treatment plan." • "How is tobacco use related to other substance use for you? Do you use them together?" • "Nicotine and other addictive substances activate overlapping pathways in the brain. This reinforces activation of those pathways in the brain, linking tobacco use and other substance use together." ***TIP:*** Understanding why people like to use tobacco is key to change.
Discuss how medication can reduce withdrawal symptoms	• "Nicotine medicines like patch, gum, or lozenge can help reduce cravings to smoke, but without all the toxic and harmful chemicals that come along with the nicotine when you smoke cigarettes." • "Gradually decreasing medication over time can help the brain recover and get used to working without as much nicotine." ***TIP***: Treatments that include counseling, medication, and supportive resources are most effective.
Identify coping strategies to move through cravings	• "We are working on coping skills when we experience triggers for alcohol. How can we apply those skills to tobacco?" • "Our environment can make it more difficult to be tobacco-free, it is important that you have support. Who is in your support system?" ***TIP:*** Use the Wisconsin Tobacco Quit Line as additional support.
Discuss social and environmental factors that influence tobacco use	• "The tobacco industry has marketed their products to many populations, including people with behavioral health conditions, contributing to disproportionate burdens of tobacco use and health outcomes."
Refer to additional resources	• "I am happy to hear you are ready to make a change. If you want extra support, you can call the Wisconsin Tobacco Quit Line (1-800-QUIT-NOW). They offer free counseling support and medication to help you be successful." ***TIP:*** Make a direct referral to the Quitline or make a warm handoff and call together.

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