**1.Webmd.com**

## What Are Nicotine Pouches?

A nicotine pouch is a small bag that contains the addictive chemical nicotine and some other ingredients. It doesn’t have tobacco leaf in it. Some companies that make nicotine pouches market them as a safer alternative to smoking and dipping. But talk to your doctor before you use them to try to kick the habit. They’re not an FDA-approved type of nicotine replacement therapy, like nicotine gum or lozenges.

## What’s in a Nicotine Pouch?

The main ingredients are nicotine, water, flavorings, sweeteners, and plant-based-based fibers. Product makers sell nicotine pouches under brands like On!, Zyn, and Velo. They come in different strengths, so some have more nicotine than others.

The lack of tobacco leaf in them makes them different from other “smokeless” products with nicotine, like chewing tobacco, snuff, and snus. Even though snus can also come in a small pouch that goes in your mouth, it’s filled with moist, finely ground tobacco.

How to use nicotine pouches

To use a nicotine pouch, you place it in your mouth between your gum and lip for up to an hour. You don’t smoke it or swallow it. Instead, your body absorbs the nicotine into your bloodstream through mucous membranes in your mouth.

## Nicotine Pouch Side Effects

Scientists need to do more studies to find out how safe nicotine pouches are and how well they work. But they can bring on side effects, like:

* Hiccups
* Gum irritation
* Nicotine addiction
* Sore mouth
* Upset stomach

Never share a nicotine pouch with someone else, and call your doctor right away if you swallow one.

Because nicotine pouches don’t have tobacco, they may be safer than snus and other smokeless tobacco products, which can cause:

* Cancers of the mouth, throat, and pancreas
* Gum disease
* Tooth loss
* Cavities and stained teeth
* Higher chances of heart disease and stroke

Does Zyn cause gum diseases?

It's unclear whether nicotine pouches like Zyn cause gum disease. But, one side effect of a similar product, snus, is a type of gum disease called gum recession. This is when your gum tissue pulls away from your teeth, revealing the roots and raising your chances of cavities.

## Long-Term Side Effects of Nicotine Pouches

Nicotine is harmful to your health and extremely addictive. It can cause heart, lung, stomach, and fertility problems, raise your blood pressure, and weaken your immune system. It could also play a role in hardening your artery walls, which may lead to a heart attack. And since nicotine is addictive, you may have side effects if you decide to stop.

Do nicotine pouches cause cancer?

Nicotine doesn't directly cause cancer. People have safely used nicotine replacement therapy (NRT) for years to help quit smoking. But research shows nicotine is a tumor promoter, making cancer more aggressive.

## Are Nicotine Pouches Safe?

Are nicotine pouches safer than regular smoking or vaping?

Experts don't know for sure how nicotine pouches might affect your health in the long run. They're not officially considered smokeless tobacco, so the FDA doesn't regulate them as closely as cigarettes or other tobacco products you light up. Since there's not enough data over a long period, you can't be sure if using these pouches, even if they expose you to less nicotine, is safer.

Why are nicotine pouches so popular, and why is that a problem?

Tobacco companies sell nicotine pouches in attractive packaging and a range of flavors, including citrus, peppermint, and coffee. Researchers are concerned that this marketing tactic is likely to appeal to young people and nonsmokers who may not be aware of nicotine's harmful effects. Some social media influencers are also promoting the use of nicotine pouches by showing how they use them in their daily lives, discreetly placing them in their mouths at school and work, and doing taste tests.

## Better Ways to Quit Tobacco

Don’t use a nicotine pouch without talking to your doctor first. If you’re a heavy smoker who lights up 10 or more times a day, they may recommend you try a type of nicotine replacement therapy that the FDA has already approved.

Nicotine replacement therapy comes in different forms, like:

* Nicotine patches
* Gum
* Lozenges
* Nasal sprays
* Inhalers

Once you stop smoking, these can ease your cravings for cigarettes. They can also help you manage nicotine withdrawal, which can make you feel sad or cranky, have trouble sleeping, or feel mild flu-like symptoms.

In general, nicotine replacement therapy is a safe quit-smoking treatment if you’re a healthy adult and you’re not pregnant. But you still need to learn about the side effects and get your doctor’s OK before you start using it. It probably isn’t right for you if you’re still using tobacco or if you were a light smoker before you decided to quit.

Some other ways to give up tobacco are:

* Work with your doctor on a plan to quit.
* Call a quit line, like 800-QUIT-NOW or 877-44U-QUIT.
* Use a program like SmokefreeTXT. (Text QUIT to 47848.)
* Get tips from an app, like the free QuitGuide.
* Avoid people, places, and situations that seem to make you crave tobacco.
* Take charge of stress with healthy habits like exercise and meditation.
* Join a quit-smoking support group.
* Ask family and friends to keep you accountable as you try to kick the habit.

## Takeaways

Nicotine pouches are small bags containing nicotine, water, flavorings, sweeteners, and plant-based fibers, but no tobacco leaf. Marketed by brands like On!, Zyn, and Velo, they're placed between the gum and lip to absorb nicotine without smoking or swallowing. While they're not FDA-approved, like nicotine gum or patches, some consider them a safer alternative to smoking. But they can cause side effects like gum irritation and addiction. The appealing packaging and flavors of nicotine pouches are concerning to researchers, who fear they may attract young people and nonsmokers unaware of nicotine's dangers. Talk to your doctor before using nicotine pouches and explore FDA-approved nicotine replacement therapies or other quitting methods.

**2.Yalemedicine.org**

# What Parents Should Know About Nicotine Pouches

Just as the use of vaping (e-cigarette) devices among young people began to decline—eliciting a collective sigh of relief from public health officials—a new, potentially worrisome product is gaining popularity among youth: nicotine pouches.

Unlike cigarettes and vaping devices, which produce smoke and vapor, nicotine pouches are more discreet and, therefore, harder for parents to notice. They are tucked in between a person’s lip or cheek and gums; the nicotine is absorbed into their bloodstream through mucous membranes in their mouth.

These pouches do not contain tobacco, the plant—and known carcinogen—used in cigarettes and smokeless tobacco, which includes chew and dip. But they do have nicotine, a chemical found in tobacco. Health experts say that nicotine has negative effects on everyone, but it is particularly dangerous for young people because it can cause physical changes in their still-developing brains. It is also a highly addictive stimulant.

Nicotine pouches were introduced in the United States in 2014. The Food and Drug Administration (FDA)’s traditional “safe and effective” standard for evaluating medical products doesn’t apply to tobacco and nicotine products. Instead, the FDA regulates them based on an intention to reduce the toll that using tobacco and nicotine has on public health.

Because nicotine pouches are relatively new, the short- and long-term health consequences of using them are unclear. And while some suggest that they may not be as harmful as cigarettes and vaping because they don’t contain tobacco, there are other concerns, including nicotine’s effects on cardiovascular and oral health (more on that below).

Nicotine pouches are sold online and in stores to people 21 and older, but they come in different flavors—including berry, cinnamon, citrus, coffee, and peppermint—that may be appealing to youth. What’s more, ZYN®, the top-selling brand worldwide, has “Zynfluencers” who promote the product on social media channels. Other brands include Rogue, Lucy, Juice Head, VELO, and On!

The good news is that the uptick in use among youth has not been as considerable as it was for vaping.

“Nationally, sales of nicotine pouches have risen dramatically in recent years, but it hasn’t been the skyrocketing growth that was initially seen with vaping,” says Meghan Morean, PhD, a research scientist at the Yale Tobacco Center of Regulatory Science.

A 2023 study from the Centers for Disease Control and Prevention (CDC) said that about 1.5% of middle and high school students reported using nicotine pouches in the last 30 days. That’s compared to 10% who reported using any tobacco product, which includes cigarettes, cigars, e-cigarettes, and nicotine pouches.

Below, Morean answers common questions about nicotine pouches.

## What are nicotine pouches?

Nicotine pouches are small rectangles that are about the size of a piece of Chiclet® gum. They contain nicotine that is either synthetic or derived from tobacco and, as mentioned above, come in a variety of flavors. They are often sold in tins of 15 to 20 pouches and come in varying strengths. One brand, for example, sells tins in either 3 or 6 milligrams of nicotine per pouch; another brand sells pouches with 13 milligrams of nicotine per pouch.

“They are small, skinny, flavored little pouches,” Morean explains. “You put them in your mouth, most commonly tucked between your gum and upper or bottom lip. Then, you leave it sitting for a while, so that the nicotine can be absorbed through the inner lining of your cheek and into your bloodstream. Some nicotine can also get into your system by swallowing the juice. When you are done, you take it out and throw it in the trash.”

How long someone keeps a pouch in their mouth can vary. “Some sites tell people to leave it in their mouths for 15 minutes or up to a half hour or 45 minutes, but there isn’t an instruction manual for them,” Morean says.

Pouches have similarities to nicotine gum, such as Nicorette®, which is used to help people quit smoking, Morean says. “Nicorette is similar in that it contains 2 to 4 milligrams of nicotine, and you let it sit in your mouth,” she says. “But there are two key differences. The first is that people say Nicorette doesn’t taste very good, which makes sense as you wouldn’t want to make it in ultra-appealing flavors to attract kids. But nicotine pouches are available in different, appealing flavors. The second is that Nicorette is an FDA-approved smoking cessation tool, whereas pouches are not.”

## Are nicotine pouches dangerous, especially for kids?

Tobacco use is the leading preventable cause of cancer and cancer deaths. Nicotine may not contain the chemicals and toxins found in cigarette smoke, but it is highly addictive. It can also negatively affect the entire body, causing lung and stomach problems, increasing blood pressure and heart rate, and narrowing arteries, which can lead to a heart attack.

And while nicotine pouches may be a safer alternative to cigarettes or vaping because they don’t contain the known carcinogens associated with tobacco and are not inhaled in the lungs, they still are not recommended as something people should pick up. And they are especially not meant for youth, says Morean.

That said, long-term data about the health risks of nicotine pouches are not yet available. “We don’t know what happens, over time, when you have varying strengths of nicotine sitting in your mouth in a pouch,” Morean says. “It’s possible that the risk is very minimal. But it’s also possible that it has an effect over time. There are studies looking at changes in cheek cells, but we don’t have all the information yet. We do know that it can irritate your gums in the short term, and some people find that nicotine gives them an upset stomach.”

Morean also notes that nicotine is a stimulant. “For adolescents and young adults, nicotine has detrimental effects on the developing brain. When your brain is forming, nicotine use can cause issues, including increased impulsivity and ADHD-type cognitive symptoms,” Morean says.

It can also lead to a predisposition to addiction, both to nicotine and other substances. If someone, including a child, is new to using nicotine, they also will feel a “buzz,” Morean says.

“The feeling doesn’t last long; it’s like a little head rush where you feel lifted,” she says. “But after using nicotine regularly, your body gets used to it, and you don’t get that buzz anymore. Once you become dependent on it, you just feel normal when you have it. And when you don’t have it, you start having cravings, headaches, or other withdrawal symptoms that indicate, ‘Hey, time for another one,’” she says. “Then, you have another one, and your withdrawal symptoms go away, and you get back to baseline.”

It becomes a cycle of withdrawal and then fixing that withdrawal, she adds.

## Are nicotine pouches a better alternative to smoking cigarettes, vaping, and smokeless tobacco?

Because nicotine pouches don’t contain tobacco, one might suggest they are on the lower end of the continuum of risk, notes Morean. For example, if an adult smokes or uses smokeless tobacco, the pouch may be a better alternative because it's delivering nicotine—not tobacco, she says.

So, for adults, it could be a viable alternative to things that are really harmful, but we don't want kids using it, she adds.

“Also, it's still nicotine, so pregnant people shouldn't use it either. People may think, ‘I'm pregnant, and I can't smoke. I’ll use a pouch instead.’ But nicotine is bad for fetal development as well,” says Morean. “So, there are different messages based on the audience. We don't want to say it's all bad, because it could be a safer alternative for adults trying to quit. But, as I’ve mentioned, we need more research to see the short- and long-term health effects.”

## What else should parents know about nicotine pouches?

Just as parents should talk to their children about the risks of vaping, cigarettes, cannabis, alcohol, and other substances, they should do the same with nicotine pouches, Morean advises.

“Even though it’s not incredibly prevalent right now, nicotine pouches are around and kids are using them. They may not look dangerous as they don’t produce any smoke, but we know they are addictive, and we know nicotine is not good for developing brains,” she says.

Morean also notes that adults who use nicotine pouches should keep them out of reach of small children and pets. “The packaging isn’t particularly appealing, but they could look like mints, and while some say they are in child-protective packaging, they can be easy to open,” she says.

**3.Nicokick.com**

## What Are Nicotine Pouches?

Nicotine pouches, also known as nic pouches, are pouches that you use orally to get your nicotine, but without tobacco leaves - offering a popular alternative to traditional Swedish snus and other oral tobacco products. They have become increasingly popular among adult nicotine users, as you can use nicotine pouches from anywhere and at any time - they are smokeless, spit- and odor-free pouches that are made with either nicotine extracted from the tobacco leaf or synthetic nicotine.

Explore our wide selection of different nicotine pouch options from nicotine pouch brands such as ZYN, Rogue, VELO and On!® in a range of different flavor and nicotine level options.

## How Long Have Nicotine Pouches Been Around?

Nicotine pouches came about to offer a new and tobacco leaf-free alternative to traditional snus. Swedish snus has been around for centuries, but it was not until the 1970s when the first pre-portioned pouches were introduced. However, over the recent decades as modern technology continues to develop and we have a better understanding of smoking risks, it was only going to be a matter of time before a tobacco-leaf free alternative to oral tobacco products was created. These pouches contain nicotine without tobacco leaf, dust, or stem.

Following the success of ZYN (the first brand to launch nicotine pouches in the U.S. in 2014), numerous brands have since entered the market, offering unique ranges of flavors, nicotine strengths, and product formulations. In 2019, sales of nicotine pouches online began to skyrocket, with an average of 80,000 cans being sold each month. 2020 saw the launch of FRĒ nicotine pouches, which are made entirely with synthetic nicotine and offer a range of higher nicotine strengths than previously seen. 2021 has brought increased awareness and acceptance of nicotine pouches and new brands are looking to enter the market with more innovative products. It is expected that the popularity of nicotine pouches will continue to grow in the coming years.

Interested in learning more about the history of nicotine pouches? Read our expert guide that explores the detailed history of the nicotine pouch!

## Nicotine Pouches Flavors

One of the main reasons that nicotine pouches are so popular includes the variety of different flavor options. Each blend has a unique blend of different flavors, meaning you can try a range of different brands until you find one that works best for you. Each pouch parks comfortably in your mouth and releases flavor when you park it between your lip and gum.

Currently in the U.S., there are many different flavors of nicotine pouch to choose from. Among the most popular brands, you can find many different flavors including:

* Wintergreen
* Mint
* Spearmint
* Peppermint
* Menthol
* Fruit (including tropical fruit flavors)
* Berry
* Coffee
* Unflavored (nicotine pouches without flavors or added sweetners)

You can choose from so many different flavor options - on Nicokick, you can find many unflavored and flavored nicotine pouches from the best brands, so there is bound to be a flavor that suits you!

Nicotine Pouch Strengths

The nicotine levels you find in each pouch differs between brands. On Nicokick, we offer nicotine pouches with a nicotine level from 2MG to 15MG per pouch - giving many nicotine level options for adult nicotine users to choose from!

We categorize our nicotine pouches into 4 different nicotine level categories:

* 2-3MG: These nicotine pouches have the lowest nicotine levels. Each pouch contains between 2mg to 3mg of nicotine.
* 4-6MG: These nicotine pouches are the most popular on Nicokick, with pouches in this category containing between 4mg to 6mg of nicotine.
* 7-9MG: These pouches can be categorized as strong oral nicotine pouches, with each pouch containing between 7mg to 9mg of nicotine.
* 10-15MG: These are the strongest pouches on Nicokick, and each pouch contains between 10mg to 15mg of nicotine.

Nicokick prioritizes product quality, ensuring all products are laboratory tested before they hit our online storefront. The highest nicotine content per pouch we offer is 20mg, as this is the maximum amount that is recommended for a nicotine pouch, and also ensure the pH and other factors that impact the pouch experience are tested. Our Nicokick product standards were established to ensure that you get quality products, as well as to develop a sustainable product and market growth in the oral nicotine category.

Nicotine Pouch Sizes and Formats

The size of a pouch can vary depending on the brand you choose. The three different pouch sizes you can typically find in the U.S. are:

1. Slim: Sometimes known as mini pouches, these are the smallest pouches you can find. Each slim pouch is small and rectangular in shape to allow for a comfortable and unobtrusive fit under the lip.

2. Regular: These pouches are slightly larger than the slim ones.

3. Large: The largest size of pouches, these pouches cover more surface area under the lip when parked. They may be bigger, but they are still comfortable and not noticeable when parked under the lip and gum.

You can learn more about the specific format of your favorite pouch in each product description.

Out of all brands, the top 4 most popular nicotine pouches on Nicokick are:

1. ZYN Pouches
2. On! Pouches
3. Rogue Pouches
4. Juice Head Pouches

## How to Use Nicotine Pouches

Nicotine pouches are super simple to use, as you just need a can of pouches to get started - no lighters, spittoons or other extras required. If you are wondering how to use nicotine pouches, here is a quick step-by-step guide to guide you through the process of how to use nicotine pouches:

1. Open the can and take out a pouch.
2. Place it under either your top lip or bottom lip and gum.
3. Leave the pouch parked for up to 60 minutes. The exact length of time you leave it parked will depend on your personal preferences.
4. Take out the pouch and dispose of the pouch. Please dispose of it responsibly by putting it in the trash or in the catch lid (if your can has one).

 It is important to be aware of the potential side effects when using nicotine pouches, as nicotine is an addictive substance. These products are intended for adults (21+) who already use oral tobacco and nicotine products: it is important that you use them responsibly and are for oral use only (so you should only park them in your mouth). Learn more about side effects of nicotine pouches in our expert guide.

**4.Tobacotactics.org**

Nicotine and Addiction

Addiction to any drug means that the use of the drug can be difficult to stop, even in those who are trying to stop. The pouches may be somewhat less addictive than cigarettes. But some level of addictiveness is probably essential to pouches being able to substitute for cigarettes. Views differ on the public health significance of nicotine addiction in former smokers, once the main tobacco smoke toxicity has been removed.

Government authorities have widely promoted that "there is no safe tobacco product." One warning on smokeless tobacco is: "This product is not a safe alternative to cigarettes." This is not adequate information for smokers and has contributed to the belief that all tobacco and nicotine products are equally harmful. Many decades ago, the public understood correctly that smokeless tobacco was less harmful than cigarettes. Yet, a recent National Cancer Institute survey found that only 9 percent of adults answered "yes" when asked if "some" smokeless tobacco products were "less harmful" to health than cigarettes.

Public misunderstanding of the differential risks from combusted and non-combusted products raises ethical issues and this can lead to avoidance of less harmful products. A study out in June suggests that the public's perceptions of differential harms of non-combusted nicotine products appears to be moving toward greater misunderstanding rather than greater accuracy.

Understanding that no tobacco or nicotine product is safe is appropriate. Consumers also need to understand that inhaled smoke from cigarettes is much more dangerous than non-combusted products, including nicotine pouches.

**[Nicotine and Addiction](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-3)**

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TTCs have identified opportunities to market these products in countries where there is either an existing market for snus, or conversely in markets where tobacco snus is currently banned.**[2](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-2)**

Researchers have cautioned that nicotine pouches in particular may appeal to youth and non-smokers, as they are often sold in a variety of fruit flavours, in attractive packaging, and can be used discreetly (more so than e-cigarettes).[2](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-2)[4](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-4)  They can also contain high levels of nicotine where unregulated.**[4](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-4)**

### “Tobacco Free”

It appears that some nicotine pouches, may use synthetic, or “tobacco-free”, nicotine (rather than nicotine derived from tobacco leaf),  creating confusion and uncertainty as to how best to regulate these products.[2](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-2)[5](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-5)[6](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-6)[7](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-7)

In its 2022 annual report, BAT states that its “current portfolio contains no synthetic nicotine”.**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)** PMI states that its pouches contain “nicotine derived from tobacco”.**[9](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-9)** JTI and Imperial Brands do not refer to synthetic nicotine and describe their pouches as “tobacco-free”.[10](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-10)[11](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-11)[12](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-12)[13](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-13)

In 2022, the UK independent scientific Committee on Toxicity (COT) noted in a discussion paper:

“the apparent variation in how manufacturers present nicotine content and strength across different products, which may be confusing for the consumer. In addition, use of the description ‘tobacco-free’ may be misleading as the nicotine may be derived from tobacco, which raises concerns regarding carry over of toxicologically relevant contaminants (e.g., metals and nitrosamines).”**[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)**

COT also raised concerns around the lack of specific regulations for nicotine pouches in the UK, and the absence of data other than that produced by the industry.**[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)** COT planned to produce a full report for the UK government in autumn 2023.**[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)**

See below for more on regulation.

The interests of the four main TTCs are summarised below, as well as those of Altria which also sells nicotine pouches outside the US. PMI was the last to acquire this product through its purchase of Swedish Match in 2022.

### **British American Tobacco**

In 2019, BAT introduced nicotine pouches to its portfolio, marketing them as Lyft in the UK and Velo in the US.[15](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-15)[16](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-16)[17](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-17) A July 2019 news report suggested that BAT’s nicotine pouches were also on sale in Sweden, Italy and Tanzania.**[18](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-18)** BAT started  promoting Lyft /Velo in “emerging markets” in LMICs.

In November 2020, BAT announced that it had acquired US-based nicotine pouch company Dryft Sciences, via its subsidiary Reynolds American Inc. (RAI), with the pouches to be sold under the Velo brand.**[19](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-19)** According to BAT this would give them a combined share in the US nicotine pouches market of around 10%.**[19](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-19)**

BAT distinguished Epok, Lyft and Velo from traditional snus and allocated them to a new product category, which it called “modern oral products”.**[15](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-15)** In November 2019, it announced that it would consolidate its NGPs under fewer brand names, and all its “modern oral” products would be sold as Velo.**[20](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-20)** It continues to market the product as Lyft in Sweden and Denmark.**[21](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-21)** It also sells nicotine pouches under its Niconovum brand Zonnic in Sweden.**[22](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-22)**

BAT reported that it had sold 4 billion pouches worldwide in 2022, and held 69% of the market in Europe, although sales in the US had declined since 2021.[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)[23](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-23) It also referred to an estimate that the global nicotine pouch market would grow by 500% by 2026, and referred to the launch of new products ranges called Velo Mini and Velo Max.**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)** In 2023, BAT said that Velo was leading the market outside of the US and contributing to revenue growth.

In 2024 BAT reported that it had opened a new “innovation centre” in Southampton, UK, to focus on the development of nicotine pouches.

For information on BAT’s other nicotine products see Newer Nicotine and Tobacco Products: British American Tobacco

Japan Tobacco International

Japan Tobacco International sells its  Nordic Spirit brand of nicotine pouches, mainly in Europe.[24](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-24)[25](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-25) In its 2020 integrated report Japan Tobacco stated that the pouch was sold in nine countries, and that it held 70% of the UK market.[26](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-26)[27](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-27) In 2021, it said that it “prioritized Sweden, Switzerland and the UK”.**[28](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-28)** In 2022, JTI announced that it had test-launched Nordic Spirit in the Philippines and was planning to launch a new “formula” in the UK.**[11](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-11)** In 2023, new strong and extra strong spearmint flavoured pouches went on sale in the UK, to meet the “demand for stronger variants”.**[29](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-29)** According to the Nordic Spirit website its extra strong pouches contain 11mg per pouch (17mg per gram).**[30](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-30)**

JTI also refers to its nicotine pouches as “modern oral” products.

For information on JTI’s other nicotine products see Newer Nicotine and Tobacco Products: Japan Tobacco International

### Imperial Brands

In May 2018, Imperial Brands announced that it had launched a version of its snus brand Skruf without tobacco leaf, called Skruf Super White, intended for sale in Sweden and Norway.**[31](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-31)** This product appears to have been rebranded as zoneX for the UK market in August 2019, however its direct sale in the UK was later discontinued.[32](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-32)[33](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-33)[34](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-34)  **[35](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-35)** In 2022 Imperial’s website stated that in 2021, ZoneX  had “first launched in Sweden and Austria”, further launched in “Norway, Denmark and Estonia” in 2022 and finally made available in “Iceland and duty-free Middle East” in 2023.[12](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-12)[13](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-13)

In 2020, IMB had previously published an article on its Imperial Science website exploring what it described as “The Tobacco-Free Nicotine Pouch Opportunity”.**[36](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-36)**They later said they had launched a “cutting edge bamboo fibre based product”.**[37](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-37)**

Imperial’s website describes ZoneX users as:

“young adult nicotine users, typically 25+, urban and open-minded. They’re making lifestyle changes and favour a discreet way to enjoy nicotine.”**[13](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-13)**

In 2023, Imperial acquired several nicotine pouch brands from Canadian company TJP Labs, to market in the US.**[38](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-38)**

### Altria

In 2019 Altria announced that it was acquiring an 80% share in oral nicotine pouch on! from Swiss tobacco company Burger Sohne.[39](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-39)[40](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-40) It set up a new subsidiary Helix Innovations, through which it would manufacture and market the product.[39](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-39)[40](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-40) Altria stated that, as on! was already on sale across the US before August 2016, it did not require pre-market authorisation from the US Food and Drug Administration (FDA).**[39](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-39)** However, by mid-2020 it had submitted 35 Pre-Market Tobacco Product Applications (PMTA) for on!, it was sold in 40,000 US stores, and Helix was increasing manufacturing capacity.**[41](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-41)** According to Altria, by the end of 2020 the number of stores selling on! had nearly doubled.**[42](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-42)** A 2020 investor transcript reported that the product was “attracting female tobacco consumers due to its spitless, white and compact format” and accounted for 30% of this type of oral nicotine product.**[43](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-43)**

In 2021, Altria acquired the remaining 20% of on!.**[44](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-44)** In 2022, it stated that it held over 20% of the UK nicotine pouch market, although the category was “increasingly competitive”.**[45](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-45)** It also stated that Helix operates internationally, although most of its oral products are sold in the US.**[45](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-45)** As of February 2023, the FDA had not issued marketing order decisions for any on! products.**[45](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-45)**

### Philip Morris International

At the beginning of 2021, PMI did not have a nicotine pouch product on the market. However, in a presentation to investors in February that year, the company noted the “attractive economics” of this small, but growing, product category.**[46](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-46)** CEO Andre Calantzopoulos said PMI was planning to develop a product through a “combination of partnerships and internal development”.**[47](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-47)**

In May 2021, PMI acquired Danish snus manufacturer AG Snus, manufacturer of Shiro nicotine pouches.[48](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-48)[49](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-49) For more details see Cigarette Companies investing in Snus.

In July 2021, PMI announced that it had acquired Fertin Pharma, a company specialising in nicotine replacement therapy (NRT) type products.**[50](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-50)** At this time, PMI also began referring to gums and nicotine pouches as “modern oral” products, as BAT and JTI do.**[50](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-50)**

For more information see: [Tobacco Company Investments in Pharmaceutical & NRT Products](https://tobaccotactics.org/wiki/tobacco-company-investments-in-pharmaceutical-nrt-products/)

At this time, PMI began referring to gums and nicotine pouches as “modern oral” products (as does BAT).**[50](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-50)**

In 2022, PMI acquired Swedish Match.**[51](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-51)** Swedish Match specialises in snus and nicotine pouches, and does not sell cigarettes. By 2023, Shiro nicotine pouches were presented on the PMI website, along with snus, as “oral smokeless products”.**[52](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-52)** Its nicotine pouch Zyn has been sold mainly in Sweden and some other European countries, as well as the US (since 2015).**[53](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-53)** It also sells the Volt Pearls product in Denmark, Iceland and Sweden.**[9](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-9)**

For more information see Newer Nicotine and Tobacco Products: Philip Morris International and Swedish Match

In its 2022 annual report, PMI stated that the Zyn trademark had an “indefinite life due to the fast growth and the leading position of the brand in the market”.**[9](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-9)**

## The Global Market

According to a Tobacco Reporter article published in 2024, Euromonitor International values the global market at over US$10 billion and projects it to reach US$15 billion by 2027.**[54](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-54)** Nearly 15 billion units were sold in 2023, but they remain a small part of the market.**[54](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-54)**

In 2023, Euromonitor analysts noted that in the US, there were over US$8.5 billion of retail sales and nearly 3% of the population uses pouches. However, the most rapid increase in sales in 2023 was in Pakistan where BAT markets Velo (see below), and they expect most growth going forward to be in Asia Pacific and Eastern Europe.**[54](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-54)** They also noted that most pouches were sold in the US in 2023, the other top five markets (Sweden, Denmark, Pakistan and Austria) between them sold less than a third of the units sold in the US market.**[54](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-54)** Other nicotine pouch markets include UK, Germany, Poland, Czech Republic, Uzbekistan, Ukraine and Indonesia.[54](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-54)[55](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-55)

PMI’s purchase of Swedish Match immediately gave it a 60% share of the global market in 2022, a jump from almost zero in 2021. BAT held around a sixth of the global market, and Altria and Swisher (a US-based tobacco company which also sells cigars, snus and snuff, and other nicotine products)**[56](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-56)** each held around a twelfth share.**[57](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-57)** The global market shares of other companies, including JTI and Imperial Brands, were negligible.

For information on TTC interests in tobacco leaf snus see Cigarette Companies Investing in Snus.

## Regulation of Nicotine Pouches

Nicotine pouches are subject to a variety of regulations around the world, from outright bans to partial or selective regulation, depending on how they are defined and classified by governments. In many cases no regulation is in place. The Institute for Global Tobacco Control (IGTC) tracks and reports regulatory approaches around the world (see below).**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** Although not all countries contribute to its Policy Scans for nicotine pouches, the most up to date information available on the IGTC database at the time of writing is referenced below.

In the UK, as of 2023, nicotine pouches are regulated under general consumer product safety regulations, not as tobacco products. They are widely available in shops and online.[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)[59](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-59) Concerns have been raised over their availability to youth, and social media marketing.[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)[60](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-60)[61](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-61) The UK Department of Health and Social Care stated that it was aware of concerns, but as the use of pouches was low (in England) it did not plan to introduce further regulation at this time.**[61](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-61)**

### European Union

While there is an EU-wide ban on tobacco snus, nicotine pouches are not covered by current tobacco product regulations. This is subject to review in the next revision of the Tobacco Products Directive.[62](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-62)[63](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-63) It is however important to note that individual member countries are diverging in the way they regulate these products.

Sweden has an exemption from the EU ban on [snus](https://tobaccotactics.org/wiki/snus/).**[63](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-63)** In Sweden, pouches containing products other than tobacco and nicotine have long been regulated as food items.**[3](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-3)** Zonnic oral pouches (owned by RAI from 2009,**[64](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-64)** and BAT from 2017) were registered as an over-the-counter (non-prescription) drug in 2013, but only available from pharmacies and other regulated outlets.**[65](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-65)** There are a range of nicotine replacement therapies (NRT) products registered under the same brand name (see below). In 2019, the Swedish National Food Administration advised that nicotine pouches should now not be regulated as food, as they were intended to be spat out and the contents were mostly absorbed through the mouth, not the stomach.**[3](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-3)**

Elsewhere in Europe regulation varies widely. In France nicotine is classified as a poisonous substance, subject to regulation, but pouches can be regulated as a medicine for cessation purposes.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** In Finland nicotine pouches are no longer classified as medicines, unless marketed as such.**[66](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-66)** In Norway (not in the EU but a member of the European Economic Area) a total ban on nicotine pouches and other newer products was lifted in July 2021, and replaced by a market approval scheme.[67](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-67)[68](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-68) Both tobacco-derived and synthetic nicotine pouches are regulated, but advertising and sponsorship are banned.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)**

In contrast, in March 2023, Belgium announced a total ban on nicotine pouches, by royal decree.[69](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-69)[70](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-70) BAT were reported to be petitioning the courts to annul the decree.**[71](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-71)** The Netherlands announced a ban a month later.[72](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-72)[73](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-73)

In 2021, the German Office of Consumer Protection and Food Safety (BVL) stated that nicotine pouches were not regulated under either the tobacco legislation or as foodstuffs and so could not be legally sold.**[74](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-74)** BAT removed its nicotine pouches from the German market that year.**[74](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-74)** Some federal states have withdrawn pouches, and some products have been classified as a health hazard due to high levels of nicotine.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)**

### North America

In the US, nicotine pouches are regulated by the FDA and subject to age restrictions, a nicotine health warning and pre-market assessment .**[63](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-63)** There are also regulations specific to synthetic nicotine.**[75](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-75)** Nicotine pouches are freely available to consumers.**[53](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-53)** US researchers have noted a “loophole”: as nicotine pouches were not included in the smokeless tobacco regulation, companies are able to advertise nicotine pouches on radio, TV and other media.**[76](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-76)**

Initially the Canadian government did not authorise the sale of nicotine pouches, and issued an alert, stating that as they had not been assessed by “safety, efficacy and quality” they might contain high levels of nicotine and be harmful to health.**[77](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-77)** These products are now regulated, either classified as a ‘Natural Health Product’ or as a prescription drug, depending on the level of nicotine.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** In July 2023, Health Canada authorized the marketing of BAT’s Zonnic nicotine pouch (with 4mg of nicotine) as a natural health product.[78](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-78)[79](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-79)[80](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-80)[81](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-81) Physicians for a Smoke-Free Canada reported that this product contains the same ingredients as BAT’s Velo,**[80](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-80)** and noted that:

“BAT will face very few restrictions on how it can market ZONNIC nicotine pouches in Canada, other than with respect to how it represents the therapeutic benefits of the product.”**[80](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-80)**

### Australia & New Zealand

As with e-cigarettes and heated tobacco products, nicotine pouches are banned from sale in Australia, and only available on prescription.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)**

In New Zealand, oral tobacco products (including snus) and nicotine pouches are banned, unless approved as medicines.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** (E-cigarettes are regulated, but not banned)

### New and emerging markets

In some low and middle-income countries, including Argentina, Bangladesh, Georgia, Indonesia, India, and Nigeria, only tobacco-derived products are regulated as tobacco products, but not those derived from synthetic nicotine.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** In others, including Brazil, Brunei Darussalam, Iran, and Thailand, both are regulated as tobacco products.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** In Ukraine there are no specific regulations in place, but synthetic nicotine pouches are regulated as a food product.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** Mauritius bans both,**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)** whereas in Uruguay, nicotine pouches are categorised as a form of nicotine replacement therapy (see below).**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)**

At the time of writing, July 2023, nicotine pouches remain unregulated in most countries.**[58](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-58)**

As researchers from Norway, among others, have pointed out:

“The boundaries between various tobacco and nicotine products are getting less clear, making it possible for the tobacco and nicotine industries to take advantage of the discrepancies in regulation.”**[4](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-4)**

* The Policy Scan Project, by the Institute for Global Tobacco Control (at Johns Hopkins University), which tracks and reports regulatory approaches to nicotine pouches around the world.
* For information on tobacco regulation more broadly, see the Tobacco Control Laws website, published by the Campaign for Tobacco Free Kids (CTFK).
* For countries that are parties to the WHO Framework Convention on Tobacco Control (FCTC) progress towards implementation of relevant articles, including newer products, is detailed in the FCTC implementation database.**[82](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-82)**

## BAT Promoting Nicotine Pouches in LMICs

BAT began marketing Lyft in Kenya in 2019, and Pakistan in 2020. In 2021, BAT said that it was also test marketing its product in Bangladesh and Indonesia.**[83](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-83)** and “consumers are familiar with other similar oral products”.**[84](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-84)** The company has identified an opportunity to market these products in countries where electronic devices are less popular, affordable, or available due to regulatory restrictions. It also referred to markets where there is was a “pre-existing ritual of oral product consumption”.[83](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-83)[84](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-84)

### Kenya

After announcing its intention to sell nicotine pouches in Kenya, BAT launched Lyft in the country in December 2019.[18](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-18)[85](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-85)[86](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-86) In February 2020, the company announced that it was planning to build a new factory in Nairobi to produce nicotine pouches, and for Kenya to become a regional export hub for the product.**[87](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-87)** BAT Kenya (BATK) managing director, Beverley Spencer-Obatoyinbo said that “Given the high incidence of oral stimulant use among smokers, we believe that this new product category will provide a viable alternative to smoking”, although she presented no evidence at the time to support this statement.**[87](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-87)**

In response to concerns about the potential impact on [tobacco farmers](https://tobaccotactics.org/wiki/tobacco-farming/), Business Daily Africa reported that BATK’s head of legal and external affairs stated that the company was “using proceeds from the tobacco portfolio to invest in the new categories. When the time comes, we will help them (farmers) transition to sustainable crops,” although this was “not a change that can happen overnight”.**[88](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-88)** Spencer-Obatyoinbo confirmed that BAT switching to “non-combustibles” was “not an immediate thing”.**[88](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-88)** Nevertheless, in September 2020, BAT was reported to be lobbying the Kenyan Revenue Authority (KRA) for a tax break for the product, citing its large investment and potential exports.**[89](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-89)** (According to BAT the nicotine for its pouches is currently manufactured in Switzerland.)**[89](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-89)** The Chief Executive of the International Institute for Legislative Affairs argued that this would be a “huge setback for tobacco control interventions in Kenya”.**[90](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-90)** For more information see the [Kenya country profile](https://tobaccotactics.org/wiki/kenya-country-profile/) page.

Nicotine pouches were initially registered as a pharmaceutical product by the Kenya poisons board.**[91](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-91)** This designation was challenged by local advocates.**[91](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-91)** Health Cabinet Secretary Mutahi Kagwe wrote to the poisons board, arguing that the product had been wrongly designated, and stated that it was being distributed via vending machines in contravention of the law.[91](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-91)[92](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-92) Although Lyft was de-registered and effectively banned, there was a reported lack of enforcement and the product was found to still be on sale in December 2020.[92](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-92)[93](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-93) In February 2021, the Kenyan government said that it was intending to classify nicotine pouches as a tobacco product under the Tobacco Control Act, making the product subject to similar marketing restrictions as cigarettes and other tobacco products.**[92](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-92)** Concerns have been raised in Kenya over potential use by children (see below).

In February 2021, BAT told investors that “In Kenya, we have temporarily suspended sales due to local regulatory challenges and continue to engage with the local authorities.”**[83](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-83)** In March it told the Kenyan media that it was planning to spend Kenya Sh1 billion (US $10 million) on marketing Lyft once the product was approved.**[94](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-94)** This included plans to set up distribution networks across 21 countries in the Common Market for Eastern and Southern Africa (COMESA).**[94](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-94)**

In 2022, BAT’s nicotine pouch was back on the market in Kenya, as Velo.**[95](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-95)** In its annual report, BAT stated it had “reintroduced Velo to a limited retail universe with positive early momentum, as we focus on driving guided trial.”**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)**

The introduction of Velo has not been without controversy, and politicians in Kenya are again asking for the product to be banned. Letters between BAT and the Kenyan Ministry of Health reveal that BAT had lobbied to reduce the size of warning labels on the product.**[96](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-96)**

BAT has also lobbied against increased taxes on these products.[97](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-97)[98](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-98)[99](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-99)

### Pakistan

Velo was launched by BAT in Pakistan in December 2019, with a campaign run by [Ogilvy](https://tobaccotactics.org/wiki/ogilvy-group/) Pakistan “positioned towards affluent adult consumers”.[100](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-100)[101](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-101)[102](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-102)

A Freedom of Information Request submitted by Bath TCRG revealed that UK High Commission staff in Pakistan had attended a “social event” for Velo in February 2020. The FOI stated that “They were invited by the event coordinator and did not meet any Velo representatives at the event.”**[103](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-103)**

* British diplomats have previously been associated with lobbying by BAT in Pakistan, and other LMICs. See the page on [UK Diplomats Lobbying on Behalf of BAT](https://tobaccotactics.org/wiki/uk-diplomats-lobbying-on-behalf-of-bat/)

BAT said it was “particularly proud of Velo’s performance in Pakistan”. **[23](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-23)** In its 2022 annual report, BAT stated that Pakistan was its third largest market for nicotine pouches. It said that the market was “enabled by powerful, consumer-centric digital activations”, and that it was selling over 40 million units a month.**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)** These sales figures, and rapid growth, are roughly consistent with Euromonitor’s estimates.**[57](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-57)**

### South Africa

Unlike NRT products, nicotine pouches are not on the South African Health Products Regulatory Authority’s list of approved medicines, for which it would be subject to clinical trials and regular monitoring updates. Nicotine pouches are also not regulated as tobacco products because the nicotine is synthetic and does not fall under the definition of tobacco products in the Tobacco Products Control Act (2018). This means that they can be sold without health warnings and can be sold to those under the age of 18.**[104](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-104)**

South Africa is also one of the target markets for PMI’s ZYN nicotine pouches. **[105](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-105)**

### Indonesia

In February 2021, BAT referred to the test marketing of its nicotine pouches in Indonesia.  BAT reported “encouraging results”.**[83](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-83)** External statistics suggest the market remained small.**[57](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-57)**

## **Concerns Around Use by Youth**

Researchers in the US have identified the risk of nicotine pouches appealing to non-smokers and in particular youth, as some products come in a range of fruit flavours and are more discreet than e-cigarettes.[2](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-2)[106](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-106) As of 2024, PMI was facing a lawsuit for ZYN in the US on the basis of the product being addictive and harmful to young people. The lawsuit states that PMI is benefiting from the promotion of the brand on social media. **[107](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-107)**The FDA has also issued warning letters and penalty charges to a number of retailers for the underage sale of flavoured ZYN nicotine pouches. As of April 2024, the FDA has not authorised the sale of ZYN products in the United States. [108](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-108)[109](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-109)

Although they can only legally be sold to adults in the UK, concerns have been raised over potential use by children.[14](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-14)[110](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-110)

In 2020, there were reports that Lyft was being used by children in Kenya.[87](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-87)[111](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-111) Children were also reported to be using the products in schools in Scotland.**[112](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-112)**

In February 2021, journalists from the Bureau of Investigative Journalism published an article describing how BAT used [social media](https://tobaccotactics.org/article/social-media/) influencers to promote its nicotine pouches in multiple countries, including Australia, [Kenya](https://tobaccotactics.org/article/kenya-country-profile/) and Pakistan. The authors argued that this was part of a campaign targeted at young people, rather than older adults trying to quit smoking.[113](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-113)[114](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-114)[115](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-115)

An investigation by The Guardian newspaper in 2023 identified further promotion in the UK via social media and music events, as well as prize draws and the provision of free samples.**[61](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-61)**

BAT also promotes Velo through [motorsport sponsorship](https://tobaccotactics.org/wiki/motorsport-sponsorship/).[116](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-116)[117](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-117)

* See [Snus: Marketing to Youth](https://tobaccotactics.org/wiki/snus-marketing-to-youth/) for information on earlier tobacco company marketing of the tobacco leaf product.

## **Industry Alliance Lobbying in the EU**

The ‘Nordic Nicotine Pouches Alliance’ (NNPA) was established in Belgium in 2020.**[118](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-118)** As of March 2024, BAT and JTI are the only partners listed on the NNPA website.**[118](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-118)**

The NNPA webpage states “We engage, inform, and increase knowledge about nicotine pouches”.**[119](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-119)**  However, on the EU transparency register, its stated goal is to “focus on regulation concerning nicotine pouches within the European Union”, specifically the [Tobacco Products Directive](https://tobaccotactics.org/article/eu-tobacco-products-directive-revision/) and the Tobacco Taxation Directive.[120](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-120)[121](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-121) Jonas Lundqvist, NNPA CEO, is listed as the accredited lobbyist on the EU register.[122](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-122)[120](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-120)[121](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-121) In 2022, the estimated cost of NNPA lobbying activities was listed as €400,000-499, 999, four times the amount listed in 2021.[120](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-120)[121](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-121)

NNPA also runs the online news platform ‘Pouchforum’.**[123](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-123)** Articles published on the platform have accused the European Commission of misrepresenting the risk of nicotine pouches,**[124](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-124)** and suggested that the Commission does not act in a transparent manner.**[125](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-125)** The site editor is Robert Casinge, also ‘Senior Partner’ in the NNPA, and previously listed as a lobbyist on the EU register.[121](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-121)[126](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-126)

## **Framing Nicotine Pouches as NRT**

TTCs appear to be framing their nicotine pouches as a nicotine replacement therapy (NRT), which is designed to help smokers quit.[127](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-127)[128](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-128)[129](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-129) However, they are also marketing them as consumer products, including for use when it is not possible to smoke or use e-cigarettes, for example on a plane. [130](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-130)[131](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-131)[132](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-132)

In 2016, researchers in the US pointed to the implications for both product regulation and smoking cessation,**[64](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-64)** and the:

“blurring of the lines between cessation products and novel tobacco products and potentially confusion and misuse by consumers which may result in initiation or situational and dual use of tobacco products.”**[64](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-64)**

All four of the main transnational tobacco companies have conducted their own research on nicotine pouches, published on their science websites.

BAT markets Niconovum NRT products, in the US and Sweden under the brand name Zonnic; in Sweden, Zonnic products include nicotine pouches.[22](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-22)[133](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-133)[134](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-134) In 2020, BAT also rebranded its Revel nicotine lozenge as Velo – the same brand as its nicotine pouch – in the US (and submitted it for pre-market approval). [135](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-135)[136](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-136)

In its 2022 annual report, BAT stated that “[t]he weight of evidence suggest Modern Oral nicotine pouches have a profile that is comparable to nicotine replacement therapy products”. It cited BAT’s 2021 research on Velo, which compared snus, nicotine pouches and NRTs.[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)[137](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-137) However, the 2022 report then went on to acknowledge “low levels of average daily consumption and high poly-usage”, leading BAT to submit a further PMTA for a “superior” product.**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)** As of February 2023, no Velo products had received pre-market approval in the US.**[8](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-8)** At the time of writing, it was not yet clear how BAT planned to promote its Zonnic nicotine pouch after it was approved for sale over-the-counter in Canada in July 2023.[78](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-78)[79](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-79)[81](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-81)

BAT’s science website presents its research on nicotine pouches, as well as a summary of the ‘Snus and the Swedish Experience’.**[138](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-138)** For more background on this topic see [The Swedish Experience](https://tobaccotactics.org/wiki/the-swedish-experience/).

PMI acquired Fertin Pharma in 2021, stating that Fertin was a “leading producer of Nicotine Replacement Therapy (NRT) solutions”.**[50](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-50)** PMI has also referred to the “medical” or “pharmaceutical” grade nicotine in its products.[9](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-9)[139](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-139) (Read more about on PMI’s [acquisition of pharmaceutical companies.](https://tobaccotactics.org/wiki/tobacco-company-investments-in-pharmaceutical-nrt-products/))

PMI’s science website presents its research on nicotine pouches.**[139](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-139)** It does not refer to its snus products on these pages.[139](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-139)[140](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-140)[141](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-141)

Imperial Brand’s science website has cited evidence on tobacco-leaf snus and other next generation products (NGP)s to support its statement that “these products are more satisfying – and acceptable – to adult smokers than traditional nicotine replacement products (NRTs) like patches, lozenges, and gums”.**[36](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-36)**  However, the evidence it cites pre-dates the widespread sale of nicotine pouches by TTCs: the 2016 report from the Royal College of Physicians (RCP) refers only to Zonnic and does not discuss satisfaction of acceptability of the product.**[129](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-129)**

Imperial refers to its use of “high purity pharmaceutical grade nicotine”.[36](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-36)[142](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-142) In May 2021, Imperial published its “comprehensive scientific assessment” of its nicotine pouches, in comparison to cigarettes.**[143](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-143)**

Japan Tobacco‘s science website does not feature nicotine pouches, although it includes  its research on these products.**[144](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-144)**

## Environmental Impact

## The impact of [cigarette filters](https://tobaccotactics.org/article/cigarette-filters/) on the environment is well documented. More recently, the impact of [single use, or ‘disposable’, e-cigarettes](https://tobaccotactics.org/article/e-cigarettes-tobacco-company-single-use-products/) has been highlighted

As the nicotine pouch market grows the disposal of these single use products is an emerging concern.[145](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-145)[146](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-146)

On its website, BAT states that the Velo plastic cans are being upgraded to use single polymer plastics in order to “align with the group’s ESG ambitions”. **[147](https://tobaccotactics.org/article/nicotine-pouches/" \l "ttref-note-147)**

**5.theguardian.com**

## What are nicotine pouches?

Nicotine pouches are small, porous, teabag-like products that users place in the mouth, between the upper lips and gums. They contain nicotine, flavorings and other fillers, but they don’t contain tobacco. The nicotine is absorbed through the gums and saliva.

Pouches are sold in small tins, each of which contains about 15 to 20 units, depending on the brand.

Most brands recommend using their pouches for up to an hour. The pouches come in a variety of flavors and strengths, generally varying in strength between 3mg and 12mg; a typical ciggarete contains 10 to 14mg of nicotine.

## Is nicotine harmful?

When US customers visit the websites of nicotine pouch brands, a large banner at the top blares: “WARNING: This product contains nicotine. Nicotine is an addictive chemical.”

As a research report by the National Institute and Drug Abuse (Nida) explains, nicotine is addictive; like other “drugs of abuse”, it increases levels of dopamine in the brain’s reward circuits, which motivates users to keep taking it. Repeated exposure to these drugs of abuse, like nicotine, can alter the brain’s sensitivity to dopamine, which means one needs to consume more of the substance to feel the same effects.

When the body becomes dependent on nicotine, being without the drug for too long can cause regular users to experience “irritability, craving, depression, anxiety, cognitive and attention deficits”, the report says.

While the risks of tobacco and smoking cigarettes are well-known (per the [CDC](https://www.cdc.gov/tobacco/basic_information/health_effects/index.htm" \l ":~:text=Smoking causes cancer%2C heart disease,includes emphysema and chronic bronchitis.), these include cancer, heart disease, stroke, lung diseases, diabetes and chronic obstructive pulmonary disease), the long-term risks of nicotine use alone are [not fully understood](https://www.nature.com/articles/d41586-023-01840-1).

## Are nicotine pouches better for you than smoking cigarettes?

“There’s no hard evidence to point to exactly what the level of risk of these products are relative to cigarettes,” says Dr Benjamin Chaffee, professor at the University of California, San Francisco (UCSF) School of Dentistry and the UCSF Center for Tobacco Control Research and Education. He adds that since, unlike cigarettes, the pouches don’t involve any combustion and inhaling of smoke, “it’s reasonable to expect that these products would be less dangerous than smoking cigarettes.”

Still, Chaffee warns, there is no concrete evidence that these nicotine products help people quit smoking regular cigarettes. They might even make quitting nicotine more difficult.

“For many individuals who smoke cigarettes and who try using, for example, an e-cigarette or another type of nicotine product, they end up using both products and remaining dependent on nicotine,” he says. “So it doesn’t necessarily reduce the smoking of old-fashioned cigarettes.”

This may be partly due to how the body absorbs nicotine. A November 2023 study in the medical journal [Addiction](https://onlinelibrary.wiley.com/doi/10.1111/add.16355) found that using nicotine pouches doesn’t do much to curb a current smoker’s nicotine addiction. Researchers found that cigarette smokers experienced greater relief from their nicotine cravings sooner than pouch users did, because smoking causes nicotine levels to spike in the bloodstream after only five minutes, whereas with pouches, the spike can take up to 30 minutes.

## Proponents say nicotine pouches have benefits. Is that true?

Former Fox News host Tucker Carlson – who once [endorsed](https://www.vanityfair.com/news/2022/04/tucker-carlson-consider-testicle-tanning-end-of-men) testicle tanning – described the pouches as [being like](https://www.youtube.com/shorts/rMlSGV0UNYo) “the hand of God reaching down and massaging your central nervous system”. Peter Thiel, the tech mogul, told [the Atlantic](https://www.theatlantic.com/politics/archive/2023/11/peter-thiel-2024-election-politics-investing-life-views/675946/) that he suspects nicotine is a “really good nootropic drug that raises your IQ 10 points”, and that he is considering wearing nicotine patches as part of his health regimen. And an article in [Bloomberg](https://www.bloomberg.com/news/articles/2024-01-31/zyn-lucy-nicotine-pouches-gain-traction-with-office-workers?sref=fqqmZ8gi) in January noted that Zyn has “inspired a fervent devotion among some workers in demanding industries like finance and tech”, circles in which the stimulant is sometimes used as a “performance-enhancing drug”.

As [Nida](https://nida.nih.gov/publications/research-reports/tobacco-nicotine-e-cigarettes/nicotine-addictive) notes, nicotine can temporarily boost certain aspects of cognition, “such as the ability to sustain attention and hold information in memory”.

However, Chaffee says that “nicotine in and of itself has some risks”. He explains that it can elevate the heart rate, raise one’s blood pressure and be harmful to those with underlying heart conditions. And, he says: “Anyone can be strongly addicted to nicotine.”

This is particularly concerning when it comes to children. While the number of children who use nicotine pouches is still [low](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/index.htm), Chaffee notes that young people are especially vulnerable to nicotine addiction. “[Nicotine] can really change the chemistry of their brains while their brains are still developing,” he says. “And that can be a long-term risk.”

6.truthinitiative.org

# What is Zyn and what are oral nicotine pouches?

As youth e-cigarette use remains a public health concern with [10% of high school students reporting current use in 2023](https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a1.htm?s_cid=mm7244a1_w), a different type of flavored nicotine product is gaining popularity: oral nicotine pouches.

With cigarette smoking on the decline, tobacco companies have shifted focus to “smokeless” tobacco products, including oral nicotine pouches. The pouches are sometimes referred to as a "lip pillow" or "upper decky" because of where they are placed between the lip and gum, often under the upper lip. Oral nicotine pouches are used similarly to snus – an oral pouch containing shredded tobacco leaf – but unlike snus, they contain a nicotine powder instead of tobacco leaf. Nicotine pouches contain nicotine which is harmful to young people in any form. Due to the absence of tobacco leaf, the Food and Drug Administration does not classify oral nicotine pouches as a smokeless tobacco product.

Oral nicotine pouches include brands such as Zyn, On! and Velo. These products have gained popularity in recent years: [overall sales of nicotine pouch products increased from 126.06 million units from August to December 2019 to 808.14 million units from January to March 2022](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2798449). During this period, sales of nicotine pouch products containing a higher concentration of nicotine (8 mg) increased more rapidly than products with lower nicotine concentrations (e.g., 4 mg and 6 mg). In addition, Altria has [announced](https://www.cspdailynews.com/tobacco/altria-announces-2-new-products" \l ":~:text=On Plus comes in Mint,for a more comfortable experience.) to its investors that it will be introducing a new version of its On! nicotine pouch product that has a higher concentration of nicotine than its current On! products.

## How much nicotine is in oral nicotine pouches?

## How much nicotine is in Zyn?

[Nicotine concentrations differ across oral nicotine pouch brands.](https://academic.oup.com/ntr/article/23/9/1590/6285126) For example, in the United States Zyn is sold in 3 and 6 mg, Velo is sold in 2, 4, and 7 mg, and On! is sold in 1.5, 2, 3.5, 4, and 8 mg, according to each brand’s website. Altria’s new On! nicotine pouch product, called On! Plus, [will offer nicotine strengths of 6, 9, and 12mg](https://www.cspdailynews.com/tobacco/altria-announces-2-new-products" \l ":~:text=On Plus comes in Mint,for a more comfortable experience.).

## What flavors do nicotine pouches come in?

## What flavors does Zyn come in?

Oral nicotine pouches come in an array of youth-friendly flavors, including [fruit, mint, and other flavors](https://academic.oup.com/ntr/article/23/9/1590/6285126" \l ":~:text=Almost all of the products had flavor descriptors (36 of 37)%2C such as mint%2C licorice%2C coffee%2C cinnamon%2C and fruit.).

The availability of sweet, fruity, and candy-like flavors is troubling because, as pod-based e-cigarettes like JUUL face federal flavor restrictions in response to high rates of youth vaping, young people may switch to other nicotine products that still offer flavors. For example, disposable e-cigarettes, which were exempted from the [partial flavor restrictions FDA enacted in January 2020](https://truthinitiative.org/press/press-release/trump-administrations-new-e-cigarette-policy-sadly-deficient), have skyrocketed in popularity. Sales of menthol-flavored e-cigarettes, [which were also exempted,](https://truthinitiative.org/research-resources/emerging-tobacco-products/what-vape-products-are-still-allowed-under-new-e) experienced a drastic, immediate rise in sales with an [increase of almost $60 million and its market share more than doubled](https://truthinitiative.org/research-resources/emerging-tobacco-products/weak-restrictions-flavored-e-cigarettes-lead-explosive).

Flavors play a significant role in drawing youth to tobacco products – [89% of young e-cigarette users chose a flavored product](https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a1.htm?s_cid=mm7244a1_w), according to 2023 NYTS data.

## How are oral nicotine products regulated?

## Is Zyn regulated?

Oral nicotine products are, as yet, not regulated as tightly as other tobacco products. The FDA places some regulations on these products, including requirements that manufacturers submit certain information to the agency, use nicotine warning labels, and comply with some basic marketing restrictions. No current federal regulations exist that prevent or restrict the sale of oral nicotine pouches, and the marketing restrictions on these products are not as strict as those on combustible tobacco products.

## What are the health effects of oral nicotine pouches?

## Is Zyn safe?

While specific long-term health effects of nicotine pouches like Zyn remain unknown, youth use of nicotine in any form is unsafe. Nicotine use during adolescence can disrupt the formation of brain circuits that control attention, learning, and susceptibility to addiction. Research has shown early age of nicotine use is correlated with daily use and lifetime nicotine [dependence](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1470478/). Nicotine use can also [intensify symptoms of depression and anxiety.](https://truthinitiative.org/research-resources/emerging-tobacco-products/colliding-crises-youth-mental-health-and-nicotine-use)

Truth Initiative strongly urges the FDA to remove all unauthorized oral nicotine products from the market, including Zyn. To prevent youth from using these products, eliminating all flavors from tobacco products is crucial, as is instituting restrictions to curb exposure to marketing.

## Quitting Zyn and oral nicotine pouches

## How to quit Zyn?

Quitting oral nicotine pouches like Zyn can be challenging, and the high levels of nicotine in Zyn can lead to nicotine addiction. The good news is, you can quit Zyn with similar strategies used to quit other nicotine products.

[Read about how to quit Zyn and other oral nicotine pouches](https://www.becomeanex.org/quitting-zyn-and-other-oral-nicotine-pouches/) from EX, a proven-effective tobacco cessation program directed and funded by Truth Initiative.

7.Nature.com

Introduction

Oral nicotine pouches are tobacco-free products that are held between the user's lip and gum, as shown in [Figure 1](https://www.nature.com/articles/s41415-023-6383-7" \l "Fig2). They deliver nicotine through the oral mucosa, being absorbed via mucous membranes and entering the blood stream. Nicotine pouches are of a similar concept to smokeless tobacco products, such as 'snus', which are widely used in countries such as Sweden.

Nicotine pouches provide a source of nicotine but without the main constituent of carcinogen-associated tobacco.[1](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4736),[2](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4740)Nicotine pouches have becoming increasingly popular in the UK since they entered the market in 2019 and are most prevalent among smokers.[3](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4744) It is of increasing importance for clinicians to have an awareness of such products and their possible implications on oral and general health. This paper will aim to summarise for the dental team the biological, public health, regulatory and clinical aspects of nicotine pouches.

## Origins and composition

Nicotine pouches are a relatively new product that began to predominately be sold in Europe, USA and Japan from around 2019.4 Nicotine, a tertiary amine, is the main active ingredient. Once absorbed, it selectively binds to nicotinic cholinergic receptors in the brain, causing the release of dopamine and triggering a pleasurable response.5 A significant decrease in brain reward function has been demonstrated with nicotine withdrawal, contributing to its addictive nature.

In addition to nicotine, approximately 80-90% of a nicotine pouch is made up of water and microcrystalline cellulose contained within a permeable pouch, which acts as the non-tobacco substrate. Other ingredients, such as additives and flavourings, are also present at food-grade standard and are sold in a variety of fruit and other flavours, such as mint and coffee.[4](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4748),[7](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4763) Nicotine pouches generally contain artificial sweeteners rather than sugars and so pose little direct risk of the development of dental caries.[8](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4767) Nicotine pouches are readily available across the UK for a relatively small cost of around £5-6.50 per pack as of March 2023.[9](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4771) They are sold in a small container consisting of approximately 20 pouches, as shown in [Figure 2](https://www.nature.com/articles/s41415-023-6383-7" \l "Fig3).

Total nicotine content within each pouch has been quoted as between 1.29-6.11 mg per pouch, with some 'strong' versions now marketed as around 11 mg/pouch.[9](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4771),[10](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4777)Comparatively, both nicotine gum and lozenges are prescribed at concentrations between 1 mg and 4 mg depending on the number of cigarettes smoked per day, up to 15 pieces per day.[11](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4782)

Chemical analysis of nicotine pouches has shown that they contain much lower toxic compounds than Swedish snus and tobacco smoking.[7](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4763) Furthermore, early data have shown nicotine pouches to be less biologically active than Swedish-style snus products.[12](https://www.nature.com/articles/s41415-023-6383-7" \l "ref-CR4788) Thus, nicotine pouches may provide another alternative nicotine replacement product to aid in smoking cessation, though its long-term effects currently remain inconclusive.

## General health effects

Due to their lack of combustion and absence of tobacco leaf, nicotine pouches are likely to be a substantially 'lower-risk product' relative to tobacco smoking.4 However, there is currently a lack of evidence to evaluate the absolute health effects of these specific products.

Nicotine is the main active ingredient and is probably the main reason most people will use these products. Nicotine binds to cholinergic receptors, activating a complex pathway leading to the eventual release of dopamine, glutamine and gamma aminobutyric acid. These contribute to the pleasurable feelings users experience and are also responsible for its addictive properties.5 Nicotine is not classed as a carcinogen and has been used for several decades in the form of nicotine replacement therapy (NRT).13,14Nicotine has well-documented cardiovascular effects, but these are likely to pose little risk in most individuals.15 There is some debate if nicotine may impact on the developing brain.16 Common side effects of NRT use are described in Table 1.

## Oral health effects

At the time of writing, there were no published data investigating the impact of nicotine pouches on oral health and so further research is required in this area. However, the authors can speculate potential impacts based upon our knowledge of the ingredients and of similar products.

Nicotine itself has been used in oral forms (lozenges, gum, sprays) for over 40 years and is our mainstay of smoking cessation support. The World Health Organisation listed NRT as an essential medicine in 2009.17 Relatively minor side effects are well-documented and include mouth and throat soreness, mouth ulcers, hiccups and coughing. A systematic review and meta-analysis combined data from hundreds of smoking cessation studies. From observational studies, they reported that 5.4% of orally administered NRT users would experience mouth/throat soreness. Randomised controlled trial data showed that orally administered NRT was associated with both mouth/throat soreness (OR: 1.87; 95% CI: 1.36-2.57) and mouth ulcers (OR: 1.49; 95% CI: 1.05-2.20).18 It is important to highlight that mouth ulcers are a common side effect of stopping smoking and reported in about 40% of individuals, although the data presented above accounted for this by comparing to suitable controls.19 There is no reported evidence of increased oral disease (cancer, caries, periodontal disease) with orally administered NRT. Numerous laboratory-based studies have investigated the potential effects of nicotine on oral cells as summarised in a recent systematic review.20 The review concluded that generally, the evidence was limited and contradictory for a number of outcomes. With respect to cytotoxicity, a dose response was reported and it was suggested that the nicotine level in the saliva of smokeless tobacco users may be high enough to achieve cytotoxicity. This may be of relevance to nicotine pouch users given the similar delivery route.

Interestingly, nicotine has been shown to have angiogenic effects (growing new blood vessels), the opposite to what we observe with tobacco use. Theoretically, this could have wound healing properties, but also, it could also facilitate growth of existing tumours, although this is not supported by clinical data.21

Duration of use is an important consideration. Traditional NRT is generally intended for medium-term use with a typical course being three months. Current National Institute for Health and Care Excellence guidance advises that NRT can be used as a complete or partial substitute for tobacco either in the short- or long-term.11 A concern is that nicotine pouch users may use the product for much longer periods than most traditional NRT users would, and this may increase the potential for side effects, although data are needed to confirm if this is the case.

We might look towards smokeless tobacco products such as snus to give an indication of potential side effect of a product being held against the oral tissues for prolonged periods. The carcinogenic effects of smokeless tobacco products are not applicable as these are not present in nicotine pouches - nicotine is not a carcinogen.14 However, one of the well-known side effects of these products is localised gingival recession near where the product is held, and we might anticipate that we will see similar effects in nicotine pouch users due to their similar methods of administration.22,23

Cariogenic risk is also worthy of consideration. We would anticipate this to be fairly low risk given that all the major manufacturers report their products to contain sweeteners rather than sugars. However, there may be some localised effects on plaque accumulation on the tooth surfaces near where the pouch is held, leading to increased caries risk.

## Could they have a role as a smoking cessation tool?

To the authors' knowledge, there is currently no published evidence involving the use of nicotine pouches as a smoking cessation tool. Nicotine pouches have been shown to deliver nicotine effectively, with maximum observed concentrations of nicotine similar to that of lozenges and higher than nicotine gum.24 Subjectively, nicotine pouches were favoured to lozenges with respect to taste and sensations within the mouth.7,25

In comparison to cigarettes, nicotine pouches produced a slower and lower magnitude of nicotine delivery to the user. These characteristics have been suggested to have 'lower abuse liabilities' but were regarded as less satisfying and rewarding.26,27 One small study suggested that when compared with nicotine gum, nicotine pouches have been shown to have lower mean ratings of craving, but this finding was not statistically significant.25

Currently, there are several NRT products available within the UK: transdermal patches, gum, lozenges, inhalator, nasal spray and sublingual tablets.11,28 A number of adverse effects have been reported with the use of the currently available NRTs (Table 1), which could lead to patients trying alternative therapies to aid in smoking cessation, such as nicotine pouches. It could be suggested that nicotine pouches are simpler and easier to use than other forms of NRT, such as nicotine gum, which requires a more complex technique to use ('park and chew').35

In a recently published survey, only 15.9% of respondents that had experience of smoking or vaping were aware of nicotine pouches.36 It seems likely that nicotine pouches would have a similar effect profile to e-cigarettes, although data are needed to confirm this.

Globally, there has been some considerable opposition to the introduction of nicotine pouches and the way in which they are marketed.37,38 It has been suggested that nicotine pouches may introduce the 'gateway effect', providing a steppingstone to cigarette smoking due to the combination of addictive nicotine, pleasant flavours and attractive packaging. This could also be attractive to previous non-smokers or young people.39 The 'gateway effect' has also been a concern around e-cigarettes, with much debate and analysis in the tobacco-control literature. A recent paper attempted to triangulate individual- and population-level data and concluded that the 'causal claims about a strong gateway effect from e-cigarettes to smoking are unlikely to hold, while it remains too early to preclude other smaller or opposing effects'.40 There is currently a paucity of evidence to determine the prevalence of nicotine pouch usage among young people. According to the International Tobacco Control Youth 2021 survey, 4% of 16-19-year-olds reported ever using nicotine pouches. This considers data across the USA, Canada and England.41 When considering England in isolation, 1% of this age group used pouches in 2019.42 Further data are urgently required to assess the popularity of these products among young people, who anecdotally appear to be the target of marketing strategies by manufacturers.

Legislation

Nicotine pouches are currently regulated in the UK by default under the General Product Safety Regulations (GPSR). The Tobacco and Related Product Regulations (TRPR) currently regulates all categories of tobacco products, with parts 6-8 of the TRPR regulating e-cigarettes. However, the TRPR does not cover nicotine pouches. As nicotine pouches are only currently marketed as consumer products in the UK, they do not fall under the Jurisdiction of the Medicines and Healthcare Regulatory Agency (MHRA). E-cigarettes, on the other hand, which have a pathway to be brought into the UK market as either a consumer product or medicinal product, are notified to MHRA before they can be legally sold in the UK. With the increasing use and popularity of nicotine pouches, it is likely that different regulatory stakeholders will begin to consider a focused regulatory framework for nicotine pouches in a similar way to that which they did with e-cigarettes.

In the UK, the use of nicotine pouches among adults more than doubled from 0.14% in November 2020 to 0.32% in October 2021,3 and although usage remains low in the UK, it is increasing and drawing the attention of regulatory authorities. For example, in 2021, Action on Smoking and Health (ASH) responded to a call for evidence from the government for UK product safety review, with concerns regarding how nicotine pouches are regulated. Their concerns were that GPSR is not the appropriate regulatory framework for nicotine pouches which are potentially highly addictive and are accessible to children under the GPSR. ASH were also cautious that there are currently no limits on nicotine strength, restrictions on age of sale, and restrictions on advertising, promotion and sponsorship of nicotine pouches.17 It is likely that more regulatory stakeholders will get involved to advocate for focused regulation for nicotine pouches as their usage increases in order to minimise the risks of unwanted use by certain populations such as young people.

The UK currently promotes the use of e-cigarettes (a novel nicotine product) for smoking cessation largely due to evidence of its success in this regard and relative safety compared to smoking. Given that nicotine pouches are also a novel nicotine product, will the UK soon begin to look at the prospects of nicotine pouches in smoking cessation? Will this influence future regulation of nicotine pouches?

## Conclusion

Nicotine pouches are a new product that the dental professional should be aware of, particularly in smokers and ex-smokers. They are likely to have a relatively low-risk profile, similar to other forms of orally administered nicotine; however, the prolonged and regular use may give increased risk of local oral problems. Further research is required.

8.Medicalnewstoday.com

# Are nicotine pouches bad for you?

Nicotine pouches are smokeless alternatives to tobacco. They contain nicotine salts that dissolve through the gums. Marketing claims that nicotine pouches are lower risk than tobacco.

Nicotine pouches are a newer way to consume nicotine, so [researchTrusted Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9937772/) is ongoing into their effects on the body. Some people use them as a way to quit smoking tobacco. However, other methods of smoking cessation have stronger evidence supporting their safety. These [includeTrusted Source](https://www.ncbi.nlm.nih.gov/books/NBK482442/) nicotine replacement therapy.

This article rounds up the available studies into whether nicotine pouches are harmful and discusses other products that may help people quit nicotine altogether.

Are nicotine pouches bad for you?

There is not enough research available on the effects of nicotine pouches to say whether they are harmful.

In theory, nicotine pouches are less harmful than burning and inhaling tobacco. Nicotine is highly addictive, but it is the other chemicals in tobacco that [increase](https://nida.nih.gov/publications/drugfacts/cigarettes-other-tobacco-products) a person’s risk of [cancers](https://www.medicalnewstoday.com/articles/323648), [lung problems](https://www.medicalnewstoday.com/articles/types-of-lung-diseases), and [heart disease](https://www.medicalnewstoday.com/articles/237191). Even smokeless tobacco can increase a person’s risk of [mouth cancer](https://www.medicalnewstoday.com/articles/165331).

The [Food and Drug Administration (FDA)Trusted Source](https://www.fda.gov/tobacco-products/products-ingredients-components/regulation-and-enforcement-non-tobacco-nicotine-ntn-products) regulations for non-tobacco nicotine (NTN) are not as strict as those for tobacco products. For this reason, there may not be the same pressure on nicotine pouch manufacturers and marketers to be clear about nicotine content and the risks of the products.

A [2022 study](https://tobaccocontrol.bmj.com/content/early/2022/08/05/tc-2022-057280) of 44 nicotine pouch products and two nicotine-free pouches found that 26 of the samples contained cancer-causing chemicals known as tobacco-specific nitrosamines (TSNAs). The same study advised that 29 of the products did not clearly state how much nicotine they provided or gave vague descriptions.

[No long-term dataTrusted Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8887571/) currently suggests that nicotine pouches are helpful for those looking to quit tobacco or slowly reduce nicotine intake.

## Side effects

As nicotine pouches are a new product, their long-term side effects are unclear. However, the [short-term effectsTrusted Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/) might include:

* [nausea](https://www.medicalnewstoday.com/articles/269511)
* [hiccups](https://www.medicalnewstoday.com/articles/181573)
* a sore mouth
* irritation in the mouth

Some nicotine products also deliver a similar amount of nicotine to other smokeless tobacco products, such as snus or snuff, at a similar speed. While a [2020 studyTrusted Source](https://pubmed.ncbi.nlm.nih.gov/32319528/) concluded that there were “no significant adverse effects,” the [FDA warnsTrusted Source](https://www.fda.gov/tobacco-products/products-ingredients-components/regulation-and-enforcement-non-tobacco-nicotine-ntn-products) that nicotine remains highly addictive. This may lead a person to continue using tobacco even if the aim is to stop.

Effects of nicotine on the body

Nicotine is a stimulant drug. When a person ingests nicotine in a pouch, cigarette, or other delivery system, it enters the bloodstream and moves to the gland that pumps out a stress chemical called adrenalin. This [increasesTrusted Source](https://www.fda.gov/tobacco-products/products-ingredients-components/regulation-and-enforcement-non-tobacco-nicotine-ntn-products):

* [blood pressure](https://www.medicalnewstoday.com/articles/270644)
* [breathing rate](https://www.medicalnewstoday.com/articles/324409)
* [heart rate](https://www.medicalnewstoday.com/articles/235710)

It also activates the reward system in the brain, releasing a feel-good chemical called dopamine. Over time, nicotine [can changeTrusted Source](https://www.ncbi.nlm.nih.gov/books/NBK493148/) how the brain functions.

This means that stopping nicotine can lead to feeling sick — a condition known as nicotine withdrawal. These withdrawal symptoms [can peak within a few days](https://nida.nih.gov/publications/research-reports/tobacco-nicotine-e-cigarettes/nicotine-addictive) and last for several week

## Effects of nicotine on the body

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## Other quitting products

The modern tobacco market has seen a huge increase in the availability of smokeless products that claim to help people manage nicotine addiction by reducing smoking.

However, the research for many has limits or is short term. Also, smokeless tobacco products still contain [at least 4,000 chemicalsTrusted Source](https://www.fda.gov/tobacco-products/products-ingredients-components/smokeless-tobacco-products-including-dip-snuff-snus-and-chewing-tobacco), 30 of which have connections to cancer development.

Snus, snuff, and dip

This is a type of tobacco that people place in the mouth in the same way as nicotine pouches, in its moist form, or sniff, in its dry form. Dipping tobacco, or “dip,” is another form of moist snuff.

While snus still exposes users to some potentially harmful chemicals in tobacco, a [2019 reviewTrusted Source](https://harmreductionjournal.biomedcentral.com/articles/10.1186/s12954-019-0335-1) suggests that it has a lower risk of [lung cancer](https://www.medicalnewstoday.com/articles/323701), [mouth cancer](https://www.medicalnewstoday.com/articles/165331), [pancreatic cancer](https://www.medicalnewstoday.com/articles/323423), and [heart disease](https://www.medicalnewstoday.com/articles/237191) than smokable tobacco products. However, limited data suggests that snus might increase a person’s risk of developing [diabetes](https://www.medicalnewstoday.com/articles/323627).

Snus may help people move away from smoking, although not tobacco or nicotine use, according to a [7-year studyTrusted Source](https://harmreductionjournal.biomedcentral.com/articles/10.1186/s12954-020-00405-z) published in 2020.

## Support for quitting smoking and nicotine products

Some nicotine replacement therapy products have a sturdy evidence base showing that they [may be effective](https://smokefree.gov/tools-tips/how-to-quit/using-nicotine-replacement-therapy). According to the American Cancer Society (ACS), these may help a person become [almost twice as likelyTrusted Source](https://www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking/nicotine-replacement-therapy.html) to quit. They are available over the counter and include:

* Patches: These are wearable on the skin, steadily releasing a small amount of nicotine.
* Gums: Chewing these releases nicotine while it dissolves in the mouth.
* Lozenges: People looking to quit smoking can suck on these like hard candy. Lozenges release nicotine slowly as they dissolve.

Stronger inhalers and nasal sprays are available with a physician’s prescription.

People often combine this with other [resources for smoking cessationTrusted Source](https://www.cdc.gov/tobacco/quit_smoking/how_to_quit/index.htm) for longer-lasting results, [includingTrusted Source](https://www.cdc.gov/tobacco/quit_smoking/how_to_quit/index.htm):

* telephone chatlines, such as [800-QUIT-NOWTrusted Source](https://www.cdc.gov/tobacco/campaign/tips/quit-smoking/quitline/index.html" \l "_blank) that provide free, confidential coaching
* free texting programs, such as [SmokefreeTXT](https://smokefree.gov/tools-tips/text-programs/quit-for-good/smokefreetxt?s_cid=OSH_tips_D9402)
* free apps, such as [quitSTARTTrusted Source](https://www.cdc.gov/tobacco/campaign/tips/quit-smoking/quitstart-app/index.html), and online resources, including [smokefree.gov](https://smokefree.gov/tools-tips/apps/quitstart) and [CDC.gov/quitTrusted Source](https://www.cdc.gov/tobacco/campaign/tips/quit-smoking/index.html)
* medications, including bupropion and varenicline
* [cognitive behavioral therapy (CBT)](https://www.medicalnewstoday.com/articles/296579), which can help people identify and avoid their triggers for smoking or relapsing
* [motivational interviewing](https://nida.nih.gov/publications/research-reports/tobacco-nicotine-e-cigarettes/what-are-treatments-tobacco-dependence), a patient-focused technique that lets patients identify gaps between their desire to quit and current behavior pattern

It is best to speak with a clinician about evidence-based options instead of resorting to an unproven product that suggests a supportive role in smoking cessation in its marketing.

## Summary

Nicotine pouches contain nicotine salts that dissolve into the gums. However, there is very little evidence available to confirm its long-term health risks.

Even though nicotine pouches contain fewer harmful chemicals than smokeable tobacco, they still contain cancer-linked TSNAs and carry a risk of several side effects, including nausea, hiccups, and mouth irritation.

No available evidence supports nicotine pouches or other smokeless tobacco products as smoking cessation aids. Those who need support in quitting smoking can supplement nicotine with NRTs to reduce withdrawal while using proven interventions to help with the psychological and emotional aspects of quitting.

9.Tobaccocontrol.bmj.com

## Abstract

Introduction Nicotine pouches are small, permeable pouches containing nicotine. The nicotine may either be derived from tobacco plants or synthetically produced. Nicotine pouches are available worldwide, but little is known as to how various countries regulate these products. This study summarises nicotine pouch regulatory policies across 67 countries.

Methods This research summarises insights obtained through active policy surveillance work in which we requested information on the availability of nicotine pouches and applicable policies and analysed responses from representatives of 67 countries (representatives included subject matter experts in government or civil society organisations). These countries span all WHO regions.

Results We found significant variation in how countries classify nicotine pouches, with many countries’ current regulatory approach failing to regulate nicotine pouches that used synthetic nicotine. We found 34 countries regulate nicotine pouches with 23 of these countries’ policies encompassing synthetic nicotine. Countries regulating both synthetic and tobacco-derived nicotine pouches generally (1) rely on existing policies for tobacco products and/or medicines or (2) have developed new policies or regulatory classifications that specify nicotine as the substance at issue rather than linking policies solely to tobacco.

Conclusion Our work offers novel insight into nicotine pouch markets and national regulatory approaches. Policy approaches vary from not regulating nicotine pouches at all to banning both forms of nicotine pouches. Policies used by countries regulating both tobacco-derived and synthetic nicotine pouches offer a roadmap for how other jurisdictions can add effective guardrails to the use of these and other non-medicinal nicotine products.

## Introduction

Nicotine pouches—such as Zyn and On!— are a type of oral nicotine product. A nicotine pouch is a small bag made of a permeable material, filled with a cellulose matrix of polymer fibres mixed with nicotine of varying concentrations, water, and other constituents that might include sweeteners or flavours.[1](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-1) Users typically place the pouch between the gum and lip,[2 3](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-2) where it is kept for several minutes so that the nicotine can enter the bloodstream primarily via absorption through the mucous membrane of the mouth.[4 5](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-4) Nicotine pouches contain nicotine either derived from tobacco or chemically produced. Tobacco-derived nicotine is extracted from the tobacco plant. Synthesised nicotine is created from petroleum-derived compounds that are enriched through chemical and enantiomeric purification processes to create nicotine.[6](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-6) See [figure 1](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "F1) for a nicotine pouch example.

Nicotine pouches represent a small yet growing global market. Euromonitor International—in its first year estimating global retail volume of nicotine pouches—estimated 292 million units were sold in 2018.[7](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-7) In 2021, Euromonitor International estimated 6.8 billion units of nicotine pouches were sold, representing a more than 2000% increase in nicotine pouch sales since 2018.[7](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-7) In recent years, global tobacco companies, such as British America Tobacco, Japan Tobacco International and Phillip Morris International, have expanded nicotine pouches’ reach into new markets and devoted greater resources to promoting and expanding nicotine pouch production.[8](https://tobaccocontrol.bmj.com/content/33/e1/e32" \l "ref-8)

Conclusion

The emergence of nicotine pouches throughout the world has heightened concern about nicotine addiction increasing, particularly for naïve nicotine users such as youth. Nicotine pouches—and especially synthetic nicotine pouches—often do not clearly fit within existing definitions of regulated tobacco products. Our work has offered insight into how countries have begun regulating tobacco-derived and synthetic nicotine pouches. By highlighting approaches taken by countries regulating both types of nicotine pouches, our work has also suggested that countries not currently regulating one or both of these products may have more authority than initially realised. For example, countries not regulating nicotine pouches have policies in place that are similar to countries regulating tobacco-derived nicotine pouches. Future work is needed to (1) expand the number of countries reporting their regulatory approaches, (2) track how policies influence use of nicotine pouches and related products, (3) update this continually evolving tobacco and nicotine product regulatory landscape and (4) assess the effect of different regulatory approaches. While our focus was on nicotine pouches, there are other nicotine products where a similar approach would be beneficial. For example, e-cigarettes using synthetic nicotine may be regulated differently from e-cigarettes using tobacco; further research is needed to understand these potential distinctions. Moving forward, policymakers must consider if their tobacco regulatory regimes need to adjust to changing market forces and shift from a tobacco-centric regulatory approach to one focused on nicotine. At the same time, policymakers need to weigh to what extent regulatory approaches for nicotine pouches should mirror those used for other tobacco products. As the tobacco industry adjusts its product constituents—and product mix—policy priorities and policy approaches need to be re-examined.

10.Vcuhealth.org

# How safe are nicotine pouches? 'Tobacco-free' does not mean 'risk-free,’ VCU expert says

## Alexandra Howell, DMD, of the VCU School of Dentistry, urges nicotine pouch users to prioritize dental screenings for health problems.

A nicotine product marketed as an alternative to smoking – and a potential way to quit – is [gaining popularity](https://www.cnn.com/2024/04/03/health/zyn-nicotine-pouches-health-concerns-wellness/index.html), but experts say there are still concerns when it comes to your health.  
  
Nicotine pouches are dissolvable pouches with a nicotine powder mix that doesn’t have tobacco leaves. One of the popular brands is ZYN, of which [350 million cans were sold the United States in 2023](https://www.cnn.com/2024/02/08/business/zyn-nicotine-pouches-sales-earnings/index.html) – an increase of 62% compared to the previous year.  
  
The amount of nicotine in oral pouches, like ZYN, is similar to smokeless tobacco products, such as snus and snuff which are placed in the lip to be absorbed through the gums.  
  
“Nicotine pouches are marketed as a nicotine product that provides a buzz without the harmful effects of tobacco or smoking. However, people using these products should be aware that ‘tobacco-free’ does not mean ‘risk-free,’” said [Alexandra Howell](https://www.vcuhealth.org/find-a-provider/alexandra-howell), DMD, oral medicine specialist and assistant professor in the [Department of Oral Diagnostic Sciences](https://oraldiagnosticsciences.vcu.edu/) at Virginia Commonwealth University’s [School of Dentistry](https://dentistry.vcu.edu/).  
  
As researchers are still studying the health impacts of these newer nicotine products, federal health experts note [smokeless tobacco products are still causing serious health problems](https://www.cdc.gov/tobacco/other-tobacco-products/smokeless-tobacco-health-effects.html), including nicotine addiction and diseases of the mouth.  
  
“While these pouches may seem like a convenient way to consume nicotine, people should be aware of the potential oral health risks,” Howell added.  
  
Howell spoke with VCU Health News about the impact nicotine pouches have on your teeth, gums and mouth as well as other health considerations for people using smokeless tobacco or oral nicotine products.

## What is in smokeless tobacco products and nicotine pouches that could be harmful?

When considering smokeless tobacco, individuals who dip or chew get about the same amount of nicotine as regular smokers. Additionally, they are subjected to at least 28 carcinogenic chemicals. Among these, tobacco-specific nitrosamines (TSNAs) pose the most significant cancer risk. The concentration of TSNAs differs among products, with higher levels correlating to increased cancer risks.  
  
The U.S. Food and Drug Administration has established a list of chemicals that are called HPHCs – [Harmful and Potentially Harmful Constituents](https://www.fda.gov/tobacco-products/products-ingredients-components/harmful-and-potentially-harmful-constituents-hphcs) – that are in tobacco products that cause or could cause harm to smokers or nonsmokers. While these oral nicotine products don’t seem to contain TSNAs, they still have been found to have low levels of several of these HPHCs.  
  
The cancer risk associated with newer variants of smokeless tobacco or oral nicotine products remains somewhat uncertain, primarily due to limited research compared to traditional chewing tobacco and snuff. Nevertheless, these newer products still harbor potentially detrimental chemicals that could elevate cancer risk.

## What other health problems are associated with nicotine pouches and smokeless tobacco products?

Nicotine pouches present [several cardiovascular risks due to the nicotine content](https://www.ahajournals.org/doi/10.1161/CIR.0b013e3181f432c3?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub 0pubmed). The use of these products can lead to increased heart rate and blood pressure, which may increase the risk of developing cardiovascular diseases such as hypertension, heart disease, and potential heart attacks.  
  
As far as the potential oral side effects are concerned, many users report significant mouth sores and gum irritation, particularly in the area where the pouch is placed. The continuous exposure to nicotine and other ingredients, like artificial flavorings and sweeteners, can lead to inflammation, redness, ulcers and swelling. Over time, this can contribute to gum recession, exposing the roots of the teeth and increasing sensitivity and risk of cavities.  
  
Nicotine has also been shown to reduce saliva production, leading to dry mouth. Saliva is crucial for neutralizing acids produced by bacteria in the mouth, washing away food particles and helping digestion. A lack of saliva can result in an increased risk of tooth decay, mouth irritation, bad breath and other dental problems.  
  
Traditional [smokeless tobacco](https://www.cdc.gov/tobacco/other-tobacco-products/smokeless-tobacco-health-effects.html) is still known to cause gum disease, dental decay, and tooth loss. In addition, it can also cause white or gray patches inside the mouth, called leukoplakia, that can lead to cancer.

## Are nicotine pouches safer than vaping?

According to the Centers for Disease Control and Prevention, [no tobacco products, including vapes or e-cigarettes, are safe](https://www.cdc.gov/tobacco/e-cigarettes/health-effects.html). Nicotine, which is found in tobacco products, is addictive. In general, tobacco-free nicotine products, like ZYN pouches or vapes, were originally developed as tools to help people quit smoking, and they are not intended for those who do not already use tobacco or nicotine products.  
  
[Some research shows](https://ncbi.nlm.nih.gov/pmc/articles/PMC9667333/) that the oral pouches’ nicotine levels are higher than medications prescribed by a doctor to help smokers quit, called nicotine replacement therapy.  
  
The dental and medical communities are urging for more comprehensive research to fully understand the long-term effects that these increasingly popular nicotine products have on oral health.  
  
It is crucial that people who use these products prioritize regular dental check-ups to screen for these potential issues and maintain good oral hygiene daily.

11.Healthline.com

Nicotine pouches are smokeless and spitless products containing nicotine, flavorings, and other ingredients.

These pouches are designed to be placed in the mouth, similar to chewing tobacco or snus, but they don’t contain tobacco leaves. Instead, they often use plant-based materials as fillers.

While nicotine pouches are generally considered less harmful than smoking, they’re not entirely risk-free and can still lead to nicotine addiction.

## What are nicotine pouches for?

Nicotine pouches are primarily used as a smokeless tobacco alternative to deliver nicotine to users without the need for smoking or traditional chewing tobacco.

While nicotine pouches aren’t designed specifically for quitting smoking, some people use them as a harm reduction strategy or an alternative to smoking to reduce their exposure to harmful tobacco smoke.

## What side effects or risks are possible with use?

The use of nicotine pouches carries some potential side effects and risks, including:

* Nicotine addiction: Nicotine is an addictive substance, and using nicotine pouches can lead to [nicotine addiction](https://www.healthline.com/health/nicotine-and-related-disorders) or dependence.
* Mouth and gum irritation: Some users may experience mouth or [gum irritation](https://www.healthline.com/health/why-do-my-gums-hurt), especially if they’re sensitive to nicotine or the ingredients in the pouch.
* Dental conditions: Using nicotine pouches may contribute to [dental conditions](https://www.healthline.com/health/dental-and-oral-health) like gum recession or tooth decay.
* Gastrointestinal upset: Swallowing excess saliva from the pouch can lead to stomach upset or nausea in some individuals.
* Allergic reactions: Some people may be allergic to specific ingredients in nicotine pouches, leading to [allergic reactions](https://www.healthline.com/health/nicotine-allergy).

## How do nicotine pouches compare to other nicotine or tobacco products?

Nicotine pouches differ from other nicotine or tobacco products in several ways, but whether they’re safer depends on the specific product and your health goals.

Here’s a comparison:

* No tobacco: Unlike traditional tobacco products such as cigarettes, cigars, or chewing tobacco, nicotine pouches don’t contain tobacco leaves. This is significant because many harmful compounds associated with tobacco combustion, like tar and carcinogenic chemicals, are absent.
* Nicotine content: Nicotine pouches, like e-cigarettes, offer varying nicotine levels, unlike cigarettes with consistent nicotine content. An [analysis](https://mobil.bfr.bund.de/cm/349/health-risk-assessment-of-nicotine-pouches.pdf) of 44 pouches revealed nicotine content ranging from 1.79–47.5 milligrams per pouch, often with an 8.8 pH and approximately 86% free-base nicotine (a more readily absorbed form of nicotine).
* Delivery method: Nicotine pouches are typically placed between the cheek and the gum, allowing nicotine to be absorbed through the lining of the mouth. Cigarettes involve inhaling nicotine through smoke, while e-cigarettes involve vaporized nicotine inhalation.
* Addictiveness: Nicotine pouches and other nicotine products can be addictive due to the presence of nicotine, regardless of the delivery method.
* Side effects: The side effects associated with nicotine pouches can vary from person to person, including mouth or gum irritation, nausea, and nicotine dependence. These side effects might differ from smoking or other tobacco products but can still pose health risks.

Are nicotine pouches similar to chewing tobacco?

Nicotine pouches and chewing tobacco are similar in the sense that they’re both smokeless tobacco products placed between the gum and cheek. However, they have some key differences:

* Ingredients: Nicotine pouches contain synthetic nicotine, flavorings, and other ingredients but no tobacco leaf. Chewing tobacco is made from tobacco leaves — when it’s chewed, it releases nicotine and various harmful chemicals.
* Spitting: Chewing tobacco typically requires users to spit out the excess saliva that builds up during use. Nicotine pouches, on the other hand, are spitless. Users don’t need to spit while using them, making them more discreet.

While both products deliver nicotine, nicotine pouches are generally considered less harmful than chewing tobacco due to their lower levels of harmful chemicals and the absence of tobacco leaves.

### Are nicotine pouches popular?

Nicotine pouches are relatively new to the market, gaining popularity in recent years as an alternative to traditional tobacco products.

In a population [studyTrusted Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10203764/) of young people in the United States, between December 2021 and May 2022, 16% of participants had tried nicotine pouches at some point, with 12% currently using them.

Those currently using pouches were more likely to be ages 21 or older, male, and have lower incomes. Importantly, 73% of current pouch users, and 33% of those who had used pouches in the past but weren’t current users, also reported smoking cigarettes.

## The bottom line

Nicotine pouches are promoted as a safer alternative to traditional smoking since they don’t involve burning tobacco. However, the long-term health consequences of prolonged use remain a subject of ongoing research.

Like e-cigarettes, nicotine pouches vary in their nicotine content. While they might be a better choice compared to smoking, it’s important to note that nicotine itself carries health risks.

The varying nicotine levels in different pouches can also be a potential concern. In summary, nicotine pouches are potentially less harmful than smoking, but their overall health impact still necessitates further research for a comprehensive understanding.

12.Apnnews.com

## HOW DO NICOTINE POUCHES WORK?

Users stick them between their lip and gums, where they slowly release low levels of nicotine that are absorbed into the bloodstream. Because pouches generally don’t contain tobacco, there’s no spitting, unlike older products like chew and snuff.

Philip Morris representatives say the nicotine-only formulation is part of Zyn’s appeal.

“People can be reluctant to move into an oral tobacco product if they view it as similar to traditional chewing tobacco,” company spokesman Corey Henry said. “Consumer acceptability is a big part of Zyn.”

## IS ZYN HEALTHIER THAN OTHER TOBACCO PRODUCTS?

All tobacco products carry serious health risks. Cigarettes are widely understood as the most harmful, increasing the likelihood of cancer, heart disease and lung problems. Chewing tobacco is linked to mouth cancer, gum disease and tooth loss.

But in the last decade or so, researchers and health regulators have begun to acknowledge [different levels of harm](https://www.fda.gov/tobacco-products/health-effects-tobacco-use/relative-risks-tobacco-products) among different tobacco products.

In 2019, the Food and Drug Administration said [a different oral tobacco product, called snus](https://apnews.com/article/84141a5ce4d04dffa33341402ba75eeb), contains lower cancer-causing chemicals than cigarettes and could benefit smokers who switch.

Snus are similar to nicotine pouches like Zyn, except that they contain fermented tobacco. Studies from Sweden and other places where they are popular have shown lower rates of lung cancer and related diseases compared with other European countries where smoking is more prevalent.

There’s little research on the long-term effects of nicotine pouches, but many researchers expect they will show similarly low rates of carcinogens and other toxic components.

Still, that doesn’t mean they’re safe. A study last year found Zyn and similar products contain low levels of harmful substances such as ammonia and formaldehyde.

## WILL THE FDA AUTHORIZE ZYN FOR ADULT SMOKERS?

Currently [FDA officials](https://apnews.com/article/science-health-public-tobacco-industry-regulation-6af0d635d7859bab914cc249ef43b6e2) are letting Zyn stay on the market while they review Philip Morris’ marketing application, which was submitted in 2020.

To win [FDA authorization](https://apnews.com/article/politics-us-food-and-drug-administration-business-health-vaping-fc7a384693fb91861a6bb17e5b5bb6d9), companies generally must show that their products will [reduce disease](https://apnews.com/general-news-3ab7ab8c73ac47e982699e08dd268d17) among adult tobacco users without attracting underage use by teens and adolescents.

## IS ZYN POPULAR AMONG YOUNG PEOPLE?

Not according to the latest federal data. Only 1.5% of high school and middle schoolers reported using nicotine pouches when surveyed last year. That’s well below the roughly 10% who used electronic cigarettes.

But anti-tobacco advocates point to worrying signs: videos of young people popping the pouches have racked up millions of views on social media in recent months. A similar surge of online activity preceded the rise of [Juul](https://apnews.com/article/science-health-lawsuits-connecticut-fce3fe4f92066a9068cf505ed1fb63b0), the sleek e-cigarette widely blamed for triggering a [spike in teen vaping](https://apnews.com/article/23cd6c85396849e1acbb7d468d239d8c) in the years before COVID-19.

Concerns about Zyn going viral have sparked debate among health experts, parents and even politicians. The FDA says it’s monitoring underage use of Zyn and other pouches and will take action, if necessary.

## CAN ADULT SMOKERS USE ZYN TO HELP QUIT?

Currently only a handful of products are FDA-approved to help with quitting smoking, including medications, nicotine gums and patches. Some researchers point out that Zyn works similarly to some of those products — gradually delivering nicotine that reduces cravings.

But early research suggests Zyn and other pouches may not be enough to help smokers quit. Ohio State University researchers recently found it took smokers 30 minutes to an hour to get enough nicotine from Zyn to relieve their cravings. With cigarettes, smokers achieved the same nicotine levels — and relief — in five minutes.

For now, Philip Morris is focused on obtaining FDA authorization to stay on the market, and eventually it has said it could seek a reduced-risk designation similar to snus. But no tobacco company — Philip Morris included — has ever asked the FDA to approve their products to help smokers quit completely.

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13.nbcnews.com

# The dark side of Zyn: How tobacco-free nicotine pouches may harm your health

Will Llamas wasn’t a regular tobacco user when a friend first introduced him to Zyn nicotine pouches.

“I had convinced myself, because there wasn’t any tobacco, these were pretty safe,” Llamas, of Stamford, Connecticut, said. “I liked how it made me feel. It tasted good. And so I was hooked.”

The 32-year-old said he quickly became addicted to Zyn, using up to 20 pouches a day. The pouches come in 3- or 6-milligram doses of nicotine in a variety of [flavors](https://www.nbcnews.com/politics/supreme-court/supreme-court-weigh-fdas-refusal-approve-flavored-vapes-rcna158798), including coffee, mint and citrus.

“It gives you a shot of dopamine, so you just feel a little energized, happier, almost focused,” Llamas said.

Nicotine pouches like Zyn have soared in popularity in recent years. Zyn, a Swedish brand, was acquired by Philip Morris in 2022, and in the first three months of this year, more than 131 million cans were sold, an 80% percent increase from the same time last year. Last month, a [shortage of Zyn](https://www.nbcnews.com/tech/internet/zyn-shortage-busting-users-buzz-company-halts-online-sales-rcna158183) sparked outcry on social media. Other products include Rogue, Velo and On!. Most are marketed as smoke-free, spit-free and hands-free alternatives to cigarettes and other tobacco products.

“Usually when you say that something is free of something, it makes it seem less harmful,” said Tory Spindle, associate professor of psychiatry and behavioral sciences at Johns Hopkins School of Medicine in Baltimore. “Our concern is that, well, does that make them more appealing to someone that otherwise would have never tried any tobacco product?”

While Spindle said nicotine pouches — which users tuck between their lip and gums and later discard — could serve as a better alternative for established tobacco users, “the challenge is, how do you make the products accessible to someone like that, while not inadvertently addicting a new wave of individuals who never would have tried [nicotine](https://www.nbcnews.com/health/health-news/sales-e-cigs-packed-nicotine-soar-regulators-try-crack-rcna90222)?”

In a statement, Philip Morris said it is “committed to developing products such as Zyn that are scientifically substantiated as a better alternative to continued smoking.”

Llamas said he had tried other smokeless tobacco products, but didn’t like the taste.

“It was honestly pretty disgusting, so the benefits weren’t there,” Llamas said. “I was not addicted to those, but these were a whole different beast,” he said, referring to Zyn.

After about a year of using Zyn, however, he started to experience gastrointestinal problems — issues he said he now attributes to the nicotine pouches.

“I got many tests done. I went to a hospital. I got an ultrasound, I got a [colonoscopy](https://www.nbcnews.com/health/cancer/colonoscopy-15-years-colon-cancer-average-risk-rcna150372), and all they found was that my stomach was inflamed,” he said. After researching his symptoms online, he thought the source of his problems may be the pouches. “I haven’t had stomach issues since the day I quit cold turkey.”

Llamas wears an Apple Watch every day and said the device detected that his resting heart rate dropped by 10 beats per minute after he stopped using the pouches.

“I really wish I had more information when I took my first pouch,” he said. “If I had known that it was going to cause me so many health issues, I wouldn’t have started.”

## **Negative health effects**

Dr. Donna Shelley, professor and vice dean for research at the New York University School of Global Public Health, said that while nicotine pouches don’t cause the same health problems as products containing tobacco, she wouldn’t call them “safe.”

“Some of the negative health effects of the nicotine pouches include gastrointestinal symptoms, like nausea, gum soreness and ulcers, and also some cardiovascular risks like elevated heart rate,” said Shelley, who researches tobacco control, adding, “We don’t know the full safety profile yet.”

A [2023 study](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1) that compared Zyn pouches to smokeless tobacco and nicotine replacement products found that while Zyn doesn’t contain “nitrosamines or some of those real known cancer-causing agents, it does contain some chemicals like formaldehyde that the FDA has said are potentially harmful,” she said.

Dr. Varisha Parikh, a prosthodontist at Parikh Prosthodontics in Los Angeles, has warned of the potential dental health effects of nicotine pouches on social media.

“Placing something on your gum tissue for a prolonged period of time, that is a chemical agent, you’re just asking for issues in that area,” she said.

Sydney Cunningham said she has gum recession from using Zyn. The 30-year-old, from Safford, Arizona, picked up the habit while pursuing her doctoral degree because she “wanted an extra kick” to help her focus and study for exams.

“I put the Zyn pouches in the back of my mouth as far as I can, kind of near the wisdom teeth on the upper side of my mouth,” Cunningham said. “And that is where I’m having these gum issues.”

Risks to kids and teens

One of the major concerns medical experts have is that these products aren’t just being used by adults, but by kids and teens.

“When young people use nicotine, it changes the way their brains work. And what it can then do is set them up for a lifelong addiction to nicotine,” said Judith Gordon, a professor and associate dean for research in the college of nursing at the University of Arizona.

Spindle, who is studying how addictive the different flavors of nicotine pouches are, said that “they do seem to be pretty heavily marketed to youth.”

“The way it’s designed is exactly the sort of thing that makes it easy for adolescents to use and, you know, convenient, concealable,” said Vaughan Rees, director of the Center for Global Tobacco Control at Harvard T.H. Chan School of Public Health. The various strengths may make the pouches easier to start using, he said. “The way it’s designed may actually encourage use among youth rather than being a viable alternative for an adult smoker.”

A study published Wednesday in the [Journal of the American Medical Association](https://jamanetwork.com/journals/jama/fullarticle/2820917) found that nicotine pouch use among adults in the U.S. remains low, despite the increase in sales.

The study, however, only looked at adults, said study co-author Adam Leventhal, the director of the Institute for Addiction Science at the University of Southern California. It’s possible, he said, that people who are underage are accounting for the increase in sales.

“While the study was focused on adults, there are data that have been published, and  forthcoming as well, that shows that an appreciable proportion of teens also use nicotine pouches at rates that are higher than what we found for adults,” Leventhal said.

Earlier this year, the Food and Drug Administration [issued 119 warnings](https://www.fda.gov/tobacco-products/ctp-newsroom/fda-issues-warning-letters-and-files-civil-money-penalty-complaints-against-retailers-underage-sales) to retailers that were selling Zyn to underage kids.

“The FDA remains concerned about any tobacco product that may appeal to youth,” an agency spokesperson said in a statement.

The FDA is in the process of reviewing the marketing applications for Zyn and other nicotine pouches, though the agency has allowed the products to be sold in the U.S. in the meantime. Multiple medical organizations have [asked the FDA](https://www.lung.org/getmedia/72150258-7733-4d36-80f1-6a49e1af8734/Tobacco-Partners-Nicotine-pouch-letter-to-FDA-4-23-24.pdf) to remove them from the market during the review period.

Last month, Phillip Morris [suspended online sales of Zyn](https://www.nbcnews.com/business/business-news/philip-morris-suspends-nationwide-sales-zyncom-dc-subpoena-rcna157645) after questions about whether it violated Washington, D.C.’s ban on the sale of flavored tobacco. But the products are still widely available online through other sellers.

In a statement, Philip Morris said that “Zyn’s marketing is directed toward legal age nicotine users who are 21+.”

It’s been six months since Llamas quit, but he said he still gets cravings.

“I don’t know if they’re ever gonna go away,” he said. Quitting was difficult, he added, because he would use a Zyn pouch doing pretty much every activity.

“So I had to relearn how to like these activities and my body has to create its own dopamine,” Llamas said. “So going to the gym, driving, you know, at work — all these things I had to relearn how to enjoy.”

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14.health.havard.edu

# Is snuff really safer than smoking?

Snuff is a smokeless tobacco similar to chewing tobacco. It rarely makes headlines. But it certainly did when the FDA authorized a brand of snuff to market its products as having a major health advantage over cigarettes. Could this be true? Is it safe to use snuff?

What is snuff, anyway?

Snuff is a form of tobacco that's finely ground. There are two types:

Moist snuff. Users place a pinch or a pouch of tobacco behind their upper or lower lips or between their cheek and gum. They must repeatedly spit out or swallow the tobacco juice that accumulates. After a few minutes, they remove or spit out the tobacco as well. This recent FDA action applies to a brand of moist snuff.

Dry snuff. This type is snorted (inhaled through the nose) and is less common in the US.

Both types are available in an array of scents and flavors. Users absorb nicotine and other chemicals into the bloodstream through the lining of the mouth. Blood levels of nicotine are similar between smokers and snuff users. But nicotine stays in the blood for a longer time with snuff users.

## Why is snuff popular?

According to CDC statistics, 5.7 million adults in the US regularly use smokeless tobacco products — that's about 2% of the adult population. A similar percentage (1.6%) of high school students use it as well. That's despite restrictions on youth marketing and sales.

What accounts for its popularity?

Snuff may be allowed in places that prohibit smoking.

It tends to cost less than cigarettes: $300 to $1,000 a year versus several thousand dollars a year paid by some smokers.

It doesn't require inhaling smoke into the lungs, or exposing others to secondhand smoke.

Snuff is safer than cigarettes in at least one way — it is less likely to cause lung cancer.

It may help some cigarette smokers quit.

## The serious health risks of snuff

While the risk of lung cancer is lower compared with cigarettes, snuff has plenty of other health risks, including

higher risk of cancers of the mouth (such as the tongue, gums, and cheek), esophagus, and pancreas

higher risk of heart disease and stroke

harm to the developing teenage brain

dental problems, such as discoloration of teeth, gum disease, tooth damage, bone loss around the teeth, tooth loosening or loss

higher risk of premature birth and stillbirth among pregnant users.

And because nicotine is addictive, using any tobacco product can quickly become a habit that's hard to break.

There are also the "ick" factors: bad breath and having to repeatedly spit out tobacco juice.

Could this new marketing message about snuff save lives?

Perhaps, if many smokers switch to snuff and give up smoking. That could reduce the number of people who develop smoking-related lung cancer. It might even reduce harms related to secondhand smoke.

But it's also possible the new marketing message will attract nonsmokers, including teens, who weren't previously using snuff. A bigger market for snuff products might boost health risks for many people, rather than lowering them.

The new FDA action is approved for a five-year period, and the company must monitor its impact. Is snuff an effective way to help smokers quit? Is a lower rate of lung cancer canceled out by a rise in other health risks? We don't know yet. If the new evidence shows more overall health risks than benefits for snuff users compared with smokers, this new marketing authorization may be reversed.

The bottom line

If you smoke, concerns you have about lung cancer or other smoking-related health problems are justified. But snuff should not be the first choice to help break the smoking habit. Commit to quit using safer options that don't involve tobacco, such as nicotine gum or patches, counseling, and medications.

While the FDA's decision generated news headlines that framed snuff as safer than smoking, it's important to note that the FDA did not endorse the use of snuff — or even suggest that snuff is a safe product. Whether smoked or smokeless, tobacco creates enormous health burdens and suffering. Clearly, it's best not to use any tobacco product.

Until we have a better understanding of its impact, I think any new marketing of this sort should also make clear that using snuff comes with other important health risks — even if lung cancer isn't the biggest one.

15.verywellmind.com

# What Is Snuff?

Snuff is a form of smokeless tobacco meant to be inhaled through the nose or chewed, or placed in the mouth to produce saliva.

Snuff comes in a "dry" form (for snorting) and in a "wet" or "moist" form (chewing or dipping tobacco). Additionally, there is a creamy snuff, which is less popular than the other forms. All deliver nicotine and other hazardous chemicals, so all are dangerous to use.

## Types of Snuff

"Snuff" often refers specially to dry snuff, but it also comes in other forms.

### Dry Snuff

Dry snuff is a powdered tobacco product that involves curing or fermenting selected tobacco leaves, which are then ground down into a fine powder. Traditional "fine snuff" highlighted the taste of different tobacco blends only, but most of what is sold today has a scent or flavor added as well.

Common flavors include coffee, chocolate, plum, camphor, cinnamon, rose, mint, honey, vanilla, cherry, orange, apricot. Even flavors like whiskey, bourbon, and cola can be found. Most snuff is aged for a period of time to allow the flavors to settle and develop before being sold.

Dry snuff is snorted or sniffed into the nasal cavity, where it sends a hit of [nicotine](https://www.verywellmind.com/what-to-expect-from-nicotine-withdrawal-22467) into the bloodstream quickly.1﻿ This action often produces a sneeze, especially in people who are new to the practice.

### Wet Snuff

There are a few different kinds of wet snuff, which is placed in the mouth to produce nicotine-laden saliva.

* Snus: This is a Swedish moist snuff product that is sold in little packets. The snuff is slipped between the upper lip and gums where it sits, mixing with saliva and leaching nicotine-containing tobacco juice into the mouth. Most snus packets contain about 30% tobacco and 70% water and flavorings.2﻿
* Dipping tobacco (dip): This American snuff product is comprised of ground-up or loose bits of shredded tobacco that users take a pinch of to place between cheek and gum. As the juice builds up, it's either spit out or swallowed.
* Chewing Tobacco (chew): Chewing tobacco comes in a few different forms: loose, leaf, pellets and plugs. Some are flavored and/or sweetened, and all forms are chewed to release tobacco juices. Both dip and chew are discarded, not swallowed, when finished.

### Creamy Snuff

Sold in toothpaste tubes, creamy snuff is meant to be applied to the gums by rubbing it on with the finger or toothbrush. It is then left in place for a few minutes before spitting out the tobacco-laden saliva it produces.

Creamy snuff comprises tobacco paste, clove oil, glycerin, and mint flavorings. It's used mainly in India to clean the teeth. Creamy snuff is addictive, just like any other snuff product.

## Health Risks of Snuff, Chew, and Dip

According to the Centers for Disease Control and Prevention (CDC), smokeless tobacco products such as snuff pose several significant health risks:3

* Addiction: All forms of snuff put users at risk for [nicotine addiction](https://www.verywellmind.com/nicotine-addiction-101-2825018).4
* Cancer: Snuff is associated with cancers of the mouth, esophagus, and pancreas.
* Dental and oral health problems: Snuff and other types of smokeless tobacco increase the risk of various dental problems, including receding gums, swollen gums, gum disease, tooth staining, bad breath, and tooth decay. It also increases the risk of other mouth problems.5
* Heart disease: Snuff is linked to increased blood pressure and heart rate and an elevated risk of dying from heart disease.6
* Poisoning: Snuff can lead to accidental nicotine poisoning in children, which can cause problems breathing, nausea, vomiting, convulsions, loss of consciousness, and death.
* Pregnancy complications: The use of snuff during pregnancy is associated with an elevated risk of early delivery and stillbirth.6

Chronic abuse of dry snuff leads to morphological and functional changes in the nasal mucosa. Users are also exposed to carcinogens in tobacco; snuff may increase the risk of head and neck cancer.7

## Is Snuff Safer Than Smoking?

While snuff doesn't contain [tar](https://www.verywellmind.com/nicotine-addiction-101-2825018) or any toxic gases produced by burning cigarettes, all forms have nicotine. Snuff tobacco also contains tobacco-specific nitrosamines (TSNAs), considered some of the most potent carcinogens in tobacco.8

The best choice is to avoid all tobacco products completely. If [you're addicted to nicotine](https://www.verywellmind.com/will-i-miss-smoking-forever-2824756) (whether it's delivered by traditional cigarettes, e-cigarettes, or smokeless tobacco products), use the [resources here to help you quit now](https://www.verywellmind.com/natural-remedies-to-quit-smoking-89997). Addiction never just fades away on its own, so be proactive and kick it out of your life.

## History of Snuff Use

Snuff has a long history of use. Mayan snuff containers dating to AD 300-900 have been found. Snuff has turned up in numerous cultures and time periods elsewhere in the world, from South America to Spain and other parts of Europe, Asia, and Africa. John Rolfe introduced commercially manufactured snuff to North America in the early 1600s.9

Following a period of time where snuff was frowned upon and banned by the Pope and a couple of French kings, it regained popularity with French, English, and even American aristocrats. The U.S Congress passed the first federal excise tax on tobacco products in 1794. A tax of 8 cents was applied to snuff and represented 60% of the cost of a container of it. Smoking and chewing tobacco were not included in this tax.

Today, snuff is still available in smoke shops throughout Europe. It is regulated in the same way as other tobacco products, including age restrictions. In the United States, dry snuff is not popular, so is not as easily obtained. It can be found in specialty smoke shops and online.

## How to Stop Using Snuff

If you want to quit using snuff, some different strategies and resources can help. Options that you can try include:

* [Nicotine replacement therapy](https://www.verywellmind.com/the-nicotine-patch-2825025) (NRT): This involves the use of patches, gums, lozenges, and other products that deliver a controlled, low dose of nicotine. These products can be used to gradually taper your nicotine intake until you can quit with fewer cravings and [withdrawal symptoms](https://www.verywellmind.com/what-to-expect-from-nicotine-withdrawal-22467).
* Prescription medications: Medications such as [Chantix](https://www.verywellmind.com/chantix-side-effects-2825341) (varenicline) and [Zyban](https://www.verywellmind.com/what-should-i-know-about-zyban-as-a-quit-aid-2825342) (bupropion) can help reduce symptoms of nicotine craving and withdrawal.
* Counseling: Therapy can also help quit snuff and help you develop coping strategies that will support long-term success.

16.vont.co

## What is snuff?

Snuff is loose, powdered smokeless tobacco used nasally. It comprises grounded tobacco leaves that are often flavoured with an essence or scents. It is sniffed or inhaled up the nasal cavity, delivering an instant nicotine rush. It is available packed in containers.

Traditional snuff flavours include a blend of various tobacco leaves grounded without any additional scents. It is what is known as original fine snuff. However, other varieties add essences including spicy, fruity, mentholated, and floral. Snuff manufacturers produce their flavours and recipes. Popular snuff flavours include cinnamon, spearmint, orange, cherry, vanilla, honey, chocolate, rose, and coffee. More recently, non-traditional snuff flavours like cola, whiskey, and bourbon.

Snuff doesn’t just vary in flavours and blends. It also varies in moistness (dry to moist), texture (fine to coarse), and nicotine levels. The drier snuff varieties are often more finely grounded and inhaled. Wet and creamy snuff is used orally.

Modern-day snuff is also available in a range of tobacco-less formulas. As a tobacco-less product, it is technically not snuffed. Tobacco-less snuff is simply a more agreeable alternative for those who wish to eliminate their tobacco or nicotine intake.

## A brief history of snuff

Snuff was first introduced to England in the 17th century, right after the Great Plague of London. During this time, snuff gained sudden popularity because people came to believe it had potent healing properties.

By the 18th century, this tobacco product had gained a reputation among the elite. Its use peaked during the reign of Queen Anne. During this period the country began its production of home-prepared snuff varieties. Snuff simply became “fashionable” among the elite and set them apart from the common man.

## Types of snuff

Traditionally and generally, snuff refers to dry snuff, which is administered nasally. However, the term is also used for other forms of loose, powdered, or cut tobacco.

### Dry Snuff

We’ve already discussed dry snuff above. Dry snuff is mainly prepared by fermenting or curing especially collected tobacco leaves, that are ground into fine powder. The traditionally used form of snuff is called “fine snuff”. It primarily features various tobacco blends as its specialty. However, most of the dry fine snuff available today has additional scents and flavours.

### Moist/ Wet Snuff

There are different types of wet snuff – snus, dipping tobacco (dip), and chewing tobacco (chew) – and they are all used orally.

### Creamy Snuff

Creamy snuff is available in tubes similar to toothpaste and is used by rubbing onto the gums and teeth with a finger or toothbrush. It is then allowed to stay in place for a few minutes before the nicotine kicks in, after which the user spits it out.

17.tidsskriftet.no

# Are the health risks of moist oral snuff (snus) underestimated?

The use of moist oral snuff (snus) has increased significantly, particularly among young adults who have not previously smoked. Snus increases the risk of cancer, cardiovascular disease, type-2 diabetes and birth defects.

In recent decades, there has been a worrying increase in the use of moist oral snuff (snus) in Norway, particularly amongst young people and adults under the age of 40. Many who use snus have not previously smoked. The nicotine content of some of the new types of snus is several times higher than that of smoking tobacco and earlier types of snus.

Commissioned by the Ministry of Health and Care Services, in autumn 2019 the Norwegian Institute of Public Health updated the evidence base for assessing the health risks associated with using Swedish snus, which dominates the Norwegian snuff market (1, 2). The update and our conclusions are based on systematic literature reviews. We have included studies that compare risk amongst users of snus with that of non-users, evidence from in vivo and in vitro studies on nicotine effects and mechanisms, knowledge about tobacco-specific nitrosamines and snus, as well as evidence of adverse health effects from using other tobacco products. Compared to earlier reports, there is now stronger evidence to suggest that the risk of contracting several serious diseases is higher among those who use snus. The results give cause for concern.

## Using snus versus non-smoking

Our emphasis was on studies that compare the risk of disease and death amongst non-smoking users of snus with that of non-tobacco users. The reason for this emphasis was that any adjustment made for smoking habits without data about smoking volume or duration, will be inaccurate and incomplete. If smokers who also use snus smoke less than those who only smoke cigarettes, this may lead to an over-adjustment of the smoking component and a consequential underestimation of the effect of snus.

In some studies, the risk estimates for snus-exposed groups were not significantly different from the control groups, and the estimates had broad and asymmetrical confidence intervals. Although such results do not provide a basis for unambiguous conclusions, they are often incorrectly interpreted as an absence of risk.

## Risk of disease

We found that the use of snus increases the risk of cancer of the oesophagus, stomach, pancreas and rectum. Using snus also increases the risk of high blood pressure, increases the mortality rate after cancer, myocardial infarction and cerebral stroke, and increases the risk of non-affective psychosis, type-2 diabetes, metabolic syndrome, weight gain and obesity. We also found evidence to suggest that the use of snus may reduce the risk of Parkinson's disease (table 1).

Estimated risk per 100,000 users of snus, based on the control groups (non-users of tobacco products) in studies included in the evidence report on health risks of snus from the Norwegian Institute of Public Health ([1](https://tidsskriftet.no/en/2020/06/kronikk/are-health-risks-moist-oral-snuff-snus-underestimated" \l "ref1)). The study populations are not directly comparable because of dissimilar follow-up periods and age distribution. RR = relative risk, HR = hazard ratio, OR = odds ratio, MD = mean difference

## Insufficient information about exposure

Insufficient data about possible changes in the participants' tobacco habits during the follow-up period was a common weakness of population studies with a long follow-up period. Good information about exposure and health outcomes is essential for population studies to reveal the true effects of exposure. Several of the population studies that we examined, were not originally designed to study the effects of using snus. In the cohort with the largest number of participants, use of snus was recorded as one of several life style factors, and the analyses were most often based exclusively on the first registration (3). Many participants may have discontinued using snus in the course of the follow-up period, as suggested by studies that repeatedly recorded the participants' snus habits. Any change in this habit will lead to misclassification of exposure, which in turn may weaken the association between using snus and health outcomes, potentially making it impossible to prove such a link.

## Impact of snus on women and fetuses

Among women who used snus throughout pregnancy, we found an increased risk of stillbirth, premature delivery, small-for-gestational age fetus, low birth weight, caesarean section, neonatal arrhythmia, oral cleft malformations and neonatal apnoea. A higher level of the nicotine metabolite cotinine detected in the urine of neonates confirmed nicotine exposure from maternal snus use. Long-term effects of using snus while pregnant have also been found: at 5–6 years of age, children of mothers using snus during pregnancy had higher blood pressure, more frequent arrhythmias and stiffer artery walls than children of mothers not using any tobacco products.

Using snus also increases the risk of high blood pressure, increases the mortality rate after cancer, myocardial infarction and cerebral stroke, and increases the risk of non-affective psychosis, type-2 diabetes, metabolic syndrome, weight gain and obesity

More than 600,000 people in Norway are estimated to regularly use Swedish snus, mainly in the younger age groups (1). Women who use snus are generally under 35 years of age. This is unique to Norway and is of particular concern in view of the health risks during pregnancy.

The disease progression, symptoms and prognoses associated with several diseases, amongst them cardiovascular disease, affect women and men differently. With the exception of pregnancy outcomes, there tended to be too few women included in the studies for the results to be reliable. Consequently, we have very little knowledge about the impact of snus on women's health.

## Interpretation of results

The literature often reports the risk of health outcomes as relative risk estimates, which says little about the impact on public health, i.e. the numbers affected. We therefore chose to calculate the absolute risk increase for 100,000 users of snus based on the absolute risk found in the control group (Table 1). Where the use of snus could worsen the disease prognosis, we calculated the absolute increase in risk per 1,000 patients who used snus.

In the pooled analyses of risk of myocardial infarction and cerebral stroke, we found that the 95 % confidence interval for myocardial infarction ranged from 214 fewer to 518 more myocardial infarctions per 100,000 users of Swedish snus, and that the confidence interval (CI) for cerebral stroke ranged from 212 fewer to 449 more strokes per 100,000 users of Swedish snus. We concluded that these are imprecise results because the confidence intervals include much more than what we would refer to as little or no difference. In a relatively recent review, Rostron et al. summarised the use of snus in the Nordic countries and the USA based on the same studies that we used (4). The authors conclude that Americans who use smokeless tobacco have an increased risk of stroke and myocardial infarction, whereas a similar increase in risk was not identified for users of Swedish snus in the Nordic countries.

## Poorer prognosis

Our calculations show that using snus results in 44 more fatalities per 1,000 patients after a cancer diagnosis, 51 more fatalities after myocardial infarction, 35 more fatalities after cerebral stroke, and 73 more fatalities during a long follow-up period (17 years) after cerebral stroke. Patients who quit using snus after a myocardial infarction halve the risk of dying in the next two years (5).

The estimated risk of dying within 28 days of both myocardial infarction and cerebral stroke had broad confidence intervals that only just included 1. The results are thus borderline statistically significant, but indicate that the risk of dying in the first four weeks after myocardial infarction and cerebral stroke increased by 28 and 42 per cent respectively. These results are supported by a considerably reduced risk of dying after a myocardial infarction when quitting the snus habit and a statistically significant increased mortality rate associated with the use of snus in a study that involved a long follow-up period after cerebral stroke. Evidence of the vasoconstrictive effect of nicotine and the ability of snus to increase blood pressure and adversely affect the endothelial cells of blood vessels also supports our conclusion that snus increases the mortality rate after myocardial infarction and cerebral stroke.

## Different conclusions for pancreatic cancer and cardiovascular diseases

In some cases, our assessment differs from that of the authors of the original study. One example concerns pancreatic cancer. In a study from 2007, Luo et al. investigated a cohort of Swedish construction workers who had been followed up for a period of up to 27 years (3). With close to 280,000 participating men, this is the largest available Swedish cohort with registered snus habits. Luo et al. found that the use of snus doubled the risk of pancreatic cancer. Nine years later, the same construction workers were included in a pooled analysis with men from eight other Swedish cohorts. Araghi et al., who conducted the pooled analysis, found a hazard ratio (HR) of 1.07 (95 % CI 0.77–1.50) for pancreatic cancer among men who used snus only, compared with men who did not use snus and did not smoke (6). The confidence interval suggested a potential risk reduction of up to 23 per cent as well as a potential risk increase of up to 50 per cent.

Users of snus who quit after myocardial infarction halve the risk of dying in the aftermath

We consider this result of the pooled analysis to be inaccurate. In their article, Araghi et al. put particular emphasis on an analysis conducted amongst men who used snus, irrespective of their smoking habits, compared to men who did not use snus, also irrespective of smoking habits (6). The authors adjusted (in the pooled analysis) for smoking, but had no data for volume or duration, and found a hazard ratio of 0.96 (95 % CI 0.83–1.11). They interpreted this to indicate that snus does not cause pancreatic cancer in men. As already discussed above, this methodology may lead to overadjustment for smoking and underestimation of the effect of using snus. Furthermore, the long follow-up period may carry an increased risk of misclassification, because many may have quit their snus habit in the course of the follow-up period. Consequently, several factors may render it impossible to reveal an association.

We therefore have most confidence in the study conducted by Luo et al. (3), which shows a doubling of the risk, i.e. an effect that is sufficiently strong to qualify for an upgrade according to the GRADE method (7). We also know that the tobacco-specific nitrosamine NNK (nicotine-derived nitrosamine ketone) causes pancreatic cancer in animal studies and that exposure to other tobacco products such as cigarette smoking leads to a similar increase in the risk of pancreatic cancer. It has been proven that the risk of this form of cancer decreases to the background level after smoking cessation. It is reasonable to assume that the same is the case on snus cessation.

The conclusions drawn in the studies on cardiovascular disease and cancer have incorrectly been cited in support of the claim that using snus does not carry a health risk (4, 6). However, the absence of a statistically significant difference is not synonymous with an absence of effect in the exposure group.

## Main message to healthcare personnel

The use of Swedish moist oral snuff (snus) is associated with an increased risk of cancer, high blood pressure, increased mortality after cancer, cardiovascular diseases, increased risk of psychosis, obesity, metabolic syndrome – and (in cases of high consumption) increased risk of type-2 diabetes. Users of snus who quit after myocardial infarction halve the risk of dying in the aftermath. Using snus during pregnancy is harmful to the child. The high rate of snus use is therefore worrying.

18.nordicwerfare.org

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The significance of flavour additives in the use of moist snuff and e-cigarettes – with a focus on young people and the Nordic region

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Flavour additives in tobacco, e-cigarettes and smokeless tobacco are appealing to young people and non-established smokers. Flavour additives are, for example, a leading cause of young people starting to use e-cigarettes.

Young people also have a perception that e-cigarettes with the flavour of fruit, for example, are less harmful to health than e-cigarettes with the flavour of tobacco. Restrictions and regulations on flavour additives in e-cigarettes and e-liquids are therefore highly likely to have an impact on the use of these products by young people.

Our report, The significance of flavour additives in the use of moist snuff and e-cigarettes – with a focus on young people and the Nordic region, is based on some of the research that is available in the field.

– The articles we have found that are relevant to the subject are based on American data, but they still give us reason to believe that the same issues may apply to young Nordic people. In the Nordic countries, we generally see a higher consumption of moist snuff and e-cigarettes among the younger age groups than the average for all age groups, says Nadja Frederiksen, Senior Adviser at the Nordic Welfare Centre.

19.bullbrand.co.uk

# What is Snuff?

Today we’re asking (and answering) a common question – what is snuff? It’s one we get from potential snuff users all the time, or fellow smokers looking for other forms of tobacco product.

So, today we’ll explore everything there is to know about the smokeless tobacco that is snuff tobacco, from common flavours to the tobacco leaves used, to where it originated, how it fares compared to smoking cigarettes or chewing tobacco.

We’ll also explore terms you might not understand, like snuff bullet, snuff box, nasal mucosa, and fine snuff.

Let’s kick things off with a definition of what snuff is.

## **What is snuff?**

Snuff, also known as tobacco snuff or nasal snuff, is similar to chewing tobacco in that it’s a smokeless tobacco product. However, among its key differences, snuff is inhaled through the nose as opposed to chewed or smoked, which is common with other forms of nicotine or tobacco specific products.

## **Where is nasal snuff from?**

Snuff has a long history, the origins are thought to date back to The Americas, specifically South America in the 17th century.

Using finely ground, selected tobacco leaves, snuff is one of the first tobacco products used in The Americas, alongside fellow smokeless tobacco product, chewing tobacco and of course pipe smoking.

## **How do you use snuff tobacco?**

Questions about using snuff are common at the moment, and we often get asked about snuff taking and how it’s done. Generally, a snuff user will simply sniff snuff, however, there are also devices to assist in the snuff ingestion process, such as a snuff bullet.

Snuff as a smokeless tobacco alternative that is inhaled into your nasal cavity. This isn’t a particularly common way of consuming tobacco products, and dry snuff or moist snuff is unlike any other tobacco product, whether you chew or smoke.

## **What is a snuff bullet?**

A snuff bullet is a term that people who use snuff will know, but people who prefer other tobacco products might not. Let’s dig a little deeper.

A snuff bullet, in essence, is a small bottle with a plug at its base, hole at the top of, and what’s known as a dosing chamber, which can be altered with more advanced snuff bullet models. Made of plastic, glass, or metal, snuff bottles are a way of ‘portioning’ out snuff before consumption.

## **What are snuff tobacco brands?**

For the best snuff use experience, there are a range of snuff brands to take note of  when considering a snuff purchase.

McChrystals is a leading snuff and smokeless tobacco products specialist, and probably the most popular snuff company in the UK. From [assorted flavour snuff mini tins](https://www.bullbrand.co.uk/collections/snuff/products/mcchrystals-flavour-selection-snuff-mini-tin) to [large snuff tins](https://www.bullbrand.co.uk/collections/snuff/products/mcchrystals-original-genuine-snuff-large-tin), as well as [individual “Genuine” snuff](https://www.bullbrand.co.uk/collections/snuff/products/mcchrystals-original-genuine-snuff-mini-tin), we have all kinds of McChrystal snuff in stock today.

[Sharrow Snuff](https://www.bullbrand.co.uk/search?q=sharrow+snuff&type=product) is another extremely popular name in the smokeless tobacco game, and we have a range of their products available to buy online today. From [Crumbs of Comfort](https://www.bullbrand.co.uk/products/sharrow-snuff-crumbs-of-comfort-tin-20g?_pos=9&_sid=59ebb4608&_ss=r) to [Dynamite](https://www.bullbrand.co.uk/products/sharrow-snuff-dynamite-tin-20g?_pos=2&_sid=59ebb4608&_ss=r), [Gold Label](https://www.bullbrand.co.uk/products/sharrow-snuff-gold-label-tin-20g?_pos=6&_sid=59ebb4608&_ss=r) and more, Bull Brand is the place to [buy Sharrow Snuff online](https://www.bullbrand.co.uk/search?q=sharrow+snuff&type=product), with a quick and simple checkout process.

Then there’s the likes of [Hedges The Snuff](https://www.bullbrand.co.uk/products/hedges-l260-the-snuff-20g-large-tin?_pos=1&_sid=4e77905bc&_ss=r), as well as various other industry leaders like [Top Mill](https://www.bullbrand.co.uk/products/top-mill-no-1-snuff-5g-small-tin?_pos=1&_sid=9f12906ff&_ss=r) and [J & H Wilson](https://www.bullbrand.co.uk/search?q=J+%26+H+Wilson&type=product), who have three snuff products online at our website.

To browse all our snuff products and tins, [browse the Bull Brand Snuff collection at this link](https://www.bullbrand.co.uk/collections/snuff).

## **How to store snuff tobacco.**

As well as buying snuff, you can also purchase a [Bull Brand Tin](https://www.bullbrand.co.uk/search?q=bull+brand+tin&type=product) to use as a snuff box or more than one to be used as multiple snuff boxes on the [Bull Brand website](https://www.bullbrand.co.uk/search?q=bull+brand+tin&type=product).

Perfect for a place to put your snuff inside, a snuff box by Bull Brand is every snuff lovers best friend, and perfect for moist snuff and dry snuff alike. Most snuff comes with its own tin, but if you have more snuff than you can manage, the Bull Brand tin is a great alternative especially when on the go.

You can also store other tobacco products in the [Bull Brand Tin](https://www.bullbrand.co.uk/search?q=bull+brand+tin&type=product), from ground tobacco and dipping tobacco to other smokeless tobacco products including chewing tobacco.

## **Snuff tobacco vs chewing tobacco**

Nasal snuff users will tell you that when it comes to smokeless tobacco use or an alternative to smoking cigarettes, using snuff is the best alternative for nicotine consumption. However, chewers of tobacco will have different opinions, but how do they differ?

The differences between snuff tobacco and chewing tobacco come down to a lot of things, but primarily, it’s the texture and consumption technique of each of them that make them completely different.

For any and all tobacco specific products, from smokeless tobacco products including chewing tobacco to dry snuff, moist snuff, to all things nicotine, [visit the Bull Brand website](https://www.bullbrand.co.uk/). With every tobacco product you can hope for, as well as smoking accessories and more, you’ll find everything you need whether you’re a tobacco smoker or one of the many smokeless tobacco users in the UK.

Nicotine and Addiction

Addiction to any drug means that the use of the drug can be difficult to stop, even in those who are trying to stop. The pouches may be somewhat less addictive than cigarettes. But some level of addictiveness is probably essential to pouches being able to substitute for cigarettes. Views differ on the public health significance of nicotine addiction in former smokers, once the main tobacco smoke toxicity has been removed.

Government authorities have widely promoted that "there is no safe tobacco product." One warning on smokeless tobacco is: "This product is not a safe alternative to cigarettes." This is not adequate information for smokers and has contributed to the belief that all tobacco and nicotine products are equally harmful. Many decades ago, the public understood correctly that smokeless tobacco was less harmful than cigarettes. Yet, a recent National Cancer Institute survey found that only 9 percent of adults answered "yes" when asked if "some" smokeless tobacco products were "less harmful" to health than cigarettes.

Public misunderstanding of the differential risks from combusted and non-combusted products raises ethical issues and this can lead to avoidance of less harmful products. A study out in June suggests that the public's perceptions of differential harms of non-combusted nicotine products appears to be moving toward greater misunderstanding rather than greater accuracy.

Understanding that no tobacco or nicotine product is safe is appropriate. Consumers also need to understand that inhaled smoke from cigarettes is much more dangerous than non-combusted products, including nicotine pouches.

20.snusforsale.com

## Understanding the Popularity of Nicotine Pouches in Nigeria

Another aspect that attracts users to nicotine pouches is the convenience they offer. These pouches are small, discreet, and can be used in environments where smoking is prohibited. Whether it’s in a crowded office, a public transportation system, or even at home with non-smoking family members, nicotine pouches provide a discreet way to satisfy nicotine cravings without causing discomfort or inconvenience to others.

Furthermore, the absence of offensive odors associated with smoking is a significant advantage of nicotine pouches. Unlike traditional cigarettes, which can leave a strong and lingering smell on clothes, hair, and surrounding areas, nicotine pouches are virtually odorless. This makes them especially appealing in social settings, where individuals can enjoy the effects of nicotine without the fear of leaving a lasting, unpleasant scent.

Additionally, nicotine pouches come in a wide range of flavors, allowing users to choose their preferred taste. From refreshing mint to fruity flavors, the variety of options adds to the overall appeal and enjoyment of using nicotine pouches. This customization aspect caters to individual preferences, ensuring that users can find a flavor that suits their taste buds and enhances their overall experience.

We do not ship nicotine pouches or snus to Nigeria. Choose a neighboring country if you want snus from us!

Moreover, the discreet packaging of nicotine pouches adds to their appeal. The small, portable nature of these pouches makes them easy to carry around and use whenever needed. Whether it’s in a pocket, a bag, or even a wallet, nicotine pouches can be conveniently stored without taking up much space.

ZYN and VELO Nicotine pouches Nigeria

ZYN and VELO are two well-known nicotine pouch brands that have recently gained popularity in Nigeria. Both brands offer a range of flavors and nicotine strengths, catering to different preferences. Users can find these pouches in various retail outlets or online stores that ship to Nigeria.

ZYN nicotine pouches are known for their high-quality ingredients and long-lasting flavors. They provide a refreshing and discreet nicotine experience, catering to individuals who prioritize taste and performance. VELO, on the other hand, offers a unique selection of flavors that appeal to a wide range of users.

With the availability of these brands, Nigerian consumers have more options than ever before when it comes to nicotine pouches. It is essential, however, to choose trusted and reputable brands to ensure product quality and safety.

Buy Nicotine pouches from Snusforsale to Nigeria

For individuals in Nigeria looking to purchase nicotine pouches, Snusforsale is a reliable online platform that offers a wide selection of brands and flavors. They provide convenient shipping options to Nigeria, ensuring that customers can access their preferred nicotine pouches with ease.

Snusforsale understands the needs of Nigerian consumers and offers competitive prices, ensuring that customers get the best value for their money. Their user-friendly website makes browsing and purchasing nicotine pouches a hassle-free experience.

We do not ship nicotine pouches or snus to Nigeria. Choose a neighboring country if you want snus from us!

When purchasing nicotine pouches from Snusforsale or any other online platform, it is crucial to check the legal age requirements for nicotine product purchases in Nigeria. It is vital to follow the laws and regulations governing the sale and use of these products to ensure a responsible and safe experience.

VELO Ice Cool in Nigeria and Abuja

Among the various flavors offered by VELO, Ice Cool has gained popularity in Nigeria and Abuja. The cooling sensation and minty flavor of VELO Ice Cool provide a refreshing experience for users. Whether it’s to satisfy nicotine cravings or simply enjoy a flavorful pouch, VELO Ice Cool has become a sought-after choice in the Nigerian market.

We do not ship nicotine pouches or snus to Nigeria. Choose a neighboring country if you want snus from us!

As with any nicotine product, it is important for individuals in Nigeria to use VELO Ice Cool responsibly and in moderation. Adhering to recommended nicotine dosages and understanding one’s own tolerance levels is crucial.

21.Australia

## **ZYN Pouches in Australia**

ZYN Pouches bought in Australia is really easy nowadays. You can import up to 1.5kg as a private person in Australia. Order ZYN pouches from us to Australia today for fast and secure delivery.

Aussie nic pouches

Snus and nicotine pouches like ZYN and VELO are a popular alternative in Aussie. With a wide range of flavors and strengths available, there’s something for everyone. However, it’s important to be aware of the regulations and laws surrounding the sale and consumption of these products to ensure that you’re using them safely and legally.

Snus and Nicotine Pouches: What Are They?

Snus is a smokeless tobacco product that originated in Sweden. It comes in small pouches that are placed under the upper lip, where the nicotine is slowly released. Nicotine pouches are a similar product but contain no tobacco, only nicotine, and other ingredients.These products offer a great alternative to smoking, giving you the nicotine hit without the effects of smoking. In Australia, they are particularly popular with people who are trying to quit smoking or reduce their tobacco intake. However, it’s important to note that they still contain nicotine and can be addictive, so proper precautions and moderation should always be exercised.One of the key benefits of using snus and nicotine pouches is that they don’t produce any smoke, making them a discreet and convenient option for those who want to use nicotine in public places. They also don’t leave any lingering smell on your clothes or in your surroundings, unlike traditional smoking products.Snus and nicotine pouches also come in a variety of flavors, making them an enjoyable experience for those who use them. Some popular flavors include mint, citrus, and black cherry. These flavors can also help mask the taste of nicotine, making it more palatable for those who are new to using these products.

Snus and nicotine pouches popular

In recent years, snus and nicotine pouches have become increasingly popular among australians who are looking for nicotine pouches brands.These nicotine pouches are designed to provide a nicotine hit. One of the most popular brands of snus and nicotine pouches in Australia is ZYN. ZYN offers a range of flavors, including citrus, peppermint, and coffee. The pouches are discreet and easy to use, making them a convenient option for those who are always on the go.

VELO nicotine pouches Australia

Another popular brand of snus and nicotine pouches in Australia is VELO. VELO offers a range of flavors, including citrus, mint, and berry. The pouches are made with high-quality ingredients and are designed to provide a long-lasting, satisfying nicotine hit.While snus and nicotine pouches are legal in Australia, it’s important to note that there are restrictions on their sale and consumption. In some states, it’s illegal to sell snus and nicotine pouches to anyone under the age of 18. Additionally, some states have restrictions on where these products can be used, so it’s important to check the local laws before using them in public places. If you’re looking to buy snus and nicotine pouches in Australia, there are several options available to you.

Buy ZYN and VELO online

Many online retailers offer a wide selection of ZYN and VELO pouches, including different flavors and strengths. However, it’s important to ensure that you’re buying from a reputable retailer and that you’re following all the regulations and laws regarding the purchase and consumption nicotine products in Australia.

## **Buy Snus and Nicotine Products in Melbourne and Sydney**

If you’re based in Melbourne or Sydney, you’re in luck, as snus and nicotine pouches are widely available online via Snusforsale.

ZYNS and Snus Perth

Buy ZYNS and snus from Snusforsale with express shipping to Perth. We ship everyday to Perth and have fresh pouches.

Snus and ZYN pouches to Adelaide and Brisbane

We ship snus and ZYN pouches to both Adelaide and Brisbane. Try our sortiment of VELO, Killa or ZYN snus.

What is snus?

Snus is a smokeless nicotine product that originated in Sweden. It’s a small pouch that’s placed under the upper lip, where it’s left to release nicotine over a period of time.

What are nicotine pouches?

Nicotine pouches, on the other hand, are a newer product that’s gaining popularity in Australia. They’re similar to snus, but they don’t contain tobacco. Instead, they’re made from plant fibers and nicotine extract.

Are ZYNS legal in Australia?

ZYN are legal in Australia if you buy them online from Snusforsale. You can import them for personal use if you are over 18 years.

When shopping for nicotine pouches, it’s important to be aware of the different types available. Snus comes in various flavors, including mint, citrus, and berry. Nicotine pouches also come in different flavors, such as coffee, mint, and fruit. Some products are stronger than others, so it’s important to choose a strength that’s right for you.

It’s also important to check the labels and ingredients carefully. Look for products that are made from high-quality ingredients and don’t contain additives. Avoid products that are overly sweetened or flavored.

Buy snus and ZYN from a reputable reseller

When buying snus or ZYN nicotine pouches, it’s a good idea to buy from a reputable retailer like Snusforsale. This ensures that you’re getting a quality product that’s safe and effective. You can also buy these products online, but make sure to choose a reputable online retailer that offers secure payment options and fast shipping.

Nicotine pouches are widely available in Melbourne and Sydney and come in a variety of flavors and strengths. Just make sure to check the labels and ingredients carefully, and buy from reputable retailers to ensure that you’re getting a quality product.

Where to buy ZYN and VELO in Australia

Wondering where to buy snus and nicotine pouches? You can buy ZYN nicotine pouches to Australia from Snusforsale.

ZYN and VELO are both popular brands of nicotine pouches that are widely available in Australia. These products come in different flavors and strengths, making it easy to find one that suits your preferences.

If you are interested in buying ZYN pouches and VELO pouches in Australia,you have come to the right place. Visit Snusforsale and just make a purchase. We ship everyday to Australia.

ZYN and VELO to Australia from Snusforsale

Buy ZYN and VELO online from retailers like Snusforsale. This online store offers a wide selection of flavors at competitive prices, making it easy to find the product you want at a price you can afford. Plus, when you order online, you can have your pouches delivered straight to your door, saving you time and hassle.

Overall, ZYN and VELO are popular and widely available nicotine pouches in Australia, offering a range of different tastes to suit different preferences.

Snusforsale, snus for sale or Snus4sale

We are Snusforsale and we have snus for sale on our website. If you are looking for snus4sale then you have come to the right place to order all kind of snus and nicotine pouches online.

Anabolic snus or Enhanced snus?

Try Snusforsale instead of Anabolic snus or enhanced snus, we have better prices, bigger sortiment and fresh snus made in Sweden.

Nicotine Pouches Australia

Nicotine pouches Australia: Discover a wide selection of premium nicotine pouches at Snusforsale.com. Our online store offers a diverse range of brands like KILLA, White Fox and ZYN ensuring you find the perfect fit for your preferences.

With our fast and reliable shipping services, your order will be delivered promptly to your location in Australia, providing you with a convenient and enjoyable way to satisfy your nicotine cravings. Shop with us today and experience the convenience and quality of Snusforsale.com’s nicotine pouches in Australia.

Australias 5 biggest cities

As the nicotine pouch popularity sweeps across Australia’s scalable terrain, cities like Sydney, Melbourne, Brisbane, Perth, and Adelaide become the quirky backbone of this evolution.

1. Sydney

Discover Sydney, the vibrant capital buzzing with new trends and exciting brands like ZYN and VELO.

2. Melbourne

Embrace the bold, diverse spirit of Melbourne, the city that thrives on adventure and welcomes new practices with open arms! Discover a place where citizens fearlessly embrace the nicotine pouch trend, igniting a journey of excitement and exploration.

3. Brisbane

Brisbane, famous for its stunning architecture, is a celebration of classic nicotine services and cutting-edge pouch products.

4. Perth

Perth, nestled in the core of the nation’s wine region, has witnessed a remarkable upsurge in aficionados of nicotine pouches, reflecting the city’s cutting-edge essence.

Adelaide

Finally, Adelaide may be smaller in comparison but is not left behind. It has joined the growing revolution with open arms, reflecting the ever-welcoming spirit of Australia.

ZYN nicotine pouches near me

We have ZYN nicotine pouches near you and ship fresh pouches express to Australia every day.

Snus shop Australia

Snus shop online in Australia, when ordering snus to Australia consider the 1,5kg import limit that the Australian authorities has when ordering snus. We are the most reputable snus shop online.

Snus and nicotine pouches can be an excellent alternative to traditional products, but they should be used responsibly and in moderation. By following all the relevant laws and regulations and using these pouches as directed, you can enjoy the benefits of smokeless nicotine pouches.

22. Flavours

## Exciting New ZYN Flavors to Try

As the popularity of ZYN continues to grow, the brand is constantly coming up with new and exciting flavors for nicotine pouch enthusiasts to enjoy. Come back regular to see all new ZYN flavors that we add to the store.

Exploring New ZYN Flavors from Around the World

ZYN is always on the lookout for unique flavors from around the world. From exotic fruits to traditional spices, these new flavors will take your taste buds on a global adventure. Imagine the tantalizing blend of tropical mangoes from the Caribbean, the aromatic spices of India, or the delicate sweetness of Japanese cherry blossoms. With ZYN’s commitment to sourcing the finest ingredients, you can expect an unparalleled flavor experience that transports you to different corners of the globe.

Anticipating New ZYN Flavors Coming to the US

If you’re based in the US, you’ll be pleased to know that ZYN is constantly expanding its flavor offerings in this market. With new flavors on the horizon, there will always be something new and exciting to try. Whether you’re a fan of classic American flavors or eager to explore unique taste combinations, ZYN has something in store for you.

Imagine the indulgence of a New York-style cheesecake, the nostalgic sweetness of a freshly baked apple pie, or the refreshing burst of a California citrus medley. These upcoming flavors cater to the diverse palates and preferences of ZYN users across the United States. From the vibrant streets of New Orleans to the picturesque vineyards of Napa Valley, ZYN’s new flavors will capture the essence of iconic American tastes and regions.

Get ready to embark on a flavor journey that celebrates the rich culinary heritage and innovation of the United States. ZYN’s commitment to delivering exceptional taste experiences ensures that you’ll always have a delightful surprise waiting for you.

With such a wide range of flavors to choose from, finding your ideal ZYN flavor has never been easier. Whether you prefer a minty sensation, a burst of coffee, or a refreshing citrus twist, ZYN has a flavor that will suit your taste. Explore the world of ZYN flavors to find your perfect match and elevate your nicotine pouch experience to new heights.

Top ZYN Flavors to Try for an Unforgettable Experience

If you’re looking for an unforgettable experience, look no further than ZYN. This innovative brand offers a wide range of flavors that are sure to tantalize your taste buds. Whether you’re a fan of minty freshness, fruity goodness, or bold and robust flavors, ZYN has something for everyone. In this article, we’ll explore the flavorful world of ZYN and help you choose the perfect pouches for your preferences.

Exploring the Flavorful World of ZYN

One of the most popular flavors in the ZYN lineup is Cool Mint. This refreshing twist on traditional mint offers a burst of coolness that will leave you feeling invigorated. The minty flavor is accompanied by a subtle sweetness, making it a perfect all-day option. Whether you’re starting your day or need a quick pick-me-up, Cool Mint is a flavor you won’t want to miss.

If you’re a fan of citrus flavors, you’ll love ZYN citrus strong. This zesty combination of lemon and spritz offers a tangy and refreshing flavor profile. The citrusy notes are perfectly balanced, making Slim citrus strong a delightful option for those who enjoy a crisp and invigorating taste.

Coffee lovers rejoice! ZYN offers an irresistible flavor called Espressino. This pouch combines the rich and robust taste of coffee with a hint of sweetness. It’s like enjoying a cup of espresso on-the-go, without the need for a coffee machine. If you’re a coffee aficionado, Espressino is a must-try flavor.

Lemon Spritz is another citrusy delight that ZYN has to offer. This flavor combines the tanginess of lemon with a hint of sweetness. It’s the perfect balance of citrus and sweetness, making it a crowd-pleaser for those who enjoy a tangy and citrusy flavor profile.

For those who want a burst of pure citrus goodness, Citrus is the flavor to try. This pouch offers a vibrant and refreshing citrus taste that is sure to awaken your senses. Whether you’re a fan of orange, grapefruit, or lime, you’ll find something to love in ZYN’s Citrus flavor.

If you’re in need of a cool and invigorating flavor, look no further than Spearmint. This refreshing pouch offers a burst of spearmint goodness that will leave you feeling refreshed and revitalized. It’s the perfect flavor for those hot summer days or anytime you need a refreshing pick-me-up.

ZYN Apple Mint is a flavor that combines the sweetness of apple with the coolness of mint. The result is a crisp and refreshing flavor that is perfect for those who enjoy a sweet and tangy taste. Apple Mint is a popular choice among ZYN enthusiasts and is definitely worth a try.

If you’re in the mood for something rich and fruity, look no further than ZYN Black Cherry. This flavor offers a bold and robust cherry taste that is sure to satisfy your cravings. It’s the perfect option for those who enjoy a rich and fruity flavor that packs a punch.

If you’re a fan of liquorice, ZYN has you covered with ZYN Violet Licorice . This pouch combines the sweet and tart taste of various berries, creating a burst of fruity goodness. It’s the perfect option for those who enjoy a medley of berry flavors.

And let’s not forget about the classic flavor of Wintergreen. This pouch offers a refreshing and minty taste that is sure to awaken your senses. It’s the perfect option for those who enjoy a traditional mint flavor with a twist.

With so many delicious flavors to choose from, it’s no wonder that ZYN has become a favorite among nicotine pouch enthusiasts. Whether you’re a fan of mint, citrus, fruit, or something more unique, ZYN has a flavor that is sure to satisfy your cravings. So go ahead, explore the flavorful world of ZYN and discover your new favorite flavor today!

Choosing the Perfect ZYN Pouches for You

Now that we’ve explored the flavorful world of ZYN, it’s time to choose the perfect pouches for you. One factor to consider is the size of the pouches. ZYN offers both Mini and Slim options.

Mini or Slim ZYN: Which Size is Right for You?

If you prefer a smaller and more discreet ZYN, Mini might be the right choice for you. These pouches offer a lower nicotine strength and a smaller size, making them perfect for those who want a quick and convenient nicotine experience.

But let’s dive deeper into the Mini pouches. These little powerhouses may be small in size, but they still pack a punch when it comes to flavor. With a variety of flavors to choose from, such as Citrus, Mint, and Berry, you’ll never get bored of the Mini pouches. The smaller size also means they fit snugly in your mouth, allowing for a more comfortable and discreet experience.

On the other hand, if you prefer a larger pouch with a higher nicotine content, Slim might be the better option. These pouches offer a more intense flavor experience and are perfect for those who want a stronger nicotine hit.

Let’s explore the world of Slim pouches a bit further. These larger pouches not only provide a bolder flavor but also offer a longer-lasting nicotine experience. With flavors like Wintergreen, Cool Mint, and Frosted, you’ll find yourself immersed in a delightful sensory journey. The larger size also means that the pouches stay in place better, ensuring a more consistent and enjoyable experience.

Ultimately, the choice between Mini and Slim comes down to personal preference. Consider your nicotine tolerance and the level of convenience you desire to make the right choice for you.

But there’s more to ZYN pouches than just their size. Each pouch is carefully crafted using high-quality ingredients, ensuring a premium and satisfying experience. ZYN pouches are made with a blend of tobacco-free nicotine and food-grade ingredients, resulting in a clean and refreshing taste. The pouches are also discreet and easy to use, making them a convenient option for any occasion.

Furthermore, ZYN pouches are designed to be spit-free, meaning you can enjoy them without the hassle of constantly needing to find a place to spit. This makes them a great choice for those who are always on the go or prefer a more discreet nicotine experience.

Whether you choose Mini or Slim, you can be confident that ZYN pouches offer a high-quality and enjoyable nicotine experience. So go ahead, explore the world of ZYN and find the perfect pouches that suit your taste and lifestyle.

Unveiling the Strengths of ZYN’s Unique Flavors

Now that you’ve chosen the perfect pouch size, it’s time to explore the strengths of ZYN’s unique flavors. ZYN offers different nicotine strengths to cater to individual preferences.

Finding Your Ideal ZYN Strengths

If you’re new to nicotine pouches or prefer a milder experience, ZYN offers a range of low and medium nicotine strengths. These pouches provide a subtle nicotine buzz without being overpowering zyn strengths.

Imagine yourself enjoying a relaxing afternoon on a sunny patio, savoring the refreshing taste of ZYN’s low-strength Citrus Burst flavor. With each pouch, you’ll experience a burst of zesty citrus notes that awaken your senses. The low nicotine content ensures a gentle buzz, allowing you to unwind without feeling overwhelmed.

For those who prefer a stronger kick, ZYN also offers high and extra strong nicotine strengths. These pouches are perfect for experienced users or anyone who wants a more intense nicotine experience.

Imagine embarking on an adventure with ZYN’s high-strength Wintergreen Chill flavor. The cool and invigorating taste of wintergreen will transport you to a snow-covered wonderland. The higher nicotine content delivers a powerful punch, giving you the energy and focus you need to conquer your day.

It’s important to find the right strength for you to ensure an enjoyable and comfortable experience. Start with a lower strength and gradually increase as needed. Remember, everyone’s tolerance is different, so listen to your body and adjust accordingly.

Let’s dive deeper into the world of ZYN’s unique flavors. The medium-strength Cool Mint flavor offers a harmonious blend of minty freshness and a touch of sweetness. Each pouch delivers a balanced nicotine experience, allowing you to stay alert and refreshed throughout the day.

For those seeking an extra strong nicotine hit, ZYN’s Spearmint flavor is a game-changer. The intense spearmint flavor invigorates your senses, while the high nicotine strength provides a bold and satisfying buzz. It’s the perfect choice for those who crave a powerful nicotine experience.

Whether you’re a fan of fruity flavors, refreshing mints, or bold and invigorating tastes, ZYN has a strength and flavor combination that will suit your preferences. Explore the wide range of options available and discover the perfect ZYN pouch to elevate your nicotine experience.

Find Your Favorite ZYN Flavors at Snusforsale

If you’re ready to embark on a ZYN flavor journey, look no further than Snusforsale. This online retailer offers a wide range of ZYN flavors, ensuring you’ll find your favorites in no time.

With Snusforsale’s convenient shipping options, you can have your favorite ZYN flavors delivered right to your doorstep. Say goodbye to searching for your favorite flavors in stores and enjoy the convenience of online shopping.

Shop from Snusforsale today and start exploring the flavorful world of ZYN. Your taste buds will thank you.

Answers to Your Burning Questions About ZYN

After discovering the unique and flavorful world of ZYN, you may have some burning questions. Let’s dive into some commonly asked questions about ZYN.

The Story Behind ZYN: Who Owns It?

ZYN is a brand owned by Swedish Match, a leading producer of smokeless nicotine pouches. Swedish Match is known for its commitment to quality and innovation, and ZYN is no exception.

Swedish Match has a long history of producing high-quality products, and ZYN is just one of their many successes. With their expertise and dedication to providing top-notch products, you can trust that ZYN is a brand you can rely on for a truly unforgettable experience.

There you have it – a guide to the top ZYN flavors to try for an unforgettable experience. From refreshing mint to fruity delights, ZYN has something for everyone. Find your favorite flavors, choose the perfect pouch size and strength, and embark on a flavor journey like no other. With ZYN and Snusforsale, your taste buds will thank you

23.Japan, tokyo

## ZYN and VELO Nicotine pouches Tokyo

[ZYN and VELO Nicotine pouches Tokyo](https://www.jluggage.com/blog/japan/why-is-japan-called-land-of-rising-sun/)

In recent years, there has been a significant rise in the popularity of snus and nicotine pouches in Japan. These smokeless alternatives have gained traction among both smokers and non-smokers, let’s explore this growing trend and discover why these products have become so popular in the Land of the Rising Sun.

When it comes to nicotine pouches, two popular brands making waves in Tokyo are ZYN and VELO. These brands offer a wide range of flavors and nicotine strengths, catering to different preferences. From refreshing mint to fruity blends, there is a flavor for every palate. You can also buy snus nicotine pouches in South Korea.

ZYN and VELO nicotine pouches prioritize quality and safety. Made with premium ingredients, these pouches deliver a consistent nicotine experience without the use of tobacco. The sleek design of the pouches ensures a comfortable fit, further enhancing the overall user experience.

Another popular snus in Japan is the snus Shiro. We unfortunately do not have it in stock but if enough customers and friends from Japan does recommend us to buy it then we will do it. Unfortunately we are not there yet so we only have the second most popular nicotine pouch for Japan that is ZYN.

I Hamodi and CEO of Snusforsale have not been to Japan but having heard from former Japanese colleagues about the popularity of nicotine pouches in Japan I concluded to write this blog.

Buy Nicotine Pouches online from Snusforsale to Japan

For those in Japan interested in trying snus and nicotine pouches, the prospect of finding these products locally may seem challenging. However, there are convenient options available for purchase online.

Snusforsale is a trusted online retailer that ships nicotine pouches to Japan. With a wide selection of brands and flavors, we offer a hassle-free way to explore the world of snus and nicotine pouches. By ordering from us at Snusforsale, Japanese consumers can order anytime and anywhere from in Japan.

Are you a fan of anime? Do you enjoy immersing yourself in the captivating worlds of One Piece and Naruto? Well, you’re not alone! Many anime enthusiasts find solace and excitement in these popular series. But what if I told you there’s a way to enhance your anime-watching experience? Picture this: you, lounging on your couch, eyes glued to the screen, and a nicotine pouch in hand. Intrigued? Let’s dive into the world of anime and nicotine pouches!

Why Combine Anime and Nicotine Pouches?

Now, you might be wondering, “Why on earth would I combine these two things?” Well, my friend, it’s all about enhancing the enjoyment factor. Anime has a way of transporting us to fantastical realms, and nicotine pouches can add an extra layer of relaxation and pleasure to the experience. It’s like a match made in otaku heaven!

You can also buy nicotine pouches in Canada

Immerse Yourself in the Anime Universe

As you settle in for your anime marathon, make sure you have your favorite nicotine pouch flavor on hand. Whether it’s mint, citrus, or something more exotic, the burst of flavor will heighten your senses and transport you even further into the anime universe. You’ll feel like you’re right there with Luffy and his crew as they embark on epic adventures!

A Moment of Relaxation

Anime can be intense, with jaw-dropping plot twists and heart-wrenching moments. That’s where nicotine pouches come in to save the day! During those suspenseful scenes, take a moment to pop a pouch in your mouth and let the nicotine work its magic. It’s like a mini relaxation session in the midst of all the action.

Stay Focused and Energized

Long anime marathons can sometimes leave us feeling drained. But fear not! Nicotine pouches can provide a gentle boost of energy to keep you engaged and focused. Say goodbye to those mid-episode slumps and hello to uninterrupted anime enjoyment!

A Word of Caution

While combining anime and nicotine pouches can enhance your experience, it’s important to use them responsibly. Remember to take breaks, stay hydrated, and be mindful of your nicotine intake. Moderation is key!

So, the next time you settle in for a binge-watching session of One Piece or Naruto, consider adding nicotine pouches to the mix. It’s a quirky combination that can take your anime enjoyment to a whole new level. Sit back, relax, and let the adventures unfold!

24.Nicotine, all you need to know

Nicotine is a widely discussed topic. It is often brought up in discussions about snus and nicotine pouches, even though the harmful effects of tobacco combustion (smoking) are not related to nicotine itself.

Nicotine can be addictive. However, different nicotine products can lead to varying degrees of addiction. And nicotine itself does not cause cancer. Here, we have gathered answers to some of the most common questions about nicotine.

What is nicotine?

Nicotine is a substance naturally found in the tobacco plant. It acts as a defense mechanism for the plant, protecting it from insect attacks. Nicotine is classified as an alkaloid. Alkaloids are a group of substances found in plants that often have medicinal effects on animals and humans.

Other alkaloids include caffeine and morphine. The tobacco plant belongs to the nightshade family, and nicotine is also present in small amounts in other species of this plant family, such as tomatoes and potatoes. See below to find how much nicotine each fruit and vegetable contains.

## How is nicotine absorbed by the body?

The four most common ways nicotine is absorbed by the body are through the mouth, lungs, skin, and the mucous membranes of the nose.

When using snus, nicotine is absorbed through the mucous membrane of the mouth and transported via the bloodstream to the brain. This means that nicotine from snus is absorbed more slowly compared to smoking.

The speed at which the body absorbs nicotine can also affect how addictive it is. Nicotine replacement therapies, such as nicotine patches or gum, like snus, have a slower absorption rate compared to smoking and are therefore less addictive.

## How does nicotine affect the body?

When nicotine is absorbed by the body, a number of neurotransmitters are released in the brain’s reward system.

For most nicotine users, this increases their sense of well-being. For many, nicotine also has both calming and stimulating effects. These feelings contribute to nicotine’s addictive properties.

Nicotine affects blood circulation, causing pulse and blood pressure to rise.

In low doses, nicotine has a stimulating effect on the nervous system, leading to increased alertness. In larger doses, nicotine has a depressant effect on the nervous system, making one feel more relaxed.

How long does nicotine stay in your system?

The duration nicotine remains in your system can vary based on several factors, including the amount used, frequency of use, and individual metabolic differences. Here is an overview of how nicotine is processed and eliminated from the body:

Absorption and Metabolism

When nicotine is consumed, it is rapidly absorbed into the bloodstream. The method of consumption (smoking, snus, patches, gum, etc.) affects how quickly nicotine enters the bloodstream. For instance, smoking leads to a quicker absorption compared to other methods.

Once in the bloodstream, nicotine travels to the liver, where it is metabolized into several compounds, the most significant of which is cotinine. Cotinine is used as a marker to measure nicotine levels because it remains in the body longer than nicotine itself.

Half-Life of Nicotine

The half-life of nicotine is approximately 2 hours. This means that every 2 hours, the concentration of nicotine in the blood decreases by half. For instance, if you consume a dose of nicotine, after 2 hours, half of that dose will be metabolized and eliminated from your bloodstream.

Detection Windows

Blood: Nicotine can be detected in blood for 1-3 days after use, while cotinine can be detected for up to 10 days.

Urine: In urine, nicotine can typically be detected for 3-4 days, and cotinine can be detected for up to 3 weeks for regular users.

Saliva: Nicotine is detectable in saliva for 1-4 days after use, while cotinine can be detected for up to 7-10 days.

Hair: Nicotine and cotinine can be detected in hair for up to 3 months, and in some cases, even longer, as hair retains traces of these substances over extended periods.

Factors Influencing Duration

Several factors influence how long nicotine stays in your system:

Frequency and Amount of Use: Regular, heavy users of nicotine may have longer detection times compared to occasional users.

Metabolism: Individuals with faster metabolic rates will process and eliminate nicotine more quickly.

Age: Metabolic rate generally slows with age, potentially leading to longer detection times.

Health Conditions: Liver and kidney function can affect how quickly nicotine and its metabolites are processed and excreted.

Hydration and Diet: Staying hydrated and maintaining a healthy diet can aid in the elimination of nicotine.

Clearing Nicotine from the Body

To expedite the clearance of nicotine from your system, consider the following:

Hydration: Drink plenty of water to help flush out nicotine and its metabolites.

Healthy Diet: Eating a balanced diet rich in antioxidants can support your body’s detoxification processes.

Physical Activity: Regular exercise can boost your metabolism, aiding in the faster elimination of nicotine.

Avoiding Nicotine: The most effective way to clear nicotine from your system is to stop using all nicotine products.

Understanding how long nicotine stays in your system can help in planning to quit or preparing for medical tests. While the withdrawal phase can be challenging, the body will gradually rid itself of nicotine.

25. How to Use Nicotine Pouches in 4 Easy Step

Comprehensive Guide on How to Use Nicotine Pouches in 4 Easy Steps

In recent years, nicotine pouches have gained popularity as a more discreet and convenient alternative to traditional tobacco products. These smokeless pouches deliver a controlled dose of nicotine, offering users a way to satisfy their cravings without the harmful effects of smoking. If you’re new to nicotine pouches, don’t worry – this comprehensive guide will walk you through everything you need to know about using them effectively in just four easy steps.

Understanding Nicotine Pouches: A Comprehensive Guide

Nicotine pouches have a rich history and are rooted in the Swedish tradition of snus. Snus, a moist tobacco product, has been used for centuries, and nicotine pouches draw inspiration from this practice. However, unlike snus, nicotine pouches don’t contain tobacco leaves but are instead filled with nicotine salts, flavorings, and plant-based fibers.gs, and plant-based fibers.

### Exploring the Origins and Composition of Nicotine Pouches

Nicotine pouches were first introduced in Sweden in the 1970s and gained popularity as a less harmful alternative to smoking. They are made of a blend of high-quality nicotine, food-grade fillers, and flavorings. These ingredients work in harmony to deliver a satisfying nicotine experience without the need for combustion or inhalation.

The process of creating nicotine pouches involves carefully selecting and processing the nicotine salts. These salts are derived from the tobacco plant and undergo a purification process to remove impurities and create a high-quality nicotine extract. The flavorings used in nicotine pouches are meticulously chosen to enhance the overall taste and provide a pleasant sensory experience.

Plant-based fibers, such as cellulose or eucalyptus, are used as the base material for the pouches. These fibers are known for their absorbent properties, allowing them to effectively hold the nicotine and flavorings while maintaining a comfortable texture. The use of plant-based fibers also contributes to the eco-friendly nature of nicotine pouches.

Different Types of Nicotine Pouches and Their Effects

There are various types of nicotine pouches available on the market, each with its own unique characteristics. From different flavors to varying nicotine strengths, these options allow users to personalize their experience based on their preferences and nicotine tolerance.

Regular strength nicotine pouches are suitable for individuals who are starting their nicotine journey or who prefer a milder nicotine experience. These pouches provide a gentle introduction to the world of nicotine and allow users to gradually adjust to the sensation.

For those seeking a more intense nicotine experience, strong strength nicotine pouches are the ideal choice. These pouches contain higher levels of nicotine and are designed for individuals with a higher nicotine tolerance or those who crave a more powerful sensation. It is important to note that these pouches should be used responsibly and in moderation.

In addition to varying nicotine strengths, nicotine pouches also come in a variety of flavors and strengths. Mint flavor pouches offer a refreshing burst of minty taste that complements the nicotine sensation. The cooling effect of mint can provide a soothing experience, making it a popular choice among users.

For those who prefer sweeter alternatives, fruit flavor nicotine pouches are a great option. These pouches come in a range of fruity flavors, allowing users to experiment and find their favorite combination. From citrusy notes to tropical blends, the fruit flavor pouches add a delightful twist to the nicotine experience.

It’s important to remember that nicotine pouches, like any nicotine-containing product, should be used responsibly and in accordance with the manufacturer’s instructions. Nicotine is an addictive substance, and it’s crucial to be mindful of one’s nicotine intake and potential effects on health.

## Mastering the Art of Using Nicotine Pouches

Now that you have a grasp of the basics, let’s dive into the step-by-step instructions for proper nicotine pouch usage.

Step-by-Step Instructions for Proper Nicotine Pouch Usage

1. Prepare yourself: Before you use a nicotine pouch, make sure to wash your hands thoroughly with soap and water. Clean hands will help maintain hygiene.

2. Select your pouch: Choose the nicotine pouch that suits your preferred nicotine strength and flavor.

3. Place the pouch: Take the pouch and gently place it between your upper lip and gum. Find a comfortable spot and adjust the position as needed.

4. Enjoy the experience: Allow the nicotine pouch to release its flavor and nicotine gradually. The length of usage may vary depending on the individual preference and strength of the pouch.

Tips and Tricks for Maximizing the Benefits of Nicotine Pouches

To enhance your nicotine pouch experience, consider the following tips:

Stay hydrated: Drinking water can help reduce dryness and enhance the flavor of the nicotine pouch.

Rotate pouches: Change the position of the pouch in your mouth to prevent any discomfort or irritation.

Start slow: If you’re new to nicotine pouches, begin with a lower nicotine strength and gradually adjust based on your preference.

Proper disposal: Make sure to dispose of used nicotine pouches responsibly to avoid any environmental impact.

### Additional insights and information to further expand your knowledge about nicotine pouches

Additional insights and information to further expand your knowledge about nicotine pouches

Nicotine pouches are a smokeless alternative to traditional tobacco products. They are small, discreet pouches that contain nicotine and other ingredients, providing a similar experience to smoking or using other nicotine products. However, unlike cigarettes or chewing tobacco, nicotine pouches do not involve combustion or require spitting.

One of the advantages of nicotine pouches is their convenience. They are easy to carry and use on-the-go, making them a popular choice for individuals who want a nicotine fix without the hassle of smoking or chewing tobacco. Additionally, nicotine pouches come in various flavors, allowing users to enjoy a wide range of tastes.

When it comes to nicotine strength, pouches are available in different levels, ranging from low to high. This allows users to choose the strength that suits their nicotine tolerance and desired experience. It’s important to note that nicotine pouches should be used responsibly and in moderation.

Another factor to consider is the duration of nicotine pouch usage. The length of time a pouch can be used varies depending on the brand and strength. Some pouches are designed for short-term use, while others can provide a longer-lasting experience. It’s essential to read the instructions provided by the manufacturer to ensure optimal usage and avoid any potential discomfort.

Furthermore, it’s worth mentioning that nicotine pouches are not meant for everyone. Individuals who are pregnant, breastfeeding, or have underlying health conditions should consult with a healthcare professional before using nicotine pouches or any other nicotine-containing products.

Overall, nicotine pouches offer a convenient and discreet way to enjoy nicotine without the smoke or spit associated with traditional tobacco products. By following the step-by-step instructions and incorporating the tips and tricks mentioned earlier, you can maximize the benefits and enhance your nicotine pouch experience.

The Lifespan of Nicotine Pouches: What You Need to Know

While nicotine pouches offer a practical and long-lasting nicotine solution, it’s essential to understand the factors that can affect their shelf life.

Factors That Affect the Shelf Life of Nicotine Pouches

Several factors can influence the shelf life of nicotine pouches:

Storage conditions: Pouches should be stored in a cool and dry place away from direct sunlight.

Expiry date: Always check the expiration date on the pouch packaging and avoid using expired products.

Hygiene: Ensure proper hygiene when handling nicotine pouches to prevent contamination.

How to Store Nicotine Pouches for Longevity

To maintain the freshness and effectiveness of your nicotine pouches, follow these storage tips:

Avoid exposure: Keep nicotine pouches away from heat, moisture, and sunlight.

Seal packaging: After opening a can, reseal it tightly to prevent air exposure.

Refrigeration (optional): If you live in a hot climate, storing your pouches in the refrigerator can help extend their shelf life.

Understanding Expiry Dates on Nicotine Pouches

When you purchase nicotine pouches, you will typically find an expiration date printed on the packaging. This date indicates the estimated length of time the pouches will remain fresh and effective. It is important to check the expiry date before using a nicotine pouch to ensure its potency.

Expired nicotine pouches may not provide the desired nicotine hit and flavor. They can also lose their texture and become dry and brittle, making them less enjoyable to use. So, always make sure to check the expiry date and use nicotine pouches within their recommended timeframe for the best experience.

In conclusion, the lifespan of nicotine pouches can be influenced by various factors such as storage conditions, manufacturing date, and nicotine content. By understanding these factors and paying attention to the expiry dates, you can ensure that you are getting the most out of your nicotine pouches.

Proper Disposal and Recycling Methods for Expired Nicotine Pouches

When nicotine pouches reach their expiration date or become unusable, it is essential to dispose of them properly. Dispose of expired nicotine pouches using the following methods:

Check local regulations: Before disposing of nicotine pouches, check your local regulations regarding the disposal of tobacco-related products. Some areas may have specific guidelines for the disposal of nicotine pouches or a designated collection point for nicotine waste.

Empty used cans: Before discarding the cans, make sure they are empty. This can be done by carefully removing the used pouches.

Dispose of in regular trash: Place the expired nicotine pouches in your regular trash bin. Recycle the can as plastic garbage.

Recycling nicotine pouches can be challenging due to the mixture of materials they contain. However, some manufacturers may provide recycling programs or suggestions for proper disposal. If such options are available, it is advisable to follow the manufacturer’s recommendations for recycling.

Remember, the proper disposal and recycling of nicotine pouches are essential for minimizing environmental impact and ensuring the safety of others. By following these guidelines, you can responsibly manage and dispose of your expired nicotine pouches.

Exploring the Reusability of Nicotine Pouches

One question commonly asked is whether nicotine pouches can be reused. Let’s delve into this topic and examine the pros and cons.

Can you reuse nicotine pouches and snus?

Nicotine pouches and snus are not designed to be reused. After use, they should be disposed of properly since reusing pouches can lead to altered nicotine levels and compromised hygiene.

Pros and Cons of Reusing Nicotine Pouches

While reusing nicotine pouches might seem economical, it comes with potential drawbacks such as diminished flavor, reduced nicotine content, and increased risk of bacterial growth. These factors can significantly impact the overall experience and safety of using nicotine pouches.

Debunking the Myths: Swallowing Nicotine Pouches

One misconception surrounding nicotine pouches is whether swallowing them is safe. Let’s address this concern and separate fact from fiction.

Is Swallowing Nicotine Pouches Safe for Your Health?

No, swallowing nicotine pouches is not recommended. While nicotine pouches are designed for oral use, swallowing them bypasses the intended absorption method through the gum and can lead to potential health risks.

Understanding the Potential Risks of Ingesting Nicotine Pouches

Swallowing nicotine pouches can cause digestive discomfort, nausea, and an unpleasant taste. Additionally, ingesting high amounts of nicotine can have more severe effects on the body and may result in nicotine toxicity. It’s crucial to use nicotine pouches as directed to ensure a safer and more enjoyable experience.

By following these guidelines and understanding the ins and outs of nicotine pouches, you can make informed decisions and maximize the benefits of this innovative alternative. Remember, moderation is key, and always consult with a healthcare professional if you have any concerns or pre-existing medical conditions. Happy pouching!

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Small pouches, but high nicotine doses—nicotine delivery and acute effects after use of tobacco-free nicotine pouches

Tobacco-free nicotine pouches are new nicotine products for oral consumption. They can contain very high nicotine amounts that have not been addressed with clinical studies yet. Thus, nicotine delivery, effects on craving, and side effects were assessed using pouches with up to 30 mg nicotine. In this single-center, five-arm, crossover study, 15 regular cigarette smokers consumed tobacco-free nicotine pouches from different brands with 6, 20, and 30 mg for 20 min. Comparators were nicotine-free pouches and tobacco cigarettes. At baseline and predefined time points over a study period of 240 min, plasma nicotine concentrations, effects on cigarette craving, and side effects were assessed. Cardiovascular parameters including arterial stiffness were measured using a MobilOGraph. Consumption of 30 mg nicotine pouches has led to a higher nicotine uptake compared with the cigarette (Cmax: 29.4 vs 15.2 ng/mL; AUC: 45.7 vs 22.1 ng/mL × h). Nicotine uptake in the acute phase was rapid during use of the 30 mg pouch and cigarette. Extraction rate of nicotine differed between pouches. Use of all products has reduced acute cigarette craving, even the nicotine-free pouch. During consumption of the cigarette and the pouches with 20 and 30 mg, heart rate increased about 27, 12, and 25 bpm, respectively. Parameters for arterial stiffness were elevated and all pouches have induced mouth irritations. The pouches with 30 mg nicotine had overall the strongest side effects and may induce addiction. As craving was also reduced by products with less nicotine, it is questionable whether such high nicotine contents should be allowed on the market. A limit of nicotine content is warranted. The nicotine release rate varies across products and needs to be known to estimate the nicotine delivery.

## 1 Introduction

Tobacco-free nicotine pouches are new nicotine products for oral consumption. They can contain very high nicotine amounts that have not been addressed with clinical studies yet. Thus, nicotine delivery, effects on craving, and side effects were assessed using pouches with up to 30 mg nicotine. In this single-center, five-arm, crossover study, 15 regular cigarette smokers consumed tobacco-free nicotine pouches from different brands with 6, 20, and 30 mg for 20 min. Comparators were nicotine-free pouches and tobacco cigarettes. At baseline and predefined time points over a study period of 240 min, plasma nicotine concentrations, effects on cigarette craving, and side effects were assessed. Cardiovascular parameters including arterial stiffness were measured using a MobilOGraph. Consumption of 30 mg nicotine pouches has led to a higher nicotine uptake compared with the cigarette (Cmax: 29.4 vs 15.2 ng/mL; AUC: 45.7 vs 22.1 ng/mL × h). Nicotine uptake in the acute phase was rapid during use of the 30 mg pouch and cigarette. Extraction rate of nicotine differed between pouches. Use of all products has reduced acute cigarette craving, even the nicotine-free pouch. During consumption of the cigarette and the pouches with 20 and 30 mg, heart rate increased about 27, 12, and 25 bpm, respectively. Parameters for arterial stiffness were elevated and all pouches have induced mouth irritations. The pouches with 30 mg nicotine had overall the strongest side effects and may induce addiction. As craving was also reduced by products with less nicotine, it is questionable whether such high nicotine contents should be allowed on the market. A limit of nicotine content is warranted. The nicotine release rate varies across products and needs to be known to estimate the nicotine delivery.

1 Introduction

Smoking increases the risk for several serious diseases such as lung cancer, cardiovascular disease, and chronic obstructive pulmonary disease (National Center for Chronic Disease Prevention and Health Promotion US Office on Smoking and Health, 2014). The combustion of tobacco and the inhalation of the smoke is the primary cause for these smoking-related diseases (National Center for Chronic Disease Prevention and Health Promotion US Office on Smoking and Health, 2014). Cigarette smoke contains not only nicotine but more than 6,500 compounds, some of them hazardous or potentially hazardous (Rodgman and Perfetti, 2013). During the last 5–10 years, several companies introduced tobacco-free nicotine pouches into the United States and many European countries (Robichaud et al., 2020; Mallock et al., 2024). These pouches contain cellulose, nicotine salts, flavors, and acid regulators but no tobacco-leaf material at all (Robichaud et al., 2020; Mallock-Ohnesorg et al., 2023). The pouches are used for durations from 20 to 60 min between lips and gum (Prasad et al., 2022). Nicotine is released and absorbed by the buccal mucosa. A study by one manufacturer analyzed four brands for several compounds such as formaldehyde, acrolein, 1,3-butadiene, benzene, nornitrosonicotine (NNN), and 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) (Azzopardi et al., 2022a). The concentrations for all these compounds were under the limit of detection (Azzopardi et al., 2022a). In a recent study, the German Federal Institute for Risk Assessment investigated 44 brands of nicotine-containing pouches, covering a range from 1.79 to 47.5 mg nicotine per pouch. Also tobacco-specific nitrosamines were analyzed in these samples, 24 of 44 showed NNN and three of 44 showed NNK above the detection limits of 0.12 ng per pouch (Mallock et al., 2024).

The pharmacokinetic properties are crucial for the development of nicotine addiction (Henningfield and Keenan, 1993; Guimarães et al., 2021). While the highly addictive cigarettes lead to a rapid uptake of nicotine into the blood and consequently into the brain, smoking cessation products such as nicotine patches or gums show a much slower uptake of nicotine (Henningfield and Keenan, 1993; Guimarães et al., 2021). An important question regarding nicotine pouches is whether their pharmacokinetic properties resemble nicotine gums or cigarettes. Up to now, several studies investigated the pharmacokinetic properties of tobacco-free pouches (Lunell et al., 2020; Rensch et al., 2021; Azzopardi et al., 2022b; Chapman et al., 2022; Liu et al., 2022; McEwan et al., 2022). Most studies have been performed by or in association with manufacturers of nicotine pouches, often tobacco companies. Many studies used pouches with nicotine concentrations between 4 and 10 mg per pouch. The application time ranged from 20 to 60 min. Four of six studies compared the pharmacokinetics of pouches with the consumption of a cigarette (Rensch et al., 2021; Chapman et al., 2022; Liu et al., 2022; McEwan et al., 2022) and only four studies included more than one nicotine dose allowing an estimation of dose-dependency (Lunell et al., 2020; Chapman et al., 2022; Liu et al., 2022; McEwan et al., 2022). None of these studies has investigated the pharmacokinetic properties of nicotine pouches with very high nicotine doses.

This five-arm, crossover study was designed to address the data gap on pharmacokinetics of nicotine pouches with high nicotine contents. The primary aim of the study was the comparison of blood plasma nicotine levels following the application of one of four commercially available products, three nicotine containing pouch brands (6, 20, and 30 mg nicotine per pouch), one brand without any nicotine and a cigarette comparator to assess any differences in the nicotine pharmacokinetic profiles over 4 h. The secondary aim of this study was to assess smoking urges and side effects with a focus on cardiovascular effects and local effects at the application site. The findings will help to understand effects of high dose nicotine pouches on addiction and craving reduction in contrast to lower dose products.

2 Materials and methods

2.1 Aim, study products and ethics

Aim of the study was to assess nicotine uptake, subjective effects, and side effects after use of nicotine pouches with medium to high nicotine contents. Nicotine concentration of venous plasma was determined to assess nicotine uptake in the acute phase (i.e., the first 5 min of consumption) and over the course of 4 h. This single-center, crossover study was conducted with the following five arms:

a. Nicotine-free pouches with mint aroma (Swedish Match, Stockholm Schweden)

b. 6 mg Nicotine pouches with mint aroma (Imperial Brands plc., Bristol, United Kingdom)

c. 20 mg Nicotine pouches with mint aroma (British American Tobacco, London, United Kingdom)

d. 30 mg Nicotine pouches with mint aroma (Fedrs Sp. Z.o.o, Warsaw, Poland)

e. Own-brand tobacco cigarette (different brands).

Pouches were kept between upper lip and gum for 20 min. Products were purchased in October 2021 from online shops. The nicotine strengths mentioned in the manuscript refer to the declared nicotine contents not the analyzed contents. The study was approved by the ethics committee of the LMU Munich (project number 21-0814) and performed in accordance with the principles of the Declaration of Helsinki in the currently valid version. It was registered at the DRKS (DRKS00026244). Informed consent was obtained from all participants before participation in the study. Four hypotheses were tested:

• Nicotine delivery of the studied pouches, measured as Cmax (maximum plasma concentration) and AUC (area under the plasma-time curve), increases in a dose-dependent manner.

• Use of the pouch with 30 mg nicotine leads to a similarly high plasma nicotine concentration as tobacco cigarettes (Cmax approximately 15–20 ng/mL).

• In contrast to pouches with 6 mg nicotine, use of pouches with high (20 mg and 30 mg) nicotine doses reduces acute craving for a cigarette comparably to smoking of one cigarette.

• Side effects of pouch use, including cardiovascular effects (i.e., heart rate, arterial stiffness), increase in a dose-dependent manner.

2.2 Participants

The single-center, five-arm, crossover study included 15 active smokers. Recruitment of participants took place via advertisement (social media, LMU intranet, LMU newsletter). Enrolled participants that fulfilled inclusion and exclusion criteria gave written informed consent. Inclusion criteria were: Age between 18 and 55 years, active smoking for at least 5 years with more than 10 cigarettes per day, 12 h of abstinence from any nicotine product prior to testing, CO levels < 5 ppm (in the expiratory air analyzed using a micro-smokerlyzer; Bedfont Scientific Ltd., Anif, Austria) and plasma nicotine concentration at baseline < 10 ng/mL to verify abstinence from cigarettes and other nicotine products, and the ability to give consent. Exclusion criteria were: Age under 18 or over 55 years, use of other nicotine products (e.g., nicotine pouches, snus, e-cigarettes) more often than once a week, acute psychiatric illness according to ICD-10/DSM IV or other serious psychiatric disorders, acute suicidality, pregnancy, breastfeeding, current abuse of drugs, medication, or alcohol, malignant cancer in the past 5 years, serious internal illness, especially cardiovascular diseases, such as manifest arterial hypertension, severe heart disease (DCM, history of heart attack), pacemaker implantation, respiratory diseases (e.g., respiratory failure, asthma, COPD), and severe active infectious disease.

2.3 Study design

Participants were instructed either to smoke one of their own-brand cigarettes as they usually do or to place the pouch between upper lip and gum and keep it for 20 min without chewing or sucking it. 30 min before, during, and 30 min after pouch use, participants were asked not to use chewing gum, eat any food, drink more than small amounts of water, and brush their teeth. Over the whole observation period of 240 min, participants were asked not to use any other further nicotine product or consume food or beverages containing caffeine, mint, or licorice. The abstinence was considered to avoid possible interferences with nicotine metabolism, subjective effects (e.g., head buzz), or cardiovascular effects (Benowitz et al., 2009; Deutch et al., 2019).

2.4 Measurements

Venous blood was sampled using peripheral venous Safety Multifly cannulas and S-Monovettes (Sarstedt AG & Co. KG, Nümbrecht, Germany) at baseline and at 2, 5, 10, 15, 20, 30, 60, 90, 120, and 240 min and was cooled until preparation for quantitative nicotine analysis as described below. Smoking urges were assessed at baseline, at 20 and at 240 min using the German version of the Questionnaire on Smoking Urges (QSU-G) (Müller et al., 2001). Acute craving after a cigarette was asked to be rated (“I now feel the urge for a cigarette”) at baseline and at 2, 5, 10, 15, 20, 30, 60, 90, 120, and 240 min on a seven-point Likert scale from 1 (not at all true) to 7 (completely true).

Cardiovascular parameters were measured using a Mobil-O-Graph (I.E.M. GmbH, Stollberg, Germany) at baseline and at 2, 5, 20, 30, 60, 90, 120, and 240 min. The parameters heart rate, peripheral and central blood pressure, augmentation index adjusted at HR 75 bpm (AIX@75), and total peripheral resistance/vascular resistance (TVR) were measured and calculated with the Mobil-O-Graph software version HMS CS 4.2 (I.E.M. GmbH, Stollberg, Germany). The instrument and measurement procedure are described elsewhere (Wassertheurer et al., 2010; Weber et al., 2011; Hauck et al., 2023).

The side effects head buzz, mouth or throat irritations, lightheadedness, dizziness, cold hands or feet, palpitations, headache, perspiration, nausea, and urge to vomit were assessed on a numeric rating scale (NRS) from 0 (no effect) to 10 (strongest effect) at 2, 5, 10, 15, 20, 30, 60, 90, 120, and 240 min. Salivation was inquired on a scale from 0 = lowest salivation (dry mouth) over 5 = normal salivation to 10 = highest salivation (hypersalivation). At study days at which a pouch was used, the oral mucosa was inspected for redness or ulceration at baseline and at 30 min.

2.5 Analysis of nicotine, cotinine, and trans-3′-hydroxycotinine from blood samples

Whole blood was centrifuged (1,500 g, 10 min, 4°C) and 10 µL internal standard mix (500 ng/mL nicotine-d3, cotinine-d3, hydroxycotinine-d3 in acetonitrile) was added to 990 µL blood plasma. Samples were stored at LMU University Hospital in Munich at −80°C and shipped to BfR in Berlin on dry ice. A previously described validated method was used for the quantification of nicotine, cotinine, and trans-3′-hydroxycotinine (hydroxycotinine) from plasma using protein precipitation and liquid chromatography—tandem mass spectrometry (LC-MS/MS) with a matrix-matched calibration (Mallock et al., 2021).

2.6 Determination of nicotine extraction from pouches

After removal, pouches were individually wrapped and stored at −20°C before they were shipped on dry ice to BfR in Berlin, Germany. Method for nicotine content determination was modified from a previously described method (Mallock et al., 2024). Pouches were weighted and placed into an Erlenmeyer flask with stopper followed by a liquid-liquid extraction using 10 mL ultra-pure water, 5 mL sodium hydroxide solution (2 M), and 20 mL n-hexane with the internal standard n-hexadecane (0.5 g/L) for 75 min at 350 rpm (orbital shaker GFL 3005, Lauda-GFL, Lauda-Königshofen, Germany). Of the organic phase, 2 µL were injected into the GC/FID system (G1530A series from Agilent Technologies/Hewlett Packard, Agilent Technologies, Waldbronn, Germany) and analyzed as described in the Supplementary Material.

2.7 Pharmacokinetic (PK) parameters and statistics

For calculation of the half-life (t1/2), the elimination rate constant (i.e., the slope of the terminal elimination phase) was determined using the last two nicotine plasma concentrations (at 120 and 240 min). The plasma nicotine concentrations determined at baseline and the individual elimination rate constant were used to determine the residual nicotine concentration at the subsequent nicotine sampling times. These values were then subtracted from the subsequent nicotine levels before PK parameters were calculated. Areas under the plasma concentration-time curve (AUC) were calculated with the linear trapezoid rule. The highest plasma nicotine concentration per curve was used as Cmax and the according time point for tmax. Delays in blood sampling were noted and considered when the individual AUCs were calculated. Relative bioavailability (Frel) between two pouches was calculated using the following equation with the analyzed nicotine content as dose (D):

Nicotine metabolite ratio (NMR) was calculated by dividing hydroxycotinine by cotinine plasma concentrations at baseline at the first study day. NMR can be used as a surrogate for CYP 2A6 activity (Dempsey et al., 2004; Allenby et al., 2016) with low values (NMR < 0.31) for slow metabolizers and higher values (NMR > 0.31) for normal or rapid metabolizers (Lerman et al., 2015). Median and interquartile ratios (IQR) were calculated for participant characteristics including NMR; for tmax, median and range. For AUC and Cmax, geometric means and coefficients of variation (CV) were calculated. Arithmetic means and 95% confidence intervals (CI) were used for mean plasma curves. Statistical Package for Social Sciences (SPSS) version 26.0 was used for statistical analysis. Two-sided paired t-tests were applied to evaluate differences between groups. For Cmax and AUC, lognormal values were used. Baseline mean values were used as statistical references for the cardiovascular parameters blood pressure, heart rate, and arterial stiffness parameters. Cardiovascular parameters were tested for normal distribution by Kolmogorov-Smirnov tests and a two-way repeated measures ANOVA based on baseline measurements was used to estimate for an interaction between the product used and time. To individually analyze differences at the various time points in between the study arms, ANOVA is used.

3 Results

3.1 Participants

Of the 18 recruited participants, three dropped out without completion of all study arms. The characteristics of the 15 participants that completed the study are summarized in Table 1. Individual characteristics are presented in Supplementary Table 1. Participants had a low to moderate physical cigarette dependence as measured with the FTCD. Eleven participants had an NMR > 0.31 and were classified as normal/rapid metabolizers; four were classified as slow metabolizers (participants 5, 7, 11, and 15). The participants were daily smokers who smoked about 12 cigarettes per day.

27.Nicotine delivery and nicotine extraction from pouches

Mean plasma nicotine curves during and after consumption of the study products are presented in [Figure 2A](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F2). Individual plasma nicotine curves are displayed in [Supplementary Figure 1](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1) and the individual nicotine concentrations are shown in [Supplementary Tables 2–6](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1). Consumption of nicotine-free pouches did not result in a nicotine uptake. A magnification of the acute phase, meaning the first minutes of consumption, is shown in [Figure 2B](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F2). Rise of plasma nicotine levels was fastest for 30 mg nicotine pouches and tobacco cigarettes compared with the other tested products.

The PK parameters Cmax, tmax, AUC0–240min, and t1/2 are summarized in [Table 2](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T2) for the nicotine-containing products. The parameters Cmax and AUC0–240min increased in the order 6 mg nicotine pouch < 20 mg nicotine pouch < tobacco cigarette < 30 mg nicotine pouch with statistically significant differences between all nicotine pouches (Cmax: all p-values < 0.0001; AUC0–240min: all p-values < 0.0001). In comparison with the tobacco cigarette, p-values for Cmax were 0.0000001, 0.001, and 0.0007 for pouches with 6, 20, and 30 mg nicotine, respectively. For AUC0–240min, these values were 0.0000001, 0.001, and 0.0002. With tobacco cigarettes, tmax was reached the fastest in line with the shorter consumption duration. The half time t½ of nicotine was calculated showing no differences between study arms.

Nicotine content of unused nicotine pouches were analyzed with GC/FID. Analyzed nicotine contents were 4.8 ± 0.4 mg, 16.3 ± 3.1 mg, and 27.1 ± 0.2 mg for the nicotine pouches declared with 6, 20, and 30 mg, respectively. Remaining nicotine in used pouches was analyzed (see [Supplementary Table 7](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1)) and rates of nicotine extraction were calculated. Mean nicotine extraction rates differed between pouches as shown in [Table 2](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T2). Considering the analyzed total content and the remaining nicotine contents, mean nicotine doses extracted were 1.8 ± 0.8 mg, 4.7 ± 3.5 mg, and 14.1 ± 3.0 mg for the pouches with a nominal nicotine content of 6, 20, and 30 mg, respectively. Relative bioavailability in relation to the 6 mg (analyzed 4.8 mg) pouch was 70% for the 20 mg (analyzed 16.3 mg) pouch and 165% for the 30 mg (analyzed 27.1 mg) pouch.

### 3.3 Effects on craving

Effects on smoking urges were measured using the QSU-G at baseline, at 20 min, and at 240 min as presented in [Figure 3](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F3). Positive reinforcement is described by factor 1 ([Figure 3A](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F3)) and reflects, for example, the anticipation of positives effects from smoking. Mean score for factor 1 was significantly reduced by tobacco cigarette and by the pouches with 20 and 30 mg nicotine at 20 min (p < 0.01). Negative reinforcement, described by factor 2 ([Figure 3B](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F3)), reflects, for example, the anticipation of relief from withdrawal. Mean score for factor 2 was significantly reduced by tobacco cigarette and by the pouches with 20 and 30 mg nicotine at 20 min (p < 0.05).

Additionally, acute cigarette craving was inquired with a single question (“I now feel the urge for a cigarette”) at each time point of blood sampling as shown in [Figure 4](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F4). All products, even the nicotine-free pouch, led to a statistically significant reduction of acute craving for a cigarette (all p values < 0.05, see [Supplementary Material](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1)). In agreement with the earlier time point for tmax, reduction was fastest for the tobacco cigarette. Difference in craving reduction was statistically significant between nicotine-free pouch and 30 mg nicotine pouch (p = 0.04). Individual ratings for acute craving are presented in [Supplementary Tables 8–12](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1).

### 3.4 Cardiovascular effects and arterial stiffness

Changes in heart rate are displayed in [Figure 5](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F5). Increases in heart rate occurred in the beginning of product use (5 min) for the 20 and 30 mg nicotine pouches, tobacco cigarettes, and slightly for the 6 mg nicotine pouches. Increases were the strongest for the 30 mg pouches and tobacco cigarettes. Effects on systolic and diastolic blood pressure were minor for all study arms as summarized in the [Supplementary Tables](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1)

Besides peripheral and central blood pressure, the parameters of arterial stiffness, augmentation index adjusted at HR 75 bpm (AIX@75) and total peripheral resistance/vascular resistance (TVR), were measured at baseline and at 5, 20, 30, 60, 90, 120, and 240 min. Besides peripheral systolic blood pressure, there was a significant increase also in central systolic blood pressure in the study arms using pouches with high nicotine concentrations and tobacco cigarette in the acute phase, the beginning of product consumption. Further, there was a significant increase in the parameters of arterial vascular stiffness. AIX@75 and TVR were significantly elevated during consumption of the high nicotine pouches (20 and 30 mg) and tobacco cigarette. Results are shown in the [Supplementary Tables 16, 17](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1).

### 3.5 Other side effects

No serious adverse effects were reported. One participant who used the 30 mg nicotine pouch experienced circulation problems with mild symptoms. By employing general measures such as elevating the legs, the participant’s condition normalized within a few minutes and no serious adverse event was reported.. Strong mouth irritations were reported in the first 10 min of use of the 30 mg nicotine pouch ([Figure 6A](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F6)). Use of the other pouches resulted in medium mouth irritations, regardless of the nicotine strength, while cigarette smoking did not have such an effect. Reported head buzz (i.e., the feeling of a slight intoxication) peaked in the cigarette arm at 2 min and in the pouch arms at 5 min. Cigarette smoking and use of the 30 mg pouch led to a head buzz with medium effect size. None of the other inquired side effects (throat irritations, lightheadedness, dizziness, cold hands or feet, palpitations, headache, perspiration, nausea, and urge to vomit) was rated higher than 3 out of 10 at any time point as summarized in [Supplementary Table 18](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1). For salivation, effects in both directions (less salivation or more salivation than usual) were monitored. No increased salivation was observed and a slightly drier mouth was reported, especially in the tobacco cigarette arm (see [Supplementary Table 19](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "SM1)).

The oral mucosa was inspected before and 10 minutes after pouch use for redness or ulceration. A slightly increased redness was revealed in 1, 4, 3, and 5 cases after use of the pouches with 0, 6, 20, and 30 mg nicotine, respectively. An ulceration was visible in one case after use of the 6 mg pouch. In the remaining cases, appearance of the oral mucosa did not change compared with the inspection at baseline.

## 4 Discussion

In the landscape of alternative nicotine delivery systems (ANDS), nicotine pouches are among the most recent products. Where available, they are mostly not adequately addressed with specific regulations regarding, for example, the nicotine content ([Duren et al., 2023](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B12)). Scientific knowledge on these products is scarce and was predominantly generated by the manufacturers of the products. In previously published clinical trials, only pouches up to 10 mg nicotine were studied ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25); [Rensch et al., 2021](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B33); [Azzopardi et al., 2022b](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B3); [Chapman et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B9); [Liu et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B24); [McEwan et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B29)). However, much higher nicotine contents are available, up to 50 mg were previously reported ([Mallock et al., 2024](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B27)). The herein presented clinical trial is the first to report nicotine pharmacokinetics, subjective effects, and side effects from use of nicotine pouches with 20 and 30 mg. Additionally, this work is the first to include nicotine-free oral pouches as a control. Nicotine content of the pouches were analyzed with GC/FID and the pouches only contained between 80% and 90% of the declared nicotine content. For brevity, the declared nicotine content is used throughout this manuscript.

An overview over results from previous pharmacokinetic studies is given in [Table 3](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T3) including highest studied nicotine strength, duration of use, highest achieved mean Cmax, and highest achieved mean AUC. Mean Cmax after 20 min of use of the 30 mg nicotine pouch was much higher compared with the highest mean Cmax values achieved in one of the other studies after the use of pouches with up to 10 mg nicotine regardless of the use duration. In three studies, the participants kept the products for 60 min in their oral cavities ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25); [Azzopardi et al., 2022b](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B3); [McEwan et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B29)), which is three times the use duration compared with the presented study. A use duration of 20 min was chosen for two reasons: Firstly, a market survey conducted by a product manufacturer has revealed that the preferred duration for holding nicotine pouches in the oral cavity ranges from 5 to 20 min in Germany ([Prasad et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B32)). The higher the nicotine strength of the pouch, the shorter was the preferred hold time ([Prasad et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B32)). Secondly, as no clinical data for the use of pouches with high nicotine concentrations were available, it was unclear how participants would react to such a high nicotine dose. Accordingly, the duration time was kept relatively short and nicotine doses above 30 mg were not included. However, as seen in [Table 2](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T2), participants only extracted 52% (14 ± 3.0 mg) of the nicotine contained in the 30 mg pouches and even less from the other pouches. It is possible that with a longer use duration, more nicotine would have been extracted potentially leading to increased side effects. In two other studies, nicotine extraction rates have been analyzed, both with use durations of 60 min. Lunell et al. have reported mean extraction rates of 56%, 59%, and 50% for pouches with 3, 6, and 8 mg nicotine, respectively ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25)). In the study by Azzopardi et al., a mean of 62% was extracted from the 4 mg pouch ([Azzopardi et al., 2022b](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B3)). The total delivered nicotine, represented by the AUC, depends on the administration time of nicotine. Accordingly, the AUC was higher in two studies with a lower nicotine dose but a longer duration of use ([Table 3](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T3)). It should be noted that the last blood sampling time point (t) has a large influence on the AUC0–t and that it varied across the studies mentioned in [Table 3](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "T3). Thus, the different AUC0–t values should be compared with caution.

n the presented study, mean Cmax and AUC were significantly higher after use of the 30 mg nicotine pouches compared with tobacco cigarettes. In addition to nicotine delivery, assessing the nicotine flush during the acute phase of consumption is crucial for evaluating the product’s risk. As seen in [Figure 2B](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "F2), use of the 30 mg nicotine pouch has led to a similarly fast nicotine uptake compared with cigarette smoking. The rate at which nicotine concentration increases in the bloodstream and, consequently, in the brain is associated with the activation of the reward system and the product’s addictive potential ([Henningfield and Keenan, 1993](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B20)). The highly addictive nature of the tobacco cigarette can serve as a reference point. A similarly rapid nicotine uptake during the acute phase may suggest a comparable level of addictiveness for the alternative product. However, addictiveness of a product cannot be ruled out only by demonstrating a slower nicotine uptake. Tobacco dependence is complex and involves many behavioral factors as for instance (sensory) conditioning or social learning ([Brandon et al., 2004](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B8); [Eissenberg, 2004](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B13); [Glautier, 2004](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B15)).

It should also be noted that inhaling cigarette smoke results in a more rapid increase in nicotine levels in arterial blood compared to venous blood ([Henningfield et al., 1993](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B21)). Nicotine is transported to the brain by arterial blood. Therefore, venous blood concentrations are a poorer surrogate for post smoking nicotine concentrations in the brain than arterial samples. Due to the buccal resorption, the distribution between arterial and venous blood in the early phase of nicotine pouch use is likely to be different to cigarette use. Thus, it remains to be studied how venous plasma concentrations translate to nicotine levels in the brain in the context of nicotine pouch consumption. As an approximation for nicotine effects in the brain, the participants were asked to rate the sensation of a head buzz at different time points. During cigarette smoking, the peak sensation was achieved immediately at the first assessment point after 2 min. During use of the 30 mg nicotine pouch, head buzz peaked after 5 min much before tmax. The peak effect sizes of head buzz during cigarette or 30 mg nicotine pouch consumption were comparable.

Another aspect related to the nicotine delivery is the reduction of craving for a cigarette. All participants were regular smokers with mild to moderate addiction according to their FTCD score. Nicotine products that efficiently reduce craving in concert with a markedly lower exposure to harmful chemicals can be beneficial for an addicted smoker who is unable to overcome nicotine use ([Kozlowski and Abrams, 2016](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B22); [Hatsukami and Carroll, 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B17)). While the toxicity of cigarette smoke, which contains over a hundred highly toxic chemicals, has been extensively studied, much less is known about nicotine pouches. However, when considering recent independent studies ([Mallock-Ohnesorg et al., 2023](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B28); [Mallock et al., 2024](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B27)), it can be expected that nicotine pouches lead to a substantially lower exposure to toxicants compared to cigarette smoke. All tested products, including the nicotine-free pouch, have significantly reduced acute cravings for a cigarette. During cigarette smoking and consumption of the 20 and 30 mg nicotine pouches, the lowest mean score for acute craving was with 20 min shortly after tmax at 15 min. Consumption of the pouches with 0 and 6 mg reduced craving for a cigarette in the first 10 minutes. This underlines that factors such as sensory cues or expectation of reward play a role in reducing craving by these oral products. The acute craving increased most rapidly in the cigarette arm following the initial satisfaction. Craving reduction was not statistically different between the tobacco cigarette and both pouches with high nicotine contents, 20 and 30 mg. Additional to the question on acute craving for a cigarette, the QSU was answered at three time points, at baseline, at 20 min, and at 240 min. With the QSU, effects on positive reinforcement factors (e.g., expectation of a positive effect from smoking) and negative reinforcement factors (e.g., expectation of relief from withdrawal symptoms) for cigarette smoking were measured with multiple items. Both factors of smoking urges were reduced by the tobacco cigarette and the nicotine pouches with high nicotine contents, 20 and 30 mg. As participants did not answer the QSU at 10 min, early effects in craving reduction by the 0 and 6 mg pouches with the single-item measurement were not assessed.

In terms of side effects, cardiovascular effects were expected to be triggered by nicotine. Nicotine stimulates the acetylcholine-receptors causing reaction in the central nervous and vegetative nerval system with a consecutive increasing heart rate and blood pressure ([Benowitz and Burbank, 2016](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B5)). Indeed, in the early phase of consumption, 30 mg nicotine pouches and tobacco cigarettes led with an increase of approximately 25 bpm to similarly strong rises of heart rate. The 20 mg nicotine pouches led to a lower rise, while the 6 mg pouch increased heart rate only slightly and the nicotine-free pouches did not affect heart rate significantly. Only two of the previously published clinical studies have monitored cardiovascular effects of nicotine pouch use ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25); [Chapman et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B9)). Chapman et al. have not reported any changes in heart rate or blood pressure after use of a 10 mg nicotine pouch with a Cmax of 7.9 ng/mL ([Chapman et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B9)). Lunell et al. have described an increase of 10.5 bpm after 60 min of use of the 6 mg nicotine pouch with a Cmax of 14.7 ng/mL ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25)). This underlines the dose-dependency of the acute effects of nicotine on heart rate from nicotine pouches.

In addition to heart rate and blood pressure, parameters to measure arterial stiffness (AIX@75, TVR) were assessed. Significant effects were found especially for the high dose pouches as well as the combustible cigarette at the first time point of measurement, at 5 min. Since our study has only a relatively short follow-up period of 240 min, long-term statements can only be formulated speculatively. Most of the variations in central and peripheral blood pressure, heart rate, and arterial stiffness parameters can be attributed to nicotine. Cigarette smoking is associated with a substantially increased risk of cardiovascular disease and mortality ([Benowitz and Liakoni, 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B7)). The main contributors are not nicotine but combustion products that induce chronic inflammation and cardiovascular dysfunction ([Benowitz and Liakoni, 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B7)). Users of snus, a type of oral smokeless tobacco, do not show an increased risk of cardiovascular disease compared to never smokers, but the risk for fatal outcomes is elevated ([Benowitz and Liakoni, 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B7)). Looking at Sweden where the male population predominantly uses snus rather than cigarettes, the cardiovascular health in men has improved over the last decades compared with other developed countries or with Swedish women ([Foulds et al., 2003](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B14)). As nicotine pouches are a very similar product as snus, it is likely that they also pose a much lower risk for cardiovascular events than cigarette smoking does. However, considering the acute effects on parameters reflecting arterial stiffness, an increased risk for arterial hypertension, atherosclerosis, or myocardial infarction especially for consumers with an already existing cardiovascular disease is possible.

Besides cardiovascular effects, local effects were of special interest. The oral mucosa was inspected 10 minutes after the pouches were removed. In some cases, an increased redness was visible and in one case, after use of the 6 mg pouch, an ulceration was detected. Moderate mouth irritation was reported by the participants at the beginning of consumption of the pouches with 0, 6, and 20 mg nicotine. The 30 mg nicotine pouches induced a strong mouth irritation, while the mouth irritation during smoking was low. This suggests a tendency that nicotine may contribute to local effects. However, as the pouches with no nicotine or low amounts also induced local adverse effects, other substances are involved. This is in line with an in vitro toxicity study of nicotine pouch extracts in oral fibroblasts in which cytotoxic effects were found to be independent from the nicotine dose ([Rinaldi et al., 2023](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B34)). Results of another in vitro cytotoxicity study in gingival epithelial cells also indicate that nicotine pouches can have adverse local effects ([Shaikh et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B37)).

One industry study has compared nicotine deliveries of nicotine pouches with similar nicotine contents (8–10 mg) but from different brands ([McEwan et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B29)). Their findings suggest that there is no direct correlation between the nicotine content of pouches and the nicotine delivered to the bloodstream. Relative bioavailability (regarding Cmax) in relation to the product with the lowest release ranged from 137% to 245% ([McEwan et al., 2022](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B29)). Results of the herein presented study also speak against a linear relationship between nicotine delivery and nicotine content in the pouch, visible in the relative bioavailability ranging from 70% to 165%. Also, the Cmax does not increase proportionally with the nicotine content. This is likely due to different nicotine releases from the pouches. The variability in residual nicotine proportions post-use indicates that different products release varying percentages of their total nicotine content. This varied from 24% for the 20 mg nicotine pouch to 52% for the 30 mg nicotine pouch. Lunell et al. have investigated three different nicotine strengths from the same brand and the Cmax increase was almost linear in relation to the nicotine content ([Lunell et al., 2020](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B25)). In vitro nicotine release studies confirm that nicotine pouches can have different release rates and different release profiles depending on the formulation ([Aldeek et al., 2021](https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2024.1392027/full" \l "B1)). This should be considered when interpreting the results from the 6 and 20 mg nicotine pouch arms of this study. The 20 mg nicotine pouch chosen for this study happened to only release 24% of its nicotine under the given use conditions. With a different formulation, nicotine pouches can release a higher percentage of nicotine. This means that higher plasma nicotine levels are possible during use of other 20 mg nicotine pouches.

## 5 Limitations

The participants of this study were not experienced users of oral tobacco/nicotine products. Experienced users of such products may have responded with different subjective effects or may have used the products differently. Although oral products do not allow the same degrees of freedom in terms of use as products for inhalation do (i.e., multiple puffing parameters), some parameters (e.g., the insalivation of the pouches) can be adjusted to manipulate nicotine release. However, enlisting regular users was not possible due to the low prevalence of regular oral tobacco/nicotine product use in Germany. The number of participants was too low for an in-depth statistical analysis investigating potential influences of participant characteristics, e.g., the metabolizer status. Another limitation is that the study only investigated a limited selection of products with its five study arms. Additionally, nicotine contents even higher than the 30 mg used in this study are available. Considering the great variability of nicotine release rates, more data on nicotine deliveries of pouches with high nicotine contents (i.e., 20 mg nicotine and more) is needed. All products come from different brands. This design was chosen in order to cover different formulations and subsequently different nicotine releases. Consequently, the results of this study including differences in subjective effects and side effects may have been affected by other constituents than nicotine as well.

## 6 Conclusion

The presented study is the first to investigate the use of nicotine pouches with high nicotine contents of up to 30 mg. The nicotine delivery of the herein used 30 mg nicotine pouches exceeded the nicotine delivery of a tobacco cigarette. Overall, these pouches with 30 mg nicotine had the strongest side effects. This study is also the first to include nicotine-free pouches and thus has a control arm with a product that comes close to a placebo. It was shown that use of nicotine-free pouches reduced cigarette craving and induced side effects such as mouth irritation. Consequently, other factors, for example, sensory aspects or expectations of reward, play an important role. Considering the craving reduction by pouches with no or low nicotine content, it is questioned whether nicotine pouches with high nicotine contents such as 30 mg are needed to provide addicted smokers with an alternative for cigarettes. The presented data also demonstrate that knowledge of only the nicotine content is not enough to estimate the nicotine delivery of a product. Further research, e.g., long-term use studies, are needed to clarify the nicotine content that is actually needed to provide an appropriate alternative for smokers. Ideally, it is as low as possible to reduce addictive potential and cardiovascular side effects. Whether nicotine pouches can pose an alternative for cigarette smoking is possible but yet unclear. However, the presented data suggest that nicotine pouches with very high nicotine doses are likely to induce addiction. Therefore, it is advisable that the nicotine content of pouches is limited and more information such as nicotine release rate are available to allow consumers to make informed choices.

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# Nicotine Pouch: Awareness, Beliefs, Use, and Susceptibility among Current Tobacco Users in the United States, 2021

## 1. Introduction

Nicotine pouches (NPs) are an emerging class of noncombustible nicotine products. These thin, prefilled, microfiber pouches contain white powdered nicotine. Similar to Swedish-style snus, NPs are placed between the upper lip and gum, where the nicotine dissolves in the mouth without requiring spitting (e.g., [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B1-ijerph-20-02050),[2](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B2-ijerph-20-02050)]). In contrast with Swedish-style snus and other traditional smokeless tobacco products, NPs do not contain any tobacco leaf [[3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B3-ijerph-20-02050)]. Rather, NPs typically contain nicotine salts, which deliver higher levels of nicotine than the free-base nicotine in most smokeless tobacco products [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B1-ijerph-20-02050)], and vary widely in their nicotine content per pouch [[4](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B4-ijerph-20-02050)]. Other common ingredients in NPs include stabilizers (hydroxypropyl cellulose), fillers (microcrystalline cellulose, maltitol, and gum arabic), pH adjusters (sodium carbonate and sodium bicarbonate), sweeteners (acesulfame K). A variety of food-grade flavorants (e.g., fruit, mint, coffee) are also typically added to NPs [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B1-ijerph-20-02050),[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B5-ijerph-20-02050)] to make them more appealing. Currently, popular NP brands include Zyn (Swedish Match North American), On! (Altria), Velo (RJ Reynolds [RJR] Vapor Company/British American Tobacco [BAT]), Dryft (Kretek International), and Nordic Spirit (Japan Tobacco International) [[6](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B6-ijerph-20-02050)].

NPs have been promoted as cost effective (comparable to a pack of cigarettes [[7](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B7-ijerph-20-02050)]; convenient (as they can be used anywhere and do not require batteries or a device [[8](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B8-ijerph-20-02050),[9](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B9-ijerph-20-02050)]; and relatively safe in comparison to other nicotine products (e.g., [[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B5-ijerph-20-02050),[10](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B10-ijerph-20-02050),[11](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B11-ijerph-20-02050),[12](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B12-ijerph-20-02050)]). As of 2021, the global NP market was valued at USD 1.50 billion [[13](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B13-ijerph-20-02050)]. Based on the steady increase in sales, industry analysts predict that NPs will be valued at USD 22.98 billion by 2030 [[14](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B14-ijerph-20-02050)]. While NPs are currently available in many countries, the industry claimed that the largest NP markets are the US and Sweden [[15](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B15-ijerph-20-02050)], which may be due to the high prevalence of smokeless tobacco product use in these countries: 2.4% in the U.S. in 2019 [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B16-ijerph-20-02050)], and 12.3% in Sweden in 2010 [[17](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B17-ijerph-20-02050)]. NPs entered the US market in 2016 and have since increased considerably in sales (from USD 709,635 in 2016 to USD 216,886,819 in 2020; [[18](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B18-ijerph-20-02050)].

Industry-funded research has claimed NPs as a “reduced-risk” product [[19](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B19-ijerph-20-02050)] and argued that these products have lower in vitro toxicity compared with conventional tobacco products, partially due to the absence of tobacco leaf and combustion [[20](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B20-ijerph-20-02050)]. However, these products have raised concerns among public health officials. These concerns include NP companies’ aggressive and targeted marketing strategies [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B1-ijerph-20-02050),[5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B5-ijerph-20-02050),[21](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B21-ijerph-20-02050)]. Some NP manufacturers may be practicing unethical marketing approaches and targeting individuals who do not use commercial tobacco and young people who are especially vulnerable to nicotine addiction [[22](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B22-ijerph-20-02050),[23](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B23-ijerph-20-02050)]. This is particularly seen with advertisements depicting young adult models [[24](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B24-ijerph-20-02050)], as well as some brands advertising their products as “flavor ban approved” [[25](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B25-ijerph-20-02050)] or “tobacco-free” [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B1-ijerph-20-02050)]. Current research also found that NPs contain carcinogens (e.g., tobacco-specific nitrosamines; [[26](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B26-ijerph-20-02050)], potentially high nicotine content [[26](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B26-ijerph-20-02050)], and/or similar concentrations and delivery speeds as other smokeless tobacco products [[3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B3-ijerph-20-02050)], and side effects (e.g., nausea, hiccups, oral soreness, or irritation) [[27](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B27-ijerph-20-02050)]. As such, there remains uncertainty on the immediate and long-term NP-related health risks and public health impact.

In light of these circumstances, evaluations of awareness, use, and beliefs about NPs are important to monitoring the evolving NP and tobacco landscape. However, few existing studies have evaluated these measures. In the UK, Brose and colleagues (2021) examined the prevalence and correlates of NP use in a cohort of adult current or former smokers and/or electronic vaping product (EVP) users in 2019 [[28](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B28-ijerph-20-02050)]. They found that 15.9% of respondents were aware of NPs, 4.4% had ever used, and 2.7% were currently using NPs. A more recent study between November 2020 and October 2021 among adults (≥18 years) in Great Britain (England, Scotland, and Wales) found that 0.21% of respondents were currently using NPs [[29](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B29-ijerph-20-02050)]. Furthermore, a 2020 study of Dutch adolescents and adults (≥13 years) found that 6.9% were aware of NPs, 0.6% had ever used NPs, and 0.1% were currently using NPs [[30](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B30-ijerph-20-02050)]. In the US, only three studies examined the prevalence of awareness, ever, and current use of NPs. Felicione and colleagues (2022) surveyed a cohort of adult former and current cigarette smokers and EVP users in 2020 and found that 19.5% were aware of NPs, 3.0% ever used NPs, and 0.9% currently used NPs [[31](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B31-ijerph-20-02050)]. Another study of US adult smokers in early 2021 found a higher prevalence of awareness and ever use measures: 28.2% were aware of NPs and 5.6% ever used NPs (this study did not assess current NP use [[32](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B32-ijerph-20-02050)]).

Understanding susceptibility to NPs is also important and must be understood in order to guide regulatory decision making and prevent increased initiation of these products. Susceptibility has been shown to significantly predict smoking initiation above and beyond other known risk factors (e.g., family members’ or peers’ smoking) or demographic factors (e.g., sex, race, SES) (e.g., [[33](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B33-ijerph-20-02050),[34](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B34-ijerph-20-02050),[35](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B35-ijerph-20-02050)]). Subsequent research has shown that there is a significant overlap in susceptibilities across various tobacco products [[36](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B36-ijerph-20-02050)]. Likewise, research examining the predictive validity of adapted susceptibility measures on alternative tobacco products (e.g., e-cigarettes, cigarettes, hookah, and cigars/cigarillo/little cigars) found that for each tobacco product, susceptibility predicted future initiation, suggesting that valid adapted susceptibility measures can be developed for different tobacco products [[37](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B37-ijerph-20-02050)]. While many studies have investigated the susceptibility to emerging nicotine and tobacco products, only two recent studies have specifically looked at NPs (e.g., [[38](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B38-ijerph-20-02050),[39](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B39-ijerph-20-02050)]), although these were with adolescent and young adult samples, respectively.

Studies are needed to track the prevalence of NP awareness, experimentation, and current use in the US given the rapid sales expansion. Examining the correlates of awareness and use is also necessary to shed light on what groups may be using these products. Moreover, to date, only one study has investigated beliefs about NPs and how these beliefs relate to NP susceptibility and use [[39](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B39-ijerph-20-02050)]. Understanding these beliefs is important for public health officials to know if there are any misbeliefs regarding the safety of these products and adequately address them. Furthermore, understanding how these beliefs relate to NP susceptibility is useful in informing efforts to prevent susceptible individuals from progressing to experimentation. Therefore, the aim of the present study was to investigate NP awareness, use, susceptibility, and beliefs among a 2021 nationally representative sample of US adult current commercial tobacco users to address these research gaps.

## 2. Methods

### 2.1. Study Population

We analyzed data from the COVID-19 and Commercial Tobacco Use Study (CaCTUS), an online cross-sectional survey of a nationally representative sample of U.S. adults who reported being recent former or current commercial tobacco users conducted in January–February 2021 [[40](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B40-ijerph-20-02050)]. Inclusion criteria were: (1) residing in the U.S.; (2) adults aged ≥ 21 years; and (3) currently used commercial tobacco or have used commercial tobacco during the 12 months prior to the study (including cigarettes, cigars, e-cigarettes, hookah, and other combustible tobacco products, and smokeless tobacco products). Survey respondents were recruited from the YouGov online survey panel. YouGov constructed a sampling frame to meet study inclusion criteria by utilizing a sample-matching approach based on data from nationally representative surveys. This approach allows for similar levels of representation as the random-digit-dialing sampling approach [[41](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B41-ijerph-20-02050)]. Subsequently, demographics and commercial tobacco use history distributions of the sampling frame were utilized to recruit a sample from YouGov online panelists with matching distributions. To ensure stable statistical estimates among Black and Asian/Asian American adults, these populations were oversampled.

### 2.2. Study Procedures

YouGov online panelists were invited to participate via email. Interested individuals completed eligibility screening, and those who were eligible were then invited to complete the survey after providing informed consent. Respondents were asked about their NP awareness, use, beliefs, and susceptibility, in that order. Respondents were compensated in accordance with YouGov policy. Among the 2404 eligible panelists, 2123 completed the survey (completion rate = 88.3%). A final sample of 1700 respondents was obtained after excluding those who provided inconsistent responses or who were in groups that exceeded the study quotas. The analytic sample was restricted to 1583 respondents who reported currently using commercial tobacco at the time of survey. This analysis did not require a review by the National Institutes of Health Institute Review Board per 45 CFR 46 as this analysis did not involve identified data and thus is considered “not human subjects research”.

### 2.3. Measures

#### 2.3.1. NP Awareness, Use, and Susceptibility

Respondents were presented with an image of some popular brands of nicotine pouches (e.g., Dryft, On, Velo, and Zyn) and asked the following questions: “Have you ever seen or heard of nicotine pouches before this study?” Those who answered “yes” were classified as being aware of NPs, and those who answered “no” or “not sure” were classified as being unaware of NPs. Respondents who were aware of NPs were then asked, “Which of the following best describes your experience with nicotine pouches?” (Response options: never used it before, used it before but not currently, currently using it some days or every day.). Additionally, all respondents were asked NP susceptibility measures: “Are you curious about nicotine pouches?”, “Do you think you will try nicotine pouches soon?”, “Do you think you will try nicotine pouches in the next year?”, and “If one of your best friends were to offer you some nicotine pouches, would you use them?” (Response options: definitely not, probably not, probably yes, definitely yes). Respondents who answered “definitely not” for all four questions were classified as non-susceptible to NP use. Otherwise, respondents were classified as susceptible to NP use. Based on their responses to the NP use and susceptibility measures, respondents were further categorized into four groups: non-susceptible never NP users (non-susceptible and never used NPs), susceptible never NP users (susceptible but never used NPs), ever-non-current NP users (used NP before but not at the time of survey), and current NP users (used NPs at least some days at the time of survey).

#### 2.3.2. NP Beliefs

Respondents were randomized to view one of three images: two showed advertisements of ZYN, and one showed a white plate. They were then asked to rate their agreement with the following statements: “Nicotine pouches are less harmful than other smokeless tobacco e.g., chewing or dipping tobacco”, “Nicotine pouches are less addictive than other smokeless tobacco e.g., chewing or dipping tobacco”, “Using nicotine pouches occasionally does not cause any harm to the users”, “Using nicotine pouches occasionally does not cause users to be addicted to nicotine”, and “Nicotine pouches are for someone like me”. To avoid ordering effects, these statements were presented in random order. Responses were categorized as “agree” (including “strongly agree” and “somewhat agree”), “disagree” (including “strongly disagree” and “somewhat disagree”), and “don’t know”.

#### 2.3.3. Socio-Demographics and Commercial Tobacco Use Statuses

Socio-demographic information, including age, sex, race/ethnicity, educational attainment, annual household income, and urbanicity, was collected since they have been previously shown to be associated with commercial tobacco use (see [Table 1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/table/ijerph-20-02050-t001/) for categories of these variables). Respondents reported their age (in years), and these responses were categorized into age groups. They also chose from a list the best race/ethnicity representing them. Due to sample sizes in some response categories, those reported as Middle Eastern or North African, Pacific Islander, American Indian or Alaskan Native, and multiracial/multiethnic were grouped as other. Educational attainment was based on self-report highest grade or year of school completed. Respondents also reported their annual household income from all members and all sources in the household. Urbanicity was a derived variable provided by YouGov. Current use (i.e., currently using the product some days or every day) of the following tobacco products at the time of survey was also assessed: cigarette, electronic vaping products, cigars (including premium cigar, cigarillos, and little filtered cigars), hookah, other combustibles, and smokeless tobacco.

The present study provided estimates on the prevalence of NP awareness, ever use, and current use among a nationally representative sample of US adult current commercial tobacco users. Overall, 46.6% of these adults reported awareness of NPs, 16.4% reported ever use, and 3.0% reported current use in 2021. We are aware of two studies to date that have examined awareness and/or use of NPs among US adult current and former tobacco users [[31](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B31-ijerph-20-02050),[32](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B32-ijerph-20-02050)]. Felicione and colleagues (2022) assessed awareness and use prevalence among US current and former tobacco users in 2020, finding that 19.5% of respondents had ever heard of, 3% had ever used, and 0.9% were currently using NPs [[31](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B31-ijerph-20-02050)]. Similarly, Hrywna and colleagues (2022) examined NP awareness, interest, and ever use among a nationally representative sample of US adult current smokers in 2021 [[32](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B32-ijerph-20-02050)]. They found that 29.2% of respondents had ever heard of, 16.8% had interest in using in the next 6 months, and 5.6% had ever used. Our findings suggest that awareness of, experimentation with, and current use of NPs drastically increased between 2020 and 2021. This may be attributed to the notable increase in NP marketing by manufacturers, suggesting that the strategies implemented by the tobacco industry are working. These strategies include advertising on radio and television, as well as mobile and online displays [[42](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B42-ijerph-20-02050)]. It is noteworthy that while the NPs are under the jurisdiction of the US Food and Drug Administration (FDA), they were not included in the Comprehensive Smokeless Tobacco Health Education Act of 1986, and are therefore still allowed to advertise on radio, television, or other media, unlike conventional smokeless tobacco products [[43](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B43-ijerph-20-02050)]. Implementing federal policies to regulate NP advertising will close this loophole that is being exploited by NP companies, especially when there is no evidence that NPs are replacing combustible tobacco products or conventional smokeless tobacco.

Our study is the first to examine beliefs on NPs’ absolute harm and addictiveness, their relative harm and addictiveness to smokeless tobacco, and their social acceptability; further, this is the first study to investigate the relationships between these beliefs and NP susceptibility and use statuses. Vogel and colleagues (2022) surveyed a cohort of young adults (19–23 years) from Southern California to examine the perceived relative harm between NPs, cigarettes, and e-cigarettes [[44](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B44-ijerph-20-02050)]. They found that 19.7% of their sample believed NPs to be less harmful than cigarettes, and 13.6% believed NPs to be less harmful than e-cigarettes. In our study, we found that between 14.6% (using NP occasionally is not addictive) and 33.2% (NP is socially acceptable) of US adult current commercial tobacco users held favorable beliefs about NPs. Holding these beliefs was associated with susceptibility to and more advanced/higher levels of NP use. These findings are supported by a previous study showing that favorable NP beliefs were related to susceptibility to NP use and NP awareness [[39](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B39-ijerph-20-02050)]. While our findings suggest that holding specific favorable beliefs is associated with NP susceptibility and use, they need to be confirmed by longitudinal studies. Additionally, studies are needed to test the relative and absolute harm and addictiveness of NPs to support or refute some of these beliefs. Furthermore, federal and state authorities need to continue surveying these beliefs and potentially develop necessary public health campaigns to correct potential misbeliefs about NPs.

Three correlates of NP use are notable. First, male adults were more likely than female adults to have ever used and currently be using NPs. Previous research suggests that while smokeless tobacco product use is more prevalent among men than women [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B16-ijerph-20-02050)], both genders appear to use them for different reasons [[45](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B45-ijerph-20-02050)]. Therefore, researchers and public health officials should further investigate the reasons for using NPs among men and women. Second, young or middle-aged adults were more likely than older adults to report ever and current NP use. This is concerning, as the health impacts of these products on younger individuals, particularly among young adults whose brains are still developing, are unknown. Additionally, NP advertisements commonly promote these products as trendy through depictions of youthful models, appealing through an array of flavor options, easy and convenient as they do not require a device or inhalation, and healthy through messaging such as “tobacco-free” [[24](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B24-ijerph-20-02050),[42](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B42-ijerph-20-02050),[46](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B46-ijerph-20-02050)]. These messages may cause confusion and further increase the likelihood of use among this younger population, which is more vulnerable to nicotine addiction than older adults [[44](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B44-ijerph-20-02050),[47](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/" \l "B47-ijerph-20-02050)]. Third, current cigarette, electronic vaping products, and smokeless tobacco users were more likely than non-users to have ever used and currently be using NPs. If NP use is replacing the use of these other tobacco products, we would expect a higher prevalence of ever and current NPs use among former commercial tobacco users, not current commercial tobacco users. Our findings suggest that NPs may be co-used with other tobacco products rather than being used as a means of switching for harm reduction purposes or as a smoking/smokeless tobacco cessation aid. Future longitudinal studies are needed to illuminate our hypotheses.

The present study has limitations. First, our findings may not be generalizable to nicotine-naïve adults and youth. Future studies are needed to examine NP awareness, use, and beliefs among nicotine-naïve adults and youth to fully understand the public health impact of these novel tobacco products. Second, given the novelty of NPs, respondents may not fully understand what NPs are and found it difficult to answer the items about NP-related beliefs. We tried to mitigate this issue by providing respondents with pictures and descriptions of NPs and by including “don’t know” as an option for NP belief-related items so that respondents were not forced to agree or disagree with those items. Third, respondents were surveyed in 2021 during the COVID-19 pandemic. It is unclear how the pandemic may have affected respondents’ beliefs (particularly in relation to health risks) and use of NPs. Fourth, the data collected were from self-reports, and responses were anonymous. Self-report surveys and anonymous responses may present issues in terms of respondent bias or inaccurate reporting. Fifth, data were collected using YouGov online panel. While using an online panel does not capture individuals who do not have online access, YouGov is well respected and accepted in the field as a representative data source. Finally, due to the low prevalence of current NP use, some statistical comparisons may have insufficient statistical power to detect a small to medium effect size. As such, it is necessary to continue surveillance of NP use with large sample sizes to confirm our findings.

## 5. Conclusions

In conclusion, while NP use is currently low among US adults and current commercial tobacco users, close to half of this population were aware of these products, suggesting that NP awareness is on the rise. Additionally, a substantial proportion of this population holds positive beliefs about these products, and holding these positive beliefs is associated with susceptibility to and more advanced/higher levels of NP use. Given the NP companies’ effort in marketing their products to younger adults, restrictions on NP advertising could be necessary to prevent the co-use of NPs with other tobacco products, which could worsen nicotine addiction. Future studies are needed to examine the harm of NP use, and the role of NP use in combustible and smokeless tobacco use cessation. Continuing monitoring of NP awareness, use, and beliefs is warranted to determine the co-use of NP and other commercial tobacco products, as well as to understand NP’s roles in tobacco product use cessation.

29.theconversion.com

Oral nicotine pouches deliver lower levels of toxic substances than smoking – but that doesn’t mean they’re safe

Oral nicotine pouches – like Zyn and Velo in the U.S. – appear to be less toxic than cigarettes and deliver comparable levels of nicotine. This makes them an alternative for people who smoke. However, people who’ve never smoked are using them, too, and youth are open to trying them. These are key findings of [**our recent systematic review**](https://doi.org/10.1093/ntr/ntae131), published in the journal Nicotine and Tobacco Research.

Oral nicotine pouches are preportioned pouches sold in various flavors and nicotine strengths. They are similar in appearance and use to [traditional ‘snus’](https://www.fda.gov/tobacco-products/products-ingredients-components/smokeless-tobacco-products-including-dip-snuff-snus-and-chewing-tobacco), a form of smokeless tobacco placed between the gum and lip, which is popular in Scandinavia. However, unlike snus, nicotine pouches do not contain tobacco leaf. As a result, they are often marketed as “tobacco-free.”

One of the studies in our review found that the “[tobacco-free” label is confusing](https://doi.org/10.1371/journal.pone.0268464) to some and may lead people to think nicotine pouches do not contain nicotine.

On average, studies in our review showed that nicotine pouches had fewer harmful chemicals, present at lower levels, than in cigarettes and smokeless tobacco, like snus.

This varied by product, though. It could be that [different flavorings have different levels of harmful chemicals](https://doi.org/10.1007/s00204-023-03554-9). The [most common reasons](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html) given for using pouches were curiosity, flavors and the perception that they were discreet and could be used where other tobacco products could not.

## Why it matters

More people are using nicotine pouches [than ever before](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1).

While manufacturers claim to target people who smoke, we found that 35% to 42% of U.S. youth were aware of oral nicotine pouches. Of those who didn’t use any form of nicotine, we found 9% to 21% open to trying pouches.

As public awareness of these products is growing – due to increased use and [increased marketing](https://theconversation.com/nicotine-pouches-are-being-marketed-to-young-people-on-social-media-but-are-they-safe-or-even-legal-223084) – people want to know more about their effects. This includes people who smoke, who might switch to them, people who don’t smoke, who might use them recreationally, and policymakers.

Central to all of this is nicotine. Nicotine is not the [component in cigarettes that causes disease and death](https://cancer-code-europe.iarc.fr/index.php/en/ecac-12-ways/tobacco/199-nicotine-cause-cancer), but it is the addictive one. Too much nicotine can make you sick, and people who don’t smoke shouldn’t use nicotine products.

At the same time, though, [safer forms of nicotine](https://doi.org/10.1002/14651858.CD000146.pub5) have been helping people quit smoking for decades.

Cigarettes remain the [leading cause of preventable disease and death worldwide](https://www.who.int/news-room/fact-sheets/detail/tobacco) and [in the U.S](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm). If they completely replace smoking, alternative nicotine products have the potential to bring substantial health benefits, both to people who smoke and the people around them.

## **What still isn’t known**

There’s a lot we researchers still don’t know about nicotine pouches.

[Hundreds of randomized trials](https://doi.org/10.1002/14651858.CD000146.pub5) show nicotine replacement therapies – like gum and patches – are safe and that they help people quit smoking.

There is also an [ever-growing number of trials](https://doi.org/10.1002/14651858.CD010216.pub7) – currently 49 – showing that e-cigarettes with nicotine help people stop smoking and are substantially less harmful than smoking.

With oral nicotine pouches, however, only a handful of studies exist. Though most studies show that [pouches expose users to lower levels of toxic substances](https://doi.org/10.1093/ntr/ntae131) than smoking, these studies were often small, and most were conducted by the tobacco industry, which has a [long history of distorting science](https://truthinitiative.org/research-resources/tobacco-prevention-efforts/5-ways-tobacco-companies-lied-about-dangers-smoking).

## What’s next

We know that smoking is remarkably lethal – cigarettes [kill approximately half](https://www.who.int/news-room/fact-sheets/detail/tobacco) of regular users. It’s probably reasonable to assume and not surprising to see data indicating that pouches are less harmful than smoking. That doesn’t mean they are safe, though.

We need large, long-term independent studies to say anything for sure about the health effects of nicotine pouches. People’s use patterns and the marketing need to be carefully monitored to ensure that products aren’t being targeted at groups who don’t smoke, and particularly aren’t targeted at historically disadvantaged or marginalized groups, [as they have been in the past](https://truthinitiative.org/research-resources/topic/targeted-communities).

30.tobaccopreventioncessation.com

Nicotine pouch awareness, use and perceptions among young adults from six metropolitan statistical areas in the United States

## INTRODUCTION

Nicotine pouches, including brands such as ‘on!’, ‘Velo’, and ‘Zyn’, entered the US in 2016[1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[2](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). These products contain nicotine salts, which deliver higher levels of nicotine than the free-base nicotine in other smokeless tobacco (SLT) products[1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[2](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Since their entrance into the US market, US nicotine pouch sales and advertising expenditures have increased dramatically[3](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html)-[5](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html).

Nicotine pouches may appeal to young adults, including non-users of nicotine/tobacco products. Research on nicotine pouches among US young adults in 2021 indicated that 37.3% were aware, 29.2% reported susceptibility to use, and 3.8% had ever used them[6](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Research in other countries has also shown that, despite low use prevalence among youth and young adults, awareness has increased in these groups[7](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html)-[9](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html).

Literature from the US and elsewhere has documented factors associated with nicotine pouch awareness and use, such as perceptions. For example, some research has found that young adults hold more favorable perceptions (e.g. less harmful) of nicotine pouches compared to tobacco-derived nicotine, and more favorable perceptions predicted ever using nicotine pouches[6](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[7](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). A 2020 California-based study of young adults documented that half were uncertain about the harm of nicotine pouches relative to cigarettes or e-cigarettes, but willingness to use nicotine pouches was higher among those who used other tobacco products (i.e. other than nicotine pouches)[10](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Research in other countries has also shown that nicotine pouch use is associated with being male, younger age, and use of other tobacco products[7](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html)-[9](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html).

How nicotine pouches are marketed has implications for consumer perceptions. They are promoted via several channels, including social media, and are often marketed as ‘tobacco-free’, ‘non-tobacco’, ‘synthetic nicotine’, and as more discreet and convenient than cigarettes or e-cigarettes[3](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[11](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html)-[13](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Nicotine pouches also have high nicotine content[4](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html) and come in a variety of flavors, such as fruit flavors (e.g. black cherry, citrus), peppermint, and coffee[2](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[3](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). These types of marketing strategies have been used by e-cigarette manufacturers to entice young people[14](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Moreover, young adults who are reluctant to use inhalable products, including e-cigarettes, may be open to trying nicotine pouches.

Nicotine pouches pose complex regulatory considerations. Although the US Food and Drug Administration (FDA) recently authorized modified risk claims in advertising for several snus products[15](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), nicotine pouches have not yet obtained such authorization. Some evidence indicates that nicotine pouches have a toxicity level lower than combustible tobacco, approaching levels comparable to nicotine replacement therapy products, and also lack exposure to toxins present in some e-cigarettes, such as metals[17](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Nonetheless, the relative health effects of using nicotine pouches compared to e-cigarettes and other non-combustible tobacco products (e.g. heated tobacco products, snus) are unknown[16](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), particularly pertaining to young adults, especially depending on their prior other tobacco product use.

Given the potential appeal of nicotine pouches to young adults, research examining young adults’ product exposure, perceptions, awareness, use, and use intentions is critical to inform regulatory efforts aimed at reducing the negative impact of nicotine pouches on population health. However, research in this area is limited. Thus, this study examined nicotine pouch awareness, use, use intentions, information and product sources, and use perceptions/motives among young adults across six US metropolitan statistical areas (MSAs).

## METHODS

This study analyzed cross-sectional data among young adults in a longitudinal study, the Vape shop Advertising, Place characteristics and Effects Surveillance (VAPES) study[17](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Participants were from six MSAs (Atlanta, Boston, Minneapolis, Oklahoma City, San Diego, and Seattle) with varied tobacco legislation[18](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Study details are given elsewhere[17](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), and only summarized here.

In Fall 2018, participants were recruited via ads on social media (Facebook, Reddit) targeting eligible individuals (i.e. those aged 18–34 years, residing in one of the six MSAs, and spoke English). After clicking ads, individuals were directed to an online consent form and eligibility screener. Eligible individuals were routed to complete the online baseline survey. Upon completion, participants were notified that, in 7 days, they would receive an email asking them to ‘confirm’ their enrollment, after which they were officially enrolled into the study and emailed their first incentive ($10 Amazon e-gift card). Purposive, quota-based sampling ensured the sample represented sufficient numbers of cigarette and e-cigarette users (roughly one-third each), roughly equal numbers of men and women, and 40% racial/ethnic minority (subgroup enrollment was capped by MSA).

Of the 10433 individuals who clicked on ads, 9847 consented, of which 2751 (27.9%) were not allowed to advance because they were either: 1) ineligible (n=1472), and/or 2) excluded to reach subgroup target enrollment (n=1279). Of those who advanced, the proportion of completers versus partial completers was 48.8% (3460/7096) versus 51.2% (3636/7096). Partial completers were deemed ineligible for the remainder of the study; the majority of partial completers (n=2469; 67.9%) completed only the sociodemographic section of the survey. Of the 3460 who completed the W1 survey, 3006 (86.9%) confirmed participation 7 days later (additional information available elsewhere)[17](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html).

The current study analyzed survey data collected in Spring 2022 among a subset of participants, selected based on their age (<30 years) as well as for representation across sexes, sexual identity, racial/ethnic backgrounds, and tobacco use to the extent possible. Of the 1147 participants targeted for this assessment, 942 (82.1%) provided complete data (and compensated with a $10 Amazon e-gift card).

### Measures

We coded participants’ MSA of residence (Atlanta, Boston, Minneapolis, Oklahoma City, San Diego, Seattle, or Other due to moving since W1), and assessed their age, gender, sexual identity, race, and ethnicity. Participants were also asked to report the number of days, in the past 30 days, during which they used cigarettes, e-cigarettes, and SLT.

We began by providing images of ‘Zyn’, ‘Velo’, and ‘on!’ and stated: ‘The next few questions are about a new group of nicotine products – tobacco-free nicotine pouches. Many of these come in pouches and packages that look like snus or other smokeless tobacco, but they are white and do not contain any tobacco in them. They do contain nicotine. Some brands include Zyn, Velo, and on!’.

Primary outcomes: nicotine pouch awareness, ever use and use intentions

Awareness and ever use were assessed by asking:

‘Have you ever heard of nicotine pouches?’ and ‘In your lifetime, have you ever tried nicotine pouches?’. Those reporting ever use were asked to report past 30-day use (i.e. current use).

To assess use intentions, participants were asked: ‘How likely are you to try or continue to use nicotine pouches in the next year?’ (1=not at all, to 7=extremely). To characterize participants’ use intentions of other tobacco products, participants were also asked: ‘How likely are you to try or continue to use cigarettes, e-cigarettes, and other SLT in the next year?’ (1=not at all, to 7=extremely).

Information and product sources

To ascertain these, we asked: ‘How did you first learn about nicotine pouches, products or advertisements (paid ads): in stores; advertisements on television; magazines/newspapers; internet/social media; social media; friends/family/co-workers; and use on television/movies?’. We also asked: ‘In the last 30 days, have you noticed advertisements for nicotine pouches via: websites; social media; inside/outside tobacco retailers; television; radio; posters/billboards; newspapers/magazines; mail; or e-mail?’. Ever users were asked: ‘Where have you bought nicotine pouches: gas station; convenience store; supermarket/grocery store; did not buy; other?’.

Use perceptions and motives

We administered 12 items assessing participant perceptions of harm, addictiveness, and social acceptability of nicotine pouches, cigarettes, e-cigarettes, and other SLT. Specifically, we asked: ‘How harmful to your health/addictive/socially acceptable among your peers do you think the use of nicotine pouches/cigarettes/e-cigarettes /other SLT are?’ (1=not at all, to 7=extremely).

To assess use motives, we asked: ‘People have various reasons for considering or trying new tobacco or nicotine products. If you do not use nicotine pouches, indicate if you potentially would try nicotine pouches for each of the following reasons. If you tried or use nicotine pouches, indicate why (check all that apply.): To help quit combusted tobacco, like cigarettes or cigars; to help reduce combusted tobacco, like cigarettes or cigars; to help quit other tobacco products, like vaping products or e-cigarettes; to help reduce other tobacco products, like vaping products or e-cigarettes; nicotine pouches are less addictive than other tobacco products; nicotine pouches are less harmful to my health than other tobacco products; nicotine pouches are less harmful than cigarettes to the health of those around me; nicotine pouches are easy to use; using nicotine pouches is discreet (easy to hide); does not cause me to smell like smoke/tobacco; I was curious about the flavors; I was curious about the “buzz”; you can use nicotine pouches in places where other tobacco products are not allowed; nicotine pouches are more acceptable to non-tobacco users; a friend offered it to me; other, please specify; none of the above’.

### Statistical analysis

Participants were characterized using descriptive statistics. Next, bivariate analyses were conducted to examine the relationships between sociodemographics and current tobacco use (i.e. cigarette, e-cigarette, and SLT use) with nicotine pouch awareness and ever use. We then conducted adjusted multivariable regressions examining sociodemographic and current tobacco use factors in relation to nicotine pouch awareness (logistic regression), as well as ever use (logistic regression) and future use intentions (linear regression) among those who were aware of nicotine pouches. All analyses were conducted using SPSS v.26, and alpha was set at 0.05.

## RESULTS

### Nicotine pouch awareness, ever use and use intentions

[Table 1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html" \l "t0001) summarizes participant characteristics (mean age=27.61 years, 34.3% men, 33.1% racial/ethnic minority). [Table 1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html" \l "t0001) also characterizes participants by nicotine pouch awareness (34.6%, n=326), ever use (9.8%, n=92) and past-month use (2.2%, n=21).

Information and product sources

Among those aware of nicotine pouches, first exposure was commonly friends, family, or co-workers (30.4%), products/ads in stores (28.5%), and advertisements (11.3%). Additionally, 31.4% of those aware of nicotine pouches reported past-month advertising exposure, often via tobacco retailers (67.3%), social media (24.6%), other websites (21.0%), posters/billboards (17.8%), newspapers/magazines (8.4%), television (8.4%), direct mail (4.5%), and email (4.5%). Those reporting ever use, bought them at gas stations (46.7%), convenience stores (19.6%), vape shops (6.5%), other tobacco specialty shops (6.5%), pharmacies (5.4%), and supermarkets/grocery stores (4.3%); nearly half (46.7%) reported not buying them.

### Use perceptions and motives

Intentions to use were significantly higher among those aware of nicotine pouches and those reporting ever use of them (vs not), and were significantly higher than for SLT (but lower than cigarettes and e-cigarettes) ([Table 1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html" \l "t0001)). Nicotine pouches were perceived as significantly less addictive and harmful than cigarettes, e-cigarettes, and SLT, as well as more socially acceptable than cigarettes and SLT ([Table 1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html" \l "t0001), [Figure 1](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html" \l "f0001)). Those who were aware of nicotine pouches perceived them to be less harmful and less addictive and more socially acceptable, compared to those who were not aware. Those who reported ever use perceived nicotine pouches to be less harmful and more socially acceptable, relative to those who reported never use.

## DISCUSSION

Current findings indicate that, despite relatively low prevalence of nicotine pouch use among US young adults, there is a substantial proportion who are aware of them, and certain groups are at particular risk for use. In this sample of US young adults (which was purposively recruited to represent roughly one-third using cigarettes or e-cigarettes), one-third had heard of nicotine pouches, one-tenth reported lifetime use, and intentions to use were higher than for SLT (but lower than for cigarettes and e-cigarettes). Cigarette, e-cigarette, and SLT users were more likely aware of nicotine pouches, SLT users were more likely ever users, and e-cigarette and SLT users reported higher use intentions. These results reflect prior research examining rates of awareness and ever use of nicotine pouches[6](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html)-[9](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Furthermore, 2021 findings indicated that one-third of young adults were aware of them, but ever use rates of nicotine pouches in the current sample were higher (9.8% vs 3.8% in 2021)[6](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), which may reflect nuances of the sample or increases in nicotine pouch marketing[5](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html).

Prior research found that the greatest proportion of ad occurrences and expenditures for nicotine pouches were accounted for by radio and television, with only about 10% accounted for by digital media[11](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). However, current findings suggest that advertising via digital media and at the point-of-sale are key strategies, potentially due to their reach and ability to influence real-time purchase decisions[19](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). For example, in the current study, advertising exposure occurred via various channels, particularly tobacco retailers and online/social media, and first product exposure in this sample of young adults was commonly from friends, family, or coworkers or seeing products/ads in stores and media. Ever users commonly bought them at gas stations and convenience stores.

Results from this study also suggest the importance of marketing on shaping consumer perceptions. Nicotine pouches were perceived as less harmful and addictive than cigarettes, e-cigarettes, and SLT, as in prior research[6](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[7](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Additionally, use intentions for nicotine pouches were higher than for SLT but lower than for cigarettes and e-cigarettes. Similarly, one study of young adults found that tobacco users were more likely to choose cigarettes over nicotine pouches[10](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Current results indicate that among the most common use motives were to help quit or reduce other tobacco use, suggesting that nicotine pouches are viewed as a smoking cessation tool. This is not surprising given that they have been marketed as ‘tobacco-free’ [3](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[11](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), which might imply harm reduction[20](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html). Aligning with marketing efforts promoting nicotine pouches by emphasizing ‘freedom’, their flavors, and the strength of the nicotine[3](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html),[11](https://www.tobaccopreventioncessation.com/Nicotine-pouch-awareness-use-and-perceptions-among-young-adults-from-six-metropolitan,163243,0,2.html), other use motives included being able to use nicotine pouches where other tobacco products are prohibited, as well as curiosity about the various flavors of nicotine pouches or the potential ‘buzz’ that could result from using them.

### Limitations

Limitations include generalizability to other young adults, the cross-sectional study design, self-reported data which are subject to recall/reporting errors, and limited power for subgroup analyses due to low rates of nicotine pouch awareness/use. Given the purposive sampling design used to achieve the parent study aims (i.e. recruitment of one-third cigarette and e-cigarette users), this study was not intended to be representative and is not a probability-based sample. Thus, rates of tobacco and nicotine pouch use may be higher in our sample and should not be interpreted as use prevalence rates.

## CONCLUSIONS

The current findings raise concern about young adults’ relatively positive perceptions of nicotine pouch harm and addiction, given the marketing of nicotine pouches without FDA authorization to be marketed as modified risk products. Additionally, those who were aware and had ever used nicotine pouches were exposed to advertising and accessed nicotine pouches via various sources. These findings underscore the importance of nicotine pouch retail and marketing surveillance in order to estimate population impact and inform regulatory efforts.

31.Nicotine pouches are being marketed to young people on social media. But are they safe, or even legal?

Flavoured nicotine pouches are [**being promoted to young people**](https://www.theguardian.com/australia-news/2024/feb/07/all-good-to-take-to-school-australian-influencers-spruik-flavoured-nicotine-pouches-to-vape-addicted-youths) on social media platforms such as TikTok and Instagram.

Although some viral videos have been taken down following a series of reports in [The Guardian](https://www.theguardian.com/australia-news/2024/feb/08/albanese-government-condemns-widespread-marketing-of-nicotine-pouches-to-young-people), clips featuring [Australian influencers](https://www.tiktok.com/@anabolicgabe/video/7300486987331472641) have claimed nicotine pouches are a safe and effective way to quit vaping. A number of the videos have included links to websites selling these products.

With the rapid rise in youth vaping and the subsequent [implementation of several reforms](https://theconversation.com/from-today-new-regulations-make-it-harder-to-access-vapes-heres-whats-changing-218816) to restrict access to vaping products, it’s not entirely surprising the tobacco industry is introducing more products to maintain its future revenue stream.

The major trans-national tobacco companies, including Philip Morris International and British American Tobacco, all manufacture nicotine pouches. British American Tobacco’s brand of nicotine pouches, Velo, is a leading sponsor of the [McLaren Formula 1 team](https://www.formula1.com/en/latest/article.mclaren-new-livery-reveal-2024-f1-season.216OAbbqt6SWUjIio6GLqP.html).

But what are nicotine pouches, and are they even legal in Australia?

## Like snus, but different

Nicotine pouches are available in many countries around the world, and their sales are [increasing rapidly](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1), especially among [young people](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10203764/).

Nicotine pouches look a bit like small tea bags and are placed between the lip and gum. They’re typically sold in small, colourful tins of about 15 to 20 pouches. While the pouches [don’t contain tobacco](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/), they do contain nicotine that is either extracted from tobacco plants or made synthetically. The pouches come in a wide range of strengths.

As well as nicotine, the pouches commonly contain plant fibres (in place of tobacco, plant fibres serve as a filler and give the pouches shape), sweeteners and flavours. Just like for vaping products, there’s [a vast array](https://storage.googleapis.com/who-fctc-cop10-source/Supplementary information/nicotine_pouch_paper.pdf) of pouch flavours available including different varieties of fruit, confectionery, spices and drinks.

The range of appealing flavours, as well as the fact they can be used discreetly, may make nicotine pouches particularity attractive to young people.

Users absorb the nicotine in their mouths and simply replace the pouch when all the nicotine has been absorbed. Tobacco-free nicotine pouches are a relatively recent product, but similar style products that do contain tobacco, [**known as snus**](https://tobaccotactics.org/article/snus/), have been popular in Scandinavian countries, particularly Sweden, for decades.

Snus and nicotine pouches are however different products. And given snus contains tobacco and nicotine pouches don’t, the products are subject to quite different regulations in Australia.

## What does the law say?

Pouches that contain tobacco, like snus, have been banned in Australia since 1991, as part of a [consumer product ban](https://www.productsafety.gov.au/products/health-lifestyle/personal/tobacco-related-products/smokeless-tobacco-products) on all forms of smokeless tobacco products. This means other smokeless tobacco products such as chewing tobacco, snuff, and dissolvable tobacco sticks or tablets, are also banned from sale in Australia.

Tobacco-free nicotine pouches cannot legally be sold by general retailers, like tobacconists and convenience stores, in Australia either. But the reasons for this are more complex.

In Australia, under the [Poisons Standard](https://www.legislation.gov.au/F2024L00095/latest/downloads), nicotine is a prescription-only medicine, with two exceptions. Nicotine can be used in tobacco prepared and packed for smoking, such as cigarettes, roll-your-own tobacco, and cigars, as well as in preparations for therapeutic use as a smoking cessation aid, such as nicotine patches, gum, mouth spray and lozenges.

If a nicotine-containing product does not meet either of these two exceptions, it cannot be legally sold by general retailers. No nicotine pouches have currently been approved by the [**Therapeutic Goods Administration**](https://www.tga.gov.au/products/unapproved-therapeutic-goods/vaping-hub/nicotine-pouches) as a therapeutic aid in smoking cessation, so in short they’re not legal to sell in Australia.

However, nicotine pouches can be legally imported for personal use only if users have a prescription from a medical professional who can assess if the product is appropriate for individual use.

We only have anecdotal reports of nicotine pouch use, not hard data, as these products are very new in Australia. But we do know authorities are increasingly [seizing these products](https://www.9news.com.au/national/more-than-1-million-in-vapes-nicotine-products-seized-in-raids-across-sydney/e86beb9b-437f-4904-b0cc-d1c46bfb2ef3) from retailers. It’s highly unlikely any young people using nicotine pouches are accessing them through legal channels.

## Health concerns

Nicotine exposure [may induce effects including](https://adf.org.au/drug-facts/nicotine/) dizziness, headache, nausea and abdominal cramps, especially among people who don’t normally smoke or vape.

Although we don’t yet have much evidence on the long term health effects of nicotine pouches, we know nicotine is addictive and [harmful to health](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1). For example, it can cause problems in the cardiovascular system (such as heart arrhythmia), particularly at high doses. It may also have negative effects on [adolescent brain development](https://www.tga.gov.au/products/unapproved-therapeutic-goods/vaping-hub/nicotine-pouches).

The nicotine contents of some of the nicotine pouches on the market is alarmingly high. Certain brands offer pouches containing more than [10mg of nicotine](https://truthinitiative.org/research-resources/emerging-tobacco-products/what-zyn-and-what-are-oral-nicotine-pouches), which is similar to a cigarette. According to a World Health Organization (WHO) [report](https://iris.who.int/bitstream/handle/10665/3724 yes63/9789240079410-eng.pdf?sequence=1), pouches deliver enough nicotine to induce and sustain nicotine addiction.

Pouches are also being marketed as a product to use when it’s not possible to vape or smoke, such as [on a plane](https://www.velo.com/gb/en/blog/post/flying-with-nicotine-products). So instead of helping a person quit they may be used in addition to smoking and vaping. And importantly, there’s [no clear evidence](https://factcheck.afp.com/doc.afp.com.34JC8Q2) pouches are an effective smoking or vaping cessation aid.

Further, some nicotine pouches, despite being tobacco-free, still contain [**tobacco-specific nitrosamines**](https://tobaccocontrol.bmj.com/content/early/2022/08/05/tc-2022-057280.abstract). These compounds can damage DNA, and with long term exposure, can cause cancer.

Overall, there’s limited data on the harms of nicotine pouches because they’ve been on the market for only a short time. But the WHO [recommends a cautious approach](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1) given their similarities to smokeless tobacco products.

32.Nicotine Pouches: What to Know About the Latest Trend

Smoking rates have plunged in recent decades. However, a variety of products have flooded the market, touted as having fewer health risks. The latest example is nicotine pouches. Often marketed to appeal to young adults and downplay side effects like lung cancer, other concerns remain.

## What Are Nicotine Pouches?

A nicotine pouch is a small, permeable sack that’s designed to be placed between the lip and the gums, similar to chewing tobacco. It doesn’t contain tobacco, only nicotine and other inactive ingredients. Like vape products, pouches include mint, citrus and other popular flavorings. Depending on the manufacturer, a pouch may contain anywhere from 1-12 milligrams of nicotine.

While the pouches don’t pose the cancer risk associated with smoking and chewing tobacco, nicotine is the primary reason people struggle with [quitting smoking](https://www.uhhospitals.org/services/heart-and-vascular-services/conditions-and-treatments/tobacco-treatment-and-counseling).

“Nicotine is highly addictive in all forms,” says University Hospitals medical toxicologist and addiction medicine specialist [Ryan Marino, MD](https://www.uhhospitals.org/doctors/Marino-Ryan-1275948648). “Nicotine pouches carry the same risk for people to develop dependence, withdrawal and addiction.”

## Who’s Using Them?

There are concerns that young people may be more likely to start using nicotine pouches because they believe they are safe or safer than other products. Recent surveys of 15-24 year-olds showed that roughly:

* 16% had used nicotine pouches
* 12% were current users
* 73% of current users also smoke cigarettes
* Current users were more likely to be age 21+, male and lower income

## The Health Effects of Nicotine

Nicotine use, particularly the chronic or heavy use most often associated with [addiction](https://www.uhhospitals.org/services/addiction-services), can affect brain development and lead to long-term disabilities and other health issues.

“Adolescents appear to have higher risk for developing nicotine addiction, and nicotine is believed to have effects on brain development, particularly in learning, attention, mood and impulse control,” says Dr. Marino. “It’s hard to say what the long-term effects are with a new product, but there’s enough information to warrant concern in younger people.”

Nicotine can also raise blood pressure and increase heart rate in the short term, but seems less likely to cause long-term [cardiovascular problems](https://www.uhhospitals.org/services/heart-and-vascular-services) in the same way as tobacco does. Tobacco products are associated with significant cardiac risks and the development of heart disease.

“Nicotine is not inherently safe,” says Dr. Marino. “It is easy to accidentally end up with adverse side effects ranging from nausea, stomach upset and diarrhea to palpitations and dizziness. Beyond these effects, nicotine can be quite toxic in higher doses, so people should be careful how much they consume. It can be particularly toxic for small children, especially when it comes to the flavored formulations.”

## Nicotine Replacement for Smokers

For current smokers, nicotine pouches offer an option to help them quit. Because they don’t contain tobacco, they can provide a net positive for a current smoker’s health.

“Smoking is the unhealthiest way to consume tobacco and nicotine products. Other forms of tobacco, like chew, are still a cancer risk even though they won’t damage the lungs,” says Dr. Marino. “Pure nicotine products like pouches pose a risk for dependence and addiction along with other health effects and health problems, but they won’t cause lung disease or cancer.”

“As someone who treats the worst complications from addictive substances, it is always concerning to me when people start using potentially addictive substances or when we see increases in people using them” says Dr. Marino. “With that said, I think nicotine pouches are a valuable tool for people who use other nicotine products, particularly by allowing people an option to stop or reduce tobacco product use.”

33.academic.oup.com

Use Patterns of ONPs

Prevalence Estimates of ONP Use

Estimates of current (mostly past 30 days) and lifetime (ever) use among youth, young adults, and adults in the United States and other countries are presented in Table S2.

United States

Data from nationally representative and population-based youth surveys show lifetime ONP use among adolescents at 3.5%–4.1 % between 2019 and 2021,28 at 1.9% in 202129,30 and at 2.3% in 202231 and 2023.32 Current use was reported by 1.5%–2.0% of adolescents between 2019 and 2021,28,33 0.8% in 2021,29,30 1.1% in 2022,31 and 1.5% in 2023.32 Non-representative surveys report from 0.6%34 lifetime use in adolescents to 16%–18%35,36 lifetime and 11%–12% current use35,36 in youth and young adults in 2021–2022, with higher estimates of lifetime (11%) and current (29%) ONP use among ENDS users.37

Adult prevalence estimates from two 2021 nationally representative surveys are limited to those with a history of tobacco use and estimate current use at 3% among current and former tobacco users,38 and lifetime use at 5.6% among current smokers16 and 16.4% among current and former tobacco users.38 Various non-representative surveys estimated current use below 1% among current and former tobacco users in 202017,39 and at 2.2% among young adult cigarette and ENDS users in 2022.40 Lifetime ONP use was reported at 3% in a sample of current and former adult smokers and ENDS users in 202017 and at 10% among young adult current tobacco users in 2021–2022.40–42

Other Countries

Lifetime ONP use among adolescents was reported at 0.3% and current use at 0% in the Netherlands,43 while current use in Canada33 and England33 was below 1.5% in 2019–2020 nationally representative surveys. Among adults, current ONP use was below 0.5% in the Netherlands43 and Great Britain44 in 2020–2021, while nearly 3% of current and former smokers reported current ONP use in the United Kingdom in 2019.45

Demographic Characteristics of ONP Users

Studies investigating demographic characteristics of lifetime ONP users were largely heterogeneous in their samples and focused mainly on adult current and/or former tobacco product users (Table S3). Except for two UK studies,44,45 all were from the United States. The majority of studies found a higher likelihood of lifetime ONP use for younger adults17,35,41 or those ages 18–45,16,38,45 males,17,35,42,45 current17,38 and lifetime16,41,42 SLT users, and current cigarette and ENDS users.45 Lifetime cigarette, cigar, and ENDS use were not associated with lifetime ONP use,16,42 except in one survey.41 The findings for lifetime ONP use and ethnicity, education, and income were inconsistent across studies: Positively associated with being white and higher education levels,17,42,45 not associated with ethnicity and income,16,17 and positively associated with lower levels of education16 and lower income.35 Among U.S. adolescents, higher lifetime ONP use was observed in male and non-Hispanic white populations,28–32 and those reporting past 30-day SLT, ENDS, and cigarette use.28

Demographic characteristics of current ONP users were less studied due to small sample sizes. Studies suggest that current ONP users are likely to be young adults35,38 and ages 35–44,38,44 males,35,44,46 and current SLT,38,46 cigarette,38,44 and ENDS38,44 users as well as former smokers.44,46

Reasons for ONP Use

Non-Industry-Funded Studies

A U.S. survey40 of youth and young adults ages 18–34, many of whom used cigarettes and ENDS, found curiosity about the product (28%) and flavors (26%), use where other tobacco products are prohibited (26%), and discreet use (29%) to be the strongest motives for ever ONP use. In a Dutch survey43 of adolescents and adults ages ≥13 most common reasons for ever ONP use were curiosity about the product (over 70%), and perceived reduced harm compared to cigarettes (over 20%). The availability of flavors (31%) was the main motive for use in a U.S. sample of ONP-experienced adults.47

Industry-Funded Studies

A Swedish Match-funded U.S. study46 found that less perceived harm compared to cigarettes was the most common reason for ZYN use among current cigarette smokers (73% of respondents) and dual cigarette and SLT users (60%) who started using ZYN. The less perceived harm compared to other tobacco products was the predominant reason for using ZYN among current SLT users (65%), current other tobacco product users (71%), former tobacco users (63%), and never-tobacco users (51%). Ease of pouch use (53%) and helping to reduce (46%) or quit (52%) other tobacco use were among other common reasons.

Beliefs and Perceptions

Product Awareness

US Youth and Young Adults

Nearly 36% of middle and high school students had heard of ONPs in a 2021 representative survey.29 Awareness was especially prevalent among ever and current users of SLT, ENDS, cigarettes, cigars, and HTPs. A 2021 Southern California survey48 of young adult never-ONP users ages 19–23 found that nearly 11% were aware of ONP products, with greater awareness in current noncombustible product users (19%) and dual (combustible and noncombustible) users (20%). A 2021 survey41 of young adults ages 18–25 (with current tobacco users oversampled) found nearly 42% awareness of ONPs. In another 2021 survey, 37% of young adults ages 18–25 were aware of synthetic nicotine ONPs, in particular.42 Higher odds of awareness were associated with younger age and lifetime cigarette and cigar/cigarillo use. A 2022 survey40 of young adults ages 18–34 (with oversampled cigarette and ENDS users) found 35% ONP awareness, with higher odds among males, nonwhite participants, and those using cigarettes, ENDS, and SLT.

US Adults

A 2020 survey17 found that nearly 20% of adults with a history of smoking and/or vaping had heard of ONPs, with increased awareness among younger ages 18–24 and those ages 40–54 compared to ≥55, and among current exclusive ENDS users, dual (ENDS and cigarette) users, and SLT users compared to non-current users. Representative surveys found that in 2021, nearly 29% of adult current established smokers16 and nearly 47% of current and former adult tobacco users38 were aware of ONPs. Higher awareness was observed for ages 18–29 and 30–44 compared to ages >60, and by ever SLT user.16

Other Countries

In a 2019 UK representative survey,45 16% of adults with a smoking and/or vaping history had heard of ONPs. In a 2020 representative survey43 of Dutch adolescents and adults, 7% were aware of ONPs, with higher awareness among adolescents (9%) and young adults ages 18–24 (10%) and 25–44 (9%) compared to ages > 44.

Product Interest/Susceptibility

US Youth and Young Adults

Measures of product susceptibility varied, but generally included not being opposed to trying ONPs. Among Southern California adolescent never-tobacco users in 2021, between 9%49 and 21%50 were susceptible to trying ONPs after viewing product images. A 2021 Southern California survey48 of young adult never users of ONPs ages 19–23 found 19% susceptible to trying ONPs after viewing ONP product images and advertising. Susceptibility was lower among non-users of any tobacco products (15%) compared to combustible product users (29%), exclusive noncombustible product (snus, ENDS, or HTP) users (34%), and multi-product users (44%). In a 2021 survey42 of young adults ages 18–25, 29% were susceptible to trying synthetic nicotine ONPs in the next year, with higher odds in males, and in lifetime cigarette, ENDS, and SLT users compared to non-users. Nearly 24% of young adults ages 18–25 were susceptible to ONP use in a 2021 survey,41 with current tobacco users oversampled.

US Adults

In a 2021 representative survey,38 43% of adult current and recent former tobacco users were susceptible to ONP use. Another 2021 representative survey16 had nearly 17% of adult current established smokers expressing interest in using ONPs in the next 6 months, with greater interest observed in those who planned to quit smoking in the next 6 months or who previously tried quitting smoking, and those who ever used ONPs.

Industry-Funded Studies

In a Swedish Match-funded adult consumer panel,46 75% of dual SLT and cigarette users found ZYN appealing after viewing its packaging and product description, followed by 52% of current SLT users, 36% of current smokers, 12% of former tobacco users and 11% of never-tobacco/nicotine users.

Risk Perception

In a Southern California survey48 of young adult never users of ONPs nearly half were uncertain whether ONPs posed less harm to health than cigarettes (49%) and ENDS (52%). Uncertainty about the harm of ONPs relative to traditional SLT was also reported in a U.S. sample41 of young adults (with current tobacco users oversampled). In a U.S. representative sample38 of adult current and former tobacco users, 23% agreed that ONPs were less harmful than SLT, while 40% disagreed and 37% were unsure. ONPs were generally rated less harmful compared to cigarettes, cigarillos, and HTPs in a representative sample of Dutch adolescents and adults.43 Susceptibility to ONP use and current and lifetime ONP use were associated with favorable harm perceptions of ONPs compared to SLT and other tobacco products.38,40,41 In particular, awareness of and susceptibility to synthetic nicotine ONP use in young adults was associated with their less perceived harm than tobacco-derived ONPs.42

Experimental studies show that ONP product packaging influences risk perception. Viewing ONP packaging with a “tobacco-free” warning label was associated with reduced harm perception in young adult men51 and with reduced risk perceptions and increased use intentions among youth, non-tobacco users, and racially minoritized groups52 compared to viewing a standard FDA nicotine warning label. Risk perceptions also varied by tobacco use behavior. Viewing ONP packaging with a modified-risk tobacco product warning label was associated with reduced harm perception compared to cigarettes, but not ENDS in young adult cigarette/ENDS users.53 Adult current smokers perceived ONPs to have similar overall health risks to cigarettes (less respiratory, but more oral and gastrointestinal), while SLT users viewed ONPs as similarly or less risky than SLT.54 ONPs were perceived as less harmful by adult tobacco users versus non-tobacco users after viewing ONP pack images, regardless of the warning label presence.55

Subjective Ratings

Five industry-funded and one non-industry-funded randomized crossover studies examined subjective ratings of ONP use in established adult tobacco users, including product likability, satisfaction, intent to use again, changes in urges to smoke, and cravings for a cigarette.

Non-Industry Funded Studies

In one study,56 smokers found ONPs to be moderately appealing, but less appealing than usual brand cigarettes. Initial withdrawal relief was greater post-cigarette use, but remained comparable for both products during a 90-minute follow-up.

Industry-Funded Studies

In a BAT-funded study,57 satisfaction with different brand ONPs was assessed in current dual snus and cigarette users after a single cigarette or ONP product use. Higher scores for product likability were observed for combustible cigarettes (60%), followed by ZYN 10 mg (Swedish Match, 54%), and lowest for the lowest strength nicotine ONP (Altria’s ON! 6 mg, 29%). Higher scores for intent to continue to use the product were received for combustible cigarettes (57%) than all ONPs (14% for ON! 6 mg- 37% for ZYN 10 mg). In an Altria-funded study58 of smokers randomly assigned to ONP or own-brand cigarette use, the desire to use the product again was highest for cigarettes (86%), with ratings also high for six favors of ON! 4 mg pouches (71%–79%). Reduction in urges to smoke, cigarette craving, and positive subjective ratings (eg, pleasant, satisfying, and calming effects) were lower after ONP use of all flavors compared to cigarette use. In another Altria-funded study,59 subjective ratings of ON! were similar between 1.5 and 8.0 mg nicotine strengths, but lower compared to participants’ own-brand cigarettes and moist SLT in dual cigarette and moist SLT users. The reduction in cigarette craving and urges to smoke post-product use was comparable between ON! 8 mg and cigarettes and moist SLT. The desire to use the product again was highest for moist SLT (93%) and cigarettes (77%) compared to ONPs (46% for 8.0 mg—66% for 1.5 mg). In an Imperial Brands study,60 product likability among tobacco users was similar for cigarettes compared to 5.8 and 10.1 mg ZoneX pouches. In an Imperial Tobacco Canada-funded study61 of cigarette smokers, a 4 mg ONP showed greater product likability with 55% of responses compared to a 4 mg nicotine lozenge (19%) and 4 mg nicotine gum (9%). Product satisfaction was highest for nicotine gum (50% of responses), followed by ONP (40%) and lozenge (16%).

Overall findings indicate greater product likability, satisfaction, and desire for repeat use of combustible cigarettes and SLT than ONPs in adult smokers and dual cigarette and SLT users.

Product Characteristics

Nicotine Content and Release From Pouches

Four studies analyzed the nicotine content in ONPs, with two funded by industry

Non-Industry-Funded Studies

An analysis62 of 37 ONPs of different brands, nicotine strengths, and flavors yielded a range of total nicotine content from 0.89 mg/pouch (Velo 2 mg) to 6.73 mg/pouch (White Fox). ON! and White Fox exhibited the highest alkalinity levels (pH of 9.36), corresponding to 95.8% free-base nicotine in ON! 3 mg, 97.3% in ON! 6 mg, and 99.2% in White Fox pouches. Higher alkalinity (pH > 6) increased the amount of bioavailable free-base nicotine (the form most easily absorbed), suggesting nicotine delivery properties of ONPs comparable to snus. In another study,63 the nicotine content of 44 ONPs from 20 brands available in Germany ranged from 1.79 to 47.5 mg/pouch, with a median value of 9.48 mg/pouch. The pH levels ranged from 5.5 to 10.5, with a median of 8.8, while the median proportion of free-base nicotine was 86%.

Industry-Funded Studies

In a Swedish Match study,64 the amount of in vivo extracted nicotine from ZYN 6 mg (3.51 mg/pouch) after a 60-minute application by a sample of snus users was higher than from their General Snus 8 mg (2.41 mg/sachet). ZYN 8 mg yielded a higher amount of extracted nicotine (3.79 mg/pouch) than Longhorn 18 mg moist snus (2.99 mg/sachet) but lower than two 8mg General Snus sachets (5.04 mg). The extracted fraction of nicotine was higher from 3 mg (56%) and 6 mg (59%) ZYN than from General Snus 8 mg (32%) and higher from ZYN 8 mg (50%) than from both reference products (19% for Longhorn snus and 33% for two 8 mg General Snus sachets). A study61 by Imperial Tobacco Canada found that the fraction of extracted nicotine from a pouch after a 60-minute application varied substantially within a sample of smokers, with mean values higher for the 4 mg ONP (62%) than the 4 mg nicotine gum (33%), but lower than the 4 mg nicotine lozenge (100%).

In summary, both industry and non-industry studies indicate levels of total and free-base nicotine in ONPs comparable to conventional SLT, suggesting the ability to deliver nicotine at a similar concentration as SLT. However, studies also indicate a high degree of variability in nicotine content between ONP brands.

Pharmacokinetics

All but one randomized crossover study analyzing the pharmacokinetic properties of ONPs were funded by industry (Table S4).

Non-Industry Funded Study

In adult smokers, using ZYN 6 mg was associated with greater plasma nicotine delivery at 30 minutes than ZYN 3 mg or cigarettes.56

Industry-Funded Studies

The nicotine plasma concentration after using a ZYN 6 mg pouch was higher than General Snus 8 mg in snus users, while for ZYN 8 mg the concentration was comparable to Longhorn 18 mg moist snuff.64 An analysis of six flavors of ON! 4 mg suggested slower nicotine release and lower nicotine plasma concentration compared to smokers’ own cigarette brands.58 A subsequent analysis59 of various nicotine strength ON! pouches found lower plasma concentrations for lower strength ONPs (<4 mg) compared to own-brand cigarette and moist SLT in dual cigarette and moist SLT users, while the pharmacokinetic profile of ON! 4 mg was comparable to moist SLT, and the profile of ON! 8 mg substantially exceeded that of cigarettes and moist SLT. Nicotine release was slower for all ONPs than for cigarettes, and comparable to moist SLT.

The nicotine plasma concentration of LYFT 10 mg was substantially greater than for a cigarette and other ONPs (ZYN 10 mg and Skruf 8 mg) in dual snus and cigarette users, while nicotine release was slower for all ONPs than for a cigarette.57 Nicotine delivery was lower and slower for both 5.8 and 10.1 mg ZoneX ONPs compared to cigarette in cigarette smokers or snus users.60 Nicotine plasma concentration of BAT-manufactured 4 mg ONPs in smokers were similar to those of the same strength nicotine lozenge, but much higher than those of nicotine gum.61

Overall, studies suggest a lower plasma nicotine concentration for lower-strength ONPs (<4 mg) compared to cigarettes and SLT, while higher-strength ONPs (≥6 mg) may deliver comparable or higher nicotine than conventional SLT products and cigarettes.

34.nytimes.com

# Can Nicotine Pouches Like Zyn Harm Your Health?\

Senator Chuck Schumer [called this week for a crackdown](https://www.cbsnews.com/newyork/news/schumer-calls-for-federal-action-on-zyn-nicotine-pouches/) on ZYN, a nicotine pouch that has become increasingly popular in the United States, alongside the rise of so-called [Zynfluencers](https://www.nytimes.com/2024/01/12/opinion/children-nicotine-zyn-social-media.html) who tout the product online.

Nationwide sales of nicotine pouches, which users tuck into their upper lips, [rose dramatically](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9667333/), with 808 million pouches sold in the first three months of 2022 alone, according to an [analysis](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9667333/) of four major brands. ZYN, which has quickly established a large footprint in the United States, accounted for the majority of sales in the analysis.

“These nicotine pouches seem to lock their sights on young kids,” Senator Schumer said, warning that products like ZYN could hook a new generation on nicotine. A [2023 study](https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a1.htm?s_cid=mm7244a1_w) from the Centers for Disease Control and Prevention found that around 1.5 percent of middle and high school students reported using nicotine pouches in the last 30 days.

[ZYN says its product](_blank) is only for consumers 21 and older who already use nicotine. “Our marketing practices — which prohibit the use of social media influencers — are focused on preventing underage access and set the benchmark for the industry,” a representative for Phillip Morris International, the parent of the company that manufactures ZYN, wrote in a statement.

Because ZYN and similar pouches are relatively new, their long-term health effects aren’t clear, said Minal Patel, a senior principal scientist at the American Cancer Society. The risks will largely depend on who’s using them and how often. Nicotine pouches are much less harmful than cigarettes, said Jonathan Foulds, a professor of public health sciences and psychiatry at the Penn State University College of Medicine, and so for someone who currently smokes, switching to a pouch may lower health risks.

But for people who have never used tobacco — especially teens and young adults — experts urge caution.

Newer products like ZYN could “really drive nicotine addiction and nicotine enjoyment,” said Dr. Panagis Galiatsatos, a pulmonary and critical care medicine physician at Johns Hopkins Medicine. “It’s the same problem we face with electronic cigarettes.”

## What are nicotine pouches?

Nicotine pouches are small, pillow-like containers of nicotine salt, which absorbs through tissues in the mouth. They often contain flavors and sweeteners and look similar to snus, a type of tobacco pouch [popular in Scandinavia](https://www.thelancet.com/journals/lancet/article/PIIS014067360761530X/fulltext). The nicotine in ZYN is derived from tobacco leaf. But unlike other nicotine-containing products, such as snus, [chewing tobacco and dip](_blank), ZYN and similar pouches don’t contain tobacco leaf itself.

## What’s known about nicotine and cancer risk

Nicotine is not considered a carcinogen. While smoking cigarettes can cause lung and other cancers, and snus has been linked to increased risk of [gastrointestinal cancers](https://onlinelibrary.wiley.com/doi/10.1002/ijc.34643), the cancer risks of tobacco-free nicotine pouches aren’t yet clear. The pouches may contain other carcinogens, Dr. Patel said.

“Most of what we know comes from the nicotine pouch industry,” said Brittney Keller-Hamilton, an assistant professor at The Ohio State University College of Medicine who has studied nicotine pouches. A rare independent study looked at [46 pouch](https://tobaccocontrol.bmj.com/content/early/2022/08/05/tc-2022-057280) products in Germany and found that 26 contained compounds known as tobacco-specific nitrosamines, which can cause cancer. ZYN nicotine pouches do not contain “any quantifiable levels” of these compounds, a representative said in an email.

## Other potential health harms

The nicotine in these pouches can be addictive. They are typically sold in the U.S. in around three or six milligram strengths; cigarettes [typically contain](_blank) 10 to 14 milligrams of nicotine, by comparison.

Teens are particularly vulnerable to addiction, because their brains aren’t fully developed, said Dr. Keller-Hamilton. “We don’t know what the end result of what a young person using nicotine pouches is — we don’t know if they would just stay using nicotine pouches until they quit, or if they start seeking other forms of nicotine that might have faster nicotine delivery, like a cigarette,” she said.

Brian King, director of the Food and Drug Administration’s Center for Tobacco Products said in a statement that the agency “remains concerned about any tobacco product that may appeal to youth.” (The F.D.A. classifies nicotine pouches as tobacco products.)

Some experts think nicotine [deteriorates gum tissue](https://www.hindawi.com/journals/ijd/2023/9437475/), which could lead to periodontal disease, said Irfan Rahman, a researcher at the University of Rochester Medicine who has studied nicotine pouches.

Nicotine can also [increase blood sugar](https://www.cdc.gov/diabetes/library/features/smoking-and-diabetes.html) and [raise your heart rate](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4958544/) and blood pressure. “It probably has a small, but real effect on your cardiovascular risk,” Dr. Foulds said. Nicotine may also [harden the walls of arteries in the heart](_blank), contributing to heart disease and attacks.

Experts are also concerned about the risks nicotine pouches pose to pregnant women and their fetuses. Dr. Bendik Brinchmann, a physician and researcher at the National Institute of Public Health and the National Institute of Occupational Health in Norway, said that [several studies](https://onlinelibrary.wiley.com/doi/10.1111/add.16114) show women who use snus during pregnancy may face a higher risk of preterm birth and stillbirth, which he suspects are related to nicotine exposure. Those risks may carry over to tobacco-free nicotine pouches, he said. “My major concern is towards the young women that really can get addicted to this,” he said.

“If you start, it’s much harder to quit.”

35.mobil.bfr.bund.de

Health risk assessment of nicotine pouches Updated BfR Opinion no. 023/2022, 7 October 2022 Nicotine pouches are new, tobacco-free products that contain a powder made up of nicotine salts and filling materials. The German Federal Institute for Risk Assessment (BfR) has assessed the health risks from these products based on existing studies and data. This updated assessment includes an evaluation of experimental studies conducted by the BfR. Pharmacokinetic studies show that at least half of the nicotine in the pouch can be absorbed. Relevant nicotine blood levels were achieved, i.e. levels were within a range that is comparable with conventional cigarettes. Use of high-dose products led to significantly higher nicotine levels than cigarette consumption. The German state authorities classify nicotine pouches as a ‘novel food’. 1 Subject of the assessment Nicotine pouches are new products, first described in countries such as Sweden, the US and the UK in 2019 [1]. In Germany, these products also formed the subject of a Bundestag resolution (Bundestag paper 19/20667 of 1 July 2020) in 2020. Nicotine pouches are small pouches that contain nicotine-based powders. According to the manufacturer, nicotine salts are used, which are mixed with microcrystalline cellulose, various other salts (including sodium carbonate and hydrogen carbonate), citric acid and flavourings [1]. These products do not contain tobacco. The BfR was asked to perform a health risk assessment for nicotine pouches. Nicotine pouches are also sometimes referred to as ‘all-white’ products.

2 Results Nicotine pouches are new, tobacco-free products The highest nicotine content identified by the BfR was 47.5 mg nicotine/pouch. Investigations by the BfR found tobacco-specific nitrosamines (TSNAs) in some of the nicotine pouches. Pharmacokinetic studies show that at least half of the nicotine in the pouch can be absorbed. Relevant nicotine blood levels are achieved, i.e. nicotine levels are within a range that is also achieved after consuming conventional cigarettes and some e-cigarettes. Use of high-dose products was observed to cause blood levels significantly higher compared with cigarette consumption. The rise in nicotine levels in blood was comparable with the rise following cigarette consumption, which suggests an addictive effect from high-dose nicotine pouches comparable with that known for cigarettes.

A few cases of poisoning from nicotine pouch use have been reported but none with a severe course. Nicotine is a toxic, biogenic alkaloid. For the oral exposure route, an acute toxicity estimate of 5 mg/kg bodyweight has been defined. Nicotine increases the risk of stillbirth and has strong effects on the cardiovascular system. The long-term effects of using nicotine pouches cannot be assessed on the basis of the limited amount of data available. Nicotine pouches are currently classified as a ‘novel food’ by the federal state authorities in Germany and are being withdrawn from the market as they exceed the acute reference dose for nicotine. In terms of effects on health, the BfR defines the following high-risk groups: Children, adolescents and non-smokers, as nicotine is an addictive substance. Pregnant and breastfeeding women, because of the effects of nicotine during pregnancy and its passage into breast milk. People with cardiovascular disease, as nicotine has strong cardiovascular effects 3 Rationale Nicotine is a natural component of tobacco leaves; the tobacco used in cigarettes contains up to 1.5% nicotine [2]. The use of cigarette tobacco, pipe tobacco and chewing tobacco is well researched and is not the subject of this assessment. Reference to the effects of cigarette consumption is made again at the end of the report. Nicotine is used as a component of liquids for electronic cigarettes (e-cigarettes). In the EU, this use is regulated in the Tobacco Products Directive (2014/40/EU), with e-cigarettes being products that do not contain tobacco. Nicotine is also used in medicines/medical devices for replacement therapy for smoking cessation.

In Sweden and some other countries, tobacco is marketed in small pouches that are placed between the upper lip and gums for a certain period of time. These products are also often flavoured. In Sweden, this form of tobacco is called ‘snus’ and has a long tradition of use in the country. In the EU, the sale of snus is prohibited with the exception of Sweden. In the USA, comparable products are available, which are usually referred to as ‘snuff’ although not technically identical. In the recent years, new products were launched on the market that do not contain tobacco in their pouches, but rather nicotine salts, inactive ingredients, flavourings and other additives. This health risk assessment from BfR focuses only on the use of nicotine in such pouches. In the following sections, this assessment also draws on studies and evaluations that deal with oral tobacco products such as Swedish snus. Studies evaluating the health hazards of tobacco smoking have not been considered here, as it is well known that, alongside nicotine, numerous other toxicologically relevant compounds can be found in tobacco smoke that also contribute to the various harms resulting from smoking tobacco. In the Netherlands, nicotine pouches containing 0.035 mg or more of nicotine have been banned since 9 November 2021. Denmark is planning to introduce a national register of tobacco-free nicotine pouches.

3.1.1 Hazard identification The BfR carried out its own analyses to gain some initial insights into the chemical composition of nicotine pouches. A total of 44 nicotine pouches were purchased online and then tested for weight, nicotine content and pH. In addition, concentrations of tobacco-specific nitrosamines (TSNAs) were analysed and pack labelling was evaluated [3]. The rate of nicotine release was characterised with the help of in vitro experiments into solubility. The pharmacokinetic study on nicotine absorption following product use by test subjects was completed together with the Tobacco Dependence Outpatient Clinic at LMU Munich. As with e-cigarettes and heated tobacco products, flavourings have a strong impact on the appeal of nicotine pouches. Definitions for flavoured or non-flavoured products, along with potential regulatory schemes, are currently being discussed [4]. Chemical characterisation of the flavourings used is in progress at the BfR. The median weight per pouch was 0.6 g and the nicotine content per pouch was 9.48 mg. The highest nicotine content was 47.5 mg per pouch and the lowest was 1.79 mg per pouch [3]. In 2020, the Dutch National Institute for Public Health and the Environment (RIVM) published a monograph on nicotine pouches in which pouch weights of 0.25 to 0.8 g were described. Nicotine content was found to be within a range of 1.6 to 32.5 mg per pouch in this monograph [5]. A study from the US CDC (Centers for Disease Control and Prevention) investigated 37 brands from 6 manufacturers, with the highest nicotine content being 6.11 mg per pouch [6]. An investigation of products by one manufacturer revealed a weight of 0.7 g for four products [7]. The nicotine levels of these four products ranged from 4.06 to 11.9 mg per pouch [7]. A study from the USA on snus from northern Europe and from the USA revealed pouch weights ranging from 0.33 to 1.13 g, with nicotine content in the snus samples being between 6.81 and 20.6 mg/g [8].

These figurative terms were then compared with the nicotine content per pouch as analysed. Products with a nicotine strength indicated as light had a slightly lower nicotine content than products stating they were of average nicotine strength. For products whose nicotine strength was described within the range ‘medium’ to ‘extra strong’, there was a lot of overlap, rendering a clear differentiation difficult. One reason could be that some manufacturers meant the nicotine content per pouch and others per gram. However, this fact is not apparent to the consumer. Switching between products from different manufacturers can result in nicotine content per pouch doubling even though the nicotine strength of these products is described using the same terms. For products whose figurative descriptors could be interpreted as indicating a higher nicotine strength than ‘extra strong’ (such as ‘ultra’, ‘extreme’, ‘danger strong’ and ‘brutal’), analysed nicotine content ranged from 12.1 mg per pouch (product described as ‘ultra’) to 47.5 mg per pouch (product described as ‘brutal’) [3]. Almost all products carried a warning advising against consumption by minors. However, Barely one in four products carried a warning about use during pregnancy. Due to the acute toxicity of nicotine, labels for products with a nicotine content of 2.5 mg/g or higher must bear the GHS07 pictogram (exclamation mark, signal word: ‘Warning’) while those exceeding 16.7 mg/g must bear pictogram GHS06 (skull and crossbones, signal word: ‘Danger’) [3].

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# Clinical study protocol on electronic cigarettes and nicotine pouches for smoking cessation in Pakistan: a randomized controlled trial

## Introduction

There are more than a billion consumers of higher risk tobacco products worldwide, including cigarettes, bidis, and cigars. The World Health Organization (WHO) estimates the tobacco pandemic kills more than eight million people annually [[1](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR1)]. In LMICs, where the burden of smoking-related illness and mortality is highest, the majority of the world’s 1.1 billion smokers reside [[2](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR2)]. With 29 million active adult tobacco users, Pakistan is one of the most vulnerable LMICs in South Asia. More than 45% households in Pakistan use tobacco [[3](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR3)].

Estimates say tobacco kills around 163,600 people each year in Pakistan. Secondhand smoke is responsible for over 31,000 of these deaths [[4](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR4)]. Annually, on average, 82 billion cigarettes are consumed [[5](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR5)]. A total of 16.8 million adults who work indoors and 56.3 million at home are exposed to secondhand smoking [[6](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR6)]. The total cost of all smoking-related illnesses and fatalities in 2019 was Rs615.07 billion (US $3.85 billion). However, the Rs120 billion collected in taxes from the tobacco industry in 2019 covered only 20% of the overall costs associated with smoking [[7](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR7)].

Pakistan’s tobacco control initiatives have focused on restricting or disrupting the demand for cigarettes, with little emphasis on cessation. The country has employed various initiatives, such as cessation clinics, public awareness campaigns, and restrictions. However, the number of smokers has grown over time. The efficacy of such therapies is questionable and requires factual research. Furthermore, information about cigarette cessation services is not readily available; few people are aware of this. Even well-educated young smokers who want to quit are unaware of the cessation programs [[8](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR8)]. Due to a lack of knowledge about cessation services, almost half of all tobacco cessation attempts in Pakistan are unassisted [[9](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR9)].

THR has garnered a lot of attention as a potential smoking cessation aid globally. As a result, numerous international studies have been conducted to evaluate the efficacy of e-cigarettes with traditional cessation approaches and nicotine replacement therapy (NRT). To determine the effectiveness of e-cigarettes in helping people quit smoking, a number of randomized controlled trials (RCTs) were carried out using a variety of study designs and participant criteria. These studies included Lee et al. [[10](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR10)], Walker et al. [[11](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR11)], Smith et al. [[12](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR12)], Chiang et al. [[13](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR13)], Nancy et al. [[14](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR14)], Halpern et al. [[15](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR15)], Martinez et al. [[16](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR16)], Tseng et al. [[17](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR17)], and Janet et al. [[18](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR18)]. Results from these trials suggested comparable effectiveness between e-cigarettes and certain NRTs, counselling, and non-nicotine, indicating that e-cigarettes might offer a viable alternative for individuals attempting to quit smoking. However, findings also highlighted the importance of additional research to understand the broader impact of e-cigarettes on both individuals and populations, especially considering potential side effects and long-term consequences.

Recent studies on barriers to smoking cessation suggest that the social interaction and friendships at work, home, and in public are the primary motivators for initiating smoking. The main deterrent to obtaining medical help to quit smoking seems to be lack of knowledge about its availability. The knowledge regarding THR, particularly e-cigarettes, can be described as imprecise. In Pakistan, tobacco control initiatives lack focus on quitting smoking. To help people stop smoking, medical and professional support is a must. This support should be provided with education campaigns about the harms of combustible smoking and the role of THR in smoking cessation [[19](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR19), [20](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR20)]. On the other hand, both the public and health professionals have little knowledge regarding nicotine. More than two-thirds of doctors (70%) in Pakistan think nicotine causes cancer. With the use of research-based therapies and communication strategies, misconceptions about nicotine can be corrected [[21](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR21)].

THR is barely making its presence felt in Pakistan. Individuals and business owners of the THR products remain wary of any possible regulations/rules that may delay or shut down their businesses. There are no clear or defined rules and regulations governing the use of THR, including import, manufacturing, or product content. E-cigarettes and other THR products are legally imported as consumer goods and subject to taxation. The availability of data regarding THR products and their use is limited. According to some estimates, the number of THR users in Pakistan is somewhere between 30,000 and 50,000 with unreliable evidence of dual use of conventional smoking and vaping. Most of the vaping outlets in Pakistan are in the upscale localities of major cities such as Karachi, Lahore, Rawalpindi, and Islamabad.

In this context, this study proposes a randomized controlled trial and primary data from two metropolitan districts — Islamabad and Rawalpindi — to examine the effectiveness and role of electronic cigarettes and nicotine pouches for smoking cessation in Pakistan. This would be the first nationwide clinical investigation into the effectiveness of nicotine pouches and e-cigarettes. This study is important because it looks specifically at the use and efficacy of nicotine pouches and e-cigarettes for quitting smoking in Pakistan. Numerous statistics demonstrate that Pakistan bears a heavy burden of tobacco-related sickness and death. The tobacco control policies have mostly focused on reducing the market for cigarettes, with little attention on programs for quitting. The number of smokers has increased in spite of numerous efforts. This important knowledge gap will be filled by the study through the implementation of a randomized controlled experiment. The study intends to produce empirical evidence that could potentially inform laws, regulations, and healthcare strategies suited to the Pakistani population and globally by performing the first nationwide clinical investigation on the efficacy of these items. With its thorough approach, it intends to add to the body of knowledge already available on smoking cessation therapies while also attempting to shed light on the practical consequences of employing THR products for quitting in developing countries.

The section on literature review presents the theoretical and empirical review about e-cigarettes and nicotine-related interventions, sample, methodology, and results. The “[Materials and methods](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "Sec13)” section describes the data and its sources as well as the methodology. The “[Discussion](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "Sec30) section” describes the THR scenario in terms of policy and regulation. The last section encapsulates the conclusions.

## Literature review

### Theoretical review

The act of burning tobacco and inhaling smoke is referred to as smoking tobacco. It is believed that pipe use began in Mesoamerica and South America from 5000 to 3000 BC. The burning of tobacco produces nicotine and other hazardous chemicals including nitrogen, carbon monoxide, and tar. As an addictive chemical, nicotine’s addiction depends on the way it is consumed. Cigarettes remain the dominant global nicotine delivery vehicle, and the global nicotine ecosystem is highly concentrated. However, the main risks associated with cigarettes are the chemicals produced during combustion, instead of nicotine, which makes them dangerous. Other compounds in smoke, such as tar, tobacco-specific nitrosamines, and benzene, primarily cause smoking-related diseases.

#### Biological aspects

A cigarette produces around 6000 chemical particles, which are the main cause of risks to human health [[22](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR22)]. Many studies show smoking kills millions of people worldwide every year. Smoking is the cause of diseases of the heart, lungs, mouth, stomach, and brain [[23](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR23)]. It also affects male and female fertility, sperm count, and mobility and increases the probability of miscarriage [[24](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR24)]. A recent study shows smoking is the leading cause of coronary heart disease, which affects people of all ages [[25](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR25)]. Another indigenous study reveals tobacco and clinical tuberculosis together account for half of adult male fatalities from tuberculosis between the ages of 25 and 69. This shows they lose, on average, 20 years of life expectancy, which is crucial for the economy [[26](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR26)]. The results of another 50-year-old follow-up study show two out of three smokers who start smoking early die from smoking-related causes. The likelihood of dying because of smoking was extremely high [[27](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR27)]. Numerous gases and particles as well as minute amounts of radioactive particles are released when people smoke tobacco. These gases and particles enter lungs, travel through blood circulation, and affect every body organ, impairing their functionality, including the lungs, brain, heart, kidneys, and stomach. This causes high blood pressure, irritate the lining of bronchial tubes, harm the inner walls of arteries, platelets, and abdomen aortic aneurysm, along with clots and blockages, decreased oxygen and blood flow, and the slow movement of lung’s cilia [[28](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR28), [29](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR29)].

#### Psychological aspects

The most crucial factors in determining what prevents a person from quitting smoking are smoking behavior and personality traits [[20](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR20), [30](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR30)]. Most tobacco or cigarette users think smoking helps them cope with anxiety, stress, and depression [[31](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR31)]. According to some studies, smokers puff cigarettes to reduce negative emotions and prevent unfavorable emotional disorders [[32](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR32)]. The relationship between smoking and psychological issues such as depression, stress, and anxiety is strong [[33](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR33)]. Most research indicates in this regard smokers have their own beliefs and presumptions. According to a study [[34](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR34)], smokers claim they smoke to relieve stress and enjoy themselves. Others argue smoking eases mental discomfort and calms the mind [[35](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR35)]. Though most smokers are confident about quitting when they want to, they are unable to give up the habit [[20](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR20)]. However, studies show that moderate and heavy smokers experienced higher levels of anxiety and depression compared to nonsmokers [[36](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR36)]. Social connections are crucial for both physical and psychological health. Even under extreme stress, empathy aids in managing emotions and feelings and encourage helpful behaviors [[37](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR37)], and one of the factors influencing smoking behavior is a lack of empathy [[38](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR38)].

#### Social and cultural aspects

The most crucial factors in implementing the smoking cessation initiatives are social and cultural characteristics of the individual and the community. A variety of social and cultural context-related factors influence smoking behavior [[39](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR39)]. A significant obstacle to quitting smoking is social acceptance of its risks [[20](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR20)]. Numerous studies highlight the lack of properly implementing tobacco control policies as one of the causes for the societal acceptance of smoking in public areas, workplaces, educational and healthcare institutions, and in local communities [[40](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR40)]. A study highlights [[41](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR41)] young smokers as “social smokers,” who exhibit less desire to give up smoking. These groups are influential in leading other teenagers and youngsters to smoking. Peer pressure is commonly acknowledged as a critical element in initiating young people’s early nicotine experimentation and their decision to continue smoking [[42](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR42)].

In numerous cultures, the tobacco plant, and its byproducts, such as snuff and cigarettes, is also meaningful. Across cultures, tobacco use has different connotations. Smoking has a direct relationship with culture and religious practices. Most religions, including Christianity, Judaism, Buddhism, Islam, and Hinduism, have anti-smoking stances, and those who participate in religious activities tend to smoke less frequently [[43](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR43)]. In many countries, men are more likely than women to smoke. These social and cultural factors affect how a government chooses to implement tobacco control policies.

#### Economic aspects

Smoking has a significant negative economic impact everywhere. The economic cost is classified into three categories — direct, indirect, and intangible. The cost of smoking-related diseases is assessed using a direct approach, and the indirect cost is determined by the loss of productivity and the absenteeism of smokers owing to smoking-related illnesses. The intangible costs cannot be easily quantified, such as loss of life and the burden of pain and suffering caused by smoking-induced illness [[44](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR44)]. Several studies have also calculated the economic cost of smoking in developed nations. In developing nations, there is little concrete information or documentation regarding the economic cost of smoking. However, the burden of noncommunicable diseases (NCDs) is significant in developing nations. NCDs result in decreased productivity and income at the household level. At the national level, smoking-related illnesses result in economic and productivity losses and are estimated to be in billions of dollars annually [[45](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR45)]. The other indirect economic cost is the spending to reduce smoking prevalence. The developed and developing countries spend billions of dollars on the tobacco control programs [[46](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR46)].

#### Nicotine, tar, and carbon monoxide

Michael Russell, who is considered the father of tobacco harm reduction, said: “People smoke for the nicotine, but they die from the tar.” One of the first researchers to identify nicotine as the primary reason smokers become addicted, Russell, was an early developer of and advocate of nicotine replacement therapy (NRT). He came up with the idea medium and high nicotine, low tar cigarettes [[47](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR47)]. Tar paralyzes and can eventually kill cilia in the airways, and when damaged, the toxins in tar can travel deeper into lungs. Eventually, this can result in emphysema, bronchitis, and lung cancer. The toxins can be carried into the bloodstream and begin moving to other parts of body and damage the heart, brain, and stomach. Carbon monoxide is a poisonous gas that takes the place of oxygen in blood. This forces heart to work much harder and stops lungs from working properly. Cells and tissues are prevented from getting the oxygen they need. This can lead to heart disease and stroke [[48](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR48)].

### Empirical review

A chronological and systematic empirical review has been employed to understand the previous research structure. These included the goals of the study, the testing of hypotheses, the use of data, the primary and secondary outcomes, the participant eligibility standards, the methodological framework, statistical analysis, and variable associations and factual findings. Authors first searched and evaluated clinical studies on smoking therapies to control smoking or lower the relative risk of smoking by using tobacco harm reduction products such as e-cigarettes, nicotine patches, public awareness campaigns, and other NRTs.

The authors carefully evaluated the search results’ titles and/or abstracts, and any papers that were not relevant were eliminated. The authors independently acquired full copies of the remaining studies and evaluated them to ensure they matched all inclusion criteria such as study topic, participants, interventions, and outcome measures. Where needed, the authors were approached for more information to help with the decision-making process with regard to irrelevancy or lacking sufficient information. As a first step, 20 potential studies pertaining to various interventions for controlling and quitting smoking were selected. The selection of the studies, published between 2015 and 2020, was based on a sampling design, methodological framework, and analysis.

Out of the 20 studies on e-cigarettes and NRTs, eight were conducted in the USA; three in New Zealand; two in the UK; two each in Italy, Canada, and Australia; and one in South Korea. These studies have been conducted in the developed countries where the health institutions are well equipped and administered efficiently. On the other side, the populations of developing nations have limited access to modern, well-run healthcare facilities. Understanding tobacco harm reduction, especially the role of e-cigarettes and NRTs in quitting smoking, is still lacking in these countries. Additionally, healthcare research and development are also lacking. Mostly studies used two-arm study design. However, seven studies used three-arm study design. All the selected studies have been published in renowned journals.

#### E-cigarettes with NRT intervention

A randomized trial of e-cigarettes for quitting smoking conducted by a study [[49](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR49)] used a three-arm design — e-cigarettes with nicotine, nicotine patches, and placebo e-cigarettes. The criteria for eligibility included at least 18 years old, smoking 10 or more cigarettes per day (CPD) for the previous year, wanting to quit, and being able to give consent. The main result was quitting smoking for seven days. The follow-up periods were 1, 3, and 6 months. The treatment and the control groups were compared with multivariate regression adjustment and the χ2 test. According to the findings, e-cigarettes, whether they included nicotine or not, were only slightly more efficient than nicotine patches at aiding smokers in quitting. A few negative side effects were also noticed. E-cigarettes’ role in tobacco control was found to be unclear, with additional research recommended to clarify their overall advantages and disadvantages, both for individuals and for populations.

To determine the effectiveness of e-cigarettes and NRT for smoking cessation, another study [[50](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR50)] conducted a two-group pragmatics multicenter RCTs. The first group received nicotine replacement treatment, while the second group was given cigarettes. To examine the effects of e-cigarettes and NRT, a total of 884 subjects were analyzed using follow-up technique. The primary objective was sustained abstinence for 1 year. It was confirmed biochemically and assessed using a mixed-method analysis with binary regression and the generalized linear method (GLM), while secondary outcomes included participant-reported treatment use and respiratory symptoms. E-cigarettes were found to be more effective method of quitting smoking compared to NRT. Lee et al. [[10](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR10)] conducted a two-arm, single-center RCT to examine the efficacy of e-cigarettes and NRT for smoking reduction and cessation. Male adults over 18 who had smoked for at least 3 years and who were motivated to quit smoking altogether or cut back on their cigarette intake were qualified as eligible subjects if they had smoked at least 10 CPD in the year prior.

The 9- to 12-week and 9- to 24-week continuous abstinence rates served as the primary outcomes, and the 7-day point prevalence of abstinence at weeks 12 and 24 was the secondary outcome. The primary and secondary outcomes of the interventions were determined by a mixed analysis with independent t-test, Fisher-Freeman-Halton extension of Fisher’s probability test, and logistic regression analyses. The results of 150 participants revealed that nicotine gum and e-cigarettes had comparable effects on quitting smoking. E-cigarettes were also well tolerated by the study participants. Consequently, using e-cigarettes as an NRT to quit smoking may be a good option. Bonevski et al. [[51](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR51)] conducted a pilot RCT comparing nicotine vaping products to NRT for smoking cessation. Under the pragmatic two-arm design, one group received NRT control plus telephone Quitline behavioral assistance, and the other group received nicotine vaping product plus telephone Quitline behavioral support.

The study was open to adults aged 18 and up who were tobacco users at the time of enrollment and had the competence to provide informed consent. The primary outcome was 7-day point prevalence abstinence with no more than five cigarettes since the date of quit. At baseline, the secondary outcomes quitting self-efficacy, motivation to quit, and the heaviness of smoking index were examined. To compare the outcome responses between the treatment and control groups at the 6- and 12-week follow-up strategies, the study employed mixed-effect models with logit and generalized linear regression conical link functions. An analysis of 63 respondents showed NRT combined with Quitline counselling was more appealing for quitting smoking. Participants who reported decreased cigarette cravings, decreased perceptions of withdrawal symptoms, and decreased cigarette smoking reported using both nicotine vaping products and NRT.

Walker et al. [[11](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR11)] carried out a three-arm pragmatic RCT with nicotine patches, nicotine e-cigarettes, and nicotine-free e-cigarettes. A total of three groups were given nicotine patches, nicotine patches and nicotine e-cigarettes, and nicotine patches and nicotine-free e-cigarettes, respectively. The qualified requirements were a current smoker who was at least 18 years old and wanted to stop smoking. The primary outcome was exhaled carbon monoxide (CO)-verified continuous smoking abstinence 6 months after the agreed quit date measurement with a Bedfont Smokerlyzer with a reading of nine ppm or lower sign. The secondary outcomes included continuous abstinence at 12 months using 7-day point prevalence abstinence (no cigarettes, not a single puff, in the previous 7 days) technology at quit date, 1, 3, and 6 months after the agreed quit date. This study used quit rates, relative risks, and risk differences at 95% confidence intervals for both the treatment and the control groups. Overall, 1124 participants received interventions. Using nicotine patches along with a nicotine e-cigarette can modestly improve smoking cessation results compared to using patches along with a nicotine free e-cigarette or using patches alone, with no signs of short-term harm.

Smith et al. [[12](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR12)] two-arm RCT gave e-cigarettes to one group and NRT to the other group. Smokers with a history of unsuccessful quitting attempts and no preference to use NRT or e-cigarettes were included as the participants for the study. The primary goal was a minimum 50% reduction in cigarette intake that was biochemically validated at 6 months, and the secondary outcome was sustained abstinence validated at 6 months. The less than 8-ppm CO level was utilized. To calculate the relative risk of e-cigarettes against NRT, binomial regressions were carried out using the generalized linear model with binomial distribution and logarithmic link. When the parametric assumptions were not met, Wilcoxon’s signed-rank tests compared the differences in product ratings and CPD between research arms. The analysis of all 135 participants revealed that e-cigarettes were superior to NRT in facilitating validated long-term smoking reduction and cessation.

#### E-cigarettes with counselling

To determine the effects of e-cigarettes and smoking cessation in pregnant women, Chiang et al. [[13](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR13)] conducted a two-arm RCT. The first group received cigarettes and text messages, while the other group received e-cigarette with dual use of cigarettes and text messages. The eligibility age was 14 years or older, currently pregnant, possesses a smartphone, willingness to receive texts, and smoked at least 15 cigarettes in the past 2 weeks. The impact of e-cigarettes on CPD was the primary outcome. Smoking cessation at the 7-day period of abstinence was the secondary outcome. The effect of e-cigarettes was investigated with the simple mean difference values. The results of this pilot study with 471 participants showed that e-cigarette’s impact on smoking behaviors among pregnant women in the USA is mixed, and relative effect of e-cigarettes on smoking reduction should be examined in future.

A study by Nancy et al. [[14](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR14)] examined the relationship between e-cigarette use and smokers quitting smoking after a hospitalization. One of the groups received regular standard care, whereas the other received regular care plus an intervention. The main result was the use of e-cigarettes in the first 3 months following discharge, with tobacco abstinence measured at 6 months using biochemically validated measures. To calculate the intervention impact of abstinence, propensity score matching (PSM) approaches were employed. The analysis of 1100 participants revealed interesting facts. Over 25% of smokers who were trying to quit used e-cigarettes for 3 months. When compared to smokers who did not use e-cigarettes regularly, this pattern of e-cigarette usage was related with a lower 6-month rate of tobacco abstinence. Further research is necessary to determine whether routine use of e-cigarettes promotes or inhibits smoking cessation.

The study by Halpern et al. [[15](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR15)] looked at e-cigarettes, rewards, and medications for cessation with a pragmatic trial. Usual care, free e-cigarettes, an incentive plus free cessation aids, and a redeemable deposit plus free cessation aids were the five implemented interventions. The biochemical proof of urine sample with a cotinine level of less than 20 ng per milliliter was the main technique for verifying abstinence. The impact of the interventions was determined by using the logistic regression analysis. Financial incentives increased the rate of maintained smoking cessation compared to free cessation aids. To better understand the short-term effects of e-cigarettes with high smoking-related risk, Masiero et al. [[52](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR52)] opted for ca double-blind, three-arm RCT with standard care, e-cigarettes, and standard care, as well as a placebo e-cigarette. The eligibility requirements included at least 55 years old, smoking an average of 10 CPD or more for at least in the last 10 years, and not being engaged in any other quit program.

The primary objective was a change in pulmonary function (dry cough, shortness of breath, mouth irritation), while the secondary outcomes were a change in daily cigarette consumption and a change in the carbon monoxide concentration of expired air. Group comparisons were made based on nonparametric statistics. To analyze differences in respiratory symptoms, e-cigarette side effects, and any other categorical factors, a chi-square test was specially applied. To assess statistical differences in cigarettes, the Mann-Whitney U- (for two samples) and Kruskal-Wallis H- (for three samples) tests were utilized. The findings showed that e-cigarettes helped participants quite smoking and reduced CPD rate significantly decreased compared to the baseline values. This was valid for smokers who were prepared to stop smoking, but it can also be helpful for less motivated smokers taking part in clinical settings.

To test the efficacy of counselling, e-cigarettes plus counselling, and non-nicotine e-cigarettes plus counselling on smoking cessation, Eisenberg et al. (2020) [[53](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR53)] conducted three arms with a multicenter RCT. Adults who wanted to stop smoking and averaged at least 10 CPD were eligible. The point prevalence smoking abstinence was at 12 weeks after randomization, and the 7-day secondary end point was at 24 weeks, which were assessed at various follow-ups. Based on the binomial distribution, the pairwise comparison and risk differences with 95% confidence level were estimated. With logistic regression models, odds ratios were estimated. The analysis of data from 376 participants showed that for smokers motivated to quit smoking, the use of nicotine e-cigarettes in combination with counselling, opposed to counselling alone, significantly boosted point prevalence abstinence at 12 weeks. The differences were no longer significant at 24 weeks.

Martinez et al. [[16](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR16)] conducted a three-arm RCT to examine smoking cessation among dual users of combustible cigarettes and e-cigarettes. The first group received self-help booklets, while the second group received smoking cessation self-help booklets and monthly cessation materials, and the third group received dual user-specific booklets and monthly cessation materials. The eligibility requirements included at least 18 years old, smoking once a week or more in the prior year, and vaping once a week or more in the previous month. Across America, participants were enrolled using print, electronic, and social media forums. Self-reported 7-day point-prevalence smoking abstinence at each assessment point served as the primary outcome. Secondary outcomes were 7-day point-prevalence vaping abstinence and the cost per incremental smoking cessation. Generalized estimating equations and mixed analysis with univariate and multivariate logistic regression evaluated the effectiveness of interventions. Findings from a total of 2896 participants show that self-help information with e-cigarettes has a large potential for encouraging smoking cessation for those who use both combustible cigarettes and e-cigarettes.

37.E-cigarettes and NRT with nicotine and non-nicotine

Using a three-arm study design, Caponnetto et al. [[17](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR17)] conducted a 12-month randomized controlled trial to evaluate the effectiveness of e-cigarettes as a combustible smoking substitute. The study included e-cigarettes without nicotine, with 7.2 mg of nicotine, 5.4 mg of nicotine for the first two quarters, and 7.5 mg for the second two quarters. The eligibility requirements included being between the ages of 18 and 70, having smoked 10 cigarettes per day for the preceding 5 years, being in excellent health, and not actively trying to quit smoking or planning to in the next 30 days. The abstinence was examined with the carbon monoxide test. The main result was a 7-ppm CO concentration without smoking. For group comparison, nonparametric econometric tests were applied. There were 3 follow-up intervals: 12, 24, and 52 weeks. The findings support the claim that using e-cigarettes, both with and without nicotine, dramatically reduces the consumption of conventional cigarettes and results in long-lasting tobacco abstinence without having any negative side effects.

Tseng et al. [[17](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR17)] carried out a randomized control trial comparing the nicotine-containing electronic cigarettes with a placebo in terms of smoking cessation in young adults. The double-blind two-arm RCT had 99 subjects who were current smokers with greater than 10 CPD and validated greater than and equal to 8 ppm. The eligible age range was 21 to 35. The main result was a self-reported decrease in CPDs of more than 50% participants after three weekends of treatment. Multiple logistic regression analysis investigated the contribution of the predictors to the result of smoking reduction and repeated measure. ANOVA statistics examined variation within and between CPD rates. With the use of e-cigarettes, a diverse young adult sample of current, daily smokers who were not ready to quit were able to cut back on smoking. To determine the function of nicotine- and placebo-containing e-cigarettes in promoting reduction and subsequent cessation, more research is required.

With a double-blind three-arm study, Backer et al. [[54](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR54)] investigated the role of NRT in conjunction with low nicotine cigarettes for smoking cessation. The participants were smokers who had smoked an average of 15 cigarettes per day for at least 1 year before randomization and were between the ages of 21 and 65 years. Entry into the study required a carbon monoxide (CO) measurement of 15 ppm. The primary endpoint was 4 weeks of abstinence, which was established by self-report and verified by inhaled CO < 10 ppm for each individual, and continuous abstinence recorded from weeks 7 to 10. The intent-to-treat (ITT) and Fisher exact test evaluated hypotheses. To identify prognostic markers and conduct an adjusted analysis of the primary outcome, logistic regression was used. At the analysis level, 346 samples were obtained, including 114 for control and 232 for treatment groups. According to the trial findings, Quest brand of cigarettes plus NRT was more effective than active control plus NRT in attaining 4 weeks of continuous abstinence. There were no major side events associated with the investigational product. Walker et al. [[55](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR55)] assessed the combined effect of low nicotine cigarettes, NRT, and behavioral quit line care in a single-blind two-arm research. The participants were 18-year-old smokers interested in quitting smoking. The participants were not eligible if they were pregnant/breastfeeding, presently using NRT or non-cigarette tobacco products, had a stroke or angina in the previous 2 weeks, or were taking bupropion, clonidine, or other similar medications.

The primary outcome was smoking abstinence for 7 days, and the quit data was after 6 months. To analyze the treatment effect over time, repeated-measures analyses were also performed with generalized estimating equation (GEE) models. According to the findings, some smokers may be helped to quit by adding low nicotine cigarettes to the normal Quitline smoking cessation support.

By using a randomized control trial, Janet et al. [[18](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR18)] studied how to improve quit-and-win competitions to increase cessation among college smokers. The study had two groups: one with 615 participants in a multiple contest with no counselling and 602 individuals in a single contest with counselling. The minimum age to participate was 18. At the completion of the treatment, the 30-day point prevalence-verified abstinence after 6 months was the primary outcome. The secondary outcome was the same at 4 months. To determine how treatments affect the prevalence of smoking, the logistic and generalized linear mixed models were used. After a 6-month follow-up, analysis showed multiple contests with college students were a more suitable and effective strategy to raise the rate of smoking abstinence than a single contest, while there were no strong signals regarding the counselling.

## Materials and methods

### Data

#### Study population

The adult smokers who are at least 18 years reside in Pakistan and smoke cigarettes daily. Additionally, they are ready to meet the inclusion requirements and motivated to establish a quit date within the next 2 weeks of recruiting. Note that other nicotine- and non-nicotine-based cessation therapies will not be allowed during the trial.

#### Inclusion criteria

The potential participants for the trial will have to meet the following requirements.

* ◦ Participants are at least 18 years old. Upper age limit is 65 years.
* ◦ Smoke more than 10 combustible cigarettes a day at the time of study enrollment
* ◦ Smoking cigarettes for at least a year
* ◦ Participants are willing to stop combustible smoking.
* ◦ Participants are ready to sign a written consent form.
* ◦ There can only be one applicant per household.
* ◦ Own a phone that supports text messaging

#### Exclusion criteria

The potential participants will be not considered in case they are the following:

* Women who are pregnant
* Currently using other nicotine- and non-nicotine-based cessation therapies
* Females who intend to become pregnant during the trial’s participation term
* Experiencing chest pain or another cardiovascular event or procedure (e.g., heart attack, stroke, insertion of stent, bypass surgery).

#### Sampling strategy and sample selection

Keeping in view the study objectives, the process of deciding the number of observations/sample respondents would be made through the determination of sample size, which is based on the extent and intensity of variation and heterogeneity in the subject population. For a population with lower variation, a small sample is adequate and vice versa, ceteris paribus. In empirical studies aimed at representing the salient features of the population under study, the sample size is important. Before calculating the sample size, a few details about the target population, including its size, variance, margin of error, and desired level of confidence in empirical estimates of important variables, are required [[56](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR56)]. A major constraint in arriving at the ideal sample size is the lack of adequate information and data regarding the standard deviation of variables/indicators. In the absence of this specific information, this study referenced international studies conducted in a similar design, although some variations were noted. To prevent bias, the study opted for the most suitable sampling method considering the budget constraints and local limitations related to variations in the target population. The study employed the equivalence trial formula to estimate the primary outcome, which focused on reducing the use of combustible cigarettes through the provided interventions (Table [1](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "Tab1)).

Based on the aforementioned formulas, from Hajek et al. [[50](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR50)], Smith et al. [[12](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR12)], Rigotti et al. [[14](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR14)], and Caponnetto et al. [[16](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "ref-CR16)] derived 222, 49, 86, and 163 for single group respectively. According to acceptable norms and standards, the selected sample should represent the population. By the safe decision and following the abovementioned procedure, this study proposes a sample size of 600 participants, which will be randomly divided into three groups as follows:

* E-cigarette: The 200 participants will receive e-cigarettes along with basic care counselling.
* Nicotine pouches: The 200 participants will receive nicotine pouches along with basic care counselling.
* Basic care counselling: The 200 participants will receive basic care counselling.

Under the Lead Researcher Dr. Abdul Hameed, ARI team will conduct interview of participants and assign and unique ID to each potential participant at the screening stage. After that, the lead research Dr. A. H. will generate the allocation sequence and will assign participants to interventions by using STATA software for the randomization.

#### Recruitment strategies

This study will establish recruitment centers in two metropolitan districts: Islamabad and Rawalpindi. Participants will be enrolled based on their eligibility criteria through local mobilization. An ARI expert will conduct screening interviews. Through this independent and robust recruitment strategy, the study will achieve the required sample size. Face-to-face adherence reminder sessions will be held during the initial recruitment and at each subsequent study visit. These sessions will cover the following:

* Emphasizing the significance of adhering to study guidelines for the daily usage of products
* Providing instructions regarding the consumption of study products, such as proper dosage timing, storage guidelines, and the importance of taking the prescribed dose as a whole
* Follow-up sessions will take place during subsequent visits. Participants will be inquired about any difficulties they might be experiencing in adhering to their study interventions. These sessions will involve a brief discussion on the reasons behind missed doses and will offer simple strategies to enhance adherence.

### Study design

After the screening of the participants, this study will conduct a baseline survey to evaluate smoking status, smoking behavior, sociodemographic characteristics, health status, economic barriers, and motivation to stop smoking before the intervention and try to make a balance randomization between the control and the treatment groups. After completing the baseline survey, the three-arm study design would randomize 600 participants into three groups.

* E-cigarette: The 200 participants will receive e-cigarettes along with basic care counselling.
* Nicotine pouches: The 200 participants will receive nicotine pouches along with basic care counselling.
* Basic care counselling: The 200 participants will receive basic care counselling.

Four basic care counselling sessions will be held over the course of 48 weeks with the supply of e-cigarettes and nicotine pouches. These e-cigarettes and nicotine pouches will be provided in line with the indicated tastes and flavors. Every 12 weeks, a standard care counselling session will be offered, followed by a study visit to track any alterations in the user’s physical or mental health as well as any side effects from using nicotine pouches or e-cigarettes. All participants will complete a follow-up survey at 60 weeks. However, the provision of e-cigarettes and nicotine pouches will be stopped after the first 48 weeks.

The remaining 12 weeks will be followed without providing any e-cigarettes or nicotine pouches. The participants must buy these items on their own. The overall five follow-ups will be conducted over the course of 60 weeks. Of these, four follow-ups will be during the period in which the participants received interventions, and one follow-up will be post-intervention period of 48 weeks. Additionally, a flowchart depicting the unified requirements of reporting trial is shown in Figs. [1](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "Fig1) and [2](https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-023-07876-y" \l "Fig2) along with the explanation of the participants’ research schedule.

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# Harmful and potentially harmful constituents (HPHCs) in two novel nicotine pouch products in comparison with regular smokeless tobacco products and pharmaceutical nicotine replacement therapy products (NRTs)

### Background

Tobacco-free nicotine pouches is a novel category of oral nicotine-delivery products. Among current tobacco users such pouches may serve as a low-risk alternative to cigarettes or conventional, tobacco-based oral products e.g., snus and moist snuff. In the United States (U.S.), the market leading nicotine-pouch brand is ZYN®. However, no data on the chemical characteristics of ZYN have been published.

### Methods

We screened for 43 compounds potentially present in tobacco products in seven oral nicotine-delivery products: ZYN (dry and moist), snus (General®), moist snuff (CRP2.1 and Grizzly Pouches Wintergreen), and two pharmaceutical, nicotine replacement therapy products (NRTs, Nicorette® lozenge and Nicotinell® gum). Thirty-six of the tested compounds are classified as harmful and potentially harmful constituents (HPHCs) by the Center for Tobacco Products at the U.S. Food and Drug Administration (FDA-CTP). Five additional compounds were included to cover the GOTHIATEK® product standard for Swedish snus and the last two compounds were chosen to include the four primary tobacco specific nitrosamines (TSNAs).

### Results

The tested products contained nicotine at varying levels. The two ZYN products contained no nitrosamines or polycyclic aromatic hydrocarbons (PAHs) but low levels of ammonia, chromium, formaldehyde, and nickel. In the NRT products we quantified low levels of acetaldehyde, ammonia, cadmium, chromium, lead, nickel, uranium-235, and uranium-238. The largest number (27) and generally the highest levels of HPHCs were quantified in the moist snuff products. For example, they contained six out of seven tested PAHs, and seven out of ten nitrosamines (including NNN and NNK). A total of 19 compounds, none of which were PAHs, were quantified at low levels in the snus product. NNN and NNK levels were five to 12-fold lower in snus compared to the moist snuff products.

### Conclusions

No nitrosamines or PAHs were quantified in the ZYN and NRT products. Overall, the number of quantified HPHCs were similar between ZYN and NRT products and found at low levels.

## Background

Long-term epidemiological studies have convincingly shown that use of traditional, tobacco-based Swedish snus is associated with substantially fewer and/or less severe adverse health effects than cigarette smoking [[1](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR1)]. In Sweden, snus has since the early 1970s to a large extent replaced cigarettes, particularly among male tobacco users and is now the dominating tobacco product on the Swedish market [[2](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR2), [3](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR3)]. The extensive use of snus instead of cigarettes has contributed to internationally record low rates of smoking and smoking-and tobacco-related disease, a phenomenon often referred to as the “Swedish Experience” in the literature. According to the World Health Organization (WHO) Swedish males have the European Union’s lowest rate of “tobacco-related” mortality [[4](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR4)].

In 2019, eight snus products marketed in the United States (U.S.) were granted a modified risk tobacco product (MRTP) order by the U.S. Food and Drug Administration’s Center for Tobacco Products (FDA-CTP) [[5](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR5)]. The scientific basis for the MRTP order came in part from the “Swedish Experience” [[6](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR6)]. Furthermore, the snus products are manufactured according to a stringent product standard (GOTHIATEK®) which includes maximum levels for several constituents classified as harmful and potentially harmful (HPHC) by the FDA [[2](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR2)].

From its launch in 2000, GOTHIATEK covered tobacco specific nitrosamines (TSNAs) (most notably N-nitrosonornicotine (NNN) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)), and polycyclic aromatic hydrocarbons (PAHs) (including benzo[a]pyrene (B(a)P)). From a long-term health point of view, NNN, NNK, and B(a)P have historically been regarded as the most problematic HPHCs in snus. Although the GOTHIATEK maximum levels have been gradually lowered over the years, and despite improved manufacturing methods snus products still contain measurable levels of NNN and NNK. However, discontinued use of fire-cured tobacco has led to over 95% lower levels of B(a)P in snus [[2](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR2), [7](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR7)]. Moreover, the levels of NNN, NNK and B(a)P are substantially lower in snus than in moist snuff products [[8](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR8), [9](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR9)].

In recent years several pouched, nicotine delivery products intended for oral use that do not contain tobacco (in the following referred to as “nicotine pouches”) have become commercially available in Europe and the U.S. A nicotine pouch is used in the same way as snus: it is placed under the upper lip where it delivers nicotine systemically via the oral mucosa. After use, the pouch is discarded. In the U.S., the market leader in this novel category is a product sold under the brand name ZYN® which in 2019 had a market share of 86% [[10](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR10)]. As nicotine pouches do not contain tobacco and the added nicotine has a purity that meets pharmaceutical standards they should, at least in theory, not expose users to the HPHCs that are typically present in tobacco, such as TSNAs.

This paper presents the results of a screening for 43 selected compounds in two nicotine pouch products, ZYN dry and ZYN moist. For comparative purposes, the screening was also performed in one pouched Swedish snus product, two types of moist snuff (loose and pouched), and two pharmaceutical nicotine replacement therapy products (NRTs, lozenge and gum).

## Material and methods

#### ZYN nicotine pouches

Two variants of ZYN were tested: ZYN dry which has a 3% moisture content and comes in a rectangular pouch made of a non-woven material. The pouch measures 14 × 28 mm and weighs 0.4 g. The pouch contains fillers (maltitol and microcrystalline cellulose), a stabilizer (hydroxypropyl cellulose), pH adjusters (sodium carbonate and sodium bicarbonate), a nicotine salt, food grade flavorings, and a sweetener (acesulfame K).

ZYN moist which has a 37% moisture content and comes in a rectangular pouch made of a non-woven material. The pouch measures 13.5 × 34 mm and weighs 0.8 g. The pouch ingredients are slightly different from that of ZYN dry: water, fillers (microcrystalline cellulose and plant fibers), a humectant (glycerine), pH adjusters (sodium carbonate and calcium chloride), sodium chloride, food grade flavorings, a nicotine solution, a monoglyceride, and a sweetener (acesulfame K).

#### NRTs

Two NRT products were tested, Nicorette Peppermint 2 mg lozenge, and Nicotinell Licorice 2 mg gum. The products weigh 0.6 g and 1.2 g per unit of use, respectively. The lozenge contains nicotine in the form of resinate, fillers (mannitol, xanthan gum, gum arabic, magnesium stearate, hypromellose, titanium dioxide, microcrystalline cellulose, potassium silicate, polysorbate 80), pH adjuster (sodium carbonate), sweetener (sucralose, acesulfame K) and flavorings. The gum contains nicotine polacrilex, chewing gum base, sweetener (acesulfame K, saccharin, sodium saccharin, sorbitol, xylitol, mannitol), pH adjusters (calcium carbonate, sodium carbonate, sodium bicarbonate), flavoring, glycerol, gelatine, titanium dioxide, canauba wax and talcum powder.

#### Swedish snus

The tested snus product was General® Portion Original Large which is one of the eight products for which FDA-CTP issued a MRTP order in 2019. General has a moisture content of 51% and comes in a rectangular pouch made of non-woven material. The pouch measures 18 × 33 mm and weighs 1.0 g. The pouch contains ground, air-cured tobacco, water, sodium chloride, sodium carbonate, humidifying agents, and food-grade flavorings. During manufacturing, the mixture of ground tobacco, water and salt is heat treated (pasteurized) to reduce microbial activity.

#### Moist snuff

Two variants of moist snuff were tested: the Cooperation Centre for Scientific Research Relative to Tobacco (CORESTA) Smokeless Tobacco Reference Product (CRP2.1) [[11](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR11)] which is a non-pouched product with a 53% moisture content. It contains both air-cured and dark fire-cured tobaccos, water, sodium chloride, burley stem, and sodium carbonate. We also tested one of the market-leading pouched products in the U.S., Grizzly Pouches Wintergreen. It has a moisture content of 52%, comes in a 18 × 44 mm pouch made of a non-woven material, and weighs 1.3 g.

The manufacturing processes for both moist snuff products include fermentation of the tobacco.

### Selected compounds

A total of 43 compounds were selected for analysis, 36 of which are classified as HPHCs by the FDA [[12](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR12)]. This included the nine compounds on the FDA-CTP’s list of HPHCs relevant for smokeless tobacco products: acetaldehyde, arsenic, B(a)P, cadmium, crotonaldehyde, formaldehyde, nicotine (total and unprotonated), NNK, and NNN [[13](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR13)]. We also screened for some other compounds covered by the GOTHIATEK standard (aflatoxin B2, G1 and G2, nitrite, and ochratoxin A) [[7](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR7)]. In addition, N-nitrosoanatabine (NAT), and N-nitrosoanabasine (NAB) were included to cover all four, primary TSNAs. All reported results are based on wet weight.

GOTHIATEK also includes maximum levels for a large number of agrochemicals. Analyses of such compounds were considered beyond the scope of the current study.

### Sample handling and analysis

The snus product and the two ZYN products were obtained from Swedish Match Distribution Center, Stockholm, Sweden. The NRT products were obtained from on-line pharmacies in Sweden. CRP2.1 was obtained from North Carolina State University Tobacco Analytical Services Laboratory, North Carolina, U.S. The pouched moist snuff product was purchased from Hardec’s Wholesale, Kentucky, U.S. One batch of each product was analyzed. All analyses were performed within 3 weeks of obtaining the product. Pending analysis, the NRTs and ZYN dry were stored at room temperature whereas ZYN moist, snus and the moist snuff products were kept refrigerated or frozen. Where applicable, we followed the CORESTA Guide No. 11 Technical Guide for Sample Handling of Smokeless Tobacco and Smokeless Tobacco Products [[14](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "ref-CR14)].

Table [2](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab2) lists the tested compounds and provides brief descriptions of the analytical methods. The analyses were performed in triplicate on the entire product including the pouch material, where applicable. The data are presented as the mean and standard deviation of the triplicate (Tables [3](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab3)–[6](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab6)). Where one or two out of the three replicates have no measurable levels i.e., below limit of quantification (LoQ), the values for the individual replicates were set to 50% of the LoQ for the mean and standard-deviation calculations. Most of the included compounds were analyzed at the external contract laboratory Eurofins, Lidköping, Sweden. Polonium-210 was analyzed at Labstat, Kitchener, Canada. A few compounds that could not be analyzed at Eurofins were analyzed in-house at the Swedish Match Laboratory, Stockholm, Sweden. All methods used by Eurofins and Swedish Match are validated and accredited to ISO 17025 for tobacco products and nicotine pouches. For NRT-matrices, the analytical methods are validated and fit for its intended purpose, but not yet accredited according to ISO 17025. All three laboratories are accredited according to ISO 17025.

## Results

In total, we analyzed 43 compounds (including nicotine). Table [3](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab3) shows the analytical results for nitrosamines, Table [4](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab4) for PAHs, Table [5](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab5) for heavy metals and radionuclides, and Table [6](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab6) for the remaining compounds.

As expected, total and unprotonated “free” nicotine at varying levels was quantified in all tested products (Table [6](https://bmcchem.biomedcentral.com/articles/10.1186/s13065-023-00918-1" \l "Tab6)).

In the two types of ZYN nicotine pouches, 38 of the 43 analyzed compounds were below the respective level of quantification. Most notably, this included all tested nitrosamines and PAHs. In addition to nicotine, a total of three HPHCs were found in both the ZYN dry and ZYN moist products: formaldehyde (10.3 µg/g and 1.5 µg/g, respectively), chromium (0.160 µg/g and 0.099 µg/g, respectively), and ammonia (62 µg/g and 66 µg/g, respectively). Traces of nickel, just above the quantification limit, were found in ZYN dry (0.067 µg/g).

In addition to nicotine, nickel at a low level (0.086 µg/g) was the only compound found in the NRT lozenge product. In the NRT gum product eight compounds in addition to nicotine were quantified. This included cadmium (0.043 µg/g), chromium (0.850 µg/g), lead (0.067 µg/g), nickel (0.243 µg/g), acetaldehyde (4.7 µg/g), ammonia (4.5 µg/g), and the uranium isotopes 235U (0.14 Bq/kg) and 238U (2.76 Bq/kg). Notably, no nitrosamines or PAHs were found in either NRT product.

All compounds quantified in the ZYN products were also found in snus and the moist snuff products, but the levels found were vastly different. In general, the ZYN and NRT products contained the lowest levels followed by snus and moist snuff. Compared to snus, 69% and 81% less chromium were found in ZYN dry and ZYN moist, respectively. ZYN dry contained 92% less nickel than snus. For ammonia, 93% and 92% less were found in ZYN dry and ZYN moist, respectively. ZYN moist and snus contained comparable levels of formaldehyde whereas the level in ZYN dry were about 5 times higher than in snus.

Where lead, cadmium, nickel, and ammonia were quantified in the NRT products, their levels were 63–99% lower compared to snus. In contrast, 63% more chromium were found in the NRT gum than snus. The NRT gum contained half as much of acetaldehyde compared to snus. Also, the two uranium isotopes were only found in the NRT gum.

The snus product contained 19 of the 43 compounds. In addition to nicotine, this included five nitrosamines (NAB, NAT, NDMA, NNK, and NNN), six heavy metals (arsenic, cadmium, chromium, lead, nickel, selenium), acetaldehyde, ammonia, anabasine, formaldehyde, nornicotine, ochratoxin A, and a polonium isotope (210Po).

A total of 27 and 26 compounds were quantified in the loose and pouched moist snuff products, respectively. Apart from nicotine, this included six nitrosamines (NAB, NAT, NDMA, NNN, NNK, and N-nitrososarcosine (NSAR)) in both products and N-Nitrosopyrrolidine (NPYR) in the loose moist snuff. The levels of NNN and NNK were about five to 12-fold higher than in the snus product. A total of six and five PAHs were quantified in the loose and pouched moist snuff products, respectively. The quantified heavy metals were the same, and at comparable levels as those found in snus: arsenic, cadmium, chromium, lead, nickel, and selenium. Other compounds present in the moist snuff products were acetaldehyde, ammonia, anabasine, coumarin, formaldehyde, nornicotine, and 210Po. In addition, the pouched moist snuff product contained ochratoxin A.

## Conclusions

A screening for 43 HPHCs in two variants of the nicotine pouch product ZYN showed that only few HPHCs were quantified and all at consistently low levels. These findings were similar to those for the tested NRT products. Notably, nitrosamines or PAHs were not found in either the ZYN or NRT products.

39.academic.oup/Tobacco-Related Harms and Harm Reduction

Unburned tobacco contains about 16 carcinogens and tobacco smoke contains more than 60, most notably tobacco-specific nitrosamines, polycyclic aromatic hydrocarbons, and aromatic amines.[1](javascript:;) There are over a billion users worldwide of higher risk forms of tobacco, consuming tobacco in smoked forms such as cigarettes, bidis, cigars, cigarillos and/or smokeless forms such as gutkha, zarda, and naswar.[2](javascript:;) It is widely accepted that current available cessation products and services are suboptimal in their effectiveness. Cost and efficacy of current smoking cessation medications on the market is an impediment to availability, accessibility and cessation success in low-and-middle income countries (LMICs) where 80% of the world’s tobacco users live.[3](javascript:;) This is compounded by the fact that in countries in South Asia, a predominant form of tobacco consumption is oral smokeless tobacco, especially among women and economically disadvantaged populations. Evidence-based cessation treatments and safer, affordable alternatives are not available for oral smokeless tobacco in these countries, widening the health inequity. Therefore, innovation in tobacco cessation products and services has the potential to reduce the societal impact of tobacco globally.[4](javascript:;)

## Oral Nicotine Pouch—Newer Nicotine Replacement Formulation

Recently new non-combustible products containing nicotine are rapidly entering the market. Examples of new product categories are electronic cigarettes, heat-not-burn products, and nicotine pouches (NP). This commentary discusses the oral NP category. The NP products are placed, like Swedish snus, between the upper lip and gum. The NP are different to Swedish-style snus in that there is no leaf tobacco in them. The precursor of today’s NP was studied in clinical studies as a new formulation for nicotine replacement (NR) treatment under the Zonnic brand in the late 2000s.[5](javascript:;)

The first NP to be widely distributed in the USA was branded ZYN that was marketed by Swedish Match North America. ZYN is a thin white pouch that contains white powdered nicotine. Other ingredients in ZYN include food-grade additives, fillers, a stabilizer (hydroxypropyl cellulose), pH adjusters, noncaloric sweeteners, and flavorings. Some other brands with mostly relatively similar compositions are Dryft, Loop, Lyft, Nordic Spirit, On!, Rouge, Rush, Velo, and ZoneX.

The NP have so far not been well researched and there are only a few papers published. One paper characterized ten different pouch products on variables relevant to uptake of nicotine such as pH, total nicotine content and protonated (free) nicotine. The authors suggest that users can draw adequate nicotine from the pouches to overcome cravings from cigarettes.[6](javascript:;) The only published pharmacokinetics study on NP showed that despite a lower nicotine content, NP delivered nicotine as quickly and in a similar concentration compared to existing smokeless products. The authors also concluded that NP efficacy in reducing withdrawal symptoms and helping smokers reduce or stop combustible tobacco use should be similar or better than NR products.[7](javascript:;) In another study, the toxicant levels of 26 harmful and potentially harmful constituents from three snus products, two NR products (gum and lozenge) and four Lyft (British American Tobacco) NP products were analyzed. Compared with snus, NPs had lower levels of 10 HPHCs and generally no difference could be seen between the two NR products and the four Lyft NP variants.[8](javascript:;)

In a consumer insight and user study of ZYN, it was found that the labeling and packaging of the product were such that almost 90% of never users and former users did not find it to be appealing. 3% of never users and 2% of former users were interested in buying the product. The majority of users were current smokeless tobacco (ST) users and former tobacco users. The most common reason for use of ZYN among current ST users was “less harmful to my health than other tobacco products.” [9](javascript:;)

## Concerns with Nicotine Pouches

The situation in which the pouches exist today may change. From a product new to the market with limited reach and sales to a product more visible due to advertising, the attitude to the category may change among non-nicotine users. The marketing practices may become more aggressive and directed towards adolescents. To identify and address unintended consequences in a timely manner, further use studies and ongoing monitoring of these products are called for. Already, as per some investigative media reports, some of the manufacturers are practicing unethical market approach and targeting non-users and vulnerable young population for the sale of nicotine products.[10](javascript:;),[11](javascript:;) This brings into question the suitable regulatory regime for these products and the research gaps that need to be filled so as to inform a science-driven regulatory policy.

Oral NP come in an array of flavors and many believe that flavors can play a significant role in drawing youth to tobacco products and possibly be the primary reason to use the products.[12](javascript:;)

An escalating ‘nicotine strength’ war is another matter of concern. Around 2018, in Russia and some Eastern European countries, pouches were increasingly sold in much higher strengths (>20 mg/pouch) than needed for craving relief and withdrawal management in tobacco cessation. The NP category is now banned in Russia.[13](javascript:;)

## A Regulatory Science Agenda for Nicotine Pouches

Large gaps in NP related research still remain, before regulators, public health, and consumers can accept these as harm reduction products and another cessation tool. In order to be appropriate for the protection of public health the following research areas would give valuable insights for regulation and consumer information

## A Scientific Evidence Driven Regulatory Policy for Nicotine Pouches

Globally, manufacturers have a duty of care to address the prevalent research and knowledge gaps about this category. In a rapidly developing area such as innovative nicotine products, it is not surprising that regulators play catch up. Conducting NP related research and making the data available can better inform the regulatory policy.

Such an approach has the potential to accelerate the delivery of a wider range of affordable evidence-based cessation tools to LMICs such as India. India has the highest prevalence of oral cancers worldwide, driven largely by a vast array of risky ST products. With around 200 million current ST users, there is a great challenge and opportunity in India to bring affordable NP that are responsibly manufactured and marketed only to adult tobacco users. It would be important to ensure that adult users’ access and affordability are not compromised by the regulatory regime and the behaviors of profit-maximizing manufacturers.

In summary, NP is a new product category, close to the composition of ingredients to some NR products, that can be an effective tool for smokers, and other tobacco users, to reduce and stop tobacco use. A comprehensive regulatory science agenda will need to be prioritized and delivered by relevant stakeholders to maximize this category’s public health potential and minimize its unintended consequences.

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# Oral nicotine pouches with an aftertaste? Part 2: in vitro toxicity in human gingival fibroblasts

## Introduction

Scientifically, the deleterious health effects of tobacco smoke were confirmed already decades ago (Evans [1962](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR16)). As a consequence of tobacco control strategies, the global tobacco smoking prevalence decreased from 26.9% in 2000 to 17.0% in 2020 (World Health Organization [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR50)); and it is projected to decline further to 15.4% by 2025 (World Health Organization [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR50)). In response to this trend, the tobacco industry has developed new nicotine delivery products with and without tobacco leaf material, such as e-cigarettes, heated tobacco products, and nicotine pouches. Nicotine pouches have been introduced to the US and European market in 2016 and 2018, respectively (Delnevo et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR10); Tobacco Tactics [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR48)). The sales increased rapidly by 124% from 2019 to 2020 (Foundation for a Smoke-Free World [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR17)). This was underlined by a recent survey conducted in the US among current smokers, in which 16.8% of the respondents reported to be interested in trying oral nicotine pouches (Hrywna et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR23)). A study from the US and another from the Netherlands found out that the most frequent reason for using nicotine pouches was the reduced risk perception in contrast to tobacco products (Havermans et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR21); Plurphanswat et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR36)). Although the age of users pointed toward a more adult population (Hrywna et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR23); Plurphanswat et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR36)), which was likely due to the study design, Havermans and coworkers found that almost 10% of minors were aware of nicotine pouches and 0.3% had tried it. In particular, young adults are being attracted by the availability of a wide range of flavors, which therefore can be judged as a major concern from the health perspective side (Robichaud et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR40)). Accordingly, nicotine pouches need to undergo toxicological investigations to shed light into possible inherent risks.

The main compositional and active ingredient of nicotine pouches is the nicotine salt itself (Stanfill et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR46)). Besides nicotine, they contain additives, such as flavorings, sweeteners, humectants, and pH regulators, all wrapped in a pouch made of viscose fibers (Azzopardi et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR4); Robichaud et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR40)). After placement of the nicotine pouch under the lip, the released nicotine is absorbed through the buccal mucosa.

In its appearance and kind of use, nicotine pouches are similar to snus, but in contrast to snus, they are free from tobacco leaf material. Despite containing much less toxicants than cigarette smoke, snus is not to be considered as risk-free (IARC [2007](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR26)). Carcinogens, such as tobacco-specific nitrosamines (TSNAs), polycyclic aromatic hydrocarbons, and aldehydes, might be also present in this kind of tobacco product (Hoffmann and Djordjevic [1997](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR22)). Accordingly, oral lesions are frequently associated with snus use and commonly observed at the site of product placement (Binmadi et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR6)). Although still detectable, the levels of genotoxic TSNAs are much lower in nicotine pouches when compared to snus, as no tobacco leaf material is present in this final product (Mallock et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR32)).

Although the tobacco industry advertises nicotine pouches as an alternative to conventional tobacco products toward harm reduction (Imperial Brands [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR27)), their health effects are still unclear. High nicotine contents of up to almost 50 mg/pouch may contribute to the onset of addiction in novice nicotine users or could lead to other negative health effects, for example, on the cardiovascular system (Mallock et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR32); Stanfill et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR46)). Further, the novel products may exert local cytotoxic effects especially in the oral mucosa. Few studies addressed these issues in the past, most of them published by manufacturers on their proprietary products (Aldeek et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR1); Bishop et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR7); East et al. [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR13); Knopp et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR30)). Only one study was without industry involvement (Shaikh et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR41)).

Further independent research addressing factors that may affect human health, such as cytotoxicity, and the identification of unknown substances are needed to inform public health professionals and regulators on the risks possibly associated with the consumption of nicotine pouches.

To address potential health risks that are new to nicotine pouches, this study was conducted in two parts. In part 1, 48 nicotine pouches and 2 nicotine-free pouches were assessed for their ingredients and for further substances identified by a GC–MS-based screening approach (Mallock-Ohnesorg et al. [2023](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR52)). An initial toxicological assessment was performed for the identified substances based on regulatory databases  (Mallock-Ohnesorg et al. [2023](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR52)). For part 2, which is described in this manuscript, in vitro toxicity in human gingival fibroblasts (HGF-1) was assessed for five different nicotine pouches and the reference snus CRP1.1. The products were extracted with salt-buffered solution, and the cells were exposed for 24 h to the extracts sampled at different time points. Lactate dehydrogenase (LDH) and metabolic activity (MTT) assays were used as a measure of cytotoxicity. The induction of reactive oxygen species (ROS) was measured using the 2’,7’-dichlorofluorescin diacetate assay (DCFDA), and alterations in the gene expression of inflammatory and oxidative stress markers were assessed via quantitative real-time polymerase chain reaction (qRT-PCR). Nicotine concentrations of sample extracts were quantified using a validated LC-DAD method. Flavorings and other substances identified in the tested pouches were discussed with regard to their potential contribution to toxicity. This two-part study was designed to identify potentially problematic constituents of nicotine pouches and to provide preliminary insights into effects of the products on oral cells. The goal was to set a starting point for future in-depth studies on the mechanisms of nicotine pouch toxicity.

## Materials and methods

### Chemicals and reagents

Nicotine of analytical grade (≥ 99%), ammonium acetate (> 99%), ammonia (25%), Hank’s Balanced Salt Solution (HBSS), hydrochloric acid, and sodium hydroxide were obtained from Merck KGaA (Darmstadt, Germany). 2’,7’-Dichlorofluorescin diacetate (DCFDA) was obtained from Thermo Fisher Scientific (Schwerte, Germany). Dulbecco’s Modified Eagle’s Medium (DMEM, P04-03596) and 4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (HEPES) were obtained from PAN Biotech (Aidenbach, Germany). 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT reagent) was obtained from Carl Roth GmbH + Co. KG (Karlsruhe, Germany). Milli Q Integral Water Purification System (Merck KGaA, Darmstadt, Germany) was used to prepare ultra-pure water.

### Nicotine pouch samples and reference snus CRP1.1

For the experiments, five nicotine pouches from five different manufacturers and the CORESTA reference snus product CRP1.1 were used. Nicotine pouches were obtained from online retailers. Nicotine contents were determined in a previous study (Mallock et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR32)) and ranged from 3.8 to 47.4 mg/pouch. They were selected based on nicotine contents and labeled product flavors (see Supplementary Information Table 1) to cover a broad range of nicotine concentrations and flavor categories.

### Sample extraction

As extraction medium and adapted from Delvadia et al. ([2012](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR11)), a solution of HBSS and HEPES was used with pH-modification according to standard artificial saliva (DIN ISO 53160–1 [2010](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR12)). For 1 L of the solution, 9.8 g HBSS were mixed with 975 mL of ultra-pure water and 25 mL of HEPES were added. The pH was adjusted to 6.8 ± 0.2 using 2 M sodium hydroxide or 4 M hydrochloric acid. This extraction medium was chosen over artificial saliva to avoid possible adverse effects on the cells by the enzymes present in saliva (Malpass et al. [2013](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR34)). The extraction medium was stored at + 4 °C.

Sample extracts were generated for the time points 5, 10, 20, 30, and 60 min to represent different time periods of product use. Per time point, one pouch was immersed into a flask filled with 10 mL extraction medium and was shaken in a Multitron Pro incubation shaker (Infors HT, Bottmingen, Switzerland) at 37 °C and 200 rpm. After the given extraction times, the whole extract was filtered using a syringe filter with a polyethersulfone membrane (0.22 µm, Merck KGaA,), aliquoted and stored at –20 °C.

### Quantification of nicotine concentrations in sample extracts

Nicotine concentrations of extracts were quantified by LC-DAD. Filtered extracts were diluted 1:10 with extraction medium and 1 µL was injected into the LC system (Agilent 1260 Infinity I + II, G7129AR autosampler, G7112BR pump and degasser, G7116AR column oven, G4212B photodiode array detector, all from Agilent Technologies, Santa Clara, CA, USA). Separation was performed at 45 °C on a Gemini column (NX-C18, 3 µm particle size, 150 mm length, 2 mm inner diameter, 110 Å pore size) with a C18 guard column (both Phenomenex, Torrance, CA, USA). Nicotine was identified by comparing the retention time and UV spectra to a standard substance; it was quantified at 260 nm. Flow rate was constant at 0.2 mL/min. Mobile phase A was 5 mM ammonium acetate and ammonia with a pH of 10 and mobile phase B was methanol. The mobile phase gradient started with 5% B for 1.5 min, followed by an increase to 95% B for 0.2 min and a hold until 8.5 min, followed by a decrease to 5% B for 1 min and a final hold for 3.5 min. Total runtime was 12 min. For data acquisition and analysis, the Chromeleon Chromatography Data System (version 7.2.10, Thermo Fisher Scientific, Schwerte, Germany) was used.

Calibration samples were prepared in extraction medium (0.5, 1, 5, 10, 50, 100, 250, 500, 750, and 1000 µg/mL). The method was validated for linearity, accuracy, precision, stability at 4 °C, limit of detection and quantification (see Supplementary Information Table 2).

### Osmolarity of sample extracts

Osmolarity measurements were performed using a semi-micro osmometer type MLA0299 (Knauer, Berlin, Germany). The apparatus was calibrated to 0 mOsm/kg using distilled water and to 400 mOsm/kg using a 400 mOsm/kg sodium hydroxide solution. Sample extracts were diluted 1:1 with cell culture medium without supplements. 150 µL of the diluted samples was examined for osmolarity.

### Cell culturing

Human gingival fibroblasts (HGF-1; ATCC CRL-2014) were cultured in the recommended Dulbecco’s Modified Eagle’s Medium (DMEM), supplemented with 10% fetal bovine serum (FBS), 1% L-glutamine and 1% streptomycin/penicillin. Cells were passaged once a week with 1–1.5 × 105/mL cells per T75 flask. Normal incubation conditions were 37 °C and 5% CO2. During culturing and experiments, cell morphology was monitored using light microscopy and morphological changes were recorded using a microscope camera (Axiocam, both from Zeiss, Oberkochen, Germany).

### Metabolic activity and membrane integrity as measures of cytotoxicity

For cytotoxicity testing, lactate dehydrogenase (LDH) (Roche, Basel, Switzerland) and MTT assays were performed. For this, 96-well plates were seeded with 5 × 103 cells/well. Cells were allowed to attach and to grow for 24 h prior to exposure. Sample extracts were diluted 1:1 with DMEM without supplements and phenol red for cell exposure. The cells were exposed to vehicle control, medium control, diluted sample extracts, nicotine control in dissolution medium or the positive control (1% Triton X-100). Following 24 h of exposure, LDH and MTT assays were performed. While the extraction times aimed to mimic product use durations with potentially different extract compositions, the exposure time of 24 h was chosen according to other studies investigating the toxicity of nicotine pouches (Bishop et al. [2020](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR7); East et al [2021](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR13); Shaikh et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR41)). This aims at the comparability of study results.

For the LDH assay, the supernatant was removed and transferred into a new U-shaped 96-well plate and centrifuged at 125 rpm for 10 min. After centrifugation, 50 µL of the supernatant were transferred into a new flat-bottom 96-well plate. The LDH reaction mixture was freshly prepared and 50 µL of it were added to the supernatant. After 10 min of incubation at room temperature and protected from light, absorbance was measured at 490 nm and 690 nm using an Agilent Biotek Synergy 2 plate reader (Thermo Fisher Scientific, Schwerte, Germany). For the MTT assay, cells were treated with 100 µL 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT reagent) per well and incubated at 37 °C for 1 h. The MTT reagent was removed and 100 µL DMSO were added to each well. After 15 min on a microplate shaker, absorbance was measured at 595 nm and 690 nm with the plate reader.

### Oxidative stress measurement

The 2',7'-dichlorofluorescin diacetate (DCFDA) assay was used to measure cellular oxidative stress. DCFDA becomes highly fluorescent upon oxidation by reactive oxidative species (ROS) to yield 2',7'-dichlorofluorescein (DCF). 1 × 104 cells were seeded into each well of 96-well plates and allowed to settle for 24 h before exposure. Cells were washed with HBSS and treated with 100 µL of 100 µM DCFDA in HBSS per well for 30 min. Cells were washed with HBSS, which was removed after 30 min. Cells were subsequently exposed to vehicle control, medium control, nicotine control in extraction medium, positive control (2 mM hydrogen peroxide), or sample extracts diluted 1:1 with DMEM without supplements and phenol red. After 4 h, the fluorescence was measured at 480 nm excitation and 535 nm emission using an Agilent Biotek Synergy 2 plate reader (Thermo Fisher Scientific, Schwerte, Germany). Four hours of exposure was used to match the time for gene expression of oxidative stress markers.

### Gene expression measurements

For mRNA extraction, 5 × 105 cells were seeded into each well of 6-well plates and allowed to attach for 24 h. Cells were then exposed to diluted 20-min sample extracts for 4 h. The 20 min sample extracts were chosen as it is a common product use duration according to a survey by one product manufacturer (Prasad et al. [2022](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR37)). A 4 h exposure was used for gene expression experiments as it has been reported that gene expression of IL8 and IL6 have their peak after 4 to 8 h. Subsequently, mRNA was isolated using the NucleoSpin RNA, Mini kit for RNA purification (Macherey Nagel, Düren, Germany). The procedure was performed following the kit’s protocol. The amount and purity of isolated mRNA was determined using NanoDrop 1000 Spectrophotometer (VWR, Radnor, PA, USA).

Reverse transcription was performed using the High-Capacity cDNA Reverse Transcription Kit (Applied Biosystems, Waltham, MA, USA). Amplification of cDNA was performed on a thermocycler (Bio-Rad, Hercules, CA, USA). QRT-PCR was performed on a Quantstudio 3 instrument (Applied Biosystems, Waltham, MA, USA). Beta-actin (ACTB) was used as housekeeping gene. The following targets were analyzed in the study upon exposure to sample extracts or vehicle control: Anti-inflammatory and anti-oxidant gene heme oxygenase 1 (HMOX1), anti-oxidant gene glutathione peroxidase (GPx1), anti-oxidative gene superoxide dismutase 2 (SOD2), pro-/anti-inflammatory gene interleukin 6 (IL6), pro-inflammatory gene interleukin 8 (IL8), pro-inflammatory gene tumor necrosis factor alpha (TNFα). For the primer sequences, see Supplementary Information Table 3. The relative gene expression was calculated based on cT values using the ∆∆cT method.

### Flavor screening of nicotine pouches using GC–MS

Screening for unknown substances contained in nicotine pouches was performed in part 1 of this study where the procedure is described in more detail (Mallock-Ohnesorg et al. [2023](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR52)). In brief, a method using liquid–liquid extraction (LLE) and gas chromatography with mass spectrometric detection (GC/MS) was adapted from Hutzler et al. ([2014](https://link.springer.com/article/10.1007/s00204-023-03554-9" \l "ref-CR25)). Nicotine pouches were submersed in ultra-pure water and extracted with ethyl acetate under acidic conditions (after addition of 0.1 M hydrochloric acid) and basic conditions (after addition of 0.2 M ammonia). A 2 µl aliquot of the organic phase was injected into the GC/MS system and separated on a DB-17 ms capillary column (30 m × 0.25 mm I.D., 0.25 µm film thickness; Agilent Technologies, Waldbronn, Germany). Peaks were identified using the software Mass Hunter Qualitative Analysis version 10.0 (Agilent Technologies, Waldbronn, Germany) and MSD ChemStation version F.01.03.2365 (Agilent, Technologies, Waldbronn, Germany) and three different spectra libraries: NIST spectral library version 11, Flavor & Fragrance Natural & Synthetic Compounds 3 (FFNSC3) library, and an in-house aroma library created with solutions of standard substances. Nicotine was included as a reference to calculate relative retention times (RRTs). For substances that were included in the in-house library, identification was verified using the RRTs (± 0.05).

### Statistics

Statistical analysis was performed using GraphPad Prism 8 (version 8.2.0 for Windows, GraphPad Software, San Diego, CA, USA). Data derived from the MTT, LDH, and DCFDA assays were analyzed using one-way ANOVA comparing exposed groups with vehicle control group. In case of statistical significance, a Dunnett’s multiple comparison test was used as post hoc test. Fold changes derived from qRT-PCR were analyzed using an unpaired, two-tailed t-test comparing exposed groups with vehicle control group. A p value of less than 0.05 was considered statistically significant. Three biological replicates with at least three technical replicates were performed for all experiments.

41. mdpi.com

## 1. Introduction

Oral nicotine pouches (ONPs), a novel type of nicotine product, have recently emerged in the USA and have been available nationally since 2019 [[1](https://www.mdpi.com/1660-4601/20/4/3383" \l "B1-ijerph-20-03383),[2](https://www.mdpi.com/1660-4601/20/4/3383" \l "B2-ijerph-20-03383),[3](https://www.mdpi.com/1660-4601/20/4/3383" \l "B3-ijerph-20-03383)]. ONPs come in packages of pre-portioned pouches containing nicotine, flavorings, fillers, and other ingredients [[4](https://www.mdpi.com/1660-4601/20/4/3383" \l "B4-ijerph-20-03383),[5](https://www.mdpi.com/1660-4601/20/4/3383" \l "B5-ijerph-20-03383),[6](https://www.mdpi.com/1660-4601/20/4/3383" \l "B6-ijerph-20-03383)]. ONPs do not contain tobacco leaf, are used between the cheek and gum to deliver nicotine, and do not require spitting as traditional smokeless tobacco does (ST; e.g., chew and dip) [[6](https://www.mdpi.com/1660-4601/20/4/3383" \l "B6-ijerph-20-03383)]. In the last 3 years, the ONP brands available in the USA have proliferated (e.g., Zyn, On!, Rogue, and Velo) and sales data indicate the popularity of ONPs is surging. From 2016 to 2020, ONP sales at U.S. retail stores increased from 0.2 million to nearly 46 million units [[3](https://www.mdpi.com/1660-4601/20/4/3383" \l "B3-ijerph-20-03383)]. Although data on the prevalence of ONP use are limited, recent studies indicate awareness and use of ONPs is highest in adults who use other types of tobacco, especially ST, and that ONPs may appeal to adults who do not use tobacco as well [[7](https://www.mdpi.com/1660-4601/20/4/3383" \l "B7-ijerph-20-03383),[8](https://www.mdpi.com/1660-4601/20/4/3383" \l "B8-ijerph-20-03383),[9](https://www.mdpi.com/1660-4601/20/4/3383" \l "B9-ijerph-20-03383)].

Consumers initially encounter novel tobacco products by engaging with marketing, and tobacco manufacturers carefully design marketing to enhance the appeal of tobacco products, affect consumer perceptions, and increase use [[10](https://www.mdpi.com/1660-4601/20/4/3383" \l "B10-ijerph-20-03383)]. Unfettered marketing is described as a “cause of the global spread of tobacco use and addiction” [[11](https://www.mdpi.com/1660-4601/20/4/3383" \l "B11-ijerph-20-03383),[12](https://www.mdpi.com/1660-4601/20/4/3383" \l "B12-ijerph-20-03383),[13](https://www.mdpi.com/1660-4601/20/4/3383" \l "B13-ijerph-20-03383)], and manufacturers shifted to packaging as a primary marketing vehicle following policies in the USA and other settings that increasingly restricted tobacco marketing channels (e.g., television) [[10](https://www.mdpi.com/1660-4601/20/4/3383" \l "B10-ijerph-20-03383),[11](https://www.mdpi.com/1660-4601/20/4/3383" \l "B11-ijerph-20-03383),[14](https://www.mdpi.com/1660-4601/20/4/3383" \l "B14-ijerph-20-03383)]. Packaging features such as conveying constituents, claims, and descriptors influence the appeal of tobacco products and the likelihood of use [[10](https://www.mdpi.com/1660-4601/20/4/3383" \l "B10-ijerph-20-03383),[11](https://www.mdpi.com/1660-4601/20/4/3383" \l "B11-ijerph-20-03383)]. Packaging is essential to tobacco marketing (e.g., point-of-sale power walls and advertising), and is used to target specific groups (e.g., young people) [[10](https://www.mdpi.com/1660-4601/20/4/3383" \l "B10-ijerph-20-03383),[11](https://www.mdpi.com/1660-4601/20/4/3383" \l "B11-ijerph-20-03383),[14](https://www.mdpi.com/1660-4601/20/4/3383" \l "B14-ijerph-20-03383)]. Policies and regulations targeting packaging include standardized or “plain” packaging, requiring health warnings on tobacco packaging, and prohibiting specific features (e.g., low, light, and mild descriptors; tar/nicotine yields on cigarette packs) [[15](https://www.mdpi.com/1660-4601/20/4/3383" \l "B15-ijerph-20-03383)], and they can reduce tobacco use and its associated morbidity and mortality [[16](https://www.mdpi.com/1660-4601/20/4/3383" \l "B16-ijerph-20-03383),[17](https://www.mdpi.com/1660-4601/20/4/3383" \l "B17-ijerph-20-03383),[18](https://www.mdpi.com/1660-4601/20/4/3383" \l "B18-ijerph-20-03383)]. For novel products such as ONPs, studying effects of packaging features can inform policies and regulations to improve public health [[1](https://www.mdpi.com/1660-4601/20/4/3383" \l "B1-ijerph-20-03383),[19](https://www.mdpi.com/1660-4601/20/4/3383" \l "B19-ijerph-20-03383),[20](https://www.mdpi.com/1660-4601/20/4/3383" \l "B20-ijerph-20-03383),[21](https://www.mdpi.com/1660-4601/20/4/3383" \l "B21-ijerph-20-03383)].

ONPs are marketed as alternatives to cigarettes and ST, with advertising emphasizing they are “spit free”, “smoke free” [[22](https://www.mdpi.com/1660-4601/20/4/3383" \l "B22-ijerph-20-03383)], and can be used in settings where other tobacco use is discouraged or prohibited [[23](https://www.mdpi.com/1660-4601/20/4/3383" \l "B23-ijerph-20-03383)]. ONP packaging features sleek designs, attractive colors, appealing flavors, and emphasizes the unique characteristics of ONPs, such as the variety of nicotine “strengths,” or the nicotine concentration per pouch available. As of 2022, all ONP brands featured nicotine concentration on the packaging [[24](https://www.mdpi.com/1660-4601/20/4/3383" \l "B24-ijerph-20-03383)], and ONP advertising emphasizes nicotine concentration as well. For example, the online retailer Nicokick.com indicates: “the [nicotine] strength you pick will depend on a number of factors” including “whether you are a first-timer or you’ve used nicotine for years” [[25](https://www.mdpi.com/1660-4601/20/4/3383" \l "B25-ijerph-20-03383)]. Zyn advertisements display packaging emphasizing that 3 mg ONPs provide “fresh nicotine satisfaction” and 6 mg ONPs deliver “even more nicotine enjoyment” [[26](https://www.mdpi.com/1660-4601/20/4/3383" \l "B26-ijerph-20-03383)]. Some research has examined how characteristics of ONP marketing such as “tobacco free” claims influence perceptions of ONPs [[27](https://www.mdpi.com/1660-4601/20/4/3383" \l "B27-ijerph-20-03383)]. However, evidence remains limited as to how ONP marketing, including packaging, influences perceptions of ONPs.

The appeal, uptake, and use of ONPs will be impacted by how packaging features affect perceptions of ONPs, including by tobacco users and non-users [[28](https://www.mdpi.com/1660-4601/20/4/3383" \l "B28-ijerph-20-03383)]. Examining how ONP packaging features affect ONP perceptions can provide evidence to guide policy and regulation surrounding ONPs. In the USA, the Family Smoking Prevention and Tobacco Control Act authorized the Food and Drug Administration (FDA) to regulate the marketing, distribution, and sale of cigarettes, smokeless, and roll-your-own tobacco [[21](https://www.mdpi.com/1660-4601/20/4/3383" \l "B21-ijerph-20-03383)]. The 2016 Deeming Rule expanded this regulatory authority to all tobacco products, and 2022 legislation further expanded the FDA’s authority to products using synthetic nicotine [[29](https://www.mdpi.com/1660-4601/20/4/3383" \l "B29-ijerph-20-03383)]. These laws position the FDA to regulate ONP packaging and grant the FDA authority to enact packaging regulations if evidence demonstrates they are appropriate for the protection of public health [[21](https://www.mdpi.com/1660-4601/20/4/3383" \l "B21-ijerph-20-03383)]. Thus, packaging regulations must be guided by research on how potential regulations impact tobacco users and non-users [[19](https://www.mdpi.com/1660-4601/20/4/3383" \l "B19-ijerph-20-03383),[21](https://www.mdpi.com/1660-4601/20/4/3383" \l "B21-ijerph-20-03383)].

The risks of health harm and addiction of ONPs are not yet known, but evidence (primarily from industry research) suggests that ONPs may pose less harm than cigarettes and ST for adult tobacco users because they do not involve inhaling combusted tobacco smoke and may expose users to fewer harmful chemicals [[30](https://www.mdpi.com/1660-4601/20/4/3383" \l "B30-ijerph-20-03383),[31](https://www.mdpi.com/1660-4601/20/4/3383" \l "B31-ijerph-20-03383)]. As research on the health risks of ONPs becomes available, it is critical to understand the effects of ONP packaging features on tobacco users’ and non-users’ perceptions of ONPs to inform potential regulations. Given the limited research in this area, the objective of this study was to experimentally examine the effects of prominent ONP packaging features on adult tobacco users’ and non-users’ perceptions of ONPs to inform future research and potential packaging regulations.

## 2. Materials and Methods

#### 2.1. Participants

From April to September 2021, we recruited a convenience sample of cigarette smokers, ST (chew, snuff, dip, and snus) users, and non-users of cigarettes or ST aged ≥21 years who resided in Ohio, USA for a cross-sectional study. We recruited participants using social media advertising, institutional study registries, and word of mouth referrals. Those responding to recruitment advertisements completed a brief online eligibility screening, assessing their age, tobacco use behavior (i.e., cigarette smoking and ST use), and contact information. We sent those meeting eligibility criteria a secure personal web link to complete a self-report online survey. We reviewed the screening and survey data quality using methods recommended for remote screening and data collection (e.g., contact information accuracy and potential fraudulent or duplicate responses) [[32](https://www.mdpi.com/1660-4601/20/4/3383" \l "B32-ijerph-20-03383)]. In total, 810 participants completed screening, 650 met the initial eligibility screening (80.2%), and 301 (46.3% of those eligible) eligible participants satisfied data quality checks and completed procedures. All participants provided informed consent, and those completing procedures received a $20 gift card for their time. The host institution’s institutional review board approved the study procedures.

For analyses, we created four tobacco user groups based on participants’ reported use of cigarettes and ST (chew, snuff, dip, and snus), with current users defined as those who reported using the product every day or some days [[33](https://www.mdpi.com/1660-4601/20/4/3383" \l "B33-ijerph-20-03383)]. The tobacco user categories included no current use of cigarettes/ST (non-user, n = 78, 24.9%), exclusive cigarette smoking (n = 53, 17.6%), exclusive ST use (n = 121, 40.2%), and dual use of cigarettes and ST (n = 49, 16.3%).

#### 2.2. Procedures

Participants completed initial questions (demographics and tobacco/nicotine use), read a brief description of ONPs, and were randomized to view an ONP pack image in a 4 (flavor) ×3 (nicotine concentration) ×2 (addiction warning label) between-subject design. Participants completed outcome assessments after viewing the pack image.

We obtained the ONP pack images from an online search and digitally edited the images to align with the conditions in the experimental design. All images were for Zyn brand ONPs, the most popular ONP brand based on U.S. sales data [[2](https://www.mdpi.com/1660-4601/20/4/3383" \l "B2-ijerph-20-03383),[3](https://www.mdpi.com/1660-4601/20/4/3383" \l "B3-ijerph-20-03383)]. Because flavor influences uptake and use of tobacco and nicotine products [[34](https://www.mdpi.com/1660-4601/20/4/3383" \l "B34-ijerph-20-03383),[35](https://www.mdpi.com/1660-4601/20/4/3383" \l "B35-ijerph-20-03383),[36](https://www.mdpi.com/1660-4601/20/4/3383" \l "B36-ijerph-20-03383),[37](https://www.mdpi.com/1660-4601/20/4/3383" \l "B37-ijerph-20-03383)], we included 4 flavors reflecting the most popular ONP flavors [[2](https://www.mdpi.com/1660-4601/20/4/3383" \l "B2-ijerph-20-03383),[3](https://www.mdpi.com/1660-4601/20/4/3383" \l "B3-ijerph-20-03383)] at the time of the study and the manufacturers’ use of unambiguous (Cool Mint and Coffee) and ambiguous (Smooth and Dark Frost) flavor descriptors. The label color reflected the labels used by the manufacturer for each flavor (i.e., Cool Mint was blue, Coffee was brown, Smooth was light gray, Dark Frost was dark gray). For the nicotine concentration, we edited the pack images to not display nicotine concentration or to display a 3 mg or 6 mg nicotine concentration. We included ONP packages with and without addiction warning labels in our design because at the time of the study some ONPs were not regulated by the U.S. FDA, manufacturers varied in the use and content of warnings, and it was important to account experimentally for potential effects of other information about nicotine (i.e., the concentration) appearing on packs with and without warnings conveying potential risks of nicotine use. For the addiction warning label, the pack images displayed the text-only warning required by the U.S. FDA under the 2016 Deeming Rule (“Warning: This product contains nicotine. Nicotine is an addictive chemical.”) [[29](https://www.mdpi.com/1660-4601/20/4/3383" \l "B29-ijerph-20-03383)] or we edited them to display no warning label. Other than the experimentally manipulated features, we edited pack images to be consistent across conditions (e.g., size and resolution). The stimuli are available from the corresponding author.

#### 2.3. Measures

Before viewing the pack image, we assessed demographics, cigarette smoking, ST use, and past 30-day use of other tobacco and nicotine products (large cigars, little cigars, cigarillos, electronic cigarettes, and waterpipe/hookah) [[33](https://www.mdpi.com/1660-4601/20/4/3383" \l "B33-ijerph-20-03383)]. After viewing the pack image, we measured outcomes assessing participants’ perceptions of ONPs. Given ONP manufacturers’ efforts to position ONPs as alternatives to cigarettes and ST [[22](https://www.mdpi.com/1660-4601/20/4/3383" \l "B22-ijerph-20-03383)] and to capture the potential appeal of ONPs among tobacco users and non-users, we assessed perceived substitutability of ONPs for cigarettes and ST in all participants with two items asking “Could this product be used as a substitute for cigarettes/traditional smokeless tobacco (chew, snuff, dip) for people who smoke/use smokeless tobacco?” Responses were on a 1 (Definitely Not) to 7 (Definitely Yes) scale.

Risk perceptions are consistently associated with tobacco use behavior [[38](https://www.mdpi.com/1660-4601/20/4/3383" \l "B38-ijerph-20-03383),[39](https://www.mdpi.com/1660-4601/20/4/3383" \l "B39-ijerph-20-03383)], and they are affected by tobacco marketing [[28](https://www.mdpi.com/1660-4601/20/4/3383" \l "B28-ijerph-20-03383)]. We used items from prior research to capture participants’ ONP risk perceptions in response to packaging features [[40](https://www.mdpi.com/1660-4601/20/4/3383" \l "B40-ijerph-20-03383),[41](https://www.mdpi.com/1660-4601/20/4/3383" \l "B41-ijerph-20-03383),[42](https://www.mdpi.com/1660-4601/20/4/3383" \l "B42-ijerph-20-03383),[43](https://www.mdpi.com/1660-4601/20/4/3383" \l "B43-ijerph-20-03383)]. We measured participants’ overall perceived harm of ONPs by asking “How harmful do you think this product is to your health?” with response options ranging from 1 (Not at All) to 4 (Very). We used a similar item to capture the overall perceived addictiveness of ONPs with response options from 1 (Not at All Addictive) to 4 (Very Addictive).

We assessed risk appraisals for health harm and addictiveness using 4 items capturing participants’ perceived likelihood of health harm/addiction and worry about health harm/addiction on a 1 (No Chance/Not at All) to 7 (Certain to Happen/Very Much) scale. We averaged the 2 items assessing risk appraisals for health harm (Cronbach’s α = 0.82) and the 2 items assessing risk appraisals for addiction (Cronbach’s α = 0.70). After participants completed outcome assessments, we measured their awareness of ONPs prior to the study and their lifetime and past 30-day ONP use.

#### 2.4. Statistical Analysis

Our recruitment and sample size were informed by a priori power analyses to test the main effects and two-way interactions between the experimental factors (nicotine concentration, flavor, and warning label) and potential covariates. For the main and two-way interaction effects, our sample of ≥300 participants provided 80% power to detect effect sizes as small as f = 0.20 with α = 0.05. This is a comparable effect size to prior studies testing the effects of packaging and labeling for ST and other combustible tobacco on similar outcomes [[44](https://www.mdpi.com/1660-4601/20/4/3383" \l "B44-ijerph-20-03383),[45](https://www.mdpi.com/1660-4601/20/4/3383" \l "B45-ijerph-20-03383)].

For each outcome, we created linear regression models that: (1) included the main effects for tobacco user status and the experimental factors; (2) tested the 2-way interactions between the experimental factors (flavor, nicotine concentration, and warning label); (3) tested the 2-way interactions between the experimental factors and tobacco user status; and (4) for completeness, tested the 3-way interactions between the experimental factors to determine if these needed to be accounted for in our analyses. None of the interactions were statistically significant; so, we report results for the models that included main effects for tobacco user status and the experimental factors. Other sociodemographic and tobacco use characteristics were balanced by randomization; so, we did not adjust for them. The missing data were <0.5% for any given variable; so, we used the complete cases for analyses. We conducted all analyses using R version 4.1.3.

## 3. Results

#### 3.1. Participant Characteristics

[Table 1](https://www.mdpi.com/1660-4601/20/4/3383" \l "table_body_display_ijerph-20-03383-t001) shows the sample characteristics (n = 301). Participants averaged 35.7 (SD 11.9) years of age, 77.1% male, 92.0% white race, and 2.3% Hispanic ethnicity, and 53.2% reported less than a college education. Most participants (60.5%) described their overall subjective financial situation as “about average.” Most participants had heard of ONPs before the study (68.1%) and 41.7% had tried ONPs. Overall, 18.6% of participants reported using e-cigarettes in the past month, 11.3% large cigars, 9.3% little cigars, 7.6% cigarillos, and 3.3% waterpipe.

## 4. Discussion

This experimental study investigated the effects of ONP packaging features including flavor, presence of an addiction warning label, and nicotine concentration on perceptions of ONPs in a sample of adult tobacco users and non-users. The findings demonstrated that adult tobacco users (cigarette smokers, ST users, and dual cigarette and ST users) perceived ONPs to be less harmful and addictive than non-tobacco users, and that nicotine concentration on the ONP packaging affected perceptions of ONPs. ONPs are a relatively new product, and there is limited research on how ONP marketing, including packaging features, influences consumers. These results add to the nascent research on ONPs and have important implications for future research in this area.

Our study sample included adults aged 21 years and older who smoked cigarettes, used ST, smoked cigarettes and used ST, or did not use tobacco. For our outcomes that captured perceived risks of health harm and addiction, the tobacco users in our sample perceived ONPs to be lower risk than the non-users. Risk perceptions are consistently associated with tobacco use behavior [[38](https://www.mdpi.com/1660-4601/20/4/3383" \l "B38-ijerph-20-03383),[39](https://www.mdpi.com/1660-4601/20/4/3383" \l "B39-ijerph-20-03383)], and low perceived risks are likely to be associated with ONP trial and use. These findings align with the limited available data suggesting ONPs are most appealing to adults who currently use other tobacco products, particularly ST [[7](https://www.mdpi.com/1660-4601/20/4/3383" \l "B7-ijerph-20-03383),[8](https://www.mdpi.com/1660-4601/20/4/3383" \l "B8-ijerph-20-03383),[9](https://www.mdpi.com/1660-4601/20/4/3383" \l "B9-ijerph-20-03383)]. The patterns we observed may also be influenced by participants’ baseline tobacco use behavior. For adults who did not use tobacco products, ONPs may introduce new risks of health harm and addiction translating to higher perceived risks. For adults who used cigarettes, ST, or both, ONPs may be less risky than their usual products translating to lower perceived risks. The potential health risks of ONP use are not yet known, and as more evidence on their potential health risks becomes available it will be important to continue to examine how tobacco users and non-users perceive the risks of ONPs and how such perceptions relate to ONP use behavior.

We did not observe significant effects of the FDA’s required addiction warning label or the flavor of the ONP products displayed. Regarding the warning label, this is consistent with other evidence that text only warnings have minimal effect on outcomes such as those that we measured [[46](https://www.mdpi.com/1660-4601/20/4/3383" \l "B46-ijerph-20-03383)]. The limited effect may also be due to the single brief exposure in the study. Regarding ONP flavor, although flavors are an important factor contributing to the uptake and use of tobacco products [[35](https://www.mdpi.com/1660-4601/20/4/3383" \l "B35-ijerph-20-03383),[37](https://www.mdpi.com/1660-4601/20/4/3383" \l "B37-ijerph-20-03383),[47](https://www.mdpi.com/1660-4601/20/4/3383" \l "B47-ijerph-20-03383),[48](https://www.mdpi.com/1660-4601/20/4/3383" \l "B48-ijerph-20-03383)], the use of fruit and sweet flavored products is more common in youth and young adults than older adults [[47](https://www.mdpi.com/1660-4601/20/4/3383" \l "B47-ijerph-20-03383),[48](https://www.mdpi.com/1660-4601/20/4/3383" \l "B48-ijerph-20-03383)]. The lack of a significant effect of flavor could be because we focused on adults versus youth, the flavors we used in our design did not align with prominent flavor preferences (e.g., Spearmint and Wintergreen are the most popular ST flavors [[2](https://www.mdpi.com/1660-4601/20/4/3383" \l "B2-ijerph-20-03383)]), or other factors. It is important in future studies to investigate different strategies for communicating the risks of ONPs via warning labels and the potential influence of flavors on their appeal in diverse populations, including youth.

For nicotine concentration, the study findings showed that adults perceived ONPs displaying 6 mg nicotine concentration on the package to be less harmful and less addictive compared with ONP packaging that did not display the nicotine concentration. They also perceived ONPs displaying 3 mg nicotine concentration on the package to be less substitutable for cigarettes than ONPs that did not display the nicotine concentration on the package. ONPs are available with nicotine concentrations ranging from 2 mg to >10 mg per portioned pouch; this information is virtually universal on ONP packaging [[24](https://www.mdpi.com/1660-4601/20/4/3383" \l "B24-ijerph-20-03383)], and it is prominently emphasized in ONP advertising [[26](https://www.mdpi.com/1660-4601/20/4/3383" \l "B26-ijerph-20-03383)]. Low perceived risks are consistently associated with tobacco use behavior [[49](https://www.mdpi.com/1660-4601/20/4/3383" \l "B49-ijerph-20-03383),[50](https://www.mdpi.com/1660-4601/20/4/3383" \l "B50-ijerph-20-03383)], suggesting this feature of ONP packaging may promote ONP use by influencing perceived risks. For other tobacco products, quantitative information about constituents (including nicotine) on packaging and advertising has been shown to mislead consumers about the potential risks, and in some settings it is prohibited on packaging and advertising [[51](https://www.mdpi.com/1660-4601/20/4/3383" \l "B51-ijerph-20-03383)]. To our knowledge, this study provides some of the first published evidence on how nicotine concentration on ONP packaging can affect consumer perceptions. Although these explanations are speculative, it is possible that consumers perceive higher nicotine concentration ONPs would translate to less frequent use and thus lower risks of health harm and addiction. It is also possible that consumers draw broad judgements about how ONP nicotine concentration affects nicotine delivery relative to other tobacco products, such as the observed pattern that 3 mg (but not 6 mg) ONP packages were viewed as less substitutable for cigarettes.

Given the wide range of available ONP nicotine concentrations and the emphasis on nicotine concentration in ONP packaging and advertising, our findings highlight the importance of further research to understand how information about nicotine on ONP packaging affects consumer perceptions and ONP use behavior. There are other aspects of ONP packaging and advertising that we did not examine that are important topics of future study as well. For example, many ONP manufactures now claim to use synthetic nicotine, and such products use “tobacco free” and “synthetic” claims on the packaging and marketing [[6](https://www.mdpi.com/1660-4601/20/4/3383" \l "B6-ijerph-20-03383)]. In future studies, it will be important to examine how “tobacco free” and “synthetic” claims on ONP packaging impact consumer perceptions, and whether they affect the impact of other packaging features (e.g., nicotine concentration and addiction warnings). This evidence can inform potential regulations of ONP packaging and pre-market review of new tobacco products by the U.S. FDA [[19](https://www.mdpi.com/1660-4601/20/4/3383" \l "B19-ijerph-20-03383),[21](https://www.mdpi.com/1660-4601/20/4/3383" \l "B21-ijerph-20-03383)] and similar regulatory agencies in other settings.

These findings should be interpreted considering limitations of the study. We conducted the study with a convenience sample of adult tobacco users and non-users recruited from a single geographic area. Although for experimental tobacco research studies, convenience samples provide consistent results with population-based samples [[52](https://www.mdpi.com/1660-4601/20/4/3383" \l "B52-ijerph-20-03383)], this could have impacted our findings, such as the higher prevalence of awareness and use of ONPs in the sample relative to other published data [[8](https://www.mdpi.com/1660-4601/20/4/3383" \l "B8-ijerph-20-03383)]. This also limits the potential generalizability of the findings to broader populations. Among tobacco users, we focused on adults who smoked cigarettes and used ST. In future studies, it will be important to examine how ONP packaging characteristics affect perceptions and use behavior in adults who use other tobacco and nicotine products, such as electronic cigarettes. We did not include youth in our study, and research to examine the appeal of ONPs to youth is important. Our experimental design was informed by the published evidence on the popular ONPs at the time of the study (e.g., brand and flavor); however, our findings are limited to a single ONP brand and a limited range of flavors and other factors. We used pack colors that aligned with flavors consistent with the ONP manufacturers’ practices to maintain external validity in our design, but due to this we cannot disentangle the effects of flavor and pack color. Future studies can build from our results by testing other ONP brands, a wider range of product characteristics, and by independently examining the effects of packaging features such as color and flavor. We focused on measures of product perceptions, and research on how packaging and marketing affects ONP trial and use is needed to understand the potential public health effects.

## 5. Conclusions

The study provided some of the first experimental evidence on the effects of ONP packaging features on adult tobacco users’ and non-users’ product perceptions. The results highlighted that consumers’ perceptions of ONPs may be influenced by nicotine concentration displayed on ONP packaging. As the number of ONP brands proliferate, marketing increases, and ONP popularity grows, continued research to understand how features of ONP packaging and other forms of marketing emphasizing nicotine (e.g., the nicotine concentration and “tobacco free” nicotine claims) impact consumers will be important to capture their potential public health effects.

42.formative.jmir.org

# Tobacco-Derived Nicotine Pouch Brands and Marketing Messages on Internet and Traditional Media: Content Analysis

### Introduction

In 2009, the tobacco company Reynolds American Inc acquired the company Niconovum AB, which produced nicotine gum, and in 2012, the company began test-marketing Zonnic brand nicotine pouches in convenience stores and gas stations [[1](https://formative.jmir.org/2023/1/e39146" \l "ref1)]. New tobacco-free nicotine pouch products marketed primarily as alternatives to other tobacco products emerged in the United States several years later. Sales of nicotine pouches in the United States increased substantially between 2016 and 2020 [[2](https://formative.jmir.org/2023/1/e39146" \l "ref2)], and almost 30% of adult smokers were aware of nicotine pouches in 2021 [[3](https://formative.jmir.org/2023/1/e39146" \l "ref3)]. A 2022 study of social media posts on Reddit found the number of posts related to oral nicotine pouches increased between 2019 and 2021, and the most common topics were sharing product information and user experiences [[4](https://formative.jmir.org/2023/1/e39146" \l "ref4)]. Nicotine pouches typically contain nicotine, binders, and flavors in a porous pouch that is placed on the oral mucosa [[5](https://formative.jmir.org/2023/1/e39146" \l "ref5)] to allow nicotine absorption similar to smokeless tobacco products [[6](https://formative.jmir.org/2023/1/e39146" \l "ref6)]. As of 2021, the most popular nicotine pouch product brands available in the United States were owned or distributed by companies that also manufacture and sell cigarettes, cigars, or smokeless tobacco products. Swedish Match introduced its pouch product, ZYN, in test markets in 2014. This was followed by the introduction of Dryft (Kretek) and on! (Philip Morris) in 2016. In 2018, Rogue nicotine pouches, gums, and lozenges were introduced by NicoGen pharma with national rollouts in 2019; Swisher International began to distribute Rogue oral nicotine products late in 2019. Reynolds American Incorporated (RAI) introduced a nicotine lozenge (Revel) early in 2019, followed by a nicotine pouch, Velo, later that year. Subsequently, in 2020, RAI rebranded Revel lozenges under the Velo brand name; it also acquired Dryftpouches and rebranded them under Velo ([Table 1](https://formative.jmir.org/2023/1/e39146" \l "table1)).

Swedish Match (which produces the ZYN brand) had the largest market share, peaking at 92.6% in July 2019 and 78.7% in June 2020 by units sold, which were much greater than the other nicotine pouch products [[2](https://formative.jmir.org/2023/1/e39146" \l "ref2)]. Nicotine pouches are available in a wider variety of flavors (eg, mango, black cherry, citrus, and dragon fruit) compared to Food and Drug Administration (FDA)–approved nicotine replacement gum or lozenges. There is a limited body of literature on nicotine pouch products, and most papers focus on the toxicant or nicotine content of the products [[6](https://formative.jmir.org/2023/1/e39146" \l "ref6)-[9](https://formative.jmir.org/2023/1/e39146" \l "ref9)]. While nicotine pouch products may have lower levels of toxicants than combustible cigarettes or smokeless tobacco products, they may also perpetuate or prolong nicotine addiction or act as a means for young people to initiate nicotine use [[10](https://formative.jmir.org/2023/1/e39146" \l "ref10)]. In studies of nicotine pouch brands sold in the United States, the maximum nicotine content was found to be under 12 mg/pouch [[8](https://formative.jmir.org/2023/1/e39146" \l "ref8),[10](https://formative.jmir.org/2023/1/e39146" \l "ref10)], but in a convenience sample consisting of 46 different pouch samples purchased in web-based shops, researchers in Germany found that nicotine contents ranged from 1.79 to 47.5 mg/pouch [[11](https://formative.jmir.org/2023/1/e39146" \l "ref11)]. One paper based on consumer data reported that nontobacco users had low interest in the ZYN pouches, and most users of ZYN were former tobacco users; notably, this paper was supported by the tobacco company Swedish Match, which has a financial interest in publicizing the product positioning as being for adult tobacco users [[12](https://formative.jmir.org/2023/1/e39146" \l "ref12)].

In addition to the toxicant and nicotine content characteristics of the products, the public health impact of nicotine pouch products depends on the marketing and advertising, which influence their uptake and patterns of use [[9](https://formative.jmir.org/2023/1/e39146" \l "ref9)]. There have been few studies on the marketing of nicotine pouch products. There has been a documented shift in advertising expenditures within the smokeless tobacco product category between 2018 and 2020, with the majority of recent promotional spending on nicotine pouches as compared to conventional smokeless tobacco and snus [[13](https://formative.jmir.org/2023/1/e39146" \l "ref13)]. One paper reviewed 50 pieces of direct mail advertising for 3 brands of nicotine pouch products (Velo, on!, and Revel) and described the basic claims in these advertisements: 90% claimed to be an alternative to another tobacco product like cigarettes or smokeless tobacco, 70% claimed that the product could be used anywhere, and almost half contained claims that oral nicotine was spit-free (58%), smoke-free (42%), or free of tobacco leaf (42%) [[14](https://formative.jmir.org/2023/1/e39146" \l "ref14)]. However, this analysis was limited to direct mail for 3 brands and did not include the market leader, ZYN. More recently, Duan and colleagues [[15](https://formative.jmir.org/2023/1/e39146" \l "ref15)] used advertising data from 2019 through 2021 to examine how nicotine pouch brands including Velo, on!, and ZYN were marketed and found themes such as freedom, brand, and flavor were most prominent. For this study, we conducted a content analysis that addresses 6 brands of nicotine pouch products produced by tobacco companies and includes web-based, website, radio, and television advertising channels used in 2019. In addition, we reviewed the trade press to identify business-to-business advertisements from 2019. The overall goal of the study was to describe messages to sell nicotine pouch products in 2019 while comparing the different brands’ positioning in messages directed at consumers and tobacco business

### Methods

#### Overview

We extracted data collected by Kantar Media from the calendar year (January to December) 2019, including expenditures on web-based advertisements, radio, television, and print for 6 nicotine pouch brands (ZYN, Velo, Dryft, Rogue, Revel, and on!). For web-based display advertisements, Kantar provided monthly reports from January to December 2019, and each monthly report included a ZIP file containing copies of all the advertisements. Each copy was reviewed to identify unique advertisements, defined as featuring a distinct combination of image and text; advertisements that varied only by the size of image, text, or layout (eg, moving the slogan from the bottom to the side of the image) were considered not unique. In addition to web-based display advertisements, Kantar provided monthly reports of all radio and television ad runs from January to December 2019 and provided a ZIP file with copies of the advertisements. From these files, 4 unique radio advertisements and 4 unique television advertisements were extracted and downloaded as MP4 files.

In addition to the data acquired from Kantar, we searched the database What Runs Where [[16](https://formative.jmir.org/2023/1/e39146" \l "ref16)] to identify additional web-based advertisements not included in the Kantar data. We identified advertising in the United States between May 2019 and February 2020 for the 6 oral nicotine product brands of interest and downloaded the list of advertisements, images, and metadata. We identified unique web-based advertisements using the same criteria as the Kantar data set. We also accessed the brand websites for each of the 5 nicotine pouch brands that had brand websites. In addition, we accessed the monthly archives from February 2019 to March 2020 for 2 web-based trade magazines, Convenience Store News & Petroleum, and Convenience Store Decisions, and reviewed each issue for nicotine pouch advertising. Pages that contained advertisements for pouch nicotine products were copied and saved as electronic files. The total combined data set consisted of 711 advertisements: 287 local radio, 211 web-based display advertisements, 99 mobile web advertisements, 42 spot television, 35 web-based video, 13 cable television, 9 national spot radio, 7 business-to-business advertisements, 6 outdoor, and 2 syndicated. Within the data set, we identified 122 unique advertisements: 105 web-based displays, 4 television, 4 radio, 5 brand websites, and 9 advertisements from the trade press.

#### Coding Guide and Development Procedures

A coding guide developed for electronic cigarette websites [[17](https://formative.jmir.org/2023/1/e39146" \l "ref17)] was adapted for nicotine pouch websites, web-based displays, and other advertising. The guide was tested iteratively on each type of advertisement, and investigators discussed the definitions, discrepancies, or missing concepts, followed by guide revision. When consensus was reached, 3 investigators double-coded all advertisements. Coders examined the entirety of each advertisement or website for products, marketing claims, and features. They recorded the availability of product features and the presence or absence of 27 marketing claims and lifestyle elements. When people were present in the advertisement and a face was visible, the demographic characteristics of the person were coded. Discrepancies in coding were reviewed iteratively by the team and discussed, and the guide was repeatedly revised to include new categories and generate consistent definitions until reliability was established. On the test sites, reliability was ĸ=0.87.

### Results

#### Advertising Spending

Spending on advertising for nicotine pouches in 2019 by the brand was reported by Kantar Media for the internet, radio, television, and other channels. A total of US $11.2 million was spent, with US $5.5 million (49.1%) spent on cable TV advertisements, followed by US $1.8 million (16.1%) on local radio and US $1.2 million (10.7%) on national radio, and US $748,000 on internet display advertisements. The majority of spending took place in the fall of 2019 after RAI launched Velo. Velo also dominated in terms of dollars spent: Velo spent US $10.7 million of the US $11.2 million estimated total spending on advertising. By ad count, most advertising was for 2 brands: Velo, which ran 407 (57.2%) of the advertisements, and ZYN, which ran 303 (42.6%) of the advertisements in the data set; most advertisements ran on local radio (n=287, 40.4%), internet display (n=211, 29.7%), and mobile web (n=99, 13.9%).

#### Conclusions

This formal content analysis of nicotine pouch brand marketing highlights substantial investments in advertising, including users and contexts different from typical smokeless tobacco marketing, particularly among the brands with the largest market share. These claims, along with those that evoke perceptions of increased safety and differentiate nicotine pouches from other tobacco products, have the potential to expand the nicotine market. Future research should address messaging that may have more claims that appeal to youth, including social media channels and nicotine pouch brands that are smaller or not associated with major tobacco companies. Continued surveillance of new products, marketing claims, population uptake, and impact on tobacco and nicotine use behaviors is warranted.

43.Oral healthcare

# Nicotine pouches

Sir, nicotine pouches, also referred to as non-medicinal nicotine pouches or tobacco-free snus, are small receptacles that contain white nicotine powder which a user places in the anterior maxillary vestibule.[1](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5375) They originated in Scandinavia and their distribution is rapidly widening to other countries, with five tobacco manufacturers currently selling their products in the UK.[1](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5375) Currently unregulated in the European Union, their packaging carries no health warnings and are widely advertised online, on billboards and buses as 'harmless tobacco-free alternatives'.[2](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5392)

The evidence behind the correlation of nicotine and cancer development is inconclusive, although several studies have illustrated that nicotine can facilitate a tumour-supporting environment and has proven genotoxic effects.[3](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5400) Oral mucosal changes (for example, hyperkeratotic changes) behind habitual oral nicotine use have been documented.[4](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5406)

These nicotine pouches are being marketed as a vogue and safe way to get a 'nicotine hit' without the associated negative health consequences of traditional tobacco or snus use. They are available in a wide variety of flavours and packaged in fashionable tins with coloured logos which have great visual appeal.[1](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5375),[2](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5392)

As a hospital clinician, I had no prior knowledge of these products despite distributing smoking cessation advice on a daily basis. With such a paucity of information available regarding these products and their associated potential harmful consequences, how is a layperson supposed to make an informed decision regarding their use?

I am deeply concerned that these pouches provide a gateway to traditional tobacco smoking via nicotine addiction. Even if they may offer a harm-reduction means for established tobacco users to get their 'nicotine hit', we must not take tobacco companies at their word; rigorous independent research is imperative. We have seen an uptake of new-generation smokers with vaping and smokeless tobacco and now know of the established detrimental health effects.[5](https://www.nature.com/articles/s41415-021-2622-y" \l "ref-CR5426) We must act urgently and in unison, lest we repeat our mistakes.

44.edition.cnn.com

# Nicotine pouches for your mouth are becoming increasingly popular. Here’s why health experts are concerned

CNN —

A relatively new nicotine product with a tobacco-free and smokeless design has drawn in a wave of new users in just the past year: oral nicotine pouches that sit at the gums and are nearly undetectable when in use.

The leading brand Zyn, introduced in the United States in 2014, shipped 350 million cans, about 15 pouches per can, in 2023 — a 62% increase compared with the previous year, Philip Morris International [announced in February](https://www.cnn.com/2024/02/08/business/zyn-nicotine-pouches-sales-earnings/index.html).

While the product is aimed at adults who already use nicotine, some health professionals and researchers are worried the attention could attract an influx of brand-new users, especially among younger people.

Zyn does not use social media influencers to market, and the company’s social media posts on Facebook and Instagram for US audiences are age-gated to 21 and older, a spokesperson for Philip Morris International said in an email. Yet colleges across the United States have seen a [rise in Zyn usage](https://www.miamistudent.net/article/2024/03/zyns-are-buzzing-the-rise-of-nicotine-pouches-at-miami) on campus, while social media has a new type of unofficial influencer for nicotine — a “Zynfluencer.”

Senate Majority Leader Chuck Schumer recently called for Federal Trade Commission and Food and Drug Administration regulators to investigate Zyn’s marketing strategies and health impacts. “I’m delivering a warning to parents, because these nicotine pouches seem to lock their sights on young kids — teenagers, and even lower — and then use the social media to hook them,” he said in a January press conference.

Here’s what experts have to say on the health risks of the product.

### Are nicotine pouches better than vaping?

Tobacco is a known carcinogen that can cause several types of cancer. Cigarette smoking is the primary cause of lung cancer, according to the [American Cancer Society](https://www.cancer.org/cancer/types/lung-cancer/causes-risks-prevention/risk-factors.html). Zyn, among other brands of nicotine pouches such as Rogue, On! and Velo, markets its pouches as an alternative product to smoking and using tobacco.

While using a nicotine pouch does not entail inhaling chemicals as with cigarettes or vape pens, Kecia Christensen, a nurse practitioner in pulmonary disease and thoracic surgery at Nebraska Medicine, does not recommend the use of pouch products as a means to quit smoking at this time.

“It’s good that these companies are trying to come up with nontobacco-related forms of nicotine for people to try to wean their addiction. … The problem, I think, with products like this is that until they are completely regulated by the FDA, what I tell my patients is, ‘I don’t really know for sure what’s in those things,’” said Christensen, who is also a certified tobacco treatment specialist.

Philip Morris International’s application for FDA authorization has been pending since 2020, [according to the company](https://www.pmiscience.com/en/smoke-free/tobacco-regulation/us-regulation-tobacco-nicotine-products/). However, FDA officials have allowed the [nontobacco nicotine](_blank) product to stay on the market while the application is under review.

While more research on the product is needed, Christensen said, the nicotine pouches could potentially help curb cravings for those looking to ultimately stop tobacco and nicotine use altogether if the amount of nicotine is incrementally decreased to be less than what a person was taking in with cigarettes or chewing tobacco.

The numbers can vary, but Christensen often tells patients to think of one cigarette as having 5 to 10 milligrams of nicotine each, with the actual amount inhaled probably less than that. Nicotine pouches have varying degrees of nicotine strength; 3 or 6 milligrams per pouch is most common, but some brands have pouches that contain upward of 28 milligrams.

### Nicotine addiction and mental health

Oftentimes, patients who are trying to quit tobacco instead get addicted to nicotine through vaping, sometimes even more so than with cigarettes, according to Christensen. That’s because vapes are easier to use and are often used indoors rather than outside on smoke breaks, she said. Nicotine pouches are even more discreet, with a small pouch measuring at 0.6 inches by 1.1 to 1.3 inches (14 millimeters by 28 to 32 millimeters), similar to a piece of chewing gum, that can be popped in the mouth virtually anywhere without anyone else knowing.

### Zynfluencers and Zyn users

Zyn does not have official social media influencers, but the hashtag “Zynfluencer” has hundreds of posts on TikTok and Instagram, and “Zyn” has upward of tens of thousands.

“Nicotine products should only be used by legal-age adults, which means those 21-plus. The latest CDC (US Centers for Disease Control and Prevention) and FDA data show that underage nicotine pouch use has remained low while providing many adult smokers with a better alternative than continued smoking,” Philip Morris International said in a statement to CNN.

The data from Swedish Match, a tobacco company that makes Zyn and acquired by Philip Morris International in February 2023, also shows that most Zyn users are “previous consumers of traditional oral, vaping and cigarette products with others coming from other nicotine product categories,” the company noted.

The advertisements for Zyn use terms such as “smoke-free,” “spit-free” and “odor-free” and can contain imagery of the products being used in places a cigarette or an e-cigarette wouldn’t be allowed, said Meghan Moran, an associate professor of health, behavior and society at Johns Hopkins Bloomberg School of Public Health in Baltimore. The discreetness is cause for concern when it comes to the attractiveness to people under 21, she added.

“When you think about young people who are not already using tobacco and who we don’t want to use tobacco, a product being discreet is potentially very attractive, because younger folks, teenagers, often find themselves in situations such as, you know, school, maybe home with the parents, where if it were discovered that they were using a tobacco product, there would likely be repercussions,” Moran said.

What’s more, the Zyn nicotine pouches come in a variety of flavors, including cool mint, wintergreen, coffee and cinnamon, that could be [appealing to younger people](https://hub.jhu.edu/2024/03/08/zyn-nicotine-pouch-tory-spindle/), according to Christensen.

In October, 1.5% of middle school and high school students reported using nicotine pouches in the previous 30 days, according to the [2023 National Youth Tobacco Survey](https://www.cdc.gov/mmwr/volumes/72/wr/mm7244a1.htm?s_cid=mm7244a1_w) conducted by the FDA and CDC.

“The FDA remains concerned about any tobacco product that may appeal to youth,” said Brian King, director of the FDA’s Center for Tobacco Products, in a statement. “As always, we are committed to holding those accountable who sell unauthorized tobacco products, including those labeled, advertised, and/or designed to encourage youth use.”

For those not used to nicotine, high amounts can cause vomiting and nausea (or “nicotine sickeness”), Christensen said. Nicotine products can also[“harm the developing adolescent brain](https://www.cnn.com/2022/11/10/health/youth-tobacco-use-2022/index.html),” according to FDA and CDC research.

### Zyn and mouth soreness

Nicotine pouch users hold the pouch to their gum for up to an hour, which may cause a sore mouth or gum irritation. But the full effects of the oral product are not known as of yet, with more research needed to understand how nicotine usage might be associated with gum disease or cavities, said Yanfang Ren, a professor and chairman of the department of diagnostic sciences at the University of Rochester Eastman Institute for Oral Health in upstate New York.

“If you put something, anything in the mouth for a long time, potentially you might have some irritation to the gum — but to what extent, that’s something we really don’t know yet,” Ren said. He was a part of a [December 2017 study](https://pubmed.ncbi.nlm.nih.gov/29251454/) that looked at the effect cigarette smoke had on the color of the teeth that was partially funded by Philip Morris International.

For those looking to quit tobacco and nicotine altogether for a healthier lifestyle, Moran recommends visiting a primary health care provider, as well as using resources provided online by the [Mayo Clinic Nicotine Dependence Center.](http://www.becomeanex.org/) [The CDC](https://www.cdc.gov/tobacco/quit_smoking/how_to_quit/index.htm) also has online resources to help those aiming to quit smoking.

45.sydney.edu.au

Nicotine pouches are being marketed to young people on social media

But are they safe, or even legal?

It's not surprising that the tobacco industry is introducing more products to maintain its future revenue stream as reforms restrict access to vaping products, writes Associate Professor Becky Freeman in The Conversation.

Flavoured nicotine pouches are [being promoted to young people](https://www.theguardian.com/australia-news/2024/feb/07/all-good-to-take-to-school-australian-influencers-spruik-flavoured-nicotine-pouches-to-vape-addicted-youths) on social media platforms such as TikTok and Instagram.

Although some viral videos have been taken down following a series of reports in [The Guardian](https://www.theguardian.com/australia-news/2024/feb/08/albanese-government-condemns-widespread-marketing-of-nicotine-pouches-to-young-people), clips featuring [Australian influencers](https://www.tiktok.com/@anabolicgabe/video/7300486987331472641) have claimed nicotine pouches are a safe and effective way to quit vaping. A number of the videos have included links to websites selling these products.

With the rapid rise in youth vaping and the subsequent [implementation of several reforms](https://theconversation.com/from-today-new-regulations-make-it-harder-to-access-vapes-heres-whats-changing-218816) to restrict access to vaping products, it’s not entirely surprising the tobacco industry is introducing more products to maintain its future revenue stream.

The major trans-national tobacco companies, including Philip Morris International and British American Tobacco, all manufacture nicotine pouches. British American Tobacco’s brand of nicotine pouches, Velo, is a leading sponsor of the [McLaren Formula 1 team](https://www.formula1.com/en/latest/article.mclaren-new-livery-reveal-2024-f1-season.216OAbbqt6SWUjIio6GLqP.html).

But what are nicotine pouches, and are they even legal in Australia?

## Like snus, but different

Nicotine pouches are available in many countries around the world, and their sales are [increasing rapidly](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1), especially among [young people](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10203764/).

Nicotine pouches look a bit like small tea bags and are placed between the lip and gum. They’re typically sold in small, colourful tins of about 15 to 20 pouches. While the pouches [don’t contain tobacco](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9915420/), they do contain nicotine that is either extracted from tobacco plants or made synthetically. The pouches come in a wide range of strengths.

As well as nicotine, the pouches commonly contain plant fibres (in place of tobacco, plant fibres serve as a filler and give the pouches shape), sweeteners and flavours. Just like for vaping products, there’s [a vast array](https://storage.googleapis.com/who-fctc-cop10-source/Supplementary information/nicotine_pouch_paper.pdf) of pouch flavours available including different varieties of fruit, confectionery, spices and drinks.

The range of appealing flavours, as well as the fact they can be used discreetly, may make nicotine pouches particularity attractive to young people.

Users absorb the nicotine in their mouths and simply replace the pouch when all the nicotine has been absorbed. Tobacco-free nicotine pouches are a relatively recent product, but similar style products that do contain tobacco, [known as snus](https://tobaccotactics.org/article/snus/), have been popular in Scandinavian countries, particularly Sweden, for decades.

Snus and nicotine pouches are however different products. And given snus contains tobacco and nicotine pouches don’t, the products are subject to quite different regulations in Australia.

## What does the law say?

Pouches that contain tobacco, like snus, have been banned in Australia since 1991, as part of a [consumer product ban](https://www.productsafety.gov.au/products/health-lifestyle/personal/tobacco-related-products/smokeless-tobacco-products) on all forms of smokeless tobacco products. This means other smokeless tobacco products such as chewing tobacco, snuff, and dissolvable tobacco sticks or tablets, are also banned from sale in Australia.

Tobacco-free nicotine pouches cannot legally be sold by general retailers, like tobacconists and convenience stores, in Australia either. But the reasons for this are more complex.

In Australia, under the [Poisons Standard](https://www.legislation.gov.au/F2024L00095/latest/downloads), nicotine is a prescription-only medicine, with two exceptions. Nicotine can be used in tobacco prepared and packed for smoking, such as cigarettes, roll-your-own tobacco, and cigars, as well as in preparations for therapeutic use as a smoking cessation aid, such as nicotine patches, gum, mouth spray and lozenges.

If a nicotine-containing product does not meet either of these two exceptions, it cannot be legally sold by general retailers. No nicotine pouches have currently been approved by the [Therapeutic Goods Administration](https://www.tga.gov.au/products/unapproved-therapeutic-goods/vaping-hub/nicotine-pouches) as a therapeutic aid in smoking cessation, so in short they’re not legal to sell in Australia.

However, nicotine pouches can be legally imported for personal use only if users have a prescription from a medical professional who can assess if the product is appropriate for individual use.

We only have anecdotal reports of nicotine pouch use, not hard data, as these products are very new in Australia. But we do know authorities are increasingly [seizing these products](https://www.9news.com.au/national/more-than-1-million-in-vapes-nicotine-products-seized-in-raids-across-sydney/e86beb9b-437f-4904-b0cc-d1c46bfb2ef3) from retailers. It’s highly unlikely any young people using nicotine pouches are accessing them through legal channels.

## Health concerns

Nicotine exposure [may induce effects including](https://adf.org.au/drug-facts/nicotine/) dizziness, headache, nausea and abdominal cramps, especially among people who don’t normally smoke or vape.

Although we don’t yet have much evidence on the long term health effects of nicotine pouches, we know nicotine is addictive and [harmful to health](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1). For example, it can cause problems in the cardiovascular system (such as heart arrhythmia), particularly at high doses. It may also have negative effects on [adolescent brain development](https://www.tga.gov.au/products/unapproved-therapeutic-goods/vaping-hub/nicotine-pouches).

The nicotine contents of some of the nicotine pouches on the market is alarmingly high. Certain brands offer pouches containing more than [10mg of nicotine](https://truthinitiative.org/research-resources/emerging-tobacco-products/what-zyn-and-what-are-oral-nicotine-pouches), which is similar to a cigarette. According to a World Health Organization (WHO) [report](https://iris.who.int/bitstream/handle/10665/3724 yes63/9789240079410-eng.pdf?sequence=1), pouches deliver enough nicotine to induce and sustain nicotine addiction.

Pouches are also being marketed as a product to use when it’s not possible to vape or smoke, such as [on a plane](https://www.velo.com/gb/en/blog/post/flying-with-nicotine-products). So instead of helping a person quit they may be used in addition to smoking and vaping. And importantly, there’s [no clear evidence](https://factcheck.afp.com/doc.afp.com.34JC8Q2) pouches are an effective smoking or vaping cessation aid.

Further, some nicotine pouches, despite being tobacco-free, still contain [tobacco-specific nitrosamines](https://tobaccocontrol.bmj.com/content/early/2022/08/05/tc-2022-057280.abstract). These compounds can damage DNA, and with long term exposure, can cause cancer.

Overall, there’s limited data on the harms of nicotine pouches because they’ve been on the market for only a short time. But the WHO [recommends a cautious approach](https://iris.who.int/bitstream/handle/10665/372463/9789240079410-eng.pdf?sequence=1) given their similarities to smokeless tobacco products.

For anyone wanting advice and support to quit smoking or vaping, it’s best to talk to your doctor or pharmacist, or access trusted sources such as [Quitline](https://www.health.gov.au/contacts/quitline) or the [iCanQuit website](https://www.icanquit.com.au/).

This article was original published in The Conversation as '[**Nicotine pouches are being marketed to young people on social media. But are they safe, or even legal?**](https://theconversation.com/nicotine-pouches-are-being-marketed-to-young-people-on-social-media-but-are-they-safe-or-even-legal-223084)'.

Declaration: Becky Freeman is an Expert Advisor to the Cancer Council Tobacco Issues Committee and a member of the Cancer Institute Vaping Communications Advisory Panel. These are unpaid roles. She has received relevant competitive grants that include a focus on e-cigarettes/vaping from the NHMRC, MRFF, NSW Health, the Ian Potter Foundation, VicHealth, and Healthway WA; relevant research contracts from the Cancer Institute NSW and the Cancer Council NSW; relevant personal/consulting fees from the World Health Organization, the Hong Kong Special Administrative Region Department of Health, BMJ Tobacco Control, the Heart Foundation NSW, the US FDA, the NHMRC e-cigarette working committee, NSW Health, and Cancer Council NSW; and relevant travel expenses from the Oceania Tobacco Control Conference and the Australia Public Health Association preventive health conference.

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# Nicotine Pouches: A New Nicotine Product is Rising in Popularity

The tobacco industry continues to shape-shift for American consumers with the rise in sales of oral “tobacco-free” nicotine pouches. Nicotine pouches are currently the fourth most used type of tobacco device, behind e-cigarettes, cigars, and cigarettes, according to the [2023 Annual National Youth Tobacco Survey](https://www.fda.gov/tobacco-products/youth-and-tobacco/results-annual-national-youth-tobacco-survey) of the U.S. Food and Drug Administration (FDA).

While oral nicotine pouches do not contain tobacco, they do contain nicotine, a highly addictive substance. These new pouches continue to be marketed to young people, with a variety of flavors like those that attracted youth to e-cigarettes. Nicotine pouches have a [strong presence on social media](https://www.nytimes.com/2024/01/12/opinion/children-nicotine-zyn-social-media.html?unlocked_article_code=1.NU0.tDEj.GjJmC-dV_yTF&smid=em-share), making them, again, targeted towards young people.

The Massachusetts Medical Society Committee on Mental Health and Substance Use is sharing information on this product to ensure physicians and other health care professionals are aware of how it can affect their patients.

### What are nicotine pouches?

Nicotine pouches are small, white triangles that contain nicotine powder manufactured by popular brand names such as Zyn, On!, and Velo. Sold in youth-appealing colorful containers, they are available in a variety of flavors, including mint, cinnamon, menthol, and fruit flavors. The pouches are placed between the cheek and the gum, similar to tobacco dip, allowing absorption of nicotine through the oral mucosa. Nicotine pouches don’t require any spitting, making the smokeless product even easier to conceal than previous oral nicotine products. A [recent cross-sectional analysis](https://www.sciencedirect.com/science/article/abs/pii/S0749379722002434?via%3Dihub) stated the highest use of nicotine pouches was among young adults aged 18−24 years old.

### Lack of regulations

Rather than containing shredded tobacco leaf, such as previous oral pouches produced by tobacco companies, nicotine pouches contain nicotine powder. Because the pouches are “tobacco-free,” they are not currently categorized as smokeless tobacco and are therefore not regulated by the FDA as strictly as tobacco products. This allows brands to produce pouches with different amounts of nicotine concentration, ranging from 3 mg to 8 mg per pouch. Sales of products with higher doses of nicotine (8 mg) have been [increasing at the fastest rate](https://www.nytimes.com/2024/01/12/opinion/children-nicotine-zyn-social-media.html?unlocked_article_code=1.NU0.tDEj.GjJmC-dV_yTF&smid=em-share) compared to products with lower doses. This year, On! is expected to produce a new product, On Plus, that contains up to 12 mg of nicotine, according to a consumer products store newsletter.

### Health effects of nicotine pouches

Nicotine use under the age of 25, while the brain is still developing, [can affect attention and learning, as well as mood](https://www.cdc.gov/tobacco/basic_information/e-cigarettes/Quick-Facts-on-the-Risks-of-E-cigarettes-for-Kids-Teens-and-Young-Adults.html). [Studies of adults](https://www.bmj.com/content/348/bmj.g1151) have linked smoking to poor mental health, including increased stress, anxiety, and depression.

[Oral health effects](_blank) for nicotine pouches are expected to be similar to those of previous oral tobacco products. These effects include irritation and/or recession of the gums where the pouch is placed, mouth and throat soreness, and mouth ulcers. Hiccups and coughing have also been seen.

As nicotine pouches become more common and their nicotine doses continue to increase, more and more young adults run the risk of developing nicotine dependence and addiction.

Nicotine in any form is harmful for the developing brain. If your patient has nicotine dependence or addiction, resources are available to help them, including:

* 1-800-QUIT-NOW and
* [**smokefree.gov**](https://smokefree.gov/), which connects individuals to a FREE, trained quit coach by phone or online.

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# US Physicians’ Self-reported Discussions About Tobacco-Free Nicotine Pouches During Clinical Encounters With Patients in 2021

Introduction

By 2020, major US tobacco manufacturers launched or acquired tobacco-free nicotine pouch brands and sales increased rapidly.[1](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r1) Like smokeless tobacco (SLT), tobacco-free nicotine pouches orally deliver nicotine but, unlike SLT, contain no tobacco leaf. Although these products are not authorized to carry claims of cessation or reduced harm, nicotine pouches contain low levels of toxicants similar to nicotine replacement therapies (NRTs).[2](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r2) Awareness is low, and use of nicotine pouches is modest, but use and interest are higher among those with smoking cessation attempts or plans.[3](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r3),[4](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r4) Because patients often ask physicians about e-cigarettes for smoking cessation[5](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r5) and nicotine pouches are similar to NRT products, this survey study assessed the extent to which physicians discussed nicotine pouches with patients.

Methods

We conducted a national cross-sectional survey study from May to October 2021 among a random sample of 500 board-certified physicians from each of 5 specialties in the American Medical Association Physician Masterfile: family medicine, internal medicine, pulmonology, cardiology, and psychiatry. We mailed a study invitation, with instructions for accessing the survey online and a $25 upfront incentive, and up to 3 reminders. The survey assessed physicians’ knowledge, perceptions, and communication about tobacco and nicotine product use and cessation treatment. The study was exempted by the Rutgers Biomedical Health Sciences institutional review board because it involved standard survey procedures and the information obtained was recorded in such a manner that human participants could not be identified, directly or through identifiers linked to participants, with a waiver of written informed consent because risk from participation was minimal and the only record linking participants to their participation in the study would be a signed consent document. This study followed the [AAPOR](https://aapor.org/standards-and-ethics/standard-definitions/) reporting guideline.

The overall response rate was 44.6%. Our outcome of interest was number of physicians ever being asked by patients about tobacco-free nicotine pouches. We also conducted a content analysis of open-ended responses to a question asking physicians to describe their conversations with patients about nicotine pouches. Based on collaboratively identified themes, 3 coders (M.H., M.B.S., and C.D.D.) independently coded all comments, initially achieving 94% agreement; discrepancies were discussed to reach consensus. Data were weighted to adjust for differing probabilities of selection by specialty. Analysis was performed in September 2022 using SAS, version 9.4 (SAS Institute Inc).

Results

Of 745 participating physicians, 63 (9.7%) reported being asked by patients about tobacco-free nicotine pouches ([Table](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075t1)). Discussions were most common for physicians younger than 46 years (17 [15.5%]), those specializing in family medicine (22 [13.2%]), and those using Public Health Service Clinical Practice Guidelines for tobacco treatment (16 [12.7%]).

Fifty respondents described patient discussions about nicotine pouches, which clustered into 3 themes: discouraging use of pouches (20 [40.0%]), learning about nicotine pouches from patients or neutral communication (19 [38.0%]), and communicating to patients that they were open to pouch use for cessation or harm reduction (11 [22.0%]) ([Box](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075b1)).

Discussion

We found that physicians were asked about tobacco-free nicotine pouches by patients. With market growth, patient prompting about nicotine pouches will likely increase. Previous guidance on e-cigarettes may be helpful to inform physicians’ approach to nicotine pouches—in a discussion of cigarette substitutes, clinicians should urge patients to quit or reduce combustible tobacco use, and while the effects of long-term nicotine pouch use remain unknown, such products are likely less harmful than combustible tobacco.[2](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r2),[6](https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2804998" \l "zld230075r6) Physicians should ask patients about any tobacco or nicotine use, helping patients differentiate among available products, including tobacco-free nicotine pouches and NRT products approved for cessation.

Study limitations include the potential for reporting bias; prevalence may be underestimated if physicians did not recall or report being asked about nicotine pouches. Although the sample was randomly drawn from a national frame, we did not study all medical specialties. Finally, our sample was small, resulting in wide 95% CIs, and prevalence of nicotine pouch use is still low. However, there were no significant differences in survey response rate by age or gender. Given the continued increase in sales of nicotine pouch products and our observations that patients are asking physicians about them, continued monitoring of physician perceptions and practices around nicotine pouch products is warranted.

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Chemical characterization of tobacco-free “modern” oral nicotine pouches and their position on the toxicant and risk continuum

## Introduction

The health risks of cigarette smoking are well established, but most smoking-related diseases are not directly caused by the addictive compound nicotine, which is considered by regulatory and healthcare bodies to be relatively harmless at the levels present in tobacco (RCP [2016](https://www.tandfonline.com/doi/full/10.1080/01480545.2021.1925691); PHE [2019](https://www.tandfonline.com/doi/full/10.1080/01480545.2021.1925691)), but by the toxic chemicals in the inhaled smoke of combusted tobacco (US Department of Health and Human Services (DHHS) [2014](https://www.tandfonline.com/doi/full/10.1080/01480545.2021.1925691)). As a result, the concept of tobacco harm reduction through the use of alternative tobacco and/or nicotine products with fewer health risks relative to cigarette smoking was proposed in 2001 by the US Institute of Medicine, who called for the development and study of tobacco and nicotine products with fewer relative risks (Stratton et al. [2001](https://www.tandfonline.com/doi/full/10.1080/01480545.2021.1925691)).