

# A Cross-Sectional Survey on Oral Nicotine Pouches: Characterizing Use-Motives, Topography, Dependence Levels, and Adverse Events

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## Abstract

**Introduction:** Oral nicotine pouches (ONPs) contain a crystalized nicotine powder instead of tobacco leaves. ONPs come in a variety of flavors and are often marketed as “tobacco-free,” but research on ONP use-motivations and related experiences is limited.

**Aims and Methods:** This cross-sectional web-based survey collected self-report data on ONP use-characteristics (eg, frequency), brands and flavors used, use-motivations, dependence (Fagerström Test for Nicotine Dependence-Smokeless Tobacco [FTND-ST]), and ONP-related adverse events (AEs) experienced.

**Results:** The sample included 118 adults who reported current (past 30-day) ONP use. On average (SD), participants reported ONP use on 13 (6) days during the past month. Most participants (% of the sample) also reported the use of tobacco cigarettes (74%) and/or electronic cigarettes (53%) during the past month. Zyn (27%) and Lucy (19%) were the most currently used ONP brands with mint (23%) and tobacco (16%) as the most currently used flavors. The availability of preferred flavors was the most frequently reported (31%) ONP use-motivation. The sample demonstrated significant dependence levels (FTND-ST = 7, SD = 2). Reported AEs included mouth lesions (48%), upset stomach (39%), sore mouth (37%), sore throat (21%), and nausea (9%). Results should be interpreted in the context of study limitations, including using a relatively small and homogeneous online convenience sample. Acknowledging the limitations, this sample was deemed appropriate to include considering the novelty of the findings, the dearth of related research, and the necessity of examining foundational ONP use-characteristics (eg, topography, AEs); however, future research should consider recruiting larger and more generalizable samples.

**Conclusions:** The availability of preferred flavors was a key ONP use-motivation in this sample. Mint and tobacco were the most currently used flavors, with Zyn and Lucy being the most currently used ONP brands. Participants reported dependence and a substantial number of ONP-related AEs. Nationally representative surveys should investigate ONP use along with outcomes included in the current study (eg, AEs) to inform ONP surveillance and policy development efforts.

**Implications:** This study is among the first to assess reasons for initiating/maintaining ONP use as well as other relevant use-experiences (eg, AEs, dependence). These results highlight the role of flavors and nicotine dependence in ONP use, which are important considerations for informing ONP regulations.

## Introduction

Oral nicotine pouches (ONPs) contain a crystalized nicotine powder instead of tobacco leaves and consist of a small bag made of a permeable material that contains either synthetically produced or tobacco-derived nicotine.<sup>1</sup> Most major tobacco companies produce a brand of ONPs,<sup>2</sup> and ONP sales are rapidly increasing.<sup>1</sup> ONPs are currently available worldwide,<sup>1</sup> come in a variety of flavors, and are often marketed with claims suggestive of modified risk (eg, “tobacco-free”<sup>2</sup>), but research on why individuals are motivated to use ONPs, as well as other relevant use-experiences, is limited.

A recently published multinational online survey study of 550 participants that endorsed current ONP use found

that the majority used several other nicotine products (eg, electronic cigarettes [e-cigarettes], tobacco cigarettes) either currently or prior to the initiation of ONP use.<sup>3</sup> Several studies with subsamples of participants reporting ONP use also found high use-rates for other nicotine products, including a representative survey of adults in Great Britain,<sup>4</sup> an online survey of young adults in the United States,<sup>5</sup> and two longitudinal surveys of US adolescents<sup>6</sup> and young adults.<sup>7</sup> Though these prior surveys provided important initial insights into broad outcomes related to ONPs (eg, use prevalence, co-use with other tobacco products), they generally did not examine several other important ONP-specific outcomes (eg, adverse events [AEs], dependence). Given that ONPs are one of

the fastest growing nicotine product categories,<sup>8</sup> it is crucial that these outcomes (eg, dependence, AEs), among others (eg, use-motives), are examined to begin developing a comprehensive understanding of how these products may impact public health. To address these research needs, the current cross-sectional, web-based survey study collected self-report data regarding ONP use-characteristics and motives, dependence, and AEs among a sample of US adults that endorsed current ONP use.

## Methods

### Participants and Procedure

Participants were recruited using the online crowdsourcing platform Amazon Mechanical Turk (mTurk) from September to November 2022. Eligibility criteria were (1)  $\geq 18$  years old, (2) use of at least one ONP(s) within the past 30 days, (3) US resident, (4) read and write in English fluently, (5) mTurk approval rating  $\geq 99$ , and (6) completion of  $\geq 100$  prior mTurk tasks.<sup>9</sup> Participants provided informed consent and completed the survey through Qualtrics (Provo, UT). Participants who completed the survey were paid \$1.00. Three attention checks were embedded throughout, and participants received an additional \$1.00 for each correctly answered. The maximum time allotted to finish the survey was set at 24 hours with completion taking an average (SD) of 49 (133) minutes (range: 8 minutes to 23 hours).

### Measures

#### Participant Demographics and Use-Characteristics

Participants provided basic demographic information (eg, age) and reported past 30-day ONP use, age of first ONP use, and tobacco- or e-cigarette use-status. Participants also indicated whether they had used alcohol, cannabis, or other nicotine products within the past month. For each substance endorsed, participants were asked “how often do you use nicotine pouches with [endorsed substance/product] either at the same time or within a time frame that you feel the effects of both substances,” (ie, co-use) with answers provided on a 5-point Likert scale, ranging from “Never” to “Always.” Participants selected their current ONP brand from “NIIN,” “Fré,” “Lucy,” “Zyn,” “FR3SH,” “On!,” “Rogue,” “Velo,” and “other.” Participants selected their current ONP flavor from “cinnamon,” “coffee,” “citrus,” “berry,” “wintergreen,” “mint,” “unflavored,” “cherry,” “dragon fruit,” “peach,” “mango,” “spearmint,” “peppermint,” “tobacco,” and “other.”

#### Use-Motives

Participants identified their primary ONP use-motive from 12 options derived from the extant e-cigarette literature<sup>10</sup>; example items included “They are/were affordable,” “Using them help(ed) me quit smoking,” and “It comes in flavors I like/liked.” Participants then answered: “What is the most important aspect of nicotine pouches to you?” with options of “nicotine level,” “flavor,” “brand,” and “other.”

#### Dependence

Dependence was assessed with a modified version of the Fagerström Test of Nicotine Dependence-Smokeless Tobacco (FTND-ST<sup>11</sup>). The FTND-ST is a six-item measure that assesses physical dependence on smokeless tobacco on a scale of 1–10.<sup>11</sup>

### Topography

Participants reported on their preferred placement of nicotine pouches in their mouth from “upper lip,” “lower lip,” “cheek,” and “other” and indicated their normal duration of use in minutes. Next, participants reported the highest number of pouches ever used, and the number normally used, during a use-session. Participants reported the most common reason for removing ONPs from the following<sup>3</sup>: “Decreased satisfaction with the impact (ie, ‘buzz’) of the used pouch,” “wish to eat or drink,” “loss of taste,” “suggested usage time being reached,” and “other.”

### Adverse Events

Participants indicated if they had ever experienced ONP-related AEs from the following options: “Nausea,” “mouth lesions,” “upset stomach,” “sore mouth,” “sore throat,” “other,” or “none.” Severity of these AEs was not assessed.

### Data Analysis

Of the total 255 participants that met inclusion criteria and completed the survey, 109 were excluded because they did not pass all three attention checks and 28 were excluded due to poor response quality (eg, unintelligible responses to open-ended items [not included in current analyses], duplicate answers). The final sample included 118 participants. Data were aggregated across participants to characterize and report primary outcomes using GraphPad Prism version 9.4.1. The STROBE cross-sectional checklist was used when writing this report.<sup>12</sup>

## Results

### Participants’ Demographics and Use-Characteristics

On average (SD), participants were 30 (10) years old and used ONPs on 13 (6) days out of the past 30. Over half of the participants (52%) reported using ONPs on at least 15 days out of the past 30 with one participant (1%) reporting daily ONP use. Most (% of samples) endorsed the past month’s use of tobacco cigarettes (74%) and/or e-cigarettes (53%) with the minority (25%) reporting exclusive use of ONPs (Table 1). Relatedly, the majority of those who endorsed tobacco- or e-cigarette use reported co-use with ONPs at least half of the time (76% and 54%, respectively; Supplementary Table 1). Mint (23%) and tobacco (16%) were the most popular ONP flavors currently being used. Zyn (27%) and Lucy (19%) were the most frequently endorsed ONP brands currently being used (Supplementary Table 2).

### Use-Motives

The most common motivation for ONP use was “it comes in flavors I like” (31%). Similarly, participants reported “flavor” (53%) as being the most important aspect of ONP use, followed by nicotine level (25%) and brand (22%) (Supplementary Table 3). For those who reported current tobacco cigarette use ( $N = 87$ ), 68% used ONPs in places where smoking was not allowed. For those who reported current e-cigarette use ( $N = 63$ ), 70% used ONPs in places where using an e-cigarette was not allowed.

### Dependence

The mean (SD) total score on the FTND-ST was 7 (2), which is considered “significant dependence”<sup>13</sup> (range: 0–9).

**Table 1.** Participant Demographics and Use-Characteristics

| Variables                                 |                                    |                                 |               |
|---|------------------------------------|---------------------------------|---------------|
| Age                                       | Mean (SD)                          | 30 yr (10)                      |               |
|   | Range                              | 18–67 yr                        |               |
| Gender [ <i>n</i> , (%)]                  | Male                               | 40 (34%)                        |               |
|   | Female                             | 78 (66%)                        |               |
| Ethnicity [ <i>n</i> , (%)]               | Hispanic/Latinx/Spanish Origin     | 10 (8%)                         |               |
|   | Not Hispanic/Latinx/Spanish Origin | 108 (92%)                       |               |
| Race [ <i>n</i> , (%)]                    | American Arab                      | 0 (0%)                          |               |
|   | Middle Eastern/ North African      | 0 (0%)                          |               |
|   | American Indian/ Alaska Native     | 3 (3%)                          |               |
|   | Asian/ Asian American              | 0 (0%)                          |               |
|   | Black/ African American            | 1 (1%)                          |               |
|   | Native Hawaiian                    | 0 (0%)                          |               |
|   | Pacific Islander                   | 0 (0%)                          |               |
|   | White                              | 115 (97%)                       |               |
|   | Past 30 days ONP use               | Number of days [Mean (SD)]      | 13 (6)        |
|   |                                    | Days [Range (% past month use)] | 2–30 d (100%) |
| Past 30-day tobacco use [ <i>n</i> , (%)] | Tobacco cigarettes                 | 87 (74%)                        |               |
|   | Electronic cigarettes              | 63 (53%)                        |               |
|   | Other nicotine product             | 1 (1%)                          |               |
|   | None <sup>1</sup>                  | 29 (25%)                        |               |

ONP = oral nicotine pouch.

<sup>1</sup>No nicotine product use within the past 30 days other than ONPs.

## Topography

Participants reported using ONPs for an average (SD) of 11 (7) minutes, with most (75%) indicating they normally place ONPs between their lower lip and gum. Participants reported using an average (SD) of 2 (1) ONPs per use-session, ranging from one to five ONPs. The most frequently endorsed reason for removing ONPs was “loss of taste” (41%), followed by “wish to eat or drink” (37%), “decreased satisfaction with the impact (i.e., ‘buzz’) of the used pouch” (12%), and the “suggested usage time being reached” (10%).

## Adverse Events

The most frequently reported AE was mouth lesions (48%), followed by upset stomach (39%), sore mouth (37%), sore throat (21%), nausea (9%), none (3%), and other (1%; “strange jaw sensation”). Overall, 97% of this sample endorsed at least one ONP-related AE.

## Discussion

The ONP retail market has seen substantial growth since 2018,<sup>1</sup> but research on ONP use among individuals who use them regularly is lacking. This online, cross-sectional survey study collected self-report data from US adults that endorsed current ONP use with the intent to address basic and important knowledge gaps by assessing general characteristics of ONP use (eg, most frequently used brands and flavors, topography), use-motives, dependence, and self-reported AEs. Mint was the most commonly used ONP flavor and Zyn was the most frequently used brand, which is in-line with market research data.<sup>14</sup> Additionally, the availability of flavors was a key ONP use-motive within

this sample. These data are generally consistent with prior ONP studies, including one multinational survey in which the vast majority of ONP-using individuals surveyed used nontobacco-flavored ONPs (most often menthol).<sup>3</sup> Thus, as with other noncombustible products (eg, e-cigarettes), it will be important to disentangle whether the availability of flavors has an overall net benefit (eg, helping those transitioning away from combustible nicotine products) or harm (eg, facilitating the initiation of ONP use among nicotine-naïve individuals) to public health. Additionally, further exploration of particular flavors that are preferred by participants (eg, mint or menthol<sup>3</sup>) and related effects appears warranted.

Participants also reported substantial levels of nicotine dependence related to ONP use. However, research on how ONP dependence compares to other nicotine products is limited. Considering many participants also reported current tobacco cigarette and/or e-cigarette use, similar to prior surveys on ONPs,<sup>15</sup> exploring product-specific dependence will be an essential area for future research. Additionally, and consistent with prior ONP surveys,<sup>15</sup> participants who currently used other nicotine products (eg, cigarettes, e-cigarettes) reported using ONPs when other options were unavailable, suggesting that ONPs are being used as a substitute for other nicotine products. Though controlled clinical ONP research is limited, a prior ecological momentary assessment study with dual users of smokeless tobacco products and cigarettes similarly found that many participants used smokeless tobacco predominantly in situations in which smoking was not allowed.<sup>16</sup> Controlled laboratory and observational studies on ONPs are warranted in order to provide insights into how these products are used concurrently

with and as a substitute for other nicotine products. Finally, considering 97% of this sample endorsed at least one ONP-related AE, additional clinical research will be useful to examine the short- and long-term health impact of ONP use (eg, mouth lesions). This exploration is particularly important considering ONPs being “less harmful to my health than other tobacco products” has been identified as a common ONP use motive<sup>15</sup>; therefore, consumers may benefit from additional information regarding potential AEs that may arise from ONP use, if the current AEs reported are also identified in future ONP research.

### Limitations

The current results should be interpreted in the context of study limitations, including using a relatively small and homogeneous (eg, 97% white) online convenience sample. For example, the majority (66%) of participants in this sample were female, which diverges from the few other prior surveys on people who use ONPs in which the majority of respondents were male; moreover, though other studies have similarly found that most (78%) people who use ONPs are white,<sup>17</sup> white individuals were likely overrepresented in the present study. Acknowledging the limitations to generalizability, the current sample was deemed appropriate to include considering the novelty of the data, the relative lack of related research, and the need of examining critical ONP use-characteristics, such as how they are used (topography) and AEs from use. However, future research should consider recruiting larger and more generalizable samples and it will be important for population-level surveys on tobacco use (eg, Population Assessment of Tobacco and Health; National Youth Tobacco Survey) to include a comprehensive array of ONP-specific questions. In addition, participants provided retrospective self-report data and thus, some participants may have misremembered their experiences or reported inaccurately on product details. It should also be noted that some assessments (eg, FTND-ST) were modified to be applicable to ONP use (eg, changing “smokeless tobacco” to “oral nicotine pouch”) but have not been psychometrically validated within this population. Finally, we did not collect detailed information on tobacco and/or e-cigarette use (eg, age of first use, dependence, number of days used out of the past 30), which limited our ability to compare these products to ONPs within this sample, and we did not assess the overall duration of ONP use among respondents (eg, in months or years) or the average number of pouches used per day, which may have been informative for interpreting dependence measures.

### Conclusions

The availability of flavors was a key use-motive in this sample of ONP-experienced participants. Mint and tobacco were the two most currently used ONP flavors, with Zyn being the most frequently used ONP brand. Participants reported ONP nicotine dependence as well as a substantial number of ONP-related AEs. Given the growing popularity of ONPs, large-scale nationally representative surveys should continue to assess ONP use along with outcomes assessed by the current study (eg, dependence, AEs) to better understand the impact of ONPs on public health.

### Supplementary Material

A Contributorship Form detailing each author’s specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

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### Declaration of Interests

MBM served as a paid expert witness in litigation sponsored by the Public Health Advocacy Institute against RJ Reynolds. The remaining authors have no conflicts of interest to declare related to this work.

### Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

### Author Contributions

Ashley Dowd (Conceptualization [Lead], Data curation [Lead], Formal analysis [Lead], Investigation [Lead], Methodology [Lead], Project administration [Lead], Writing—original draft [Lead], Writing—review & editing [Lead]), Johannes Thru (Conceptualization [Supporting], Methodology [Supporting], Writing—review & editing [Supporting]), Lauren Czaplicki (Conceptualization [Supporting], Methodology [Supporting], Writing—review & editing [Supporting]), Ryan David Kennedy (Conceptualization [Supporting], Methodology [Supporting], Writing—review & editing [Supporting]), Meghan Moran (Conceptualization [Supporting], Methodology [Supporting], Writing—review & editing [Supporting]), and Tory Spindle (Conceptualization [Supporting], Funding acquisition [Lead], Investigation [Supporting], Methodology [Supporting], Resources [Lead], Supervision [Lead], Writing—original draft [Supporting], Writing—review & editing [Supporting])

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