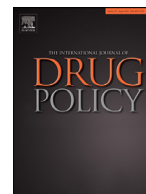




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Research paper

Multi-level drivers of tobacco use and purchasing behaviors during COVID-19 “lockdown”: A qualitative study in the United States

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ABSTRACT

Background: The COVID-19 pandemic and associated public health prevention measures (e.g., “stay at home” orders) may impact tobacco supply and demand among consumers. This qualitative study identified multi-level drivers of shifts in inhaled tobacco product use and access patterns during the initial COVID-19 “lockdown” period in the United States.

Methods: Between April and May 2020, we conducted semi-structured telephone interviews ($n = 44$) with adults who use cigarettes and/or electronic nicotine delivery systems (ENDS). Transcripts were thematically analyzed using a socioecological framework.

Results: Nearly all participants reported changes in their product use during lockdown, though patterns varied. Increased use was most common and was predominantly driven by individual-level factors: pandemic-related anxiety, boredom, and irregular routines. Decreased use was common among social users who cited fewer interpersonal interactions and fear of sharing products. At the community level, retail access impacted cigarette and ENDS use differently. While cigarettes were universally accessible, ENDS access was more limited, driving some to purchase products online. Delayed deliveries led some ENDS users to compensate with readily-available cigarettes.

Conclusion: To mitigate ways that the COVID-19 pandemic may exacerbate an existing public health crisis, multi-level policy strategies, such as expanded virtual cessation services and implementation and enforcement of smoke-free home rules, can better support population health during this critical period. Policies that facilitate access to lower risk products can help minimize harm among those who cannot or do not want to quit smoking.

Introduction

COVID-19, the infectious respiratory disease caused by the SARS-CoV-2 coronavirus, has become a worldwide pandemic since its identification in Wuhan, China in December 2019. By December 2020, COVID-19 infected over 70 million people worldwide and claimed more than 1.5 million lives (Johns Hopkins University, 2020). The United States (US) has been particularly hard-hit, reaching over 15 million confirmed cases and nearly 300,000 fatalities – 20% of the global death toll (Johns Hopkins University, 2020).

Clinical studies suggest that tobacco use – particularly cigarette smoking – is associated with worse outcomes among COVID-19 patients (Alqahtani et al., 2020; Vardavas & Nikitara, 2020). Evidence on the risk of becoming infected with COVID-19 by tobacco use status remains inconclusive, highlighting the need for better data collection and more rigorous study designs (Simons, Shahab, Brown, & Perski, 2020). Research has begun to expand beyond questions of whether tobacco use is a risk

factor for COVID-19, and to examine whether strict policy measures imposed by states and cities to limit coronavirus spread (e.g., stay-at-home orders, business closures) – hereafter referred to as “lockdown” periods – impact the ways in which people use tobacco products. A nationally representative survey in England found no significant changes in cigarette smoking prevalence pre- and post-lockdown period, despite reported increases in smoking quit attempts (Jackson, Garnett, Shahab, Oldham, & Brown, 2020). Similarly, a survey of tobacco users in India, which had a national lockdown, showed that 70% of the sample did not change their tobacco use behaviors during this time period (Gupte, Mandal, & Jagiasi, 2020). In contrast, Belgian residents who smoked reported consuming more cigarettes on average compared to the period before national lockdown measures were imposed (Vanderbruggen et al., 2020). An Italian survey indicated that changes in tobacco use varied considerably based on the type of product(s) used: whereas exclusive cigarette users reported decreases in daily consumption, those who used electronic nicotine delivery systems (ENDS) – such as e-cigarettes – reported comparatively stable consumption behaviors (Caponnetto et al., 2020).

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While quantitative, survey-based studies provide valuable insight into changes in tobacco use during lockdown periods, this approach often fails to capture the complex drivers and mechanisms that may contribute to these shifts. Indeed, lockdown measures could impact patterns of tobacco use through multi-level factors that influence both supply (e.g., ability to access tobacco products) and demand (e.g., motivation to increase or decrease use). At the community level, COVID-19-related shifts in the tobacco retail environment may shape consumption patterns. While “essential businesses,” such as convenience stores, gas stations, and grocery stores that sell tobacco, were allowed to remain open in the initial stages of the pandemic, other retailers (e.g., vape shops, tobacconists) were deemed non-essential in some states and required to close. In one Californian study, 40% of sampled vape shops temporarily shut down during the lockdown (Medel, Meza, Galimov, Baezconde-Garbanati, & Sussman, 2020). Generally, tobacco specialty stores, such as vape shops, carry a much larger inventory of nicotine products compared to “traditional” tobacco retailers (e.g., convenience stores, gas stations), including advanced generation vaping products that many consumers prefer (Pattinson, Lewis, Bains, Britton, & Langley, 2018). Moreover, individuals’ willingness to access tobacco products in community settings may be influenced by the fear of being outside, inside a crowded store, or by their ability to get to the store. Factors that limit people’s ability to access tobacco products may be most salient among those with greater nicotine dependence.

Social distancing and stay-at-home orders, key COVID-19 prevention measures, substantially alter interpersonal interactions. In addition to engaging in fewer social activities, many individuals are confined to their homes during lockdown periods, either alone, with family members, or with other housemates. As a result, the context of tobacco use behaviors (i.e., where, when, and with whom people use tobacco) may differ from pre-COVID routines. These changes may be especially relevant for those who use tobacco socially or who live with children or other vulnerable populations. Finally, at the individual level, pandemic-related factors may cause heightened stress and anxiety, emotions known to contribute to tobacco use (Hajek, Taylor, & McRobbie, 2010; Lawless, Harrison, Grandits, Eberly, & Allen, 2015). Notably, increases in smoking behaviors were observed after other disasters or traumatic events in the US, such as the September 11th terrorist attacks and Hurricane Katrina (Alexander, Ward, Forde, & Stockton, 2019). Other individuals, however, may view a respiratory disease pandemic as an optimal time to reduce use or quit. In a recent survey of 366 concurrent cigarette and ENDS users (i.e., “dual users”), approximately one-third reported increased motivation to quit due to COVID-19 health concerns (Klemperer, West, Peasley-Miklus, & Villanti, 2020).

While we can speculate how store closures, social isolation, increased anxiety, fear of an infectious respiratory disease, and other factors might independently impact tobacco use based on theory or historical events, the unprecedented COVID-19 pandemic led to a convergence of these factors for many tobacco users. Descriptive qualitative research can be a useful tool to reveal detailed information about individuals’ complex experiences, uncover topics not initially considered, and give context to the mixed results of existing quantitative studies. The primary aim of our study is to identify – via qualitative methods that foreground participant voices – multi-level factors that exerted particularly strong influences on participants’ product use and purchasing behaviors at the height of the initial lockdown period in the US.

To achieve this goal, we conducted semi-structured interviews in April-May 2020 with US adults who use cigarettes and/or ENDS. Although cigarettes and ENDS differ in important ways, we included users of both products for several reasons: Dual-use frequently occurs among adults. For example, nearly 70% of current adult e-cigarette users in the US also currently smoke cigarettes (Baig & Giovenco, 2020). Additionally, ENDS are increasingly used by some cigarette users as a tool to quit smoking (Delnevo et al., 2016; Glasser et al., 2020) or as a form of tobacco harm reduction. Because ENDS deliver nicotine without the harmful byproducts of combustion, researchers believe that they are

considerably less risky than traditional cigarettes (Glasser et al., 2017; McNeill, Brose, Calder, Bauld, & Robson, 2020; National Academies of Sciences, 2018). Including participants who use either or both products can provide insight into whether perceptions of harm reduction relate to product use behaviors during the pandemic.

Given the current shortcomings of existing COVID-19 treatments, possible delays in vaccine distribution, and the potentially cyclical nature of outbreaks and lockdowns, results can help identify the unique needs of cigarette and ENDS users during these critical periods. And while the end of this pandemic may be on the horizon, COVID-19 has already impacted individuals and altered aspects of society in ways that will extend beyond the pandemic and plausibly influence tobacco use behaviors moving forward. This study can highlight ways that public health interventions and policies can better support quit attempts and/or harm reduction, both during the COVID-19 pandemic and beyond.

Methods

Participant recruitment

Participants were recruited using an advertisement campaign on Facebook and Instagram from April 14 to 24, 2020. During this window, approximately 88% of the US population experienced some form of state lockdown. Forty states ordered non-essential businesses to close, 38 banned group gatherings, and 32 enacted stay-at-home orders (Law Atlas, 2020). Advertisements targeted social media users in the US over the age of 18 and linked to a screener questionnaire that collected information on tobacco use and demographic characteristics. Eligibility criteria included: 1) being 18 years of age or older, 2) being able to communicate in English, and 3) reporting use of cigarettes and/or ENDS “every day” or “some days” in the past month (a standard measure of “current use” among adults in the US) (Cornelius, 2020). Among 71 participants who were eligible based on criteria in the screener questionnaire and who were contacted by study team members, 44 completed a telephone interview. Two participants were found to be ineligible during the telephone interviews, and 25 did not respond to our outreach or responded after the study period ended. There were no substantial differences in product use, age, or other characteristics between those who completed an interview and those who did not.

Data collection

Interviews were conducted between April 17 and May 13, 2020 (range: 35–50 min); participants provided informed verbal consent. The open-ended, semi-structured interview questions explored product use and purchasing behaviors during COVID-19 lockdown, with a focus on comparisons to pre-lockdown use (see supplemental file). We first asked participants to describe their typical cigarette and/or ENDS-related behaviors prior to the pandemic (i.e., January-February 2020); parallel questions were asked about use during the COVID-19 lockdown. The interview guide was primarily organized to assess: a) behavioral shifts in patterns of product use before and after COVID, b) potential supply-side related drivers (e.g., shifts in retail availability), and c) potential demand-side related drivers (e.g., perceived COVID risk to access and/or use products).

The interview questions further assessed potential drivers at multiple levels within a socioecological framework. Socioecological models posit that health behaviors and outcomes are influenced by factors at multiple levels (e.g., community, interpersonal, individual), as well as their interactions. Although this theory has its origins in the study of human development, (Bronfenbrenner, 1977) socioecological frameworks have been adopted more generally in the field of public health – including tobacco control (US National Cancer Institute, 2017) – to help conceptualize and measure drivers of various health-related issues. Interview questions focused on the role of structural drivers (lockdown policies),

community drivers (product availability), interpersonal drivers (shifts in peer networks under COVID), and individual drivers (anxiety and stress levels). We also ensured that question probes incorporated this framework. For example, in one interview, we inquired: “You mentioned that you now live with your parents as a result of the pandemic. Tell me about how this living situation impacts your vaping” (interpersonal factor). Following the interview, participants received a \$30 electronic gift card as compensation. The Institutional Review Board at Columbia University approved all study procedures.

Data analysis

Interviews were digitally recorded and transcribed verbatim. Three members of the study team conducted initial line-by-line “open coding” on the first five interviews to develop a provisional coding scheme (i.e., inductive coding). We also created initial deductive codes based on multi-level factors known to influence tobacco use (e.g., stress, social influences, tobacco retail environment) (US National Cancer Institute, 2017). Team members then coded a random sample of 10 additional transcripts to refine the code dictionary and develop a codebook, which was reviewed and amended by all team members (MacQueen, McLellan, & Kay, 1998). Two coders independently applied the final coding scheme to all interview transcripts, and full-team discussions resolved any discrepancies. Data were analyzed using the constant comparative method (Buetow, 2010; Glaser & Strauss, 1967) to develop themes related to behavioral shifts and to explore potential axes of difference by product use status (e.g., cigarette-only, ENDS-only, dual use). We organized major themes under their respective levels of the socioecological model to better conceptualize multilevel drivers of behavior change and identify potential prevention strategies. Dedoose, a web-based software application for qualitative and mixed-methods analyses, was used for coding and analysis (Dedoose, 2020).

Results

A total of 44 participants from 21 US states completed an interview. At the time of their interviews, nearly all participants (90%) lived in a state that closed “non-essential” businesses, and approximately 70% lived in states with school closures. Further, three-quarters of respondents lived in a state with a mandated stay-at-home order: generally, these limit all travel outside the home with the exception of essential activities, such as doctor visits, grocery shopping, or going to work for essential workers. Notably, however, all participants were voluntarily isolating at home unless required to leave the house. As shown in Table 1, nearly half (48%) reported past month dual use, 39% reported cigarette-only use, and 14% reported ENDS-only use. The majority of participants self-identified as white (59%), followed by Black (21%), Hispanic/Latinx (11%), Asian (5%), and not stated/unknown (5%). Over half identified as female gender (55%) and nearly half (41%) reported having an underlying health condition (e.g., asthma, chronic obstructive pulmonary disease, cardiovascular disease, or diabetes).

Shifts in patterns of use during COVID-19 lockdown

The majority of participants reported some shift in patterns of product use during COVID-19 lockdown, including the frequency or amount of use; however, these patterns varied considerably (Table 2). Overall, reported increases were slightly more common among cigarette-only and dual users, with dual users often reporting increases in ENDS use. Decreases in use were common among ENDS-only users, although there were only six people in this group. We note that nearly all ENDS users referred to their product use as “vaping” in the illustrative quotes presented throughout the manuscript.

We used a socioecological framework to examine the multi-level drivers of product use and purchasing behaviors in the context of COVID-19 prevention policies. Common themes were nested under 3

Table 1
Participant tobacco use status and demographic characteristics (n = 44).

	n (%)
Current tobacco use^a	
Cigarette-only	17 (38.6)
ENDS ^b -only	6 (13.6)
Dual use ^c	21 (47.7)
Gender identity	
Female	24 (54.5)
Male	20 (45.5)
Age group	
18–34	18 (40.9)
35–59	17 (38.6)
60+	9 (20.5)
Race or ethnicity	
White	26 (59.1)
Black	9 (20.5)
Hispanic/Latinx	5 (11.4)
Asian	2 (4.5)
Not stated/unknown	2 (4.5)
Education	
Less than high school	2 (4.5)
High school or GED	8 (18.2)
Some college or associate degree	16 (36.4)
Bachelor's degree or higher	18 (40.9)
US census region	
South	16 (36.4)
West	11 (25.0)
Northeast	9 (20.5)
Midwest	8 (18.2)
Underlying health condition^d	18 (40.9)

^a Measured as some day or daily use in the past month.

^b ENDS: electronic nicotine delivery systems.

^c Reported past month use of both cigarettes and ENDS.

^d Underlying health condition that has been linked to poorer COVID-19 outcomes, including: asthma, chronic obstructive pulmonary disease, cardiovascular disease, diabetes.

primary levels: community, interpersonal, and individual (Fig. 1 highlights these key findings).

Community level

Product accessibility

Despite observing other product shortages in retail stores (e.g., toilet paper, yeast), participants shared that cigarettes seemed to be well-stocked and always available in the gas stations, convenience stores, and grocery stores that remained open during state lockdowns. Some participants observed a slight increase in cigarette prices, although most individuals described no changes in prices. One individual described the accessibility of cigarettes despite shortages of other essential items:

There are so many products out there that you cannot find, such as toilet paper - and when I went to the grocery store today the meat department was barren. And the fruit department, barren. But they never run out of cigarettes. They sure have tons of smokes. It's a product that I don't think they're ever going to run out of. (Male, 60+, Cigarettes-only)

In contrast, participants described greater variability in ENDS accessibility, including limited variety and lack of availability. This was because vape shops, smoke shops, and other tobacco specialty stores – which tend to carry a larger inventory of ENDS brands, flavors, nicotine concentrations, and device accessories – were often deemed non-essential businesses and thus closed, or had significantly reduced hours. Some participants noted that the businesses that remained open (e.g., gas stations, grocery stores) had unsatisfactory ENDS product selections, including limited flavor options, compared to vape shops. Although a few individuals reduced the frequency of their ENDS use due to these circumstances, more shifted to online purchasing during the lockdown.

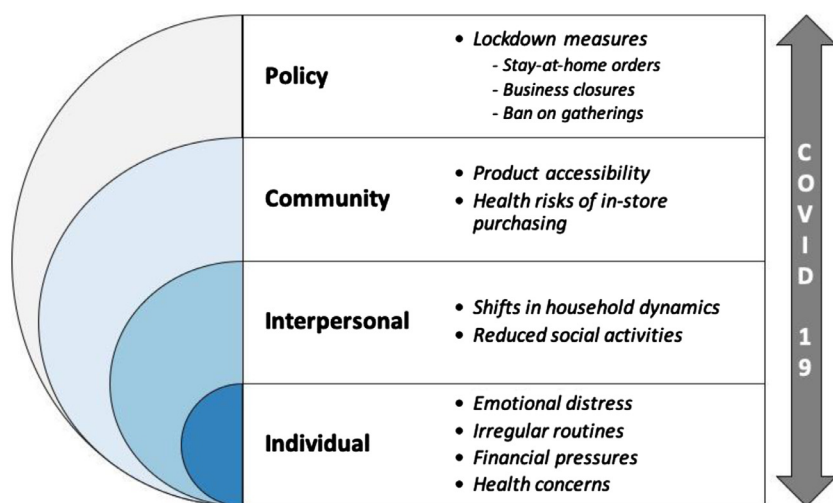


Fig. 1. Key findings: Ecological framework of factors that impacted tobacco use and purchasing behaviors during COVID-19 lockdown.

I can't find any at Walmart or different little convenience stores where I would get them. I just think people are buying a lot of them in bulk so they're really hard to find. So I had to look online on the website to buy them. Which is really annoying because I have to wait to get them. (Male, 18–34, Dual use)

Participants who resorted to purchasing their products online described barriers to ordering, such as longer wait times due to shipping delays, or product backorder due to high demand. Participants discussed being more mindful of their supply and ordering products in advance to avoid the stress of being without an ENDS product.

The ordering process is definitely different. You have to completely plan it. This isn't like cigarettes, where you can go to any corner store and get them. Every vape store is closed... We're low right now and I'm going to have to place another order even though I have five bottles on the way. But I don't know when they'll be here. (Female, 18–34, Dual use)

Some dual users noted that waiting longer for ENDS products caused them to smoke cigarettes more, as cigarettes were readily available.

[Online delivery] takes like 2–3 business days which isn't a long time, but if you want to vape, you want it right then and there. So it can be a little annoying sometimes. Which has caused me to smoke [cigarettes] more because I have them on hand. (Male, 18–34, Dual use)

Participants described other accessibility-related changes in purchasing patterns, such as buying products in bulk to avoid repeated online purchases (and therefore more waiting) and for greater security about the duration of their supply.

Health risks of in-store purchasing

Many participants who continued to purchase products in-store shifted purchasing patterns based on their desire to reduce COVID-related health risks. Participants sometimes traveled to stores that were less crowded, visited during non-peak hours, or reduced the number of visits to grocery stores, gas stations, or convenience stores to avoid potential contact with other people.

I strive not to go out as often anywhere and do anything outside just to avoid potential contact. So that has probably played a little bit into how much I smoke. If I look into a pack and I'm down to 4–5 and that's, let's say, at 8'clock at night, I make a very conscious effort to squirrel away what I got until the next day. Instead of running out that night. (Male, 60+, Cigarettes-only)

Some participants resorted to stockpiling patterns such as purchasing cigarette cartons (each containing 10 packs) or buying more packs per trip instead of a single pack. A majority of those who stockpiled

described a subsequent increase in overall product use due to the availability of these products at home.

Since I'm not going out so much, I'll buy a carton. That'll last me a while and I don't have to go back out there. I only want to go out once a week and that's it. (Female, 60+, Cigarettes-only)

Furthermore, several participants resorted to rationing their cigarettes and ENDS to save money and mitigate health risks of store visits. In doing so, they would smoke old cigarette butts, roll or re-roll cigarettes, or combine “juice” from old ENDS cartridges for longer use.

Interpersonal level

Shifts in household dynamics

Many participants experienced shifts in household composition and dynamics during quarantine. Some were newly cohabitating with parents, grandparents, siblings, and other relatives, while others now had full-time childcare responsibilities. Though this did not always affect the frequency or intensity of product use, it often altered use context. For example, participants expressed heightened cognizance of those present while they used cigarettes or ENDS. Several participants used their product(s) in private spaces or outside to avoid family members observing their habits. One participant noted:

I have a room for [smoking and vaping] now...I don't do it in public. I don't do it with the kids. I just lock myself in the room and do it. I don't want my kids to do that. (Male, 35–59, Dual use).

Another participant preferred using ENDS over cigarettes when spending time with his children.

I haven't really been smoking conventional cigarettes, it's been more vaping. When we go outside it's like a family thing, so it's not like I've been smoking a cigarette while walking outside with my kids. I don't want to do that with them. I don't know why but it's not good to have that look so I usually vape. When I come in I go straight to the bathroom or garage or wherever and I vape for a long time. (Male, 18–34, Dual use)

Other dual users who reported increased ENDS use and decreased cigarette use attributed this shift to spending more time indoors and not wanting to expose others living in the house to smoke. One participant, now confined to being indoors, justified her shift to greater ENDS use:

In my mind, the vape was like less pollution in the house. It's not as bad as the cigarette. We still stayed in the bathroom because the kids were in the house. I'm still kind of funny about that. Like I said, I didn't like the pollution from the cigarettes as much in the house. So when I was really

Table 2
Summary of participants' tobacco use changes during COVID-19 lockdown (n = 44).

Tobacco use status and reported changes	Illustrative quotes
Cigarette-only	
- Increase (n = 8)	"I smoked much less [before COVID] because I was doing things. You know, I was getting out of the house. So if you go to a restaurant and bar, it's no smoking. I can sit there and not smoke for 2 or 3 h. So I would say maybe half a pack a day then. And now perhaps I'm up to a pack." (Female, 60+)
- Decrease (n = 6)	"But without a doubt, the first isolation I was smoking more. It was something to do with my hands, something to do just to have another sense of normalcy." (Male, 60+)
- No change (n = 3)	"But yeah, since I have been doing the 100% telecommute, I typically only smoke one [cigarette] a day at this point. Just because not wanting to be outside. It's an apartment complex, so you'll run into people. And, you know, I don't want to upset anyone with the smoke itself. [Smoking] was easier to do when I was commuting into the city." (Female, 35-59)
ENDS-only	
- Increase (n = 1)	"Honestly, I feel much better now. Probably after the COVID, I'm going to continue smoking just the half pack per day. I don't want to smoke that many cigarettes anymore. If I can do it right now, there's no reason not to after that." (Male, 35-59)
- Decrease (n = 3)	"I find that I am vaping a bit more because I have more free time...I think now I'm vaping because I have nothing to do." (Male, 18-34)
- No change (n = 2)	"Vaping right now is more like an occasional thing...it's more of a thing that I do like here and there rather than on a consistent basis." (Female, 35-59)
Dual use	
- Increase in both (n = 8)	"So yeah, I've been thinking about should I even bother ordering, then there's like, well you better, because of what's going on. I really don't need any because I'm not vaping as much. I'm not vaping outside the house anymore. My entire vaping life has changed because of this virus." (Female, 60+)
- Decrease in both (n = 5)	"Well, I'm not working right now so I'm at home more. And now I think I tend to smoke cigarettes a lot more because I have a lot more time on my hands. I think part of it is stress and part of it is availability with my time, my free time." (Male, 18-34)
- No change in either (n = 2)	"Before [COVID] I was smoking and vaping every day. Now it has been cut down just because, you know, that's more times that I have to go to the gas station or to the store to get products...So, it's definitely changed." (Female, 18-34)
- Increase in cigarettes, decrease in ENDS (n = 1)	"I was smoking cigarettes more [before COVID], but now I'm vaping more if that makes sense. Now that I'm inside, I'm smoking less and vaping more because I want to be healthy and smoke the vape instead of cigarettes. If I were to smoke cigarettes the same amount as how much I vape now, I would've been dead by now." (Male, 18-34)
- Increase in cigarettes, no change in ENDS (n = 1)	"I guess I do vape a little bit more. I want to say I probably smoke, like I said, about the same. Maybe a tiny bit less. But I don't think it's changed my habits too much on smoking. I probably just vape a little bit more than I used to." (Male, 18-34)
- Increase in ENDS, decrease in cigarettes (n = 3)	
- Increase in ENDS, no change in cigarettes (n = 1)	

stressed out and I needed a quick [inhalation noise] on the vape I could do that. (Female, 35-59, Dual use)

These behavioral shifts reflected a perception that using ENDS indoors and around others are less risky than smoking indoors.

Reduced social activities

Four participants described their product use pre-COVID as an activity that primarily occurred with friends, sometimes in bars or other nightlife venues, or while attending sporting events or concerts (i.e. "social smoking/vaping"). Thus, the absence of social activities during lockdown generally decreased their cigarette and ENDS use. In addition to shifts as a result of limited social activities due to the lockdown, perceptions of risk related to being near others while using products, or even sharing products, affected patterns of use.

For the most part, I've avoided using vapes just to avoid sharing stuff. I never really cared about sharing drinks or sharing vapes or bumming a cigarette or anything. But now I haven't really been doing it. The friend whose house we'd go to, he got a job at a grocery store. So I was just like, 'Nah, I'm not going to hit his vapes or anything.' So I actually haven't vaped at all since this started. I'm trying to avoid sharing things. You know, mouth-to-mouth contact on objects. (Male, 18-34, Dual use)

Importantly, these social product users were probably less nicotine dependent, given that they used cigarettes or ENDS less frequently/intensely compared to other participants.

Individual level

Emotional distress

Nearly all participants reported increased stress related to COVID-19, and described it as the primary driver of increased cigarette and/or ENDS use. Participants attributed their stress and anxiety to factors such as fears about the virus, job uncertainty, isolation, and changes in household dynamics in the wake of stay-at-home orders. As one woman noted:

I just pile on stress from every direction. I got the normal kind of household stress. Then taking away all the time I had outside the house to just reset a little bit, it just kind of keeps the baseline pretty high. I know it probably doesn't make a lot of sense but I stress because I know that it would make the situation worse if I were to get sick and then I get stressed over that. That's more stress and then I smoke more. (Female, 18-34, Dual use)

Boredom commonly co-occurred with increased anxiety and was also a driver of increased use. This was especially true among participants who were unemployed or working fewer hours, and therefore spending more free time at home. As one participant noted:

Every now and then my fiancé's sister will come by and we'll sit on the patio. Since there's not much else to do, we'll just sit out there and smoke. We actually even smoked some hookah the other day. We were just that bored. (Male, 18-34, Dual use)

For a number of participants, smoking and/or ENDS use were described as stress relievers even before the pandemic; thus, many participants gravitated towards these behaviors to manage stress and boredom during this period of uncertainty and social isolation.

Irregular routines

Some participants reported that the daily routine disruptions due to COVID-19 affected their product use behaviors. These disruptions were primarily attributed to employment/workplace changes, including working from home, working reduced hours, and unemployment. Due to these factors, some participants described their smoking and/or ENDS use patterns as having less structure compared to pre-COVID times.

I basically always smoked less when I worked. I'd take a smoke break every couple of hours. But when I'm home, I smoke every hour basically. So going without working makes me smoke more. So if I'm not out and

about or working, I'm smoking more because I'm home. (Female, 35–59, Cigarettes-only)

Several other participants described shifting from having set times and settings in which they would use their product (e.g., lunch breaks, while commuting, etc.) to more constant and uninterrupted use throughout the day.

Financial pressures

While several participants described serious financial challenges as a result of COVID-19, most participants still continued purchasing some form of cigarettes and/or ENDS. To mitigate financial difficulties, however, a few individuals modified their product use by switching to less expensive brands or styles.

I used to be loyal – when I had the financial means, it was Marlboro Menthols. Now it's whatever the cheapest menthol is. Which ranges from \$3.18 to \$3.58. (Male, 35–59, Cigarettes-only)

More rarely, participants were forced to stop buying cigarettes or ENDS entirely or began to ration existing products due to severe financial constraint and an inability to afford basic necessities.

Health concerns

For some participants, COVID-19 created a renewed sense of awareness of their general health. A few participants mentioned reevaluating their product use behaviors, with some decreasing their use and others contemplating quitting.

[Vaping] was just something that was a habit, something that I did every day and I didn't think much about it. But after COVID, I think I did less of it because it wasn't like a priority for me. I was more concerned about other health issues, things like catching COVID, and worrying about family and friends catching COVID. I just instinctually started reducing my consumption of vaping. I didn't find a desire to really vape as much now than I did before the pandemic. (Female, 35–59, ENDS-only)

However, these motivations were not necessarily attributed to participants' perceptions of product use as a direct COVID-19 risk factor. Rather, decreasing use was perceived as a measure that would better one's overall health, and thus make one less susceptible to a poor COVID-19 prognosis. Additional examples of illustrative quotes from all identified themes are provided in Supplemental Table 1.

Discussion

The intense shifts in day-to-day life brought about by the COVID-19 pandemic and public health response measures meaningfully shaped product use behaviors. Virtually all participants reported changes in their cigarette and ENDS use behaviors during the initial lockdown period, though patterns varied considerably and were influenced by factors at multiple levels. Reported increases in product use were generally more common than decreases, and were most frequently described as resulting from individual-level factors: irregular routines, boredom, and heightened anxiety about the future. COVID-related distress – increasingly referred to as “COVID stress syndrome” (Taylor et al., 2020) – was particularly pervasive and influential, often overriding factors that might conceivably reduce use, such as financial insecurity and health concerns. This finding is consistent with established research on smoking as a powerful coping mechanism, especially among those experiencing emotional distress or mental illness (Krueger & Chang, 2008).

While less common, some participants reported decreases in product use that were predominantly influenced by individual and interpersonal factors. At the individual level, renewed attention to health occasionally motivated participants to reduce consumption. For others who frequently engaged in social product use before the pandemic, the lack of interpersonal interactions during home isolation and uneasiness about sharing products resulted in decreased use behaviors. Previous studies

on social smoking found that this behavioral subgroup is more primed to quit and has better cessation outcomes compared to other types of cigarette users (Song & Ling, 2011). Thus, individuals who use tobacco more regularly and may be more nicotine dependent represent a priority group for cessation interventions during the pandemic.

Irrespective of changes in use frequency or intensity, all participants noted changes in contextual patterns of use. For example, smoking and ENDS use behaviors generally became much less structured, more solitary, and often occurred in different settings. These contextual shifts may impact cessation success among those who make a quit attempt: on the one hand, the pandemic's interruption of daily routines may reduce social smoking or ritualistic smoking triggers (e.g., while driving, during work breaks), offering an opportunity to break these associations. Conversely, irregular routines may lead to more continuous and unpredictable use, resulting in greater difficulty managing cravings and perhaps greater dependency. Given the likelihood that the coronavirus pandemic will permanently alter elements of the workplace (e.g., increased remote work), education (e.g., virtual learning), consumer behavior (e.g., online purchasing), and socialization for many individuals, cessation treatment plans must be tailored to address these daily conditions and their unique impacts on tobacco use behaviors.

Taken together, these findings have implications for US tobacco control policies related to access and cessation. Most states in the US ensure that state-regulated private insurance plans, insurance plans offered to state employees, and Medicaid programs cover at least some evidence-based cessation treatments (e.g., pharmacotherapy), although the scope of coverage varies by state (US Centers for Disease Control and Prevention, 2020). During this period of global turmoil, smoking and ENDS use will increase among some individuals. State and local governments and public health agencies must anticipate potential surges in both use and treatment-seeking by ensuring that cessation programs are sufficiently supported, promoted, and even expanded. This includes national and state-based “quitline” services, remote forms of telephone cessation support. Traditional treatment approaches that typically occur in-person (e.g., individual or group counseling) must be adapted and enhanced for remote delivery given the movement toward virtual medicine during the COVID-19 pandemic and beyond. Training cessation counselors to effectively deliver these remote sessions would be a beneficial approach for health agencies and healthcare organizations. Indeed, innovative cessation interventions that leverage mobile and virtual technologies show promise as an alternative to traditional face-to-face clinical visits (Nomura et al., 2019; Whittaker, McRobbie, Bullen, Rodgers, & Gu, 2016).

Most participants in this study were following their state's stay-at-home order, including working remotely. As a result, many reported using cigarettes and/or ENDS inside the home more than before COVID. Establishing and enforcing tobacco-free home rules – whether voluntary or mandatory, such as those implemented in some types of multi-unit housing – can reduce the health risks of secondhand smoke and other exposures among residents who do not use tobacco products. Importantly, any mandatory smoke-free housing policies should be coupled with strategies to support resident cessation attempts so as to minimize unintentionally aggravating social and economic hardships experienced by low-income and/or marginalized populations who use cigarettes and/or ENDS products.

For individuals who are unable or do not want to stop using tobacco products, harm minimization strategies (e.g., smoking outside of the home, switching to non-combusted or pharmaceutical nicotine products) may be an initial step to reduce health risks to those who smoke and other household members. Several dual users in this study reported smoking cigarettes less and using ENDS more during the lockdown period, citing an aversion to the smell of cigarette smoke in their homes and the desire to reduce smoke exposure among family members with whom they were isolating. ENDS – though not risk free – pose less harm to users and bystanders than combusted cigarettes (Glasser et al., 2017). Therefore, policies that enable access to products lower on the

tobacco risk continuum (e.g., tactfully deciding which types of tobacco retailer are deemed “essential”) may ultimately benefit individuals who might otherwise continue to smoke or switch to cigarettes. Conversely, restricting access to lower risk products may have harmful, unintended consequences.

At the community-level, we found that product access in local retailers affected smoking and ENDS use behaviors in different ways. Cigarettes were unfailingly available in “essential businesses” during the lockdown period. Although participants may have altered their cigarette purchasing practices to avoid the risk of virus exposure (e.g., stockpiling), retail access was rarely cited as directly impacting behavioral changes. ENDS products, however, tended to be more limited due to store closures or inconsistent inventory. Notably, these access-related barriers did not necessarily result in ENDS use reductions. ENDS users instead acquired their products by other – typically less convenient – means, such as online ordering. Some participants, while awaiting frequently delayed deliveries, compensated by smoking more cigarettes. While this is particularly problematic during the COVID-19 pandemic, it raises broader questions about the extent to which public health policies align with principles of harm reduction. Pandemic response policies that intentionally or inadvertently restrict access to lower risk products – through availability, supply chains, or even postal service slowdowns – while leaving more harmful products widely accessible may have unintended consequences that should be considered during policy development.

This study is subject to several limitations. First, while a qualitative approach allowed us to capture key drivers of tobacco product use during the COVID-19 lockdown, the small sample size of cigarette and/or ENDS users prohibited us from identifying the full range of potential patterns and trajectories of use. Future larger, quantitative studies can more precisely describe subgroups who increased or decreased their tobacco use – and under which circumstances – during the COVID-19 pandemic. Future research should also assess some of the multi-level drivers we identified in our interviews, as well as more macro-level factors (e.g., state-level policies). Second, this study included individuals who use cigarettes and/or ENDS, but tobacco use behaviors are increasingly diverse. Behavior changes may vary across product styles (e.g., device types, flavors) or categories (e.g., cigars, smokeless tobacco). Future studies should examine how the pandemic has impacted tobacco use across multiple products. Third, interviews were conducted in the early stages of the COVID-19 pandemic and during a near-universal national lockdown. Research should continue to monitor changes in tobacco use as the pandemic and public health response continue to evolve.

Presently, countries around the world are beginning to distribute the first doses of COVID-19 vaccines, offering hope that the pandemic will soon subside. Nevertheless, mitigation strategies to curb transmission will continue for the foreseeable future. This study indicates that policies to prevent the spread of COVID-19 have affected patterns of tobacco use in ways that may persist in future lockdown periods and beyond the COVID era. Reported increases in smoking and ENDS use, largely driven by pandemic-related anxiety, are particularly concerning. Indeed, tobacco use remains a leading cause of preventable death worldwide. To mitigate the potential contributions of the COVID-19 pandemic to an existing public health crisis, the medical and public health workforce must implement multi-level, innovative strategies that support cessation attempts, reduce relapse, and minimize harm among those who use tobacco products during this time and in the years ahead.

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Declarations of Interest

The authors have no conflicts of interest.

Supplementary materials

Supplementary material associated with this article can be found in the online version, at doi:[10.1016/j.drugpo.2021.103175](#).

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