



Factors affecting tobacco, nicotine, and cannabis product use among California young adults during the COVID-19 pandemic: A qualitative study

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ARTICLE INFO

Keywords:
 COVID-19
 Tobacco
 Nicotine
 Cannabis

ABSTRACT

The effects of COVID-19 on tobacco and cannabis use have been variable, and it is unclear the extent to which factors affecting changes in tobacco and cannabis use differ. The purpose of this study was to identify the COVID-19-related factors that affect changes in tobacco and cannabis use during the pandemic. Focus groups with 114 young adults in California in April 2021 were held to discuss tobacco and cannabis use patterns, adverse events, and the effect of COVID-19 on tobacco and cannabis product use. Factors affecting changes in use were largely similar between tobacco products and cannabis products. Increases in product use were a result of changing social environment, coping with emotional and psychological distress, and product related factors. Decreases in product use were a result of social isolation, COVID-19-related health concerns, disruptions in daily patterns of living, and reduced access. Drivers of increased cannabis use distinct from tobacco or nicotine product use included feeling greater freedom to disengage and perceptions of less harm. Improved understanding of how the pandemic has affected tobacco and cannabis use can inform tailored interventions to both support those who have decreased or quit and assist those who have increased use during the pandemic to reduce or cease their consumption.

1. Introduction

Wide ranging measures were enacted to reduce the spread of the COVID-19 pandemic, including stay at home orders, closure of commercial and social venues, mask wearing, and social distancing. While these measures were intended to minimize the spread of COVID-19, they also had unintended health consequences (Ammar, Mueller, & Trabelsi, 2020; Barbosa, Cowell, & Dowd, 2021; Killgore, Cloonan, Taylor, & Dailey, 2021; Termorshuizen, Watson, & Thornton, 2020).

Tobacco use is related to increased risk of worse COVID outcomes (Baker, Krishnan, Abroms, & Berg, 2022; Patanavanich, Siripoon, Amponnavarat, & Glantz, 2022; Reddy et al., 2021), but the impact of COVID-19 and related mitigation strategies on tobacco use varied. Among U.S. adults, studies have found bidirectional variability in tobacco use (Kalkhoran, Levy, & Rigotti, 2021; Klemperer, West, Peasley-Miklus, & Villanti, 2020; Knell, Robertson, Dooley, Burford, & Mendez, 2020; Vogel, Henriksen, Schleicher, & Prochaska, 2021; White, Li, & Snell, 2021), increased odds of cigarette consumption (Gonzalez, Epperson, Halpern-Felsher, Halliday, & Song, 2021), and no change in consumption among adults (Driezen, Kasza, & Gravely, 2022). Highly

variable patterns in tobacco use behavior during the pandemic have also been observed in Asia (Bella, Swarnata, Melinda, Nurshadrina, & Darto, 2022; Hwang, 2022; Liao, Tang, Quah, Fong, & McNeill, 2022; Sun, Wang, & Cheung, 2022) and Europe (Elling, Crutzen, Talhout, & de Vries, 2020; Gaggero, 2022; Kale et al., 2021; Kilian, Neufeld, & Manthey, 2022; Koopmann, Georgiadou, & Reinhard, 2021; Rogés, Bosque-Prous, & Colom, 2021; Rossinot, Fantin, & Venne, 2020). Increases in tobacco use have been associated with stress, boredom, and lower harm perception (Clendennen et al., 2021; Kalkhoran, Levy, & Rigotti, 2021; Vanderbruggen, Matthys, & Van Laere, 2020; Vogel, Henriksen, Schleicher, & Prochaska, 2021; Yingst et al., 2021) whereas high risk perception and health concerns have been found to be associated with decreases in tobacco use (Sun, Wang, & Cheung, 2022; White, Li, & Snell, 2021). Giovenco et al. (Giovenco, Spillane, Maggi, Lee, & Philbin, 2021) identified multi-level factors affecting changes in tobacco use. Emotional distress, boredom, and irregular routines led to increasing use; less availability of products, less social activity, and fear of sharing products led to decreased use; and more time with children and more time outdoors contributed to switching among product types.

Prior to the pandemic, young adults, a high risk population for

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substance use (Skidmore, Kaufman, & Crowell, 2016), had lower rates of cigarette use than other age groups but were more likely to use alternative tobacco products (ATPs), such as e-cigarettes (Cornelius, Wang, Jamal, Loretan, & Neff, 2020), with polytobacco use more common than mono-tobacco use (Osibogun, Ben Taleb, Bahelah, & Salloum, 2018). In addition, co-use of tobacco products with cannabis products has also been increasing (Schauer et al., 2015). COVID-19 was disruptive to these trends in tobacco and cannabis use in young adults. During the pandemic, variability in tobacco use was observed, with one study finding among 13–24 year olds that 56.4% of e-cigarette users changed their use during the pandemic with 32.4% reporting quitting, 35.3% reducing the amount of nicotine consumed, and 17.6% increasing nicotine use (Gaiha, Lempert, & Halpern-Felsher, 2020). In a study among college students (average age: 21.2 years old), smoking and vaping frequency declined but quantity remained stable after pandemic restrictions were implemented (Sokolovsky et al., 2021). In two studies focused on young adults, one found among a cohort of young adults (average age: 27.6 years old) a significant decrease in prevalence of smoking and vaping (Denlinger-Apte, Suerken, & Ross, 2022) with another finding lower odds of current e-cigarette use among young adults age 18–20 (Kreslake et al., 2021). Klein et al. (Klein et al., 2021) found that increased use of cigarillos or e-cigarettes among young adults (age 21–28) was affected by stress and more time at home whereas decreased use resulted from less social access for sharing, job loss, and fears related to COVID-19. Similar findings were observed among smokers age 17–25 in Hong Kong (Lam et al., 2022).

Though polytobacco use (Kasza, Ambrose, & Conway, 2017; Osibogun, Ben Taleb, Bahelah, & Salloum, 2018) and tobacco and cannabis dual use are increasing among U.S. adults (Goodwin, Pacek, & Copeland, 2018; Schauer, Berg, Kegler, Donovan, & Windle, 2015), the effects of COVID-19 on cannabis use among tobacco users remains unclear. Similar to tobacco use, studies have found variability in changes in cannabis use during the pandemic (Brenneke, Nordeck, & Riehm, 2022; Nguyen, Mathur Gaiha, & Halpern-Felsher, 2021; Vidot, Islam, & Camacho-Rivera, 2021) while other studies found no change in use (Graupensperger et al., 2021) or increased use (Leatherdale, Bélanger, & Gansaonré, 2021; Clendennen et al., 2021). As with tobacco, increased use of cannabis was affected by negative emotions, less socialization, and boredom during the pandemic (Bonar, Chapman, & McAfee, 2021; Chong, Acar, West, & Wong, 2021; Czeisler, Ma, & Petrosky, 2020; Graupensperger et al., 2021). Among young adults, a study among 13–24 year olds found that 6.8% of respondents reported increasing cannabis vaping since the pandemic, 37.0% quitting or reducing vaping in general, and 42.3% no change (Nguyen et al., 2021).

Few studies that have examined the impact of COVID-19 on tobacco use behavior have explicitly included cannabis, especially qualitative studies focused on understanding reasons for changes in tobacco and cannabis use. With concern over the effects of tobacco and cannabis dual use (Georgiades & Boyle, 2007; Hernández-Serrano, Gras, & Font-Mayolas, 2018; Moore & Budney, 2001; Schauer, Berg, Kegler, Donovan, & Windle, 2015), it is important to ascertain how changes during COVID-19 affected both tobacco and cannabis use patterns in a single study sample. The purpose of this study, therefore, was to assess the factors which contributed to changing patterns of tobacco and cannabis product use among young adults during the pandemic using a qualitative research approach.

2. Methods

2.1. Data collection

In spring 2021, young adults in California who have used an electronic nicotine delivery system (ENDS), or e-cigarette, were recruited by a market research company from a proprietary panel into online focus groups as part of a larger study on ENDS-attributed adverse events (AE). In California at this time, COVID-19 vaccine eligibility was expanding to

adults over age 16 years; mask mandates and limitations on large group gatherings remained in place but reopening restrictions for businesses were loosening. Study inclusion criteria were: (1) 18–29 years of age, (2) used ENDS in the past three years, and (3) resident of California. Eligible participants were assigned to one of 16 focus groups stratified on 3 criteria: (1) having ever experienced an ENDS-attributed AE or not; (2) current (past 30 days) or former (past 3 years but not past 30 days) ENDS user; and (3) product use pattern (ENDS only; ENDS and cigarette dual use; ENDS and ATP dual use, including cigar, cigarillo, or hookah; and ENDS and cannabis product dual use).

Participants completed an online consent form and survey covering demographic characteristics, experiences with AEs, and tobacco-related social media use prior to focus groups. Age was collected as an open-ended variable, with sex, sexual orientation, race/ethnicity, educational attainment, and student and employment status recorded as categorical variables as listed in Table 1. Tobacco use patterns were obtained through questions asking about lifetime, past 3-year, and past 30-day use of cigarettes; cigars, little cigars, or cigarillos; electronic cigarettes; non-combusted cigarettes; chewing tobacco, moist snuff, snus, or similar products; waterpipe (e.g., hookah); bidis; kreteks; dissolvable tobacco products; and spliffs. Participants were also asked to identify whether they experienced any of 28 AEs from a list derived from the literature on the online questionnaire. Past 30-day cannabis use was determined from screener questions. Online focus groups facilitated by the first author were held in April 2021 and video recorded. Focus group

Table 1
Sample Description.

N = 114			
Age		24.1 years	
Sex	Male	51.8 %	
	Female	45.6 %	
	Other	2.6 %	
Sexual orientation	Bisexual	10.5 %	
	Gay	1.8 %	
	Lesbian	2.6 %	
	Heterosexual	80.7 %	
	Decline	4.4 %	
Race/ethnicity	White	39.5 %	
	Black	8.8 %	
	AA-NHPI	16.7 %	
	Latino	17.5 %	
	MENA	5.3 %	
	Two or more	12.3 %	
	Highest level of education completed	High school diploma	17.5 %
		Some college	16.7 %
Associate's degree		13.9 %	
Vocational degree		3.5 %	
Bachelor's degree		38.6 %	
Graduate degree		4.4 %	
Student status	Current student	43.0 %	
	Non-student	56.3 %	
Employment status	Not working, not looking	13.2 %	
	Not working, looking	22.8 %	
	Part-time	28.1 %	
	Full-time	34.2 %	
	Number of tobacco products used in lifetime	1	11.4 %
2		14.9 %	
3		19.3 %	
4		21.1 %	
5		18.4 %	
6		10.5 %	
7+		3.6 %	
Past 30-day tobacco use	Yes	69.3 %	
	No	30.7 %	
Past 30-day e-cigarette use	Yes	50.9 %	
	No	49.1 %	
Past 30 day e-cigarette and THC dual user		14.0 %	
Past 3 year, not past 30 day e-cigarette and THC dual user		30.7 %	

discussions included current and previous tobacco, nicotine, and cannabis use; ENDS-attributed AEs; EVALI knowledge and experiences; and, specific to the present analysis, COVID-19 and ENDS and other product use (*What have you heard about vaping or other tobacco use and their relationship to COVID-19? Where do you get your information about vaping and its relationship to COVID-19? How has the COVID-19 outbreak affected your attitude toward vaping or combustible tobacco use? How has the COVID-19 outbreak affected vaping or combustible tobacco use?*). On average, there were 7.1 individuals per group (range: 4–9) and discussions lasted 90 min (range: 55–118 min). A \$150 incentive was issued by the market research firm to each participant upon completion. The study protocol was approved by the Institutional Review Board at California State University, Fullerton (HSR 19–20-565).

2.2. Data analysis

Focus group recordings were professionally transcribed, reviewed for accuracy, and uploaded into ATLAS.ti 9 for analysis (ATLAS, 2019). The codebook was developed using a team based approach (MacQueen, McLellan, Kay, & Milstein, 1998). The first author developed an initial coding scheme based on the focus group discussion protocol, informal focus group notes, and a close reading of two transcripts. Two research assistants coded a subset of three transcripts (18.8%) using the coding scheme and added new codes as needed. The analysis team met to review and finalize the codebook.

Research assistants coded the same transcript until an intercoder agreement of Krippendorff's $\alpha = 0.883$ was reached, exceeding the level of accepted data reliability (Friese, 2019), after which transcripts were coded by one coder. For the present analysis, data from codes related to tobacco and/or cannabis products having a positive or a negative relationship with COVID-19; increasing, decreasing, or unchanged use of tobacco or cannabis products during COVID-19; and reasons for changes in use patterns were extracted into a spreadsheet and subcoded into categories within each code by the first author. Subcoding of data was reviewed by a research assistant for fit, with any differences in application and interpretation of subcodes resolved through discussion and a consensus resolution. Subcodes were then added to ATLAS.ti to recode the data. Through an iterative analysis of data memos, comparison of subcodes, and analysis of transcripts, subcodes were grouped into themes within each code.

3. Results

3.1. Sample description

Among 114 participants, the average age was 24.1 years, and 45.6% were female (Table 1). Whites made up 39.5% of participants, with 17.5% Latino, 16.7% Asian American, Native Hawaiian, or Pacific Islander, 8.8% Black, 5.3% Middle Eastern or North African, and 12.3% two or more racial/ethnic categories. Most participants tried between 3 and 5 tobacco products in their lifetime, and 69.3% and 50.3% were past 30-day tobacco users and ENDS users, respectively. Nearly-one-third (30.7%) were former e-cigarette and cannabis dual users and 14.0% were current e-cigarette and cannabis dual users.

3.2. Knowledge

Information about the effects of tobacco or cannabis use on COVID-19 was obtained from friends, significant others, family members, news articles, social media (e.g., Reddit, TikTok, Twitter, and Instagram), anti-smoking advertisements, and government health agencies. Information centered primarily on a negative effect, in particular contracting the virus or increasing symptom severity. Participants accepted information of a negative effect based on “common sense” over a specific biological explanation. While some participants discussed weakened immune systems, most articulated that since smoking harms the lungs

and COVID-19 attacks the lungs, smoking increases disease susceptibility or severity. For example:

“Common sense just tells me that because smoking involves the lungs, and so does COVID, that smoking makes you more vulnerable to a more severe experience of COVID.”

A sizable minority of participants reported hearing that tobacco and/or cannabis use were protective against COVID-19, such as “people that smoke won't get [COVID]” and “people who smoke are actually getting COVID less.” With cannabis, participants heard that “smoking marijuana strengthens your lungs because you're inhaling and exhaling a lot more” or that “people who smoke marijuana have healthier lungs and stronger lungs so [COVID] won't affect them as much.” Participants who reported hearing about reduced risk of COVID from tobacco or cannabis use, however, expressed skepticism about such a relationship, referring to sources from which they heard the information as “not reliable,” “a weird article,” “so ridiculous,” and “crazy.”

3.3. Increasing use during COVID-19

The two most commonly mentioned factors for increased use of tobacco and cannabis products were coping with COVID-19-related emotional and psychological distress and changes in the social environment (Table 2). For example, a respondent was “smoking [e-cigarettes] more because I'm really bored” and another attributed her partner's increased use of cannabis flower to being “bored and [he] feels there's nothing else to do to take away that boredom.” Other participants reported increased use because they did not feel restrained in their use from being alone: “The reason I leaned so far into [e-cigarettes] for five of six months was because of the fact that I wasn't hanging out with anybody and could do it privately.” For others, increased use was a result of being quarantined with people who increased their use. One respondent increased cannabis use because her roommates were buying “like quarters of an ounce almost every day” as well as nicotine vaping because “the people that I was around started getting into Puff Bars.” For some social ENDS users, COVID-19 made them more apprehensive about sharing with others and prompted them to buy their own e-cigarettes resulting in more frequent use.

Participants also reported increasing tobacco and/or cannabis use to cope with anxiety, loneliness, and stress brought on by the pandemic. One respondent mentioned increasing nicotine vaping “when I'm feeling anxious or just to calm myself down” while another described using cannabis for the same purpose: “I smoked more flower... to kind of manage anxiety and stress.” Participants noted these patterns among others as well, suggesting that “a lot of people are smoking more, whether it be cigarettes or vape, for stress relief.”

The discretion and ease of access and use with vaping of nicotine or THC were discussed as a factor in increased use. One participant vaped THC more “because it was more convenient and easier to hide” while another recalled a friend whose nicotine vape use was “so high, so consistent” in part because “it's way more convenient for her at work, you can hit it more discreetly inside.” Nicotine and THC vape use also increased because “it's basically in my hands at all times.”

Unique to increased cannabis use was a feeling that COVID-19 created more spare time to engage in creative activities. One participant stated that their cannabis use went up because it makes them more creative in their music and art. Another respondent suggested that:

“People are home more often and have more time to themselves to do creative things or to do things that don't require their full mental capacity.”

3.4. Decreasing use during COVID-19

The two most common themes around decreasing product use during COVID-19 were less opportunity for social interaction and health

Table 2
Reasons for increased product use.

Theme	Thematic Categories	Example
Social environment	Alone more	The reason I leaned so far into it for five or six months was because of the fact that I wasn't hanging out with anybody and could do it privately.
	Around others who use more	My vaping did go up. And that also had to do with the people that I was around.
	Boredom	I am definitely smoking more just because I am sitting at home pretty bored.
	Nothing else to do	I personally think it increased for many because COVID had us just locked in and we had nothing else to do but, you know, it was just something to do while we are locked in.
	Not sharing	People might have COVID, we shouldn't be sharing like devices that you put your mouth on. Then everyone just kinda got their own so that they could have their own and not have to share. So, that did, I think, contribute to, increasing [use].
	Emotional and psychological distress	Anxiety I think, for me, like my use has increased just for anxiety and being home. Comfort For a lot of people, [vaping] is like the comforting friend analogy. It just provides a level of safety for a lot of people. Loneliness People are lonely. Then they'll start smoking more as just kind of something to do to keep the time passing. Relaxation [Smoking] was definitely a huge spike right at the beginning [of the pandemic]... just the way to kind of almost escape and relax, you know? Stress relief And so like, in my situation, like with stress level going up, especially the industry that I work in, it's very stressful, and so I felt like my nicotine habits went up because that was a way for me to destress.
Product-related factors	Buying more	I got nothing to do, right? Okay, let me restock, because even if I finish my cartridge or I head over to the STIIZY shop where I know they have a location in downtown LA, or if not, I would, um, accessibly order it from like the Ease Delivery app.
	Discreet	I usually use a STIIZY when quarantine happened just because it was more convenient and easier to hide.
	Easy access	When I'm at home, right now I'm doing quarantine, you know I'm smoking more because I'm really bored. And it's just like so easy to access and it's basically in my hands at all times.
Engagement	Increased creativity	I have nothing to do. And I'll make music or - or art or - or whatever. And I agree where part of me thinks that [cannabis] makes me more creative.
	Less need to be engaged	Cannabis use has gone up for me, and I think for a lot of other people too, just because a lot of people are at home more often and, uh, just have more time to themselves to do... things that don't require their full mental capacity.

Table 2 (continued)

Theme	Thematic Categories	Example
Try something new		Some people they have a lot of down time these days, so, they just - they're bored and maybe they want to try new things.

concerns (Table 3). As one participant said, "I think cutting back [on the THC vape] came naturally as COVID first started, because I stopped seeing friends as well." This was a common sentiment with e-cigarettes and cigarettes as much, with one participant saying they "stopped using [e-cigarettes] because due to COVID, I haven't seen anyone in a year" and another describing themselves as "a social smoker, bumming cigarettes off people... since COVID happened, you can't really hang out with friends."

Beliefs regarding smoking increasing risk of worse COVID-19 outcomes also prompted participants to cut back or quit tobacco or cannabis use. One participant decreased their e-cigarette use because "COVID is bad for your lungs and makes your lungs worse and nicotine products also damage your lungs." Attribution of harm, however, was more frequently tied to tobacco than cannabis. One participant, for example, said COVID-19 "was enough for me to be like, 'I won't smoke cigarettes' even though I only did it in a social setting... But I don't feel that way about THC and weed... I'm like, 'this is healthy and natural and healing'." Other participants reported decreasing their use as part of a desire for general self-improvement. For example, one participant noted that:

"Due to COVID, I want to say I wanted to self-improve... That's when I came to the conclusion that, 'Okay, I'm going to stop smoking tobacco'."

Decreased use was also related to not wanting to share products with others ("You use your mouth to smoke, and so it was more so we really didn't want to share with people... maybe they're asymptomatic or something") and to avoid the stigma of symptoms that were associated with smoking and COVID-19 such as coughing ("You can't go out in public and cough because people will like run away from you").

3.5. Divergent patterns of use

Some tobacco and cannabis dual users reported increasing use of one product while decreasing use of another, with an increase in cannabis use and decrease in tobacco use more common. People tended to decrease use of one product due to declines in social interaction and increase use of a second product for stress relief or increased time for leisure. For example:

"[COVID-19] decreased my use of... any kind of nicotine product. Mostly because I was doing that socially and I was never going to like to go out and buy it anymore... I definitely did see an increase on smoking the THC pen, just because that was something that I feel like there was a lot more stress because of work."

"THC [has] always been more like a social situation for me. And so, I feel like that went down drastically because, obviously, we weren't hanging out with that many friends... in my situation, with stress level going up... so I felt like my nicotine habits went up because that was a way for me to destress."

Other participants reported changing the direction of their use of a single product more than once during the pandemic, with more reporting an initial increase in use because they were "stuck at home," "cooped up in the house," or "had way too much time on my hands," then returned to pre-pandemic levels of use or lower for reasons such as being "really focused on my health" or stopping "after I got COVID."

Table 3
Reasons for decreased product use.

Theme	Thematic Categories	Example
Reduced social interaction	Less socializing	Yeah, I think cutting back kind of came naturally as, uh, COVID first started, because, um, I stopped seeing friends as much. So, naturally, those social interactions kind of just slowed down or completely stopped.
	Commercial gathering areas closed	During COVID, since everything is closed, I wasn't able to like go out to like bars and stuff... And so I actually like stopped smoking for a good amount of time.
Health concerns	COVID/smoking health concerns	For like a month or two, I stayed away from e-cigarettes and cigarettes and just everything. Because... me hearing about COVID-19.
	Desire for general self-improvement	Due to COVID, I wanna say I wanted to self-improve, so I started, uh, looking for things I could either start or stop. And so, that's when I came to the, uh, conclusion that, "Okay, I'm gonna stop smoking tobacco."
	Infected with COVID	I actually had COVID back in December so that is part of the reason why I stopped vaping.
	Do not want to share products	I feel like [using THC] went down drastically because... it's a respiratory situation, and when you think respiratory it's like people are coughing. And it's like those are mouth products. Like, you use your mouth to smoke, and so it was more so we really didn't wanna share with people because we didn't know like, maybe they're asymptomatic or something.
	Social distancing	Uh, well I have friends that like really love to go hookah. But with like social distancing, I don't usually go to hookah recently. And people are more aware of the symptoms that [smoking or vaping] can induce. And a lot of them are related to COVID. And then uh when they walk into public settings, they obviously don't want to display those symptoms.
Disruption of patterns in daily living	Change in daily routine	I tend to smoke while I'm driving a lot and I'm not driving as much.
	Cannot use privately	The house is really small... there's like no vacations or anything like that if your parents are off for the weekend or for the week.
	Disapproval of others	I'm at home not doing much, just playing Xbox or PlayStation and I did some and my wife did not like the smell, so... I just quit.
	Reduced or lost employment	Due to hours being affected from COVID. Like the Puff Bar pen usage definitely went down just based off of hours being cut because I really only do it at work with my coworkers.
Reduced access	Less money to spend	My financials [took] a hit as a result of COVID also... I was just like, 'Man, I need to find like free or cheaper ways, and safer ways, to chill out [than smoking]'. I'd say I use less [because of] availability.
	Unable to obtain	[My] workload [has] gone up, so... [smoking] takes away any time to
Need to focus on increased		

Table 3 (continued)

Theme	Thematic Categories	Example
	workload	focus... so you kinda have to plan out, like do I have a day to do nothing. And if the answer's no, then you just can't [smoke].
	Used a different product	I've been home a lot more just because of like COVID and stuff. And I have a hookah at home. So, I can just kinda smoke it whenever I want now [instead of an e-cigarette].

4. Discussion

Increases in product use among study participants were driven by changes in the social environment such as spending more time alone, spending more time with people who use products frequently, boredom, and no longer sharing products with others, and as a means of coping with stress, anxiety, and loneliness resulting from COVID-19. Decreases in product use were most influenced by reduced social interaction and health concerns related to COVID-19.

Many of the themes in this study support findings in the existing literature. Pandemic-related stress and anxiety, boredom, home confinement, and disrupted social routines were factors leading to increase use during the pandemic found in this study that reinforce previous studies; less social activity, health concerns related to COVID-19, social stigma, saving money, and fear of sharing products were factors contributing to reduced tobacco use during the pandemic (Giovenco, Spillane, Maggi, Lee, & Philbin, 2021; Klein et al., 2021; Lam et al., 2022; O'Donnell, Eadie, Stead, Dobson, & Semple, 2021). This study extends these findings to cannabis use, showing little difference in how the pandemic affected cannabis use compared to tobacco use. Differences between the use of the two products during the pandemic included increased cannabis use because of easier disengagement with one's environment, to be more creative, or beliefs that cannabis was a healthier alternative to tobacco products.

In addition, perceived knowledge about possible protective effects of smoking for risks associated with COVID-19 may reflect findings from studies conducted earlier in the pandemic (Besaratinia, 2021). Potential protective effects of tobacco were viewed skeptically, however, because such a relationship seemed counterintuitive. This reasoning did not hold as strongly with cannabis, which some participants felt had salutary effects on COVID-19 outcomes in part because it was "natural" and is used for medicinal purposes. With increased dual use of tobacco and cannabis products, identifying the similarities and differences in the basis for their use is important to shape more targeted interventions to reduce overall use, particularly during high-stress events, such as a pandemic.

In addition to supporting earlier findings on divergent use patterns of two or more products (Giovenco, Spillane, Maggi, Lee, & Philbin, 2021), participants in the present study reported changes in use patterns over the course of the pandemic. Because many studies examining changes in tobacco and cannabis use during the pandemic were conducted in its early months (Gaiha, Cheng, & Halpern-Felsher, 2020; Gonzalez, Epperson, Halpern-Felsher, Halliday, & Song, 2021; Klemperer, West, Peasley-Miklus, & Villanti, 2020; Knell, Robertson, Dooley, Burford, & Mendez, 2020; Nguyen, Mathur Gaiha, & Halpern-Felsher, 2021), it is unclear how stable these reported changes made during the pandemic will be as restrictions are lifted. Public health efforts should be strengthened and retooled to help those who increased tobacco and cannabis use during the pandemic to reduce known health-related harms and also support those who reduced their use or quit during the pandemic.

The extreme nature of COVID-19 created temporary social changes that are unlikely to be replicated in non-emergency conditions, but two

findings from the conditions created by COVID-19 have broader implications. First, increasing tobacco, nicotine, and cannabis use were often attributed to emotional and psychological distress. Though pandemic-specific mental health challenges may be abating, young adults nevertheless report high rates of poor mental health (Kaiser Family Foundation, 2022). With strong evidence on the relationship between poor mental health and substance use (Bierhoff, Haardorfer, Windle, & Berg, 2019; Leventhal, Bae, Kechter, & Barrington-Trimis, 2020; Marsden, Loukas, Chen, Perry, & Wilkinson, 2019; McKenzie, Olsson, Jorm, Romaniuk, & Patton, 2010; Obisesan, Mirbolouk, & Osei, 2019; Romm, Wang, & Duan, 2022; Saeed, Chavan, & Haile, 2020; Sumbe, Wilkinson, & Clendennen, 2022; Weinberger, Kashan, & Shpigel, 2017; Wiernik, Airagnes, & Lequy, 2019), the results of this study and others highlight the need to better incorporate substance use prevention and treatment with mental health interventions, and vice versa, as co-morbid conditions. Second, changes in product use during COVID-19 were affected by changes in social and environmental conditions such as changes in socializing and declining access. These findings support continued efforts to change social norms around tobacco and cannabis use, expand smoke-free policies, and limit product access as ways to reduce tobacco and cannabis use among young adults.

This study has limitations. First, the convenience sample of participants limits the generalizability or representativeness of the study findings to other young adults. Second, the relatively small sample size prevented deeper exploration of themes that emerged but were not sufficiently discussed in-depth by enough people to develop a rich analysis. Third, this study included individuals who reported current and former ENDS users but did not quota sample for other tobacco products or co-use with other products to better understand patterns of polytobacco use during the pandemic. Future studies should systematically examine use of multiple tobacco products and their co-use.

5. Conclusion

The present study examined how the COVID-19 pandemic has affected tobacco and cannabis use among California young adults a full year after it began. The existing literature has found that changes in tobacco and cannabis use have been bidirectional, and findings of this study suggest a variety of factors influence those changes. With a return to pre-pandemic social patterns, these findings can inform future tobacco control efforts that should focus on helping to maintain declines in and cessation of tobacco and cannabis use spurred by the pandemic, expand efforts to address substance use and mental health comorbidity, and continue to change social and commercial environments to reduce smoking and vaping tobacco and cannabis products.

Funding Sources

This project was partially supported by funds provided by The Regents of the University of California, Tobacco-Related Diseases Research Program, Grant No. T31IP1928. The opinions and conclusions herein are those of the author and do not necessarily represent those of The Regents of the University of California, or any of its programs. CP was supported by Grant MHRT 2T37MD001368 from the National Institute on Minority Health and Health Disparities, National Institute of Health.

CRediT authorship contribution statement

Joshua S. Yang: Conceptualization, Investigation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. **Claudia Pacheco:** Data curation, Formal analysis. **Tim K. Mackey:** Conceptualization, Funding acquisition, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgement

The authors would like to acknowledge Regina Merrill for her helpful research support on this manuscript.

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