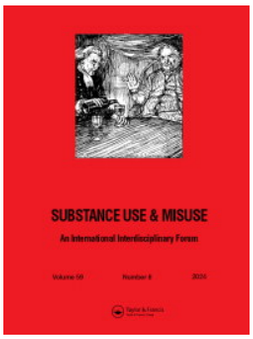

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ORIGINAL ARTICLE

'Spice' Use Motivations, Experiences, and Repercussions among Veterans of the United States Armed Forces

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ABSTRACT

Background and Objectives: The potential for synthetic cannabinoids (SCs) to function as an alternative to marijuana without the same risk of a positive urinalyses led to claims of pervasive military SC use. Case studies confirm use among veterans, but no study has adequately explored SC use in the military using detailed interview data.

Methods: Interviews (1-2 h) were conducted with 318 justice-involved veterans. Recruitment was attempted with all participants in eight veterans treatment courts in three U.S. states (54.9% of 579 eligible veterans). Interviews were transcribed and thematic analyses completed.

Results: SC use was reported by 65 participants (21.3%). Major emergent themes indicated SCs were perceived as unpleasant, overly powerful, and a poor substitute for marijuana. Further, habitual use was rare as many chose not to reuse after initial negative experiences. Few indicated that the perception that SCs would not appear on routine military urinalyses enabled their use. Veterans were aware of the changing drug composition and feared "bad batches."

Conclusions: SCs were explicitly disliked both independently and relative to marijuana. Nine discussed avoiding positive military drug screens as a consideration, but negative initial experiences generally prevented progression to habitual use. Veterans did not view SCs as a suitable marijuana replacement. Fears that SCs are being used as a marijuana alternative among veterans subject to frequent drug testing appear unfounded. These interviews suggest that routine military drug testing did not motivate individuals to use SCs habitually as a marijuana replacement; however, veterans' negative interpretation of SC effects contributed to this outcome.

KEYWORDS

Synthetic cannabinoids; spice; cannabis testing; military; veterans

Introduction

The emergence of new psychoactive substances (NPS) has challenged law enforcement officers, health care providers, and legislators over the last 20 years (Loeffler et al., 2012; Reuter & Pardo, 2017). Often referred to as "designer drugs," "synthetics," or "legal highs," these compounds were designed to mimic traditional recreational drugs or serve as a more powerful alternative, while potentially circumventing legal restrictions (Khey et al., 2014). Legal channels and black markets have marketed many artificially created CB1 and CB2 agonists, or "synthetic cannabinoids" (SCs), as an alternative to marijuana (Caviness et al., 2015). Early reports suggested that SCs represented a particular problem for the military as routine drug screenings for marijuana might encourage personnel to seek SCs as an alternative (Bebarta et al., 2012; Castaneto et al., 2014; Johnson et al., 2011). As early as 2011, the United States military identified groups of SC users at Tinker Air Force Base and on two carriers, and quickly developed educational materials about risks associated with SCs (Loeffler et al., 2012). As a result, assumptions about SC use within the military became pervasive (Bebarta et al., 2012; Castaneto et al., 2014; Johnson et al., 2011; Berry-Cabán et al., 2012; Flor, 2010; Perrone et al., 2012; Walker et al., 2014), yet relatively little academic investigation into the phenomenon exists.

Early research into military SC use relied on case studies or small samples (Berry-Cabán et al., 2012). Following a user presenting psychosis symptoms, Johnson et al. (2011) argued SCs were prevalent in the military. Johnson et al.'s (2011) hypothesis seemed tied to retail reports: "head shop" operators had reported that active-duty personnel often purchased large quantities of SCs before deployments (Flor, 2010). Bebarta et al. (2012) described the medical presentation of three service members who received care for an acute SC reaction, and hypothesized that use originated in the U.S. Navy. Perrone et al. (2012) concluded that seeking a career in the military (which requires negative drug screens) was a reason some students used SCs instead of marijuana.

Two larger studies utilized non-representative samples of military personnel, but neither collected interview data to contextualize use. First, in a sample of 368 active-duty members who had substance use issues, 11.1% reported SC use;

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SCs were the drug of choice for 7.3% (Walker et al., 2014). The study also depicted a perception of excessive SC use within the military. While significantly more respondents believed civilians used each of seven other categories of substances more often than military personnel, the reverse was true for SCs (Walker et al., 2014). Additionally, in a convenience sample of 790 veterans under the age of 34, 17.0% had used SCs, and a significant association with PTSD symptoms suggested veterans may be using SCs to cope or relax (Grant et al., 2016). Previous studies have not adequately explored SC use within a broad military sample through interview data.

Synthetic cannabinoids

Though many SCs were first produced for research purposes (Castaneto et al., 2014; Perrone et al., 2012), the term now refers to compounds applied to dried botanicals and used for recreational purposes—colloquially known as "synthetic marijuana," "fake weed," "Spice," or "K2" (the latter two being popular brand names prior to regulation limiting their sale; Griffiths et al., 2010; Spaderna et al., 2013). As the synthetic marijuana moniker implies, SCs are believed to be an alternative to traditional cannabis use due to their initial legality, potency, and exclusion from standard urinalysis (Winstock & Barratt, 2013). In previous literature, composition of SC samples tends to be inconsistent in both contained compounds and concentration (Dresen et al., 2010; Ralphs, Gray, & Sutcliffe, 2021), suggesting that SC users may be receiving different SCs at different times. Some SC packages may only include inert materials, caffeine, or another recreational drug (Zuba & Byrska, 2012; Ralphs, Gray, & Sutcliffe, 2021). Ralphs, Gray, and Sutcliffe's (2021) work suggests that broad bans shifting sales to black markets exacerbated the variability in potency and purity of SC packages. Both homeless SC users and stakeholders interviewed within their study indicated inconsistencies in SC products contributed to direct acute harms and victimization. Gas chromatography-mass spectrometry of 69 street SC samples confirmed the users' suspicions; some sample concentrations were two to three times that found in typical products while others only contained trace amounts of SCs (Ralphs et al., 2021). While often used to achieve euphoria and relaxation, SCs appear to carry significantly greater risks than marijuana (e.g., kidney injury, tachycardia, stroke, cardia arrest, seizures, hyperemesis, "spiceophrenia," self-harm, accidents, and more than 20 deaths; Bernson-Leung et al., 2014; Hermanns-Clausen et al., 2012; Ibrahim et al., 2014; Papanti et al., 2013; Papanti et al., 2014; Tait et al., 2016; Streich et al., 2014).

In the U.S., SCs were initially sold in "head shops," gas stations, tattoo parlors, and online labeled as "incense," "potpourri," and "not for human consumption" (Khey et al., 2014; Vandrey et al., 2012). Following a legislative ban of certain compounds, clandestine labs began producing other analogues to sidestep regulation (National Conference of State Legislatures, 2017; Khey et al., 2014). By 2012, the federal government instituted a broad ban on all CB1 agonists, effectively removing all SCs from stores. Military regulation of SCs broadly preceded civilian restrictions (Vardakou et al., 2010), but penalties would likely not have included criminal charges (Loeffler et al., 2012; Johnson et al., 2011). Implementation of NPS awareness campaigns, with special attention to its dangers, preceded a two-thirds drop in positive urinalysis tests for NPS in military personnel (Loeffler et al., 2012). While legality may have initially helped SCs gain a foothold in substance-using communities, surveys indicate SCs are still used by 1.4% of Americans under 30 (Johnston et al., 2019).

In civilian samples, use is more common among males (Egan et al., 2015), Whites and Hispanics individuals (as compared to Black individuals; Stogner & Miller, 2014), those who identify as LGBT (Lowe et al., 2020), and users of other substances (Caviness et al., 2015; Egan et al., 2015). Walker et al. (2014) study noted no variation in SC use by race, ethnicity, religion, or deployment history among active-duty personnel. SC users were more likely to be single, younger, and less educated compared to non-users (Walker et al., 2014). Grant et al. (2016) did not compare SC users and non-users except for PTSD symptoms, which were more common among SC users.

Systematic studies encouraging SC users to describe their experiences, motivations for use, and future intentions to use are rare. Analyses of online forums are often used as an alternative (Angulski & Gerber, 2019). However, Bilgrei conducted 14 1-h interviews with SC users (2016). Positive marijuana-like effects, "bad trips," and psychoses alike were reported. Respondents in the study referred to SCs as "crap" and described the effect as "heavy" with "something missing" when compared to marijuana (Bilgrei, 2016). Gray et al.'s interviews with 53 homeless individuals indicated that low cost, potency, and lack of detection (less smell) made SCs appealing (2021). Former heroin and cocaine users in the sample described SCs as highly addictive and related to severe withdrawal issues (e.g., loss of appetite, stomach cramps, sweating, tremors, and hallucinations). They viewed SCs as more comparable to heroin than marijuana (Gray et al., 2019). Other qualitative works affirm user descriptions of craving and dependence (Dalgiç & Coşkunol, 2021), and introduce victimization as a concern (Ellsworth, 2022). Because interview-based SC studies are rare and lack military samples, extant literature may be omitting key issues that are not well addressed with quantitative survey methodology.

Current focus

Despite the assumption that military drug testing programs for other substances facilitate higher use of NPS among active-duty personnel (Loeffler et al., 2012; Morris & Stogner, 2017), no study has adequately explored this hypothesis in a large qualitative sample. We build on prior research summarizing the Multisite Evaluation of Veterans Treatment Courts (MEVTC; Stogner et al., 2023) and using its quantitative portion to identify demographic correlates of synthetic cannabinoid use (Santangelo et al., 2022) by adding this much

needed detailed qualitative assessment. It is prudent to explore motivations for use in an unstructured framework to capture potentially unanticipated use dynamics. For example, the ability to elude detection may be a central factor because military testing for SCs was slow to develop and often not uniformly applied (Navy Medicine, 2015). Finally, an understanding of how SCs affected military personnel, how users perceived effects, the degree to which use became habitual, if/why veterans sought treatment, and why use changed can clarify how the needs of substance-using personnel can best be met and inform the development of policies to curtail SC use.

Methodology

Data source

The formation of veterans treatment courts (VTCs) for justice-involved veterans (JIVs) created an opportunity to reach former members of the military who were willing to discuss illicit behaviors prior to, during, and after military service. Further, the JIV populations are ideal for efficiently studying NPS use within the military as they are arguably more likely than veterans not involved in the criminal justice system to have experimented with less common substances. Based on both the logic and success of other specialty courts (e.g., drug courts, mental health courts, domestic violence courts), VTCs are centered on problem-solving and connecting veterans and service members in the criminal justice system to treatment programs and services to address their unique needs, including traumatic brain injuries, concussions, and exposure to violence (Miller & Johnson, 2009; VHA 2022). The substance use component of the MEVTC data is used to detail SC use among those who served in the military (Baldwin & Hartley, 2022).

Eight VTC sites in three states were purposely chosen to provide representation of VTCs of distinct structures, sizes, demographics, and operations. Interviews (1-2 h in length) were conducted with 318 participants in these eight VTCs between 2016 and 2018. Recruitment was attempted with all 579 veterans physically appearing in the VTCs, and a $20 gift card was used as an incentive (response rate = 54.9%). Male JIVs comprised most of the sample ($n = 292$, 91.8%). Over half served in the Army (57.8%) with the remainder having served in the Air Force (8.6%), Marines (17.6%), and Navy (16.0%). Among these veterans, 42.4% classified themselves as non-Hispanic White, 24.8% as non-Hispanic Black, 27.4% as Hispanic, and 5.4% as Native American, Asian American, or multiracial.

Study protocols and measures

All interviews were conducted by MEVTC research team members; court staff were not allowed to conduct or observe interviews or be aware of whom participated. The MEVTC substance use interview included the item, "In YOUR LIFETIME, have you ever used SYNTHETIC MARIJUANA (e.g., Spice, K-2)?" *(emphasis as it appeared on instrumentation)*. If a participant reported SC use, follow-up items were administered. These items addressed timing, patterns, frequency, and motivation of/for SC use.

Analysis

Each interview was transcribed verbatim, entered into NVivo, and read by the research team. A list of SC-related codes/themes was then developed based on prior research and theory. Two senior members of the research team reread each transcript separately to identify any additional themes. Following a collaborative assessment of these supplemental themes, the inductively derived codes were incorporated into the existing list. The lead author then reevaluated each transcript, coding within NVivo. Thematic analysis was completed using an iterative categorization process (Neale, 2021). All interview data remained paired to identification codes indicating the respondent's gender, veteran court site, and military service branch. As SC-related commentary did not largely vary across sites, genders, and military branches, we present findings for the full sample.

Results

SC use was reported by 65 VTC participants (21.3% of the sample after the 11 who halted the interview prior to this section and two who refused to answer were removed [$n = 305$]). Six of these used SCs before military service, 25 used while in the military, and 43 used after separation. Last-year use was reported by seven, and only two reported use in the last month. Eight major themes emerged within the 65 veterans' responses about their SC use: 1) SCs are linked to an unpleasant experience; 2) SCs were perceived as overly powerful and associated with extreme impairment; 3) The first SC use is often the last; 4) Habitual SC use does occur; 5) Some recurrent SC use is driven by stress or insomnia; 6) Consistencies change and "bad" SC batches are a concern; 7) Users believed SC use would not appear on drug screens; and 8) Only some see SCs as a substitute for *marijuana*. These themes are explored below with quotes from veterans used to contextualize findings. To maintain confidentiality, the participants' names and case numbers have been replaced with sequential letters. Following this summary, three other issues described less frequently ($n \leq 5$) by SC users are presented: SC use in prisons, being tricked into using SCs, and SC use being paired with other substances.

Major themes

Unpleasant experience

Nearly half of SC users (32) reported being dissatisfied with SC use. While some simply reported not liking them, more preferred to use colorful language to express disgust for these compounds. Often, and prior to being prompted, they described their experience with SCs as "horrible," "no good," "terrible," and "nasty." Respondents rarely detailed their

dislike for SCs in relation to marijuana—it was not that SCs were viewed as inferior to marijuana, but they simply did not like SCs at all. This explicit disdain for SCs is notable since it could be compared to any other substance use. While all reported marijuana use, most had used illicit stimulants (cocaine or methamphetamine; 92.3%), heroin or opioids for non-medicinal purposes (66.2%), and hallucinogens (70.8%), all spoke most negatively about SCs.

> "It tasted like I was smoking fertilizer, like just eating dirt. It was so disgusting." *(A; Male/Army)*

> "Oh my God that was the worst. Oh my God. It was horrible." *(B; Female/Army)*

> "I did and… it was garbage and never did that again." *(C; Male/Army)*

> "I can't even put it into… I didn't like it." *(D; Male/Army)*

> "It's horrible. Shit is god-awful." *(E; Male/Army)*

Overly powerful/extreme impairment

Several veterans (16) went beyond indicating SC use as an unpleasant experience and characterized it as dangerous. They described SCs as more potent than marijuana and associated them with unanticipated outcomes. While a smaller number valued the potency (as they could reach their desired level of effect with minimal hits), veterans felt SCs were too powerful, particularly when they were expected to have effects similar to marijuana. Two went so far as to label it as "originating from the devil." While some of these effects could be considered extreme versions of those associated with marijuana, others appear inconsistent with traditional cannabis smoking, like paralysis, tachycardia, and seizures.

> "It makes you feel like you have popcorn going off in your brain." *(F; Male/Air Force)*

> "I took one hit and I went catatonic and I couldn't swallow. I could hear everything that was going on. I just remember laying on the couch and my whole body, I couldn't move anything… You know when you curl your big toe under and it sticks? You just have to wait for it to come back up. That's how my entire body felt. It was terrifying. It was terrifying… I couldn't move. It was like being nailed in a coffin." *(B; Female/Army)*

> "I had a seizure or something. I passed out, and this other dude had a seizure and threw up all over." *(G; Male/Army)*

> "I was like damn my heart it beating really fast and I was so paranoid. I thought I was going to have a heart attack… I was about to tell his mom to call an ambulance, like I was about ready to surrender and give up, like white flag it in his room, and he had to talk me out of it. Yeah, that shit sucks, dude. I'll never go back. I'll never do that again. That shit should be… that shit's way worse that weed. Way worse." *(A; Male/Army)*

First SC use is often the last

With such negative descriptions, it is not surprising that subsequent use was avoided. Twenty-seven veterans reported they used once or a few times, quickly determining use unappealing and discontinuing use. When commenting about only using SCs once or twice, many noted they first tried SCs to satisfy their curiosity/experiment (15), while others indicated first use was partially due to peer pressure (7) or boredom (3). Initial experience was generally not positive enough to lead most to future use—their curiosity was satisfied, and they determined they did not like using SCs.

> "I just did it like one time, and I said no that's alright, that shit's crazy." *(H; Male/Navy)*

> "Just used it just to see what it would do… curious." *(I; Male/Marines)*

> "Boredom. I never tried it before. I only tried it once. It was horrible, so never did it again." *(J; Male/Navy)*

Habitual use does occur

While many chose to use SCs a limited number of times and others only occasionally used, nine veterans reported daily or near daily use over an extended period. Notably, two of the nine were incarcerated during the time they used regularly.

> "A couple of times a day, here and there. I'd say maybe in a week, I'd probably smoke it seven or eight times a week, back in the day." *(K; Male/Army)*

> "I think I went, probably, 4 months strong. Probably, every day." *(L; Male/Navy)*

Some recurrent use for stress or insomnia

Eight veterans mentioned using SCs to relax, calm down, deal with stress, or sleep. While all other themes showed no clustering within study sites, six of these eight were in a single VTC. SC products distributed in this location may have had a more calming/sedating effect than elsewhere.

Changing consistencies and bad batches

Nine veterans who used SCs several times seemed aware that a variety of substances were being sold as synthetic marijuana. While none knew which compound they used at any specific time, they were adamant that different batches affected them differently and even noted changes when using the same supply chain. Some attributed inconsistencies to evolving legislation in the early 2010s while others described both "bad batches" and ineffective batches (producing no effect). Four of these eight were habitual users; the other four did not report ever using daily/near daily but did use recurrently and noticed differences.

> "Sometimes we'd get a bad batch or something, and them guys [less experienced drug users] would go crazy over that stuff… the next thing you know, they're running around the dorm naked, and cops [military police] coming in and getting them. They cracked down on it for a little bit, but it was so easy to hide and it didn't smell, you could smoke it and baby powder afterwards, and it was gone." *(M; Male/ Marines)*

"One shit we smoked, I didn't even feel it…I didn't even get high, but the other shit I smoked got me fucked up to the point where I was about to just to call it. I was about to be like tell the police, tell the judge, everybody. I need some help… because it's a little chemical they change each time to keep it legal and I've even heard stories about like the shit that I smoked, like K2 Diablo…That's a terrible drug." *(A; Male/Army)*

"[While in prison] I'd have to smoke it. It's about like smoking crack…Now they've made it weaker and short-acting, you have to smoke it about every 30 minutes or an hour, something like that." *(N; Male/Army)*

"I don't know if it was something they were coming out with, or they changed something, I don't know what. At first, it was like I take a couple hits and it was like getting high on weed, but after a while it was like take a half a hit and then end up not remembering why you're here or what you're doing." *(O; Male/Army)*

Belief SC use would not appear on drug screens

Ten veterans explicitly described how their belief that SCs would not show up on a military or correctional drug test contributed to their decision to use. Only one mentioned any information provided to the contrary within the military—this participant believed his commanding officer was using SCs and believed he could also get away with use. Most described being convinced that SCs were unlikely to be detected by a peer who exposed them to SCs. One of these veterans was screened after using SCs and tested positive; no details about the ramifications of this screen were provided.

"[When I used SCs once] they were all like, 'Well it's not gonna show up on a drug test.' And I'm like, 'Are you sure?' Then I found out that's super dangerous." *(P; Male/Army)*

"Somebody offered it. He was a truck driver he said… 'Oh this is…' that's when they first came out with it. I was like, 'Oh look he can pass his test now.' And because he was a truck driver, they test him all the time." *(Q; Male/Army)*

Few consider it a marijuana substitute

The majority considered SCs as distinct compounds rather than a suitable replacement for marijuana when supplies were limited. Two veterans explained using SCs because they were unable to obtain marijuana; for them, SCs were a temporary substitute for marijuana ("I couldn't get the real stuff." *[R; Male/Air Force]*). In addition to those who described effects inconsistent with marijuana, several participants explicitly stated that SC use was not like smoking marijuana.

"It was nothing like marijuana." *(S; Male/Army)*

"Somebody had it, and I wanted to smoke a J. Thought it was gonna be like that. Nope, not the same thing ever." *(T; Male/Army)*

Minor themes

Use was limited to incarceration

Five veterans described having used SCs during a period of incarceration prior to the offense yielding VTC contact. They described SC use as rampant in correctional settings with inmates making little effort to hide it. SCs were a cheaper alternative to marijuana in prison and perceived as less likely to produce a positive drug test. While use of a smoked substance could be challenging to conceal, respondents denied this concern. Whether they were under military or civilian justice system jurisdiction when this SC use occurred is unclear.

"Because you could get away with it and it could get you high. Because they piss-tested you in prison, so I knew, and it was a big thing, they [SCs] all blew up when I was in, so it was easy to get, it was cheaper than the weed, too." *(M; Male/ Marines)*

"I was incarcerated. That's where I found it, people bring it in the jails… it's actually the number one most abused drug in the prison system… This is how it works. You ready? You've got 100 rapists, murderers, thieves, and drug dealers in a room. You've got one guy [correctional officer]. What are you gonna do? They're not… Yeah. [chuckle] And plus, dude's like, 'You come over here and put it out' and they're like, 'Nah. We're good.' [laughter]… Plus, most of the CO's bring it in anyways. It don't all come up people's butts. [Mine] was slung over a fence." *(U; Male/Marines)*

Unsuspected use/tricked into using

Two veterans reported they had used SCs but believed they were smoking marijuana instead. They both smoked a substance given to them by a deceptive peer and later learned, after experiencing a distinct high, that it was not marijuana. If this is a common phenomenon, the number of SC users may be higher than reported; however, the differentiation between SCs and marijuana reported by other participants would suggest this is unlikely.

"Not on purpose, I didn't know it was. Somebody gave it to me, and I thought it was marijuana." *(V; Male/Army)*

"I was tricked. I'm thinking it was a joint. They rolled it up in a cigar, and I wanted to kill him. That thing had me so screwed up, girl, you wouldn't believe it." *(W; Male/Army)*

Combining SCs with other substances

Twenty veterans acknowledged using SCs concurrently with another substance; however, we label this as a minor theme due to the way veterans contextualized their use. Many reported they had been drinking when they tried SCs or that use simply overlapped with other substance use as opposed to describing SCs as a substance that they desired to combine with other substances. None described SCs as being used to potentiate other substances, and only one described it having utility in counteracting another substance. This individual argued that SCs provided a marijuana-like high following methamphetamine use and that SCs were effective while on methamphetamine whereas marijuana was not.

"When I was using meth, I found that it's [SC] actually the only thing that counteracts it. Because like, marijuana itself, you can't get high on meth like you can when you smoke K2 or Spice. Smoking marijuana under the influence of methamphetamines,

you'll get that euphoric feeling but it goes away real fast but it's nowhere near the comparison as if you were sober and smoked marijuana. If you were under the influence of methamphetamines and smoked Spice you have that, it would feel like you just smoked a joint." *(X; Male/Navy)*

Discussion

Despite limited research on NPS use among veterans, speculation that soldiers frequently utilized compounds like SCs as an alternative for marijuana was prevalent (Johnson et al., 2011; Morris & Stogner, 2017; Flor, 2010; Perrone et al., 2012). This hypothesis rested on the untested assumptions that 1) frequently drug-tested service members would turn to psychoactive compounds less likely to be included in standard screening programs and 2) military personnel perceived SCs to be an acceptable alternative for marijuana. Neither of these assumptions appear consistent with the rationale or experiences of former service members reporting past SC use.

Interviews with 65 veterans demonstrated explicit disdain for SC use. Most viewed SCs as "disgusting," "awful," and "garbage," both independently and relative to marijuana," reflecting observable patterns of lack of interest in SCs following initial experimentation. They disliked the high, taste, and smell. Veterans also experienced SC effects they considered too potent, too uncomfortable, and too dangerous to continue use including seizures, paranoia, and paralysis. Even among a sample with extensive substance use histories, these experiences made SCs unappealing. Boredom and curiosity were frequent themes for initial use, although use generally ceased once that curiosity was satiated. Veterans tended to view SCs as distinct entities rather than marijuana substitutes. Those who used SCs expecting an experience consistent with marijuana use were unequivocally disappointed. Fears that SCs are being used to replace marijuana when individuals are subject to frequent drug testing appear unfounded.

The ability to avoid a positive drug test was mentioned as a reason for use in nine of the 65 interviews; however, these veterans generally indicated that the perceived exclusion of SCs from routine drug tests facilitated their experimentation with SCs as opposed to habitual use. SCs have been included in military drug test protocols for some time, albeit inconsistently (Navy Medicine, 2015), so it is important to note that the *testing perceptions* of veterans were reported as a motivation for experimentation and not *actual* protocols. One participant did report having been caught for SC use once during drug screening. In contrast, reports of repeated SC use in lieu of marijuana due to frequent drug testing were reported during periods of incarceration (prior to the offense associated with their inclusion in the VTC). While SCs may not take the place of marijuana for those active in the military, they may do so within correctional settings (Ralphs et al., 2017). The legal status of SCs did not seem to influence its use; most SC users showed to have experience using other highly regulated drugs, so were likely unconcerned with a substance's legal status. It is unclear if SCs' initial legal status affected use among those less experienced with illegal substances.

Veterans were keenly aware of inconsistencies in the substances they believed to be SCs. They noted that SC products yielded different effects at different times. Rather than believing changes were the result of tolerance/intolerance development, interactions, or psychological adaptation, veterans were convinced that the composition of SC products changed over time and even sometimes included only non-psychoactive products. This interpretation is consistent with evidence from NPS product composition analyses (Zuba & Byrska, 2012; Annual Report 2019/2020,2020, 2020; Ralphs, Gray, & Sutcliffe, 2021) and the pattern of clandestine labs repeatedly reformulating and producing new compounds to stay ahead of evolving regulatory schemes (Khey et al., 2014). The fear of "bad batches" does seem to act as a deterrent for some forms of NPS use among veterans or, at a minimum, lead them to only seek products from trusted dealers (Miller et al., 2016). Much like the homeless SC users Ralphs et al. (2021) interviewed, veterans viewed inconsistencies negatively; concern lover "bad batches" led some veterans to curtail SC use.

While these interviews do shed much needed light on SC use among military personnel, this assessment is not without limitation. Findings from this study are not generalizable to veterans broadly—the sample was drawn from veterans with a civilian criminal charge. This allowed for efficient identification of SC-using veterans and procurement of their experiences and motivations, although the results cannot be used as an indicator of SC prevalence in the military as a whole. While 21.3% of veterans in the sample reported SC use, this is likely higher than veterans generally, since substance use contributed to many veterans' eligibility for the sample. This study also focused on SCs broadly and not specific SC compounds due to individuals' inability to identify specific SCs used. This study is also limited to U.S. veterans. Finally, NPS questions occurred near the end of an interview that often lasted 2 h. Fatigue may have affected the detail of participants' responses.

The interviews with veterans reporting SC use suggest that routine drug testing in the military did not motivate individuals to habitually substitute SCs for marijuana. Negative interpretations of SC effects likely contributed to this outcome, but findings suggest that military drug testing programs are largely achieving their desired effect: service members are not habitually using newer compounds in lieu of traditional recreational drugs. Most participants reported that all substance use, other than alcohol consumption, stopped or reduced significantly after joining the military due to drug testing. Therefore, the current research does not advocate for an overhaul of military drug-testing protocols. Instead, an increased educational emphasis and/or NPS campaigns addressing SC risks, SC inclusion on drug screens, peer dissatisfaction with SC, and notable differences between marijuana and SC may deter veterans from using such substances further, if at all. Further, as bad batch/inconsistency concerns seemed impactful, it may be useful to detail that as a risk within NPS informational campaigns.

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Author contributions

Dr. Stogner oversaw the study, completed all analyses, and authored the methods, results, and discussion. Dr. Baldwin oversaw data collection and assisted with final manuscript preparation. Amelia Wiercioch assisted with the introduction/ literature review and edited the manuscript. Each author certifies that their contribution to this work meets the standards of the International Committee of Medical Journal Editors.

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The authors report there are no competing interests to declare.

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