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Traversing the triangulum: the intersection of tobacco, legalised marijuana and electronic vaporisers in Denver, Colorado

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ABSTRACT

Objective To explore the intersection of tobacco, legalised marijuana and electronic vaporiser use among young adults in the 'natural laboratory' of Colorado, the first state with legalised retail marijuana.

Methods We conducted semistructured interviews with 32 young adults (18–26 years old) in Denver, Colorado, in 2015 to understand the beliefs and practices related to the use of tobacco, marijuana and vaporisers.

Results We found ambiguity about whether the phrase 'to smoke' refers to the use of tobacco or marijuana products. Smoking marijuana blunts (emptied cigarillo or tobacco wrap filled with marijuana) was common, but few interpreted this as tobacco use. Marijuana vaporisers were used to circumvent public consumption laws (eg, while at work or when driving). Young adults considered secondhand tobacco smoke dangerous, but perceived secondhand marijuana smoke as benign.

Discussion Using tobacco products as a delivery method for marijuana (eg, blunts) might be increasing and normalising tobacco use among young adults. Surveillance should explicitly ask about use of tobacco products for marijuana. Marijuana vaporisers, often indistinguishable from nicotine vaporisers, may be used to circumvent public consumption laws; communities concerned about use of marijuana in public spaces should include vaporisers (for nicotine or marijuana) in smoke-free regulations. Tobacco, marijuana and electronic vaporisers should be studied together, rather than separately. This approach is essential in informing research and policy as more US states and countries worldwide move to legalise marijuana.

INTRODUCTION

The legal landscape around marijuana in the USA is changing rapidly. Currently, medical marijuana is legal in 25 states and Washington DC, with retail ('recreational') marijuana legalised in four states and Washington DC. On 1 January 2014, Colorado became the first state to legally sell retail marijuana to people 21 years or older. Shifting regulations have been accompanied by technological innovations, including electronic vaporisers for tobacco and marijuana. These developments are likely to transform use of these substances, especially among young adults.

Nationally, young adults have the highest rates of current (past 30 days) marijuana use, with 18.9% aged 18–25 years using in 2013, compared to 7.1% aged 12–17 years and 5.5% aged ≥ 26 years.¹ According to 2014 data, almost 30% of young adults in Colorado reported current marijuana use.² Young adults also have the highest current

rates of tobacco smoking (37%).³ More young adults have ever tried e-cigarettes (21.6%) compared to other age groups.⁴ Rates of dual and poly use are also high: in 2013, among US young adults who smoked cigarettes in the past 30 days (16% of the sample), 47% were current marijuana users.⁵

Given high rates of co-use of tobacco and marijuana among young adults,^{6–9} as well as transformations in the realm of policy and technology, tobacco, marijuana and vaporisers are most effectively studied in relationship to one another.¹⁰ Referred to as 'the triangulum' (Latin for triangle), this approach reflects interest in the intersection of tobacco, marijuana and electronic vaporiser use, with implications for surveillance (eg, evaluating tobacco and marijuana use, product taxonomies), policy (eg, smoke-free policies related to marijuana and e-cigarettes)^{11 12} and treatment (eg, effects of dual use on cessation).¹³ Several quantitative studies examined some aspects of the triangulum, including co-use of combustible tobacco and marijuana,¹⁴ perceptions of comparative harm of tobacco and marijuana,¹⁵ prevalence of vaporiser use among marijuana users^{16 17} and reasons for use of marijuana vaporisers.^{17 18} Two qualitative studies examined the intersection of tobacco and marijuana by interviewing youth in Scotland.^{13 19} The data in the studies, however, were collected over a decade ago and do not reflect changing legal and normative environments around marijuana or the proliferation of vaporising devices. Several quantitative studies have addressed marijuana vaporisers use by adults, including Lee *et al*¹⁷ and Etter,¹⁸ but neither was designed to explore in depth why users choose to vaporise marijuana, or the social or policy contexts shaping vaporiser use. To the best of our knowledge, this is the first in-depth, qualitative investigation of the triangulum in the 'natural laboratory' of Colorado. We interviewed young adults in Colorado to understand how they use, perceive and ascribe meaning to various tobacco, marijuana and vaporiser products.

METHODS

Collaboration

As part of the State and Community Tobacco Control (SCTC) research initiative (<http://www.sctcresearch.org>), this project was developed in strategic partnership with Denver Public Health and Jefferson County Public Health departments in Colorado. Beginning in early 2014, we worked with local agencies to identify research questions that would advance policy solutions and practice. These questions were further refined iteratively



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throughout the data collection period. Local agencies provided staff to recruit participants, assisted with interviewing, provided space for interviews and engaged key stakeholders in reviewing early findings.

Study recruitment

Participants were recruited using flyers placed in marijuana dispensaries, vape shops, cafes, stores and on bulletin boards at community colleges in the Denver Metro area. Online recruitment was conducted through Craigslist and posting on Facebook. Inclusion criteria included being 18–26 years old and current use (past month) of at least one of the three products (marijuana, tobacco or electronic vaporisers). Prospective participants were screened and enrolled in the study via telephone by trained research staff. We attempted to interview all 32 enrolled participants twice, in order to allow conversations to develop more deeply. Twenty-four completed both interviews. Participants were compensated \$35 for the first interview and \$65 for the second. Each participant gave written consent. All study protocols were approved by the Committee on Human Research at the University of California, San Francisco.

Data collection

Semistructured interviews were conducted between January and August 2015 by six trained interviewers (three PhDs, one MD and two MPHs), following a standard interview guide. Interviews were conducted individually (one participant with one or more interviewers) in public places (coffee shops, libraries) or in meeting rooms in local health departments. Before each interview, participants completed brief questionnaires with demographic information and past tobacco and marijuana use history. Discussion topics included definitions of smoking, experiences with tobacco, e-cigarettes, marijuana, marijuana vaporisers and other products, perceived benefits and risks of products and experiences with marijuana legalisation in Denver. Interviews lasted between 60 and 90 min, and were audio recorded.

Data analysis

Audio recordings were professionally transcribed. Data were coded using Dedoose software. Researchers McDonald and Popova independently blind-coded a subset of transcripts, which were then compared to develop coding guidelines. Researchers created code definitions and developed a consistent coding scheme to ensure that codes were applied consistently. The larger set of transcripts was divided and coded independently. Themes were generated iteratively during review of coded transcripts. Memos summarising each theme with illustrative quotes were reviewed by authors and discussed iteratively to reach consensus and theme saturation. Pseudonyms are used for all participants quoted in this article and no real names have been used.

RESULTS

Sample characteristics

Participants were 32 young adults with a mean age of 23 (SD=2.36) years; 43.8% were women, 34% were Hispanic, 31% non-Hispanic white, 19% non-Hispanic black and 13% more than one race, non-Hispanic. The majority (19 participants or 59%) were not currently enrolled in or attending school, five participants were in community college, four in high school, two in a 4-year college or university, one in a technical or trade school and one in a professional (law or medical) school.

Ninety-one per cent of participants had ever smoked a tobacco cigarette; 56% smoked 100 cigarettes or more; 97% ever smoked marijuana and 44% were daily marijuana smokers. Table 1 shows rates of use of each product as collected in our intake questionnaire. Three-quarters (75%) of participants reported dual use of tobacco and marijuana in the past 30 days, while 19% reported only marijuana use and 6% only tobacco use in the past 30 days. Sixty-nine per cent of participants had used all three products—combustible tobacco, marijuana and vaporisers (for nicotine or marijuana)—in the past 30 days.

Themes

Participants highlighted fluidity between use of tobacco, marijuana and vaporisers. Reflecting this fluidity, the terms ‘smoke’ and to be a ‘smoker’ were used to describe either tobacco or marijuana use in ways that left unclear which substance was referred to. While dual and poly use was our primary focus, some participants also reported co-use through merging products, including use of tobacco wraps (blunts) or little cigars/cigarillos to smoke marijuana and the use of tobacco cigarettes to ‘extend’ the effects of marijuana. Vaporising devices were used to consume either nicotine or marijuana concentrates, with such devices nearly indistinguishable in appearance. Participants remarked upon the increasing popularity of ‘vaping’, expanded interest in vaporisers for nicotine and marijuana products and the convenience of vaporisers for use in public spaces.






In some contexts, participants clearly distinguished between tobacco, marijuana and vaping, as they did when discussing the risks of secondhand smoke. Participants viewed secondhand tobacco smoke as potentially dangerous, often limiting or prohibiting use of combustible tobacco in homes or cars. Marijuana secondhand smoke, in sharp contrast, was widely considered safer and more pleasant smelling than tobacco smoke, with few participants restricting combustible marijuana indoors.

Do you smoke?

Our question ‘Do you smoke?’ was frequently met with the question: ‘smoke *what?*’ The term ‘smoking’ was used interchangeably to refer to the use of marijuana or tobacco, with this ambiguity only uncovered through conversation: when a researcher asked ‘Ethan’, 22, ‘In terms of your social circle in Colorado, do many people smoke?’ ‘Ethan’ responded, ‘[e]veryone that I work with under the age of 30 smokes. I have five roommates and they all smoke. Just about everyone I know in Denver smokes. I have one friend that doesn’t, just because he gets panic attacks’. When the researcher asked whether these friends were regular or occasional smokers, ‘Ethan’ responded, ‘Much more regular marijuana smokers...[pause] are we still talking about tobacco smoking? When I hear “smoking” now, I associate it more with marijuana than tobacco smoking’. ‘Ethan’ clarified that among his friends, only five were regular tobacco smokers, whereas the majority smoke marijuana. In Colorado, he elaborated, the term ‘smoke’ primarily indicates use of marijuana, but added, ‘If I go back to Texas, and somebody says, “I’m going to go for a smoke,” I know [they mean] cigarettes—tobacco’.

When asked if he ever smoked while drinking, ‘Owen’, 20, commented, ‘Yeah... if I have one drink I’ll probably be smoking before, you know?’ When the researcher asked him to clarify whether he meant smoking marijuana or tobacco, he responded, ‘Marijuana. I don’t really smoke tobacco products like that. The only reason why I put 20 times [of tobacco use per month on the questionnaire] is because [of] Swisher Sweets

Table 1 Participants' use of tobacco and marijuana products (N=32)

Product	Ever use (%)	Past 30 days (%)	Daily user (%)	Days used in past 30, median (IQR)
Tobacco cigarettes 	90.6	43.8	15.6	0 (0–10)
Little cigars or cigarillos 	78.1	43.8	9.4	0.5 (0–9.3)
Electronic cigarettes 	78.1	46.9	9.4	0.5 (0–10)
Hookah 	81.3	34.4	3.1	0 (0–1)
Moist snuff 	25.0	0	0	0 (0–0)
Snus 	18.8	0	0	0 (0–0)
Smoked marijuana 	96.9	93.8	43.8	28 (15–30)
Marijuana vaporisers 	90.6	81.3	6.3	2 (1–10)
Marijuana edibles 	93.8	68.8	3.1	1 (0–3.8)

[cigarillos]. I'd have to get a Swisher Sweet to roll up the marijuana, you know?'. He added that he would not smoke cigarillos 'straight', but only as a wrap for marijuana.

Blunts: bringing together marijuana and tobacco

Participants frequently discussed smoking marijuana using blunts (the emptied shell of a tobacco cigarillo or a tobacco wrap filled with marijuana). However, many of these participants did not report using blunts as a form of tobacco use.

Some participants seemed unsure whether to categorise the use of blunt wraps or cigarillos for marijuana as a form of tobacco use. 'Daniela', 22, states, 'I've never smoked a cigar... the blunt wrap, I don't know if it should even be considered [tobacco] just because it's its own [product]... it's just a paper... it's not like you can get addicted to blunt wraps'.

Other participants recognised the effects of nicotine in blunt wraps when compared to other methods of consuming marijuana. 'Nia', 19, commented she could 'feel' the nicotine in blunt wraps and elected to use 'papers' rather than blunt wraps, 'because the papers don't have any nicotine'.

Traditional surveys may fail to record tobacco wrap use. When asked about his response of using tobacco products on 3 of the past 30 days, 'Andre', 22, clarified:

Interviewer: You're smoking a tobacco product three days out of the month?

'Andre': Yeah.

Interviewer: How often are you using wraps for marijuana, tobacco wraps?

'Andre': Oh, tobacco wraps? Definitely every day. Definitely every day.

Interviewer: Okay. How many times per day are you using blunt wraps?

'Andre': I'd say three, four blunts a day maybe.

Interviewer: Walk me through the timing of those during your day.

'Andre': Let's start with 8:00 and I'll usually finish that whole blunt. That would be one gone. And then by noon or 1:00 at least. After lunch usually, that's when I have my second one. And then depending how tired I am, after my day is done, it's my winding down. Sometimes it takes one, sometimes it takes two. So, that's what I mean...three or four.

One reason participants used cigarillos to consume marijuana was enjoyment of flavours. 'Andre' commented that while he had smoked joints (marijuana rolled in paper), he preferred blunt wrap flavours:

I love wraps way more. It might be the tobacco, but there's something about smoking weed in the wraps that's different from blunt papers to me. When you inhale it, you get that flavor sometimes of whatever flavor wrap you choose...I just love fruit flavors...they put out new flavors all the time too. I tried a chicken and waffle wrap flavor the other day. It tasted like syrup mainly, but that's what I'm saying. I didn't know they could do stuff like that so I'm like, 'I've got to try it!' It's just kind of fun to me. I do it with my brothers and we'll just chill—we'll have a good time.

Another reason participants reported choosing blunts over other forms of marijuana consumption was the social nature of sharing with partners or friends. 'April', 24, commented she often smokes blunts with her boyfriend, sharing up to four a day. When she is not sharing with him, she prefers to use her personal vaporiser while at work, or, if by herself, smoke marijuana in a glass pipe. She reflected, 'blunts are kind of more social...I'd rather smoke blunts in a social setting rather than hitting a pipe and passing it...That's just how it's always been with me and my friends. If we're all together, a blunt will last longer and it's easier [to] just pass...you keep it continuously lit and continuously circling'.

Participants also reported using cigarettes, particularly menthols, to extend the high from marijuana, or for mixing marijuana with comparatively inexpensive tobacco. As 'Andre' states:

I know a lot people who need cigarettes and weed...they smoke a blunt and then they're high...they say cigarettes keep their high going. They'll have like two cartons of cigarettes...weed is way more expensive...so they'll try to have plenty of cigarettes and just a little bit of weed...that's a cheaper way to keep a buzz going. I've even seen people with a little bit of weed...break down the cigarette, use all the tobacco. It will be more tobacco than weed, but they mix it all together... *cigaweed*. That's what they call it, *cigaweed*. [laughs].

Electronic vaporisers for nicotine and marijuana

Adding complexity to this 'smoking' landscape, participants questioned whether or not electronic cigarettes should be considered tobacco products, and reflected on the use of electronic vaporisers for marijuana.

'Victor', 24, used to smoke marijuana blunts using Dutch Masters cigar wraps when living in Florida. But since moving to Colorado, he has switched to vaporising concentrates, primarily cannabis wax in a portable vaporising pen. As he explains, he barely smokes 'real weed' anymore, because 'flower' does not get him high. He tries not to smoke much while at his job in construction, 'if anything I'll take a little hit (from a vape pen), just to line up the head, and just keep going'.

Participants also reflected on using marijuana vaporisers in locations where marijuana use is illegal due to public consumption laws. For example, 'Rashawn', 24, indicated that vaporisers can be used while driving. He explained, 'I do drive when I'm high...marijuana is not necessarily something that makes you

impaired'. When asked if he worried about the legality of driving under the influence, he explained, '...I try and be a little safe since I know what [the police are] looking for. I use a vaporizer if I'm driving because they're basically odorless...and it's a lot better than smoke because if they do smell marijuana in your car, I guess they're allowed to search it or check you for anything'.

Another reason for using marijuana vaporisers was the ability to smoke while at work. 'April' commented, 'If I'm traveling and I don't really want to be smoking a bowl in the middle of wherever, then I like the marijuana version of [an e-cigarette]. If I'm at a job where I'm okay smoking, then on break I'll go out to the parking lot or whatever and maybe smoke a vaporizer'.

The lack of potent smell was associated not only with evading public consumption laws but also with managing social stigma. 'Danielle', 25, commented:

I guess it's more—especially the vape pens—more subtle... This one girl at school...she always gives me this death stare. It's like, 'I can't believe you're smoking pot.' So yeah, I'm trying to vaporize just for that. There's still a little bit of a stigma there. I mean, everyone [in Colorado] smokes...at the same time, I feel it's polite to keep it under wraps sometimes.

Participants commented that some personal vaporisers could be used for marijuana concentrates or for nicotine solutions. When asked to clarify whether she was referring to using a vaporiser for nicotine or marijuana, 'Angela', 18, commented 'You can do both on the pen that I have...You can go up to the [marijuana] dispensary and get it filled up for 30 bucks. Or you can go to the gas station and get nicotine for 5 bucks'.

Some participants reported that the legalised marijuana market has encouraged the proliferation of electronic devices and expanded interest in electronic vaporisers more broadly. 'Molly', 25, commented, 'I think because marijuana has been so present in Colorado, all these different smoking devices are very common. You just see everyone walking around with electronic cigarettes or with vape pens...it's just the culture here'.

Some exclusive nicotine users felt troubled by the inability to distinguish between vaporisers used for marijuana and nicotine. 'Samuel', 21, commented, 'A lot of vape shops take a negative stance towards the electronic vaporization of marijuana because then people tend to associate you with [marijuana] no matter what. When you're walking down the street and you're vaping, a lot of people straight up just assume it's marijuana'. He continued, '...if I ever get pulled over while driving...the cop comes up, and he's, like, 'well, what's all this? Is this just an electronic cigarette or is there tetrahydrocannabinol (THC) in it?' Because there's no public knowledge of this; you wouldn't know unless you were vaping'.

Smoke is smoke? Young adults assess harm of secondhand tobacco and secondhand marijuana smoke

Participants consistently viewed secondhand tobacco smoke negatively, commenting that it 'smells bad' and is harmful for bystanders. Secondhand marijuana smoke, however, was identified as having a 'pleasant aroma' that quickly dissipated. Participants sometimes mentioned that there may be harmful effects of secondhand marijuana smoke ('smoke is smoke'), but marijuana smoke was generally considered less dangerous.

Participants often differentiated between cigarettes and marijuana in maintaining smoke-free spaces. 'Scott', 26, remarked that marijuana and alcohol were similar in that 'you can't drink on the streets, you can't smoke on the streets. You have to go to a private place'. Yet, he noted, there are no public cannabis bars,

requiring young adults to create their own use rules in private (and sometimes public) spaces. Here, the distinction between cigarettes and cannabis comes into relief. As ‘Scott’ remarked:

As far as secondhand cigarette smoke goes, I’m glad that you can’t smoke cigarettes in a bar because I personally don’t like the smell. I think it leaves a really gross stench. And I don’t let people smoke [cigarettes] in my apartment...[or] in my car...I’m not concerned about the health effects of secondhand smoke because it just never concerned me. But for me, it’s just I don’t like the smell.

When asked to compare the smell of cigarette smoke to cannabis smoke, ‘Scott’ explained:

I enjoy the smell of cannabis. And I think a lot of people [do]. Ever since I was younger, I love the smell of it. It was just intoxicating. And the smell doesn’t linger as much.

Smoke tobacco outside, smoke marijuana inside

While many young adults established household rules prohibiting tobacco smoke indoors, they were far more lenient about indoor use of marijuana or e-cigarettes.

‘Danielle’ maintained strict rules prohibiting the use of cigarettes in her home, but had no such prohibitions against smoking marijuana. When asked if she lets friends smoke inside her home, she explained:

No, no, no. I mean, we smoke *weed*. Yeah, that’s for sure. But not smoke tobacco. I don’t see why not [smoke marijuana] unless the smell is too bad. We can open a window. But no cigarettes in the house for sure...cigarettes smell worse. They’re no fun for secondhand smokers. It’s worse for you as a secondhand smoker than it is as a first-hand smoker.

‘Danielle’ mentioned that while growing up in Southern California, she saw many educational antitobacco messages, which she described as ‘these horror stories of how tobacco destroyed lives and families and stuff’. Most saliently, she recalled the story of a man whose smoking affected his kids and pets. As she remembered thinking, “*Not the dog!*” So, I won’t have [tobacco smoke] around my cats or dog. You’re going to kill them. That’s why I don’t like that in the house’. When asked if secondhand marijuana smoke would affect her pets, she explained, ‘Oh, I mean, it definitely affects them, but...it’s not bad for them...there’s marijuana in pet medicine...there’s so many medicinal properties’.

When asked about rules regarding smoking in his multiunit housing complex, ‘Xavier’, 24, mentioned that ‘technically’ he was in a non-smoking building. He explained that cigarette smoke negatively affects furniture and walls, and that tenants ‘*technically* would have to go outside’. When asked if these rules also applied to marijuana, he responded, ‘I don’t know. I think it might say cigarettes specifically. I know the picture [on the sign] is cigarettes. But, it could just say a general “no smoking,” with a cigarette and the non-smoking [symbol]. I couldn’t tell you. I just assumed it was cigarettes, I guess’. He continued, ‘marijuana smoke disappears a lot quicker...just the smell and the aroma. I don’t think it’s as harmful. Not only to you, but to the surrounding area. That’s just my personal opinion on marijuana smoke’.

Another reason participants chose to smoke marijuana inside is that doing so had protected them from police surveillance during the years marijuana was illegal. ‘Teresa’, 21, explained that when she started smoking marijuana at the age of 13, her mother told her ‘just smoke the weed in the house. Don’t go

outside. Just go in the bathroom. Lock yourself in there. Don’t let nobody see you. Don’t do it out on the street’.

Finally, some participants elected to smoke marijuana indoors because they did not have access to private, outdoor spaces (such as a backyard), or lived in multiunit housing where outdoor space was shared. When young adults did have access to private, outdoor spaces, they reported being more likely to smoke outside. ‘Daniela’ stated that, ‘[m]ost of my friends are not super-duper potheads. They don’t want their house smelling like marijuana or anything like that, so they do go outside... they have a little patio—their backyard’.

DISCUSSION

The emerging issues uncovered in this qualitative study highlight the need to reconsider the traditional silo-based approach to tobacco control and marijuana research. It is particularly important to consider the triangulum of tobacco, marijuana and vaporisers, and we believe this is the first study to address this intersection in the context of legalised marijuana.

We found widespread ambiguity about whether ‘to smoke’ referred to the use of tobacco or marijuana products. While not unique to Colorado, this linguistic equivalence between tobacco and marijuana use may signal increasing normalisation of marijuana. Researchers should be aware of this ambiguity in designing precisely worded research instruments. Additionally, antitobacco messaging that focus on ‘smoke’ or ‘smoker’ identity may be diluted in this context, as combustible marijuana moves towards legality and widespread availability.

Participants reported the use of tobacco products as part of the consumption of marijuana. This points to several key issues. Tobacco products are used as a delivery method for marijuana (eg, blunts) because of convenience and/or to facilitate sharing, even when tobacco products are not explicitly desired. Therefore, tobacco consumption may increase and become normalised even in the absence of the desire to use tobacco. Second, as noted previously,^{20 21} participants reported using traditional tobacco cigarettes to extend the ‘high’ of marijuana consumption, particularly because of tobacco’s comparatively lower cost. Third, participants did not uniformly agree whether the use of tobacco products for consuming marijuana ‘counted’ as using tobacco. This may lead to a significant under-reporting of current tobacco use. For example, the participant who reported using tobacco products 3 days of the last 30 on the questionnaire revealed during his interview that he used tobacco wrappers for marijuana 30 days out the past 30 (3–4 per day). It was not until specifically asked about his method of marijuana consumption that it became evident he was a daily tobacco user. Tobacco researchers should be aware that tobacco products used to consume marijuana may not be reported as tobacco use, and should specifically ask about the use of blunt wraps and cigarillos for marijuana consumption. While this issue has been raised before,¹⁴ with at least one nationally representative survey (National Survey on Drug Use and Health (NSDUH)) asking about cigarillos for marijuana consumption,²² it has not been widely adopted and will become increasingly critical as marijuana is more widely legalised.

Participants reported the appeal of electronic vaporisers for nicotine and marijuana. Some participants used the same vaporiser for both products (switching cartridges between marijuana concentrates and nicotine solutions), while others reported owning devices for each. Although past studies showed that vaping was less common than smoking marijuana among a convenience sample of adults,¹⁶ given the rapid growth of the marijuana vaporiser industry^{23 24} and the growing popularity of

electronic vaporisers, especially in states with legalised medical marijuana,¹⁶ it is essential to study perceptions and practices related to electronic vaporisers for marijuana.

Reduced odour was frequently mentioned in the appeal of marijuana vaporisers, cited as advantageous when consuming marijuana in public spaces (currently illegal under Colorado's public consumption laws). Those wishing to vaporise marijuana in public may benefit from the broader normalisation of nicotine vaporising (legal in many, though not all, outdoor, public spaces), as the similar appearance of the devices may make it difficult for the passers-by or law enforcement to identify which product is being consumed. This was experienced negatively by some participants who exclusively vaporise nicotine, as they felt falsely identified as marijuana users.

Communities concerned about the use of marijuana in public spaces should consider including all vaporisers (for nicotine or marijuana) in smoke-free regulations to prevent this confusion. Additionally, there is a concern that growing popularity of vaping, for tobacco and marijuana, might renormalise smoking.²⁵

Participants clearly differentiated between secondhand tobacco and secondhand marijuana smoke. Many were quick to cite the dangers of tobacco, including secondhand smoke, and enforced rules determining where combustible tobacco could and could not be used in their own spaces. In contrast, marijuana smoke was largely regarded as benign, neutral or even pleasant. Few participants expressed concern about secondhand marijuana smoke, or limited where combustible marijuana could be used. This was, in part, due to the subjective experiences of marijuana smoke being much 'milder' than tobacco smoke, and dissipating more quickly. Participants also reported that aerosol produced by vaporisers ('vapour'), whether nicotine or marijuana, smelled less strongly than combustible smoke, and generally allowed its use indoors.

This is in contrast to a study in Georgia that found 83% of surveyed college students adopted smoke-free policies for marijuana and 86% for tobacco in their homes.²⁶ State policies around legal marijuana might affect young adults' personal smoke-free rules. Our participants reported that smoking combustible marijuana indoors was often the only viable option available. Colorado law prohibits the use of marijuana in public places (including public outdoor spaces adjacent to homes). Since many of our participants lived in lower income, multiunit housing, they did not often have private outdoor spaces where they could legally smoke marijuana. Their choice, therefore, was either to break the law and smoke marijuana in an outdoor public space, or, following the law, smoke combustible marijuana in indoor, home spaces. Furthermore, 'no smoking' signs in housing units and other spaces were sometimes unclear, with young adults unsure whether prohibitions were limited to tobacco or included marijuana.

Current research indicates that secondhand marijuana smoke contains many of the same chemicals as secondhand tobacco smoke and some in greater concentrations²⁷ with recent studies demonstrating that secondhand marijuana smoke has negative cardiovascular effects similar to tobacco smoke.^{28–29} Non-smokers exposed to secondhand marijuana smoke had detectable levels of THC and metabolites, with levels increasing when higher potency marijuana was used.^{30–33} Non-smokers exposed to cannabis smoke for 60 min in an unventilated room had detectable levels of THC in blood following the exposure, increased heart rate, mild to moderate self-reported sedative drug effects and performed worse on a cognitive test.³⁴ As normalisation of marijuana use continues, it is important to

monitor the effects of normalisation on tobacco use, perceptions and smoke-free spaces. Smoke-free policies should cover all products, including combustible marijuana and electronic vaporisers for tobacco and marijuana. Signs and information signalling smoke-free policies should be adapted to clearly include marijuana smoke where applicable. Information about harmful effects of secondhand tobacco smoke was found to be a deterrent to smoking initiation and a motivator for cessation for youth.^{35–37} Studies should explore messaging around the negative effects of secondhand marijuana smoke.

As a qualitative study, our relatively small sample provides insight into how some young adults in Colorado integrate tobacco, marijuana and vaporiser use. While these experiences may not be representative, this work begins to shed light on how these products are used and made sense of alongside one another. Further in-depth qualitative work is needed to document the complexities of perceptions of tobacco and marijuana in distinct legal contexts (including in other states and countries), and examine differences between perceptions of medical and retail marijuana in relationship to tobacco. More work is also needed to understand those who primarily vaporise nicotine, those who vaporise marijuana and those who use both.

The SCTC research initiative addresses high-priority gaps in tobacco control research through collaboration between academic researchers and local tobacco control agencies and community organisations. Legalisation of marijuana is one area that is highly salient for many state and community tobacco programmes because of its potential to affect use and perceptions of tobacco. Moreover, tobacco control experts within agencies are frequently tasked with recommending marijuana policies or educating citizens about rules of use and potential health effects.

Tobacco, marijuana and vaporisers are most effectively studied together and future research should address perceptions of comparative harm of these products; social, political and health effects of their use; and adequate measurement of use patterns, especially when products are combined. Finally, tobacco programmes and policies should take into account emerging research on the complexities of this triangulum, particularly in the context of marijuana legalisation.

What this paper adds

- ▶ In collaboration with local health agencies, we conducted the first in-depth qualitative study exploring the triangulum of tobacco, marijuana and electronic vaporisers among young adults in Colorado, the first state with legal retail marijuana.
- ▶ We found widespread ambiguity about whether 'to smoke' refers to the use of tobacco or marijuana products. Smoking marijuana blunts (the emptied shell of a tobacco cigarillo filled with marijuana) was common, but few interpreted this as tobacco use. Marijuana vaporisers were used to circumvent public consumption laws (such as when at work or while driving). Young adults considered secondhand tobacco smoke dangerous, but secondhand marijuana smoke was seen as benign and its use indoors was common.
- ▶ Tobacco, marijuana and electronic vaporisers are frequently used together and should be studied together, rather than separately, in order to inform policy.

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REFERENCES

- Substance Abuse and Mental Health Services Administration. *2012–2013 National Survey on Drug Use and Health: model-based prevalence estimates (50 States and the District of Columbia)*. Rockville (MD): Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services, 2015.
- Colorado Department of Public Health & Environment. *Marijuana use in Colorado: Colorado adults, ages 18 and older, 2014. Results from the Colorado Behavioral Risk Factor Surveillance System*. <https://www.colorado.gov/pacific/cdphe/marijuanause>
- Substance Abuse and Mental Health Services Administration. *Results from the 2013 national survey on drug use and health: detailed tables*. Rockville (MD): Substance Abuse and Mental Health Services Administration, US Department of Health and Human Services, 2013.
- Schoenborn CA, Gindi RM. Electronic cigarette use among adults: United States, 2014. *NCHS Data Brief* 217, 2015:1–8. <http://www.cdc.gov/nchs/products/databriefs/db217.htm>
- Cohn A, Villanti A, Richardson A, et al. The association between alcohol, marijuana use, and new and emerging tobacco products in a young adult population. *Addict Behav* 2015;48:79–88.
- Schauer GL, Berg CJ, Kegler MC, et al. Differences in tobacco product use among past month adult marijuana users and nonusers: findings from the 2003–2012 National Survey on Drug Use and Health. *Nicotine Tob Res* 2016;18:281–8.
- Ramo DE, Delucchi KL, Hall SM, et al. Marijuana and tobacco co-use in young adults: patterns and thoughts about use. *J Stud Alcohol Drugs* 2013;74:301.
- Ramo DE, Liu H, Prochaska JJ. Tobacco and marijuana use among adolescents and young adults: a systematic review of their co-use. *Clin Psychol Rev* 2012;32:105–21.
- Morean ME, Kong G, Camenga DR, et al. High school students' use of electronic cigarettes to vaporize cannabis. *Pediatrics* 2015;136:611–16.
- Tobacco-Related Disease Research Program. The triangulum: tobacco, marijuana, and e-cigarettes, 2016. http://trdrp.yes4yes.com/events/webinar_form.php?code=ecigarettes2016
- Maida V. Vaping rules still need tweaking. *Toronto Star*, 15 Mar 2016.
- Ontario finally gets it right on medical weed: editorial. *Toronto Star*, 10 Mar 2016.
- Amos A, Wiltshire S, Bostock Y, et al. 'You can't go without a fag...you need it for your hash'—a qualitative exploration of smoking, cannabis and young people. *Addiction* 2004;99:77–81.
- Delnevo CD, Bover-Manderski MT, Hrywna M. Cigar, marijuana, and blunt use among US adolescents: are we accurately estimating the prevalence of cigar smoking among youth? *Prev Med* 2011;52:475.
- Berg CJ, Stratton E, Schauer GL, et al. Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: marijuana, hookah, and electronic cigarettes win. *Subst Use Misuse* 2015;50:79–89.
- Borodovsky JT, Crosier BS, Lee DC, et al. Smoking, vaping, eating: is legalization impacting the way people use cannabis? *Int J Drug Policy* Published Online First: 2 Mar 2016. doi:10.1016/j.drugpo.2016.02.022
- Lee DC, Crosier BS, Borodovsky JT, et al. Online survey characterizing vaporizer use among cannabis users. *Drug Alcohol Depend* 2016;159:227–33.
- Etter JF. Electronic cigarettes and cannabis: an exploratory study. *Eur Addict Res* 2015;21:124–30.
- Highet G. The role of cannabis in supporting young people's cigarette smoking: a qualitative exploration. *Health Educ Res* 2004;19:635–43.
- Callahan Research Associates. A summary of focus group research among young Black people on mentholated cigarettes, Feb 1972. <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=shhj0016>
- Brown and Williamson Tobacco. *Young adult smoker life styles and attitudes, 1974*. <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=mjff0045>
- Cohn A, Johnson A, Ehlike S, et al. Characterizing substance use and mental health profiles of cigar, blunt, and non-blunt marijuana users from The National Survey of Drug Use and Health. *Drug Alcohol Depend* 2016;160:105–11.
- Schroyer J. Industry snapshot: vaporizers. Data, trends and challenges, 2015. <https://mjbizmagazine.com/industry-snapshot-vaporizers/>
- Mincer J. The US vaporizer market is booming, 2015. <http://www.businessinsider.com/r-in-rise-of-us-vape-shops-owners-eye-new-marijuana-market-2015-7>
- Budney AJ, Sargent JD, Lee DC. Vaping cannabis (marijuana): parallel concerns to e-cigs? *Addiction* 2015;110:1699–704.
- Padilla M, Berg CJ, Schauer GL, et al. Allowing cigarette or marijuana smoking in the home and car: prevalence and correlates in a young adult sample. *Health Educ Res* 2015;30:179–91.
- Moir D, Rickert WS, Levasseur G, et al. A comparison of mainstream and sidestream marijuana and tobacco cigarette smoke produced under two machine smoking conditions. *Chem Res Toxicol* 2008;21:494–502.
- Wang X, Derakhshandeh R, Liu J, et al. One minute of marijuana secondhand smoke exposure substantially impairs vascular endothelial function. *J Am Heart Assoc* 2016;5:e003858.
- Wang X, Derakhshandeh R, Narayan S, et al. Brief exposure to marijuana secondhand smoke impairs vascular endothelial function. *Circulation* 2014;130 (Suppl 2):A19538.
- Cone EJ, Bigelow GE, Herrmann ES, et al. Non-smoker exposure to secondhand cannabis smoke. I. Urine screening and confirmation results. *J Anal Toxicol* 2015;39:1–12.
- Niedbala RS, Kardos KW, Fritch DF, et al. Passive cannabis smoke exposure and oral fluid testing. II. Two studies of extreme cannabis smoke exposure in a motor vehicle. *J Anal Toxicol* 2005;29:607–15.
- Röhrich J, Schimmel I, Zörtlein S, et al. Concentrations of Δ^9 -tetrahydrocannabinol and 11-nor-9-carboxytetrahydrocannabinol in blood and urine after passive exposure to cannabis smoke in a coffee shop. *J Anal Toxicol* 2010;34:196–203.
- Cone EJ, Bigelow GE, Herrmann ES, et al. Nonsmoker exposure to secondhand cannabis smoke. III. Oral fluid and blood drug concentrations and corresponding subjective effects. *J Anal Toxicol* 2015;39:497–509.
- Herrmann ES, Cone EJ, Mitchell JM, et al. Non-smoker exposure to secondhand cannabis smoke II: effect of room ventilation on the physiological, subjective, and behavioral/cognitive effects. *Drug Alcohol Depend* 2015;151:194–202.
- Glantz SA, Jamieson P. Attitudes toward secondhand smoke, smoking, and quitting among young people. *Pediatrics* 2000;106:E82.
- Romer D, Jamieson P. The role of perceived risk in starting and stopping smoking. In: Slovic P, ed. *Smoking: risk, perception, and policy*. Thousand Oaks (CA): Sage, 2001:65–80.
- Song AV, Glantz SA, Halpern-Felsher BL. Perceptions of second-hand smoke risks predict future adolescent smoking initiation. *J Adolesc Health* 2009;45:618–25.