Review of: "What substances are adolescents vaping? Estimating nicotine-specific and marijuana-specific vaping from US national youth surveys"

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The authors present an important and timely study of the substances that are actually “vaped” by adolescents, based on the analysis of data recorded in major demographic surveys in the US. Its relevance is clear, given the concern of academic research and regulatory authorities (specially in the USA) on adolescent vaping.

The traditional term “vaping” is associated with usage of e-cigarettes, electronic battery operated devices that generate a mist-like aerosol by condensing (through users inhalation) of the vapor produced by heating a liquid solution (the e-liquid), formed by propylene glycol, glycerol (solvents) and possibly nicotine and flavor chemicals. The chemical composition of e-liquids is based on the appropriate vaporization of hydro soluble compounds like nicotine.

However, an analogous form of “vaping” (understood as the aerosol based delivery mechanism described before) is possible and viable for cannabinoids (THC and CBD). Pending the necessary modification of the chemical composition of the liquid solutions (due to the different psychoactive substances, cannabinoids are liposoluble), cannabis can also be “vaped”, as an alternative to its consumption by smoking.

As the authors explain, questionnaires of major surveys (NYTS and MTF) in the US do collect data on cannabis vaping and several papers (cited by the authors) have examined this phenomenon, but most studies that analyze demographic data and the regulatory criteria to draft public policy in the US tend to obscure its scope and significance by conflating all vaping as youth usage of “tobacco products”, which (as mentioned by the authors) results in youth nicotine/cannabis consumption becoming over/under estimated. Given the damage from the “EVALI” outbreak produced by illegal adulterated THC cartridges, it is counterproductive to address youth vaping in such abstract terms, without providing proper information on the different vaped substances and the different risks each one involves.

Before 2018 the majority of adolescents in the US vaped only flavorings from nicotine-free e-liquids, but this changed with the emergence of pod devices (specially Juul) and (more recently) disposables. Changes also came from increasing cannabis vaping, with a 2021 study reporting 40% having tried it. The authors complement this information by looking at exclusive and combined vaping of nicotine and cannabis, looking also at usage frequency and smoking status, as reported in the NYTS and MTF surveys. The results are interesting: never smokers show a high likelihood of not vaping nicotine (thus, vaping only cannabis), with about 1/6 of all those reporting past 30 days vaping not vaping nicotine.

Cannabis usage was about 40%. Those reporting both nicotine and cannabis vaping were more likely frequent users (over 20 of 30 days) and current and former smokers. These are important new findings that must be considered in drafting regulatory and risk retention public policies.

I have the following recommendation to the authors that would enhance the article. First, it would be useful for the readership to explain briefly (in a paragraph) that nicotine and cannabis vaping involve liquid solutions with distinct chemical compounds and properties. Second, to improve the sampling accuracy of questionnaires in distinguishing nicotine/flavoring and cannabis vaping, it is useful to consider the different types of devices and consumer usage patterns.

The main web page of the site “Leafly”

https://www.leafly.com/learn/consume/what-is-cannabis-vaping

and its links (one of which is cited by the authors) provides a wealth of useful information on cannabis vaping and consumer usage. For example, cannabis can be delivered through aerosol in two basic forms (1) through heating a chamber containing grind dry “flower” or cannabinoid concentrates or through water (also known as “dabbing”) and (2) through “vape pens” that heat a liquid solution (in a cartridge) appropriate to the vaporization of cannabinoid chemistry. The former mechanisms (1) are roughly analogous to shisha smoking, while “vape pens” are basically cannabis e-cigarettes.

These technical features can be useful to take into consideration when drafting questionnaires or analyzing data in surveys. Generating aerosol by mechanisms in (1) above requires a learning curve and some expertise, while “vape pens” are as simple to operate as nicotine based e-cigarette pods: the cartridge is placed or screwed in the device and aerosol is generated as the user pushes a button and inhales. As e-cigarette pods, “vape pens” are portable, discreet and do not require complicated maintenance. These characteristics (more than flavors) might make them quite appealing to adolescents.

This information suggests that it should be extremely likely that adolescents vape cannabis overwhelmingly through “vape pens”. Also, the term “vape pen” (but not “e-cigarette”) seems to be extensively used by cannabis vapers and retailers, but not by nicotine vaping consumers and retailers. Of course, many adolescent users might confuse these terms and the devices using nicotine or cannabinoids, but this confusion might not be so widespread because the devices actually look different. From the pictures displayed in Leafly (and other websites), “vape pens” look very similar to old 2nd generation nicotine e-cigarettes, which are currently regarded as obsolete devices of marginal usage (and hard to find in retail nicotine vape shops). It is likely that most adolescents can distinguish these “vape pens” from the currently used and more popular devices they prefer to use for nicotine or pure flavoring vaping: 4th generation pods and disposables (JUUL, SMOK, Suorin, Vuse, blu, Puff Bar, or STIG).

Perhaps, survey questionnaires should focus on using the terms “vape pens” and “e-hookas” in distinct question from “e-cigs”, “mods” and “vapes”, something which could better identify and distinguish cannabis and nicotine/flavoring vaping,

though this distinction might be difficult in a rapidly changing and largely unregulated market (even illegal for cannabis in many jurisdictions). Unfortunately, research on vaping (not only institutional demographic surveys) often ignores consumer patterns.

Finally, the lipid based chemistry of cannabinoid liquids and concentrates is much more complex than that of water soluble nicotine e-liquids. This might lead to higher likelihood of a larger production of toxic byproducts in the aerosol generation process and also to a higher health risk potential. Although there is still insufficient research, this seems to be supported by available research, as for example this paper on cannabis vaping aerosol gas phase:

- Meehan-Atrash, J., Luo, W., McWhirter, K. J. and Strongin, R. M., Aerosol Gas-Phase Components from Cannabis E-Cigarettes and Dabbing: Mechanistic Insight and Quantitative Risk Analysis. ACS Omega 2019, 4, 16111−16120. http://pubs.acs.org/journal/acsodf

While this one examines respiratory symptoms in young cannabis vapers

- Boyd, C. J., McCabe, S.E., Evans-Polce, R.J., Veliz, P.T., Cannabis, Vaping, and Respiratory Symptoms in a Probability Sample of U.S. Youth. ADOLESCENT HEALTH BRIEF, VOLUME 69, ISSUE 1, P149-152, JULY 2021 https://doi.org/10.1016/j.jadohealth.2021.01.019