

“I Get the Flavors and It Makes Me Love Vaping More”: How and Why Youth Users Modify Electronic Nicotine Delivery Systems

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Abstract

Introduction: Youth in the United States are using electronic nicotine delivery systems (ENDS) at a high rate. Modifications to ENDS by youth can introduce additional health hazards which have not been previously considered. To better understand these risks, we need more information on what these modifications are, the motivations behind them, and the sources of information on modifications.

Aims and Methods: Utilizing a trained moderator, in 2020–2021, we conducted one-on-one interviews with 19 youth ENDS users aged 16–17 living in the United States and analyzed their responses using a qualitative description approach.

Results: The most prominent modification was to the e-liquid; youth indicated they mixed e-juices to create new flavors and added substances not intended for vaping, including illicit drugs such as cannabis and cocaine. Few youths from our sample were interested in achieving a specific nicotine level to vape, and modifications to the battery, coil and wick were less frequently mentioned. Some of these modifications were motivated by a desire to achieve specific experiences with their device. At other times, modifications were made due to necessity because of limited access to ENDS devices and supplies. YouTube and peers were the main sources of information about modifying.

Conclusions: Youth are making modifications that are both intended and unintended by the manufacturer. Adding illicit drugs and other substances not made for vaping is of particular concern. Understanding how youth modify ENDS and how that changes their use is important to guide regulatory policy intended to reduce harm to youth from ENDS use.

Implications: Youth from our study indicated that they make modifications to the ENDS devices, specifically to the e-liquid. These modifications are both intended by the manufacturer, such as changing the e-liquid and replacing coils, and unintended, such as adding substances not meant for vaping. Future policies aimed at reducing youth ENDS use should consider mandating better safeguards against modifications that appeal to youth.

Electronic nicotine delivery systems (ENDS) were introduced to the United States market in 2007 and became popular among youth around 2013,¹ surpassing the use of combustible tobacco products among middle and high school-aged students in 2015.^{2,3} In 2019, 27.5% of high school students and 10.5% of middle school students in the United States used ENDS.⁴ Early exposure to nicotine can affect cognitive functioning^{5,6} and is associated with an increased risk of becoming nicotine dependent later in life.^{7–9} Evidence indicates youth may be using ENDS devices as intended by the manufacturer, as well as making modifications.^{10,11} While modifications by adult ENDS users have been studied,^{12–15} little is known about how youth modify their devices. The few studies that have been published were limited to closed-ended surveys¹⁶ and focused on specific, pre-selected modifications such as vaping cannabis¹⁷ and “dripping.”¹⁸ The results of these quantitative studies indicate that youth are making

modifications to their ENDS, with one study reporting that 41% endorsed modifying at least one aspect of their ENDS,¹⁶ and 24% of current cannabis users modifying ENDS to vape cannabis.¹⁷ Closed-end survey measures may not capture the full range of modification behaviors or the experiences and motivations of people who modify ENDS devices. Pairing closed-end data with descriptive qualitative work can help investigate ENDS modifications from different—yet complementary—perspectives providing a better understanding.¹⁹ Thus, our study aimed to understand how and why youth modify ENDS which will facilitate further assessment of the appeal and potential increased harm from the modifications identified in the interviews.

Modifications can be “intended”²⁰ when they are within the manufacturers’ specifications and “unintended” when they differ from what was originally designed by the manufacturer. Common ENDS modifications include changing

e-liquid, replacing the coil, or changing the battery.²¹ Modifications may be made to extend the life of a disposable device, for example by opening up a closed device to replenish the e-liquid.²² These modifications produce a customized experience for the ENDS user, such as specific taste, throat hit, or cloud size.¹⁵ Unintended modifications, such as adding substances not meant for vaping to the e-liquid or adding extra batteries to increase the power of the device, are potentially more dangerous.^{23–25} Researchers do not know the exact prevalence of modifications among ENDS users. The Population Assessment of Tobacco and Health survey has started to include questions to quantify modifications, but to date, the results of these findings have not been published.

Given the prevalence of youth ENDS use in the United States and the potential harms associated with modifying ENDS, descriptive research on youth ENDS modifications provides valuable insight into prevention efforts and regulatory decision-making about the modifiability of ENDS products. We conducted in-depth interviews with youth current ENDS users in the United States. Our study sought to answer three research questions: (1) How do youth modify their ENDS devices?, (2) What are the motivations for these modifications?, and (3) What sources of information do they use as instructions for these modifications?

Methods

A *qualitative description* approach was used to explore youth ENDS modifications. This approach uses a structured interview guide to understand interviewees' lived experiences.^{19,26} Results are reported in participants' own words.^{26–28} This paper follows the suggested format from Standards for Reporting Qualitative Research.²⁹

Research Team and Reflexivity

An experienced moderator from a research company (JSI Research & Training Institute, Inc [JSI]) conducted all interviews. This moderator was a white, non-Hispanic female in her early 30s with masters' degrees in social work and public health. The rest of the research team all had advanced degrees and experience working in both tobacco and qualitative research. The moderator was the only person who interacted with participants.

Participants and Procedures

Purposeful and snowball sampling was used to identify and recruit participants.³⁰ Eligibility criteria were: 13 through 17 years old; had used ENDS in the past 30 days; and were living in the United States. Recruitment and interviews took place in 2020–2021. Since this was during the coronavirus disease 2019 (COVID-19) pandemic, all contact with potential participants was done remotely, and the interviews were completed using a web-based conferencing system. Recruitment wave 1 was August–November 2020 and used a nationwide panel research company, resulting in two completed interviews. Wave 2 of recruitment (December 2020–February 2021) utilized social media postings (ie, Reddit) and sharing study information directly with a youth advisory board in California, as well as snowball sampling. Study investigators were not involved with the youth advisory board and simply shared the information about the study with the board members asking them to disseminate it. At the time of recruitment, the advisory

board, which focused primarily on issues related to substance use behaviors, comprised of approximately 20 students aged 14–22. Wave 2 resulted in 17 completing the interviews for a total of 19 individual interviews. The primary differences between wave 1 and 2 were the recruitment strategies, as well as the enrollment process. In wave 1, parents were selected by the panel research company and the parents introduced the study to their children. In wave 2, youth reached out directly to the research team and completed the assent and screener before the parents were approached to provide consent. The second wave involved more direct communication with the youth, which may have aided in achieving a higher rate of completed interviews. Using the qualitative description approach, which aims to report participants' experiences in their own words, we conducted interviews until the descriptions of participants' experiences were sufficiently overlapping, and no new explanations or novel descriptions emerged from interviews.³¹ The video- and audio-recorded interviews lasted between 27 and 60 minutes (median: 44 minutes). The Georgia State University Institutional Review Board approved the study, and JSI obtained electronic (screeners) and verbal (interviews) assent from all participants and written consent from the youth's parents or legal guardians.

Data Collection

Participants were asked to complete a short online survey to assess their demographics and tobacco use. The research team developed the interview guide based on their previous experience studying ENDS modifications by adult ENDS users.^{14,15,20} Upon completion of the interviews, participants were emailed a fact sheet with information on quitting electronic cigarettes and a \$50 gift card. After the first several interviews, the moderator and observers debriefed and refined the moderator's guide (rewording some questions to make them clearer).

Data Analysis

The one-on-one interviews were transcribed and anonymized by JSI. before dissemination to the research team. R.T.F. and V.C. independently coded one transcript, then met with Z.B.M. to discuss the minimal discrepancies. R.T.F. and V.C. split and coded the remaining transcripts in NVivo 13.³² Utilizing a qualitative description approach, Z.B.M., R.T.F., V.C., L.P., and D.L.A. reviewed coded transcripts, wrote memos summarizing the results of each code, and discussed those results. V.C. assigned pseudonyms and synthesized the memos into the first draft of the manuscript.

Results

Participant demographics and tobacco use are shown in [Table 1](#). All youth were either 16 or 17 years old; the majority were male (60%) and identified as black or African American (80%). About a third of the youth reported currently living in California ($n = 6$), and about a quarter lived in Texas ($n = 5$).

E-liquid modifications, such as mixing flavors, adding nicotine, and other substances, were mentioned by all participants. Adding drugs, most commonly cannabis, was also mentioned. Some discussed making modifications to the batteries and coils though some youth specified they did not modify batteries or coils due to the perceived danger and mess. Friends, family, and online sites were the predominant sources of information for modifications.

Table 1. Demographics and Smoking and Vaping Behaviors for Youth ENDS Users (*n* = 19)

Pseudonym	Gender	Age	Race and Ethnicity	State	Lifetime cigarette count ^a	Times used an ENDS (lifetime) ^b	ENDS use frequency	Age at first ENDS use	Type of ENDS product used ^c	Ever use cannabis or other drugs in ENDS
Aliyah	Female	16	Non-Hispanic Black	NY	21–99	21–99	Every day	13	1, 2, 3, 4, 5	Yes
Andre	Male	17	Non-Hispanic Black	TX	21–99	≥100	Some days	12	1, 2, 3, 5	Yes
Braedon	Male	16	Non-Hispanic Black	CA	2–20	2–10	Rarely	14	1, 2, 3, 4, 5	Yes
Christina	Female	17	Hispanic White	TX	0 < 1	21–99	Some days	16	2, 3, 5	No
Corey	Male	16	Non-Hispanic Black	CA	2–20	11–20	Every day	13	1, 2, 5	Yes
Darion	Male	17	Non-Hispanic Black	TX	21–99	21–99	Some days	14	1, 2, 3, 4, 5	Yes
Ethan	Male	17	on-Hispanic Black	NY	21–99	≥100	Every day	14	1, 2, 5	Yes
Isaac	Male	17	Non-Hispanic Black	CA	21–99	21–99	Every day	12	1, 2, 3, 4, 5	Yes
Jonathan	Male	16	Non-Hispanic Black, White	TX	2–20	≥100	Every day	15	1, 5	No
Jordan	Other	16	Non-Hispanic Asian, White	MI	0	≥100	Some days	14	2, 5	Yes
Kira	Female	17	Non-Hispanic Black	CA	≥100	≥100	Every day	15	1, 2, 3, 4, 5	Yes
Lucas	Male	17	Hispanic Black	TX	≥100	≥100	Every day	15	1, 2, 3, 4, 5	Yes
Mason	Male	16	Non-Hispanic White	NY	21–99	2–10	Some days	6	1	Yes
Myles	Male	17	Non-Hispanic Black	GA	0	21–99	Every day	15	2, 3, 4, 5	No
Olivia	Female	17	Non-Hispanic Black	CO	≥100	21–99	Some days	14	1, 2, 3, 4, 5	Yes
Patrick	Male	16	Non-Hispanic Black	FL	21–99	≥100	Every day	11	1, 2, 5	Yes
Sydney	Female	16	Non-Hispanic Black	GA	0 < 1	2–10	Some days	15	1, 3, 5	Yes
Trinity	Female	17	Non-Hispanic Black	CA	≥100	≥100	Every day	14	1, 2, 3, 4, 5	Yes
Zoe	Female	17	Non-Hispanic Black	CA	21–99	21–99	Every day	15	1, 2, 3, 4, 5	Yes

^aSurvey questions and options were as follows: “How many cigarettes have you smoked in your entire life? A pack usually has 20 cigarettes in it.” None; 1 or more puffs but never a whole cigarette; 2–20 cigarettes; 21 to 99 cigarettes (more than 1 pack but less than 5 packs); 100 or more cigarettes (5 packs or more).

^bSurvey question and options were as follows: “During your ENTIRE LIFE, about how many times have you used an electronic vapor product?” None; 1 time, even just a few puffs; 2 to 10 times; 11 to 20 times; 21 to 99 times; 100 times or more.

^cResponse options were as follows: 1 = “Ones that look like a cigarette,” 2 = “Ones to which you can add e-juice,” 3 = “Ones that allow you to adjust the power setting,” 4 = “Ones that are home-built from separate parts,” 5 = “JUUL or similar type.”

Modifications: E-liquids

Mixing Flavors and Refilling Devices

The most common modification to e-liquids was mixing e-juices to create custom flavors blends. The flavor blend “depends with the mood” that the youth were in when they vaped or wanted to achieve by choosing certain flavors. For example, Kira (all names are pseudonyms) explained, “I don’t use the same flavors every time. If I’m with my friends maybe we’ll put a fruity flavor, compared with I’m alone, when I want to chill.” Ethan described “different feelings from different flavors, especially, cinnamon . . . because it’s really revitalizing.”

Multiple participants mentioned adding easily accessible substances to e-liquids, such as “honey to sweeten [the e-liquid]” or a “bit of lemon [juice].” Trinity discussed having “some friends who are doing research to see how the normal [fruit] juice is made so that” they could make e-juice using real strawberries. Similar to mixing e-liquids, the addition of food products to e-liquids was described in terms of improving flavors.

Participants also reported mixing flavors as a recreational activity on their own or with friends. Participants listed curiosity and a desire to “try out something new” as driving forces behind these modifications. Reflecting about a time she mixed e-liquids with friends, Christina recalled “having

a good time. It felt like we were doing a science experiment, but we were being very clean . . . because after all, we would be putting this in our bodies.” Based on participants’ descriptions, not only are modifications done to change the vaping experience itself, but they can also be enjoyable activities.

Participants reported attempting to extend the life of their ENDS devices by fixing or replacing certain parts, even in ENDS devices designed to be disposable. For instance, Jordan knew of “some people who will open up Puff Bars and then either refill the juice or fix the battery in there, which either one goes first....because usually, if the juice is gone, the battery is still alive” and “people . . . were trying to get their money’s worth” from their devices. Jordan lamented that “pods were expensive and really hard to get when you needed them” and “if you wanted to use [the ENDS device] you had to do something. And the only thing we had on hand was a bottle of juice and an empty Juul pod,” suggesting that there are ways to refill closed systems to extend the longevity of their device.

Adjusting Nicotine Level

Nicotine levels did not seem like a major driver behind modifications with participants willing to use whatever devices or e-liquids were available, regardless of the nicotine content. Christina, who indicated in the interview that her father also vapes, explained, “We didn’t add nicotine to [the e-liquid]....My parents were very happy about that . . . I liked that it didn’t have nicotine but the flavor overall, it just tasted kind of the same as if I had purchased it.” Sydnee described making her own flavored e-liquid with nicotine: “What I mix, it’s the nicotine and also the flavor. If I’m going for the strawberry, that’s what I’m going to mix with the nicotine . . . I always ensure that I’ve measured the . . . [vegetable glycerine], and also the [propylene glycol].” When vaping with friends who make their own e-juice Corey reported, “I can’t say that I control the amount of nicotine. It’s them who control maybe when mixing the e-juice.”

Adding Drugs to E-liquids

Cannabis was the most mentioned drug reportedly added to e-liquids. The process of adding cannabis was described in similar detail by multiple participants, regardless of the legal status of cannabis in the state in which the participants resided. For example, Braedon explained, “When I have the [cannabis] plant now, I may grind it on my own . . . Now after grinding, I add on the liquid. Then after adding on the liquid, now I may smoke it.” Olivia discussed a similar process for adding plant cannabis to e-liquids. “I have to take off the buds from the plant and then I have to grind them. I have a grinder; it’s round you just twist it and then the marijuana comes up really refined.” Olivia indicated that she adjusts the potency of the cannabis in her e-liquid by heating it to activate the psychoactive elements of the plant. She explained: “And then depending on how high I want to get, I can decarbonize it with my oven. And then I mix it with my flavor.” Olivia further said “Marijuana is really, really . . . not dangerous, but . . . you have to measure the amounts you’re taking or else you get really, really high. High enough not to function.”

Others mentioned using cannabis e-liquid either on its own or with another flavor. Kira talked about vaping with friends: “Sometimes we put the marijuana flavor. Just to relax and listen to soft music. It mimics the real marijuana but it’s not the real marijuana.” Andre also mentioned using just a

“marijuana flavored juice”; however, there was confusion on whether the “marijuana flavor” actually contained the psychoactive component THC as it seemed some youth were unsure or unwilling to disclose.

A few participants discussed knowing others who have tried using cocaine in their ENDS devices, though the consensus was that it is dangerous and less acceptable than vaping cannabis. Isaac remembered being “dared” to vape cocaine, recalling it being “very strong,” and that he did not want to vape cocaine again. Olivia explained how she watched someone else put cocaine into an e-liquid and was surprised by this behavior, noting that she was “shook” by the incident. Olivia also recounted a friend who added “drinking alcohol” to their e-liquid, and the experience “went really bad” with the friend getting “so high, like too, too high. Very, very high.”

Modifications: Coils and wicks

Changing to Improve Taste and Flavor

Most of the modifications to the operating mechanisms of the device described by the youth were switching existing coils and wicks with new ones. Several youth mentioned changing coils frequently, motivated mainly by the taste and flavor. After a while, the coils produced a change in flavor that participants described as “burnt” or “just off the usual taste.” Some participants also described the coil when it reached the point that it affected the taste as “done.” As Andre said, “I will notice that the smoke . . . Maybe I’m inhaling less smoke, so maybe my coil is removing a small amount of cloud. So I notice that maybe some coils are burnt, and I have to replace it.” Participants also indicated a desire to maintain flavor purity by using different coils for different flavors, “because every coil has its own flavor.” Some, like Ethan, had systems to keep from cross-contaminating their flavors by storing coils “in a Ziploc” so that they could be used “at a later time.”

Cleaning and Disinfecting

Participants described various ways of cleaning and disinfecting ENDS devices. For instance, Olivia shared that “people soak [coils and wicks] in different solutions depending on their preferences.” Olivia further explained: “I do the alcohol mostly and for disinfecting, because you can’t use actual disinfectant on the wick. Yeah, just some warm water and salt. A lot of salt for it and vinegar.” Kira also used “dish soap and warm water” to clean ENDS devices.

Participants mentioned that cleaning removed any remaining flavor from the device and helped maintain flavor purity. Some participants described the process of cleaning their coils as easy and that it did not require any tools (“just your hands”). Other participants mentioned avoiding coil modifications, including cleaning the coils. Myles shared that “those [ENDS coils] are the kind of things that if you are to damage you wouldn’t have a replacement unless you get another vape pen.”

Device Longevity

Being able to replace coils gave youth in our sample the freedom to vape as much as they wanted because it meant they would not have to worry about using up the coil and then not being able to vape. As Darion said, “because if you know how to change your coil and your e-juice you’re comfortable even if you vape frequently in a day, you know if it’s exhausted you can change it. But if you don’t know how

to do so, you'll be protective, because you don't want it to end." Jordan confirmed that they too modified the coil in their closed-pod system to extend its life: "I have messed with the coils sometimes. If it was with an old Juul, the coils got really burnt so I changed the cotton and then put a new coil just to fix it up, with the help of a friend though."

Modifications: Battery

Unusual Modifications

There were few mentions of battery modifications; the ones that were discussed seemed to be experimental. Jordan reflected on the time "someone was talking about how she would cook her Juul over a kitchen flame . . . She said it would fix the battery . . ." Trinity tried to "[attach] the wires [from the battery] directly to the socket to see if it will last longer when [she charged] it directly, but it didn't really work." After that, she "just decided, 'let me get another one'" rather than continuing her attempt to modify the battery. Myles was inspired by "external power banks" used for phones and tried using one to "extend the usage of the vape pen by just using an external battery."

Reasons Not to Modify

Participants found some modifications, such as replacing e-liquids, to be "messy" and undesirable. Others said that it is easier to replace parts rather than modify devices. As Myles explained, "if you are to damage [a part] you wouldn't have a replacement unless you get another vape pen." Youth in our sample did express concerns about how modifications affected the safety of their devices. A few participants indicated that they trusted the manufacturers over their own "amateur" modifications. Jonathan went so far as to say, "the manufacturer decided to build this in the safest way possible to use. If they wanted you to use that way then they would let you know." He continued by saying his friends were "so eager to [modify their devices] they might as well just go . . . work on the Juul board to go help them improve their design." Being "young and stupid" and not "know[ing] anything," according to Jonathan, contributed to the concerns about the safety of doing their own modifications.

Youth from our study were not compelled to modify components of their devices because they felt it was unnecessary. For example, Ethan said the "battery is not that expensive," so it is not a "really important" component to modify. Likewise, Christina reported that she keeps "everything very much like how it arrives" and does not "really modify many things."

Sources of Information

Friends and Siblings

Most of the youth we interviewed mentioned learning about modifications from friends and had friends who would do the modifications for them. Myles said that "a friend of mine . . . showed me, because [modifying] wasn't that easy . . . I've gotten used to the vaping and the vape pens all over the years, but then I'm not that much into kind of exploring. So a friend of mine actually [mixes e-liquids] for me." Siblings were also valuable sources of information. Christina's brother showed her how to modify the coil "a couple of times," but subsequently, she "looked it up on YouTube." She also indicated "a while ago I wanted to change the coil, and I was mad at my brother, so I'm like 'ugh, I can't ask him for help', so I

looked that up [online]." Having connections to peers who also used ENDS devices appeared to be a consistent theme among participants.

YouTube

According to our participants, there are thousands of YouTube videos on modifications, and it's easy to "look up how to change a coil on . . . a vape" and "go on the first video, look at what they're doing" and if it's "too difficult . . . go on the second one." ENDS users can "have [their] vape right next to [them], as the video is playing" while they work on the modifications. Christina explained that she would "pause the video, do a little bit, pause the video" to complete the modification, though the "whole process [is] definitely not super simple."

Discussion

Youth ENDS users in our sample discussed a wide range of modifications. Changing and mixing e-liquids were the most common modifications mentioned by the youth we interviewed. These modifications occurred with both open- and closed-pod systems. Contrasted to earlier research on adult ENDS modifications,^{15,20} the practices of coil building and cloud blowing were not mentioned by youth in our interviews, which is consistent with recent research.³³ Alarming, youth also discussed adding illicit drugs such as cannabis and cocaine to e-liquids; the latter has not been examined in the literature but warrants careful monitoring, particularly in light of increased presence of fentanyl (a deadly synthetic opioid) in cocaine-related overdoses.³⁴ Together, the results advance our understanding of ENDS modifications among youth ENDS users, a group that deserves greater attention from the research community.

Our interviews showed that having access to such a large variety of e-liquids is appealing to youth, and it gives them ways to interact with friends by sharing flavors. Without a flavor ban, youth may continue to experiment with e-liquids, which may thwart efforts to reduce youth ENDS use. Youth participants predominantly described mixing several flavored e-juices rather than creating their own mixes from scratch (as we saw in our research with adult ENDS users).¹⁵ Since flavors are a prime motivator behind youth ENDS use, understanding the consequences of changes in the availability of flavors will be necessary to limit the harm to youth, particularly in relation to unintended or risky modifications.³⁵⁻³⁷ Youth behaviors will need to be monitored, and campaigns discouraging homemade e-liquids prioritized.

Some youth mentioned modifying the battery and coil. However, no youth mentioned building their own coil, contrasting what we saw among adults and in our content analysis of YouTube videos.²⁰ The new generation of ENDS devices may contribute to the youth in our study finding modifications unnecessary due to design features that eliminate the need to change components of the device.

Modifications that are not explicitly intended by the manufacturer but are still frequently occurring raise questions about how well these products can be controlled by regulation. For example, while closed-pod systems are not created to be refilled with e-liquids, many videos online provide instructions on how to open them so the user can add their own e-liquids, extending the product's life. This may be particularly important to youth who have difficulty

acquiring new pods for their devices.²⁰ It is important to monitor how devices are being used in the real world to inform policies aimed at minimizing harms associated with ENDS products.

While it was not the intention of the project to focus on youth identifying as racial minorities, due to the nature of the recruitment process the sample was predominantly non-Hispanic black. Studies have shown that black youth are less likely to use ENDS compared to their white counterparts.^{4,38,39} Because the overrepresentation of non-white participants was unanticipated at the inception of the project, questions that would be relevant to address the issue of race and ENDS use were not included. However, while our findings are not generalizable to non-Hispanic black adolescents overall, they point at areas that future research looking at ENDS use and modifications by race should examine, with particular attention to flavors as motivators for modifying ENDS.

Finally, the youth in the recruited sample were either 16 or 17 years old, even though the intention was to recruit ENDS users as young as 13 years old. This is not unusual considering that the mean age of ENDS initiation is estimated to be 17.5 years old,⁴⁰ and older adolescents are more likely to be current ENDS users than younger adolescents who have ever used ENDS.⁴¹

Limitations

Our sample is not representative of all youth ENDS users. Due to the difficulty in recruiting underage ENDS users, we used convenience and snowball sampling, which may have created disproportionately dominant themes. These interviews were conducted during the COVID-19 pandemic and difficulty with obtaining their preferred device and e-liquids may have changed ENDS use behavior of some of the participants.⁴² Being at home with parents or guardians due to COVID-19 pandemic possibly resulted in fewer participants being willing to take part in this study, likely due to privacy concerns. The interviews were conducted online, there may have been challenges in interpreting the meaning for both the youth and the moderator based on restricted nonverbal communication.⁴³

Conclusions

Preventing youth ENDS use is a public health priority. Understanding how youth are modifying ENDS and how that changes their use is important to reduce youth ENDS use. Our research shows that, among the participants we interviewed, youth are modifying their ENDS devices and e-liquids. Some of these modifications are motivated by a desire to achieve specific experiences with their device, such as adding cannabis to e-liquids to get high. At other times, modifications are made due to necessity because of limited access to ENDS devices and supplies.

In evaluating population-level impacts of specific ENDS devices, the FDA should consider the intended modifications built into the products, as well as how easy it is to modify products not intended to be modified. For example, the ease of opening a closed device and replacing the e-liquid should be a factor in determining the appropriateness of the product for the protection of public health. FDA should also consider mandating better safeguards against modifications that appeal to youth.

Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

Funding

Research reported in this paper was supported by the National Institute on Drug Abuse of the National Institutes of Health and Food and Drug Administration Center for Tobacco Products (R01DA047397 to L.P. and D.L.A.). This manuscript is not under consideration for publication elsewhere and its publication is approved by all authors. If accepted, this manuscript will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright holder].

Declaration of Interest

D.L.A. has received funds for work done for the World Health Organization Tobacco Free Initiative, as a consultant for Pfizer and McKing Consulting, Inc., as an employee of Cherokee National Operational Systems, and as a Special Government Employee of the U.S. Food and Drug Administration. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Food and Drug Administration.

Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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