

Original investigation

E-cigarettes, Hookah Pens and Vapes: Adolescent and Young Adult Perceptions of Electronic Nicotine Delivery Systems

Kimberly G. Wagoner DrPH, MPH¹, Jennifer Cornacchione PhD¹,
Kimberly D. Wiseman MS¹, Randall Teal MA², Kathryn E. Moracco PhD,
MPH³, Erin L. Sutfin PhD¹

¹Department of Social Sciences and Health Policy, Wake Forest School of Medicine, Winston-Salem, NC; ²Lineberger Comprehensive Cancer Center, University of North Carolina at Chapel Hill, Chapel Hill, NC; ³Department of Health Behavior, UNC Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC

Corresponding Author: Kimberly G. Wagoner, DrPH, MPH, Department of Social Sciences and Health Policy, Wake Forest School of Medicine, Medical Center Blvd, Winston-Salem, NC 27157, USA. Telephone: 336-713-4223; Fax: 336-716-7554; E-mail: kwagoner@wakehealth.edu

Abstract

Introduction: Most studies have assessed use of “e-cigarettes” or “electronic cigarettes,” potentially excluding new electronic nicotine delivery systems (ENDS), such as e-hookahs and vape pens. Little is known about how adolescents and young adults perceive ENDS and if their perceptions vary by sub-type. We explored ENDS perceptions among these populations.

Methods: Ten focus groups with 77 adolescents and young adults, ages 13–25, were conducted in spring 2014. Participants were users or susceptible nonusers of novel tobacco products. Focus group transcripts were coded for emergent themes.

Results: Participants reported positive ENDS attributes, including flavor variety; user control of nicotine content; and smoke trick facilitation. Negative attributes included different feel compared to combustible cigarettes, nicotine addiction potential, and no cue to stop use. Participants perceived less harm from ENDS compared to combustible cigarettes, perhaps due to marketing and lack of product regulation, but noted the uncertainty of ingredients in ENDS. Numerous terms were used to describe ENDS, including “e-cigarette,” “e-hookah,” “hookah pens,” “tanks,” and “vapes.” Although no clear classification system emerged, participants used product characteristics like nicotine content and chargeability to attempt classification. Perceptions differed by product used. E-hookah users were perceived as young and trendy while e-cigarette users were perceived as old and addicted to nicotine.

Conclusions: Young adults and adolescents report distinct ENDS sub-types with varying characteristics and social perceptions of users. Although they had more positive than negative perceptions of ENDS, prevention efforts should consider highlighting negative attributes as they may discourage use and product trial among young nonusers.

Implications: Our study underscores the need for a standardized measurement system for ENDS sub-types and additional research on how ENDS sub-types are perceived among adolescents and young adults. In addition, our findings highlight negative product attributes reported by participants that may be useful in prevention and regulatory efforts to offset favorable marketing messages.

Introduction

In 2007, electronic nicotine delivery systems (ENDS) became available in the United States, launching a new category of tobacco products. The first generation of ENDS resembled combustible cigarettes (cigalikes) and were commonly referred to as electronic cigarettes. However, in recent years new variations have emerged that look like pens, have high-capacity batteries, are more efficient at delivering nicotine, and offer an endless array of e-liquid flavors.^{1,2} There is no common language for these more advanced systems, as they are called several different names including vape pens, hookah pens, and e-cigarettes.

ENDS use is currently measured in most national population surveys that assess tobacco use, with the nomenclature of “electronic cigarette” or “e-cigarette”.^{3,4} Results from national surveys show increased ever and current use among all age groups, and young adults have the highest prevalence of current use (14.2%).^{5,6} Recent data from the National Youth Tobacco Survey showed that in 2014, e-cigarettes were the most commonly used tobacco product among middle and high school students, and use tripled from 2013 to 2014.⁷ However, recent research suggests that users use multiple names for the devices besides electronic cigarettes and e-cigarettes.⁸⁻¹⁰ For example, McDonald and Ling¹⁰ conducted focus groups and interviews with young adult smokers to assess their e-cigarette experiences. When asked if they used e-cigarettes, some participants indicated they did not, but later referred to using e-hookahs and other electronic devices, suggesting they are perceived as distinct from e-cigarettes.

There is a growing body of evidence focused on motivations for young adults and adolescents use of these products. These younger populations find the flavors appealing and like that they can use them in locations where smoking is not allowed.^{10,11} Electronic cigarettes are perceived to be accessible, easy to conceal, convenient, and modern.¹¹⁻¹⁴ Findings have also shown that electronic cigarettes are perceived as having few health risks and a healthier alternative to combustible cigarettes.^{10,12,13} While these studies provide some information on adolescent and young adult perceptions, they do have limitations, such as limited geographic scope, focus only on smokers’ perceptions and focus on one gender. More importantly, none of the studies examined perceptions of ENDS sub-types. In addition, new ENDS products continue to emerge in the retail environment, underscoring the need to further examine ENDS perceptions among adolescents and young adults. The goal of this qualitative study was to explore adolescents’ and young adults’ perceptions of ENDS and the language used to describe the array of products.

Methods

Focus groups were used to understand adolescent and young adult perceptions of ENDS. The primary purpose was to provide formative data for a larger study that aims to develop risk communication messages for novel tobacco products targeting these populations.

Participants were recruited in Raleigh, Durham and Chapel Hill, North Carolina. Advertisements were placed on craigslist, in university and local newspapers, flyers, e-mails to various listserves, social media, radio, and TV. In-person recruitment was conducted in bars, coffee shops, retail outlets, high schools, colleges, and recreation centers. Most participants (45%) were recruited via e-mail, while snowball sampling accounted for about 17% of participants. Approximately one-third (28%) were recruited from the advertisements and in-person recruitment. Interested participants were directed to a website

where they completed an eligibility screener. Eligibility included age between 13 and 25 years and past 30-day use or susceptible nonuse of novel tobacco product. Users included those who reported use of any novel tobacco products (ie, electronic cigarettes, hookah, cigarillos, or smokeless tobacco) within the past 30 days. Susceptible nonusers were those who indicated they were willing to try, but did not currently use, novel tobacco products.¹⁵ Individuals under 18 were required to provide a parent’s email or mailing address so they could be contacted about their adolescent’s interest in participating. Parents were sent an informational letter and given the opportunity to respond within 5 days if they did not want their adolescent to participate. A total of 21 parental informational letters were sent out and no parents responded that their adolescent was prohibited from participating. Eligible participants were then invited, by e-mail, phone and mail to one of 10 focus groups conducted between February and April, 2014.

Focus Group Procedures

Ten focus groups, stratified by user status and age, were held, including four young adult user groups, two young adult nonuser groups, two adolescent user groups and two adolescent nonuser groups. Written informed consent or assent was obtained at the beginning of each focus group. Three research team members, consisting of a moderator, co-moderator, and detailed note taker, facilitated each group. All focus groups were digitally recorded and averaged 90 minutes in length. Upon completion, a handout on novel tobacco products and their potential harm was distributed, which was based on information from the Campaign for Tobacco-Free Kids, the American Lung Association, the American Cancer Society, and the National Cancer Institute. All participants received a \$50 Amazon gift card for participating. Human subject review and study oversight was provided by the Institutional Review Board at Wake Forest School of Medicine. The study also received a Certificate of Confidentiality from the Department of Health and Human Services to secure additional privacy protection for participants.

Measures

A semi-structured moderator’s guide was developed that organized the order and content of the discussion. The guide was developed based on a literature review, prior pilot work, and input from the study team. At the time we created the moderator’s guide, cigalikes dominated the retail market and electronic cigarette was the term being used by the field to describe the products; thus, electronic cigarette was used in the guide to describe the products of interest. Also included were questions about participants’ product familiarity and knowledge, and concerns about possible health effects. Based on information acquired during the first 6 focus groups and the rapidly evolving ENDS marketplace, new questions regarding other electronic devices were added to focus groups 7–10, including: “Have you ever heard of e-hookahs or hookah pens? What do you know about them? Are they different from e-cigarettes? How? Do you know people who use them? Are there other devices like this we should know about?”

Analysis

All interviews were transcribed verbatim and personal identifiers removed by an independent transcriptionist. A codebook was developed using the moderator’s guide, and codes created for each question. Eight research team members read two transcripts to test the codebook and make edits. After finalizing the codebook, teams of two coders independently coded five of the 10 transcripts using ATLAS.ti.7.0 software. New codes were created and added,

as needed. Upon coding completion, the team reviewed the codes to ensure agreement. The first author reviewed codes for emergent themes related to participants' knowledge and beliefs about ENDS and subsequently met with the research team to discuss themes across age groups and user status.

Results

Participant Characteristics

A total of 77 persons, 21 adolescents, and 56 young adults, participated in the study. Table 1 provides participant demographic characteristics. Just over half were female (56%) and non-Hispanic white (57%), while 26% were black. Forty-seven were users of novel tobacco products and 30 were susceptible nonusers. Of the 47 users, 33 reported past 30-day or past year use of ENDS. Participant ages ranged from 13 to 25, with a mean age of 15.8 years for adolescents and 20.5 years for young adults.

Terminology and Product Perceptions

Several participants questioned if the term electronic cigarette included all ENDS even before the moderator's guide was altered. They used a variety of terms to describe the assortment of products including "electronic cigarette," "e-cigarette," "e-cig," "e-pen," "e-hookah," "electronic hookah," "hookah pen," "hookah vape," "pen," "portable hookah," "shisha pen," "tank," "vape pen," "vapor pen," and "vape." When asked to explain the major differences among the products, there was no clear agreement on what differentiated an electronic cigarette from the other devices, although most participants agreed that electronic cigarettes were different than hookah pens. One adolescent user said, "I think e-cigarettes and hookah pens; I think they're completely two different things." Participants described products based on product characteristics including: rechargeable/disposable; flavoring/no flavoring; and nicotine content. While there was some disagreement on the rechargeable versus disposable aspect, many participants used this characteristic when explaining differences. Some reported that the disposable variety was a hookah pen and the rechargeable was an electronic cigarette, while others thought the opposite. For example, one adolescent

user said, "The ones you have to charge and refill, to me, are definitely different [than e-cigarettes]." It also appeared that some participants used the term hookah pen to describe tank systems. Another adolescent user said, "For the hookah pen, you have to charge it. If you run out of e-juice, you have to buy that, that's like \$3. Then, after a month, it has a wick in it to get down to the liquid and you have to buy a new one [wick]. You unscrew the top and pour in liquid then you screw it back in and you're good."

Product characteristics such as flavorings and nicotine content were also used to classify products. Most believed that electronic cigarettes do not contain flavor, but do contain nicotine, while hookah pens are available with various flavors and no nicotine. One adolescent user explained that hookah pens are safer than e-cigarettes because "they have the option of not having nicotine in it," while another user said, "I don't think there's nicotine in the electronic hookah, so you can't get addicted to it."

Participant views of users were dependent on the subtype of products used. For example, e-cigarette users were described as addicted to nicotine and older in age, while hookah pen users were described as cool, fun, up-to-date with new technology, and connected with social media. One young adult user explained her perceptions of e-cigarette users, "Whenever I think of people who smoke e-cigarettes, they're usually older and trying to quit so it seems like something old people do." Others described why hookah pens are different than e-cigarettes. An adolescent user said, "It just sounds like it's better because if you have an electronic cigarette, it's still a cigarette in a way. Then you have a hookah pen. It's like hookah, it's kind of cool. It's better, I think."

Positive Attributes

Participants described several positive attributes of ENDS including that they were portable, discreet, novel and had a relatively low cost. One adolescent user explained of e-hookahs, "They're easy to access. You just carry it around in your back pocket," while another user explained, "I like it because it doesn't leave smoke behind so your parents wouldn't know if you're using..." Another adolescent user described how the products are used at school, "My friend, in class, he has one. He'll pull it out and smoke it, but he won't do it when the teacher's looking." Participants also liked the product novelty. One

Table 1. Demographic Information by Age Group and Novel Tobacco Product Use

	Total (N = 77)	Adolescent susceptible nonusers (N = 12)	Adolescent users (N = 9)	Young adult susceptible nonusers (N = 18)	Young adult users (N = 38)
Mean age	19.2	16.0	15.6	20.8	20.3
Gender					
Female	43 (56%)	7	7	13	17
Male	34 (44%)	5	2	5	21
Ethnicity					
Non-Hispanic	70 (91%)	11	9	17	33
Hispanic	7 (9%)	1	0	1	5
Race					
White	44 (57%)	7	7	11	19
Black	20 (26%)	0	0	6	14
Asian	3 (4%)	2	0	1	0
Other	10 (13%)	3	2	0	5
User status					
Past 30-day ENDS use	22 (28.6%)	—	5	—	17
Past year ENDS use	11 (14.3%)	—	0	—	11
Past 30-day ONTP use	14 (18.2%)	—	4	—	10
Past year ONTP use	0 (0%)	—	0	—	0

ENDS = electronic nicotine delivery systems; ONTP = other novel tobacco product.

young adult nonuser explained, "I also feel like we're in a tech generation, so like it's just like cool to keep up with the social norms," while another added, "It's like, not mainstream." A young adult user commented on the low cost of electronic cigarettes, explaining, "It's cheaper to replace the tank or whatever versus buying a pack of \$5 or \$6 cigarettes every day or so." Participants also reported that they liked to use them wherever they wanted. Even a young adult nonuser explained, "... you can smoke an e-cig wherever you want."

Adolescent and young adult participants particularly liked the variety of flavors that are available such as cherry, bubble gum, and coffee. Interestingly, when participants discussed flavors, they specifically mentioned hookah pens, not e-cigarettes. One adolescent user described a hookah pen, "If it's minty, it kind of feels like breathing in fresh air." A young adult user commented, "If you are walking around campus, everybody has one [e-hookah]. It's like a grape fruity aroma or sugary aroma following them." Another said, "Me and my friends will be listening to music in our common rooms and we'll just be passing it [hookah pen] around and enjoying the smell that the vapor leaves in the air because it smells all fruity and candy-ish and delicious."

Adolescents and young adults perceived electronic cigarettes to be an aid to smokers to either help them quit smoking or serve as a bridge until they could smoke. One adolescent user reported, "After I got my e-cig, I didn't smoke cigarettes for a month..." and a young adult nonuser said, "...e-cigs are a lot more popular now because they're seen as a way to help people quit smoking cigarettes." A few reported that e-cigarettes and hookah pens are used as a bridge to tide smokers over until they could smoke a combustible cigarette. One young adult user explained, "Just that element of just tiding you over until you can get an actual cigarette." An adolescent user explained, "A lot of people that smoke cigarettes, they smoke hookah pens in the bathroom at school. Then when they get home, they smoke cigarettes."

Both users and nonusers discussed nicotine in e-cigarettes. Users reported that they weren't surprised that nicotine was in the product because they perceive ENDS as tobacco products. In addition, some don't perceive nicotine to be harmful. One young adult user said, "Well, nicotine in and of itself is not bad for you, I don't think." However, nonusers didn't like the potential addictive nature of nicotine. A young adult nonuser said, "But water vapor and nicotine, like too much of anything is not good. So you will be addicted to the e-cig and you will be addicted to a cigarette, what's the difference? They both can be potentially harmful."

A few participants emphasized that the user could control how much nicotine, if any, is used in the product. On young adult user explained, "...but the thing I like about e-cigs, you can choose how much nicotine you get in it. There are 0 grams, 4 grams. I think there's 12, 18 and 24." An adolescent said, "You can get some without nicotine in it. That's an option. It's like you can make your own."

Several adolescents and young adults reported that they use ENDS for social reasons, including having fun with friends and doing smoke tricks. A young adult said, "I honestly got this [electronic cigarette] because I thought it's just sort of a fun thing to do." An adolescent explained, "If you're bored at a sleepover, someone will bring one [e-hookah], and you just have fun." Another adolescent explained why ENDS facilitate smoke tricks, "...if you're smoking weed or something, it would hurt to do a French inhale or something, but with vapor it doesn't hurt to do that." Adolescents also reported posting pictures of themselves on social media using the products. An adolescent user explained, "Some of my friends in

class will use a hookah pen, record it, and put it on their [Snapchat] story so everybody can see it."

Negative Attributes

Participants also described several negative attributes of ENDS. First, young adult ENDS users compared electronic cigarettes to combustible cigarettes, reporting differences in feel and appearance. Several commented on why they prefer combustible cigarettes. One said, "I want mine to feel like I'm smoking a cigarette," while another commented, "You're just pressing a button and it's less exciting." Another said, "I don't smoke that often, so I'd rather just smoke the real thing. I think e-cigarettes, at least to me; they always feel like a toy." They described how e-cigarettes were used differently than combustible cigarettes. A young adult explained, "I pull harder on an e-cigarette than I have to on a real cigarette...just trying to get the same effect." Another described a sibling's use of e-cigarettes, "...she told me she would have to smoke it like 2-3 times to get the same effect as from a cigarette."

A few users and nonusers noted that although the long-term financial costs for electronic cigarettes were less than combustible cigarettes, there are higher upfront costs for more advanced systems. One young adult nonuser said, "I don't know the pricing. But, at least early on, I think that it's pretty steep for some smokers." An adolescent user commented, "They can be pretty expensive..... You can also get one for like \$8. But then they're like crap."

Young adult users and nonusers acknowledged that electronic cigarettes do not have an inherent cue to stop use, like combustible cigarettes. One user explained, "Your effect is kind of standardized with cigarettes because when the cigarette is gone, that's when you stop. With e-cigarettes you just keep going until you want." Another said, "...like people who only smoke an e-cig, I see them pull it out, take a hit, take another hit. They don't know how much they're smoking when they're actually smoking an e-cigarette because.... it's not going down. It's not burning out. So they have no idea actually how many cigarettes they're smoking in this e-cigarette." Participants described how this overuse can lead to negative health effects, like nausea and headaches. One young adult described how his friend got sick, "... he was studying for an exam and you're in the library for 9, 10, 11, 12 hours and you're just not really thinking about it, and you're on a grind, you're moving. He just sat there and smoked the entire thing and like towards the end he was greening out and like really got sick."

Risk Perceptions

Many participants perceived ENDS as less harmful than combustible cigarettes. A young adult user said of an e-cigarette, "It's a healthier option than cigarettes," while an adolescent user reasoned, "I mean they might not be good for you, but cigarettes are pretty awful. So they got to be better for you than natural cigarettes." An adolescent user said, "... people think there's nothing wrong with them," and a young adult user explained "The ability to smoke it inside makes it appear like 'Oh, it must be healthier.'" Another young adult user said, "I think it's healthier though, in my opinion, because if people are trying to quit, they'll go to the drug store and buy Nicorette gum. I think e-cigs are kind of like that, there's not as much additives, there's no real tobacco, the plant is not in what you're smoking. It makes a water vapor and whatnot..."

Participants also reported that ENDS do not produce second-hand smoke. The predominant perception was that ENDS produce water vapor. A young adult user said, "There's literally no harm to

anyone by just exhaling water vapor,” while another added, “When I think of e-cigs, I think of it more as a benefit to the people around you instead of a personal benefit since it does still have the nicotine in it. I can sit here and smoke it in this room and not be worried about giving you all secondhand smoke.” Nonusers had similar perceptions. An adolescent nonuser added “How bad can water vapor be for you?” and a young adult nonuser said, “My perception of it is I wouldn’t mind being around it.”

Adolescents were concerned about the uncertainty of product ingredients and how it could affect their health. One nonuser said, “... we know where tobacco comes from and we know it’s bad but this is a little plastic thing and we have no idea what’s in it.” Another adolescent nonuser agreed, “They’re [e-cigarettes] more dangerous than cigarettes because I don’t know what’s in them. I have no idea. It could be anything, so to me, the not knowing is more dangerous than knowing.” Another commented, “You may not be getting, say, more smoke, but you are getting more nicotine, or whatever the hell is in them.”

Marketing and Advertising

Participants reported getting product information from ENDS marketing and advertising, especially in malls and from TV commercials. One adolescent said “...their advertising, they make such a point of saying there’s no by-products; like that’s one of their main points.” A young adult explained, “I’ve also seen it marketed recently as the answer to the smoking bans everywhere because it’s supposed to only be water vapor and nicotine. There’s literally no harm to anyone by just exhaling water vapor.” Another said, “From the commercials and what you hear about people trying them, I guess they seem to be pretty harmless to other people.” An adolescent commented, “The commercials always say it’s better for you and I know that it very well might not be, but it’s kind of like you get told it’s better for you, it’s better for you, it’s better for you than cigarettes, so I feel like everyone internalizes that...” Several commented on product availability and advertising in mall kiosks that echoed similar messages. One young adult said, “...just the fact that they are allowed in public and they have that cart in the mall, that they’re always just like, ‘Come, there’s nothing bad about it.’” An adolescent reported similar experiences, “At malls they have little kiosk saying, like they’re smoking, and [saying] ‘This isn’t hurting anybody.’”

Lack of Regulation

Some participants commented on the lack of ENDS regulation, with varying perceptions. For example, one adolescent stated “I wouldn’t want to be inhaling something that isn’t being regulated by anyone.” An adolescent nonuser explained how regulation may influence decisions to use, “Well I mean if it didn’t have anything bad in it then it would be okay but if it got regulated and you saw that it has whatever, arsenic or something in like that, then I think obviously I wouldn’t do that.” Another adolescent nonuser said, “I think with the regulation would come the truth about it [electronic cigarettes].” One young adult user explained how ENDS nonregulation contributes to perceptions that they are safe to use, “...with all the regulations that they have on tobacco smoke, people just sort of trust that if there’s no laws that say you can’t smoke it [e-cigs] inside it’s probably because it’s not bad for you to smoke it inside.”

Discussion

This study expands the literature on adolescent and young adults by examining their perceptions of ENDS. Several of our findings

highlight the need for additional research and could be informative for ENDS messaging, as well as regulatory efforts at the federal, state and local level.

Our finding that participants particularly like the variety of ENDS flavors is consistent with existing research^{11,10,16} and the well-documented finding that flavors appeal to youth and encourage experimentation with tobacco.¹⁷⁻¹⁹ Interestingly, in our study, participants discussed flavors only in regards to e-hookahs and hookah pens, not e-cigarettes. It is possible that e-hookahs and hookah pens are being marketed to younger audiences as an alternative to e-cigarettes, which, in our study, were perceived as products for older smokers. These findings could also be an artifact of how questions were asked during the focus groups. Therefore, future studies should explore whether participants perceive flavor differences by ENDS sub-type and if the products are marketed to different audiences.

Nicotine content was also a salient issue for participants. Participants reported that nicotine-free varieties were available and safer than the nicotine-containing e-cigarettes because of the reduced addiction potential. In addition, participants reported some ENDS types allow users the option of controlling how much nicotine is used. In our study, users reported that nicotine addiction was not a concern for them because they were already using nicotine-containing products. However, nonusers reported that they were concerned about nicotine in the products because they didn’t want to become addicted to anything. These findings could inform the FDA’s proposed deeming regulation, which includes a warning label on ENDS products containing nicotine that states, “WARNING: This product contains nicotine derived from tobacco. Nicotine is an addictive chemical.” Future efforts are needed to determine if public health messages focusing on nicotine in ENDS and the potential risk of addiction are in fact, effective in preventing use among nonusers, as this appears to be an important characteristic for adolescent and young adult nonusers. However, because these warnings will not be required for non-nicotine containing ENDS, more research is needed to determine if warning labels are needed for non-nicotine containing ENDS, and if so, effective messages to prevent use of these products, especially among adolescents and nonusers.

Perceptions about ENDS users also appeared to be tied to product characteristics and what they called the products, underscoring the need for a taxonomy of ENDS sub-types. McDonald and Ling¹⁰ reported a similar finding in their study of young adult electronic cigarette users. These findings, along with media articles documenting the differences among adolescents’ and young adults’ terminology for ENDS,^{20,21} suggests more work is needed to better understand the multiple terms being used and which product characteristics and/or devices these terms refer to. Future studies should consider measuring multiple ENDS types and perceptions and providing detailed descriptors to ensure product use and perceptions are being assessed across the wide-range of ENDS products.

Positive attributes of ENDS were reported by users and nonusers. Adolescent and young adult users reported that ENDS are healthier than combustible cigarettes and adolescent and young adult users and nonusers reported that ENDS have no secondhand effects for nonusers. However, nonusers brought up health effects including the potential for nicotine addiction (adolescent and young adult nonusers), and the unknown health effects (adolescent nonusers). While ENDS are considered less harmful than combustible cigarettes, balanced regulatory efforts are needed that motivate cigarette smokers to switch to ENDS, but prevent new users from initiating, as there is evidence to indicate that ENDS are not without risks, especially

for adolescents, young adults or nonsmokers.^{8,22,23} The long-term health effects of using these products is unknown^{24,25} and nicotine may impact brain development of adolescents, which continues into the 20s.^{26,27} In addition, new research suggests that ENDS are engaging non-tobacco users^{28,29} and may encourage combustible cigarette use.^{30–34}

There were varying perceptions about the current lack of ENDS regulation. Some participants reported that lack of regulation equates to product safety because the products must not be harmful if they are unregulated. Many commented on observing ENDS use and advertising in public places, where other tobacco product advertising has been prohibited for decades.³⁵ Coupled with industry claims of being “healthier” and “a safe alternative to cigarettes,” it is plausible that at least some adolescents and young adults are interpreting the lack of regulation to mean that ENDS are “harmless” products. Other participants commented that the current lack of regulation made the products seem riskier and would deter use. While it is unclear if product regulation would equate to product safety for these individuals, it does point to the need for future research on perceptions of regulation (and lack thereof).

Several participants also commented that unknown health effects, the lack of a natural end point, and the potential for nicotine addiction were negative attributes that would discourage them from trying the products. More research is needed to determine if highlighting these negative attributes would be effective in countering the favorable aspects of ENDS to reduce interest in product trial and use, as well as alert consumers to the high potential for unintentional overuse. In addition, more evidence is needed to determine if seeing advertising and ENDS use in places where tobacco use is banned contributes to the renormalization of smoking, the normalization of ENDS use,³⁶ and perceptions of harm.^{12,37} These findings could inform future regulations on ENDS advertising in media outlets that have high adolescent audiences, such as TV and radio.

Some participants commented favorably on the relatively low cost of ENDS, suggesting that price could be a factor in why young users experiment with ENDS. Raising prices on combustible cigarettes and alcohol has consistently shown to be inversely related to use,^{35,38,39} particularly among younger populations.^{40,41} Therefore, policy makers could consider price measures, such as excise taxes, to increase ENDS prices and thus deter experimentation. However, some have argued that ENDS prices need to be lower than combustible cigarettes so that ENDS remain an attractive substitute for smokers.⁴⁰ Therefore, a coordinated tobacco tax strategy that includes ENDS and sales taxes based on product risk should be considered.^{26,42}

Limitations

As with all research, our study has some limitations. First, our convenience sample, which was highly educated, may not be representative of all adolescent and young adult populations. However, we did have an ethnically and racially diverse sample of both genders. Secondly, the study has limited geographic generalizability since focus group participants were recruited from three cities in North Carolina. In addition, the ENDS landscape changes rapidly, making it difficult to measure the most recent products. In this study, we were unable to connect the various terms participants used with the exact product they were describing. Future research should consider trying to connect products with participant terms by using pictures or actual products. Finally, the focus groups of users were not restricted to ENDS users which could affect the comprehensive of our findings. While over two-thirds of the sample (70.2%) used

ENDS in the past 30 days or past year, the remaining participants did not report ENDS use, and instead, reported past 30-day use of at least one of the other novel tobacco products (ie, hookah, cigarillos, or smokeless tobacco). Increasing the number of ENDS users and excluding other tobacco product users may have resulted in additional findings

Conclusions

We found that young adults and adolescents differentiated electronic cigarettes from other subtypes of ENDS, for which they had multiple names and varying perceptions of product users. These findings point to the need for measurement of ENDS sub-types; highlight the need for additional research on ENDS sub-types to more fully understand product perceptions; and should be considered in future prevention and regulatory efforts. In addition, while many positive attributes of ENDS were reported, key negative attributes that may discourage use, such as the potential for unintentional overuse and addiction, were also described. Participants also had opposing interpretations on the lack of product regulation, underscoring the need for more research and targeted messaging about product risks.

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Declaration of Interests

None declared.

References

1. Farsalinos KE, Spyrou A, Tsimopoulou K, Stefopoulos C, Romagna G, Voudris V. Nicotine absorption from electronic cigarette use: comparison between first and new-generation devices. *Sci Rep*. 2014;4:1–7. doi:10.1038/srep04133.
2. Zhu S-H, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: implications for product regulation. *Tob Control*. 2014;23(suppl 3):iii3–iii9. doi:10.1136/tobaccocontrol-2014-051670.
3. Centers for Disease Control and Prevention. National Adult Tobacco Survey Questionnaire, 2012–2013. 2014. www.cdc.gov/tobacco/data_statistics/surveys/nats/pdfs/2012-2013-questionnaire.pdf. Accessed June 23, 2015.
4. US Department of Commerce, Census Bureau. National Cancer Institute-sponsored Tobacco Use Supplement to the Current Population Survey (2010–11). 2012. <http://appliedresearch.cancer.gov/tus-cps/>. Data files and technical documentation: <http://thedataweb.rm.census.gov/ftp/cpsftp.html#cpsusps>. Accessed June 23, 2015.
5. Johnston LD, O’Malley PM, Miech RA, et al. *Monitoring the Future National Survey Results on Drug Use: 1975–2014: Overview, Key Findings on Adolescent Drug Use*. Ann Arbor, MI: Institute for Social Research, The University of Michigan; 2015.
6. McMillen RC, Gottlieb MA, Shaefer RMW, Winickoff JP, Klein JD. Trends in electronic cigarette use among U.S. adults: use is increasing in both smokers and nonsmokers. *Nicotine Tob Res*. 2015;17(10):1195–1202. doi:10.1093/ntr/ntu213.
7. Arrazola RA, Singh T, Corey CG, et al. Tobacco use among middle and high school students - United States, 2011–2014. *Morb Mortal Wkly*

- Rep. 2015;64(14):381–385. www.cdc.gov/mmwr/preview/mmwrhtml/mm641493.htm. Accessed December 21, 2015.
8. Brandon TH, Goniewicz ML, Hanna NH, et al. Electronic nicotine delivery systems: a policy statement from the American Association for Cancer Research and the American Society of Clinical Oncology. *J Clin Oncol*. 2015;33(8):952–963. doi:10.1200/JCO.2014.59.4465.
 9. Grana RA, Ling PM, Benowitz N, Glantz S. Electronic cigarettes. *Circulation*. 2014;129(19):e490–e492. doi:10.1161/CIRCULATIONAHA.114.008545.
 10. McDonald EA, Ling PM. One of several “toys” for smoking: young adult experiences with electronic cigarettes in New York City. *Tob Control*. 2015;24(6):588–593. doi:10.1136/tobaccocontrol-2014-051743.
 11. Kong G, Morean ME, Cavallo DA, Camenga DR, Krishnan-Sarin S. Reasons for electronic cigarette experimentation and discontinuation among adolescents and young adults. *Nicotine Tob Res*. 2015;17(7):847–854. doi:10.1093/ntr/ntu257.
 12. Choi K, Fabian L, Mottey N, Corbett A, Forster J. Young adults’ favorable perceptions of snus, dissolvable tobacco products, and electronic cigarettes: findings from a focus group study. *Am J Public Health*. 2012;102(11):2088–2093. doi:10.2105/AJPH.2011.300525.
 13. Peters RJ, Meshack A, Lin M-T, Hill M, Abughosh S. The social norms and beliefs of teenage male electronic cigarette use. *J Ethn Subst Abuse*. 2013;12(4):300–307. doi:10.1080/15332640.2013.819310.
 14. Trumbo CW, Harper R. Perceived characteristics of e-cigarettes as an innovation by young adults. *Health Behav Policy Rev*. 2015;2(2):154–162. doi:10.14485/HBPR.2.2.7.
 15. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychol*. 1996;15(5):355–361. doi:10.1037/0278-6133.15.5.355.
 16. Choi K, Forster JL. Beliefs and experimentation with electronic cigarettes: a prospective analysis among young adults. *Am J Prev Med*. 2014;46(2):175–178. doi:10.1016/j.amepre.2013.10.007.
 17. Klein SM, Giovino GA, Barker DC, Tworek C, Cummings KM, O’Connor RJ. Use of flavored cigarettes among older adolescent and adult smokers: United States, 2004–2005. *Nicotine Tob Res*. 2008;10(7):1209–1214. doi:10.1080/14622200802163159.
 18. Ashare RL, Hawk LW, Cummings KM, O’Connor RJ, Fix BV, Schmidt WC. Smoking expectancies for flavored and non-flavored cigarettes among college students. *Addict Behav*. 2007;32(6):1252–1261. doi:10.1016/j.addbeh.2006.08.011.
 19. King BA, Tynan MA, Dube SR, Arrazola R. Flavored-little-cigar and flavored-cigarette use among U.S. middle and high school students. *J Adolesc Health*. 2014;54(1):40–46. doi:10.1016/j.jadohealth.2013.07.033.
 20. MacMillan T. Fear the “e-hookah.” New Haven Independent. 2014. www.newhavenindependent.org/index.php/archives/entry/e-hookahs/. Accessed June 23, 2015.
 21. Richtel M. E-Cigarettes, by other names, lure young and worry experts. The New York Times. March 4, 2014. www.nytimes.com/2014/03/05/business/e-cigarettes-under-aliases-elude-the-authorities.html. Accessed June 23, 2015.
 22. Callahan-Lyon P. Electronic cigarettes: human health effects. *Tob Control*. 2014;23(suppl 2):ii36–ii40. doi:10.1136/tobaccocontrol-2013-051470.
 23. Durmowicz EL. The impact of electronic cigarettes on the paediatric population. *Tob Control*. 2014;23(suppl 2):ii41–ii46. doi:10.1136/tobaccocontrol-2013-051468.
 24. Dwyer JB, McQuown SC, Leslie FM. The dynamic effects of nicotine on the developing brain. *Pharmacol Ther*. 2009;122(2):125–139. doi:10.1016/j.pharmthera.2009.02.003.
 25. Chapman S. E-cigarettes: the best and the worst case scenarios for public health—an essay by Simon Chapman. *BMJ*. 2014;349:g5512. doi:10.1136/bmj.g5512.
 26. England LJ, Bunnell RE, Pechacek TF, Tong VT, McAfee TA. Nicotine and the developing human: a neglected element in the electronic cigarette debate. *Am J Prev Med*. 2015;49(2):286–293. doi:10.1016/j.amepre.2015.01.015.
 27. Yuan M, Cross SJ, Loughlin SE, Leslie FM. Nicotine and the adolescent brain. *J Physiol*. 2015;593(16):3397–3412. doi:10.1113/JP270492.
 28. Wills TA, Knight R, Williams RJ, Pagano I, Sargent JD. Risk factors for exclusive e-cigarette use and dual e-cigarette use and tobacco use in adolescents. *Pediatrics*. 2015;135(1):e43–e51. doi:10.1542/peds.2014-0760.
 29. Barnett TE, Soule EK, Forrester JR, Porter L, Tomar SL. Adolescent electronic cigarette use: associations with conventional cigarette and hookah smoking. *Am J Prev Med*. 2015;49(2):199–206. doi:10.1016/j.amepre.2015.02.013.
 30. Goniewicz ML, Gawron M, Nadolska J, Balwicki L, Sobczak A. Rise in electronic cigarette use among adolescents in Poland. *J Adolesc Health*. 2014;55(5):713–715. doi:10.1016/j.jadohealth.2014.07.015.
 31. Dutra LM, Glantz SA. Electronic cigarettes and conventional cigarette use among U.S. adolescents: a cross-sectional study. *JAMA Pediatr*. 2014;168(7):610–617. doi:10.1001/jamapediatrics.2013.5488.
 32. Lee S, Grana RA, Glantz SA. Electronic cigarette use among Korean adolescents: a cross-sectional study of market penetration, dual use, and relationship to quit attempts and former smoking. *J Adolesc Health*. 2014;54(6):684–690. doi:10.1016/j.jadohealth.2013.11.003.
 33. Leventhal A, Strong D, Kirkpatrick M, et al. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA*. 2015;314(7):700–707. doi:10.1001/jama.2015.8950.
 34. Primack B, Soneji S, Stoolmiller M, Fine M, Sargent J. Progression to traditional cigarette smoking after electronic cigarette use among US adolescents and young adults. *JAMA Pediatr*. 2015;169(11):1018–1023. doi:10.1001/jamapediatrics.2015.1742.
 35. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention (US); 2012. www.ncbi.nlm.nih.gov/books/NBK99237/. Accessed May 28, 2015.
 36. Centers for Disease Control and Prevention. Letter of Evidence Regarding E-Cigarettes. 2015. www.tobaccopreventionandcontrol.ncdhhs.gov/Documents/CDC-LetterofEvidenceonElectronicNicotineDeliverySystemsNorthCarolina-April2015.pdf. Accessed August 4, 2015.
 37. Ling PM, Glantz SA. Why and how the tobacco industry sells cigarettes to young adults: evidence from industry documents. *Am J Public Health*. 2002;92(6):908–916. www.ncbi.nlm.nih.gov/pmc/articles/PMC1447481/. Accessed December 21, 2015.
 38. van Hasselt M, Kruger J, Han B, et al. The relation between tobacco taxes and youth and young adult smoking: what happened following the 2009 U.S. federal tax increase on cigarettes? *Addict Behav*. 2015;45:104–109. doi:10.1016/j.addbeh.2015.01.023.
 39. Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*. 2009;104(2):179–190. doi:10.1111/j.1360-0443.2008.02438.x.
 40. Chaloupka FJ, Wechsler H. Binge drinking in college: the impact of price, availability, and alcohol control policies. *Contemp Econ Policy*. 1996;14(4):112–124. doi:10.1111/j.1465-7287.1996.tb00638.x.
 41. Slater SJ, Chaloupka FJ, Wakefield M, Johnston LD, O’Malley PM. The impact of retail cigarette marketing practices on youth smoking uptake. *Arch Pediatr Adolesc Med*. 2007;161(5):440–445. doi:10.1001/archpedi.161.5.440.
 42. Grace RC, Kivell BM, Laugesen M. Estimating cross-price elasticity of e-cigarettes using a simulated demand procedure. *Nicotine Tob Res*. 2015;17(5):592–598. doi:10.1093/ntr/ntu268.