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E-Cigarettes Use Behavior and Experience of Adults: Qualitative Research Findings to Inform E-Cigarette Use Measure Development

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Abstract

Objectives: To gain a better understanding of electronic cigarette (e-cigarette) use behavior and experience among adult e-cigarette users, with the goal of informing development of future e-cigarette use measures.

Methods: Between August and October 2014 six focus groups were conducted in Seattle. Participants (63% male; 60% >35 years old; 60% White): e-cigarette users who used combustible tobacco products either currently or in the past. E-cigarette discussion topics covered: their daily use pattern (eg, frequency), product-related characteristics (eg, nicotine levels), and perceptions about health risks and benefits.

Results: Participants' descriptions of daily use were so varied that no common "unit" of a "session" easily summarized frequency or quantity of typical e-cigarette use. Most users had difficulty in tracking their own use. Participants reported nicotine craving relief when using e-cigarettes, but described e-cigarettes use as less satisfying than combustible cigarettes. Valued characteristics included "ready availability" and the possibility of using indoors. A unique aspect of the e-cigarette use experience is the option of adding flavors and having the ability to exhale "big clouds" of vapor/aerosol. Most perceived e-cigarettes as a better and safer alternative to conventional cigarettes, yet still sought further information about health consequences and safety of e-cigarettes from trusted sources.

Conclusions: E-cigarettes users are far from homogeneous in their behavior and motivation for adopting e-cigarettes. A range of use patterns arising from both hedonic and utilitarian factors, along with product characteristics (eg, variable nicotine levels and flavors) extending beyond those of conventional cigarettes, suggest that new, specific e-cigarette use measures must be developed.

Implications: The current study provides timely information on adult e-cigarette use behavior, which is a crucial step in measuring this new phenomenon and assessing the risks associated with using e-cigarette products. Our findings reveal that vaping is not a mere replacement for combustible cigarette smoking and that many users of e-cigarettes enjoy product characteristics such as flavors and "clouds" that are unavailable in combustible cigarettes. Therefore, commonly available cigarette smoking measures are not well suited to measurement of e-cigarette use behavior, and indication that new measures need to be developed to accurately track e-cigarette use.

Introduction

Although combustible cigarette smoking in the United States has declined over time, vaping, via electronic cigarette (e-cigarette) use, has expanded rapidly over the past several years. The public's fast-paced adoption of these new products is occurring without users or scientists having adequate knowledge or full understanding of the characteristics, long-term health impacts, and implications of e-cigarette use, which are critical to inform future tobacco control regulations.[1–6] Such regulations need to be carefully targeted for different subpopulations at risk. Among US high school students the estimated prevalence of e-cigarette use in last 30 days was 13.4% in 2014, surpassing all other types of tobacco or nicotine products.[7] Increases in the use of e-cigarettes by high school (and middle school) students seem to have offset decreases in the use of traditional tobacco or nicotine products.[7] In the US adult population, 12.6% of adults in 2014 had ever tried an e-cigarette even one time and about 3.7% of adults currently used e-cigarettes.[8] Recent studies suggest that there are several motivations for e-cigarette use in adults.[6,9–12] These include a perception that vaping is healthier, an expectation that it will lead to less tobacco smoking, or a desire to reduce costs associated with traditional tobacco products.[6,9] In one study, about half of regular smokers expressed an interest in trying e-cigarettes.[9] Thus, dual users (that is, those who smoke conventional cigarettes but also use e-cigarettes) may be an especially important category of e-cigarette users to study because of the similarity of the two activities.[12] Although recent studies have explored the motivations for and attitudes toward e-cigarette use, the development of validated quantitative use measures has lagged adoption rates.[13] Lacking a shared set of e-cigarette measures, researchers are hindered in their efforts to discern long-term health implications of e-cigarettes, which are currently not fully understood.

The present work, which gathers information to help understand e-cigarette user behaviors and experiences, has been undertaken with the goal of developing e-cigarette use measures analogous to those of combustible cigarette use. Researchers seeking to identify and define certain characteristics of a user's vaping topography, nicotine dependence, cravings, and urges currently face challenges in applying standard combustible cigarette use questionnaires to e-cigarette users. Combustible cigarette use is measured in terms of the number of cigarettes consumed per time period, a relatively simple measure because combustible cigarettes are finite in nature, typically consumed, depleted, extinguished, and discarded over a 6–12 min interval of time. For these reasons cigarette smokers can easily track how many cigarettes they smoke per day and can characterize themselves in terms of the number of cigarettes consumed per given unit of time (eg, a "half-pack daily smoker").[14] Unfortunately, these measures do not easily map onto e-cigarette use. For example, in the Fagerström Test for Nicotine Dependence one of the questions is: "How many cigarettes/day do you smoke?" In the present form this question is not adequate as a measure of nicotine dependence for e-cigarette. Thus, the present work, which is a qualitative study of e-cigarette users' behaviors and experiences as well as their perceptions about new features and benefits, is an important initial step toward the development of validated e-cigarette use measures. To expand upon extant research on combustible cigarette users, we conducted focus groups composed of current e-cigarette users who were either past or current users of combustible cigarettes. Our goal was to discover how their use of, experience with, and perceptions of these products could inform our development of new e-cigarette use measures. In the present paper, however, we restrict our focus to our research findings, which we group into three categories related to e-cigarette use: use pattern (eg, frequency), product-related characteristics (eg, nicotine levels), and perceptions (eg, health benefits). Because e-cigarettes are more readily differentiated by technology and product features (relative to conventional cigarettes, which are essentially a commodity), understanding users' perceptions of the products and features is important if we wish to predict future usage, especially for those new-to-be users who have had no experience with conventional smoking. Thus, although our main focus is on use measures, we include our findings on product-related characteristics and perceptions as these factors have implications for the design of e-cigarette use measures.

Methods

We relied mainly on focus groups to amass the appropriate data. We also conducted in-depth interviews, both antecedent and subsequent to the focus groups. The two initial semistructured interviews with current users of both e-cigarettes and tobacco products yielded insights into the behaviors and motivations of e-cigarette users that informed our focus group discussion guide. This discussion guide was modified and further expanded as a result of a single pilot focus group conducted prior to the six main study focus groups. Two post-focus group in-depth interviews were conducted both to confirm information gathered and to explore in more detail several themes that emerged during the focus groups. Although the post-focus group interviews corroborated what we learned from the focus groups, no further insights emerged from them so we do not refer to them again.

For the main study adult e-cigarette users were recruited in the Seattle area through local newspapers (print and online), Craigslist, flyers at vape and tobacco shops, and by word-of-mouth. To be eligible, participants had to be 18–65 years old and to have used e-cigarettes for at least 2 months. As originally formulated, our plan had been to recruit participants from three categories of users: (1) those who were current users of both e-cigarettes and combustible cigarettes; (2) those who were former combustible cigarette users; and (3) those who had never smoked combustible cigarettes. We simply were unable to locate anyone in the relevant age bracket who was in the last category (that is, without any pre-experience of smoking). For that reason, we relied on respondents representing the first two categories. Participants were paid $65 for their time and participation.

Data Collection

Focus group discussions were held August–October 2014. Because we expected participants' experiences to differ by current cigarette smoking status we assigned participants to specific focus groups on the basis of their e-cigarette and cigarette smoking status: "sole users" (composed of those who used only e-cigarettes), "dual users" (composed of those who smoked as well as used e-cigarettes), and "mixed users" (composed of both "sole' and "dual" users). Our rationale for mixed groups is that they would provide an opportunity for sole users and dual users to discuss and compare their behavior and experience. A total of six focus groups were conducted (two sole, two dual, and two mixed). In addition to the input from the pilot studies, the development of our focus group discussion guide was based on a literature review of published and unpublished data on new tobacco products and user behaviors. The guide was also informed by our discussions with experts in the tobacco scientific

community. Topics in the guide included: e-cigarette use patterns, similarities/differences of user behaviors and experiences, feelings and sensations for combustible and e-cigarettes, flavors, "e-juice" nicotine levels, product characteristics, and perceptions related to e-cigarette use, including health implications. Focus group discussions were led by the first author. Each was about 90 min in duration. Besides being audio recorded, the focus groups also had two note takers/observers present. Before a discussion, participants completed a short questionnaire eliciting demographic information and tobacco use history. After a discussion, a debriefing session with the moderator and note takers took place to discuss what was observed and possible modifications for subsequent sessions. Our results rely on the main six focus group discussions having a total of 35 adults (63% males; 60% >35 years old; 60% White; 83% <college degree; four to eight per group). Table 1 summarizes characteristics of the focus group participants. Supplementary Table 1 provides quotations relevant to the themes.

Data Analysis

Our goal was to identify major themes arising from participants' comments. This entailed a two-stage process, which was iterative and involved deductive and inductive approaches. First, each of the focus group audio-recordings were transcribed verbatim. The authors, who are trained in qualitative methods, reviewed all transcripts, which were analyzed for recurring themes using NVivo 9 software.[15] Major themes regarding e-cigarette use and experiences (eg, frequency and flavors) were derived from our initial basic framework involving tobacco use and related characteristics. However, additional themes (eg, clouds) emerged from participants' discussions. The appropriateness of those themes were determined by the first author and a data analyst, who reviewed and discussed the results to further refine themes. Any disagreement on themes was resolved through discussion. The resulting themes constituted the codebook.

The data analyst next coded all the transcripts, categorizing relevant statements in the transcripts under the codebook themes using NVivo. The data analyst also looked for deviant cases. Finally, all four authors reviewed the coded themes and verified the results of the analysis.

Results

E-Cigarette Use Compared to Combustible Cigarettes

Use Pattern

Of primary interest was the pattern of e-cigarette use, including daily/weekly frequency, quantity and intensity of a session in terms of nicotine consumed, and extent to which use was consciously monitored by participants. With combustible cigarettes, respondents typically can accurately describe their level of use, but use characterization proved challenging to e-cigarette users. Indeed, it was revealing that our participants often spontaneously described their e-cigarette use behavior in terms of combustible cigarette use behavior by linking them together. For example, consider one response to the query of how e-cigarettes were used during a typical day: "I wake up and roll over and I start my day—I've never smoked inside but with the e-cigarette, you know, it's not that big of a deal." The use of e-cigarettes extended to situations outside the home that might inhibit combustible cigarette use, such as while driving. In some cases, e-cigarettes replaced combustible cigarette where smoking was prohibited (eg, at work). Because e-cigarettes are not uniformly accepted at work places, this might entail "sneak vaping" in the bathroom or another location. For some participants, a large part of their vaping occurred on weekends in their homes. Prompted by the moderator to describe their usual vaping "sessions" in more detail, participants often struggled to define or characterize their behavior. According to one participant: "A typical session for me, I mean, it all depends on where I'm at while I'm doing it. . . . it's anywhere from 10–15 puffs for

Table 1. Characteristics of Focus Group Participants ($n = 35$)

Characteristic	*N* (%)
Gender	
Male	22 (63%)
Female	13 (37%)
Age group, years	
18–21	1 (3%)
22–34	13 (37%)
35–44	7 (20%)
45–54	6 (17%)
55–65	8 (23%)
Race/ethnicity	
White	21 (60%)
Black	10 (29%)
American Indian	1 (3%)
Two or more races	3 (9%)
Education	
Less than high school, no diploma	1 (3%)
High school graduate, diploma or GED	8 (23%)
Some college credit, no degree	10 (29%)
Trade/technical/vocational training or associate degree	10 (29%)
Bachelor's degree or higher	6 (17%)
Employment status	
Working full-time paid employment (≥35 h/week)	7 (20%)
Working part-time paid employment (<35 h/week)	8 (23%)
Self-employed (≥35 h/week)	1 (3%)
Self-employed (<35 h/week)	4 (11%)
Casual employment	6 (17%)
Not currently in paid employment	9 (26%)
Marital status	
Married	2 (6%)
Living with a partner	5 (14%)
Divorced	7 (20%)
Widowed	1 (3%)
Separated	2 (6%)
Single, that is, never married and not now living with a partner	18 (51%)
Current combustible cigarette smoking status	
Every day	11 (31%)
Some days	13 (37%)
Not at all	11 (31%)
Number of combustible cigarettes per day if smoked	9.8 (6.6)[a]
E-cigarette user category	
Sole user	13 (37%)
Dual user	22 (63%)
E-cigarette device type	
Personal vaporizers/tank/mods style	25 (71%)
Cigalike/cartridge type	10 (29%)
Plan to quit e-cigarette use some day?	
Yes	23 (66%)
No	11 (31%)
Maybe	1 (<1%)

[a]Mean (SD).

each session." The same participant also noted: "In the morning I'll probably take from the time that I wake up to the time that I get on the bus—I'll probably take in that couple of hours probably like 40 puffs, but not steadily." Some indicated taking as few as one to four puffs during a session, while others reported as many as 10–20 puffs. The number of sessions varied as well. Others described a session in terms of the number of minutes (usually lasting 4–10).

Although participants struggled to estimate the quantity of puffs per session or amount of vaping time, comparisons to smoking seemed to come naturally. Some compared their vaping activity to their smoking activity, and several mentioned that they were not forced to smoke an entire cigarette at a session: A few puffs at a time were enough to relieve cravings. In contrast, some characterized their e-cigarette sessions as similar to their combustible cigarette sessions. With regard to monitoring, most indicated difficulty in keeping track of their puffing behavior. Some claimed not to know how to monitor their puffing behavior; others noted it was not a priority to do so. Still, participants were aware that their e-cigarette puffing behavior differed from that of combustible cigarette puffing. For example, with combustible cigarettes, "You have to keep puffing on it; otherwise it goes out or it will burn up…. With the vape you don't have to." Participants also highlighted the convenience of e-cigarettes because they were able to vape as desired throughout the day instead of needing to finish an entire cigarette during a conventional smoking break.

Dependence

Many participants mentioned that e-cigarettes taste good and have an appealing mouth taste, and some participants noted that combustible cigarettes taste bad after using e-cigarettes. Participants currently smoking conventional cigarettes described e-cigarettes as less satisfying than combustible cigarettes, and not addressing nicotine cravings as well as combustible cigarettes do. This has to be balanced with the understanding that the majority of participants viewed vaping as a way to control or reduce smoking. E-cigarettes were cited as a convenient way to satisfy nicotine cravings for smokers, especially for those unable to smoke. Participants reported using e-cigarettes in the morning, when nicotine cravings were strongest, and throughout the day whenever they started to feel physical withdrawal symptoms. Some participants reported they successfully quit smoking as a result of using e-cigarettes; others indicated they hoped to quit smoking. The theme of reduction was apparent even for those who were not seeking to cease smoking: "I'm teeter-tottering. Mostly, I'm using it as a crutch. Mostly at the point that it was to get off, and then I said that okay, I'm not going to really give up cigarettes yet. Somehow I'm going to supplement it and try to cut so much of the cigarettes in half." Interestingly, some participants who were daily smokers expressed the notion that if they ever quit smoking combustible cigarettes they would no longer have an interest in e-cigarettes. The ultimate goal for some participants was not replacement of combustible cigarettes with e-cigarettes, but rather complete retreat from any form of nicotine delivery: "I'm in a struggle, you know? I hope that in the future I smoke less conventional, and then eventually I'll quit this [e-cigarette]."

At the same time, e-cigarettes were useful in dealing with the "social addiction" aspects of combustible cigarettes, such as when spending times with others who are smokers (eg, during a smoke break), even if the participant had quit conventional smoking. Related to this is the desire to smoke while drinking coffee or alcohol, or to have the feeling of something akin to a cigarette in the hand: "The initial way that I started with the e-cigarette was that I noticed when I was smoking and trying to quit, I couldn't because there was a large social and physical addiction, both for the chemical addiction portion of it, and the physical characteristics of the hand-to-mouth, the talking and socializing with other people."

E-Cigarette Product Characteristics

Compared to combustible cigarettes, e-cigarettes have unique characteristics that appeal to many users. For example, nicotine levels and flavor profiles are user-selectable. However, not all users make use of these features or even are aware of them. Knowledge tended to correlate with device preference. Mod-type users were more likely than cigalike type users to explore product characteristics described below. Of the 35 focus group participants, 10 reported using cigalike type and 25 mod-type e-cigarettes.

Nicotine Levels

Whereas just 20% of cigalike users could describe what their nicotine levels were, 80% of mod users were aware of their nicotine levels. For example, according to one cigalike user: "I have absolutely no clue. I just go into 7-Eleven and buy the cartridges." A key finding of the present research is that there are clear differences in knowledge and variety-seeking among user segments. Of those who knew their nicotine level, the most common level reported was 6–8 mg/mL. Heavy cigarette smokers indicated around 18–24 mg/mL. How a dosage was settled on is interesting: Many participants initially consulted with vape shop owners/managers for dosage recommendations. For example, according to one participant, at one shop "you can try it out while you're in the store. Just figure, see how your head feels after you take a puff off of it. I got the 24 mg because I wanted the conventional cigarette. I said to get me as close to a Camel straight as possible, and that's what he did." Some sought Internet information; after trial, they adjusted the dosage. Younger participants appeared more knowledgeable about nicotine levels (eg, what's available and "appropriate") and tended to more actively explore different levels to meet their needs. Some older participants stated that they lacked the knowledge to make informed decisions. While the majority of mod-type users were aware of their nicotine levels, only a couple of cigalike users could describe their nicotine levels, and several stated that they were unaware of their nicotine levels. Some participants who quit smoking claimed to use "zero" levels of nicotine, but were satisfied. Most participants hoped to lower their dosage of nicotine in the future.

Flavors

For most participants, flavor was an exciting e-cigarette feature—one not really available in cigarette smoking. According to one participant: "I love finding new flavors. I think it's a lot of fun." While some switched between multiple flavors, others preferred to stick to a favorite. In general, younger participants (aged 18–34) were more likely to be flavor seeking. Older adults (aged 45–65) appreciated the flavor options, but seemed less likely to explore different flavor varieties, and more likely to stay with traditional tobacco flavors. The topic of tobacco flavor arose most often with dual users. Menthol, mild, and even "no flavor" e-cigarettes were mentioned. E-cigarette-only users most often preferred using fruit or sweet dessert-type flavors, which reduced the harshness of nicotine. The contrast also reminded them of how much they disliked the taste of nicotine in combustible cigarettes. Favorite flavors included fruits

(berries, cherry, apple, watermelon), menthol (mint), and sweet dessert-type flavors (vanilla, honey, butter pecan). Interestingly, one participant reported using a zero-level of nicotine because of the enjoyment of trying new flavors, and several mentioned they knew of others who vaped with no nicotine.

Exhale/Clouds

Another feature of e-cigarettes that many participants enthusiastically described was an "exhale" (that is, the production of large clouds of vapor), especially with flavors. Younger participants in particular enjoyed making "big" clouds, which was described as fun and satisfying: "…'powerful' would be a word I'd use. It makes me feel really cool being a tiny woman walking down the street blowing a giant cloud like a train. A part of that is very satisfying to me, and it's part of why I use the device I use. I don't know, maybe I just like to be the center of attention." A few participants mentioned that nonsmokers and bystanders often seemed to enjoy being surrounded by these flavored clouds, even though they themselves were not engaged in the action. For some participants, being able to produce a large cloud is very important. A few participants described the popularity of "cloud chasing" events. Mod-type e-cigarette users tended to seek and explore more product characteristics, compared to cigalike type e-cigarettes users. Those who enjoyed flavors and the exhale/clouds tended to prefer mod-type e-cigarettes, as they found that mod-type e-cigarettes provide more features such as bigger clouds and more flavor selections.

E-Cigarette Perceptions

When discussing the experience of using e-cigarette compared to smoking cigarettes (current or past smoking), most participants brought up their perceptions about health risks, perceived benefits, acceptability, social norms, and intentions. We also asked about factors influencing their use of e-cigarettes, such as health claims or safety issues, or any other factors. We asked whether they would recommend other nonsmokers to try e-cigarettes, and the reasons for their recommendations. A related question was, "What if scientific evidence collectively concludes that e-cigarettes are determined to be unsafe to human health; would this information change your use of e-cigarettes?" The following subthemes emerged from their responses.

Healthier/Cleaner/Safer/Better

While the majority of participants perceived e-cigarettes as healthier, safer, and cleaner alternatives to combustible cigarettes, several participants were unsure about the safety of e-cigarettes and felt that there was not enough information or studies out yet on e-cigarettes. Although most wanted to learn more about e-cigarettes through scientific research, many claimed to feel better, breathe better, have more energy, and cough less after switching to e-cigarettes: "…I know that it's not substantiated by any data that I have seen, but it feels safer and it tastes safer." Several participants mentioned they began using e-cigarettes based on recommendations by either family or friends who wished to help them quit smoking. Many attributed the positive health effects of e-cigarettes to the heating, rather than the burning, of ingredients, so that what was inhaled (and exhaled) was water vapor instead of smoke. Some of the participants perceived e-cigarettes to be using a "natural" form of nicotine, without added toxins.

Greater Social Acceptability

Several participants indicated that e-cigarettes allow them to avoid having to deal with the negative social connotations and consequences of conventional cigarettes, such as secondhand smoke, low self-control, guilt, and cancer. Participants liked being able to vape indoors and felt others did not mind it as much since e-cigarettes do not smell like conventional cigarettes: "Well, the thing that I like about vaping is that you can do it anywhere. You don't have that stigma…." Some participants also spoke about e-cigarettes not being allowed in certain settings, or not wanting to use e-cigarettes in certain settings (eg, around children or family). Indeed, several began using e-cigarettes because of spousal disapproval of smoking.

Reaction to Future Scientific Evidence on Health Effects

Participants responding to the question, "What if scientific evidence collectively concludes that e-cigarettes are determined to be unsafe to human health," were split on whether this would impact their decision to continue using e-cigarettes. Some stated it would influence them to reduce, but not to completely quit, their e-cigarette use. Others claimed they would quit e-cigarettes completely, as the main reason they had started using e-cigarettes was for better health. For those who would still use e-cigarettes, reasons cited included e-cigarettes still being cheaper and cleaner than combustible cigarettes, as well as better because they do not burn. The answer to the question of "Who conducted the study" was also important to some participants in their decision to continue to use e-cigarettes. Some participants stated that they would not trust any studies funded by tobacco companies: "As long as it's not funded by the tobacco companies, then maybe I might believe it. I might think about believing it, but there is no way that your burning—just the paper you're burning in the cigarette, and now that they have fire-safe cigarettes, even more chemicals are in your paper of the cigarette…."

Discussion

A key finding is that participants' descriptions of their daily use patterns were so varied that no common "unit" of a "session" could easily summarize frequency or quantity of typical e-cigarette use pattern, especially when the mix of use behaviors includes different battery power levels and different nicotine levels. Indeed, the challenge will be to develop a common "unit" of a "session" that can easily summarize frequency or intensity of typical e-cigarette use. A related issue is user awareness, as usage reports necessitate conscious activity on the part of reporters. In order to capture these irregular types of use, data collection methods adopting real-world settings have been reported and discussed, such as mobile e-cigarettes or Ecological Momentary Assessment.[16,17] Initial Ecological Momentary Assessment data have revealed an under-reporting of the number of e-cigarette puffs relative to data from Bluetooth-enabled e-cigarettes.[16] One thing that is apparent from the focus groups is that much of the behavior of today's vapers is not consciously tracked. Thus, our findings confirm the challenge e-cigarettes pose to tobacco researchers and public health communities in the construction of scientific objective measures for understandings user behaviors.[18]

Our findings suggest that e-cigarettes users are far from homogeneous in their e-cigarette use behaviors and motivations for adopting e-cigarettes. In contrast to cigarette smokers, e-cigarette users appear to have different levels of involvement with their devices. "Involvement" here refers to the degree of engagement and attention directed to using e-cigarettes. For example, those with higher involvement tend to know the nicotine levels they use, and to seek out additional information about possible nicotine and device options. The options include greater concentrations, as well as higher voltages for heating e-liquid. Unlike conventional cigarettes, which are essentially

commodities, e-cigarettes offer more opportunities for manufacturers to differentiate themselves from one another. The implication is that at least for the current generation of e-cigarette users, producers may have more power to create brand switching opportunities as well as greater product involvement on the part of users by adding or modifying product features (eg, Bluetooth-technology apps that track usage or enjoyment) relative to conventional tobacco products. Because brand switching is not common with conventional cigarettes, existing tobacco measures ignore the issue. It is our conjecture, however, that product variations (and perceptions thereof) may drive e-cigarette usage now and in the future, thus e-cigarette measures should be prepared to incorporate such factors. Although the purpose of the current paper is not the development of specific measures, we discuss below some of factors that are likely to be relevant, such as e-cigarette users' perceptions about health risks, perceived benefits, acceptability, social norms, and intentions.

Users tend to be more aware of flavors besides the tobacco versions, and to actively experiment with various flavors. Whether this level of involvement reflects a novel interest of an existing tobacco product user, or merely represents the enthusiasm of a convert to new technology is an open empirical question. But this understanding would certainly inform the development of any new measures directed to nicotine delivery devices including e-cigarettes. We note that although this distinction would not be necessary in the construction of a use measure for combustible cigarettes, it is important for e-cigarette researchers to be aware of such diversity in e-cigarette users when developing use measures.

Similarly, new measures should be sensitive to the apparent bifurcation of e-cigarette users by primary usage motivation. For example, it is clear that some users appreciate e-cigarettes for the "utilitarian" benefits they confer on users, such as the ability to reduce nicotine cravings without committing to smoking an entire cigarette, or to engage in usage without fear of censure or penalty. However, other users appear to respond more to the "hedonistic" aspects of e-cigarettes, such as the different flavors, and the ability to generate huge attention-getting clouds of vapor. Such factors do not enter into measures of combustible measures, but it would be myopic not to consider them in the development of measures of e-cigarette use. Further, the perception that, healthwise, e-cigarettes are largely harmless to users or bystanders needs to be incorporated into future e-cigarette measures. An erroneous belief that vapers are inhaling/exhaling "water vapors" which are completely inert rather than an aerosol of particles and a vapor of gas containing a complex mixture of chemicals,[19,20] presents numerous public health implications, not the least being that of properly communicating e-cigarette constituents to users and nonusers.

There are certain limitations to the present work. First and foremost, our relatively small sample is unlikely to be representative of the entire population of e-cigarette users. Our goal, however, was to gain a basic understanding of e-cigarette users' behavior and experience so as to identify characteristics pertaining to this new nicotine delivery technology as well as the limitations of existing measures as they might be adapted for e-cigarette purposes. The insights provided from these focus groups should inform the development of these use measures, especially with regard to the factors that differ from those of conventional cigarettes, in particular, the product characteristics of e-cigarettes and the perceptions about these products. Second, although many other interesting issues emerged from the focus group sessions, time limits precluded further exploration beyond the scope of our original questions. However, to illustrate with one example, several participants mentioned the "community" aspect of the e-cigarette business or "vape shops." Given the exploratory nature of the devices and associated products, might this aspect play a more prominent role in the initiation, development, and maintenance of an e-cigarette habit? In other words, might the time-honored ritual of sneaking a few drags with one's young peers evolve into a coming-of-age vaping event with one's friends at a state-sanctioned retail outlet (or at a "vaping lounge")? As well, the cost of vaping (at least with respect to retail price) was another important area that we were unable to explore fully. Many cited e-cigarette option to be cheaper than smoking. Indeed, one participant claimed to patronize local stores in order to support them even if their prices were higher than online prices. Admittedly, this "small business" perspective of vaping in contrast to the "big business" of tobacco as a behavioral predictor is intriguing.

In conclusion, e-cigarettes using new nicotine delivery technologies highlight the challenges to the measurement of use patterns and the general inadequacy of existing combustible cigarette usage measures. As part of a larger plan to develop these updated and enhanced measures of e-cigarette use, we explored a range of topics related to e-cigarette users' experiences and behaviors in order to better understand how current adult users use new electronic nicotine delivery systems, and their experiences and perceptions. In particular, information gathered in this study on use patterns, product characteristics, and perceptions provided a series of qualitative factors to be considered for the development of comprehensive survey questionnaires. Although current US national surveys, such as PATH, include questions assessing general prevalence-related topics at the population level, they are limited by the nature of the questions they ask about specific use behaviors and perceptions. Incorporating information from the current study into the development of survey questionnaires would be required to accurately reflect heterogeneous user behaviors in the general population as well as various subpopulations. The resultant survey measures will allow researchers in public health and tobacco regulatory science communities to be able to quantitatively estimate the level of e-cigarette use and to further examine the relationships with e-liquid consumption and nicotine and toxin exposure. This effort is a fundamental step toward the development of a regulatory framework involving e-cigarettes and future nicotine delivery devices.

Supplementary Material

Supplementary Table 1 can be found online at http://www.ntr.oxfordjournals.org

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Declaration of Interests

None declared.

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