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Assessment of Electronic Cigarette User Terminology and Knowledge using Mixed Methods

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ABSTRACT

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Electronic cigarettes (ECIGs) have evolved rapidly over the past several years, and it is unclear if terminology used when assessing ECIG knowledge and use behavior has objective and well-understood definitions between consumers, as well as between consumers and the research community. The purpose of this study was to use semi-structured interviews to obtain a better understanding of ECIGs from the perspective of regular ECIG users. One-hour interviews consisted of both open- and closed-ended questions. Questions probed the terminology used by participants to describe both individual and combination device features, as well as ECIG use behaviors. Qualitative data was used to better inform the quantitative data collected using a concurrent triangulation design. Study results overall showed many similarities in terminology used by different device users; however, some differences were observed in terminology used to describe device types and characteristics among mod and pod users with users describing devices similar to their own in more detail (i.e., more mod users using ‘mod’ and ‘tank’ for the mod-style device and more pod users using ‘pod’ for the pod-style devices). Users were able to provide basic information about their own devices (i.e., brand name, refillable/disposable); however, questions about more details of their devices/liquids were difficult to answer, especially for pod users (i.e., nicotine type, power levels). This study provides evidence of a disconnect in terminology use among device users and a lack of knowledge of some device/liquid characteristics. This is important information as it may help improve ECIG education and regulation efforts and the topic should be further explored.

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Introduction

Electronic cigarettes are devices that use a liquid often containing nicotine that is vaporized and inhaled and is considered by many to be similar to the experience of smoking tobacco. Electronic cigarettes (ECIGs) remain a major concern in the United States (U.S.) today, especially with regard to the high rates of use in young adults and youth. From 2017-2018, there was an increase of 46.2% in the use of ECIGs in young adults aged 18-24 (Dai & Leventhal, 2019) and a larger increase of 77.8% in high school students (Gentzke et al., 2019). As of 2019, ECIGs (3.2%) were the third most popular tobacco product among U.S. adults, behind regular cigarettes (13.7%) and cigars (3.9%) (Creamer et al., 2019); ECIGs have been the most popular tobacco product among youth since 2014 and was measured at 19.6% among high school students in 2019 (CDC, 2020). Still, there is much for researchers to learn about these complex devices and what effects they have on those who use them so that the knowledge gained can inform regulations to protect younger users of these devices.

As the popularity of these products has increased, a need for their regulation also increases. In 2009, the Family Smoking Prevention and Tobacco Control Act gave the U.S. Food and Drug Administration (FDA) control of the regulation of cigarettes, smokeless tobacco, and roll-your-own tobacco products (Tobacco Control Act; FDA, 2020). However, it was not until 2016 when the FDA extended the authority of their regulation also to include cigars, hookah, pipe tobacco, and ECIGs. Since the implementation of this authority, the FDA has introduced other regulations for ECIGs including products requiring warning labels, the banning of sales to minors, and the banning of liquids in flavors other than tobacco and menthol for certain device types (Tobacco Control Act; FDA, 2020). As part of these new regulations put in place in 2016,

all manufacturers must have their products reviewed and authorized before they enter the market. This authorization process has helped to regulate some of the newer devices (e.g. Puff Bar) that became popular after the ban of flavors in older device styles (e.g. JUUL) (Dai et al., 2020; Hemmerich et al., 2020). Much more recently, the other regulations were passed in many states, including West Virginia, to restrict the sale of tobacco products to those aged 21 and over(FDA, 2019) and the banning of liquids in flavors other than tobacco and menthol for certain device types (Tobacco Control Act; FDA, 2020). The hope is that these combined regulations, along with more that can be passed based on the knowledge gained by research, will help reduce the appeal and use of these products in young people as well as minimize the appeal of ECIGs to those who might otherwise remain nicotine naïve. The current study being presented will provide policy makers with better tools on how to address the population of users and how to design policy and prevention methods in a way that is better understood by users.

ECIG Design

ECIGs, also known as electronic nicotine delivery systems (ENDS), were created to produce an aerosol containing nicotine that can be inhaled. ECIGs can have a variety of shapes, sizes, and colors, but also have some common components. All devices generally have a battery, a heating element, a storage component for liquid, and the liquid solution itself (Breland et al., 2017; Williams & Talbot, 2019). The liquid solution will typically contain some combination of propylene glycol, vegetable glycerin, nicotine, and flavoring (Breland et al., 2017). Depending on the specific device, the battery provides power to the heating element in the device that heats the liquid into an aerosol, and the battery can become activated either by manually pushing a button or just by inhaling through the mouthpiece. ECIG devices have gone through a fast-

moving evolution since they were first patented in 2003 and introduced to the U.S. in mid-2000s (CDC, 2016). As of 2014, over 460 different brands of ECIGs and over 7,700 different liquid flavors were known to have existed (Zhu et al., 2014); therefore, researchers began to study them more extensively due to the growing amount and popularity of these devices in the tobacco market. Today, devices are available with battery power levels up to ~200 watts, and liquid with nicotine concentrations that can range from 0-70mg/mL, PG/VG ratios that can range from 0/100 to 100/0, and nicotine formulations that are protonated (i.e., salts) or unprotonated (Hsu et al., 2018). Consequently, consumers can choose from thousands of different device and liquid combinations.

As ECIG devices evolved, researchers began categorizing them according to their "generation" (see Table 1). The earliest ECIGs, "first generation" devices, were similar in size and shape to a combustible cigarette and thus referred to as "cig-alikes." They consisted of low powered batteries and pre-filled liquid storage containers, sometimes called "cartridges," and most were fully disposable. "Second generation" ECIGs then evolved into pen-shaped devices that had higher power levels to deliver more nicotine and storage containers called "tanks" that were refillable, and therefore have been referred to as "vape pens" or "tanks." "Third generation" ECIGs also had refillable storage containers but were characterized primarily by having features that could be modified by the user, most notably the power level, making them more personalized and, therefore, more appealing some users. Consequently, these device types were commonly known as "mods." "Fourth generation" ECIGs were designed with storage containers that were pre-filled like those of first-generation devices, but these containers were referred to as "pods" instead of "cartridges." Their battery power also was low, but the liquid contained nicotine salts that are more palatable than previously used free base nicotine, allowing for the

user to use liquids with much higher nicotine concentrations and still obtain a pleasant experience.

Today, however, there now exist many newer devices that do not clearly fit within any of these previous categories. One example would be Puff Bar (https://puffbar.com/), which has features that overlap with those of some "fourth generation" devices (i.e., resembles a USB key, uses a "pod" to hold the liquid, contains nicotine salts) but is fully disposable like early "first generation" devices. Another example could be devices that are advertised as "pod tank combinations," such as the "VOOPOO PNP pod tank" (https://vaperoyalty.com/product/tanks-coils/voopoo-pnp-pod-tank/), which allows for switching back and forth between liquid containers akin to those from "second generation" ("tanks") and "fourth generation" ("pods") style devices. There is also the Gemini Hybrid Pod Mod (https://lostvape.com/product-item/gemini-hybrid-80w-pod-mod/) that has a refillable tank like "third generation" devices and uses pods like "fourth generation" devices. Finally, some newer 'pod-style' devices permit users to refill the containers and/or adjust the power level, like the Smok Nord 4 (https://www.vaporfi.com/smok-nord-4-vape-pod-starter-kit/), which creates an overlap between defining characteristics of both "third generation" and "fourth generation" devices. The ever-growing volume of devices, with characteristics from overlapping generations, may be creating endless options for a user to choose from, but it can make understanding these devices infinitely more difficult. Also, the complexity of these device characteristics increases the complexity of the language used by consumers and researchers making it harder for researchers to understand the popularity and effectiveness of these newer devices. Categorization criteria and definitions of device characteristics that researchers developed originally to discuss and explain these devices are becoming irrelevant because they are not inclusive of some of these new device types.

Because of this, many researchers have strayed away from these traditional terms in several different directions, making it harder to compare research findings across multiple studies.

ECIG Terminology

When surveys or interviews are administered to assess ECIGs, it is unclear if the terms being used (e.g., “disposable,” “pod,” “nicotine salt”) are understood in the same way between consumers and researchers. To date, only a few studies have examined specific ECIG terminology, and the corresponding definitions associated with the terms used. An early study relied on focus groups to assess the language used by young adult ECIG users to refer to products generally (e.g. “vape pen,” “e-hookah,” “electronic nicotine delivery device,” and “e-cigarette”), terms to refer to ECIG use behaviors (e.g. “vaping,” “smoking”), terms to describe select individual features of ECIGs (e.g. “refillable,” “rechargeable”) or names of specific product brands (e.g. blu, NJOY) (Alexander et al., 2016). Most participants made similar distinctions to those of the researchers with regard to individual device features and brands, but not with terms to describe products generally or product use behaviors. That is, these latter terms were often identified by the users as being similar and interchangeable (i.e., an “e-cigarette” is not different from an “e-hookah”; “vaping” is not different from “smoking”) whereas the researchers see these terms as distinct from each other. Moreover, participants viewed the term “regular user” as use every day, use throughout the day, or both. Also, in this case and in other research, many participants did not define themselves as a “regular user” if they did not own their own device and only borrowed ECIGs from friends (Wong et al. 2019). This is just one example of how ECIG users may have different or multiple definitions for a term that researchers often try to use a singular, specific definition to explain.

Other researchers have directed questions about knowledge of brands and the distinguishing characteristics of "pod-style" devices to a sample of young adults, 26% of whom had ever used one or more "pod-style" devices (McKelvay & Halpern-Felsher, 2020). The majority of the sample (85.9%) were able to recognize a Juul device by picture identification, but other "pod-style" device types (e.g., Suorin Drop, Myblu, and Phix) were recognized by only 9.1-19.5% of participants. Participants also demonstrated confusion about how to describe the different brands of "pod-style" devices; participants most often identified Juul as a "type of vape" (30.9%), Suorin as a "type of nicotine delivery system" (35.2%), Myblu as a "type of e-cigarette" (38.5%), or Phix as a mixture of these descriptions (29.7%). Of those participants who were regular pod users, almost half (43.5%) were unsure of whether the brand of pod container that they used matched the brand of their device (i.e., Juul pods for Juul devices). Together, this work suggests that consumers may not be consistent with their language or accurate in their knowledge regarding ECIG products since these users could not identify devices similar to their own and they used different general ECIG terms to describe devices of different brands when in actuality they are very similar devices.

Some individuals in the research community have begun to develop an ECIG ontology, or an electronic collection of all the currently available research and corresponding literature that could be available online and represents a wide array of terms that are defined and the relationship of these terms to each other (Cox et al., 2020). The ontology created would be a current, active representation of the research on ECIGs and would provide standard definitions for all terminology and corresponding literature for those terms. One example of this is categorizing ECIG devices as open system, devices in which all of the main components are interchangeable, or closed system, devices in which none of the main components is

interchangeable (Cox et al., 2022). Creating a collection such as this would be able to provide some clarity and efficiency to the literature reviews done by researchers, as well as make it easier to produce more literature that is consistent and comparable with what has previously been done. This collection of objective terminology would make it much easier to make cross-study comparisons and be extremely beneficial long-term. Still, this ontology will include only terms that derive from the scientific literature (i.e., researchers); therefore, work would still be needed to determine if researcher terminology matches that of product consumers.

User Knowledge

Confusion between researchers and ECIGs users also could stem from users' information sources. Research was conducted using mixed methods of surveys and interviews to understand better where young users of ECIGs are obtaining most of their knowledge and opinions about their ECIGs, such as negative and positive consequences of use (Dobbs et al., 2020). A significant association was observed between the information sources reported (e.g., social sources, media, advertising, education/research) and the specific knowledge recalled. For instance, participants recalled learning of positive consequences of ECIG use from advertisements, education, and social sources but on the other hand, they recalled learning of negative consequences from education and the media. Also, this sample of college students identified social sources, such as other vapers, or the media as being the two most credible sources of information. While this study did not assess any information about specific device or liquid characteristics, it did still identify information sources that are trusted by young adults and may also be used as sources of information for these other device features of ECIGs. This knowledge regarding sources of information is important because it will make it easier for

everyone to understand if researchers, policy makers, and consumers all use the same terminology and definitions in these commonly used information sources as well as in the research.

A lack of user knowledge could be due to other factors besides terminology, such as the knowledge of the makeup of the product itself. ECIG liquid can be made up of many different combinations of PV and VG along with different concentrations of nicotine and different flavors. As for nicotine concentration specifically, this ingredient may be displayed using different units of measurement. For example, a liquid that is labeled as 12 mg/ml nicotine on one product could be labeled as 1.2% nicotine on another product. Not surprisingly, these varying units have been found to be confusing to consumers. On average, adult users can more accurately describe the strength (i.e., low, medium, and high as determined by researchers) of concentrations in mg/mL versus in percentage format; however, they could not identify strength correctly in either format nearly two-thirds of the time (Morean et al. 2021). It was also found that adults classified concentrations presented as percent as weaker than equivalent concentrations presented as mg/ml when shown in pairs. As an example, they perceived liquid labeled as 5% nicotine as weaker in strength than liquid labeled as 50 mg/mL despite the fact that these nicotine concentrations are the same. Similarly, other work shows that users do not consistently describe quantities of liquid used in a particular time period. For some users, it may be much easier for them to have knowledge of their approximate number of “puffs” or “times” they used throughout the day, but for others it may be easier to describe how much they used by reporting the number of full tanks, cartridges, or pods they went through in a day (Liu et al. 2021). Having multiple forms of measurement of this quantity can be complicated for a consumer as well as a researcher trying to understand the user's regular behaviors.

To avoid confusion of terminology in questions, an alternative method could be to use images. One previous study (Pearson et al., 2019) asked participants to view images of ECIGs and to respond to the question "What do you call the item in the picture below?" The majority of participants could identify the pictured devices as some type of ECIG, but the specific term used to describe the products (e.g., "e-cigarette," "vape") varied across users. Also, some of the devices, especially the earlier generation devices, were more likely to elicit a "don't know" response or to be misidentified as a non-ECIG product (e.g., a cigarette). This finding is important for researchers to understand because the accuracy of their data collection in surveys may be greatly improved by knowing more about the extent of user knowledge of the devices. It is also important to consider what terminology ECIG users are using when they speak with others in their peer groups or the ECIG user community. In a review of online public posts (e.g., blog posts/replies, group discussion posts/replies, wall posts) from 2008-2015 involving any mention of terms related to electronic nicotine devices (Pearson et al., 2017), the most used terms were "e-cigarette" and "vape." Other less common terms included those related to specific brand (e.g., blu) or individual device features (e.g., "e-liquid," and "vaporizer"). These findings add to the information researchers have about what ECIG users know about their devices by knowing more about the names they use for them and their characteristics; however, devices continue to evolve each day and associated terminology can also.

The combination of specific ECIG device characteristics is becoming more important as researchers understand better device mechanics and how they affect nicotine delivery and dependence potential. Previously, devices characteristics had less variability; however, now there are so many combinations of features (i.e., device type, power level, nicotine concentration, etc.) that a user can create to have a unique nicotine delivery and a researcher much understand how

all of these features work together within the device. Consequently, researchers need participants to provide consistent and accurate descriptions of the devices that they use. In one study, researchers asked adult ECIG users to record the nicotine concentrations, voltage, and resistance of their devices (Rudy et al., 2017). Most participants (89.7%) provided a nicotine concentration that was within the range of those available on the market (0.0-30.0 mg/mL); however, most reported "don't know" in reference to their voltage (51.5%) or resistance (63.6%). Also, among those who provided a power level for their device, the upper limit of the range they provided (32,670 W) was much higher than any device known to be available on the market (~200 W). Other researchers have used mixed methods to identify that users can have difficulty answer many questions about their devices, including but not limited to frequency, quantity, device features, nicotine levels, flavorings, and co-use (Wong et al., 2019). For example, participants identified many ways to describe the quantity of use: the number of cartridges or the number of tank refills (51%), the number of bottles of e-liquid (33%), the number of puffs (26%), and the number of milliliters of e-liquid (12%). Knowing that users may not have the knowledge to report accurately on these characteristics, researchers may choose not to ask participants these questions; however, it is important to ask these questions, so more work needs to be done to help both researchers and users better understand the pieces of these devices. Also, researchers may need to explore more forms of data collection besides self-report surveys, such as more face-to-face qualitative interviewing and focus groups.

Statement of the Problem

Extant research suggests inconsistencies and inaccuracies with regard to ECIG user terminology and knowledge. For instance, current research shows that terminology differs

between different users, and potentially between users and researchers based on the current literature (Alexander et al., 2016, McKelvay & Halpern-Felsher, 2020). Also, some users demonstrate that they are unable to provide details about their products (e.g., brand of their liquid container), and others report that they lack the knowledge to understand certain product characteristics (e.g., nicotine concentration, power, etc.) (Rudy et al., 2017, Wong et al., 2019). ECIG users' lack of knowledge and differences in terminology use might be explained, in part, by the existence of so many different products on the market today and the fact that new products are being introduced rapidly. Consequently, our understanding of ECIG product characteristics and use patterns as measured by self-reports may be limited.

Purpose

The purpose of this study is to better understand users' terminology and knowledge regarding device features generally and those related to their own devices and use behaviors. Also, it will be explored as to whether terminology and knowledge of ECIGs differs as a function of users' device type. This interview used a combination of closed and open-ended questions to better understand the knowledge that consumers have of the science and terminology of their devices as well as the actions involved in using an ECIG. The information collected could be critical in validating the accuracy of survey results about ECIG use and help researchers to better understand the users and their devices in future data collection. Having common terminology and definitions among researchers will also make it easier to do cross study comparisons in the future. Information from this study could also be helpful in adapting prevention material or policy development to reach the users in a more personal and straight-forward manner that they can better understand, as well as being able to better educate

consumers about the products they are using. In addition, this project has potential to later be restructured and directed towards researchers to obtain data for comparison to that collected from consumers.

Hypotheses

Study hypotheses were developed for differences between users' device knowledge as a function of their usual device type. Specifically, it was hypothesized that users of mod-style devices, relative to users of pod-style devices, would be more accurate (e.g., reporting individual characteristics of their device such as power level, nicotine concentration and/or formulation) and detailed (e.g. describing power, coils, atomizers) with the descriptions of their own devices.

Method

Sample

Participants were recruited through several online venues: Craigslist (https://craislist.org/), Facebook (https://www.facebook.com/), Amazon Mechanical Turk (MTurk; https://www.mturk.com/), and an ECIG forum (https://www.e-cigarette-forum.com/). Other avenues for recruitment included flyers posted around the community (e.g. vape shops) and university listservs (e.g., WVU E-NEWS). Participants were required to be English speakers, $\geq$ 18 years of age, report current use of an ECIG containing nicotine > 4 days per week for the past > 3 months, and currently reside in the United States. Participants were required to have access to zoom (https://zoom.us/) and a computer with a camera for the interview. These ECIG-specific criteria ensured enrollment of users who are most likely to be knowledgeable about their device, and/or devices in general, and thus be able to provide details about products and use behaviors. An approximate sample size of 30 participants was chosen based on the sample sizes

of other studies using qualitative interviews and how many participants it typically takes to reach saturation (Mason, 2010; Vasileiou et al., 2018). Quota sampling was conducted to include users of tank-style (pens or mods) or pod-style (reusable or disposable) as these device types are the most popular among ECIG users.

Informed Consent and Screening

All screening and interview procedures were approved by the university's Institutional Review Board. Individuals interested in the study were sent a link to a REDCap survey (Appendix A) which described the study purpose and asked several questions that assessed eligibility criteria. Those who met these criteria were directed to the electronic informed consent letter (Appendix B) provided via a secure REDCap link that explained more details about the study, including potential risks and benefits of participation, and also monetary compensation. Individuals who consented to participate were contacted by a study team member to schedule the interview and to obtain information about the interview procedures. For instance, they were given instructions for accessing and operating the primary video conferencing platform (i.e., Zoom), as well as a secondary platform (i.e., Google Meet) if needed due to technical difficulties. They also were reminded of the general interview requirements, which included being available for ~one hour, remaining visible on camera, not permitting others to appear on camera, and having their ECIG device(s) and liquid accessible.

General Interview Procedures

All interviews were performed by M.C., and followed the semi-structured interview guide shown in Appendix C. Once the interview began, participants were reminded of the interview guidelines and asked to retrieve their ECIG device(s) and liquid(s) if needed. During

the scheduled interview, the participants were asked a series of questions about their understanding of various ECIG device and liquid characteristics. They also were asked questions about their knowledge of their own ECIG device(s) and liquid(s), and their use behaviors. During this portion of the interview the participants were asked to show their own ECIG products on camera. Overall, the interview included a mix between open- and close-ended questions. The study team member conducting the interview recorded participants' answers to close-ended questions on a secure Redcap link, and the transcript of the interview was recorded and saved via Zoom. The interview concluded with compensation via a $50 amazon gift card that was delivered electronically to their email address.

Interview Questions

During the semi-structured interview, which has not been validated, questions assessed terminology and understanding surrounding the characteristics and use of ECIGs. Participants first were presented a series of images and asked to state all terms they would use to describe the images via open-ended questions. These images include a variety of ECIG types (e.g., tank-, mod-, pod-style) displayed first as a group and then individually. Next, participants were asked to choose from a list of terms, displayed as a group, that were applicable to a corresponding picture via closed-ended questions. Once the participant chose which term(s) they believed were applicable to the device picture, they also were asked to elaborate on why they chose those terms. The same series of pictures was used for both steps. Next, they were shown images of different liquid storage containers (i.e., pods, tanks, cartridges) and asked questions regarding their definitions and differences between each other. The participants were then asked about their personal devices and current ECIG use behaviors (e.g., frequency, duration). During this section,

participants were asked to display their personal device(s) on camera. If multiple devices were used by one participant, they were asked to choose their two most preferred devices. There were questions asking them to state the typical terms they use for their personal device and the act of using their devices. All questions collectively assessed the user's knowledge and understanding of their ECIGs and ECIGs in general.

Data Analysis

A mixed-methods analysis was conducted using qualitative data to better understand quantitative data that was collected simultaneously in the semi-structured interviews. For quantitative data (i.e., baseline characteristics, frequency data) descriptive statistics, as well as chi square and t-tests, were performed. These close ended questions were coded simply with yes=0, no=1 and I don't know= 2, or they were coded by assigning a number to each multiple-choice item. Descriptive statistics were compared to identify how the type of device a person uses may dictate their answers to the other questions regarding specific terminology used generally towards devices and their own user behavior. Some t-tests were performed on continuous variables, such as nicotine concentration and power levels, to compare averages between different device users as well as plausibility of accurate responding by comparing to products currently on the market. Also, a comparison was made between some reported answers and verified factual information regarding specific characteristic definitions to assess the user's knowledge of their own device. Due to the volume of statistical comparisons made, the false discovery rate (FDR) correction was used to control for Type I error. This FDR correction helps to control for the expected proportion of false positives of rejected hypotheses by ranking the p-values from smallest to largest and comparing each one to a modified critical value developed by Benjamini and Hochberg (1995). The FDR correction was chosen because the more common

Bonferroni correction can be overly conservative increasing the likelihood of Type II error and weakening the power of the study.

The analysis of open-ended data collected from the semi-structured interviews was conducted by using a generalized set of steps taken with analyzing qualitative data (Elliot & Timulak, 2021). This involved a descriptive-interpretive approach in which participant responses were systematically analyzed and organized based on similarities into manageable categories that can create a coherent and descriptive model that can also be summarized quantitatively. Analysis was ongoing during data collection. Transcripts were first compared to the audio recording for accuracy. Prior to analyzing, team members were informed of procedures for the coding process and trained by primary researcher M.C. on how to review and categorize the information in the transcripts. The qualitative data from all transcripts was analyzed by two different team members who independently reviewed transcripts and recorded recurring terms, definitions, or categories of answers to each open-ended question in Microsoft Excel. Notes from both team members were compared, and disagreements were reconciled until common categories were agreed upon for each question by three researchers. This process occurred following every 2-3 interviews in order to be descriptive and inclusive of answers provided for each question. As interviews continued, new themes or categories were created as needed to encompass enough information, as answers to many questions were nonexclusive and a predetermined code was not established because of the nature of the data being collected. Also, regular reviews of all data were conducted with a larger group several times throughout the data collection and analyzing process. This was used to develop a codebook establishing categories of answers for each question. The data was then reviewed for the commonality of the answers for each question to try to determine the level of knowledge and misconceptions ECIG users may be having about

their devices when being asked specific questions about them. For some variables, commonality was assessed using descriptive statistics after the data were coded into a quantitative format and compared to other quantitative data collected. In addition, the raw qualitative data provides more detailed descriptions as well as reasoning for answer choices that were used to better explain the quantitative data that is collected simultaneously. Quotes taken directly from the interview transcripts were used as examples of language directly from the user and provide insight that is not explained by choices to other closed-ended questions. By doing this, the quantitative and qualitative data collected within the same interview provide a better understanding of one another, following the design of concurrent triangulation mixed methods research (Creswell & Plano Clark, 2006). The data from this interview was also compared to questions and terminology commonly used in research questionnaires.

Results

Participant Demographics

A total of 363 participants completed the screening questionnaire, and 216 were eligible to participate. Of those who were eligible and contacted, n=30 provided informed consent and completed the interview; n=19 were users of pod-style devices (reusable like JUUL or disposable like Hyde) and n=11 were users of tank-style devices (e.g., mods like Geekvape). Users of pod-style devices were recruited and completed quickly relative to users of mod-style devices. Thematic saturation was considered reached for these former users following n=19 completers, and thus their enrollment was halted thereafter to focus on the recruitment of additional mod-style device users. Demographic characteristics for the final sample of n=30 are shown in Table 2. Participants were young adults (mean age = 27.33) and identified primarily as male (56.7%),

white (83.3%), and heterosexual/straight (66.7%). They had been using an ECIG, on average, for 3.38 (SD = 2.02) years and most used only one type of device (90.0%). Nearly all participants had tried cigarettes (96.7%) but only two were currently smoking cigarettes (6.7%). Pod- and mod-style users differed significantly on a few of these characteristics. Pod-style (versus mod-style) users were younger in age (mean = 21.42 versus 37.55 years, respectively) and more identified as smoking <100 cigarettes in their lifetime (81.3% versus 9.1%, respectively) (p's <.05).

General Device Terms

Participants were first shown images of six different devices side by side at the same time (see Figure 1). For this picture, participants were asked about terms they would use to describe the devices generally (i.e., as a product class). As shown in Tables 3 and 4, the terminology participants used was similar between pod-style and mod-style users; "vapes" was the most commonly used term (94.7% and 90.9% respectively) while "Electronic Nicotine Delivery Devices" (10.5% and 9.1%, respectively) and "ENDS" were the least used terms (5.3% and 9.1%, respectively). When asked why they chose these specific terms, some users felt it best described the class rather than any individual device types (50%), that it was easier to use (13.3%), or that it was what they heard others using (13.3%). Table 5 shows specific comments made by participants to these open-ended questions. Participants also were asked where they first heard of these terms and common answers included friends/family use (23.3%), advertisements (20.0%) and others talking about it at school (16.7%).

Device Type and Individual Characteristics Terms

Device Type Terms. Respondents were shown pictures of the same devices as described above (see Figure 1), except that each device type was presented individually. The order in which each device was presented is numbered in the figure starting with image #1 of the pen-style ECIG, and these same numbers are used to represent these images in Tables 3 and 4. For each of these individual pictures, participants were asked to choose terms that best described them as a device type (select all that apply). Collapsed across user groups, the most commonly used term to describe device types was 'pen' for a vape pen devices (100.0%), 'pod' for both pod-style devices (56.7% for JUUL-style and 53.3% for NJOY-style), 'box mod' for mod devices (83.3%), 'pen' for cig-alike devices (73.3%), and 'disposable' for disposable devices (90.0%) (see Table 3). Also highly preferred were the terms 'tank' (76.7%) and 'mod' (66.7%) to refer to mod devices, as well as 'cig-alike' (70.0%) and 'disposable' (70.0%) to refer to cig-alike devices. In contrast, the terms 'pod mod' (<17%) and those referencing the product generation (<14%) were chosen by few participants. When considered by user group, some terms used to describe devices were similar. Table 4 shows that most pod and mod users referred to vape pen devices as 'pens' (100% for both), mod devices as 'tanks' (68.4% and 90%, respectively) and 'box mods' (84.2% and 81.8%, respectively), disposable devices as 'disposables' (94.7% and 81.8%, respectively), and cig-alike devices as 'cig-alikes' (73.3% and 63.6%, respectively), 'vape pens' (68.5% and 81.8%, respectively), or 'disposables' (73.7% and 63.6%, respectively). Regarding differences between user groups, significantly more mod (versus pod) users chose the term 'mod' (45.5% versus 0.0%; χ^2 (1) = 10.36, p=.001) to refer to the vape pen device.

Individual Characteristic Terms. For the same pictures of different devices (Figure 1), users also were asked to choose from other terms that described individual characteristics (select

all that apply). Collapsed across user groups (see Table 3), the term ‘cartridge’ was chosen most often for vape pen devices (56.7%) followed by the two pod-style devices (30.0-33.3%). The term ‘rechargeable’ was chosen most often for all devices (56.7-76.7%) except for the cig-alike (23.3%) and disposable (13.3%) devices. Participants chose the terms ‘refillable’ and ‘variable voltage’ most often for the mod device (70-86.7%) and less for all other device types (0-33.3%). There also were differences in the individual characteristic terms chosen between pod and mod users (see Table 4). Significantly more pod users (versus mod users) chose this same term for the NJOY pod style device (84.2% versus 18.2%; χ^2 (1) = 12.66, p<.001). Moreover, the term was ‘cartridge’ was chosen by more mod than pod users to describe the disposable device (45.5% versus 0.0%, χ^2 (1) = 10.36, p=.001).

Open-Ended Statements. Participants also were asked to provide explanations for the terms they chose to describe the different devices depicted in the images (see Table 5). Across all devices, participants explained their choices based on the general function of the device and how its different parts work together (20.0-43.3%). For some device pictures, the shape of the device was a defining feature: vape pen (23.3%), cig-alike (26.7%), and disposable (36.7%). Some participants immediately recognized the brand: JUUL pod-style (66.7%), NJOY pod-style (23.3%), or disposable (36.7%) (PuffBar brand). The vape pen was commonly described as a device used to consume substances other than nicotine (e.g., THC) (36.7%). While no common themes emerged for the mod-style device, users tended to make general comments about the device function, features, or overall appearance. It is notable that 21.1% of pod users were not able to describe the mod-style device or specific terminology they use for the device because they were unfamiliar with it.

Liquid Storage Container Terms

Participants were shown pictures of the liquid storage containers shown in Figure 2. The four liquid storage container images were shown at the same time side by side and never individually, but the images are numbered in Figure 2 as these are the numbers used to represent each in Tables 3 and 4. For this picture, participants were asked to select which one(s) they would identify with specific terms (pod, tank, cartridge). As shown in Table 3, nearly all participants matched the term ‘pod’ with the picture of the pod-style container (93.3%) and the term ‘tank’ with the picture of the mod-style container (93.3%). In contrast, for the term ‘cartridge’, choices were split between the vape pen (53.3%), cig-alike (40.0%), and pod (26.7%) storage container pictures. There were no significant differences between groups regarding the choices of images to represent the different liquid storage containers.

Participants also explained why they chose each picture to match with a given term (see Table 5). Pod-style containers were considered ‘pods’ primarily because of their specific shape/size and because they are prepackaged and replaceable. For the term ‘tank’, participants commented on their ability to be refilled and customized, as well as to hold more liquid than other containers because of their larger size. The term ‘cartridge’ was associated with being used for other substances (e.g., THC) and being disposable. Participants then explained how these different containers were similar versus different. They were considered similar in that they all hold the liquid and are the part of the device that is refilled/replaced. Common differences described included whether they are refillable versus disposable, and therefore how long they will last, as well as the contents of the liquid used (e.g., nicotine versus THC; salt versus freebase nicotine).

Personal Device Questions

Table 6 shows participant responses to questions that asked about their own personal device (only their primary device used), while Table 7 provides corresponding examples of participants' statements. The majority of participants reported they neither mix their own flavors (93.3%) nor switch between flavors in a single day (73.3%). Still, many buy a variety of flavors to use over time, including those within the categories of fruit (e.g., strawberries, banana, sour green apple), dessert/candy flavors (e.g., gummy worms), ice (e.g., blue raspberry ice, banana ice), mint/menthol, and/or tobacco. Notable is that 21% of pod users specifically stated that they used menthol only because other flavors they previously used were recently removed from the market and could no longer be purchased. Almost all mod users reported that their device was refillable (100%), not disposable (100%), and had adjustable power (90.9%). In contrast, most pod users reported that their device was disposable (57.9%), prefilled (94.7%) and did not have adjustable power (89.5%). The reporting of devices being refillable and having adjustable power was significantly different between device users (χ^2 (1) = 26.05, p <.001 and χ^2 (2) = 25.92, p<.001, respectively). Mod users rarely used a liquid containing nicotine salt (9.1%), while some pod users did use nicotine salts (31.6%) or did not know the nicotine formulation of their liquid (52.6%) (χ^2 (2) = 16.15, p<.001). Participants generally found questions about nicotine concentration to be easy (80%) because of their personal experience and knowledge gained from using the products. Only 30% of all participants were able to provide the PG/VG ratio for their liquid but those who did provided ratios that were within the values commonly sold (e.g., 30/70, 50/50). Nearly all of these same participants reported using their specific PG/VG ratio for the following reasons: a) preferred a higher VG value believing it is healthier (22.2%), b) preferred a lower PG value to reduce the throat hit (44.4%), or c) preferred the ratio recommended for their

device type (22.2%). The self-reported mean nicotine concentration for all users was 34.56 (SD=22.26) mg/ml; the concentration reported by pod users (51.05 [SD=3.15]) was significantly higher than that reported by mod users (6.09 [SD=3.21]) ($t=37.40$, $df=28$, $p<.001$).

All participants were able to accurately name the brand of their device, and many were able to name other brands that sold similar device types (76.7%). All participants were able to provide a nicotine concentration that was within the range of concentrations typically sold; however, many were unable to convert between units of measurement (e.g., % versus mg/ml). Among those participants who believed that their nicotine concentration was typical for users, they stated that it is popular at vape stores or with their friends (33.3%) or that lower concentrations were used only when trying to quit using ECIGs (16.7%). Others reported that their concentration was higher than typically used (13.3%) or that no typical concentration exists (13.3%). Liquid flavor (50.0%), nicotine concentration (26.7%), or a combination of these two (13.3%) were reported as the most important characteristic(s) of their device liquid, usually because it/they provided an enjoyable experience. As for power level, all mod users provided levels that were within the range of those commonly available on the market, ranging from 20-78W, except for one who had a device with three power settings and stated they used the "one in the middle" and was not able to provide a wattage. They also were able to provide reasons for adjusting their power level (i.e., when changing the coil, when getting a new flavor, increasing throughout the day for a stronger hit, etc.) and details about the coil used in their devices (i.e., type of coil, ohms, etc.). Pod users, however, were either unable to provide a power level (89.5%) or provided a level that was inaccurate (10.5%) (i.e., 800W). They also gave little to no details about the coils in their devices. Overall, most participants expressed that the questions

about device power were difficult (63.3%) because they did not know the answers due to a lack of information available or a lack of interest to learn the information.

ECIG Use Behaviors

As shown in Table 6, when participants were asked if they consider themselves to be a 'regular' user, all but one agreed (n=1 pod user responded 'don't know'). Many considered 'regular' use to encompass using daily (26.7%) or using multiple times per day (20.0%); less common (≤10% for each) answers including using weekly or owning a device. In terms of their frequency of ECIG use, 46.7% reported engaging in 'vaping sessions' (i.e., using like one uses a cigarette, using only on breaks at work) versus not having specific vaping sessions (53.3%). Across all participants, it was reported that an average of 134.48 (SD= 155.57) puffs are taken per day and 17.36 (SD=14.66) puffs are taken per session for those that have vaping sessions. Virtually none of the participants were able to report on the volume of liquid they use daily. Rather, participants were able to describe the frequency with which they refill/replace their device (43.3% reported ≤1 time per week; 56.7% reported ≥1 time per day). The participants were asked which measure of frequency of use they believed to be easiest to provide an accurate answer and 30% reported describing their vaping 'throughout the day' (i.e., they have their device with them and use it constantly throughout the whole day making it difficult to quantify) and 20% referred to the number of puffs/hits per day with all other methods being chosen by fewer participants or not at all.

Most users also agreed that they are addicted to their ECIG (80%), continue vaping when sick (63.3%) and have made previous attempts to quit ECIGs (60%) (see Table 6). Of all participants who tried to quit, only 16.7% used products to help them try to quit (i.e., Zin

pouches, nicotine gum) despite 82.4% of them reporting having side effects (e.g., headaches, irritability) when they tried quitting. Only two participants reported using their own device to vape THC in addition to nicotine (6.7%), and only three reported trying synthetic nicotine (10.0%). When asked how they first began vaping, answers varied based on device type with pod users referring to 'high school' or 'friends using' (36.8% versus 21.1% for mod users) and mod users reporting that they used it to quit cigarettes/other tobacco products (63.6%). Few participants of either group endorsed quitting ECIGs if their device or favorite flavors were banned by the government (16.7-23.3%).

Discussion

The primary purpose of this study was to examine the knowledge and terminology surrounding ECIG products among a sample of current ECIG users. Overall, users tended to agree on the terms used to describe devices as a product class and with regard to specific device types. Still, agreement for some terms differed across user groups, with users choosing the same terms for device types and features most similar to their own. Also, there were differences between user groups in their ability to describe some characteristics of their personal device.

General device terms. Few participants used or were aware of the general terms of "electronic nicotine delivery device" or its abbreviation "ENDs" to describe ECIGs, both of which are commonly used by researchers in the scientific literature (Cohen et al., 2022; Tremblay et al., 2022; Coleman et al., 2018) and on public health agency websites FDA (2022), CDC (2022), and NIH: National Cancer Institute (2022), as well as by media outlets (i.e., https://www.cnn.com/2022/10/18/health/e-cigarette-manufacturers-fda-justice-department/index.html) Almost all participants used and were most familiar with the term

"vapes" followed by the term "E-cigs/ECIGs"; therefore, it may be better for researchers to rely on these terms when communicating with the ECIG user community. They might also consider referencing several terms to ensure that they capture the attention of users of all device types. As an example, some national level surveys have begun using several terms when asking questions about these products, including the National Youth Tobacco Survey that states:

> "*The next several questions are about electronic cigarettes or e-cigarettes, such as JUUL, SMOK, Suorin, Vuse, blu, Puff Bar, or STIG. You also may know them as vapes, mods, e-cigs, e-hookahs, or vape-pens. For the rest of this survey, these products and devices will be called e-cigarettes. E-cigarettes are battery powered devices that usually contain a nicotine-based liquid that is vaporized and inhaled*".

Together, these findings are consistent with previous work that assessed users' device-related terminology (Alexander et al., 2016; Pearson et al., 2020; Coleman et al., 2018).

Device type and individual characteristic terms. Some terms for device types were chosen at high rates by all users (e.g., 'pen' for the vape pen device, 'box mod' for the mod device, 'cig-alike' for the cig-alike device). Interestingly, for the pod-style devices (i.e., JUUL and NJOY), the term 'pod' was chosen by only a little over half of users. Indeed, this term was clearly preferred over others among pod users (63.2%-73.7% versus 5.3%-26.3%, respectively). For mod users, the terms 'pen' or 'disposable' were chosen as often or more often (27.3%-45.5%) than 'pod' (27.3%-36.4%) for these same devices. Other terms like 'tank', 'mod', 'pod' to identify device types varied between the device users with each appearing to be more familiar and have more terms for devices similar to their own. For example, more mod users chose 'mod' and 'tank' for mod devices (compared to pod; 100% versus 47.4% and 90.9% versus 68.4%,

respectively), and more pod users chose ‘pod’ for the two pod style devices (compared to mod; 73.7% versus 27.3% for the JUUL pod device and 63.2% versus 36.4% for the NJOY pod device). It is not surprising that users would have higher agreement about devices similar to their own and would be able to describe them in more detail compared to other devices; however, this idea of there being a great difference in knowledge dependent on device type has only been demonstrated in one other study (Pearson et al., 2020). Mod users also were more likely than pod users to use the terms ‘mod’ and ‘tank’ for the pen-style device as well, which may be attributed to the mod users being older on average and therefore, more familiar with earlier ECIG models such as this one. Vape pens came onto the U.S. market shortly after cig-alikes, which entered around 2007, and the vape pens were commonly used by consumers during the late 2000s to early 2010s (Williams and Talbot, 2019; King et al., 2017). It is therefore possible that the mod users, whose average age was older than that of pod users (i.e., 37.55 versus 21.42 years, respectively), are more familiar with these types of devices. Interestingly, the term ‘pod mod’ was chosen by few users regardless of their preferred device type. This term has been used by both government agencies (https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/ecigarette-or-vaping-products-visual-dictionary-508.pdf), retailers (https://www.elementvape.com/pod-mod-systems) and researchers (Talih et al., 2022; Kava et al., 2021; Leavens et al., 2021), though the origin of this term is unknown. The lack of use of this term may be a result of users not understanding what type of device a “pod mod” defines. The differences in responses among different device users is important to consider, but due to the small sample sizes, future work is needed to determine their reliability.

Finally, it is important to recognize that few users chose generation-related terms to categorize different device types. Researchers commonly use these terms in scientific literature

to describe different device types based on when they entered the marketplace (Ozga et al., 2021; Williams and Talbot et al., 2019; Cwalina et al., 2021); however, few users chose these terms to describe any device type and those who did were not always using them accurately (e.g., ‘second generation’ or ‘third generation’ for pods and disposables). While this finding is not surprising, this study is the first to provide direct evidence to support the idea that these terms are largely unknown to users. Recently, arguments also have been made to drop these terms in the scientific literature (Ozga et al., 2021; Eversole et al., 2020).

As for individual characteristics, the terms ‘refillable’ and ‘variable voltage’ were used similarly across participants in that they were applied primarily to the mod-style device. In contrast, there was more variability in use of the terms ‘rechargeable’ and ‘cartridge’. For instance, ‘rechargeable’ was used by most for the mod-style device (73.7-81.8%) and for the JUUL pod-style device (45.5-73.7%). However, this same term was used more often by mod users for the vape pen device, and more often by pod users for the NJOY pod-style device. One reason for these differences may be users’ understanding of the concept of ‘rechargeable’; with mod users thinking of rechargeable as specifically recharging the battery and being able to keep the device long-term, like most users do with mod-style devices, versus others thinking of it as just not being a disposable device. While many pod devices are able to be recharged, those who have not used one or do not immediately recognize the device due to popularity, like with the JUUL, may tend to think they are not for long-term reuse due to them being inexpensive and smaller in size. The term ‘cartridge’ was used similarly by participants for all devices except that more mod users chose this term for the disposable-style device (45.5% versus 0% of pod users). This may be due to the mod users’ unfamiliarity with newer disposable devices and the devices similar look to pod-style devices of which some tend to use pod and cartridge interchangeably.

Also, ‘cartridge’ was applied to the vape pen and pod-style devices across all participants, while this term has historically been used by researchers to reference earlier cig-alike models (Ozga et al., 2021; Aherrera et al., 2020). Still, this term has been used by at least some researchers (Walley et al., 2019; Gaiha et al., 2022) and retailers (https://www.elementvape.com/replacement-pod-cartridges) to reference the pod-style containers specifically. The term ‘cartridge’ used to describe vape pens may derive from the description used by retailers of THC vaping products. Specifically, some products used to vape THC are akin to a vape pen (i.e. they have a similar appearance and are marketed using this term) and the storage container is commonly labeled as a ‘cartridge’ (Blueberry Pie THC Vape Pen Kit or Refill Cartridge (Hybrid) | LiT Vape Pens #1 Weed Vape Pen). Overall, this term may want to be avoided since it is used so differently by different groups. ‘Disposable’ was used by most participants to describe the disposable (90%) and cig-alike (70%) devices, as well as by a notable portion to describe the pod-style devices (30.0-33.3%). Cig-alike devices have traditionally been reusable, though some newer brands are fully disposable (https://www.blu.com/en/US/blu-disposables). Likewise, while the pod-style devices are typically reusable, many fully disposable devices look very similar in appearance to some of the pod-style devices. Indeed, the devices depicted in the pictures shown to participants included the JUUL brand pod-style device (i.e. rechargeable battery with replaced storage containers) and the PuffBar brand disposable device (i.e. entire device fully disposable). Participants unfamiliar with the specific brands depicted may have perceived them as having similar characteristics.

Liquid storage containers. These discrepancies are also applicable to specific parts of the devices such as the liquid storage containers. Users identified images to represent ‘pods’ and ‘tanks’ similarly across groups (90.9-94.7% identified the liquid storage container of a pod-style

device as best representing a ‘pod’ and 90.9-94.7% identified the mod-style liquid storage container as best representing a ‘tank’); however, a notable portion of mod users also identified the pen-style device container as representing a ‘tank’ (36.4% versus 0% of pod users). This could also be attributed to mod user being older on average and more familiar with these devices, as discussed previously.

Answers varied greatly when it came to identifying the liquid storage container that best represented a ‘cartridge’. Researchers have historically defined a ‘cartridge’ as being the liquid storage container for earlier cig-alike devices (Ozga et al., 2021; Aherrera et al., 2020). Interestingly, when identifying images that represent this term, the cig-alike container was chosen by only 40% of participants, but for the pen-style container by over half of participants (53.3%) and for the pod-style container by a quarter of participants (26.7%). As seen in Table 4, significantly more mod (versus pod) users referred to the pod-style container as a ‘cartridge’. One reason for this difference might be due to a lack of experience with that type of device and the age of mod users, as they may be more familiar with older devices that they have been using for years compared to the newer technology on the market. Also, the term ‘cartridge’ was commonly described by participants as being “not for nicotine” and instead being used for marijuana or THC. Recently, using ‘cartridges’ for THC and/or marijuana products appears to be a common trend among researchers in their work related to vaping THC (Pray et al., 2020, Cherian et al., 2020, Lim et al., 2021), among the media (https://www.washingtonpost.com/business/how-legal-weed-has-changed-the-us/2022/10/06/e8a80f06-45c0-11ed-be17-89cbe6b8c0a5_story.html), and in advertising some THC products on retailer websites (Blueberry Pie THC Vape Pen Kit or Refill Cartridge (Hybrid) | LiT Vape Pens #1 Weed Vape Pen). Evidence from this study and other sources

demonstrates that users may not think of these terms in the same ways as researchers in reference to nicotine products (Ali et al., 2020; Voos et al., 2019; Breland et al., 2017), but users and researchers do use the term similarly for marijuana/THC products; therefore, researchers should be attentive to how they ask questions regarding these different device components.

Personal devices. Users were knowledgeable about some basic characteristics of their devices and liquid. Almost all users were familiar with basic terms regarding their device and were able to name the brand of the device they use. Many were also able to accurately describe if the device was refillable or disposable. Many mod users were able to report on additional device characteristics such as power levels and coil information; however, most pod users were not knowledgeable of this additional information and could only accurately answer if their device had adjustable power, supporting the original hypothesis that mod users would likely be more knowledgeable of their devices. This lack of knowledge among pod users could be attributable to differences in their devices relative to those for mod users. Mod-style devices often allow for the user to adjust or modify device features and/or have display screens that depict information such as the specific power level in use. In contrast, pod-style devices often do not allow for user modification and/or display such information (Douglas et al., 2022). For the liquids used within the devices, most participants were able to provide common flavors they used as well as nicotine concentrations that were comparable to the concentrations currently sold on the market. While research is limited on the topic, it has been demonstrated that users of pod-style devices specifically have difficulty reporting nicotine concentrations at all or reporting accurate values (McKelvey & Halpern-Felsher, 2020). While not prompted specifically in this interview, some participants attempted to provide their nicotine concentration in more than one unit of measurement; however, users were not all knowledgeable of the unit conversion of percentage to

mg/ml or vice versa which reflects previous work (Morean et al., 2021). Providing more information about the liquids was more difficult for some, especially the pod users.

Fewer pod users were able to report their liquid contents including if the liquids were a nicotine salt and PG/VG ratios in the liquids which is reflective of existing literature (Crespi et al., 2022) and supports the hypothesis that these users may be less knowledgeable of their devices. This lack of knowledge among some device users may be attributed to the pod and disposable products they are using that are designed to be easier to use and have less adjustable parts. Also, these liquid characteristics are less often featured on the product packaging and manufacturer websites compared to vape e-liquid that is sold in bottles to refill devices. As an example, the website and packaging for JUUL (https://www.juul.com/) and Hyde disposable vapes (https://hydevapeofficial.com/) provides the percentage of nicotine (e.g. 3% or 5%) but no information about power level (e.g. wattage), PG/VG ratio, or other characteristics. Also, mod users may be generally more familiar with the details of their devices and liquids due to them being more likely to shop in vape shops, rather than purchasing their products at any gas station or convenience store, and more likely to go online to learn more about features they are able to modify with their devices; therefore, they may have more opportunities to discuss their devices with others and develop a sense of community with other users (Langley et al., 2019; Barker and Rohde, 2019).

User behaviors. Another important outcome of this study is acknowledging the variability of descriptions when it comes to use behaviors. When asked to define what qualifies someone as being a regular user, descriptions varied greatly with some believing it is based on frequency of use (i.e., using multiple times daily, daily, or weekly) while others have other qualifications, such

as owning a device. The variability in answers to describe use behaviors is important for researchers to consider when asking these types of questions, especially when asking in a survey format where participants may not have the chance to provide explanations for their answers. Researchers acknowledge that measuring the frequency and intensity of ECIG use is difficult because of varying device types and liquid characteristics that influence user behaviors (Soule et al. 2021; Blank et al., 2016). In this study, participants described their frequency of use differently and many felt they could not report on certain behaviors such as the volume of liquid used per day and how many puffs they take in a session or day. Many users instead preferred to describe their patterns of use "throughout the day" (30% versus all other forms of measurement chosen by 20% or less). This latter finding conflicts with some previous work showing that many users preferred to report on how often they have to refill their liquid (for users of refillable devices) or replace their container/ECIG (for users of devices with replaceable containers or that are fully disposable) (Cassidy et al., 2017; Strickland et al., 2021). Together, these results further support the need for standardized measurement methods or a combination of measurements of ECIG use. The interview also revealed that many users report signs of nicotine/tobacco dependence: believing they are addicted to their ECIG, continuing to vape when sick, having unsuccessful quit attempts, and experiencing withdrawal symptoms when they have tried to quit (Bokyan et al., 2019; Tacket et al., 2021; Dai et al., 2021; Pulvers et al., 2020; Hobkirk et al., 2022; Do et al., 2022). A few of these signs were more prevalent in pod users, consistent with previous work (Tackett et al. 2021; Bokyan et al., 2019; Leavens et al., 2022).

Strengths

This project showed several strengths. This is one of the first attempts to collect both quantitative and qualitative information from ECIG users to assess their knowledge of many characteristics of devices generally as well as their own devices and use behaviors. This study allows for a more complete understanding of what users are able to report (i.e., provide an answer besides “I don’t know”) and accurately report about their devices and use of the devices. The results of this study may better inform future self-report research by helping researchers to determine which questions are best to ask in a self-report setting and how those questions could be worded differently in a way that it is easier for users to understand, such as providing additional terms, picture examples, and/or definitions to clarify terminology being used (Douglas et al., 2022). The semi-structured interview format allowed for participants to feel more comfortable answering “I don’t know” to some questions rather than just guessing by choosing an answer from multiple choice options, such as might be the case on survey research. Also, these interviews prompted explanations from the participants of why they answered questions the way they did or why they are unsure of answers to some of the questions. Surveys may want to allow for participants to give more written explanations and/or make it clear that it is appropriate to choose “I don’t know” when necessary, rather than guessing. This helps researchers identify reasons for gaps in knowledge among the users of these devices. Another possible addition would be researchers using cognitive interviews with a sample in order to test and refine material before launching a survey to a larger group (Hinds et al., 2016).

Lastly, allowing the participants to further explain their answers resulted in understanding more about their opinions and influences surrounding ECIGs. Participants were able to provide more detailed information about their initial experiences and uses of these products as well as where they continue to get the most information about the devices. They also were able to

provide their opinions surrounding quitting the use of ECIGs and how some government policy changes have or could influence their use habits. These details could be important for designing and distributing prevention and educational materials by targeting places where users receive the most information about their devices.

Limitations

In addition to its strengths, this study also had its weaknesses. The sample size was similar to that of other studies collecting qualitative data (Mason, 2010; Vasileiou et al., 2018); however, more comparisons between user groups (pod versus mod users) would benefit from larger sample sizes in future work. While some comparisons were made here, more could be done to assess the associations between the device type used and other characteristics or behaviors in future work. For instance, more specific device type groups (e.g., considering modern disposables and pod devices separately, including regular users of vape pens also) could be identified within a larger sample and device type could potentially be used as a predictor of common terminology used, knowledge of device and liquid characteristics, and/or use behavior and user perceptions of ECIGs. Also, conducting multiple tests on this small sample size has risks of greatly inflating the Type 1 error. To account for this, a False Discovery Rate (FDR) correction was applied; however, a larger sample size would also help increase the power of the study (Button, 2013). Additionally, the sample obtained came from several different recruitment locations, with the majority of participants recruited from the student community at the university (n=18; 60%). These means of recruitment could potentially have contributed to differences between the pod and mod users, especially differences that are likely related to age differences among the groups.

Another limitation would be the amount of information asked in a single interview as it limits the amount of time that can be spent on each topic discussed. While a one-hour interview is not likely to be burdensome to the participants; the interviews encompassed many different topic areas for a single interview of this time frame. Future work may want to be more precise in questioning specific information and allowing for the participants to provide more details within that specific area. This could be done by extending the time of the interview to allow for more questions or by breaking the questioning up into separate interviews about each specific topic (i.e., general terminology, personal device knowledge, user behaviors). Additionally, the semi structured interview could be adapted to be used in focus groups discussions involving both types of device users. Having users discuss their terminology and knowledge surrounding ECIGs may be a better way to understand the differences between these different types of ECIG users.

This study was also designed with the hopes of identifying possible differences in device terminology and definitions between ECIG users and what is used by researchers in existing literature. While the results of this study provided some insight into those discrepancies, this information could be better explored by conducting an additional set of interviews in which researchers are asked similar questions regarding terminology and knowledge of the different device types. Interviews with researchers would likely not include questions regarding personal use; however, questions regarding different device types generally and definitions traditionally used for related terminology froth their perspective. This could allow for a more direct comparison between ECIG users and researchers which has not been addressed in the current literature.

Conclusions and Future Directions

In conclusion, this study shows evidence that there is a disconnect between different types of device users when it comes to ECIG terminology and knowledge; however, there were also some consistencies with what users reported and terminology used in the literature, as well as between user groups. These problems can be seen in reporting of device type, device and liquid characteristics, and user behaviors. This disconnection may be leading to misunderstandings and inaccurate reporting of information in self-report data collection, such as the reporting of characteristics like nicotine concentration, nicotine type, power levels, and others. This is supportive of other research done that has found differences in reporting related to user device type and research identifying users may not be knowledgeable of some of these device details (McKelvey & Halpern-Felsher, 2020; Morean et al., 2021; Crespi et al., 2021; Douglas et al., 2022). In the future, this study could inform researchers using other self-report data collection and those creating material used in prevention efforts. This information could also be used to inform regulation efforts by having a better understanding of the users' knowledge and priorities regarding ECIGs as they are the target audience whom researchers and policy makers want to direct information towards. This information can be used as a tool for creating material that may be better understood by ECIG users; therefore, they would be able to better understand the information presented to them and provide more accurate responses to questions asked. This information may be used to help inform further regulations, such as those related to flavored ECIG products, by having more information about the importance of flavor and other product characteristics and how they affect product consumption. Any material that is intended to be distributed to consumers of these products, whether it be educational or regulatory, could be improved by the addition of more inclusive terminology, the omission of dated or confusing terminology, the inclusion of definitions of terms, and/or the inclusion of example pictures and

brands of any specific devices being discussed. Also, this information could help researchers better identify questions they should be asking and how those questions should be phrased in order to obtain the most information that is accurate.

References

Adams, W. (2015). *Conducting Semi-Structured Interviews*. https://doi.org/10.1002/9781119171386.ch19

Aherrera, A., Aravindakshan, A., Jarmul, S., Olmedo, P., Chen, R., Cohen, J. E., Navas-Acien, A., & Rule, A. M. (2020). E-cigarette use behaviors and device characteristics of daily exclusive e-cigarette users in Maryland: Implications for product toxicity. Tobacco Induced Diseases, 18, 93. https://doi.org/10.18332/tid/128319

Alexander, J. P., Coleman, B. N., Johnson, S. E., Tessman, G. K., Tworek, C., & Dickinson, D. M. (2016). Smoke and Vapor: Exploring the Terminology Landscape among Electronic Cigarette Users. *Tobacco Regulatory Science*, *2*(3), 204–213. https://doi.org/10.18001/TRS.2.3.1

Ali, F. R. M., Diaz, M. C., Vallone, D., Tynan, M. A., Cordova, J., Seaman, E. L., Trivers, K. F., Schillo, B. A., Talley, B., & King, B. A. (2020). E-cigarette Unit Sales, by Product and Flavor Type—United States, 2014–2020. Morbidity and Mortality Weekly Report, 69(37), 1313–1318. https://doi.org/10.15585/mmwr.mm6937e2

Barker, J. O., & Rohde, J. A. (2019). Topic Clustering of E-Cigarette Submissions Among Reddit Communities: A Network Perspective. *Health Education & Behavior*, *46*(2_suppl), 59S-68S. https://doi.org/10.1177/1090198119863770

Benjamini, Y., & Hochberg, Y. (1995). Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society. Series B (Methodological)*, *57*(1), 289–300.

Blank, M. D., Breland, A. B., Cobb, C. O., Spindle, T., Ramôa, C., & Eissenberg, T. (2016). Clinical Laboratory Evaluation of Electronic Cigarettes/Electronic Nicotine Delivery Systems:

Methodological Challenges. *Tobacco Regulatory Science*, *2*(4), 426–439. https://doi.org/10.18001/TRS.2.4.12

Boykan, R., Goniewicz, M. L., & Messina, C. R. (2019). Evidence of Nicotine Dependence in Adolescents Who Use Juul and Similar Pod Devices. International Journal of Environmental Research and Public Health, 16(12), Article 12. https://doi.org/10.3390/ijerph16122135

Breland, A., Soule, E., Lopez, A., Ramôa, C., El-Hellani, A., & Eissenberg, T. (2017). Electronic cigarettes: What are they and what do they do? Annals of the New York Academy of Sciences, 1394(1), 5–30. https://doi.org/10.1111/nyas.12977

Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & Munafò, M. R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*(5), Article 5. https://doi.org/10.1038/nrn3475

Cassidy, R. N., Tidey, J. W., Colby, S. M., Long, V., & Higgins, S. T. (2017). Initial Development of an E-cigarette Purchase Task: A Mixed Methods Study. Tobacco Regulatory Science, 3(2), 139–150. https://doi.org/10.18001/TRS.3.2.2

Centers for Disease Control and Prevention: National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health (2020) Retrieved from: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/youth_data/tobacco_use/index.htm

Cherian, S. V., Kumar, A., & Estrada-Y-Martin, R. M. (2020). E-Cigarette or Vaping Product-Associated Lung Injury: A Review. *The American Journal of Medicine*, *133*(6), 657–663. https://doi.org/10.1016/j.amjmed.2020.02.004

Cohen, J. E., Hardesty, J. J., Nian, Q., Crespi, E., Sinamo, J. K., Kennedy, R. D., Welding, K., Kaplan, B., Soule, E., Eissenberg, T., & Breland, A. B. (2022). Combinations of electronic

nicotine delivery system device and liquid characteristics among U.S. adults. Addictive Behaviors, 135, 107441. https://doi.org/10.1016/j.addbeh.2022.107441

Coleman, B., Johnson, S., Alexander, J., & Williams, P. (2018). An E-cigarette by Many Other Names: How Users Describe and Categorize ENDS. Tobacco Regulatory Science, 4, 61–70. https://doi.org/10.18001/TRS.4.5.6

Cox, S., Hastings, J., West, R., & Notley, C. (2020). The case for development of an E-cigarette Ontology (E-CigO) to improve quality, efficiency and clarity in the conduct and interpretation of research. *Qeios*. https://doi.org/10.32388/5YYRPJ

Cox, S., West, R., Notley, C., Soar, K., & Hastings, J. (n.d.). Toward an ontology of tobacco, nicotine and vaping products. Addiction, n/a(n/a). https://doi.org/10.1111/add.16010

Creamer, M. R., Wang, T. W., Babb, S., Cullen, K. A., Day, H., Willis, G., Jamal, A., & Neff, L. (2019). Tobacco product use and cessation indicators among adults—United States, 2018. MMWR. Morbidity and Mortality Weekly Report, 68(45), 1013–1019. https://doi.org/10.15585/mmwr.mm6845a2

Crespi, E., Hardesty, J. J., Nian, Q., Sinamo, J., Welding, K., Kennedy, R. D., & Cohen, J. E. (2022). Agreement Between Self-reports and Photos to Assess e-Cigarette Device and Liquid Characteristics in Wave 1 of the Vaping and Patterns of e-Cigarette Use Research Study: Web-Based Longitudinal Cohort Study. *Journal of Medical Internet Research*, *24*(4), e33656. https://doi.org/10.2196/33656

Creswell, J. W. & Plano Clark, V. L. (2006). *Designing and Conducting Mixed Methods Research*

Cwalina, S. N., Braymiller, J. L., Leventhal, A. M., Unger, J. B., McConnell, R., & Barrington-Trimis, J. L. (2020). Prevalence of Young Adult Vaping, Substance Vaped, and Purchase

Location Across Five Categories of Vaping Devices. *Nicotine & Tobacco Research*, *23*(5), 829–835. https://doi.org/10.1093/ntr/ntaa232

Dai, H. (2021). Prevalence and Factors Associated With Youth Vaping Cessation Intention and Quit Attempts. *Pediatrics*, *148*(3), e2021050164. https://doi.org/10.1542/peds.2021-050164

Dai, H., & Leventhal, A. M. (2019). Prevalence of e-cigarette use among adults in the United States, 2014-2018. JAMA, 322(18), 1824. https://doi.org/10.1001/jama.2019.15331

DeJonckheere, M., & Vaughn, L. M. (2019). Semistructured interviewing in primary care research: A balance of relationship and rigour. *Family Medicine and Community Health*, *7*(2). https://doi.org/10.1136/fmch-2018-000057

Do, E. K., O'Connor, K., Perks, S. N., Soule, E. K., Eissenberg, T., Amato, M. S., Graham, A. L., Martin, C. K., Höchsmann, C., & Fuemmeler, B. F. (2022). E-cigarette device and liquid characteristics and E-cigarette dependence: A pilot study of pod-based and disposable E-cigarette users. *Addictive Behaviors*, *124*, 107117. https://doi.org/10.1016/j.addbeh.2021.107117

Dobbs, P. D., Clawson, A. H., Gowin, M., & Cheney, M. K. (2020). Where college students look for vaping information and what information they believe. Journal of American College Health, 68(4), 347–356. https://doi.org/10.1080/07448481.2018.1549557

Douglas, A. E., Felicione, N. J., Childers, M. G., Soule, E. K., & Blank, M. D. (2023). Predictors of electronic cigarette dependence among non-smoking electronic cigarette users: User behavior and device characteristics. *Addictive Behaviors*, *137*, 107500. https://doi.org/10.1016/j.addbeh.2022.107500

Elliot, R. & Timulak, L. (2021). *Essentials of Descriptive-Interpretive Qualitative Research: A Generic Approach*.

Electronic Nicotine Delivery Systems | NIOSH | CDC. (2022, April 6). https://www.cdc.gov/niosh/topics/tobacco/electronicnicotinedeliverysystems.html

Electronic Nicotine Delivery Systems (ENDS) Use | Division of Cancer Control and Population Sciences (DCCPS). (n.d.). (October 13, 2022) https://cancercontrol.cancer.gov/brp/tcrb/electronic-nicotine-delivery-systems

E-Cigarettes, Vapes, and other Electronic Nicotine Delivery Systems (ENDS). FDA. (2022) https://www.fda.gov/tobacco-products/products-ingredients-components/e-cigarettes-vapes-and-other-electronic-nicotine-delivery-systems-ends

Eversole, A., Maloney, S., Talih, S., Salman, R., Karaoghlanian, N., Lipato, T., Eissenberg, T., & Breland, A. (2020). Variable Voltage, Tank-Style ENDS Do Not Always Deliver Nicotine. *Tobacco Regulatory Science*, *6*(6), 416–422. https://doi.org/10.18001/trs.6.6.5

Gaiha, S. M., Lempert, L. K., McKelvey, K., & Halpern-Felsher, B. (2022). E-cigarette devices, brands, and flavors attract youth: Informing FDA's policies and priorities to close critical gaps. Addictive Behaviors, 126, 107179. https://doi.org/10.1016/j.addbeh.2021.107179

Gentzke, A. S., Creamer, M., Cullen, K. A., Ambrose, B. K., Willis, G., Jamal, A., & King, B. A. (2019). Vital signs: Tobacco product use among middle and high school students—United States, 2011–2018. MMWR. 68(6), 157–164. https://doi.org/10.15585/mmwr.mm6806e1

Hess, C. A., Antin, T. M. J., Annechino, R., & Hunt, G. (2017). Perceptions of E-Cigarettes among Black Youth in California. *International Journal of Environmental Research and Public Health*, *14*(1), 60. https://doi.org/10.3390/ijerph14010060

Hinds, J. T., Loukas, A., Chow, S., Pasch, K. E., Harrell, M. B., Perry, C. L., Delnevo, C., & Wackowski, O. A. (2016). Using Cognitive Interviewing to Better Assess Young Adult E-

cigarette Use. *Nicotine & Tobacco Research, 18*(10), 1998–2005. https://doi.org/10.1093/ntr/ntw096

Hobkirk, A. L., Hoglen, B., Sheng, T., Kristich, A., Yingst, J. M., Houser, K. R., Krebs, N. M., Allen, S. I., Bordner, C. R., Livelsberger, C., & Foulds, J. (2022). Intentions and Attempts to Quit JUUL E-Cigarette Use: The Role of Perceived Harm and Addiction. *Preventing Chronic Disease*, *19*, E06. https://doi.org/10.5888/pcd19.210255

Hsu G, Sun JY, Zhu S. (2018) Evolution of electronic cigarette brands from 2013-2014 to 2016-2017: Analysis of brand websites. *J Med Internet Res*. 2018;20(3):e80. doi:10.2196/jmir.8550

Jamshed, S. (2014). Qualitative research method-interviewing and observation. *Journal of Basic and Clinical Pharmacy*, *5*(4), 87–88. https://doi.org/10.4103/0976-0105.141942

Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, *72*(12), 2954–2965. https://doi.org/10.1111/jan.13031

Kava, C. M., Soule, E. K., Seegmiller, L., Gold, E., Snipes, W., Westfield, T., Wick, N., & Afifi, R. (2021). "Taking Up a New Problem": Context and Determinants of Pod-Mod Electronic Cigarette Use Among College Students. *Qualitative Health Research*, *31*(4), 703–712. https://doi.org/10.1177/1049732320971236

King, A. C., Smith, L. J., McNamara, P. J., & Cao, D. (2018). Second Generation Electronic Nicotine Delivery System Vape Pen Exposure Generalizes as a Smoking Cue. *Nicotine & Tobacco Research*, *20*(2), 246–252. https://doi.org/10.1093/ntr/ntw327

Langley, T., Bell-Williams, R., Pattinson, J., Britton, J., & Bains, M. (2019). 'I Felt Welcomed in Like They're a Little Family in There, I Felt Like I Was Joining a Team or Something': Vape Shop Customers' Experiences of E-Cigarette Use, Vape Shops and the Vaping Community.

International Journal of Environmental Research and Public Health, *16*(13), Article 13. https://doi.org/10.3390/ijerph16132341

Leavens, E. L. S., Carpenter, M. J., Smith, T. T., & Nollen, N. L. (2021). Exploratory evaluation of online brief education for JUUL pod-mod use and prevention. *Addictive Behaviors*, *119*, 106942. https://doi.org/10.1016/j.addbeh.2021.106942

Leavens, E. L. S., Nollen, N. L., Ahluwalia, J. S., Mayo, M. S., Rice, M., Brett, E. I., & Pulvers, K. (2022). Changes in dependence, withdrawal, and craving among adult smokers who switch to nicotine salt pod-based e-cigarettes. *Addiction*, *117*(1), 207–215. https://doi.org/10.1111/add.15597

Lim, C. C. W., Leung, J., Chung, J. Y. C., Sun, T., Gartner, C., Connor, J., Hall, W., Chiu, V., Tisdale, C., Stjepanović, D., & Chan, G. (2021). Content analysis of cannabis vaping videos on YouTube. *Addiction*, *116*(9), 2443–2453. https://doi.org/10.1111/add.15424

Liu, S. T., Newsome, J., Castleman, V., Poonai, K., Creamer, M. R., Kimmel, H. L., & Zandberg, I. (2021). Qualitative insights on how adult e-cigarette users describe quantity of e-cigarettes used – PATH Study 2018. *Preventive Medicine Reports*, *23*, 101421. https://doi.org/10.1016/j.pmedr.2021.101421

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qualitative Health Research*, *26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444

Mason, M. (2010). Sample Size and Saturation in PhD Studies Using Qualitative Interviews. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *11*(3), Article 3. https://doi.org/10.17169/fqs-11.3.1428

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. Biochemia Medica, 22(3), 276.

McKelvey, K., & Halpern-Felsher, B. (2020). How and Why California Young Adults Are Using Different Brands of Pod-Type Electronic Cigarettes in 2019: Implications for Researchers and Regulators. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, *67*(1), 46–52. https://doi.org/10.1016/j.jadohealth.2020.01.017

Morean, M. E., Bold, K. W., Kong, G., Gueorguieva, R., Camenga, D. R., Simon, P., Jackson, A., Cavallo, D. A., & Krishnan-Sarin, S. (2019). Adolescents' awareness of the nicotine strength and e-cigarette status of JUUL e-cigarettes. *Drug and Alcohol Dependence*, *204*, 107512. https://doi.org/10.1016/j.drugalcdep.2019.05.032

Morean, M. E., Wackowski, O. A., Eissenberg, T., Delnevo, C. D., & Krishnan-Sarin, S. (2021). Adults who use e-cigarettes have difficulty understanding nicotine concentrations presented as mg/ml and percent nicotine. *Addictive Behaviors*, *120*, 106965. https://doi.org/10.1016/j.addbeh.2021.106965

Ozga, J. E., Felicione, N. J., Douglas, A., Childers, M., & Blank, M. D. (2021). Electronic Cigarette Terminology: Where Does One Generation End and the Next Begin? *Nicotine & Tobacco Research*, ntab164. https://doi.org/10.1093/ntr/ntab164

Park, E., Kwon, M., Gaughan, M. R., Livingston, J. A., & Chang, Y.-P. (2019). Listening to Adolescents: Their Perceptions and Information Sources About E-cigarettes. *Journal of Pediatric Nursing*, *48*, 82–91. https://doi.org/10.1016/j.pedn.2019.07.010

Pearson, J. L., Amato, M. S., Wang, X., Zhao, K., Cha, S., Cohn, A. M., Papandonatos, G. D., & Graham, A. L. (2017). How US Smokers Refer to E-cigarettes: An Examination of User-Generated Posts From a Web-Based Smoking Cessation Intervention, 2008–2015. *Nicotine & Tobacco Research*, *19*(2), 253–257. https://doi.org/10.1093/ntr/ntw206

Pearson, J. L., Hitchman, S. C., Brose, L. S., Bauld, L., Glasser, A. M., Villanti, A. C., McNeill, A., Abrams, D. B., & Cohen, J. E. (2018). Recommended core items to assess e-cigarette use in population-based surveys. *Tobacco Control*, *27*(3), 341–346. https://doi.org/10.1136/tobaccocontrol-2016-053541

Pearson, J. L., Reed, D. M., & Villanti, A. C. (2020). Vapes, E-cigs, and Mods: What Do Young Adults Call E-cigarettes? *Nicotine & Tobacco Research*, *22*(5), 848–852. https://doi.org/10.1093/ntr/nty223

Pray, I. W., Atti, S. K., Tomasallo, C., & Meiman, J. G. (2020). E-cigarette, or Vaping, Product Use–Associated Lung Injury Among Clusters of Patients Reporting Shared Product Use—Wisconsin, 2019. *Morbidity and Mortality Weekly Report*, *69*(9), 236–240. https://doi.org/10.15585/mmwr.mm6909a4

Pulvers, K., Correa, J. B., Krebs, P., El Shahawy, O., Marez, C., Doran, N., & Myers, M. (2021). JUUL E-Cigarette Quit Attempts and Cessation Perceptions in College Student JUUL E-Cigarette Users. *American Journal of Health Promotion*, *35*(5), 624–632. https://doi.org/10.1177/0890117120982408

Rudy, A., Leventhal, A., Goldenson, N. I., & Eissenberg, T. (2017). Assessing electronic cigarette effects and regulatory impact: Challenges with user self-reported device power. *Drug and Alcohol Dependence*, *179*, 337–340. https://doi.org/10.1016/j.drugalcdep.2017.07.031

Sanders-Jackson, A. N., Tan, A. S. L., Bigman, C. A., & Henriksen, L. (2015). Knowledge About E-Cigarette Constituents and Regulation: Results From a National Survey of U.S. Young Adults. *Nicotine & Tobacco Research*, *17*(10), 1247–1254. https://doi.org/10.1093/ntr/ntu276

Schober, M. F., Suessbrick, A. L., & Conrad, F. G. (2018). When Do Misunderstandings Matter? Evidence From Survey Interviews About Smoking. *Topics in Cognitive Science*, *10*(2), 452–484. https://doi.org/10.1111/tops.12330

Singh, B., Hrywna, M., Wackowski, O. A., Delnevo, C. D., Jane Lewis, M., & Steinberg, M. B. (2017). "Knowledge, recommendation, and beliefs of e-cigarettes among physicians involved in tobacco cessation: A qualitative study." *Preventive Medicine Reports*, *8*, 25–29. https://doi.org/10.1016/j.pmedr.2017.07.012

Soule, E., Bansal-Travers, M., Grana, R., McIntosh, S., Price, S., Unger, J. B., & Walton, K. (2021). Electronic cigarette use intensity measurement challenges and regulatory implications. *Tobacco Control*. https://doi.org/10.1136/tobaccocontrol-2021-056483

Stepney, M., Aveyard, P., & Begh, R. (2019). GPs' and nurses' perceptions of electronic cigarettes in England: A qualitative interview study. *British Journal of General Practice*, *69*(678), e8–e14. https://doi.org/10.3399/bjgp18X699821

Strickland, J. C., Vsevolozhskaya, O. A., & Stoops, W. W. (2021). E-Cigarette Demand: Impact of Commodity Definitions and Test–Retest Reliability. *Nicotine & Tobacco Research*, *23*(3), 557–565. https://doi.org/10.1093/ntr/ntaa139

Tackett, A. P., Hébert, E. T., Smith, C. E., Wallace, S. W., Barrington-Trimis, J. L., Norris, J. E., Lechner, W. V., Stevens, E. M., & Wagener, T. L. (2021). Youth use of e-cigarettes: Does dependence vary by device type? Addictive Behaviors, 119, 106918. https://doi.org/10.1016/j.addbeh.2021.106918

Talih, S., Salman, R., Soule, E., El-Hage, R., Karam, E., Karaoghlanian, N., El-Hellani, A., Saliba, N., & Shihadeh, A. (2022). Electrical features, liquid composition and toxicant emissions from

'pod-mod'-like disposable electronic cigarettes. Tobacco Control, 31(5), 667–670. https://doi.org/10.1136/tobaccocontrol-2020-056362

Tremblay, B., Turk, M. T., Cooper, M. R., & Zoucha, R. (2022). Knowledge, Attitudes, and Perceptions of Young Adults About Electronic Nicotine Delivery Systems in the United States: An Integrative Review. Journal of Cardiovascular Nursing, 37(1), 86–97. https://doi.org/10.1097/JCN.0000000000000731

U.S Food and Drug Administration. (2020c). Newly Signed Legislation Raises Federal Minimum Age of Sale of Tobacco Products to 21. Retrieved from https://www.fda.gov/tobacco-products/ctp-newsroom/newly-signed-legislation-raises-federal-minimum-age-sale-tobacco-products-21

U.S. Food and Drug Administration. (2018a). Light, Low, Mild or Similar Descriptors. Retrieved from https://www.fda.gov/tobacco-products/labeling-and-warning-statements-tobacco-products/light-low-mild-or-similar-descriptors

U.S. Food and Drug Administration. (2018b). Retailers: Chart of Required Warning Statements on Tobacco Product Packaging and Advertising. Retrieved from https://www.fda.gov/tobacco-products/retail-sales-tobacco-products/retailers-chart-required-warning-statements-tobacco-product-packaging-and-advertising

U.S. Food and Drug Administration. (2019). Interpretation of and Compliance Policy for Certain Label Requirement; Applicability of Certain Federal Food, Drug, and Cosmetic Act Requirements to Vape Shops. Silver Spring, MD: U. S. Food and Drug Administration.

U.S. Food and Drug Administration. (2020a). Enforcement priorities for electronic nicotine delivery systems (ENDS) and other deemed products on the market without premarket authorization (revised). Silver Spring, MD: U. S. Food and Drug Administration.

U.S. Food and Drug Administration. (2020b). Family Smoking Prevention and Tobacco Control Act - An Overview. Retrieved from https://www.fda.gov/tobacco-products/rules-regulations-and-guidance/family-smoking-prevention-and-tobacco-control-act-overview

Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018). Characterising and justifying sample size sufficiency in interview-based studies: Systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology*, *18*. https://doi.org/10.1186/s12874-018-0594-7

Voos, N., Goniewicz, M. L., & Eissenberg, T. (2019). What is the nicotine delivery profile of electronic cigarettes? *Expert Opinion on Drug Delivery*, *16*(11), 1193–1203. https://doi.org/10.1080/17425247.2019.1665647

Walley, S. C., Wilson, K. M., Winickoff, J. P., & Groner, J. (2019). A Public Health Crisis: Electronic Cigarettes, Vape, and JUUL. Pediatrics, 143(6), e20182741. https://doi.org/10.1542/peds.2018-2741

Weaver, S. R., Kim, H., Glasser, A. M., Sutfin, E. L., Barrington-Trimis, J., Payne, T. J., Saddleson, M., & Loukas, A. (2018). Establishing consensus on survey measures for electronic nicotine and non-nicotine delivery system use: Current challenges and considerations for researchers. *Addictive Behaviors*, *79*, 203–212. https://doi.org/10.1016/j.addbeh.2017.11.016

Williams, M., & Talbot, P. (2019). Design Features in Multiple Generations of Electronic Cigarette Atomizers. *International Journal of Environmental Research and Public Health*, *16*(16), 2904. https://doi.org/10.3390/ijerph16162904

Wong, S.-W., Lin, H.-C., Piper, M. E., Siddiqui, A., & Buu, A. (2019). Measuring characteristics of e-cigarette consumption among college students. *Journal of American College Health*, *67*(4), 338–347. https://doi.org/10.1080/07448481.2018.1481075

Zhu S-H, Sun JY, Bonnevie E, et al. Four hundred and sixty brands of e-cigarettes and counting: Implications for product regulation. *Tobacco Control.* 2014;23:iii3-iii9.

Table 1. Terms and example images of ECIG device types and characteristics commonly used by researchers (Ozga et al., 2021)

Generation	Device Style	Liquid / Container	Battery	Example images
1st Generation	Cigalike Vape Stick Pen-Style Cigalike	Cartridge Cartomizer Not Refillable Reloadable Closed	Rechargeable Fully Disposable Fixed Low Voltage Not Rechargeable Low Capacity	
2nd Generation	Tank System Tank-Style Vape Pen Pen-Like Personal Vaporizor	Cartridge Tank Clearomizer Refillable Prefilled Cartridge Open	Pen-Style Variable Voltage Thin Rechargeable Has a Button	
3rd Generation	Mod Box Mod Tank-Style Tank System Sub-Ohm Tank Modifiable Mechanical Mod Vaping Product Regulated Mod	Refillable Open	Modifiable Adjustable Voltage Adjustable Wattage Adjustable Power Rechargeable	
4th Generation	Pod Pod Mod	Pod, Cartridge, Prefilled, Refillable, Disposable, Contains atomizer	Rechargeable Fixed voltage Various shapes Adjustable wattage Adjustable voltage Sub-ohm resistance	
Other	Newer Disposable Pod Tank Refillable Pod	Disposable Nicotine Salts Not Refillable Pod Tank Refillable Prefilled	Fully Disposable Fixed Rechargeable Adjustable Power Modifiable	

Table 2. Demographic Information

	Total (N=30)	Pod/disposable users (N=19)	Mod users (N=11)		
		Mean (SD) or N (%)		t or χ^2 (df)	p
Age	27.33 (9.69)	21.42 (2.67)	37.55 (8.85)	**-5.89 (28)**	**<0.001**
Gender					
Male	17 (56.7%)	10 (52.6%)	7 (63.6%)	0.79 (2)	0.675
Female	12 (40.0%)	8 (42.1%)	4 (36.4%)		
Nonbinary/fluid queer/gender queer	1 (3.3%)	1 (5.3%)	0 (0.0%)		
Sexual Orientation					
Straight	20 (66.7%)	12 (63.2%)	8 (72.7%)	1.29 (3)	0.731
Gay or Lesbian	2 (6.7%)	2 (10.5%)	0 (0.0%)		
Bisexual	5 (16.7%)	3 (15.8%)	2 (18.2%)		
Prefer not to answer	3 (10.0%)	2 (10.5%)	1 (9.1%)		
Race					
White	25 (83.3%)	15 (78.9%)	10 (90.9%)	1.29 (2)	0.524
Asian	2 (6.7%)	2 (10.5%)	0 (0.0%)		
Prefer not to answer	3 (10.0%)	2 (10.5%)	1 (9.1%)		
Hispanic or Latino	2 (6.7%)	2 (10.5%)	0 (0.0%)	1.29 (2)	0.524
Marital Status					
Single (never married)	26 (86.7%)	19 (100.0%)	7 (63.6%)	7.97 (1)	0.005
Married	4 (13.3%)	0 (0.0%)	4 (36.4%)		
Education level					
High School or equivalent	3 (10.0%)	1 (5.3%)	2 (18.2%)	3.60 (3)	0.308
Some college	14 (46.7%)	9 (47.4%)	5 (45.5%)		
Trade/Technical/Vocational training	1 (3.3%)	0 (0.0%)	1 (9.1%)		
Advanced degree	12 (40.0%)	9 (47.4%)	3 (27.3%)		
Employment status					
Full/part time	12 (40.0%)	5 (26.3%)	7 (63.6%)	6.14 (2)	0.046
Unemployed	7 (23.3%)	4 (21.1%)	3 (27.3%)		
Student	11 (36.7%)	10 (52.6%)	1 (9.1%)		
Houshold Income					
Less than $50,000	19 (63.3%)	11 (57.9%)	8 (72.7%)	0.66 (1)	0.417
More than $50,000	11 (36.7%)	8 (42.1%)	3 (27.3%)		
ECIG Use					
Duration of use (years)	3.38 (2.02)	2.34 (1.69)	4.59 (2.19)	-2.78 (28)	0.005
THC vaping	13 (43.3%)	11 (57.9%)	2 (18.2%)	4.47 (1)	0.034
More than one device type	3 (10.0%)	1 (5.3%)	3 (18.2%)	0.82 (1)	0.364
Cigarette smoking status[a]				1.93 (2)	0.381
Never	1 (3.3%)	1 (5.3%)	0 (0.0%)		
Ever	27 (90.0%)	16 (84.2%)	11 (100.0%)		
Current	2 (6.7%)	2 (10.5%)	0 (0.0%)		
Lifetime Cigarettes[b]					
<100 cigarettes	14 (51.9%)	13 (81.3%)	1 (9.1%)	**13.60 (1)**	**<0.001**
≥100 cigarettes	13 (48.1%)	3 (18.8%)	10 (90.9%)		

Bolded text represents significant results after FDR correction

[a]Categories are mutually exclusive (e.g. "ever" smokers do not include those who currently smoke)

[b]Includes only Ever smokers

Table 3. General and Device Type Frequencies

General Terms	'Electronic Cigarettes'	'E-cigarettes'	'E-cigs/ECIGs'	'Vapes'	'Electronic Nicotine Delivery Devices'	'ENDS'
Use this term	3 (10.0%)	5 (26.3%)	2 (10.5%)	22 (73.3%)	0 (0.0%)	0 (0.0%)
Also use this term	4 (13.3%)	6 (20.0%)	11 (36.7%)	6 (20.0%)	3 (10.0%)	2 (6.7%)
Never use this term	9 (30.0%)	4 (13.3%)	5 (16.7%)	0 (0.0%)	26 (86.7%)	27 (90.0%)
Never heard of this term	0 (0.0%)	0 (0.0%)	2 (6.7%)	0 (0.0%)	14 (46.7%)	24 (80.0%)
Device Pictures	**(1) Pen Style**	**(2) Pod Style (JUUL)**	**(3) Pod Style (NJOY)**	**(4) Mod**	**(5) Cig-alike**	**(6) Disposable**
Device Type						
Tank	7 (23.3%)	0 (0.0%)	1 (3.3%)	23 (76.7%)	0 (0.0%)	0 (0.0%)
Box Mod	1 (3.3%)	0 (0.0%)	1 (3.3%)	25 (83.3%)	0 (0.0%)	1 (3.3%)
Mod	5 (16.7%)	0 (0.0%)	3 (10.0%)	20 (66.7%)	0 (0.0%)	1 (3.3%)
Pod	3 (10.0%)	17 (56.7%)	16 (53.3%)	1 (3.3%)	1 (3.3%)	0 (0.0%)
Pod Mod	1 (3.3%)	5 (16.7%)	5 (16.7%)	2 (6.7%)	0 (0.0%)	1 (3.3%)
Pen	30 (100.0%)	4 (13.3%)	2 (6.7%)	0 (0.0%)	22 (73.3%)	4 (13.3%)
Cig-alike	3 (10.0%)	3 (10.0%)	1 (3.3%)	0 (0.0%)	21 (70.0%)	3 (10.0%)
Disposable	2 (6.7%)	10 (33.3%)	9 (30.0%)	0 (0.0%)	21 (70.0%)	27 (90.0%)
1st Generation	3 (10.0%)	1 (3.3%)	0 (0.0%)	1 (3.3%)	4 (13.3%)	0 (0.0%)
2nd Generation	1 (3.3%)	3 (10.0%)	1 (3.3%)	0 (0.0%)	2 (6.7%)	1 (3.3%)
3rd Generation	0 (0.0%)	1 (3.3%)	2 (6.7%)	2 (6.7%)	0 (0.0%)	1 (3.3%)
4th Generation	0 (0.0%)	0 (0.0%)	1 (3.3%)	2 (6.7%)	1 (3.3%)	0 (0.0%)
Individual Characteristics						
Cartridge	17 (56.7%)	10 (33.3%)	9 (30.0%)	2 (6.7%)	3 (10.0%)	5 (16.7%)
Rechargeable	17 (56.7%)	19 (63.3%)	18 (60.0%)	23 (76.7%)	7 (23.3%)	4 (13.3%)
Refillable	10 (33.3%)	3 (10.0%)	6 (20.0%)	26 (86.7%)	1 (3.3%)	0 (0.0%)
Variable Voltage	5 (16.7%)	1 (3.3%)	2 (6.7%)	21 (70.0%)	0 (0.0%)	1 (3.3%)
Liquid Storage Container Pictures	**(1) Pen Style**	**(2) Mod Style**	**(3) Cig-alike Style**	**(4) Pod Style**		
Pod	2 (6.7%)	0 (0.0%)	2 (6.7%)	28 (93.3%)		
Tank	4 (13.3%)	28 (93.3%)	2 (6.7%)	3 (10.0%)		
Cartridge	16 (53.3%)	0 (0.0%)	12 (40.0%)	8 (26.7%)		

[a]Pictures of devices and liquid storage containers are numbered according to the order presented to the participants. Device pictures were shown as a group and individually, while liquid storage container pictures were shown only as a group.

Table 4. General and Device Type Frequencies by User Device Type

General Terms	**'Electronic Cigarettes'**		**'E-cigarettes'**		**'E-cigs/ECIGs'**		**'Vapes'**		**'Electronic Nicotine Delivery Devices'**		**'ENDS'**	
	Pod Users	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**
Use this term (open-ended)	2 (10.5%)	1 (9.1%)	2 (10.5%)	3 (27.3%)	0 (0.0%)	2 (18.2%)	17 (89.5%)	5 (45.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Also use this term	2 (10.5%)	2 (18.2%)	5 (26.3%)	1 (9.1%)	7 (36.8%)	4 (36.4%)	2 (10.5%)	4 (36.4%)	2 (10.5%)	1 (9.1%)	1 (5.3%)	1 (9.1%)
Never use this term	6 (31.6%)	3 (27.3%)	3 (15.8%)	1 (9.1%)	3 (15.8%)	2 (18.2%)	0 (0.0%)	0 (0.0%)	16 (84.2%)	10 (90.9%)	17 (89.5%)	10 (90.9%)
Never heard of this term	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (10.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (36.8%)	7 (63.6%)	13 (68.4%)	11 (100.0%)
[a]Device Pictures	**(1) Pen Style**		**(2) Pod Style (JUUL)**		**(3) Pod Style (NJOY)**		**(4) Mod**		**(5) Cig-alike**		**(6) Disposable**	
	Pod Users	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**
Device Type												
Tank	2 (10.5%)	5 (45.5%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	13 (68.4%)	10 (90.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Box Mod	0 (0.0%)	1 (9.1%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	16 (84.2%)	9 (81.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (9.1%)
Mod	**0 (0.0%)**	**5 (45.5%)**	0 (0.0%)	0 (0.0%)	2 (10.5%)	1 (9.1%)	9 (47.4%)	11 (100%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)
Pod	1 (5.3%)	2 (18.2%)	14 (73.7%)	3 (27.3%)	12 (63.2%)	4 (36.4%)	1 (5.3%)	0 (0.0%)	0 (0.0%)	1 (9.1%)	0 (0.0%)	0 (0.0%)
Pod Mod	0 (0.0%)	1 (9.1%)	4 (21.1%)	1 (9.1%)	2 (10.5%)	3 (27.3%)	2 (10.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)
Pen	19 (100%)	11 (100%)	1 (5.3%)	3 (27.3%)	1 (5.3%)	1 (9.1%)	0 (0.0%)	0 (0.0%)	13 (68.4%)	9 (81.8%)	0 (0.0%)	4 (36.4%)
Cig-alike	1 (5.3%)	2 (18.2%)	1 (5.3%)	2 (18.2%)	1 (5.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (73.7%)	7 (63.6%)	2 (10.5%)	1 (9.1%)
Disposable	1 (5.3%)	1 (9.1%)	5 (26.3%)	5 (45.5%)	5 (26.3%)	4 (36.4%)	0 (0.0%)	0 (0.0%)	14 (73.7%)	7 (63.6%)	18 (94.7%)	9 (81.8%)
1st Generation	2 (10.5%)	1 (9.1%)	1 (5.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	2 (10.5%)	1 (18.2%)	0 (0.0%)	0 (0.0%)
2nd Generation	1 (5.3%)	0 (0.0%)	3 (15.8%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	1 (9.1%)	1 (5.3%)	0 (0.0%)
3rd Generation	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	2 (10.5%)	0 (0.0%)	2 (10.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)
4th Generation	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	0 (0.0%)	1 (5.3%)	1 (9.1%)	1 (5.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Individual Characteristics												
Cartridge	12 (63.2%)	5 (45.5%)	5 (26.3%)	5 (45.5%)	5 (26.3%)	4 (36.4%)	1 (5.3%)	1 (9.1%)	2 (10.5%)	1 (9.1%)	**0 (0.0%)**	**5 (45.5%)**
Rechargeable	8 (42.1%)	9 (81.8%)	14 (73.7%)	5 (45.5%)	**16 (84.2%)**	**2 (18.2%)**	14 (73.7%)	9 (81.8%)	4 (21.1%)	3 (27.3%)	1 (5.3%)	3 (27.3%)
Refillable	4 (21.1%)	6 (54.5%)	3 (15.8%)	0 (0.0%)	5 (26.3%)	1 (9.1%)	15 (78.9%)	11 (100%)	0 (0.0%)	1 (9.1%)	0 (0.0%)	0 (0.0%)
Variable Voltage	4 (21.1%)	1 (9.1%)	0 (0.0%)	1 (9.1%)	0 (0.0%)	2 (18.2%)	12 (63.2%)	9 (81.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (9.1%)
[a]Liquid Storage Container Pictures	**(1) Pen Style**		**(2) Mod Style**		**(3) Cig-alike Style**		**(4) Pod Style**					
	Pod Users	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**	**Pod Users**	**Mod Users**				
Pod	1 (5.3%)	1 (9.1%)	0	0	1 (5.3%)	1 (9.1%)	18 (94.7%)	10 (90.9%)				
Tank	0	4 (36.4%)	18 (94.7%)	10 (90.9%)	1 (5.3%)	1 (9.1%)	12 (63.2%)	2 (18.2%)				
Cartridge	12 (63.2%)	4 (36.4%)	0	0	6 (31.6%)	6 (54.5%)	2 (10.5%)	6 (54.5%)				

Bolded text represents significant results after FDR correction

[a]Pictures of devices and liquid storage containers are numbered according to the order presented to the participants. Device pictures were shown as a group and individually, while liquid storage container pictures were shown only as a group.

Table 5. Open-ended Common Themes and Quotations		
Concept and Common Themes	**Term(s)**	**Examples**
General term		
group/generic term		P7: "Definitely vape and just because I feel like it is more broad. Just because it does, like everything is, like everything's a little bit different like here like each device is different, like one is a pod system, one is a refill, one is just an e cigarette so I just feel like that all.You know, when it comes together it's all a vape, so I just feel like it's just easier just to classify them as vapes."
easier to use		P13: "The vape is you know it's so shortening of you know, electronic vapor cigarettes, you know it's just you know shortening shortening it all up to just vape."
word of mouth		P6: "Um I feel like that's just what i've grown up with like my me and everyone around them, have called them vapes like I know there's there's sometimes they're called E-cigs, but I feel like vapes is more of like a millennial answer."
Origin of terms		
friends/family use		P24: "I mean at that time I was younger but like my mom used to smoke. So she wanted to like quit smoking so she was interested in them, but I mean she knew way more than I, at that point so like I think she I mean i'm pretty sure I heard it from her. Instead of like real cigarette she want to reduce the amount of nicotine and that was like the starter like path I would say."
advertisements		P1: "Probably like the the advertisements on TV like from forever ago by e cigarettes. Being like maybe slightly healthier than like smoking, but that was forever unless before they really got popular maybe like 2015 2016."
school		P9: "In high school probably like my sophomore junior year people started talking about them and they were on social media more. And then, when I got to college and around that time, like in high school, I would say, people used E cigs more, but when I got to college, it was everybody was talking about vapes."
Device type description		
pen-style device		
not for nicotine	dab pen, vape pen, cannabis or delta 8 vaporizer, cartridge devce	P2: "That's a dab pen. um it's usually used for thc extract.Umm, the reason I can tell its a dab pen it's because it's got the glass top on it right there they usually go with the DAB liquid then it would burn"
shape	vape pen, electronic cigarette, tank, cartridge	P12: "Probably electronic cigarette just because of the shape. I feel like that most times I've seen somebody market it as an electronic cigarette its had a similar shape and design to something like that."
pod-style device (JUUL)	JUUL	P28: "Probably call that a JUUL. There's a you know, one of that kind of design is the one that well actually just recently got banned actually from what I come to understand anyway, since that was the more marketed one, at least in like storefronts like traditional stores like seven eleven's or convenience stores so I wouldn't categorize that as a JUUL because you don't really see those devices in your traditional vape shops."
pod-style device (NJOY)		
brand name	NJOY	P10: "NJOY just because I remember these became popular probably freshman year of college, so like 2019-2020ish and I know this one more just because, like my boyfriend and like a few of my friends have an NJOY."
general term/unfamiliar	vape, ecig, disposable	P15: "I've never used it. it kind of looks like a juul I guess, I think. i'm not really sure I had never, never seen a juul, I went straight to vape shops when I started so vape or ecig."
mod-style device (no prominent theme)		
unfamiliar/general term		P12: "Probably just vape. I feel like um, I don't know that's the only term is or commonly that like applies that one in particular."
more features/customizable		P28: "This is the one i'm most familiar with this is a MOD a tank system, a sub Ohm atomising a vaporizer. So with this one you got that tank portion with this, you have a lot more customizable features on it, you can change the wattage, how hard the vape actually hits and stuff like that. This is where you would get more advanced vapers would want to get into these you know because ones from before those are more for beginners or people who don't really want to think too much about how they're vaping. With this one, this is where you can really get into customizing it yourself your own personalization when it comes to your vaping experience."
appearance/shape/size		P5: "A vape, but kind of like a box mod sometimes too because they're so big. They look like a box."
cigalike device		

shape	pen, ecig, ecigarette	P14: "Again I probably say vape but if there was another term I probably say E CIG and I think that's just because of the shape. I think it like the fact that it's kind of like emulating like the cylindrical like cigarette shape is probably what makes me think I would say ECIG more often for this one."
appearance	disposable, pen, ecigarette	P21: "Appears to be another disposable and it just it looks like one of oh God, what were those called the one that had the blue tip on it. I don't remember what that one was called, it was like one of the first ones. And that was one where again you hit it until it was done and then you threw it away."
disposable device		
brand name	Puffbar	P5: "That one kind of looks like a juul too but it doesn't have a pod in it. Like oh um those look like the old PuffBars so a PuffBar. The flat ones with arrows on top yeah that's what that is... Like if I know what brand it is i'm going to call it that, over a nic stick or a vape."
general term/unfamiliar	ecig, vape, generic version of a JUUL	P22: "Don't know this is the trickiest one I think we talked about the one that looked almost like that I don't really know I don't know that i've really messed, with many that look like that. I don't really know that I guess, I would just call that an ecig as well you know or portable device I don't know that's the one that I haven't really messed with much that style."
Pod		
replaceable/not refillable		P13: "I would say the defining characteristics of a pod would be you change out the container. It's, the pod is a container that holds that the vape juice that you change out, dispose, when the juice in the old cartridge or old pod cartridge container is is finished, that would be the defining characteristic."
prepackaged		P26: "The pods are going to have the coils that are already pre installed into it, and so you cannot remove the coil you cannot change it, change your cotton, change your wiring, find new ones anything like that, so the picture the image on the far right, that is a pod because you have to keep buying those the whole unit itself, and then they also don't use traditional E juice, like this one, they use salt nicotine, which is a lot smaller bottle higher nicotine concentrate but, like this one is six milligrams of nicotine salt nicotine, you get a minimum of 12 milligrams of nicotine because it only takes a tiny little bit and it doesn't let off a huge cloud of vapor so people who work in office settings oh my God, I have so many co workers that were using those to sit in their cubicle and you couldn't tell."
specific appearance		P18: "Pod, I think of a more rectangular shape. I mean it's just a refill for your vape, that's just what I associate with it."
Tank		
refillable & customizeable		P26: "Refillable, so it has a refillable glass you put your own coil into it, you fill it with the juice and so it's multiple pieces to make one whole unit, as opposed to the pod system"
larger		P8: "Um when I think of a tank, I think of one of those like boxy vapes and I would think that would be a tank because it's a lot bigger, like pod compared to like tank, you know."
holding more liquid		P20: "If I heard that I might think it last long. It has more puffs and more liquid as well, so it has to be bigger now."
Cartridge		
other substances		P3: " I think cartridges when I think of them I just think of thc like you know marijuana vapes that's where I see them commonly used so that is what I would consider a cartridge."
disposable/not refillable		P16: "Um you know the cartridges would definitely be the first would be the first entry there and a cartridge is basically as far as I know, a type of tank that's made to also be disposable. Yeah it's sort of you screw it on you know you use it, you throw it out when you're done, so I would yeah I would generally consider a cartridge to be sort of disposable tank."
Similarities		
all hold liquid		P17: "They all hold a liquid that will turn into vapor they all have, one way or another, a coil or method and them to heat it up and they all need to have power from a battery."
needs refilled/replaced		P11: "All three of them are generally refillable or are tanks, as opposed to like what they call a dripable atomizers where you'd have to apply the juice every single time"
Differences		
refillable vs. disposable		P30: "The one uh second from the left, and furthest right are refillable, so that would make them different from the other two, because the one on the left and the one on the second from the right is, those are typically disposable."
contents of liquid		P24: "That like I cannot talk about a tank, because I don't know like exactly what it is, but cartridge and pods for me to say, I mean there's still like electronically device but for me one is like let's say weed and the other one is nicotine."
duration of use		P1: "What we see to the right in the pod that's not going to be used for long maybe might get a few uses. I'm sure i'm sure that that looks like it's refillable but it's not going to last for more than maybe a month or two. The tank that is refillable E juice, that can last you a lifetime and then the cartridge that'll last you, depending on, you know how much you use it, a couple weeks, you know week or two weeks it's going to be thrown away."

Table 6. Personal Device and Use Behavior Frequencies

	Total (N=30)			Pod/disposable users (N=19)			Mod users (N=11)		
	Yes	No	DK	Yes	No	DK	Yes	No	DK
Personal Device									
Mix flavors	2 (6.7%)	28 (93.3%)	0 (0.0%)	1 (5.3%)	18 (94.7%)	0 (0.0%)	1 (9.1%)	10 (90.9%)	0 (0.0%)
Switch flavors	8 (26.7%)	22 (73.3%)	0 (0.0%)	6 (31.6%)	13 (68.4%)	0 (0.0%)	2 (18.2%)	9 (81.8%)	0 (0.0%)
Refillable	12 (40.0%)	18 (60.0%)	0 (0.0%)	**1 (5.3%)**	**18 (94.7%)**	**0 (0.0%)**	**11 (100%)**	**0 (0.0%)**	**0 (0.0%)**
Refillable when purchased	11 (36.7%)	1 (3.3%)	0 (0.0%)	1 (100%)	0 (0.0%)	0 (0.0%)	10 (90.9%)	1 (9.1%)	0 (0.0%)
Disposable	11 (36.7%)	19 (63.3%)	0 (0.0%)	11 (57.9%)	8 (42.1%)	0 (0.0%)	0 (0.0%)	11 (100%)	0 (0.0%)
Typical nicotine concentration	20 (66.7%)	8 (26.7%)	2 (6.7%)	16 (84.2%)	2 (10.5%)	1 (5.3%)	4 (36.4%)	6 (54.5%)	1 (9.1%)
Nicotine salt	6 (20.0%)	13 (43.3%)	11 (36.7%)	**6 (31.6%)**	**3 (15.8%)**	**10 (52.6%)**	**0 (0.0%)**	**10 (90.9%)**	**1 (9.1%)**
Adjustable power	11 (36.7%)	18 (60.0%)	1 (3.3%)	**1 (5.3%)**	**17 (89.5%)**	**1 (5.3%)**	**10 (90.9%)**	**1 (9.1%)**	**0 (0.0%)**
Use Behaviors									
Regular users	29 (96.7%)	0 (0.0%)	1 (3.3%)	18 (94.7%)	0 (0.0%)	1 (5.3%)	11 (100%)	0 (0.0%)	0 (0.0%)
Addicted	24 (80.0%)	4 (13.3%)	2 (6.7%)	15 (78.9%)	3 (15.8%)	1 (5.3%)	9 (81.8%)	1 (9.1%)	1 (9.1%)
Vape when sick	19 (63.3%)	8 (26.7%)	3 (10.0%)	15 (78.9%)	4 (21.1%)	0 (0.0%)	4 (36.4%)	4 (36.4%)	3 (27.3%)
Previous quit attempts	18 (60.0%)	12 (40.0%)	0 (0.0%)	14 (73.7%)	5 (26.3%)	0 (0.0%)	4 (36.4%)	7 (63.6%)	0 (0.0%)
Experience withdrawal effects	15 (83.3%)	3 (16.7%)	0 (0.0%)	12 (85.7%)	2 (14.3%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	0 (0.0%)
Used pharmacotherapy to quit	3 (16.7%)	15 (83.3%)	0 (0.0%)	2 (14.3%)	12 (85.7%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)
Vape THC	2 (6.7%)	28 (93.3%)	0 (0.0%)	1 (5.3%)	18 (94.7%)	0 (0.0%)	1 (9.1%)	10 (90.9%)	0 (0.0%)
Tried synthetic nicotine	3 (10.0%)	7 (23.3%)	20 (66.7%)	2 (10.5%)	1 (5.3%)	16 (84.2%)	1 (9.1%)	6 (54.5%)	4 (36.4%)
Quit if device banned	5 (16.7%)	21 (70.0%)	4 (13.3%)	1 (5.3%)	14 (73.7%)	4 (21.1%)	4 (36.4%)	7 (63.6%)	0 (0.0%)
Quit if flavor(s) banned	7 (23.3%)	23 (76.7%)	0 (0.0%)	6 (31.6%)	13 (68.4%)	0 (0.0%)	1 (9.1%)	10 (90.9%)	0 (0.0%)

DK indicates participants who reported they did not know the answer to the question being asked

Bolded text represents significant results after FDR correction

Table 7. Open-ended Personal Device and User Behavior Common Themes and Quotations	
Concept and Common Themes	**Examples**
Own device term	
generic term	P22: "Uh yeah this is, you know I know they call it a MOD box. I just call it i'm grabbing my vape. Just a generic word that I use I guess for catch all but you know I know they call these a MOD box, which you know it's just I don't understand why people would want to modify it, but I know that's what they call them maybe I would just refer to it as the box, more than a MOD."
brand name	P4: "Just the juul I mean there's really only one."
device features	P11: "I guess, I would just call it a rechargeable disposable vape that's yeah and that's that's just because it doesn't have a removable pod system and it is both disposable and rechargeable."
Typical concentration	
popular at stores	P8: "Every time I go into a vape store like I notice every pod, I guess, they're usually 5% so."
typical unless quitting	P10: "For like juuls and njoys I feel like there are, there's like 5% and then there's like 2.5 or 3% but I really never hear anyone using those unless they're like trying to quit quickly, but other than that it's only been like 5%."
higher than average	P2: "Um I feel like most people most vapes around, most vapes in general, usually do not have as high as six percent like disposables at least so probably not and most re-, most refill ones use salt nic"
no typical, everyone is different	P29: "There is no typical nicotine concentration for any user, because the devices vary wildly based on the ohms. So the older devices, you know back in the day, the little pens that didn't produce any vapor. I used 12 milligrams of nicotine liquid with those because and sometimes we would literally drip you know you take the top off and you drop it in there, and you weren't using very much vapor, so the 12 milligrams was like a weak cigarette these produce a lot of vapor. I even have this turned down, but they produce a lot of vapor and so because there's more liquid being used, you need to have a lower nicotine content."
Flavors	
	P11: "This device, because these are disposable they only contain one flavor this one currently I believe is bananas and cream which it does taste like bananas and cream... I usually jump around flavors a lot otherwise there's sort of like a weird phenomena that occurs with flavors every time and this holds true for most types of flavors for e cigarettes and vaporizers it's almost like i'm like a taste blindness to it like a you know how you have like an attentional blindness like if you stare some if you start the same thing for a really long time."
	P3: "I use menthol flavored stuff so it's like a strawberry menthol icy type juice and I normally just stick to one I don't branch out I just always get the same one"
	P28: "Well, there is a giant Rainbow like array of variety when it comes to flavors so typically there's two kind of flavor profiles I go after either a berry flavor or a fruity flavor. I do like to explore and try to taste more of what they have available if there's a new flavor at a shop they'll say hey throw it in the bag let's give it a shot and see if I like it. They do come up with some pretty interesting flavors like a apple fritter which kind of blew my mind sure hey you can make any kind of flavor."
Adjusting power levels	
getting a new device/coil	P26: "No I only adjust it based off of the coil types like these particular coils that I have here they do best at 70 to 80 Watts...which they actually have a safety feature whenever you put a new coil it auto adjusts it."
getting a new flavor	P21: "depends on the juice um with the one that i'm using now the fruit loops I have it on 20, yeah have it on 20 Watts, but if I use like my watermelon I have to kick it up to 25 so it really depends, it depends on the flavor and the flavor profile."
adjusting throughout the day	P16: "um I go somewhere around 75 Watts because that's what i'm familiar with, sometimes it goes higher or lower mainly depending on if i've accidentally adjusted it in my pocket and don't feel like turning it down or if I feel like it my, it hits to weak I might dial it up a little bit by I try to keep it around 75."
Important characteristic	

flavor	P5: "Flavor, I don't know anything about making it or what comes in it my body, just likes it so i'm like okay like i'll give something that I like."
nicotine concentration	P26: "Well let's see well definitely the six milligrams of nicotine for me because when I quit smoking, I had smoked for 14 years or whatnot. So I tried going to the three milligrams of nicotine and that no no that's that's not me can't do it but the 6 milligrams of nicotine that is very important to me like i've actually left vape shops before when they said oh i'm so sorry we only have it in three milligrams i'm like okay i'm good"
flavor & concentration	P14: "I would say, one is flavor just because it's the most like apparent when you use it number two is probably concentration um just because again that's something that's going to be pretty apparent when you're using the product."
First use	
high school	P8: "Um, well they started becoming popular around like 2018, I think, and I was in high school at the time, everyone was doing it, and so one of my friends was like oh just try it. So I tried it, and then I eventually was like everyone has one and I don't, so I eventually bought one myself because I was like I wanna be cool, but now i'm addicted so."
friends	P13: "My brothers were having a bonfire bunch of their friends were over and a bunch of their friends also either smoked cigarettes or had a vape and I was out there and then. You know it's just I was like oh hey you know someone's like oh hey you want to hit and it's like all right yeah sure you know round a bonfire with bunch of Dudes you know they're all doing it so yeah might as well."
to stop smoking/other tobacco	P29: I had wanted to stop smoking and I looked online and the safe cig company had come out with a cigarette shaped battery with the cartridge on the end and I ordered one tried it out and I liked it."
Frequency of use	
use throughout the day	P7: "When you asked if I do it like constantly throughout the day or if it's like one of those like you know if it's like a session or not just because you know, it's one of those things. I always have it on me so it's always in my hand, it's always on my person, so it's one of those things where if I feel it i'm usually probably going to end up hitting it so."
daily amount of puffs/hits	P12: "Um probably puffs just because that's I guess easiest that was easy for me to count and then e liquid was the hardest, I feel like that also depends on the method where, if you had if you were refilling something you might measure that in e liquid and if you're buying a new one, you were just measure that in disposables."
Regular user definition	
daily use	P25: "Someone that probably uses a vape every day."
multiple uses daily	P19: "Regular user is a person, that use so frequently this equipment, for example, a person that you use every day and the different times along the day."
Information source	
vape/smoke shops	P15: "I think, just the local vape shops and then, my friend kind of pointed me towards different battery sources online and places that have deals."
friends/social gatherings	P18: "You know I don't try to learn that much but say I'm in my frat house or something like that and there's multiple people vaping you know hear a lot of different slang for what you call it device and yeah."
Withdrawal effects	
	P6: "I think the biggest thing when I stop is I get like really like angry, like I just have like random like mood swings. I get headaches and I just crave like I just need something. I think it's also like an oral fixation where I just like need to be doing something so they are not too pleasant. um sometimes I break out, like my skin. But just the headaches, mood swings, and sometimes I break out too. Thats about it. Sometimes weight gain because I feel like I'm eating more when I don't have anything to hit."
	P18: "yeah you get some side effects uhh you know the headaches. Pretty irritable. It's been a while, since i've tried to quit but basically you feel a little sick for a few days, basically time to calm it down, headaches, a lot of cravings, lot of irritability."

Figure 1. ECIG device type images used in participant interviews

Figure 2. Liquid Storage container images used in participant interviews

1 **2** **3** **4**

Appendix A

Screener

1. Do you speak English?
    a. Yes
    b. No
2. Do you currently live in the United States?
    a. Yes
    b. No
3. What is your age in years? _____
4. Have you ever smoked a cigarette, even one or two puffs, in your lifetime?
    a. Yes
    b. No
5. If yes, do you consider yourself a regular cigarette smoker?
    a. Yes
    b. no
6. If yes, on average how many cigarettes do you smoke in per day?
    a. _____
7. If yes, approximately how many months have you been smoking that number of cigarettes per day?
    a. _____
8. If no, approximately how many cigarettes have you smoked in your lifetime? (there are 20 cigarettes in a pack) _____
9. Have you used an ecig/vape containing nicotine in the past 30 days?

a. Yes

b. No

10. If yes, for how long have you used an ecig/vape? Respond in months or years

_____

11. If yes, over the past 3 months, approximately how many days per week have you used?

a. 1-3 days per week

b. 4-7 days per week

Demographics

1. What gender do you most identify with?

a. Male

b. Female

c. Transgender

d. Nonbinary/fluid queer/gender queer

e. Other

f. I prefer not to answer

2. If other, please describe: _____

3. What sexual identity do you most identify with?

a. Straight/Heterosexual

b. Gay or Lesbian

c. Bisexual

d. Other

e. I prefer not to answer

4. If other, please describe: _____

5. What is your ethnicity?
    a. Hispanic or Latino
    b. Not Hispanic or Latino
    c. I prefer not to answer
6. What is your race?
    a. American Indian or Alaska Native
    b. Asian
    c. Black or African American
    d. Native Hawaiian or Pacific Islander
    e. White
    f. Other
    g. I prefer not to answer
7. If other, please describe: _____
8. What is your marital status?
    a. Single (never married)
    b. Married
    c. Widowed
    d. Divorced
    e. Separated
9. What is your highest level of education completed?
    a. Some high school
    b. High school diploma or equivalent (e.g., GED)
    c. Some college

d. Trade/technical/vocational training

e. Associate degree

f. Bachelor's degree

g. Advanced degree (e.g., Master's Professional, or

h. Doctorate degree)

10. Are you currently...?

a. Employed full time

b. Employed part time

c. Unemployed

d. Homemaker

e. Student

f. Military

g. Retired

h. Unable to work

11. What is your household income?

a. Less than $20,000

b. $20,000 to $34,999

c. $35,000 to $49,999

d. $50,000 to $74,999

e. $75,000 to $99,999

f. Over $100,000

Device Characteristics

12. Do you ever use e-cigs/vapes containing THC, or synthetic cannabinoids?

a. Yes

b. No

13. If yes, when you vape, which of the following substances do you vape most often?

a. Nicotine

b. THC / CBD / synthetic cannabinoids (e.g. K2, spice)

c. I don't know

14. How many device types of nicotine containing e-cig/vape devices do you use on a normal day?

a. One device

b. Two or more devices

15. For the following questions, please answer based on the device that you use most often to vape nicotine. If you use more than one type of device to vape nicotine, think about the device that you prefer the most. The following questions do not refer to any cannabis/marijuana or aromatherapy.

16. What brand of e-cig/vape do you use most often? _____

17. Of the following images below, which is the most similar to your device?

a. 1

b. 2

c. 3

d. 4

e. 5

f. 6

1 2 3 4 5 6

18.

If use more than one:

19. If you use more than one device type containing nicotine daily: For the following questions, please answer based on the nicotine-containing device you use second most often. The following questions do not refer to any cannabis/marijuana or aromatherapy

20. What brand of e-cig/vape do you use second most often?

    _____

21. Of the following images below, which is the most similar to your device?

    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6

1 2 3 4 5 6

22.

23. Please leave your email address if you would like to be contacted for further participation in this study _____

Appendix B

Key Information for:
Assessment of Electronic Cigarette User Terminology and Knowledge

You are being asked to participate in the research described below. This page provides key information that may help you to make this decision; more detailed information can be found after this section.

Why is this research being done and what is involved?

The purpose of the study is to assess electronic cigarette (ECIG) knowledge and terminology among individual ECIG users.

As a participant, you will be asked to participate in a semi-structured interview. This interview will be approximately one hour long and will be completed online via zoom. The interview will consist of open- and closed- ended questions about ECIG devices, characteristics and use behaviors. During the interview, you will also be asked to present your ECIG device and liquid on camera. The audio and video of the interview will be recorded for further analysis.

Do I have to participate and what are the risks involved?

Participation in this research study is completely voluntary and you are free to withdraw from the research at any time. If you do not wish to participate, please discuss alternatives with the researcher or refer to the "Alternatives" section in the consent form. You may or may not directly benefit from participating in this research.

Risks from participation in this study include possible discomfort from questions asked regarding your knowledge and opinions surrounding electronic cigarettes. If you find any effects or data collection procedures unacceptable, you may stop your participation at any time.

Who can I talk to if I have questions or concerns?

If you have any questions or concerns about this research or would want to withdrawal from the study, you can contact Dr. Melissa Blank at (304) 293 0551 from the Dept. of Psychology at West Virginia University.

For more information, please see the Informed Consent Form.

Informed Consent for Research | Minimal Risk

Principal Investigator (PI) |	Dr. Melissa Blank
Department |	Psychology
Co-Investigator(s) |	Margaret Childers, Ashley Douglas, and Andrea Milstred
Sponsor or Funding Source |	Departmental funding for completion of master's thesis
WVU IRB Protocol # |	2108379831
Study Title |	Assessment of Electronic Cigarette User Terminology and Knowledge

Introduction

You have been asked to participate in this research study, which has been explained to you by an authorized member of the research team. This research is being conducted to fulfill the requirements for a master's thesis in Behavioral Neuroscience from the Department of Psychology at West Virginia University. This research is being conducted under the supervision of Dr. Melissa Blank, PhD.

Purpose

The purpose of this study is to use open- and closed- ended questions to gather a better understanding of the knowledge and terminology of ECIGs among ECIG users. WVU expects to enroll approximately 30 subjects. A total of approximately 30 subjects, at all sites, are expected to participate in this study.

Description of Procedures

As a participant, you will be asked to participate in a semi structured interview. This interview will be approximately one hour long and will be completed online via zoom.

All interviewers will follow an interview guide. Once the interview begins, participants will be reminded of the interview guidelines and asked to retrieve their ECIG device(s) and liquid(s) if needed. You will also be reminded that participation is voluntary, and you are free to leave at any time.

During the scheduled interview, you will be asked a series of questions about you understanding of various ECIG device and liquid characteristics. You will also be asked questions about their knowledge of their own ECIG device(s) and liquid, and their use behaviors. During this portion of the interview, you will be asked to show their own ECIG products on camera. Overall, the interview will include a mix between open- and close-ended questions.

The study team member conducting the interview will record your answers to close-ended questions on a secure Redcap link, and the transcript of the interview will be recorded and saved via Zoom.

The interview will conclude by thanking you for your participation and rewarding you via a $50 amazon gift card that is delivered electronically to your provided email address.

Risks and Discomforts

Risks from participation in this study include possible discomfort from questions asked regarding your knowledge and opinions surrounding electronic cigarettes. If you find any effects or data collection procedures unacceptable, you may stop your participation at any time.

In addition, there is always the risk of uncommon or previously unknown side effect(s) or event.

Alternatives

You do not have to participate in this study.

Benefits

You may or may not directly benefit from participating in this research. The knowledge gained from this study may eventually benefit others.

Financial Considerations

You will be compensated $50 for one interview.

If you do not complete the study, you will be compensated only for visits you do complete.

For information regarding the method of payment, contact the Principal Investigator.

You may be asked to provide their Social Security Number and verification of U.S Citizenship or Permanent Resident Status to receive payment. Your information may be provided to the appropriate parties for billing and/or payment purposes. Please be advised that any compensation received for participation in a research study, including a gift card, is considered taxable income and must be reported to the Internal Revenue Service (IRS).

Your data, health information, research results, or any and all other information related to this research study used in this research study may contribute to a new discovery or treatment. In some instances, your data, your health information, your research results, your specimens, these discoveries or treatments, or any other information related to this research study, even if identifiers are removed, may be of commercial value and may be sold, patented, or licensed by the investigators and West Virginia University for use in other research or the development of new products. You will not retain any property rights, nor will you share in any money or commercial profit that the investigators, West Virginia University, or their agents may realize.

Confidentiality

Any information about you that is obtained as a result of your participation in this research will be kept as confidential as legally possible. Your research records and test results, just like hospital records, may be subpoenaed by court order or may be inspected by the study sponsor or federal regulatory authorities, including the Food and Drug Administration (FDA), without your additional consent.

In addition, there are certain instances where the researcher is legally required to give information to the appropriate authorities. These would include mandatory reporting of infectious diseases, mandatory reporting of information about behavior that is imminently dangerous to you or to others, such as suicide, child abuse, etc.

Audiotapes or videotapes will be kept locked up and will be destroyed as soon as possible after the research is finished.

In any publications that result from this research, neither your name nor any information from which you might be identified will be published without your consent.

Identifiers might be removed from the identifiable private information or identifiable biospecimens and that, after such removal, the information or biospecimens could be used for future research studies or distributed to another investigator for future research studies without additional informed consent.

Voluntary Participation

Participation in this study is voluntary. You are free to withdraw your consent to participate in this study at any time. If you choose to withdraw your participation from the study, the data collected on you up until that time remains a part of the study database and may not be removed. No additional information will be added to the study database after your withdrawal.

Refusal to participate or withdraw will not affect your class standing or grades and will involve no penalty to you.

Refusal to participate or withdraw will not affect your future care or status at West Virginia University.

In the event new information becomes available that may affect your willingness to participate in this study, this information will be given to you so that you can make an informed decision about whether or not to continue your participation.

Contact Persons

If you have any questions, concerns, or complaints about this research, you can contact Dr. Melissa Blank and all co-investigators of this project at 304-293-0551.

If you are hurt from being in this research, you should contact Dr. Melissa Blank at 304-293-0551. If injury occurs outside of business hours and is related to your participation in this research, please contact Dr. Blank at (304) 906-8109.

For information regarding your rights as a participant in research or to talk about the research, contact the WVU Office of Human Research Protection (OHRP) at (304) 293-7073 or by email at IRB@mail.wvu.edu.

Future Contact

Future research may be conducted for which you are eligible. If you are interested in being contacted for future research, please indicate so by completing this section.

☐ Yes, I want to be contacted if future research studies, for which I am qualified, become available.

☐ No, I **do not** want to be contacted if future research studies, for which I am qualified.

Signatures

You have been given the opportunity to ask questions about the research, and you have received answers concerning areas you did not understand. Upon signing this form, you will receive a copy.

Participant Signature

I willingly consent to participate in this research.

Signature of Subject or Subject's Legal Representative

Printed Name Date

Consenting Individual Signature

The participant has had the opportunity to have questions addressed. The participant willingly agrees to be in the study.

Signature of Person Obtaining Informed Consent

Printed Name Date

Appendix C

Thesis Semi Structured Interview Guide

Reminder:

- Confirm contact information and reconnection instructions of a google meets link in case of zoom disconnection
- Begin recording the meeting and remind the participant you are doing so along with confirming their consent to be recorded
- Confirm consent to participate vie recap link
- Remind participant to keep their camera on for the duration of the interview

Total time required:

60 minutes *(without informed consent & incentive disbursement processes)*

Introduction (5 minutes)

Greet participants, review the informed consent form and process with the participant verbally, and inform them that we will send them a copy of their consent form via email.

Facilitator introduction

"Welcome and thank you for taking the time to meet with me today. My name is _____ and I am the _____ for the West Virginia University study _____. You have already received a consent form and provided your consent via email, but I will answer any questions you have before we begin the interview. Remember, taking part in this research is entirely voluntary. You may choose not to take part or stop at any time. The possible risks of participating are minimal.

As the facilitator for today's interview, my job is to make sure that we get through our interview and keep to the time slot discussed. I will be taking notes along the way and as stated before, I will also be recording the interview to help us remember what we talked about and to ensure that the record of the discussion is accurate. Our discussion will take approximately **60 minutes,** and everything discussed today will remain confidential. You are free to leave the interview at any time; however, if you do not remain present for all questions you will not receive payment for participation. Your answers may be used in a report for publication, but your name will not be included. Please feel free to ask any questions or make additional comments you have throughout the interview. "

Introduction:

"I will now be asking you a series of questions. Please try to answer the questions to the best of your abilities. You will not be penalized for incorrect or incomplete responses, and it is okay to respond "I don't know" to any of the following questions. You may be asked at times to elaborate further on an answer provided. We are simply interested in understanding your thoughts about electronic cigarette products."

General ECIG Questions

- {Pull up screen with group picture of device types}
  "*What are some terms or names you would use to describe these products in general / as a group?*"
  "*If you could choose only one term to describe these products, which would you choose and why?*"

- {Pull up screen with list of terms}
  "*Here is a list of terms that some people use to describe these types of products.*"
  a. "*Are there any terms or names shown here in that you use but forgot to include in your last answer?*"
  b. "*Are there any terms or names shown here that you would never use?*"
  c. "*Are there any terms or names shown here that you have never heard of?*"
  d. "Where did you originally hear these terms being used?"

Electronic Cigarettes
E-cigarettes
E-cigs/ECIGs
Vapes
Electronic Nicotine Delivery Devices
ENDS

Specific ECIG Types Questions

1. {Each of the device types shown in the below picture will be presented individually, for a total of six pictures.}
   "*I will now show you different pictures of electronic cigarette devices. For each picture, please tell me any terms/names that you use to describe the device shown. Please try to be as specific as possible and please explain why you chose that term or terms."*
   a. Picture 1: Tank device
   b. Picture 2: Pod device (e.g. JUUL shape)
   c. Picture 3: Pod device 2 (e.g. NJOY Ace shape)
   d. Picture 4: Mod device
   e. Picture 5: Cigalike device
   f. Picture 6: Disposable device

2. {Each of the device types shown in the below picture will be presented individually, for a total of six pictures. Included with each picture will be the list of terms shown below.}
   "*I will now be showing you another series of pictures. With each picture, there will be a list of words presented. From the list, please tell us which terms or names you believe accurately describe the electronic cigarette device shown and please explain why you chose that term or terms.*"
   a. Picture 1: Tank device
   b. Picture 2: Pod device (e.g. JUUL shape)
   c. Picture 3: Pod device 2 (e.g. NJOY Ace shape)
   d. Picture 4: Mod device
   e. Picture 5: Cigalike device
   f. Picture 6: Disposable device

- 

Tank	Box Mod
Mod	Pod
Pod Mod	Pen
Cigalike	Disposable
Cartridge	Rechargeable
Refillable	Variable Voltage
1st Generation	2nd Generation
3rd Generation	4th Generation

- {Pull up screen with group picture of device liquid containers}

3. "*When you hear the term "pod", what does that mean to you? What makes it a 'pod'?*"

    a. *"Of the images shown, which of them would you identify as a pod?"*

4. *"When you hear the term 'tank', what does that mean to you? What makes it a 'tank'?"*

    a. *"Of the images shown, which of them would you identify as a tank?"*

5. *"When you hear the term 'cartridge', what does that mean to you? What makes it a 'cartridge'?"*

    a. *"Of the images shown, which of them would you identify as a cartridge?"*

6. *"How specifically do you consider these the same?"*

7. *"How do you consider them different from each other?"*

Probe question: "How did you come up with the answer to this question? Was it easy or difficult to answer?"

8. *"When you talk about your device liquid with family, friends, or others, what term or label do you tend to use?"*

9. *"What do you call the liquid after it has been inhaled and later expelled from your mouth?"*

    a. *If further probing is needed, "For example, do you use terms such as aerosol, cloud, and/or vapor?"*

Personal ECIG Device Questions

"*I'd now like to ask you some questions about your own personal ECIG devices. As a reminder, please answer these questions regarding the devices you use for nicotine consumption, unless otherwise specified in the question. Can you show me all the devices that you own?*"

{For participants who own >1 type, ask which device type is their preferred (i.e. the one used most often). Begin with the preferred device type. Repeat all questions for second preferred device type.}

"*For the questions that I'm now going to ask you, I want you to think about your X (specify to participant which device you will be discussing) device. Only think about that particular device when answering these questions.*"

1. "*What term/name do you use to refer to that specific device type and why?*"

    a. "*Are there any other terms/names that you use for that device?*"

Probe question: *"How did you come up with the answer to this question? Was it easy or difficult to answer?"*

2. "*Do you know the brand of that particular device?*"

3. *"Are there other brands for that particular type of device that you can name?"*

4. *"Think about the company or store that sells this product. What is the name or label that is used by the seller to describe your device type?"*

5. *"What flavors do you use?"*

    a. "Do you mix flavors?"
    b. "Do you switch flavors throughout the day?"

6. "*Is that device refillable in that you replace the liquid as needed?*"

    a. If YES "*Please describe how you refill the liquid for that device using as much detail as possible*"

    b. If YES "*Was the device refillable when initially when purchased or was it modified to be refillable afterwards*?"

7. "*Is that device disposable in that you throw out the entire device once all of the liquid has been used?*"

8. "*Do you know the nicotine concentration for the liquid that you use for that device?*" {If they don't provide a unit of measurement, prompt for an answer (e.g. milligram, percent).}

    a. *"Do you consider this concentration level to be typical for yourself? Compared to other users? Why or why not?"*

Probe question: "*Were these questions about concentration easy or difficult for you to answer? Why?"*

9. "*Do you know if the liquid for that particular device uses a nicotine salt?*"

    a. If YES, "*What do you know about nicotine salt? How is it different from other types of nicotine?*"

10. *"Have you ever used synthetic nicotine products?"*

11. "*What all do you know about synthetic nicotine?"*

12. "*For the liquid for that device, do you know how much propylene glycol and/or vegetable glycerin is included, or what is called PG and VG?*"

    a. If YES, "*Do you have a preference to that specific ratio? Why or why not?"*

13. *"Of all the different characteristics of the liquid that we just talked about, which ones are most important to you and why?"*

14. "*For that particular device, can you adjust/change the power level?*"

    a. If YES "*What power level do you typically use for that particular device?*"

        i. *"Do you often increase or decrease the power level? How do you decide when to increase or decrease"*

    b. If NO/I DON'T KNOW "*Do you know at what power level that particular device is set at?*" {if not stated prompt for knowledge of unit of measurement}

c. *"Can you tell me anything about the coil in this device?"*

d. {prompt for more information about power, voltage, and resistance if participant appears knowledgeable of these features and the device accommodates them} *"What else can you tell me about the voltage and resistance of your device?"*

Probe question: "*Were these questions about power easy or difficult for you to answer?"*

15. {Repeat all personal device questions for second device if applicable}

User Behavior Questions

"*The final set of questions ask about your use of these devices, rather than the devices themselves. Again, as a reminder, please answer these questions regarding use of your devices for nicotine consumption, unless otherwise specified in the question*"

1. *"To the best you can remember, how did you first start using ECIGs/vapes?"*
    a. *"Where did you first hear of an ECIG/vape?"*
    b. *"Do you remember the first time you used an ECIG/vape? Can you tell me about that and what it was like?"*

2. "*Can you describe how much of your particular device/liquid you use each day?*"
    a. *"How much liquid per day?"*
    b. *"How often do you have to refill your liquid?" (Or change out a pod/cartridge or replace the entire disposable?)*

3. *"Can you describe how often you puff on your device throughout the day?"*

{Additional probing questions if participant needs it to be more specific}

    a. *"How many vaping sessions/sittings do you have per day"*
    b. *"How many puffs do you, on average, do you take per session/sitting?"*
    c. *"How many puffs, on average, do you take per day?"*

4. *"What is the easiest way for you to describe how much you use your ECIG/vape and why?"*
5. *"How soon after you wake up do you start using your ECIG/vape?"*
6. *"Do you continue using your ECIG/vape even when you are sick?"*
7. *"In addition to use for nicotine consumption, do you use this device for consumption of THC also?"*

a. If YES, *"describe how often?"*

{Repeat user behavior questions 1&2 for second device if applicable}

8. *"Do you consider yourself a regular user/vaper?"* yes/no/I don't know

9. *"How would you define a regular user/vaper?"*

Probe question*: "How did you come up with your answer to this question? Was it easy or difficult for you to answer?"*

10. *"What do you call the act of using your device?"*

11. *"What do you call a person, such as yourself, who regularly uses an ecig/vape?"*

12. *"What are some of the places or people where you receive the most information or hear the most terms regarding ecigs/vapes?"*

13. *"If the government were to ban your specific type of ECIG/vape device, would you stop using ECIGs/vapes?"*

14. *"If the government were to ban your favorite flavors, would you stop using ECIGs/vapes?"*

    a. *"What if all flavors were banned except tobacco and menthol?"*

15. *"Have you ever tried to quit ECIGs/vapes? If yes, tell me about those experiences"*

    a. *"Did you use any products to help you quit, like nicotine gum or patch?"*

    b. *"What side effects did you experience when you tried to quit?"*

16. *"Do you think that you are addicted to your ECIG/vape?"*

Closing statement:

"This completes our interview for this study. Thank you again for participating in this interview. Just as a reminder, your answers provided will remain confidential. Thank you and have a nice day!"

Participant unique code #: