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## IDENTIFYING AND PREDICTING INTENTION TO QUIT USING JUUL AMONG EMERGING ADULTS

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IDENTIFYING AND PREDICTING INTENTION TO QUIT USING JUUL AMONG  
EMERGING ADULTS

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THESIS

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A thesis submitted in partial fulfillment of the  
requirements for the degree of Master of Science in the  
College of Education  
at the University of Kentucky

By

Jakob W. Hester

Lexington, Kentucky

Director: Dr. Melinda J. Ickes, Professor of Health Promotion

Lexington, Kentucky

2020

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## ABSTRACT OF THESIS

### IDENTIFYING AND PREDICTING INTENTION TO QUIT USING JUUL AMONG EMERGING ADULTS

Objectives: (1) Describe intention to quit, (2) identify relationships between sociodemographic factors or social influences and intention to quit, (3) explore if Theory of Planned Behavior-informed constructs can predict intention to quit as well as identify which construct best predicts, and (4) discover if descriptive norms strengthen a predictive model of intention to quit among emerging adults currently using Juul.

Participants: Full-time, first-year students currently using Juul, an e-cigarette product, at a large university in the southeastern United States ( $N = 182$ ). Methods: A November 2018 online survey assessed sociodemographic characteristics, social influences, patterns of use, quit intention, and attitudes, norms, and perceived behavioral control toward Juul.

Results: A quarter of participants reported current use, with nearly half intending to quit within six months. Recent quit attempts was the only factor related to intention. Two models were created that successfully predicted intention to quit, but only perceived behavioral control was individually significant as a predictor. Conclusions: Cessation-focused campaigns and interventions are needed on college campuses and could be less tailored than prevention to save time and money.

KEYWORDS: Juul; e-cigarette cessation; emerging adults; Theory of Planned Behavior

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IDENTIFYING AND PREDICTING INTENTION TO QUIT USING JUUL AMONG  
EMERGING ADULTS

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## **Chapter 1: Introduction**

### **Background**

Beginning in 1964 with the release of the landmark report on the dangers of cigarettes by the Surgeon General, tobacco use has been a target for public health in the United States. Following this report, scientists, researchers, policymakers, and organizations, both public and private, have worked to reduce current and prevent future tobacco use (Centers for Disease Control and Prevention, 2018a). This once common, socially acceptable behavior (Centers for Disease Control and Prevention, 1999), has been steadily and drastically reduced over the past 55 years.

In 2017, an all-time low of 14% of adults aged 18 or older reported regular use of combustible cigarettes. This marked a 28-point reduction from the 42% of adults who reported regular use in 1965 (CDC, 2018a). Despite a short spike in use among American youth in the mid-to-late-1990s, rates of current use of combustible cigarette among this demographic also reached an all-time low of 4.8% in 2019—2.3% among middle school students and 5.8% among high school students (Wang et al., 2019). These results can be primarily attributed to the combined effects of the public health efforts carried out by the groups listed previously; however, additional factors such as the evolution of the tobacco market may have also contributed in recent years.

Although positive strides have been made in the fight against combustible cigarette use, the sale and use of tobacco products have been on the rise in recent years overall (CDC, 2019a). This can be attributed to the introduction of electronic cigarettes (e-cigarettes), which first hit the tobacco market in 2007. As combustible cigarette use continued to drop, use of e-cigarettes began to grow at a much higher rate, especially

after becoming more mainstream around 2011. In fact, it became the most used tobacco product among youth and young adults in 2014 (CDC, 2019a). Following a brief decline in use from 2015-2017, there was an even sharper increase in use, particularly among youth and young adults (CDC, 2018a). One in five (20.8%) high school students reported current e-cigarette use in 2018, a 78% increase in use from the previous year (CDC, 2019a). Although adults reported current use at approximately one-eighth the rate of youth (2.8%), young adults make up a bulk of adult use. Young adults are significantly more likely to use than are older adults, according to the CDC (2018a). Data from the American College Health Association (2019a) supports this as well, with 12.6% of college students reporting current use of e-cigarettes in their Spring 2019 survey, which was over three percent higher than Spring 2018 (ACHA, 2018a).

E-cigarettes, a product falling under the broader classification of electronic nicotine delivery systems (ENDS) as defined by the U.S. Food and Drug Administration (FDA), are commonly known as “e-cigs” or “vapes” among users. ENDS products come in a variety of shapes and sizes, including refillable tank and modifiable systems (a.k.a., “tanks” or “mods”), disposables, and pod-based versions. Each work by heating a liquid solution (e-liquid) that creates an aerosol that users inhale; however, this aerosol is not harmless. Nearly all e-liquids contain nicotine, which is highly addictive (USDHHS, 2016). In addition to potentially high levels of nicotine (Willett et al., 2019), aerosol from various e-cigarette products have been found to contain heavy metals, volatile organic compounds, and other cancer-causing agents that can negatively affect the lungs (U.S. Department of Health and Human Services, 2016).

Among youth and young adults, rechargeable, pod-based e-cigarettes have

become exceptionally popular due to their ease of use, sleek design that is easy to conceal, and low initial cost (Ickes et al., 2019; Willet et al., 2019). The fastest growing and most popular of these products is Juul, which is owned in part by big tobacco company Altria. Juul garnered nearly 70% of the market share of all ENDS products in September 2019 (Wu, 2019).

Juul, like other e-cigarettes, is now marketed as a cessation tool for current adult cigarette smokers (Juul, 2019). However, limited evidence suggests Juul or other e-cigarettes are viable smoking cessation tools, and these products have yet to be approved as such. Those using these products may be more likely to use combustible cigarettes or other tobacco products (Loukas, Marti, Cooper, Pasch, & Perry, 2018; Murthy, 2017; Spindle, Hiler, Cooke, Eissenberg, Kendler, & Dick, 2017)—up to four times as likely for youth according to a study by Primack and colleagues (2018). Youth and young adults are at a particularly high risk using e-cigarettes—a large number of which are never or non-smokers initially (Leavens et al., 2019; Ross et al., 2018). Nicotine dependence is of particular concern for this demographic, given that nicotine has been shown to hinder brain development through the mid-20s—affecting attention, learning, mood, and impulse control (USDHHS, 2016)—and a single disposable “Juul pod” contains roughly the same amount of nicotine as a pack of conventional cigarettes over the approximate 200 puffs each pod provides (Campaign for Tobacco-Free Kids, 2018)

### **Significance**

The disparity in use between youth, young adults, and older adults is a significant concern, highlighting a need to focus public health efforts on the former two groups. Despite what appears to be positive progress in the public health community—limits and

bans on flavors, a raise in the age to purchase to 21, and extensive media focus (Ducharme, 2019; Nedelman, 2020; O'Reilly, 2020)—large numbers of youth and young adults are still using these products, particularly Juul. In fact, in a survey of college students in spring 2018, more students reported current use of Juul than the broader category of e-cigarettes (Ickes et al., 2019), highlighting a possible need to focus solely on that product.

Though rates appear higher among youth than young adults, if many of the youth previously identified as current users are continuing to use, then it stands to reason that current use rates among young adults could continue to rise given the addictive nature of nicotine and the ease at which it can be consumed through products like Juul. Since 70% of high school graduates are enrolling in college (U.S. Department of Labor, 2019), focusing on emerging adults (i.e., individuals in the early stages of the transition into adulthood; approximately 18-20 years old) could prove to be a pivotal time to intervene with cessation efforts. This is a time of great change for many, as freedom and individual responsibility are increased, so it stands to reason that this is an ideal timing, given the amount of change they are undergoing and the number of potential young, emerging adults that could be reached.

Research on e-cigarette cessation, especially among young adults and college students, is minimal given the recent rise in e-cigarette popularity. However, early studies suggest that the intention to quit using e-cigarettes among young adults is low, particularly among naïve users—those that had previously not used tobacco products (Vu et al., 2019). Some studies of adults have also asked former e-cigarette users why they quit. The most cited answers have included that initial use was only for experimentation

(Pepper, Ribisl, Emery, & Brewer, 2014), a negative perception felt from others, and a concern that the product may be detrimental to their health (Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015). Despite the limited e-cigarette cessation research, various studies have focused on the cessation of combustible cigarettes.

### **Theoretical Framework**

The Theory of Planned Behavior (TPB) is one of the most widely used and cited models for understanding and predicting health behaviors (Ajzen, 2011). It has been used toward a variety of health behaviors, such as healthy eating (e.g., Åström & Rise, 2001), exercise (e.g., Downs & Hausenblas, 2005), and condom use (e.g., Albarracín, Johnson, Fishbein, & Muellerleile, 2001). Combustible cigarette cessation is another health behavior to which the TPB has been applied (e.g., Rise et al., 2008). The present study aims to use the TPB as a guide for understanding and predicting the intention to quit the use of e-cigarettes like Juul among young adults. Given the high rates of e-cigarette use among youth and young adults, as well as its prior use in tobacco cessation research, this theory could also be viable for predicting intention to quit using Juul to better understand how to target and tailor e-cigarette cessation efforts among young, emerging adults.

### ***Overview***

According to the theory, three main constructs influence intention: attitudes, subjective norms, and perceived behavioral control. These constructs influence intention individually and collectively; they can also be predictive of it. Intention to perform a behavior, measured directly, is considered the single best predictor of performing said behavior (Ajzen, 1991). Each of the constructs of TPB interacts with each other to affect

one's intention to perform a behavior as well; however, they do not necessarily influence intention equally, particularly when it comes to tobacco cessation (Rise et al., 2008). Therefore, it is important to assess their individual and collective contributions to the intention to perform a behavior.

As an expectancy-value model, the theory also posits that individuals consider the value they will receive from performing a behavior prior to initiating it (Fishbein & Ajzen, 1977). The beliefs one holds about various behaviors are used by the individual to form the attitudes, subjective norms, and perceived behavioral control toward those particular behaviors. In addition to direct measures, these beliefs can be used as indirect proxies for measuring each of the three constructs of the TPB.

This theory evolved from the Theory of Reasoned Action, or TRA (Fishbein & Ajzen, 1977), which only included attitudes and subjective norms initially. The addition of perceived behavioral control addressed the criticism that TRA was not able to account for behaviors in which individuals may have little-to-no control over (Ajzen, 1988). Nicotine dependence is one such behavior.

### ***Theoretical Definitions***

This section will define the key concepts related to the TPB and e-cigarette cessation.

**Intention.** Behavioral intention is the likelihood an individual believes they will engage in a behavior. As mentioned above, the intention to perform a behavior is influenced by one's attitudes toward the behavior, their subjective norm perceptions, and their perceived behavioral control over performing the behavior (Ajzen, 1991). Intention to quit using e-cigarette products, specifically Juul, is the basis of the present study.

**Attitude.** Attitude is a valanced response toward a behavior, viewed as favorable or unfavorable. Behavioral beliefs, which influence attitudes, are positive or negative beliefs held toward a behavior and its associated outcomes (Fishbein & Ajzen, 1977). Attitude, in this study, is the perception current Juul users have regarding the current and future use of Juul. A more favorable view of e-cigarettes should result in less intention to quit.

**Subjective Norms.** The perception of social pressure one feels to perform a behavior is considered one's subject norms. This perception is influenced by the normative beliefs one holds, which are the beliefs that significant others (e.g., close family or friends) will approve or disapprove of the behavior (Ajzen, 1991). Perceived approval of Juul, or any e-cigarette use, from close friends and family make up the subjective norms of the present study. As perceived social pressure (disapproval toward e-cigarette use) increases, so should the intention to quit.

**Perceived Behavioral Control.** Perceived behavioral control, which is related to the concept of self-efficacy found in Bandura's (1977) Social Cognitive Theory, is an individual's perceived level of difficulty in performing a behavior. It is influenced by control beliefs, which are one's belief in the level of control one has toward performance, after accounting for barriers and facilitators toward action (Ajzen, 1991). The level of control one believes they have in stopping the use of e-cigarettes like Juul is measured in the current study. More perceived control over quitting should result in a higher intention to quit.

### ***Previous Research***

No prior research utilizing the TPB to predict intention to quit using e-cigarettes



was found at the time of writing. However, TPB has been used to predict quit intentions for combustible cigarettes among various populations. Results have varied, particularly among adults. Depending on the study, attitudes (e.g., Rise et al., 2008), norms (e.g., Hilley, Johnson, Royce, & McGough, 2019), and perceived behavioral control (e.g., Norman, Conner, & Bell, 1999) have each been shown to be the best predictor of ceasing this behavior.

Previous tobacco cessation research has also advocated for an extension of the TPB. Descriptive norms, which are what an individual thinks others are doing related to a behavior, is a construct that has been successfully added to the previous three constructs. In their study predicting the intention to quit using combustible cigarettes, Rise and colleagues (2008) found that the addition of descriptive norms to their original model was statistically more significant. This could also prove true in predicting the intention to quit the use of e-cigarettes and therefore warrants researching.

Despite the lack of research on predicting e-cigarette cessation intention specifically, there is some early e-cigarette research broadly related to the different constructs of the TPB. For example, attitudes toward the product have been found to be generally more positive among users (Vallone, Bennett, Xiao, Pitzer, & Hair, 2019). Various social influences seem to play a role in both the initiation and cessation of e-cigarettes as well (Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2014). E-cigarettes also appear to be more socially acceptable compared to cigarettes (Coleman et al., 2016), and e-cigarette users less concerned with addiction or the need to quit using (Katz et al., 2019). More specifically, Juul use among youth and young adults appears to be a highly social activity (Ickes et al., 2019), which suggests that norms could be more

influential than with previous tobacco products.

### **Purpose Statement**

Given the high rates of e-cigarette use among young adults and the gap in current e-cigarette cessation research overall, more studies are needed to better understand the intention to quit using products like Juul, particularly among the young, emerging adult population. Therefore, the purpose of this study is to: (1) identify patterns of current Juul use and intention to quit using Juul; (2) better understand how personal and demographic factors, as well as other social influences, relate to users' intention to quit using Juul; (3) determine if attitudes, subjective norms, and perceived behavioral control toward the product could predict intention to quit using Juul and identify which of the three best predicts; and (4) discover if the addition of descriptive norms strengthens a predictive model of intention to quit among young, emerging adults currently using Juul. To date, no studies have been found utilizing the Theory of Planned Behavior to predict quitting behaviors among current e-cigarette users.

### **Research Questions and Hypotheses**

RQ1: What proportion of currently using first-year college students intend to quit using Juul?

RQ2: How many currently using first-year college students have attempted to quit using Juul?

RQ3: What statistically significant differences exist in the intention to quit using Juul among various sociodemographic factors (e.g. gender), social influences (e.g., number of friends using), and patterns of use of currently using first-year college students?

*Hypothesis 3.1:* There will be significant differences in the intention to quit using

Juul between groups various sociodemographic factors, social influences, and/or patterns of use.

RQ4: What is the relationship between attitudes and the intention to quit using Juul among currently using first-year students?

*Hypothesis 4.1:* There will be a significant relationship between attitudes and the intention to quit among first-year college students currently using Juul.

RQ5: What is the relationship between subjective norms and the intention to quit using Juul among currently using first-year students?

*Hypothesis 5.1:* There will be a significant relationship between subjective norms and the intention to quit among first-year college students currently using Juul.

RQ6: What is the relationship between perceived behavioral control and the intention to quit using Juul among currently using first-year students?

*Hypothesis 6.1:* There will be a significant relationship between perceived behavioral control and the intention to quit among first-year college students currently using Juul.

RQ7: What is the relationship between descriptive norms and the intention to quit using Juul among currently using first-year students?

*Hypothesis 7.1:* There will be a significant relationship between perceived behavioral control and the intention to quit among first-year college students currently using Juul.

RQ8: Which of the three constructs of the Theory of Planned Behavior, if any, best predict intention to quit among currently using first-year students?

*Hypothesis 8.1:* Subjective norms will be the strongest predictor of intention to

quit among first-year students currently using Juul.

RQ9: Is the addition of descriptive norms to the traditional constructs of TPB a better predictor of intention to quit among first-year students currently using Juul?

*Hypothesis 9.1:* The addition of descriptive norms to the TPB constructs will be a better predictor of intention to quit among current Juul users and should be included as an extension of the Theory of Planned Behavior for predicting intention to quit e-cigarettes.

### **Delimitations**

This study focused specifically on full-time, first-year students that were 18 years of age or older and who reported use of Juul, a popular brand of e-cigarette, within the past 30 days. Research among younger populations largely focuses on high school students (i.e., youth) or college students (i.e., young adults) more broadly, while less has been conducted during the transition between the two age groups or educational settings (Arnett, 2000). This transition is likely a pivotal moment in a young person's life (Corwin & Cintron, 2011). It is a time when personal freedom and exploration are highest (Arnett, 2000), which could be influential in future health behaviors or status. Therefore, this demographic was chosen to better understand the tobacco-related health behaviors and quit intentions of emerging adults transitioning from high school to college.

### **Limitations**

One limitation for the current study is that it is a cross-sectional design taken at a single time-point within the participants' first semester of college, thus only providing a snapshot of use and intention to quit using Juul. Responses to patterns of use relied on self-reporting and recall rather than observation, logging, or measurement of biomarkers,

which could have led to minor inaccuracies in this portion of data, likely an under-reporting of actual use (Patrick et al., 1994). Generalizing the results to all emerging adults or college students should also be limited as well since this study occurred at a single large public university in the southeastern United States and only included full-time, first-year students. Finally, the data for this study were analyzed secondarily, as a response to the changing e-cigarette landscape from survey administration to data analysis. As such, not all items utilized were written as recommended by Ajzen (2002). Because the items used to build the predictive models were more global in nature and not specific to cessation outcomes, this study is TPB-informed rather than a strict application of the theory.

### **Assumptions**

It is assumed that participants of this study accurately and truthfully completed the survey. Participants were notified that responses were confidential and that they could withdraw from the survey at any point. Based upon the demographic makeup of the sample, it can also be assumed that the sample was representative of the university's full-time, first-year student population.

### **Summary**

Despite all-time lows in combustible cigarette use nationwide, the emergence of e-cigarettes has presented new challenges to tobacco control efforts. Risks of e-cigarette use include nicotine dependence, increased risk of combustible cigarette use, and lung injury or illness, among others. Use among youth and young adults has skyrocketed in recent years, putting them at additional risk for impaired brain development. This prompts the immediate need for further research and intervention efforts aimed at e-

cigarette cessation among these groups. College students, particularly those transitioning from high school, are the focus of the present study, which aims to better understand the relationship between attitudes, norms, perceived behavioral control, and the intention to quit using e-cigarettes like Juul among current Juul users.

## **Chapter 2: Literature Review**

### **Prevalence and Risk Factors of Use**

In the spring of 2019, an alarming number of high school students reported current use of e-cigarettes. According to data from the 2019 National Youth Tobacco Survey (Cullen et al., 2019), an estimated 27.5% of high school students had used an e-cigarette in the past 30 days, equating to over five million high school current users nationwide. Although previous studies have shown adolescents, particularly high school students, as more likely to use e-cigarette products (USDHHS, 2016), young adult use is also on the rise. Approximately 70% of high school graduates go on to enroll in college (U.S. Department of Labor, 2019), making the transition from high school to college an important time in the vast majority of emerging adults' lives, especially for students in their first year of college. As high school students continue to age and potentially continue use, the first year of college could become a critical intervention point for stopping future, continued use.

One of the best sources for national data on young adult use comes from the American College Health Association (ACHA), which provides national data on college students' health and health behaviors twice a year. In the Spring 2019 survey, over 25% of undergraduate college students reported ever using e-cigarettes; a majority of those (14.3% overall) reported current, past 30-day use (ACHA, 2019b). Of the current e-cigarette users in this survey, approximately half reported use on ten or more of the past 30 days (ACHA, 2019b), indicating a large number of students are using more regularly. In Fall 2015, the first year this survey was used, just 5.4% reported use and use on ten or more of the past 30 days was reported by a third of the current users (ACHA, 2016).

In under four years, over two and a half times the number of college students reported current use while a little under four times as many reported regularly using—a drastic increase in a short amount of time. At the time the present study’s data was collected (Fall 2018), ever use of e-cigarettes by undergraduate students nation-wide was nearly identical to Spring 2019 but reported past 30-day use was slightly higher at 15.1% (ACHA, 2018b). This is despite the fact that as of October 2019, there were over 2,000 colleges and universities that included a campus-wide e-cigarette ban in their tobacco policies (American Nonsmokers’ Rights Foundation, 2019).

What the ACHA data lacks are details on specific product use, particularly Juul. Given the sales and Juul’s popularity nationwide, and frequent news coverage on the product (Ducharme, 2019), it could be assumed that Juul or similar pod-based e-cigarettes are the reason for the explosion in use. Still, more concrete data is necessary to make that claim. Various researchers have attempted to fill this void by administering surveys to young adults with more specific items related to the use of certain brands like Juul.

In a November 2017 national survey from the Truth Initiative Schroeder Institute, 12% of those aged 18-24 years old reported having used Juul specifically; 80% of which reported past 30-day use (Willet et al., 2018). In a similar survey from the Truth Initiative’s Schroeder Institute in Spring 2018, those aged 18-21 were the most likely age group to use Juul—11.2% reported ever use, while 7.7% reported current use at the time (Vallone et al., 2019). Of those aged 18-21 that reported current use in the second study, nearly 30% used Juul on ten or more days in the last month (Vallone et al., 2019). Although the rates in these national studies are lower than that of the most recent ACHA,



they are comparable to ACHA (2018c) data from a similar time frame and also represents just one brand of e-cigarette.

Studies on individual college campuses have shown a wider range of prevalence of Juul use in recent years. For example, preliminary research conducted in the spring of 2018 on the same college campus as the present study found that over one-third (36%) of college students reported having ever used Juul, while one out of every five (21%) of students were currently using (Ickes et al., 2019). More regular use of 10 or more of the previous 30 days was reported by 36% of the current users (Ickes et al., 2019), which is consistent with the national data on young adult e-cigarette users presented above. Also, of note from the Ickes et al. (2019) study was the higher reported use of Juul compared to e-cigarettes, despite Juul being a single brand of e-cigarette.

Other studies of college students have also provided more detailed data on the prevalence and patterns of Juul use among this young adult population. Leavens and colleagues (2019) found that 29.6% of students at a large Midwestern university reported daily or weekly use of Juul, while only 3.7% of those surveyed had reported quitting after previously using regularly. This could mean that those who are regularly using may be less likely to quit, showing signs of dependence. In fact, in a survey of Texas college students in Spring 2018, researchers found that 20.6% of current ENDS users reported Juul as their usual brand and that the mean number of days used in the past 30 days was 12.1 (Case, Hinds, Creamer, Loukas, & Perry, 2020).

Perhaps most similar to the present study's data is a study from Bourdon and Hancock (2019) on first-year college students in August 2018. The authors found that nearly one-third (32.3%) of freshman from seven different college campuses in the mid-

Atlantic area were current users of Juul (Bourdon & Hancock, 2019), a number significantly higher than ACHA (2018b) data for undergraduate students across the United States. This may indicate that younger college students (i.e., first- and second-year students) may be more at risk of using e-cigarettes, particularly Juul, but additional correlates (e.g., gender) of Juul use are likely to be present.

A few studies identifying correlates of Juul use among college students were identified. One of the studies found the following sub-populations of college students to be more likely to currently use Juul: males; those under 21 years of age; those identifying as lesbian, gay, or bisexual; those perceiving Juul to be less harmful than combustible cigarettes; and those who reported feeling more comfortable in their current financial situation (Vallone et al., 2019). For ever use of Juul, Vallone and colleagues (2019) also found current combustible cigarette users to be more likely to at least try Juul. In addition, Ickes and colleagues (2019) found males, white/non-Hispanics, lower undergraduate students, and combustible cigarette users as significantly more likely to use Juul. When comparing college students' use of Juul versus other ENDS brands or products, Case et al. (2020) found that males, younger young adults, current combustible cigarette users, those with a higher socioeconomic status, and those using ENDS, including Juul, on more days in the past 30 were more likely to be Juul users. Based on these three studies of college students, males, lower undergraduates, and those students also using combustible cigarettes are most at risk for using Juul.

### **Risks of E-Cigarette Use**

From their onset, e-cigarettes have been primarily marketed as a smoking cessation tool designed to get users to either quit using combustible cigarettes or use a

seemingly healthier product. However, these companies have pushed these messages with limited evidence to back up their claims. Additional marketing themes from early brands included the technological advancement of the product as well as a device that could be used to circumvent smoke-free policies indoor and outdoor (Haardorfer et al., 2017). These types of messages continued with the newer products like Juul, whose product is claimed to “hit” more like a combustible cigarette, thereby giving smokers a more realistic feel when switching from combustible cigarettes (Juul, 2019). Unfortunately, these messages appeared to have salience with young adults. The perceived healthiness of Juul or similar products relative to combustible cigarettes, the ease of use (due to the technological advancement), and their ability to be used anywhere have been found to be reasons for first and current use among a majority of ever and current Juul using college students (Ickes et al., 2019).

Due to their relatively recent emergence, the long-term effects of e-cigarettes are not well known at this time. The Truth Initiative (2019) even likens young adult users to human test subjects because these products are available without knowing the long-term damage they may cause. The U.S. Food and Drug Administration has still not conducted a full review of ENDS products and has allowed them to stay on the market in the meantime (Truth Initiative, 2019). As time has passed and the popularity of these products has increased, however, short-term effects are beginning to emerge in news reports and research.

Despite producing fewer carcinogens than combustible cigarettes and being marketed as a cessation or harm-reduction tool for smokers, the aerosol produced by these products is not harmless (USDHHS, 2016); in fact, they nearly present an entirely

different set of risks. A large majority of the liquids used in e-cigarette products contain nicotine, a highly addictive substance. Youth and young adults are at particularly high risk when developing a nicotine dependence because nicotine has been shown to affect brain development, which occurs up through a person's mid-20s. This hindrance to the developing brain can lead to issues with attention, learning, mood regulation, and impulse control (USDHHS, 2016).

Juul pods contain some of the highest nicotine concentrations available on the e-cigarette market (Truth Initiative, 2019)—roughly equivalent to a single pack of combustible cigarettes per pod (Campaign for Tobacco-Free Kids, 2018). This is especially concerning because users are even more susceptible to nicotine dependence, and Juul has cornered nearly three-quarters of the ENDS market (Wu, 2019). In a recent study of participants aged 13-21 that compared self-reported use rates of pod-based e-cigarettes with urine cotinine levels, a nicotine biomarker, Goniewicz and colleagues (2018) found that regular Juul users with little-to-no exposure to combustible tobacco had one and a half times the cotinine levels of regular combustible cigarette users.

Many never or non-smokers are initiating and continuing the use of e-cigarettes (eet al., 2019; Ross et al., 2018), which is introducing many youth and young adults to nicotine dependence and the subsequent effects that may not have been at risk otherwise. E-cigarettes have been classified as “harm-elevating” (Katz, Erkinen, Lindgren & Hatsukami, 2019) rather than harm-reducing because of this. Some research also suggests that the use of e-cigarettes by tobacco-naïve youth and young adults may even lead to combustible tobacco use (Leavens et al., 2019; Loukas et al. 2018; Murthy, 2017; Spindle et al., 2017). For example, in a longitudinal study of college students by Loukas and

colleagues (2018), students who reported only using e-cigarettes at wave 1 of the study were 2.26x more likely to initiate cigarette use up to a year and a half later than non-tobacco users. Those who go on to use combustible cigarettes are then at risk for the adverse outcomes associated with nicotine dependence, combustible tobacco use, and repeated inhalation of e-cigarette aerosol.

Recently, a rash of injuries, illnesses, and deaths have been connected with the use of e-cigarette products. At the end of October 2019, there were nearly 2,000 reported lung injuries related to e-cigarette use across the United States. Patients aged 18-24 made up 40% of those affected, the highest group by 15 percentage points. Among the injuries were 37 confirmed deaths, with more pending investigation (CDC, 2019b). Other negative side effects associated with the use of e-cigarettes have included seizures among youth and young adults (U.S. Food and Drug Administration, 2019), exploding batteries leading to injury (CDC, 2019c), and high bacterial and fungal contamination within popular ENDS products (Lee, Allen, & Christiani, 2019).

Regardless of future findings related to the long-term use of e-cigarette products, there is enough evidence of short-term negative impacts to focus public health efforts on cessation of e-cigarettes utilizing research, regulation, and programming cessation among youth and young adults.

### **Theory of Planned Behavior and Tobacco**

The Theory of Planned Behavior and its three main constructs (i.e., attitudes, subjective norms, and perceived behaviors) have been broadly applied to a range of health behaviors to predict or better understand them (Rise et al., 2008). In the theory, intention precedes action and is thus the best predictor of it. Attitudes, subjective norms,

and perceived behavior control not only influence each other but, more importantly, one's intention to perform or not perform a behavior (Ajzen, 1991). Although it has been the most widely applied model for health behaviors (Rise et al., 2008), limited research currently exists on its use with the intention to use or stop using e-cigarettes, especially research focusing on the latter. The remaining sections will highlight various tobacco and e-cigarette research studies related to users' attitudes, subjective norms, intention to quit, as well as prediction of users' intention to quit.

### *Attitudes*

Based on the available research, attitudes seem likely to be the most studied construct within TPB research focused on e-cigarettes. However, attitudinal research specific to Juul is more limited, requiring assumptions to be made based upon research related to general e-cigarette attitudes. Additional research is needed to better understand the similarities and differences between attitudes on Juul versus e-cigarettes in general because some research suggests youth and young adults may not perceive Juul to be an e-cigarette or may think of them differently (Ickes et al., 2019).

Generally, those using e-cigarettes tend to have a more positive attitude toward the use of the product compared to those not using (Case, Crook, Lazard, & Mackert, 2016; Coleman et al., 2016; Vallone et al., 2019). This basic assumption makes sense, given they are currently using the product. As noted earlier, early marketing focused on portraying e-cigarettes as a healthier alternative to combustible cigarettes (Haardoefer et al., 2017), and this idea seems to have since stuck with individuals, particularly those that went on to use. In a qualitative study using focus groups with college students, Case and colleagues (2016) found a mix of attitudes among the focus group's overall population.

E-cigarette users tended to have a more positive attitude toward e-cigarettes, though. Positive-leaning participants generally commented on how they saw e-cigarettes as healthier or less harmful than combustible cigarettes (Case et al., 2016), a common theme throughout e-cigarette attitude research.

A qualitative study by Katz et al. (2019) noted varying responses regarding young adults' attitudes toward e-cigarettes. Consistent with previous research, the authors described responses that framed e-cigarettes as the "younger, newer, modern, technologically-savvy" (p. 82) product and that cigarettes were outdated. Some described them as cool, but there was a noted distinction between regular and social users. Regular users were thought to think of themselves as cool but were often perceived by others as trying too hard. Participants in this study also thought of the product as less risky compared to combustible cigarettes and the aerosol produced safer because it wasn't smoke, but rather a water vapor (Katz et al., 2019)—highlighting how misconceptions and misinformation are altering attitudes. In fact, when trying to recall where they learned about the information that formed these attitudes, they were unclear but acknowledged overall that they were not well informed (Katz et al., 2019). This, too, presents a need to correct the misconceptions around the safety of e-cigarettes.

Participants in a qualitative study of adult e-cigarette users by Coleman et al. (2016) generally had positive attitudes towards e-cigarettes, as expected. This was especially true as they related e-cigarettes to combustible cigarettes, such as the variety of flavors available, the ability to use in places where smoking wasn't allowed, and their view of e-cigarettes as a smoking cessation tool. However, not all attitudinal responses among users have been entirely positive. Some negative attitudes emerged among users,

including e-cigarettes not having quite the same effect as combustible cigarettes (Coleman et al., 2016)—something Juul has tried to remedy by making the product’s effect feel more like a cigarette (Juul, 2019).

In a 2016 survey of adults, researchers found that current combustible cigarette smokers perceived e-cigarette use as a riskier behavior than did non-smokers, which is contrary to what might be assumed (Ma et al., 2019). The authors posit that it could be a fear-reducing tactic for themselves to justify the continued use of cigarettes. It was also thought to be an underlying reason for the higher risk of practicing dual use of e-cigarettes and combustible cigarettes in the future (Ma et al., 2019).

Juul-specific attitudinal research, although limited at this point, appears to come to similar conclusions. Vallone and colleagues (2019) surveyed older adolescents and young adults and found those perceiving ENDS to be less harmful than combustible cigarettes were more likely to use Juul. Case et al. (2020) found similar results in their survey of young adult ENDS users. Juul users and those using other ENDS products were statistically as likely to perceive Juul and similar pod-based e-cigarettes as harmful or extremely harmful—just over half of each group. Interestingly, when rating addictiveness of Juul and similar pod-based e-cigarettes, Juul users were statistically more likely to perceive them as very or somewhat addictive; however, it was only approximately one-third overall and just under half of Juul users (Case et al., 2020). Again, this misconception could lead to the initial trial, but the correction could lead to intention to quit.

### ***Subjective Norms***

Understanding the subjective norm perceptions of e-cigarette users has also seen



an emphasis on recent research. What individuals perceive that others close to them think or would think about their e-cigarette use appears to be linked with use (Coleman et al., 2016; Leavens et al., 2019; Noland et al., 2013) or potential use (Case et al., 2016; Katz et al., 2019). Social acceptability appears to be relatively high for e-cigarettes, particularly in relation to combustible cigarettes. No studies on subjective norms of e-cigarette cessation were found, warranting additional research to add to the knowledge base.

Early e-cigarette research, like that of Noland and colleagues (2016), seemed to highlight the potential for social influences like subjective norms to influence e-cigarette use behavior. In the 2013 survey of college students' social influences on tobacco use, Noland et al. (2016) found that e-cigarette social norm scores on the three following items: (1) "How would your best friend react if you use cigarettes/e-cigarettes?" (2) "People important to me think I should not use cigarettes/e-cigarettes." (3) "It is OK for someone like you to use cigarettes/e-cigarettes." were higher compared to cigarettes. This finding is interesting, given how less pervasive e-cigarettes were at the time of the study—only 1.5-3% estimated use nationwide (Noland et al., 2016). Correlates to more perceived support included males, current tobacco users, and individuals exposed to more tobacco users (Noland et al., 2016). If subjective norms are found to significantly influence the intention to quit, then these correlates could help target and guide cessation programming.

Multiple qualitative studies were found that included discussion among participants about the perceived or known acceptability of e-cigarette use from friends and family. In one study, Case et al. (2016) commented that non-users were more likely

to report that friends nor family would approve of their use; however, the second most common response was that friends would likely approve of them using. On the other hand, current users reported more perceived approval from friends, as well as family likely to be more approving than if they were using combustible cigarettes (Case et al., 2016).

Among those receiving actual feedback from friends and family in the qualitative study by Coleman et al. (2016), participants received positive reactions from their friends and families when they knew they were using e-cigarettes to reduce or quit using e-cigarettes. Some described friends and family members as being wary of their use, with one participant saying, "...most of my friends are still pretty skeptical of it. I mean, it's still putting nicotine and vapor in your lungs one way or the other" (Coleman et al., 2016, p. 83). Again, what individuals perceive or receive regarding support for use appears to matter and be relevant.

Overall acceptability in social contexts also emerged as a theme in the literature. In the Coleman et al. (2016) study, the authors also found younger adults, in particular, had the perception that e-cigarettes were more socially acceptable than "outdated" combustible cigarettes. Participants in the Katz et al. (2019) study noted similar results from focus groups, but with a distinction between casual and regular use. Social stigma seemed to appear only for regular use and was consistent whether the conversation was about the participants' views of other users or their perception of how others would or do view their use (Katz et al., 2019). Keamy-Minor and colleagues (2019) posit that pod-based e-cigarettes may have played a role in shifting social stigma given that tank and mod systems evoked a stereotype but use and sharing of pod-based e-cigarettes was

common among friends.

Like attitudes, Juul-specific research on subjective norms was limited. In the Leavens article (2019), researchers found that 78.6% of Juul ever users would tell at least one of their five closest friends of their Juul use. Additionally, 89.3% thought at least one of their closest five friends would approve. Nearly half of those surveyed would have told all five of their closest friends (49.8%) and that all five would subsequently approve—49.8% and 47%, respectively (Leavens et al., 2019).

Subjective norms, and social norms more broadly, appear to play a significant role in the use of and culture surrounding e-cigarettes. This seems to be especially true among young adults. More research is needed to understand its influence on e-cigarette behaviors, however.

### ***Social Influences and Descriptive Norms***

Although not included in the traditional constructs, descriptive norms are related to subjective norms and could also play a role in the intention to quit using tobacco products (Rivis & Sheeran, 2003). Social influences have been widely studied in tobacco control research. It includes a broad range of factors that can affect an individual's behavior, such as peer and family use, social norms, and more (Noland et al., 2016). Social influences on e-cigarettes have been less studied given the recency of its rise and rapid evolution. However, there has been enough evidence from which some broad conclusions can be drawn regarding the effect social influences has on e-cigarette use.

Use by friends and family has been shown to be positively associated with current e-cigarette or Juul use in various quantitative studies (Scholly, Garcia, Dodge, & Pokherl, 2018; Schoren, Hummel & de Vries, 2017; Vallone et al., 2019; Vu et al., 2019). In fact,

it has been cited as a top reason for initial trial of e-cigarettes or Juul by young adults (Ickes et al., 2019; Leavens et al., 2019; Pepper, Ribisl, Emery, & Brewer, 2014).

Qualitative studies on young adults also found friends' use to be a reason for initial use (Coleman et al., 2016; Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015).

Given that college students often do not live at home, it stands to reason that friends' use plays a more important role in e-cigarette use than family use does.

Descriptive norms (i.e., what behaviors individuals think others are doing), a social norm category that has been studied within tobacco control research, appears to contribute as a social influence for e-cigarette use or prevention among youth and young adults as well. Although not traditionally included in the norms construct of the TPB, descriptive norms could be added to subjective norms (i.e., what individuals think those important to them think about their behaviors) to understand intention and tobacco use (Rise et al., 2008). Descriptive norms often appear to be at odds with actual rates of use; individuals over-estimate how many people similar to themselves are actually using (e.g., ACHA, 2019b; Noland et al., 2016).

Recent studies have described the descriptive norms related to e-cigarette use among college students. The Spring 2019 survey data from the ACHA mentioned above also provided national data on college students' perceptions of how many college students were using. Of those surveyed, the average student thought 85% of college students were using. Of those surveyed, the average student thought 85% of college students were currently using e-cigarettes (ACHA, 2019b). As noted above, only 14.3% of college students surveyed reported current use of e-cigarettes (ACHA, 2019b), which was nearly a 70% difference from perception to reality. Interestingly, despite rates of use being significantly lower in 2015, there was only a 10% increase in the perceived number

of college students using e-cigarettes from 2015 to 2019; however, this roughly corresponded with an increase in actual use (ACHA, 2016, 2019b).

Even data from early e-cigarette research found disparities in perceived versus actual use of e-cigarettes. In a 2013 survey of college students attending the same university as those in the present study, Noland and colleagues (2016) showed that college students perceived that 19% of their peers were currently using e-cigarettes, while national estimates for current use were between 1.5% to 3% at the time (Noland et al., 2016). More specific descriptive norm data on Juul use would be beneficial in understanding the brand's meteoric rise in popularity.

### ***Perceived Behavioral Control***

Of the three constructs of TPB, perceived behavioral control appears to be the least studied theoretical construct in tobacco-related research, particularly e-cigarette use and cessation. Past research has shown that perceived behavioral control may be a limiting factor in quitting combustible cigarettes (Bledsoe, 2006). This could be due to the addictive nature of nicotine that needs to be overcome in order to quit, as highlighted in an article by Norman and colleagues (1999). The researchers applied TPB to predict intention to quit smoking among currently smoking participants who had visited a health promotion clinic at a primary care facility and found that perceived behavioral control was shown to be the most important predictor of intention (Norman et al., 1999).

However, e-cigarettes appear to present a different picture regarding perceived behavioral control. Katz and colleagues (2019) offered one of the best views into young adults' perceived behavioral control with e-cigarettes. Because students viewed e-cigarettes as less harmful and less addictive, they expressed less concern with the

addictiveness and future need for cessation. One participant even commented, “So you feel like more immune to the addiction...and you’re in control” (Katz et al., 2019, p. 84). E-cigarette use was generally viewed as more of a hobby than a habit in this study. Regular users were perceived by participants to be in less control, though, so there could be a difference in personal perceived behavioral control between those using casually and those using regularly. When asked how they felt responding to an offer to use, many felt comfortable in turning one down; however, nearly all of the participants were either non-users or casual users. Participants also said e-cigarette use was less linked to the college experience than alcohol and felt less like they would be missing out if they were not using e-cigarettes. This is an interesting point given the high rates of use on college campuses (Ickes et al., 2019).

More research is needed in the area of perceived behavioral control for e-cigarette cessation to make any determinations. Still, unlike previous tobacco cessation research, it appears e-cigarettes may be viewed differently by the younger generation.

### ***Intention to Quit Using E-Cigarettes***

Like other areas of e-cigarette research, focus on the intention to quit using e-cigarettes has been minimal since most users have likely only been using for a few years at most, particularly pod-based e-cigarettes like Juul. Early research indicates that intention to quit using e-cigarettes is relatively low, particularly among young adults (Vu et al., 2019), those only using e-cigarettes when compared to dual or combustible cigarette users (Azagba, Shan, & Latham, 2019; Schoren, Hummel, & de Vries, 2017), or e-cigarette users who had never used combustible cigarettes (Vu et al., 2019). These groups may require additional or specific messaging and programming, as they differ

from correlates of initiation and use described in the prevalence and correlates of use section above.

In the study by Coleman and others (2016), the authors also discussed future plans for e-cigarette use with focus group participants. Contradictory to the above-cited studies, those who reported using e-cigarettes socially were more likely to say they might terminate use in the near or long-term (e.g., one to five years) than were those who were using to reduce or stop the use of combustible cigarettes. Specific reasons that participants discussed why they would stop using e-cigarettes in the future included having children, a decrease in e-cigarette popularity, new adverse health effects becoming known, and if they are able to terminate use of all tobacco products (Coleman et al., 2016). One participant noted the social aspect of e-cigarette use, saying, “now I do it because I’m in college and like everybody around me is doing it. If like people aren’t doing it later, then I probably won’t be doing it,” (Coleman et al., 2016, p.83).

More research on e-cigarette quit intentions is needed before additional conclusions can be drawn.

### ***Predicting Intention to Quit***

Most research applying TPB to tobacco focuses on the intention to use rather than the intention to quit. There is even more limited research predicting intention to quit using e-cigarettes. Research that included e-cigarettes and utilized TPB to predict quit intentions tended to focus on smoking cessation and the relationship to e-cigarette use instead (e.g., Park, Seo, & Lin, 2016). Since research is limited, we can still learn from the previous research on combustible cigarettes to inform research on the intention to quit using e-cigarettes.

For addictive behaviors such as nicotine use, TPB has been shown to perform well in predicting intention. In a study by Norman, Connor, and Bell (1999), the researchers applied TPB in an effort to predict smoking cessation intention in a sample of people following their attendance at a health promotion clinic. As with other research on TPB and tobacco, the theory was predictive of intentions to quit—nearly 50% of the variance in behavioral intention was explained using TPB (Norman, Connor, & Bell, 1999). This level of variance appears to be higher than most studies, however. Higher intention may be a result of the visit to the health promotion clinic, which could have implications for e-cigarette cessation programming on college campuses.

Although TPB can predict behavioral intention, even in addictive behaviors, the movement to action (i.e., cessation) is less predicted by the theory's constructs of attitudes, subjective norms, and perceived behavioral control (Rise et al., 2008). In their study of students at the University of Oslo, Rise and colleagues (2008) found that TPB accounted for 30% of the variance in the intention to quit smoking but was less predictive of actual behavior initiation. This was consistent with past meta-analytic research that found 39% of the variance in intention scores on a range of health behaviors, but lower variance in behavioral performance. Of the traditional constructs included in TPB, affective attitudes (e.g., unpleasant-pleasant, comfortable-uncomfortable) were the best predictor of intention to quit smoking combustible cigarettes. In a previous, related study, Moan and Rise (2005) note that young adult smokers may exaggerate their perceived control over an addictive behavior, which may contribute to why perceived behavioral control is not a good predictor beyond intention to quit among that population. The authors of the Rise et al. (2008) study also extended the model and found that descriptive



norms (i.e., the perception of what others do) were more important than how their friends would approve or disapprove of the behavior. Results from a meta-analysis on the inclusion of descriptive norms in an extended TPB model lead Rivas and Sheeran (2003) to the same conclusion.

Hassandra and colleagues (2011) also found interesting results that may forecast potential e-cigarette prediction research. They found that as adolescents age, the influence of the various constructs on tobacco intention evolves. For students in senior high school, attitudes were less likely to predict intention to use compared to younger adolescents, while perceived behavioral control and subjective norms increased—the former contributing most significantly for the older population (Hassandra et al., 2011). The authors believed that this might happen as adolescents age because they become more independent. Subjective norms related to the family appear to decline as adolescents age for this same reason (Hassandra et al., 2011), so it stands to reason that this continues as adolescents move into adulthood and enter higher education.

Reasons for quitting the use of e-cigarettes may also be useful in informing prediction research on the intention to quit using e-cigarettes. Besides only using for experimentation (Pepper et al., 2014), top reasons high school and college students cited for discontinuing use of e-cigarettes included reasons related to subjective norms (e.g., being “uncool”) and attitudes (e.g., potential negative health consequences) (Kong et al., 2015). These two constructs appear to be more important in the context of e-cigarette quit intentions, but the evidence is too scarce, and perceived behavioral control items may not have been included in the list of reasons for quitting the use of e-cigarettes. More research is needed to fully understand and predict intention to quit using e-cigarettes.

## **Summary**

Many college students are currently using e-cigarettes, with the product Juul making up a vast majority. Current users appear more likely to be white, male, younger, or current combustible cigarette users. High rates of use are putting young adults at risk for nicotine dependence and a variety of adverse health outcomes such as impaired brain development, lung injury or illness, and death. Overall, current users tend to have a more favorable attitude towards e-cigarettes, find them more socially acceptable, have more friends that use, and possibly view them as easy to quit. Intention to quit is mixed among current research, warranting additional research to better understand intention and its relationship with attitudes, norms, and perceived behavioral control.

## **Chapter 3: Methodology**

This chapter contains the methodology utilized in the present study. Research design, as well as descriptions of the population, data collection, measures used, and analysis of data are covered.

### **Research Design**

The purpose of this study was to identify patterns of Juul use and subsequent quit intentions, as well as examine the relationships between the constructs of the Theory of Planned Behavior (i.e., attitudes, subjective norms, and perceived behavioral control) and the intention to quit using Juul, one brand of e-cigarette product. In addition, descriptive norms were also included as an extension of the TPB due to the apparent social nature of the product among youth and young adults. A cross-sectional design was utilized with an online survey of first-year college students currently using Juul to better understand their patterns of use and attempt to predict intention to quit among this population. The cross-sectional nature of this study provides a snapshot of first-year students near the end of their first semester in college (fall 2018)—a time when students are still navigating what is likely one of the most significant transitions in their lifetime (Corwin & Cintron, 2011).

### **Study Population**

A purposive sample of first-year college students enrolled at the University of Kentucky—a large public university located in Lexington, Kentucky—in the fall semester of 2018 was recruited for the present study. According to official University of Kentucky student data (University of Kentucky Institutional Research and Advanced Analytics, 2018), a total of 5,077 first-year students were enrolled at the time of the study, of which 4,980 were full-time. Of the full-time, first-year students enrolled at the

university, a majority were female (58%) and white (75.9%). Black or African Americans (7.3%) and Hispanic or Latino (4.8%) students represented the next two largest race/ethnicity categories.

Similar demographics were found in the overall sample of this study ( $N = 950$ ). Survey participants were 67.7% female, and 81% were white, non-Hispanic. Of those responding to the survey, a majority identified as straight/heterosexual (89.2%), lived on campus in university housing (88.8%), and were not part of social fraternity and sorority, nor planned to join in the future (62.5%). The age of retained participants ranged from 18 to 31, with an average age of 18.29 ( $SD = .66$ ).

### **Data Collection**

Data for this study were gathered via an online survey of full-time, first-year students at the University of Kentucky. The survey utilized in the present study was the second of three time-points in a longitudinal study of e-cigarettes use and various other health behaviors among incoming college students across their first year attending the university. Each time-point in the longitudinal study was distributed to all current full-time, first-year students and contained a base set of items to track over time. However, additional items were included at each point based upon trends from the previous surveys and anecdotal conversations with students. This allowed each timepoint to serve as a stand-alone cross-sectional survey. Administration for the second survey occurred for a three-week period beginning in mid-November and ending early December 2018. Data were obtained from measures relevant to the present study, including demographics, patterns of use and ownership, recent quit attempts, intention to quit using Juul or other e-cigarette products, as well as attitudes, norms, and perceived behavioral control related to

e-cigarette and Juul use (described further in the “Measures” section below). This time-point was selected for a cross-sectional analysis due to its inclusion of the necessary measures related to participants’ e-cigarette quit intentions, as well as patterns of use following exposure to the unique influences of college.

At the beginning of the larger survey (August 2018), a complete list of all full-time, first-year students and their corresponding university emails was obtained by the principal investigator from the University of Kentucky Institutional Research and Advanced Analytics department. All students on the list were recruited via email invitation from the principal investigator at each time-point to complete the corresponding survey. However, students had the option of unsubscribing from the email communications at any point in the study by clicking a link within the invitation or reminder emails. A total of 4,939 students received emails for this study. Two additional reminder emails were sent during the duration of the survey window. Only responses by participants aged 18 or older were retained.

Qualtrics, an online survey software, was used to distribute email communications and administer each survey, as well as ensure confidentiality and protect survey response data. Each student received a unique, confidential link to each survey and could only submit one response for any of the surveys. To encourage response rates (Laguilles, Williams, & Saunders, 2011), all students who completed the survey and submitted their emails on a separate page not connected to their responses were eligible to receive one of 100 \$25 gift cards to the online retailer Amazon through a random drawing. In a study conducted by Laguilles, Williams, and Saunders (2011), the researchers found that online survey response rates by college students can be improved using a lottery-based

incentive. This incentive was paid for with research grant funds from the University of Kentucky Center for Clinical and Translational Science (Ickes - PI).

The study and procedures were approved by the University of Kentucky Office of Research Integrity's Institutional Review Board. The institutional review board also approved a waiver of documentation of informed consent. Participants received a cover letter at the beginning of the survey stating the purpose, procedures, and inherent risks of participation. Completion of the survey indicated their consent to participate; however, participants were asked if they were willing to participate prior to completing the survey. A copy of the consent statement presented at the beginning of the survey can be seen in *Appendix A*.

## **Measures**

The following sub-sections will describe the various measures used for this study.

### ***Demographic Variables***

Various demographic items were used to identify personal and demographic factors among the sample population. Participants were asked their age (in years), location of housing (on-campus/university or off-campus housing), and whether they were a current member of a fraternity or sorority (yes; no, but I plan to join in the future; no, and I do not plan to join in the future). They were also asked how they would describe their gender identity (male, female, transgender, or do not identify as male, female, or transgender), race/ethnicity (White, non-Hispanic; Black, non-Hispanic; Hispanic or Latinx; Asian or Pacific Islander; American Indian, Alaskan Native, or Native Hawaiian; Middle Eastern; biracial or multiracial; and other), and sexual orientation (straight/heterosexual; gay or lesbian; bisexual; not sure; other). Due to small cell sizes,

only those identifying as male or female were retained for the analyses utilizing gender identity, and sexual orientation was dichotomized to “straight/heterosexual” and “lesbian, gay, bisexual, or other sexual orientation.”

### ***Patterns of Use and Ownership***

Four items were used to identify patterns of Juul use and ownership among all survey participants. The first, “Have you ever used a JUUL, even 1-2 puffs?” assessed ever use of Juul. For current use, participants were given the following item: “During the past 30 days, on how many days did you use each of the following?” E-cigarettes, Juul, and other pod-based systems were listed separately, with participants choosing between “have never used,” “have used, but not in the past 30 days,” “1-2 days,” “3-5 days,” “6-9 days,” “10-19 days,” “20-29 days,” and “daily” for each. Both items were adapted from the National Youth Tobacco Survey (CDC, 2018b).

First use of Juul was reported with the item, “When did you first use a Juul?” (I have never used Juul; in the past week; in the past 30 days; in the past 3 months; in the past 6 months; in the past year; more than a year ago). Participants, regardless of use status, also responded yes or no to the following item on Juul ownership: “I currently own at least one Juul device.”

### ***Social Influences***

Two items were used to assess social influences related to Juul. For friends’ use, all participants were asked, “Out of your five closest friends, how many of them currently use the following,” of which Juul was a choice. Respondents were given six choices (from zero to five) for this item, which was adapted from Berg and colleagues (2011). For family use, participants were asked whether “parental figures (e.g., mother, father,

stepparent, guardians)” or “other close family members (e.g., siblings, cousins, grandparents)” currently used Juul. Participants selected “yes” or “no” for each category.

### ***Recent Quit Attempts and Intention to Quit***

To correspond with the length of time participants had attended the university and assess if participants had recently had any quit attempts of e-cigarettes or Juul, all survey respondents were asked, “In the past 3 months, have you attempted to quit using e-cigarettes or Juul?” They could select from “yes,” “no,” or “I have not used an e-cigarette or Juul in the past 3 months.” Of the current users that responded to the item, 18 selected “I have not used an e-cigarette or Juul in the past three months,” indicating nearly 8% of defined current users may not have believed they were currently using and thus had not needed to attempt to quit. These 18 current users were included in the no recent quit attempts category.

All respondents, regardless of current use status, were asked, “Are you currently thinking of quitting using e-cigarettes or Juul?” to determine intention to quit. Options included “yes, I intend to quit in the next 30 days,” “yes, I intend to quit in the next 6 months,” “no, and I do not intend to quit in the next 6 months,” and “I do not currently use an e-cigarette or Juul,” and respondents could only choose one. This item included the final response even for those who were current users to assess any possible differences between current use classification and perceived current use. This item was adapted and combined from smoking cessation items used by DiClemente et al. (1991). Those defined as current users above who answered they were not currently using an e-cigarette or Juul were removed from analyses because they did not personally believe they were currently using the product, and there was no way to determine why they chose



this option. To avoid assuming that these participants lacked intention and therefore could be included in the no intention group, an explicit intention or lack of intention to quit using was needed to be included in analysis. After this removal, the 30-day and six-month intention to quit groups were combined since the purpose of the study was to examine relationships with any intention to quit in the near future, not how soon. No significant differences in sociodemographic factors existed between the two intention groups. Recoding created intention vs. no intention groups for analysis.

### *Attitudes*

Participants who had ever used Juul were given 14 different statements to rate their level of agreement on a four-point Likert scale ranging from one (“strongly disagree”) to four (“strongly agree”) related to their attitudes and perceptions towards Juul. Response options were limited to the four-point Likert scale (i.e., removing a “neutral” response) to simplify analysis and force participants to choose; this has been found to be a reliable and valid method (Nadler, Weston, & Voyles, 2015). Of the 14 statements, two were used for analysis based upon the relationship to attitudes toward Juul. These included (1) “Juuls are addictive” and (2) “Juuls ‘smoke’ or vapor is dangerous to breathe.” A summative score was computed for the two items to create an attitude scale for further analysis. This sub-score ranged from two to eight, with a higher score representing a more desirable response—a more negative attitude or belief toward the use of Juul.

### *Subjective Norms*

Two items adapted from Trumbo and Harper (2016) were used to assess respondents’ subjective norms: “It would be acceptable to my (1) closest

friends/(2)family members if I used Juul.” All participants, both Juul users and non-users, were given these two items and rated them on a four-point Likert scale from “strongly disagree” to “strongly agree.” A higher level of agreement indicated higher perceived acceptability by friends or family, so the items were reversed scored to have a higher score indicate a more desirable response (i.e., low perceived acceptability among friends or family). The subjective norm score ranged from two to eight, with a larger number indicating a lower perceived social pressure to continue using Juul.

### ***Descriptive Norms***

Perception of college student use was used to assess descriptive norms. Participants were asked, “In your opinion, how many college students, out of 100, currently use Juul?” and were presented a sliding scale from zero to 100. This item was adapted from the ACHA National College Health Assessment (2014).

### ***Perceived Behavioral Control***

Two items were used to assess perceived behavioral control. Survey participants were given a four-point Likert-type scale for each:

1. “When it comes to using tobacco, e-cigarettes, Juul, or similar products, I am confident I could say no if my closest friends or family members asked me to use.” Responses ranged from “strongly disagree” to “strongly agree.”
2. “If one of your friends or family members were to offer you a JUUL, how likely would you be to use it?” Responses ranged from “very unlikely” to “very likely.”

A summative perceived behavioral control score was created by combining the scores of the two items related to perceived behavioral control. The likelihood of Juul use if offered by someone close to them was reversed scored so that “very unlikely” (a desired response) was scored highest and “very likely” was scored lowest. This summative score ranged from two to eight. A score closer to eight indicated a higher perceived behavior control over Juul use.

## **Data Cleaning and Analysis Procedures**

### ***Data Cleaning***

All survey responses were recorded and stored in Qualtrics before analysis. The de-identified data were transferred to Microsoft Excel and Statistical Package for Social Sciences (SPSS) for additional cleaning and analysis. A total of 1,091 responses were received initially. After removing those who did not consent to the study ( $n = 8$ ), those under the age of 18 or did not respond ( $n = 76$ ), and those that did not answer necessary outcome measures (i.e., past 30-day use of Juul and intention to quit using Juul;  $n = 57$ ), a total sample of 950 participants remained for an effective response rate of 19.2%. To retain as much power as possible during each analysis, additional missing data were handled pairwise since most missing data appeared to be missing at random. The remaining sections explain the statistical tests performed during the analysis. Statistical significance was set at  $p < .05$ .

### ***Descriptive Statistics***

Frequency distributions or means and standard deviations were calculated for all individual measures described above, including research questions one and two which sought to describe the number of first-year college students with intentions to quit in the

next six months, as well as the proportion that have attempted to quit in the previous three months.

### ***Research Question Three***

To identify any statistically significant differences between personal and demographic factors or social influences and the intention to quit using Juul among currently using first-year students, Chi-square analysis, independent sample *t*-test, and Mann-Whitney *U* test were used, where appropriate. Intention to quit using Juul served as the dependent variable, while personal and demographic factors (e.g., gender, sexual orientation, current Juul ownership) served as the independent variables.

### ***Research Questions Four through Nine***

A hierarchical binomial logistic regression was used to determine if any relationships existed between each of the three constructs of the TPB (i.e., attitudes, subjective norms, perceived behavioral control), as well as descriptive norms, and the intention to quit using Juul among first-year students currently using the product.

The first model, a binomial logistic regression, included the TPB constructs as the independent variables and the intention to quit as the dependent variable. This test determined the fit of this model, which of the three constructs significantly predicted intention to quit using Juul, as well as which of the three best predicted intention to quit using Juul. Because the constructs interact with each other in addition to intention (Ajzen, 1991), this model provided fit for the three constructs collectively (Nagelkerke  $R^2$ ), as well as each construct individually (*exponentiated values of the coefficients*).

The second model added descriptive norms to the independent variables to determine if the addition of this variable to the first model significantly improved the

predictive model of intention to quit, thereby extending the TPB. A statistical difference between the two models' pseudo  $R^2$  values would indicate a stronger or weaker model with the addition of descriptive norms. The exponentiated values of the coefficients were compared in the second model to determine any differences between the four independent variables.

## Chapter 4: Manuscript

### Identifying and Predicting Intention to Quit Using Juul Among Emerging Adults

Primary proposed journal: Journal of American College Health

- Theoretical, scientific, and research manuscripts and reviews will be considered as major articles. The preferred length is 15 to 20 double-spaced pages (no more than 20 pages) (4,000–6,000 words), not including tables, figures, and references.
- Should be written with the following elements in the following order: title page; abstract; keywords; main text introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figures; figure captions (as a list)
- Should be no more than 6000 words, exclusive of the abstract, tables, references, figure captions, footnotes.
- Should contain a structured abstract of 150 words. Objective, Participants, Methods, Results, and Conclusions.
- Should contain between 3 and 5 **keywords**. Read [making your article more discoverable](#), including information on choosing a title and search engine optimization.

Secondary proposed journal: American Journal of Health Promotion

## **Abstract**

**Objectives:** (1) Describe intention to quit, (2) identify relationships between sociodemographic factors or social influences and intention to quit, (3) explore if Theory of Planned Behavior-informed constructs can predict intention to quit and identify which predicts best, and (4) discover if descriptive norms strengthen a predictive model of intention to quit among emerging adults currently using Juul. **Participants:** First-year students currently using Juul at a large university in the southeastern United States ( $N = 182$ ). **Methods:** A November 2018 online survey assessed sociodemographic characteristics, social influences, patterns of use, quit intention, and attitudes, norms, and perceived behavioral control toward Juul. **Results:** A quarter of participants reported current use, with nearly half intending to quit within six months. Recent quit attempts was the only factor related to intention. Two models were created that predicted intention to quit, but only perceived behavioral control was individually significant. **Conclusions:** Cessation-focused campaigns and interventions are needed on college campuses and could be less tailored than prevention.

*Keywords:* Juul; e-cigarette cessation; emerging adults; Theory of Planned Behavior

## **Introduction**

Tobacco use, namely combustible cigarette use, has been a major target for public health organizations in the United States for over 55 years. Efforts have appeared to work, as the use of combustible cigarettes has steadily declined, reaching all-time lows of 14% among adults (CDC, 2018a) and 4.3% among youth (Wang et al., 2019). Despite these positive strides, the sale and use of tobacco products have been on the rise recently, particularly among youth and young adults (CDC, 2019a). This rise can be attributed to the increasing popularity of electronic cigarettes (e-cigarettes), a type of tobacco product classified under the electronic nicotine delivery system (ENDS) umbrella. E-cigarettes, also known as “e-cigs,” “vapes,” or “vape pens” by users, became the most used tobacco product among youth and young adults in 2014 (CDC, 2019a) and use continues to be of concern among our youth. In 2019, over one in four (27.5%) high school students (Cullen et al., 2019) and nearly one in five college students (14.3%) (ACHA, 2019b) reported current use of e-cigarettes—any use in the past 30 days.

E-cigarette makers claim their products are cessation tools for adult cigarette smokers, but limited evidence exists showing that they are viable cessation tools. Despite their claims, some e-cigarette makers also appeared to target youth and young adults with unique flavors and advertising, which drew scrutiny from the government at the local, state, and federal levels, as well as from the media (Ducharme, 2019; Kaplan, 2019). This practice is concerning because many youth and young adults are initiating use of e-cigarettes as naïve or non-current tobacco users (Leavens et al., 2019; Ross et al., 2018), putting them at high risk for dual-use or use of combustible tobacco (Loukas, Marti, Cooper, Pasch, & Perry, 2018; Murthy, 2017; Primack et al., 2018; Spindle, Hiler,



Cooke, Eissenberg, Kendler, & Dick, 2017). One study found that college students who reported exclusive use of e-cigarettes were more than two times as likely to initiate combustible cigarette use up to a year and a half later when compared to non-tobacco users (Loukas et al., 2018).

At present, the long-term effects of e-cigarette use are not well known, and the U.S. Food and Drug Administration has yet to complete a full review of ENDS products (Truth Initiative, 2019). What researchers currently know is troubling, however. Given newer generations of e-cigarettes expose users to high levels of nicotine (Willet et al., 2019), dependence is of concern for youth and young adults. A study of participants aged 13-21 that compared self-reported usage rates of pod-based e-cigarettes with urine cotinine levels, a nicotine biomarker, found that regular users with little-to-no exposure to combustible tobacco had one and a half times the level of cotinine compared to regular combustible cigarette users (Goniewicz et al., 2018). Nicotine has also been shown to hinder brain development through the mid-20s—affecting attention, learning, mood, and impulse control (USDHHS, 2016).

In addition to the effects of high nicotine exposure, the aerosol produced from various e-cigarette products has been found to contain heavy metals, volatile organic compounds, and other cancer-causing agents that can negatively affect the lungs (UDHHS, 2016). This may have contributed to recent outbreaks of lung illnesses and injuries across the country. At the end of 2019, over 2,500 lung illnesses and injuries and 55 deaths related to e-cigarette use had been reported (CDC, 2019b). Patients aged 18-24 were the largest population affected, making up 40% of the total (CDC, 2019b). Seizures among youth and young adults (USFDA, 2019), exploding batteries leading to injury

(CDC, 2019c), and high levels of bacterial and fungal contamination within popular ENDS products (Lee, Allen, & Christiani, 2019) have also been reported.

Rechargeable e-cigarettes that use disposable pods have become exceptionally popular among youth and young adults due to their ease of use and concealment, sleek and modern design, and low initial cost (Haardoefer et al., 2017; Ickes et al., 2019; Willet et al., 2019). One brand, Juul, gained popularity among youth, reaching an astonishing 70% market share of all ENDS products at the end of the third quarter in 2019 (Wu, 2019). One Juul pod provides approximately 200 puffs and contains roughly the same amount of nicotine as a pack of combustible cigarettes (Campaign for Tobacco-Free Kids, 2018).

Current use rates of Juul among young adults have varied. Nationally, 11.2% of those aged 18-21 reported current use in the spring of 2018 (Vallone et al., 2019). Recent studies reporting current rates of Juul use on college campuses appear to be even higher, ranging from 21% (Ickes et al., 2019) to 29.6% (Leavens et al., 2019). Among college freshmen, the same population as this study, rates have been reported as high as 32.3% (Bourdon & Hancock, 2019). One study even found reported rates of Juul use to be higher than e-cigarettes, despite Juul falling under the e-cigarette category as a single brand (Ickes et al., 2019). Various sociodemographic factors have been found to be related to current use of Juul among college students, such as those who are white/non-Hispanics, younger undergraduates, current combustible tobacco users (Ickes et al., 2019; Vallone et al., 2019), males (Ickes et al., 2019), those with greater financial comfort, a less harmful perception of e-cigarettes, household use, and higher sensation-seeking traits (Vallone et al., 2019).

Given the risks of nicotine and e-cigarette aerosol exposure and the high rates of use, particularly Juul use, among youth and young adults, e-cigarette cessation needs to be emphasized among these populations. College campuses could serve as a prime catalyst for this shift due to the high rates of use among lower undergraduates and the potential for increased availability of resources compared to public middle and high schools.

### ***Theoretical Foundation***

One of the most commonly utilized theories in health behavior research is the Theory of Planned Behavior, or TPB (Ajzen, 2011). In the theory, intention (i.e., the likelihood an individual believes they will engage in a specific behavior) precedes action and is considered the best single measure of it (Ajzen, 1991). Three primary constructs are presented that individually and collectively influence one's intention to perform or not perform a behavior. These are (1) attitudes, which are positive or negative beliefs held toward a behavior or its outcomes, (2) subjective norms, which is a perception of social pressure from significant individuals that one feels to perform a behavior, and (3) perceived behavioral control, a concept similar to self-efficacy and is a perceived level of difficulty to perform a behavior (Ajzen, 1991). A more positive attitude, a higher perceived expectation from others of importance, or an increased belief that one has control over performance can lead to a higher intention to perform said behavior and, in turn, action on the behavior.

Tobacco research, specifically combustible cigarette cessation, has been a focus of TPB research in the past (e.g., Rise et al., 2008). In fact, due to the addictive nature of nicotine, the TPB is better suited to tobacco cessation research than its predecessor, the

Theory of Reasoned Action (Fishbein & Ajzen, 1977), because of the addition of perceived behavioral control (Ajzen, 1988). Past nicotine research has shown the theory to be an effective predictor, with upwards of approximately 30% (Rise et al., 2008) to 50% (Norman, Connor, & Bell, 1999) of the variance in behavioral intention explained by the constructs of the TPB. Given the high amount of nicotine often present in Juul and similar products, the TPB should be a good theoretical guide for e-cigarette prevention and cessation research. No previous research utilizing the TPB to better understand and predict the intention to quit using e-cigarettes, namely Juul, was found at the time of writing. However, similar research could provide some insight.

Past research on e-cigarettes has found that users tend to have a more positive attitude toward the use of the product than non-users (Case et al., 2016; Coleman et al., 2016; Vallone et al., 2019), which could be expected given their use of the product. Youth and young adults appear to view them as a healthier or less risky alternative (Case et al., 2016; Katz et al., 2019) and a “younger, newer, modern, technologically-savvy” product (Katz et al., 2019; p.82). Regarding attitudes toward Juul specifically, one study of older adolescents and young adults found that those perceiving ENDS to be less harmful than combustible cigarettes were more likely to use Juul (Vallone et al., 2019). Another found Juul users to be as statistically likely to perceive them as harmful when compared to combustible cigarettes, but more likely to perceive them as addictive (Case et al., 2020).

Subjective norm perceptions of e-cigarette users have also seen an emphasis in recent research, and there appears to be a link between what others close to an individual think about their current (Coleman et al., 2016; Leavens et al., 2019; Noland et al., 2016)

or potential use (Case et al., 2016; Katz et al., 2019). E-cigarettes tend to be more socially acceptable than combustible cigarettes overall (Coleman et al., 2016; Katz et al., 2019), as well as among close friends or family (Case et al., 2016; Noland et al., 2016).

Research by Leavens and colleagues (2019) found that Juul users were overwhelmingly likely (78.6%) to tell at least one close friend of their use and even more likely (89.3%) to perceive at least one close friend of approving.

Perceived behavioral control has likely been a limiting factor in quitting combustible cigarettes (Bledsoe, 2006), likely due to the need for overcoming the physically and mentally addictive nature of nicotine (Norman et al., 1999). However, e-cigarettes may be viewed differently, as users in one study noted how they felt more in control over the use of the product due to what they perceived as casual personal use and thus feeling “more immune to the addiction” (Katz et al., 2019, p. 84). Regular and more casual users may perceive their control over the product differently, which could, in turn, affect their intention to quit using the products.

Based on prior tobacco research related to the TPB, social influences and descriptive norms could also play a role in the intention to quit using e-cigarettes. Use by friends and family has been shown to be associated with current e-cigarette or Juul use (Scholly, Garcia, Dodge, & Pokherl, 2018; Schoren, Hummel & de Vries, 2017; Vallone et al., 2019; Vu et al., 2019), with use by friends often cited as a top reason for initiating use (Coleman et al., 2016; Ickes et al., 2019; Kong et al., 2015; Leavens et al., 2019; Pepper, Ribisl, Emery, & Brewer, 2014). Descriptive norms (i.e., what an individual thinks others are doing) have been advocated to be added as an extension of the TPB (Rise et al., 2018; Rivis & Sheeran, 2003). Research shows college students tend to

overestimate e-cigarette use by peers (e.g., ACHA, 2019b; Noland et al., 2016), which could be why it would be a good fit in extending the TPB to predict quit intentions.

Overall, quit intentions have been shown to be low, especially among young adults (Vu et al., 2019) and those exclusively using e-cigarettes (Azagba, Shan, & Latham, 2019; Schoren, Hummel, & de Vries, 2017; Vu et al., 2019). Social users have been found to be more likely to have intention to quit compared to those using the product as a cessation tool for combustible cigarettes, however (Coleman et al., 2016). Predicting users' intention to quit using e-cigarettes, particularly Juul, remains unseen at the time of writing.

### ***Purpose***

High rates of Juul use by those transitioning into adulthood and entering college (i.e., emerging adults), along with gaps in current e-cigarette cessation research among all age groups, necessitates studies to better understand users' intentions to quit using any e-cigarette product and to ensure that future e-cigarette cessation campaigns and interventions are more likely to be successful. Using the constructs of the TPB as a guide, the purpose of this study is to: (1) identify current patterns of Juul use and users' intention to quit using; (2) better understand how sociodemographic factors and social influences relate to users' intention to quit using Juul; (3) determine if attitudes, subjective norms, and perceived behavioral control toward the product can predict intention to quit using Juul and identify which best predicts intention; and (4) discover if the addition of descriptive norms strengthens a predictive model of intention to quit among emerging adults that are currently using Juul.

## **Method**

### ***Design and Sample***

The present study, a descriptive, cross-sectional design conducted via an online survey of full-time, first-year undergraduate students at a large state university in the southeastern United States, was the second of three time-points in a more extensive longitudinal study assessing various health behaviors among this population. In August 2018, the university's institutional research office provided a complete list of university email accounts for all full-time, first-year students at the university. Emails inviting the students to participate totaled 4,939, of which 1,091 responded. After removing those who selected they did not consent to participate in the research study, those under the age of 18 or missing an age response, and those missing responses for key outcomes (i.e., past 30-day use of Juul and intention to quit using Juul), 950 remained—an effective response rate of 19.2%. Fairly consistent with the official reported university statistics on full-time, first-year year students, the sample was 68% female, 81% white, non-Hispanic, and an average age of 18.3 years. A final sample of those who reported any use of Juul within the past 30 days (i.e., current users) was retained for analysis ( $n = 236$ ) and will be described in the results section.

### ***Procedures***

Students were invited to participate in the second of three surveys in mid-November 2018 and had until early-December to complete the survey. Online survey software Qualtrics (Qualtrics, Inc., 2020) was used to distribute all email communications to the students, administer the survey, and ensure confidentiality by protecting survey response data. Students received a unique and confidential link for the survey, allowing

for only one response per student. To encourage response rates, two follow-up reminder emails at one-week intervals were sent to those who had not completed the survey at that time. Additionally, all students who completed the survey were offered a chance to win one of 100 \$25 gift cards to a large online retailer if they clicked the provided link and submitted their email address on the separate page that was not linked to their responses. Prior to data collection, university's institutional review board approved the study and procedures.

### ***Measures***

**Demographic Variables.** Age, gender identity, race/ethnicity, sexual orientation, housing location (on-campus vs. off-campus), and membership within or intention to join a social fraternity or sorority were assessed. Only those identifying as male or female were retained for analyses utilizing gender identity due to small cell sizes. Sexual orientation was dichotomized to straight/heterosexual and other sexual orientations (i.e., lesbian, gay, bisexual, not sure, and other).

**Patterns of Use and Ownership.** Four items were used to assess and identify patterns of Juul use and ownership among all survey participants. Participants were asked if they had ever used Juul, even 1-2 puffs (yes or no) (CDC, 2018b) to assess ever use of Juul. Current use, defined as any use within the past 30 days, was assessed on an item asking participants how many of the past 30 days they had used Juul (had never used, had used but not in the past 30 days, 1-2, 3-5, 6-9, 10-19, 20-29, or daily) (CDC, 2018b). Participants were also asked when they first used Juul (have never used, in the past week, in the past 30 days, in the past three months, in the past six months, in the past year, or more than a year ago) and whether they currently owned at least one Juul device.



**Intention to Quit and Recent Quit Attempts.** All participants, regardless of current use status, were asked whether they were currently thinking of quitting using e-cigarettes or Juul. Response options included intention to quit within the next 30 days, intention to quit within the next six months, no intention to quit in the next six months, or indicating they did not currently use. This item was adapted from smoking cessation items used by DiClemente et al. (1991) to assess the stages of readiness and capture behavioral intention. Those defined as current users above who answered they were not currently using an e-cigarette or Juul were removed from analyses because they did not personally believe they were currently using the product, and there was no way to determine why they chose this option. To avoid assuming that these participants lacked intention and, therefore, could be included in the no intention group, an explicit intention or lack of intention to quit using was needed to be included in analysis. After this removal, the 30-day and six-month intention to quit groups were combined since the purpose of the study was to examine relationships with any intention to quit in the near future, not how soon. No significant differences in sociodemographic factors existed between the two intention groups. Recoding created intention vs. no intention groups for analysis.

Participants were also asked whether they had attempted to quit using e-cigarettes or Juul within the last three months, which corresponded with the amount of time since the previous survey and is considered a recent quit attempt in this study. Of the current users that responded to the item, 18 selected “I have not used an e-cigarette or Juul in the past three months,” indicating nearly 8% of defined current users may not have believed they were currently using and thus had not needed to attempt to quit. These 18 current

users were included in the no recent quit attempts category.

**Social Influences.** Friends and family use were used to assess social influences for Juul use. For friends' use, participants were asked how many of their five closest friends currently used Juul (Berg et al., 2011). Juul use by family members was split into two categories. Participants were asked whether "parental figures (e.g., mother, father, stepparent, guardians)" or "other close family members (e.g., siblings, cousins, grandparents)" currently used Juul, with participants selecting yes or no for each group.

**Attitudes.** Two items were used from the survey to assess attitudes toward Juul. Participants who had ever used Juul were asked to rate their level of agreement on a four-point Likert scale ranging from one ("strongly disagree") to four ("strongly agree") whether they thought (1) Juuls were addictive and (2) the vapor they produced was dangerous to breathe. Response options were limited to the four-point Likert scale (i.e., removing a "neutral" response) to simplify analysis and force participants to choose—a method found to be reliable and valid (Nadler, Weston, & Voyles, 2015). Scores from both items were added together to create an attitude score ranging from two to eight, with a higher number indicating a more desirable response (i.e., a more negative attitude).

**Subjective Norms.** All survey participants, both Juul users and non-users, were asked to rate perceived acceptability of Juul use from (1) closest friends and (2) family members (Trumbo and Harper, 2016) on a four-point Likert scale from "strongly disagree" to "strongly agree." These two items were reverse-coded and then added together to create a subjective norm score ranging from two to eight, where a higher value indicated lower acceptability of Juul use from family and friends.

**Perceived Behavioral Control.** The first item to assess perceived behavioral

control asked all survey participants to rate on a four-point Likert scale from “strongly disagree” to “strongly agree” that they would be confident in saying “no” to a friend or family member if they asked them to use a tobacco product, including Juul. The second asked participants how likely they would be to use a Juul, specifically, if it were offered by a friend or family member. Response options to this item, which was reverse-coded to match the valence of the previous item, were also on a four-point Likert scale ranging from “very unlikely” to “very likely.” The two items were summed to create a perceived behavioral control score from two to eight, where a higher number indicated a higher perceived control over the use of Juul or similar products if they were offered.

**Descriptive Norms.** Perception of college student use of Juul was used to assess descriptive norms. Participants were asked how many college students, out of 100, they believed currently used Juul, which was adapted from the American College Health Association (ACHA) National College Health Assessment (2014). A sliding scale from zero to 100 was used to record their response.

### ***Data Analysis***

Descriptive statistics, including frequency distributions or means and standard deviations, were used to identify patterns of use and intention among the sample population. Chi-square tests of association, independent sample *t*-tests, or Mann-Whitney U test were used, where appropriate, to identify any associations between current users’ intention to quit using e-cigarettes or Juul and various sociodemographic variables, recent quit attempts, patterns of Juul use and ownership, and social influences.

A binomial logistic regression was used to examine the potential relationships between the constructs of the TPB and current users’ intentions to quit using Juul, as well

as the constructs' collective ability to predict quit intentions among current Juul users. A second model was created that added descriptive norms as an additional independent variable to determine if the addition of this variable created a more predictive model than attitudes, subjective norms, and perceived behavioral control alone. Thus, a hierarchical or stepwise binomial logistic regression was used overall. The Homer-Lemeshow test was used to assess the overall model fit, and multicollinearity checked to ensure parameter estimates were not distorted. All analyses were done using IBM SPSS Statistics 26; an alpha level of .05 was used.

## **Results**

Of the 950 responses retained, 236 (24.8%) participants reported use of Juul within the past 30 days. Over two out of every five participants (43.2%) reported use on ten or more of the past 30 days. Less than half (45.3%) of the full-time, first-year students currently using Juul reported some intention to quit using within the next six months. Close to one-third (31.8%) reported no intention to quit using Juul in the next six months, while just shy of a quarter of current users (22.9%) did not consider themselves as currently using an e-cigarette or Juul. Of those reporting an intention to quit using Juul, approximately one-third (31.8%) had intention to quit in the next 30 days, while the remaining 68.2% reported an intention to quit within the next six months. The 54 participants that did not believe they were currently using Juul were removed from the remaining analyses, leaving an effective sample size of 182 participants in the intention to quit modeling.

### ***Association of Sociodemographic Factors and Intention to Quit Using Juul***

After comparing sociodemographic factors and social influences with the

intention groups, the only statistically significant differences that existed between the intention groups was with the recent quit attempt groups ( $\chi^2 = 37.51$ ;  $p < .001$ ; see Table 1). Gender, race/ethnicity, sexual orientation, housing location, social fraternity/sorority status, Juul ownership, use by family (parental or other close family members), number of days of Juul use within the past 30, and number of five closest friends using were not associated with intention to quit in the unadjusted analysis. Overall, 24.7% of the participants had attempted to quit in the past three months. Upon further analysis, among the participants who had attempted to quit within the past three months ( $n = 45$ ), 97.8% reported an intention to quit within the next six months, whereas 46% ( $n = 63$ ) of those who did not report a recent quit attempt indicated intention to quit.

### ***Predicting Intention to Quit Using Juul***

Frequencies for the individual items used for the logistic regression analysis can be found in Table 2. A majority of current users agreed or strongly agreed that Juuls were addictive (91.2%), the vapor they inhaled was dangerous to breathe (66.1%), their friends would approve of their use (94.2%), their family would not approve of their use (73.7%), and they felt confident they could say no to a close friend or family member if offered a Juul (78.3%). However, an overwhelming majority (89.4%) also said they would be likely to use it if offered. Current users also perceived that 65.2% of college students were currently using Juul. Means and standard deviations for current Juul users' attitude, social norm, and descriptive norm scores, as well as perceived behavioral control, are presented in Table 3.

The first of the two-step binary logistic regression models, which utilized attitude, subjective norm, and perceived behavioral control score to predict intention to quit using

Juul, was statistically significant compared to no model ( $\chi^2(3) = 13.09; p = .004$ ; see Table 3). Using Nagelkerke's  $R^2$  value, the model accounted for an estimated 9.9% of the variance. Among the three constructs included in this model, perceived behavioral control was the only individually significant variable ( $OR = 1.42, 95\% CI [1.07, 1.89]; p = .016$ ).

The second model, which added descriptive norms to attitudes, subjective norms, and perceived behavioral control, was also significant overall ( $\chi^2(4) = 13.98; p = .007$ ) and accounted for an estimated 10.6% of the variance (Nagelkerke's  $R^2 = .106$ ). However, there was no statistically significant difference between the two models ( $p = .346$ ). In this case, adding descriptive norms did not create a better model. Users' descriptive norm perceptions were also statistically insignificant on their own ( $p = .348$ ). As with the first model, perceived behavioral control was the only individually significant variable ( $OR = 1.42, 95\% CI [1.07, 1.90]; p = .016$ ).

## **Discussion**

To better understand the quit intentions of young, emerging adults currently using Juul, this study identified relationships that existed between quit intentions and current users' patterns of use, sociodemographic factors, and social influences. It also determined whether models informed by the TPB constructs could predict current users' intention to quit using Juul. The present study adds to the growing body of research on e-cigarettes, specifically Juul, as no previous studies were found describing young adults' intentions or factors related to intention to quit using Juul, nor were any studies that used the TPB to guide a predictive model for quitting e-cigarette products like Juul.

A significant portion of the full-time, first-year college students in this study were

found to be current Juul users, with close to one quarter self-reporting use of Juul at least one time in the past 30 days. Nearly half of the current Juul users reported use on ten or more of the days, indicating that many users are using at least somewhat regularly. Current rates of Juul use in this study are consistent with recent research on college students (Ickes et al., 2019; Leavens et al., 2019), but slightly lower than a sample of first-year college students in another study (Bourdon and Hancock, 2019). Interestingly, current rates of Juul use among this sample population were significantly higher than reported current e-cigarette use rates among undergraduates from a similar time frame in the ACHA National College Health Assessment II survey (ACHA, 2018b). This finding underscores the importance of adapting measurement and surveillance tools more regularly as the product landscape evolves quickly. This could mean including specific brands like Juul as examples, or ensuring language is updated with the current product landscape (e.g., disposables) when attempting to identify rates of e-cigarette use. Younger users may not be perceiving Juul as an e-cigarette product, as suggested by previous research (Ickes et al., 2019), and newer brands or products like disposable e-cigarettes appear to be gaining in popularity as well (Associated Press, 2020).

An encouraging finding from this study was that nearly half of the current Juul users had an intention to quit using the product within the next six months. Close to one-third of those who reported intention to quit using Juul intended to quit within the month, while the remaining two-thirds had an intention to quit between one and six months. On the same intention item, however, a quarter of those defined as current Juul users appear not to consider themselves a current user, despite having used within the past 30 days. These participants had to be removed from further analyses to avoid making assumptions

without context. These findings suggest many Juul users could benefit from e-cigarette quit support resources on college campuses.

When comparing the various sociodemographic factors, social influences, and patterns of use and ownership with users' intentions to quit, only the recent quit attempts category was shown to be significantly correlated. Nearly all current Juul users reporting at least one quit attempt in the past three months appeared to be undeterred by failed attempts at cessation, as they were significantly more likely to have an intention to quit. Again, this further supports the need for campaigns and resources on college campuses designed to support current users from intention to action. Additionally, longitudinal research is needed to determine what protective factors lead users from intention to action to sustained cessation.

Despite statistical insignificance among the other sociodemographic factors and current users' intentions to quit, there is a practical significance in the findings. Previous research has identified relationships between multiple sociodemographic factors and e-cigarette or Juul-specific use (e.g., Ickes et al., 2019; Vallone et al., 2019). While these previously identified relationships could be used to target prevention campaigns and interventions, approaches for cessation-focused campaigns and interventions may vary. Findings in this study suggest that once these emerging adults become Juul users they are as statistically as likely to have quit intentions across various sociodemographic factors. Therefore, approaches for campaigns, interventions, and resources aimed at e-cigarette cessation may be more generalized, which can save valuable time and money in developing them, as well as possibly improving their efficacy nationwide. More research is needed in this area before definitive conclusions can be drawn, as there were no similar



studies found that compared sociodemographic factors and e-cigarette quit intentions.

A few findings from the items related to the TPB constructs (i.e., attitudes, subjective norms, and perceived behavioral control) are worth noting. Current Juul users in this study overwhelmingly agreed that Juuls were addictive, which had not been seen in previous studies (e.g., Case et al., 2020). Along with the majority agreeing Juul aerosol was dangerous to breathe, it could be assumed that users recognize the dangers and previous prevention messages have permeated. Also, a difference among subjective norm perceptions was found between friends and family. A vast majority of current Juul users perceived higher acceptance of use from friends but not family, which may need to be taken into account when building future predictive models or when trying to cultivate protective factors toward cessation. Finally, a disconnect was also found between the confidence in being able to say no to using Juul and the likelihood of use if offered by family or friends. Most current users felt confident in saying no but were still likely to agree they would use it if offered. Additional research is needed to examine the potential differences between the self-efficacy of saying “no” and the likelihood of use, which could be a difference in the perception of mental and physical dependence, or a social influence or misperception of a social influence at play.

The first model to predict current Juul users’ intention to quit, which utilized attitudinal, subjective norm, and perceived behavioral control scores, was found to be statistically significant when compared to no model, though the amount of explained variance was relatively low compared to previous tobacco research predicting intention to quit using the TPB constructs (Norman, Connor, & Bell, 1999; Rise et al., 2008). Not enough evidence exists within this or other studies to determine whether this is a result of

the model, the use of the theory, the differences in tobacco products, or some combination of these factors, though, which presents a need for validated measures specific to quitting. The second model, which added descriptive norms to the independent variables, was also able to predict intention to quit. Despite a slight improvement in explained variance, however, it was not statistically different from the first model. This suggests that what participants think others like themselves are doing may not be as influential to a Juul users' intention to quit, and the addition of descriptive norms may not significantly improve predictive models. More research is needed to determine whether the statistical significance translates into practical significance.

Among the individual TPB-informed construct scores used in the two models to predict intention to quit using Juul, only perceived behavioral control was found to be individually statistically significant in either model. Past research has also suggested perceived behavioral control to be the most important factor leading to intention for behaviors in which individuals may have little-to-no control over, like nicotine dependence (Ajzen, 1988), so it is unsurprising it was to be the most predictive. This finding suggests that self-efficacy could be a primary focus of e-cigarette cessation campaigns and interventions and that resources are needed to counter the physical dependence on nicotine that is likely occurring as well. Additional research is needed to confirm these findings, however.

### ***Limitations and Future Directions***

The sample population in this study (i.e., full-time, first-year students at a single university in the southeastern United States) and focus on a single product (i.e., Juul), limits generalizability for younger or older populations, those at other universities, or

other e-cigarette products, potentially. This specific age group was intentionally chosen, however, and could be seen as a strength, given that emerging adults are going through a significant life change and the first year of college presents an opportune moment to intervene before behaviors are influenced by the college environment and further cemented for the future. At the time of the study, Juul was the most popular e-cigarette product on the market, by far, justifying the specific product focus. This research also only provides a snapshot in time—the end of the fall 2018 semester—as a cross-sectional design. Therefore, longitudinal data on students across multiple colleges and universities would provide more detail and allow for further understanding of the factors that influence e-cigarette users' intention to quit.

Another limitation of this study for predicting intention to quit Juul was the use of items that were more global in nature (e.g., attitude toward the product) rather than behavior-specific (i.e., attitude toward quitting the use of Juul). Data were analyzed secondarily, so TPB-related items were gathered from the available survey items. Grounding future research items in the theory, as suggested by Ajzen (2002), could further strengthen the model. Future research should also add more items to assess the individual constructs, and those items should be more behavior-specific to better understand the scope of influence attitudes, subjective norms, descriptive norms, and perceived behavioral control have on intention to quit using e-cigarette products. Qualitative research could also help inform these items and add more context across different populations.

As the e-cigarette landscape evolves and regulation of the products increases to try and curb youth and young adult use (Ducharme, 2019; O'Reilly, 2020), colleges and

universities must prepare to meet the needs of their students by increasing their focus on e-cigarette cessation while maintain prevention efforts. Many flavors have already been banned and the age to purchase has been raised to 21 nationwide (Nedelman, 2020; O'Reilly, 2020), which has already led to increases in the use of disposable e-cigarettes among youth and young adults (Associated Press, 2020). The development of campaigns and interventions designed to move e-cigarette users from intention to action, as well as programs and resources supporting the e-cigarette cessation process, are needed. Given the rapidly changing nature of the e-cigarette market, these campaigns and interventions need to be designed and studied with adaptability and universality in mind.

### ***Conclusions***

A significant number of first-year, full-time college students are currently using Juul, one type of e-cigarette product, making action on the part of colleges and universities across the country necessary. While nearly half of current users reported an intention to quit within the next six months, many campuses have not yet implemented e-cigarette cessation campaigns and interventions, and efficacy of e-cigarette cessation campaigns and interventions is limited. Only recent quit attempts were found to be statistically significant when identifying relationships between Juul quit intentions and various sociodemographic-related factors. There appear to be virtually no differences in intention to quit among different gender identities, races/ethnicities, etc., once emerging adults become users, but additional research is needed to confirm. The two models created in this study were found to be significant in predicting intention, suggesting that the TPB could be a good fit for predicting intention and future action toward quitting Juul or other e-cigarette products. However, the second model, which added descriptive

norms, did not statistically improve from the first model. This warrants revisiting in future research since it has been found to be significant in previous tobacco research on quit intentions (Rise et al., 2008) and more research is needed to determine the practical significance. Finally, perceived behavioral control was the only individual construct found to be significantly related in either model, indicating a need to focus on self-efficacy and refusal skills, as well as resources for nicotine dependence.

Overall, while results from this study show a high percentage of full-time, first-year students are currently using Juul, there is a desire from current users to quit using Juul or similar e-cigarette products. The results also suggest that time and money could potentially be saved by being able to generalize these campaigns and interventions compared to the more tailored and targeted ones needed for prevention, given that there may not be any personal or demographic differences in intention once emerging adults become users. More research is needed before any definitive conclusions can be drawn.

## Tables

Table 1. Associations among sociodemographic factors and intention to quit using Juul.

Characteristic	Overall ( <i>n</i> = 182)*		No Intention to Quit ( <i>n</i> = 75)*		Intention to Quit ( <i>n</i> = 107)*		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Gender							0.865
Female	122	67.80%	50	68.50%	72	67.30%	
Male	58	32.20%	23	31.50%	35	32.70%	
Race/ethnicity							0.427
White/non-Hispanic	155	85.16%	62	82.70%	93	86.90%	
Other race/ethnicity	27	14.84%	13	17.30%	14	13.10%	
Sexual orientation							0.896
Straight/heterosexual	168	92.31%	69	92%	99	92.50%	
LGB & other sexual orientations	14	7.69%	6	8.00%	8	7.50%	
Housing location							0.896
On-campus/university housing	168	92.31%	69	92.00%	99	92.50%	
Off-campus housing	14	7.69%	6	8.00%	8	7.50%	
Social fraternity or sorority status							0.621
Yes	75	41.21%	31	41.30%	44	41.10%	
No, but plan to join	31	17.03%	15	20.00%	16	15.00%	
No, and no intention to join	76	41.76%	29	38.70%	47	43.90%	
Juul ownership							0.361
Yes	121	66.48%	47	62.70%	74	69.20%	
No	61	33.52%	28	37.30%	33	30.80%	
Recent quit attempts							<.001
Yes	45	24.73%	1	1.30%	44	41.10%	
No	137	75.27%	74	98.70%	63	58.90%	
Juul use by parental figure							0.965
Yes	161	96.99%	66	97.10%	95	96.90%	
No	5	3.01%	2	2.90%	3	3.10%	
Juul use by other close family member							0.904
Yes	73	44.51%	29	43.90%	44	44.90%	
No	91	55.49%	37	56.10%	54	55.10%	

Table 1 continued.

Number of days used in past 30 <sup>t</sup>							0.412
1-2 days	44	24.18%	19	25.30%	25	23.30%	
3-5 days	20	10.99%	12	16.00%	8	7.50%	
6-9 days	21	11.54%	8	10.70%	13	12.20%	
10-19 days	24	13.19%	8	10.70%	16	15.00%	
20-29 days	18	9.89%	6	8.00%	12	11.20%	
Daily	55	30.21%	22	29.30%	33	30.80%	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	
Number of 5 closest friends using <sup>^</sup> ( <i>n</i> = 171)	3.79	1.25	3.76	1.26	3.80	1.15	0.832

Note: \**n* sizes vary due to sporadic missing data; <sup>t</sup>Mann-Whitney *U* test; <sup>^</sup>two-sample *t* test

Table 2. Frequency table of Theory of Planned Behavior-related items ( $n = 171$ ).

		Strongly disagree or Very unlikely	Disagree or Unlikely	Agree or Likely	Strongly agree or Very likely
Attitude	"Juuls are addictive."	2 (1.2%)	12 (7.6%)	79 (46.2%)	77 (45.0%)
	"Juul 'smoke' or vapor is dangerous to breathe."	8 (4.7%)	50 (29.2%)	82 (48%)	31 (18.1%)
Subjective Norm	"It would be acceptable to my closest friends if I used Juul."*	1 (0.6%)	9 (5.3%)	74 (43.3%)	87 (50.9%)
	"It would be acceptable to my closest family if I used Juul."*	66 (38.6%)	60 (35.1%)	34 (19.9%)	11 (6.4%)
Perceived Behavioral Control	"...I am confident I could say no if my closest friends or family members asked me to use."	10 (5.8%)	27 (15.8%)	78 (45.6%)	56 (32.7%)
	"If one of your friends or family members were to offer you a Juul, how likely would you be to use it?"*	2 (1.2%)	16 (9.4%)	89 (52.0%)	64 (37.4%)

Note: \*Item was reverse scored



Table 3. Descriptive statistics of construct scores and descriptive norms ( $n = 171$ ).

Construct	Possible Range	Min	Max	Mean	SD
Attitude score	2-8	2	8	6.15	1.20
Social norm score	2-8	2	8	4.61	1.20
Perceived behavioral control score	2-8	2	8	4.80	1.15
Descriptive norm	0-100	8	100	65.22	20.82

Table 4. Hierarchical binary logistic regression results ( $n = 171$ ).

Predictor	Model 1					Model 2				
	<i>b</i>	<i>SE(b)</i>	W	OR	<i>p</i>	<i>b</i>	<i>SE(b)</i>	W	OR	<i>p</i>
Attitude score	.27	.14	3.65	1.30	.056	.26	.14	3.50	1.30	.061
Subjective norm score	.21	.14	2.27	1.23	.132	.21	.14	2.30	1.23	.129
Perceived behavioral control score	.35	.15	5.77	1.42	<b>.016</b>	.35	.15	5.79	1.42	<b>.016</b>
Descriptive norm score						-.01	.01	.88	.99	.348
Summary statistics			$\chi^2$	<i>df</i>	<i>p</i>			$\chi^2$	<i>df</i>	<i>p</i>
Likelihood ratio test			13.09	3	<b>.004</b>			13.98	4	<b>.007</b>
Hosmer and Leseshow			5.19	8	.737			3.68	8	.887

## **Chapter 5: Discussion, Implications, and Conclusion**

The purpose of this study was to: (1) identify patterns of current Juul use and intention to quit using Juul: (2) better understand how personal and demographic factors, as well as other social influences, relate to users' intention to quit using Juul: (3) determine if attitudes, subjective norms, and perceived behavioral control toward the product could predict intention to quit using Juul and identify which of the three best predicts: and (4) discover if the addition of descriptive norms strengthens a predictive model of intention to quit among young, emerging adults currently using Juul. Previous studies describing young adults' intention or factors related to intention to quit using Juul were not found, nor were any studies that used the TPB to guide a predictive model for quitting e-cigarette products like Juul. This study adds to the growing body of research on e-cigarettes, specifically Juul.

### **Summary of Results**

A significant portion of the sample population of full-time, first-year students were found to be currently using Juul. Approximately one-quarter of participants reported using Juul on at least one day in the past 30 days. Of those current Juul users, nearly half reported using on at least 10 of the past 30 days, indicating many current users are using at least somewhat regularly. These findings are consistent with recent Juul research conducted on college students (Ickes et al., 2019; Leavens et al., 2019), but was a little lower than rates reported by college freshmen in another recent study (Bourdon and Hancock, 2019). Contrary to what might be expected, current rates of Juul use, a single product, among this sample population were significantly higher than reported overall e-cigarette rates of use among undergraduates at a similar time frame from the ACHA

National College Health Assessment II survey (ACHA, 2018b), the most comprehensive data available on college students nationwide.

A desire to quit was evident among current Juul users in this study, which was an encouraging finding. Nearly half of current Juul users indicated they had an intention to quit using the product within the next six months. Of those who reported having an intention to quit using Juul, close to one-third intended to quit within the next month, while the remaining two-thirds reported an intention to quit between one and six months. An important note, however, is that on the same item that assessed intention, a quarter of those defined as current Juul users did not consider themselves a current user, despite having reported use of the product within the past 30 days. This led to the need for removing these respondents from further analyses to avoid making assumptions on their use and quit intentions without additional context.

Among the various sociodemographic factors, social influences, and patterns of use and ownership that were utilized to discover any relationships that existed with current Juul users' quit intentions, only the recent quit attempts category was shown to be significantly correlated. Those who reported trying to quit using Juul within the past three months were significantly more likely to indicate having a current intention to quit within the next six months. This is important to note because nearly all current Juul users who had attempted to quit recently appear undeterred by failed or on-going cessation attempts. Gender, race/ethnicity, sexual orientation, housing location, social fraternity/sorority status, Juul ownership, use by family (parental or other close family members), number of days of Juul use within the past 30, and number of five closest friends using were not associated with intention to quit in the unadjusted analysis; however, the practical

significance of these findings will be discussed in the implications section.

From the items utilized in this study that related to the TPB constructs (i.e., attitudes, subjective norms, and perceived behavioral control), a few findings are noteworthy. The first is that most Juul users appear to recognize the potential dangers and consequences of using the product. Current Juul users in this study overwhelmingly agreed that the product was addictive—something not found in previous studies (e.g., Case et al., 2020). A majority also agreed that the aerosol produced by Juul was dangerous to breathe. A second noteworthy finding from these TPB-informed items was the difference among subjective norm perceptions between friends and family. A vast majority of current Juul users perceived a higher acceptance of use from friends and a lower acceptance of use from family. Finally, there was also a disconnect found between current Juul users' confidence in being able to say no to using and the likelihood of using if offered by a close family member or friend. Overall, most current users indicated that they felt confident refusing the use of the product, but most users were also likely to agree to use it if it were offered.

Two models were created to predict current Juul users' intention to quit using the product. The first model utilized attitudinal, subjective norm, and perceived behavioral control scores and was found to be statistically significant compared to no model. However, compared to similar tobacco research using the TPB constructs to predict the intention to quit (Norman, Connor, & Bell, 1999; Rise et al., 2008), the amount of explained variance was relatively low in this study. Evidence within this or other studies is insufficient to determine if the lower explained variance is a result of the model, the applications of theory to decide the measures used, the differences in tobacco products, or

some combination of these factors. Future examination would also allow researchers to determine whether the statistical significance is considered meaningful in practice.

The second model, which added descriptive norms to the original three constructs, was also found to be statistically significant. It was not statistically different from the first model, however, despite a slight improvement in the explained variance of the second model. Within this research, descriptive norms score was not a necessary addition to TPB-related constructs in order to predict intention to quit using Juul, but additional evidence would confirm this finding, as well as practical significance.

Finally, among the individual TPB-informed construct scores used in the two models, only perceived behavioral control was found to be a statistically significant individual predictor of the intention to quit. Past research has suggested perceived behavioral control to be the most important factor leading to intention for behaviors in which individuals may have little-to-no control over, such as nicotine dependence (Ajzen, 1988), so the findings appear to be in line. Attitudes also approached significance in both of the models; however, until it, subjective norms, or descriptive norms are found to be statistically significant individually, this research suggests that self-efficacy could be the main factor in the prediction of intention to quit using Juul or similar e-cigarette products.

### **Strengths**

The sample population is one major strength of this study. Although focused on full-time, first-year students, the first year of college could present a critical moment for intervention given that emerging adults are going through a significant life change and they have been exposed to the influences of the college environment to a lesser extent than upper-level students so externally-influenced behaviors may be less solidified.

Compared to the available demographic data for all full-time, first-year students at the university, the overall sample of respondents was fairly representative as well. The size of the sample population was also large enough to provide ample power for analyses thanks to an effective response rate of nearly 20% of the entire full-time, first-year student population at the university. This effective response rate was higher than a previous similar survey of college students at the same university (Ickes et al., 2019), which could be attributed to the inclusion of an incentive.

This study also filled in additional gaps and added to the knowledge base of current e-cigarette research. It confirmed high rates of single e-cigarette product use (i.e., Juul) and the importance of adapting surveillance tools to match the rapidly evolving market. The study was presumably the first to try to identify relationships between an individuals' intention to quit using Juul and various sociodemographic and social influence factors. Prediction of intention to quit using an e-cigarette product like Juul had not been seen in previous research as well, which provides vital knowledge to inform various implications described later in this chapter.

### **Limitations**

Cross-sectional surveys have their limitations because they only capture a single moment in time. The data from this survey only provides a snapshot of the end of the fall 2018 semester at a single university in the southeastern United States for this sample population of full-time, first-year students. Along with the specific, focused nature of the population and the product, the findings may not be as generalizable to other institutions, the student body at-large, or other e-cigarette products. However, the time frame of this study could be an ideal time for intervention as first-year students have had some time to

settle into college life but have not been immersed in it for so long that changing habits may prove more difficult.

Another limitation of this study was the use of items that were more global in nature (e.g., attitude toward the product) rather than behavior-specific (e.g., attitude toward quitting the use of Juul) in creating the attitudinal, norm, and perceived behavioral control scores for the prediction models. This data was analyzed secondarily, so items could not be altered to be more representative of the theory's constructs. Therefore, this study should be considered theoretically informed by TPB rather than a strict application of the theory and its constructs.

## **Implications**

### ***Theoretical***

This study was the first of its kind within the context of e-cigarette cessation research. It attempted to apply the constructs of the TPB to predict the intention to quit using Juul among emerging adults who were currently using the product. The first of two models created in this study was statistically significant and able to explain at least some variance in the intention to quit. This suggests that the TPB is a viable theoretical foundation for predicting intention to quit using Juul or similar products. However, as noted in the limitations section, the items utilized from this secondary data were more global in nature and should be directed more toward one's attitudes, perceived norms, and perceived behavioral control related to the behavior of quitting, ideally. More evidence is needed to determine if the model itself, the application of the theory to create the items used, any differences in tobacco products, or some combination of these factors are reasons for lower explained variance and whether this is practically significant in



addition to being statistically significant. Grounding future e-cigarette cessation research items in the theory, as suggested by Ajzen (2002), could further strengthen this type of research and potentially explain more variance in the intention to quit.

Another theoretical implication of this research involves extending the theory to include other factors, such as how many people an individual thinks are performing a particular behavior (i.e., descriptive norms). This idea has been approached and advocated in previous tobacco research (e.g., Rise et al., 2008) and was tested in the current study. The second model used in the prediction of intention to quit using Juul was also statistically significant on its own. When compared to the first model, however, there was no statistical difference in them. More evidence is needed to confirm, but an extended model including descriptive norms may not provide any additional predictive power and highlights what could be a lesser need for norm-setting in future e-cigarette cessation research and practice.

### ***Future Research***

As e-cigarette research is still in a relatively early stage, and the market continues to evolve, future research needs and opportunities are plentiful. There is still a large gap in e-cigarette cessation research, with many topics yet to be explored. The following recommendations for future research are based on the findings of this study:

- Include a definition of “current use” on any items that provide an option that allows participants to identify as non-current users, despite reporting past 30-day use. The use of additional measures, such as frequency or recency of use, could also help confirm.
- Conduct longitudinal data on students across multiple colleges and

universities to better understand intention and action over time, as well as allow for further identification and understanding of the protective factors that influence e-cigarette users from intention to action and eventually to cessation.

- Further explore potential differences related to the intention to quit in the subjective norm perceptions between family and friends, as well as their individual relationships to intention.
- Analyze potential differences between physical and mental dependence, as well as other influences, in the use of products like Juul, especially in relation to users' perceived behavioral control and quit intentions.
- Conduct qualitative research to better understand students' needs and intentions, help inform future TPB-based items, and add more context to future findings.
- Continue to explore additional constructs, like descriptive norms, that could extend and improve TPB and the prediction of intention to quit.

### ***Health Promotion Practice***

Colleges and universities must prepare to meet the needs of their students by increasing their focus on e-cigarette cessation. The findings in this research suggest a captive audience awaits, as many full-time, first-year college students reported intention to quit using Juul by the end of their first year. Development of campaigns and interventions designed to move e-cigarette users from intention to action, as well as programs and resources supporting the e-cigarette cessation process, are needed. Additional key learnings from this study could help guide these early efforts.

Despite statistical insignificance among all but one of the sociodemographic factors that were compared to current users' intentions to quit using Juul, a practical significance exists. Previously, relationships between multiple sociodemographic factors and e-cigarette or Juul-specific use have been identified (e.g., Ickes et al., 2019; Vallone et al., 2019). These relationships could be useful in targeting prevention campaigns and interventions to the most at-risk sub-populations. Cessation-focused campaigns and interventions are not necessarily the same, however. The findings in this study suggest that once these students become Juul users they are as equally likely to have quit intentions across various sociodemographic factors. Therefore, campaigns, interventions, and resources toward e-cigarette cessation may need to be different. The need for less-tailored cessation efforts allows these campaigns and programs to be simpler and more generalized, which could save valuable time and money in developing them, as well as possibly improving their efficacy nationwide. As noted in the future research section, more research is needed to confirm this for long-term sustainability.

Being able to predict current users' intentions to quit using an e-cigarette product could also help health communicators, health education specialists, and practitioners. Knowing users' attitudes, perceived norms, and perceived behavioral control towards these products may allow those in the field to identify users who could be most ready to quit and tailor their approach to help move those less ready towards quitting. They could also craft campaigns and resources to be more effective by understanding attitudes, highlighting subjective norms, and working on self-efficacy related skills. This research, though limited as the first of its kind in this context, points to the later construct, perceived behavioral control, as a good starting point to help move those with intention

toward action and eventual cessation.

The e-cigarette landscape continues to evolve quickly, and regulation of e-cigarette products has increased to try and curb the high rates of use among youth and young adults (Ducharme, 2019; O'Reilly, 2020). Many flavors have already been banned, and the age to purchase has been raised to 21 nationwide (Nedelman, 2020; O'Reilly, 2020). Early evidence suggests that this may have already led to increases in the use of the less-regulated disposable e-cigarettes among youth and young adults (Associated Press, 2020). Given the rapidly changing nature of the e-cigarette market, research, campaigns, and interventions need to be designed and assessed with adaptability and universality in mind.

## **Conclusion**

Many first-year, full-time college students were found to be currently using Juul, just one type of e-cigarette product. This troubling trend warrants swift action on the part of colleges and universities across the country. While many campuses have not yet implemented e-cigarette cessation campaigns and interventions, nor were any studies found on their efficacy at the time of writing, a captive audience appears to await their arrival. Nearly half of current users in this study reported an intention to quit by the end of their first year of school. Of the various sociodemographic and social influence factors included, only recent quit attempts had a statistically significant relationship with current Juul users' intentions to quit—those with recent quit attempts were more likely to have an intention to quit. This also seems to suggest that once emerging adults become users there are virtually no quit intention differences between different gender identities, races/ethnicities, etc., but additional research is needed to confirm.

Both models created in this study to predict intention to quit were found to be statistically significant, which suggests that the TPB could be a good fit for predicting intention and future action toward quitting Juul or similar e-cigarette products. However, given the low explained variance, more research is needed to determine if this provides practical significance. Additionally, the second model, which added descriptive norms, was not statistically different from the first model. Exploring other constructs, like descriptive norms, that could be added to the traditional TPB constructs to extend and improve the TPB and the prediction of intention to quit is warranted in future research since it has been found to be significant in past tobacco research on quit intentions (Rise et al., 2008). Finally, the only individually significant construct in the TPB-guided models was perceived behavioral control, highlighting a need to focus on self-efficacy and refusal skills, as well as resources for nicotine dependence.

Overall, this study appears to show that characteristics associated with the risk of initiation are not the same as those related to cessation. Prevention and cessation may need to be approached differently in both research and practice. If it holds true in future research, this also suggests that time and money could be saved by being able to generalize campaigns and interventions compared to the more tailored and targeted ones needed for prevention. However, more research is needed before definitive conclusions can be drawn.

## Appendices

### Appendix A

#### JUUL Survey Fall 2018- T2 Incoming Students

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##### **Start of Block: Default Question Block**

Q1 Hello, [First Name].

Researchers at the University of Kentucky are inviting you to take part in an online survey to learn about college students' health behaviors. Your responses will help us improve on-campus programming. You were identified as a freshman enrolled at the University of Kentucky during the 2018-2019 academic year(s) and we invite you to complete a brief online survey. You may have already participated in a similar survey in August. We appreciate that and hope you will take a moment to complete this survey as well. We will also be following up one more time in April.

**After you complete the survey, you will be eligible for one of 100 \$25 Amazon gift cards through a random drawing.** A link at the end of the survey will lead you to a different survey page, where you can enter your e-mail address to sign up for the drawing. It will not be possible to tie your survey responses to entry into the drawing. The likelihood of winning the gift card will vary depending on how many students take part in the research study. The odds of winning are no worse than 1 in 50. We will be offering additional incentives for participation in the next survey.

The survey will take about 10-15 minutes to complete. The survey will include questions related to your attitudes toward and participation in certain health behaviors. You will have until November 28th to complete this survey. Should you participate in all three surveys, total time commitment will be about 30-45 minutes over an 8-month period.

There are no known risks to participating in this study. Your response to the survey is confidential which means no names will appear or be used on research documents, nor be used in presentations or publications.

We hope to receive completed surveys from about 1500 freshmen, so your answers are important to us. Of course, you have a choice of whether or not to complete the survey, but if you do participate, you are free to skip any questions or discontinue at any time. Your consent to participate in the study is determined by the completion and submission of the surveys.

Please be aware, while we make every effort to safeguard your data once received from the online survey company, given the nature of online surveys, as with anything

involving the Internet, we can never guarantee the confidentiality of the data while still on the survey company's servers, or while en route to either them or us. It is also possible the raw data collected for research purposes will be used for marketing or reporting purposes by the survey/data gathering company after the research is concluded, depending on the company's Terms of Service and Privacy policies.

If you have questions about the study, please feel free to ask; my contact information is given below. If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff at the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-866-400-9428.

Thank you in advance for your assistance with this important project. **To ensure you are entered into the gift card drawing, please submit your completed survey/questionnaire by December 1.**

Sincerely,

Melinda J. Ickes, PhD  
Associate Professor  
*Department of Kinesiology and Health Promotion*  
*College of Education*  
University of Kentucky  
PHONE: 859-257-1625  
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Q2 Do you consent to participate in the study?

- Yes (1)
- No (2)

**Skip To: End of Survey If Do you consent to participate in the study? = No**

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## Jakob W. Hester

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### CURRICULUM VITAE

April 2020

#### EDUCATION

2017 – 2020 M.S. in Health Promotion, University of Kentucky  
Advisors: Melody Noland, PhD and Melinda Ickes, PhD

2011 B.S. in Kinesiology, University of Kentucky  
B.S. in Health Promotion, University of Kentucky

#### PROFESSIONAL EXPERIENCE

9/2018 – Present **Wellness Specialist**  
HR Health & Wellness, University of Kentucky, Lexington, KY

8/2017 – 8/2018 **Graduate Assistant**  
HR Health & Wellness, University of Kentucky, Lexington, KY

7/2016 – 10/2018 **Team Prevent Lifestyle Coach**  
CoachShellie, Lexington, KY

9/2016 – 8/2017 **Exercise Consultant; Wellness Guide**  
HR Health & Wellness, University of Kentucky, Lexington, KY

8/2012 – 7/2016 **Assistant Coach, Cross Country & Track and Field**  
Transylvania University, Lexington, KY

#### RESEARCH EXPERIENCE

8/2018 – Present **Co-Investigator**, *Predictors of JUUL Use Among Incoming College Students: Longitudinal Study*  
Supervisor: Melinda Ickes, PhD, University of Kentucky

1/2018 – 8/2018 **Co-Investigator**, *Predictors of JUUL Use Among Emerging Adults: A Pilot Study*  
Supervisor: Melinda Ickes, PhD, University of Kentucky

#### GRANT EXPERIENCE

PI: Melinda Ickes, PhD

Title: Predictors of JUUL Use Among Young Adults

Funding Source: Centers for Clinical and Translational Science, University of Kentucky

Amount: \$5,000

## **PUBLICATIONS**

Ickes, M., **Hester, J.W.**, Wiggins, A.T., Rayens, M.K., Hahn, E.J., & Kavuluru, R. (2019) Prevalence and reasons for Juul use among college students, *Journal of American College Health*, DOI: 10.1080/07448481.2019.1577867

## **CONFERENCE PRESENTATIONS**

**Hester, J.W.**, Wiggins, A.T., & Ickes, M. (2019). JUUL use among emerging adults transitioning from high school to college. Poster accepted at the annual meeting of the National Conference on Tobacco and Health. Minneapolis, MN.

Ickes, M., **Hester, J.W.**, & Wiggins, A.T. (2019). E-cigarette use among emerging adults: Is juuling just a trend? Oral presentation at the Athens Institute for Education and Research during the Annual International Conference on Public Health. Athens, Greece.

Ickes, M., **Hester, J.W.**, & Wiggins, A.T. (2019). Student tobacco use behaviors on college campuses by strength of tobacco-free campus policies. Poster presented at the American College Health Association Annual Conference. Denver, CO.

**Hester, J.W.**, Wiggins, A.T., & Ickes, M. (2019). Patterns of JUUL use among incoming college students. Poster accepted at the annual meeting of the American College Health Association. Denver, CO.

**Hester, J.W.**, Wiggins, A.T., & Ickes, M. (2019). JUUL Patterns of use and purchase among college students. Poster presented at the annual meeting of the Society for Public Health Education. Salt Lake City, UT.

Ickes, M., **Hester, J.W.**, & Wiggins, A.T. (2019). Attitudes toward JUUL regulation and tobacco control policies among emerging adults. Oral presentation at the annual meeting of the Society for Public Health Education. Salt Lake City, UT.

## **HONORS AND AWARDS**

2018-2019                      Collegiate Champion, Society for Public Health Education

2018                              Summer Research Funding, Department of Kinesiology and Health Promotion, College of Education, University of Kentucky