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Effects of Vaping on Positive Affect, Negative Affect, and Stress: A Pilot Study of a College

Sample

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Abstract

As it is a relatively new concept, there is little research on the topic of vaping and e-cigarette usage among young adults. These practices were branded as being a healthier alternative to smoking, and while this may be true, young adults who do not already engage in smoking have become increasingly more likely to start vaping. While the long term effects of vaping and e-cigarette use are still unknown, they have been linked to several changes in affect and stress levels. To explore the reasons that college-aged young adults are starting to use e-cigarettes and how their behaviors might be affecting them, as well as the feasibility of using ecological momentary assessment to collect data, an ecological momentary assessment study was conducted on Elizabethtown College undergraduate students ($n=7$, 85.7% female, 85.7% White, $M_{age}=20.14$). Participants completed a baseline study once, before completing 3 randomly scheduled surveys a day. They were also asked to complete one event-dependent survey a day. The daily surveys lasted for 14 days. The preliminary results indicated an increase in positive affect after vaping ($p<.05$) and a decrease in negative affect after vaping ($p<.05$). Additionally, compliance rates indicated that EMA is a valid data collection method for smoking and vaping studies.

Keywords: Stress, affect, vaping behaviors, e-cigarettes, ecological momentary assessment

Introduction

In recent years the use of traditional cigarettes has decreased, however, the use of electronic or e-cigarettes is becoming increasingly popular among young adults and adolescents (Miller et al., 2017). In fact, data collected by the Pew Research Center (2020) shows that since 2017, regular vaping has increased from 9% to 21% among college aged students. Additionally, adults under the age of 30 are far less likely to view vaping as harmful, as compared to adults older than 30 years of age (Schaeffer, 2020). Despite the lack of current evidence, cigarette smokers and nonsmokers alike have begun to view vaping or e-cigarette use as a healthier alternative to cigarettes (Harrell et al., 2019). While people who are using e-cigarettes to quit smoking may be seeing better health results, there appears to be a more pressing concern among nonsmokers. Young and emerging adults are significantly more likely to try vaping even if they have never tried a cigarette (Harrell et al. 2019). Even though the risk of vaping is highest for young adults, there is little research exploring why this might be, as vaping is a relatively new concept (Pokhrel et al., 2015). Specifically, little is known about the relationship between mental health issues and vaping (Park et al., 2017).

Alternative forms of smoking, namely e-cigarettes or vapes, have become quite popular among young adults. Smoking an e-cigarette is often referred to as vaping, as the e-juice is heated to a certain temperature, which creates a vapor that can be inhaled by the user (Pokhrel et al., 2015). The term e-cigarette can refer to any device used to vaporize the substance that is being smoked (Kenne et al., 2017). Examples of these devices are “mods, advanced personal vaporizers, and vape pens” (Kenne et al., 2017). Most commonly, the e-juice or e-liquid is made up of glycol or vegetable glycerin, nicotine, and flavor concentrates, though nicotine-free liquid

is also available (Pokhel et al., 2015). It is important to note that aside from nicotine, e-cigarettes may also be used to vape illicit substances such as cannabis (Kenne et al., 2017). Vapes are inherently more convenient than cigarettes as they can be covertly used indoors and they do not emit a staining cigarette smell (Harrell et al., 2019; Popova et al., 2018). Emerging adults have been shown to find vapes more convenient and as a result they are more likely to try e-cigarettes, and use them for long periods of time (Harrell et al., 2019; Pokhel et al., 2015).

Beyond convenience, researchers have identified a number of other positive consequences that incline young adults to try vaping. Multiple studies have suggested that emerging adults view vaping as significantly safer than cigarettes, and therefore they are more likely to experiment with e-cigarettes (Harrell et al., 2019; Kenne et al., 2017; Pokhel et al., 2015; Popova et al., 2018). Considering a study by Harrell et al. (2019), young adults who have never smoked cigarettes may be at a high risk for experimenting with vaping; approximately 70% of participants reported never smoking a cigarette prior to e-cigarette use. A number of other positive consequences expressed by emerging adults are that vaping nicotine-based products relieves stress, suppresses appetite, reduces boredom, and gives them a nicotine “buzz” (Harrell et al., 2019; Pokhel et al., 2015). Moreover, for adults who already engage in traditional smoking, the use of e-cigarettes has the ability to contribute to smoking cessation, which may be a positive for smokers of all ages, although the long term effects of vaping are still unknown (Pokhel et al., 2015). Even though vapers may identify these effects as positive, it remains unclear whether each of these effects happens as a result of vaping, or as a result of another external variable. To expand on that, a growing concern among researchers is that despite the

perceived positive consequences, the influence of vaping on overall psychological well-being is not clear.

When analyzing vaping behaviors, it is important to consider the relationship between psychological well-being and e-cigarette use. In many cases, e-cigarette use is associated with pre-existing mental health issues, such as depression and anxiety; for those who experience mental health issues, e-cigarette use is more likely (Park et al., 2017). Furthermore, Miller et al. (2017) proposes that young adults who experience low affect may be more likely to use nicotine products, even if they have never tried them before. Notably, when youth perceive reduction in negative affect immediately after vaping, their frequency of vaping has been shown to increase in order to maintain positive affect (Miller et al., 2017). This is concerning for young adults, as constant vaping of nicotine products could result in substance dependence, and the experience of withdrawal symptoms (Harrell et al., 2019). In this way, vaping also presents users with negative consequences such as worries of developing addiction and an inability to function without the presence of regular vaping. Study participants have also identified experiencing significant worrying related to their future health since inhaling anything foreign into one's lungs can be damaging to overall health (Harrell et al., 2019). Comprehensively, vaping results in both positive and negative consequences for users, but research that ascertains data of daily vaping habits is sparse, and has been generally challenging to conduct.

One reason that young and emerging adults might begin and continue vaping is because it helps to regulate stress and mood. There is some evidence, for example, that young adults' positive expectancies for e-cigarette use is predictive of their e-cigarette usage over time (Correa et al., 2019). While existing research points to an association between affect-regulating and

stress-reducing expectations for e-cigarettes and e-cigarette usage, the direct in-vivo effect of e-cigarette usage on affect and stress is not established. For example, it is not known whether e-cigarette usage increases positive affect, diminishes negative affect, or reduces stress in the moments following use. The existing research that is related to the relationship between e-cigarette use and various aspects of mental health remains mixed, therefore, it is important to further examine what is currently known about e-cigarette use.

Past research has examined variables such as affect, stress, and mood in relation to cigarette use, however, few studies have focused on e-cigarettes or vapes. A study done by Gonzalez et al. (2008) recruited daily cigarette smokers in order to assess smoking motives related to emotional dysregulation, negative affectivity, and anxiety sensitivity. Researchers were able to identify a significant relationship between anxiety sensitivity and coping, addictive, habitual smoking motives (Gonzalez et al., 2008). Additionally, it was established that emotional dysregulation was associated with habitual smoking motives, while negative affectivity was associated with relaxation smoking motives. A study such as this suggests that for daily cigarette and nicotine users especially, negative affect, anxiety, and emotional dysregulation may act as significant motivators for smoking engagement. Similarly, a study by Mermelstein et al. (2010) utilized ecological momentary assessment (EMA) to assess the relationship between mood and smoking among adolescents. As described by the researchers, directly prior to smoking, adolescents felt significantly more negative as compared to other background moments during the day. Following instances of smoking, adolescents reported feeling happier, calmer, and more socially accepted (Mermelstein et al., 2010). Again, these studies support the idea that smoking motivation is at the very least associated with anxiety, stress, and mood. Despite the described

studies being focused on cigarette smoking trends, it is possible that these results will generalize to e-cigarette trends as well since both products are intended to deliver similar experiences to users.

In the past, vaping habits have been particularly difficult to study as it is not always possible to gather data that is in the moment, and reflective of naturalistic habits. However, researchers have begun using ecological momentary assessment (EMA) in order to gather data that actually represents daily vaping habits. More specifically, EMA involves sampling subjects multiple times per day so they are able to self-report about experiences and behaviors in real-time, in natural environments (Jones et al., 2018). Most commonly, researchers use online platforms and applications to create surveys that can be administered to participants on their own mobile device, or a device provided by researchers (Jones et al., 2018; Mackessy-Amiti & Donenberg, 2019; Moore et al., 2014). Research studies that have implemented EMA have successfully ascertained data related to positive and negative affect in substance users, addictive, drug-related behaviors, and active engagement with various substances (Jones et al., 2018; Mackessy-Amiti & Donenberg, 2019). Moreover, EMA data collection can reduce the likelihood of recall bias, meaning participants are less likely to forget details about events since they are prompted soon after they occur. Since data is collected in the moment, researchers have the ability to maximize ecological validity and produce data that is representative of true substance use habits (Kuntsche & Labhart, 2013).

The purpose of the present study is to examine the association between mood, affect, and vaping habits among emerging adults. More specifically, ecological momentary assessment (EMA) will be used in order to administer repeated daily surveys to participants. EMA is ideal

for assessing changes in affect following behaviors such as e-cigarette usage because it allows for temporal modeling between daily events and yields a more accurate recounting of events than retrospective measures administered days or weeks later. Being that this is a pilot study, researchers hope to assess whether or not EMA is a valid technique for obtaining data related to vaping habits. As described above, vaping has been associated with various mental health issues, however, researchers are unable to identify directional relationships between the use of e-cigarettes and various aspects of well-being (Jones et al., 2018; Mackessy-Amitit & Donenberg, 2019). For this reason, the current study aims to expand upon what is presently known about vaping habits and their relation to an individual's well-being. Considering the discussed literature, researchers hope to answer the following questions as a result of examining the effects of vaping on stress and mood through the use of EMA:

1. Is EMA a feasible means of collecting data about e-cigarette usage, affect, and stress in student and community samples?
2. What vaping-related beliefs or expectations predict daily vaping behaviors?
3. What is the effect of vaping on momentary changes in positive affect, negative affect, and perceived stress?

Method

Participants

The participants in this study were 7 current Elizabethtown College students who were aged 18-22. All participants were required to have regular access to a smartphone and endorse regular vaping behaviors, meaning that they vaped at least once a week. Participants were primarily recruited through a flyer sent by email. The flyer was also posted on social media (Instagram, Facebook, Etown app). 5 of the 6 participants identified as female with the

remaining participant identifying as male. 5 of the 6 identified as white, while the remaining participant identified as biracial/multiracial. 50% (3 of 6) of participants reported that they identified as straight/heterosexual and the other 50% identified as bisexual/pansexual (Table 1). Advertisements were also put onto an Elizabethtown Community page to encourage community members to participate.

Procedure

Before starting the study, participants were required to fill out an informed consent form that was sent to them by email. They were provided with an online copy as well. All participants who filled out this form were assigned a number code to keep their identity anonymous. These participants were invited to join the survey on ExpiWell where they completed the baseline and 4 daily surveys. The baseline survey included questions about the participants' basic demographics (e.g. gender, race, education status). Additionally, the baseline survey measured current cigarette/e-cigarettes habits and stress/affect levels. The baseline survey measured current cigarette/e-cigarette habits, stress, mood, affect and beliefs about the consequences of vaping. Other questions used in the baseline were taken from an assortment of similar studies.

Participants filled out the baseline questionnaire the day before they were invited to start filling out the daily surveys. The following day they began to receive 3 notifications to fill out the daily survey randomly throughout the day. The first was sent between 10am and 1pm, the second between 2 and 5pm, and the third between 6 and 9pm. Participants had an hour to complete each survey. The fourth daily survey was event based. Participants were asked to complete the fourth survey once a day immediately after vaping. If they did not vape that day, they were instructed to not fill it out. These 4 surveys were available everyday for 14 days.

Measures

Vaping consequences and behaviors. The Brief Smoking Consequences Questionnaire (Rash & Copeland, 2008) was adapted to ask about beliefs about the implications of vaping instead of smoking. This is a 25-item questionnaire and participants were asked to rate how likely the consequence was on a scale from 0 (Not likely at all) to 9 (Very likely) (Rash & Copeland, 2008). The questionnaire involved statements like “The more I vape, the more I risk my health” and “Vaping helps me enjoy people more” (Rash & Copeland, 2008). This scale has a Cronbach’s Alpha score ranging from .68 to .88 (Rash & Copeland, 2008).

The Short Form Vaping Consequences Questionnaire (Morean & Wedel, 2017; Myers, McCarthy, MacPherson & Brown, 2003) was used to measure the beliefs about the impacts that vaping may have. It is a 21-item 10-point likert-type scale. Participants were asked to rate how likely each situation may be. A rating of 0 indicates that the situation is “Completely unlikely” and a rating of 9 indicates that is “Completely likely” (Morean & Wedel, 2017; Myers, McCarthy, MacPherson & Brown, 2003). An example of one of these situations is “Vaping helps me deal with depression” (Morean & Wedel, 2017; Myers, McCarthy, MacPherson & Brown, 2003).

Nicotine dependency. The Hooked on Nicotine Checklist (DiFranza, et al. 2002) was used to measure the participants’ perceived level of addiction to vape/e-cigarettes. Originally, this measure was meant to measure nicotine addiction, but it was adapted to ask about nicotine dependency in the form of vaping for the purposes of this study. This questionnaire has 10-item and participants answered questions with a yes or no and it has a Cronbach’s Alpha score of .91

(DiFranza, et al. 2002). Participants were asked questions like “Do you ever have strong cravings to vape” and “Have you ever felt like you were addicted to vaping” (DiFranza, et al. 2002).

Stress and mood. The Perceived Stress Scale (Cohen, Kamarck & Mermelstein, 1983) was used to assess the degree of stress the participant felt they were under. Participants were asked to rate on a scale of 0-4 how often they experienced the statement during the previous month. 0 indicated “Never”, 1 meant “Almost Never”, 2 meant “Sometimes”, 3 equated “Fairly often” and 4 meant “Very Often” (Cohen, Kamarck & Mermelstein, 1983). The questionnaire contains 10 items including statements like “In the last month, how often have you been upset because of something that happened unexpectedly” (Cohen, Kamarck & Mermelstein, 1983).

Depression, anxiety, and stress. The Depression, Anxiety, and Stress Scale (DASS-21) (Lovibond & Lovibond, 1995) was used in the baseline to measure participants’ levels of stress and the emotions that the participants are feeling before starting the daily measures. The original format is 42 items, but the shortened 21-item version was used for the purposes for this study. The scale requires participants to rate statements on a scale of 0 to 3. A rating of 0 indicated “Did not apply to me at all”, 1 indicated “Applied to me to some degree or some of the time”, 2 indicated “Applied to me to a considerable degree or a good part of the time”, and 3 indicated “Applied to me very much or most of the time” (Lovibond & Lovibond, 1995). The DASS-21 has three subscales: Depression ($\alpha = .82$ to $.84$), Stress ($\alpha = .74$ to $.81$) and Anxiety ($\alpha = .74$ to $.81$) (Nanthakumar, et al. 2017). The depression scale involved statements like, “I couldn’t seem to experience any positive feeling at all” and “I found it difficult to work up the initiative to do things” (Lovibond & Lovibond, 1995). The anxiety scale involved statements like, “I was aware of dryness of my mouth” and “I felt close to panic” (Lovibond & Lovibond, 1995). The stress

scale involved statements like “I found it hard to wind down” and “I found it difficult to relax” (Lovibond & Lovibond, 1995).

Positive and negative affect. The Positive and Negative Affect Scale (Watson, Clark & Tellgen, 1988) was used to measure the general moods of the participant in the preceding week. It is a 20-item 5-point Likert-type scale. 1 represented “Very slightly or not at all” and 5 represented “Extremely” (Watson, Clark & Tellgen, 1988). The participants were given different feelings and asked to rate them according to how often they had felt them in the previous week. These included affects such as “Proud” and “Ashamed” (Watson, Clark & Tellgen, 1988).

Daily Measures

Vaping. In each of the daily measures, participants were first asked to answer questions about positive and negative affect that were chosen from the Positive and Negative affect scale. They were then asked if they had engaged in vaping behavior since the last time that they completed a daily measure, and how many puffs they had taken and how much “e-liquid” they used if they had vaped. If the participant reported a vaping behavior they then answered the same affect questions in the context of how they felt before vaping.

Stress and affect. To measure stress and affect participants were asked to fill out a portion of the Positive and Negative Affect Scale (Watson, Clark & Tellgen, 1988). The daily measure began with 5 questions from the positive subscale and 5 questions from the negative subscale. Participants were asked to answer them according to how they felt in the current moment. After answering the vaping questions, participants were again asked to answer the same 10 Positive and Negative Affect Scale questions but in the context of how they felt before they engaged in the vaping behavior.

Data Analysis

Study descriptive statistics and correlations between baseline variables were conducted in IBM SPSS Statistics Software Version 24 (cite). EMA data was analyzed using the Mixed models With Intensive Longitudinal Data (MixWILD) standalone application (Dzubur et al., 2020). The study utilized a two-stage data analysis approach; the first stage involved a mixed-effects location scale modeling estimation of subjects' mean, or location, and variable, or scale. The second stage provided an integration of location and scale effects into subject-level linear regression (Hedeker & Nordgren, 2013).

Results

Baseline

Vaping and smoking behaviors. Roughly half of the participants (42.9%) reported vaping every day for the past thirty days. Two participants (28.6%) reported vaping 5-6 times per day in the past 30 days. One of the remaining participants (14.3%) disclosed that they had vaped once in the past thirty days, and the other participant (14.3%) stated that they vaped once a week for the past thirty days.

In regards to use of flavored e-liquid, four of the participants (57.1%) reported using flavored vape liquid 100% of the time that they vaped. One participant (14.3%) used flavored liquid 75% or more of the time that they vaped, one (14.3%) used flavored liquid 50-75% of the time, and one participant (14.3%) used flavored liquid 50% or less of the time that they vaped. Finally, scores for perceived nicotine addiction ranged from 4-7, with the overall mean score being 4.17 (Table 2). In a sample of college students who smoked cigarettes, the average HONC

score was 4.3 (SD= 3.3, range= 1-10) (Wellman et al., 2008). Higher average scores (M=5.4) were associated with more frequent, daily usage of nicotine products (Wellman et al., 2008).

Vaping and smoking consequences. Table 3 presents summary scores for each subscale of the Brief Smoking Consequences (BSC) questionnaire. The mean score for the health risks subscale was 14.86. Next, the mean score for the boredom reduction subscale was 9.71. Mean score for the positive reinforcement subscale was 32.71, while the average score for negative reinforcement was 29.67. For the negative consequences subscale, the average reported score was 29.14. Finally, the mean score for the appetite/weight control subscale was 26.83 (Table 3).

Stress and affect. Summary results for the Positive and Negative Affect Scale (PANAS), Perceived Stress Scale (PSS), and the Depression, Anxiety, and Stress Scale (DASS) are displayed in Table 4. The average score for anxiety was 7.42, and the average score for depression was 8.43. For the anxiety subscale, scores ranging from 0-7 are associated with normal levels of anxiety. Similarly, depression scores ranging from 0-9 are also considered normal. In terms of stress, the mean score for perceived stress was 21.86. Next, the average score for positive affect was 31.43, and the mean score for negative affect was 24.71 (Table 4).

Vaping, stress, and affect. Table 5 shows the results of the correlational analysis for relationships between vaping and smoking behaviors, and stress and affect in the described sample. Participant's negative affect was significantly positively associated with individuals overall PSS total, as well as their score on both the anxiety and stress subscales of the DASS . In terms of vaping consequences, boredom reduction was shown to have a significant negative relationship with positive affect. Also, boredom reduction and craving were shown to have a significantly positive relationship with negative reinforcement. Participant's past 30 day

e-cigarette usage had a significant positive relationship with boredom reduction, and a significant negative relationship with positive affect. Finally, scores on the anxiety subscale of the DASS were significantly positively associated with scores on the depression subscale of the DASS (See Table 5 for correlations).

Daily Surveys

Compliance. Submission rates were calculated in order to determine the feasibility of EMA as a means of obtaining daily data. The average overall submission rate was 72.98% which is consistent with other EMA studies reporting a completion rate ranging from 72.37% to 77.65% (Jones et al., 2018). The average submission rate for the 3 randomly scheduled daily surveys was 81.91% with submission rates ranging from 64.29% to 95.24%. While these rates were both fairly successful, the average submission rate for the event based survey was 45.72%, ranging from 14.29% to 85.71%.

Vaping habits. On average, participants vaped approximately 10 days over the span of the 14 days that EMA surveys were administered. Participants who did report vaping most commonly indicated using 1-2 milliliters of vaping liquid. Additionally, the mean number of puffs, or inhaled, that participants took upon vaping was 6.74. The observed range of puffs taken was 1-10. Participants reported using both nicotine based vaping products and non-nicotine based vaping products.

Vaping & affect. A paired samples *t* test revealed that participants experienced a higher levels of positive affect after engaging in a vaping behavior ($M = 31.63$, $SD = 8.44$) than before vaping ($M = 28.18$, $SD = 10.09$), $t(102) = -6.93$, $p < .01$). Participants' positive affect before and after vaping were strongly correlated ($r = .87$, $p < .01$). Vaping also had an effect on participants'

negative affect. Participants experienced lower levels of negative affect after engaging in a vaping behavior ($M = 10.93$, $SD = 7.54$) than before vaping ($M = 15.17$, $SD = 9.54$), $t(103) = 5.99$, $p < .01$. Participants' negative affect before and after vaping were moderately correlated ($r = .67$, $p < .01$).

A paired samples t test revealed that before vaping, participants experienced higher levels of positive affect ($M = 28.02$, $SD = 9.99$) than levels of negative affect ($M = 15.37$, $SD = 9.52$), $t(101) = 7.575$, $p < .01$. Similarly, after vaping, participants reported higher levels of positive affect ($M = 32.42$, $SD = 10.65$) than negative affect ($M = 14.32$, $SD = 10.33$), $t(252) = 15.68$, $p < .01$.

An independent sample t test suggested that participants who reported vaping prior to the daily measure signal experienced lower levels of negative affect ($M = 10.87$, $SD = 11.36$) than those who reported that they did not vape prior to the daily measure signal ($M = 16.56$, $SD = 7.40$), $t(251) = -4.49$, $p < .01$.

Results of the EMA analyses, which account for the nested nature of the data, also indicated that participants reporting vaping prior to the daily measure signal experienced lower negative affect than participants who reported they had not vaped prior to the signal ($n_{\text{level1}} = 253$, $n_{\text{level2}} = 7$; $b = -18.50$, $p = 0.04$); however, this effect was not significant at the within-subject level. Results of the EMA analyses indicated that the effect of vaping prior to the signal on positive affect was not significant ($n_{\text{level1}} = 252$, $n_{\text{level2}} = 7$; $b = -1.50$, $p = 0.89$).

Discussion

This pilot study intended to explore vaping-related beliefs and the effect that vaping has on momentary changes in affect through the use of EMA data collection. The feasibility of this method of data collection was also assessed.

Feasibility

While the small sample size of this pilot study does not allow for definitive results, the compliance rates of the participants suggest that in a larger study the use of EMA is a valid and useful means of collecting data about smoking and vaping practices. On average, participants responded to the majority of the randomly scheduled surveys, as was described in the results. Our results regarding overall compliance rates were similar to those of previous literature. For example, a study exploring compliance with EMA practices in substance users found an overall compliance rate of 75.06% (Jones et al., 2018). The lower response rates of the event-dependent survey is expected because participants were instructed to only fill out the event dependent survey immediately after vaping. That is to say, participants were responsible for completing the event dependent surveys without the presence of a direct notification. In the future we hope to continue exploring EMA data collection in a larger study, as our preliminary results support previous research on the matter. The event dependent surveys may be most helpful in the study as previous research suggests EMA allows for a reduction in recall bias and more accurate reports from the participants (Kuntsche & Labhart, 2013). Additionally, participants were generally willing to answer the questions and there was very little missing data. Finally, this study was completed entirely remotely. This includes recruitment and set up. The compliance/submission rates suggest that this is a reasonable way to enroll participants.

Affect/Stress

The preliminary results suggest a moderate negative correlation between positive affect and participants E-cigarette usage in the preceding 30 days. Use of vaping as a means of boredom reduction was negatively correlated with positive affect. Because the samples for both of these baseline correlations were so small, these results are not definitive. They do suggest, however, that the present findings are consistent with past literature, and that a study with a larger sample size would be worthwhile. Previous research suggests that adolescents experience an increase in positive emotions following the use of a nicotine product (Mermelstein et al., 2010). The preliminary results of this study support this as participants reported an overall increase in positive affect and a decrease in negative affect after vaping. Additionally, the results suggest that overall, participants experienced higher levels of positive affect than negative, before and after vaping. This is consistent with previous research that explains that youth may increase their vaping behaviors in order to reduce negative affect and maintain a more positive one (Miller et al., 2017). While a larger sample size is needed to draw more definitive conclusions, the present pilot study findings are consistent with study hypotheses and prior literature concerning the relationship between vaping and affect.

Vaping and Beliefs about Vaping Consequences

In addition to affect and stress, participants' beliefs and expectations about smoking and vaping were assessed. The preliminary results suggest a negative correlation between E-cigarette usage in the previous 30 days and positive affect, as well as a positive correlation between usage in the previous 30 days and boredom reduction. Previous research on the consequences involved with smoking or vaping found that boredom reduction was a motivator (Harrell et al., 2019). While our results are not definitive due to the small sample size and we cannot make any strong

conclusions based on them, these correlations suggest the need to explore the topic further. A positive correlation between craving nicotine and boredom reduction/negative reinforcements was also found. If this is true, it would imply that when a user felt bored or wanted something to do, they may engage in a vaping/smoking behavior, which in turn would strengthen their craving for nicotine. This is consistent with previous literature, which suggests a link between anxiety, negative affect, emotional dysregulation and addictive behaviors (Gonzalez et al., 2008). This is an example of a topic that we would explore in a larger study. The correlation between craving and negative reinforcements is also one that we would explore in a larger study. Negative reinforcements could include decreasing negative affect, which is consistent with study hypotheses.

Limitations and Future Aims

The sample size of the baseline was only 7 and the sample size for the daily measures was only 5; however, the number of daily observations assessed was 254. Because of this small sample size, we were unable to draw any definitive conclusions. The small sample size also reduced our ability to generalize the preliminary results as the demographics were primarily white and female. In the future we plan to continue the study and collect data from more participants. With this larger study, we will explore how vaping affects stress and mood, as well as further our exploration of EMA data collection. Additionally, the two week daily surveys will be able to provide more definitive information when the study is completed with a larger number of participants. Nonetheless, results of the pilot study suggest that remote data collection via an EMA app is a feasible and appropriate way to collect data about daily vaping behaviors.

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Tables

Baseline Data

Table 1. Demographics	M	SD	Range	<i>n</i>	%
<i>Age</i>	20.14	1.574	18-22		
<i>Gender</i>					
Female				6	85.7
Male				1	14.3
<i>Race/Ethnicity</i>					
White				6	85.7
Biracial/Multiracial				1	14.3
<i>Sexual Orientation</i>					
Heterosexual				4	57.1
Bisexual/Pansexual				3	42.9

	M	SD	Possible Range	Observed Range	n	%
Table 2. Vaping and Smoking Behaviors						
<i>E-cigarette Usage (Past 30 Days)</i>	6.29	2.360		2-8		
Once					1	14.3
Once a week					1	14.3
5-6 Times a Week					2	28.6
Everyday					3	42.9
<i>Flavor Use</i>	6.14	1.215		4-7		
50% or less of the time					1	14.3
50-75% of the time					1	14.3
75% or more of the time					1	14.3
100% of the time					4	57.1
<i>Perceived Nicotine Addiction</i>	4.166	4.215	0-10	0-10		
Table 3. Vaping and Smoking Consequences						
<i>Health Risks</i>	14.857	3.078	0-18	11-18		
<i>Boredom Reduction</i>	9.714	3.638	0-18	3-13		
<i>Negative Reinforcement</i>	29.666	14.637	0-63	2-45		
<i>Positive Reinforcement</i>	32.714	6.369	0-45	21-29		
<i>Negative Consequences</i>	29.142	5.047	0-36	24-36		
<i>Appetite/Weight Control</i>	26.833	11.034	0-45	12-38		
Table 4. Stress and Affect						
<i>Anxiety</i>	7.428	4.157	0-21	2-14		

<i>Depression</i>	8.428	5.968	0-21	1-19		
<i>Perceived Stress</i>	21.857	4.298	0-40	14-27		
<i>Positive Affect</i>	31.428	6.803	10-50	24-41		
<i>Negative Affect</i>	24.714	7.204	10-50	14-33		

Table 5

Correlational Analysis for Relationships Between Vaping and Smoking Behaviors and Stress and Affect in a Sample of Elizabethtown College Students (n = 7).

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) PSS	--												
(2) PNA-N	.790*	--											
(3) PNA-P	-.311	-.232	--										
(4) NegCon	-.183	-.210	.017	--									
(5) NegRn	.092	.039	-.637	-.570	--								
(6) BSC-Bd	.104	.136	-.836*	-.342	.917*	--							
(7) BSC-Cr	.234	.120	-.655	-.535	.984**	.808*	--						
(8) BSC-Ta	-.650	-.523	-.218	.321	-.153	.083	-.249	--					
(9) BSC-Sc	.691	.586	-.025	-.057	.223	.071	.313	-.974**	--				
(10) DASd	.672	.686	.089	-.628	.309	.083	.408	-.900*	.767*	--			
(11) DASa	.461	.761*	.004	-.718	.342	.241	.309	-.527	.425	.831*	--		
(12) DASs	.703	.820*	.011	-.381	-.046	-.026	-.142	-.386	.315	.583	.733	--	
(13) P30-EC	-.307	-.367	-.777*	.094	.615	.768*	.606	.516	-.295	-.460	-.371	-.582	--

Note. PSS=Perceived Stress Total, PNA-N=Negative Affect, PNA-P=Positive Affect, NegCon=SFVC Negative Consequences, NegRN=SFVC Negative Reinforcement, BSC-Bd=BSC Boredom Reduction, BSC-Cr=BSC Craving, BSC-Ta=BSC Taste, BSC-Sc=BSC Social, DASd=DASS Depression, DASa=DASS Anxiety, DASs=DASS Stress, P30-EC= Past 30 days E-cigarette usage; * $p < .05$, ** $p < .01$.

Daily Measures Data**Table 6. Positive and negative affect prior to, and during vaping**

	Vaped	N	Mean	Std. Deviation
Current Positive Affect	Yes, I vaped a nicotine-based product.	90	30.92	8.170
	No, I have not vaped.	148	32.74	11.842
Current Negative Affect	Yes, I vaped a nicotine-based product.	90	10.49	7.341
	No, I have not vaped.	149	16.56	11.361
Before Vaping Positive Affect	Yes, I vaped a nicotine-based product.	88	27.10	9.898
Before Vaping Negative Affect	Yes, I vaped a nicotine-based product.	90	14.84	9.510