Personality and impulsivity as predictors of tobacco use among emerging adults: A latent class analysis

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Abstract

The tobacco industry markets their products toward emerging adults (18–29), with the goal of increasing use among this age group. To inform prevention efforts, researchers are investigating how specific demographic and psychological traits may predict tobacco initiation and continuation. Participants were 578 incoming university freshmen from the Appalachian region. Participants provided information on demographics, personality traits, impulsivity characteristics, lifetime use of cigarettes and electronic cigarettes (ECIGs), and current use of cigarettes, ECIGs, small cigars/cigarillos, large cigars, smokeless tobacco, and waterpipe. Latent class analysis identified tobacco-use classes and regressions identified psychological predictors of class membership. Participants were *Nonusers, Experimenters*, and *Polytobacco Users*. Lower agreeableness and conscientiousness as well as higher extraversion and neuroticism were associated with being *Experimenters* or *Polytobacco Users*. Lower impulsivity was associated with being *Nonusers*. Distinct types of emerging adults belong to each tobacco use class, suggesting that individual differences be incorporated in prevention efforts.

Keywords

Polytobacco; Emerging adult; College student; Prevention; Alternative tobacco product

1. Introduction

Many adult users report initiating use of a tobacco product before the age of 18 (CDC, 2014; Lipari & Van Horn, 2017; Sharapova et al., 2018). However, the transition from youth (ages 13–17) to emerging adulthood (ages 18–29; Arnett, 2014) is a critical developmental period whereby individuals experience many lifestyle changes and establish lifelong health-related

behaviors (Arnett, Zukauskiene, & Sugimura, 2014). Emerging adulthood is characterized by changes in residence, relationships, financial status, and education (Arnett, 2000) and emerging adults gain new roles, responsibilities, and freedoms that are associated with increased engagement in a range of health-risk behaviors, including tobacco use (Lipari & Van Horn, 2017; SAMHSA, 2017; Wang et al., 2018). The tobacco industry has also targeted emerging adults specifically (Ling & Glantz, 2002) and given this historical targeting along with the legal purchase of tobacco products at 18 years of age in most states, it follows that use of tobacco products increases during the transition from youth to emerging adulthood (Lipari & Van Horn, 2017; SAMHSA, 2017; Wang et al., 2018).

Of concern is that with the rising popularity of alternative tobacco products such as electronic cigarettes (ECIGs), cigars, and hookah (Cullen et al., 2018; Evans-Polce, Lanza, & Maggs, 2016; Harrell, Naqvu, Plunk, Ji, & Martins, 2017), as well as openness to using such products among emerging adults (Mays et al., 2016), experimentation may lead to continued use and transitions between product types (Best, Haseen, Currie, Ozakinci, Mackintosh, & Stead, et al., 2017; Chaffee, Watkins, & Glantz, 2018; Cooke et al., 2016; Mays et al., 2016). Additional concerns arise when considering polytobacco use (i.e., use of two or more products concurrently), which is prevalent among emerging adult tobacco users (30.0–66.4%; Lisha, Thrul, & Ling, 2019; West et al., 2019), and may lead to more detrimental effects on the developing brain (Yuan, Cross, Loughlin, & Leslie, 2015) and later cessation attempts (Messer et al., 2015). Thus, prevention efforts need to be developed to reduce tobacco initiation among this age group. Although identifying individual risk factors are critical for these efforts (Dierker, Avenevoli, Goldberg, & Glantz, 2004), little is known about those factors outside of demographic (e.g., gender, race; Erickson, Lenk, & Forster, 2014; Evans-Polce et al., 2016; Harrell et al., 2017; Lisha et al., 2019) and tobacco-related characteristics (e.g., dependence level, access; Harrell et al., 2017; Lisha et al., 2019; Yu, Sacco, Choi, & Wintemberg, 2018).

Two potentially relevant factors may be personality and impulsivity given that these characteristics predict a multitude of health behaviors and risk for mortality (Bogg & Roberts, 2004; Hampson & Friedman, 2008; Turiano, Chapman, Gruenewald, & Mroczek, 2015). The Big Five model of personality includes the following characteristics— conscientiousness (e.g., goal-directed and in control), agreeableness (e.g., not hostile), neuroticism (e.g., emotional instability), extraversion (e.g., outgoing and sociable), and openness to experience (e.g., creative; McCrae & Costa Jr., 1997). Adolescent and adult cigarette smokers are significantly less conscientious, less agreeable, more neurotic, more extraverted, and more open to experience compared to non-smokers (Harakeh, Scholte, de Vries, & Engels, 2006; Malouff, Thorsteinsson, & Schutte, 2006; Terracciano & Costa Jr., 2004; Turiano, Whiteman, Hampson, Roberts, & Mroczek, 2012; Zvolensky, Taha, Bono, & Goodwin, 2015). Fewer studies have investigated the associations between personality and alternative product use, although existing work is in line with that reported for cigarette smokers. Specifically, users of smokeless tobacco are more extraverted and neurotic (Foreyt, Jackson, Squires, Hartung, Murray, & Gotto Jr., 1993), whereas cigar users are less conscientious (Brikmanis, Petersen, & Doran, 2017), than are nonusers of these products.

Impulsivity is defined as a tendency to act out in response to impulses and overlaps with some aspects of neuroticism and conscientiousness (Hofmann, Friese, & Strack, 2009; Um, Hershberger, Whitt, & Cyders, 2018). Impulsivity is a multidimensional construct that can be broken down into specific domains: lack of premeditation (i.e., acting without thinking), lack of perseverance (i.e., inability to remain focused), positive urgency (i.e., acting rashly in response to positive affective state), negative urgency (i.e., acting rashly in response to negative affective state), and sensation seeking (i.e., seeking out novel/thrilling experiences; Cyders, Smith, Spillane, Fischer, & Annus, 2007). Individuals that are more impulsive tend to engage in behaviors that provide short-term rewards at the expense of long-term benefits, including use of tobacco products. Specifically, lack of premeditation (Brikmanis et al., 2017), greater positive and negative urgencies (Doran & Trim, 2015; Leventhal et al., 2016), and greater sensation seeking (Brikmanis et al., 2017; Doran & Trim, 2015) are associated with cigarette, cigar, and ECIG use among emerging adults and adolescents. Polytobacco users may also be more impulsive than single product users (Leventhal et al., 2016).

Associations between personality/impulsivity characteristics and tobacco use are studied primarily using variable-centered approaches, in which relations are quantified using separate models. Person-centered approaches have the advantage of assessing how tobacco use behaviors interact and may better reflect the complexity of such behavior. One type of person-centered approach is Latent Class Analysis (LCA), which models latent subgroups within a population by clustering participants into classes based on their responses to specific questions. With the identification of tobacco use classes, various individual difference factors can be used to predict group membership. Understanding how these factors predict classes of tobacco use may aid in identifying those that are most likely to engage in the most problematic profiles of tobacco use (e.g., use of multiple products) and provide insight into which factors to potentially target during prevention efforts. Thus, the present secondary data analysis was designed to 1) use exploratory LCA to identify classes of emerging adult tobacco users and 2) to determine whether demographics, personality, and/or impulsivity characteristics predict class membership identified through exploratory LCA.

2. Materials and methods

2.1. Participants and procedures

Participants were 578 incoming freshmen enrolled at a large university in a mid-Atlantic state (M_{age}=18.13 years, SD=0.94; $range$=18–28 years). Most participants identified as female (69.62%), whereas 30.38% identified as male. For race, 89.43% identified as White, 2.94% identified as Black or African American, 1.73% identified as Asian/Native Hawaiian or Pacific Islander, 0.69% identified as American Indian or Alaskan Native, 3.63% identified as more than one race, and 1.56% identified as a race not listed. Participants were from West Virginia (53.97%), Pennsylvania (14.26%), Maryland (6.06%), Ohio (5.88%), Virginia (5.02%), New Jersey (3.81%), or another state (11.00%).

Participants were recruited via email from a list of incoming freshmen provided by the university's Office of Enrollment Management. An email was sent to all incoming freshmen (approximately 5000 students) in July 2016 asking students to consent to the study via

SurveyMonkey. The survey was closed after 578 responses were received. Surveys were completed online during the summer before participants arrived on campus for their first semester of college. Participants received $20 for completing the survey. All outlined procedures were approved by the university's Institutional Review Board.

2.2. Measures

Data were collected as part of a larger project aimed at understanding demographic and psychological factors that predict prospective patterns of various types of substance use among college students over their freshman year.

2.2.1.   Demographic variables—Participants were asked to indicate whether they identified as male or female. Subjective familial socioeconomic status (SES) was assessed using the MacArthur Scale of Subjective Social Status (Goodman et al., 2001), which includes an image of a 10-rung ladder with the instructions: "Imagine that this ladder shows how your society is set up. Now think about your family. Please tell us where you think your family would be on this ladder." The top rung (coded as a 10) was labeled "the people who are best off – they have the most money, the highest amount of schooling, and the jobs that bring the most respect" and the bottom rung (coded as a 1) was labeled "the people who are the worst off – they have the least money, little or no education, no jobs or jobs that no one wants or respects."

2.2.2.   Big Five personality traits—Personality was assessed using the Big Five Inventory (*BFI-2*; Soto & John, 2017). The *BFI-2* is a 60-item self-report with subscales measuring openness to experience (e.g., "I am a person who is curious about many different things."; 12 items; α=0.80), conscientiousness (e.g., "I am a person who is dependable, steady."; 12 items; α=0.85), extraversion (e.g., "I am a person who is outgoing, sociable."; 12 items; α=0.86), agreeableness (e.g., "I am a person who is compassionate, has a soft heart."; 12 items; α=0.81), and neuroticism (e.g., "I am a person who worries a lot."; 12 items; α=0.89). Participants indicated how much they agreed with each item on a five-point Likert scale (1=Strongly disagree, 5=Strongly agree). Mean scores were computed by averaging scores for each of the items that comprise each subscale, with higher scores indicating higher levels of each trait.

2.2.3.   Impulsivity—The UPPS-P Impulsivity Scale was used to assess five distinct features of impulsive behavior (Cyders et al., 2007; Lynam, Smith, Whiteside, & Cyders, 2006): negative urgency (e.g., "Sometimes I do impulsive things that I later regret."; 12 items, α=0.84), positive urgency (e.g., "When I am very happy, I feel that it is okay to give in to cravings or overindulge."; 14 items; α=0.94), lack of perseverance (e.g., "Sometimes there are so many little things to be done that I just ignore them all."; 10 items; α=0.60), lack of premeditation (e.g., "Before making up my mind, I consider all the advantages and disadvantages."; reverse coded; 11 items; α=0.84), and sensation seeking (e.g., "I would enjoy fast driving."; 12 items; α=0.85). Each item was rated on a 4-point Likert scale (1=Disagree strongly, 4=Agree strongly). Mean scores were computed by averaging scores for each of the items that comprise each subscale, with higher scores indicating higher levels of each feature of impulsive behavior.

2.2.4. Tobacco use—Tobacco use was quantified by lifetime use of cigarettes or ECIGs and current use of cigarettes, ECIGs, large cigars, small cigars/cigarillos, smokeless tobacco, or waterpipe. Lifetime use was not assessed for large cigars, small cigars/cigarillos, smokeless tobacco, or waterpipe due to an error at baseline in the SurveyMonkey questionnaire. Given that the primary aim of data collection was to evaluate prospective patterns of substance use, participants were not re-contacted to obtain lifetime history of other tobacco products. Participants were asked, "Have you ever tried a cigarette (even if only one puff) in your lifetime?" (0=No, 1=Yes) and "Have you ever used electronic cigarettes (e.g. e-cigarettes)?" (0=No, 1=Yes). The latter question was followed by images of examples of ECIGs that included first- and second-generation devices. If participants indicated that they had tried a cigarette or an ECIG in their lifetime, they were asked, "Do you currently smoke cigarettes?" or "Are you currently using e-cigarettes?", respectively (0=No, 1=Yes). Participants were also asked, "Have you used any of the following tobacco products in the past 30 days?", which was followed by a list of products including large cigars, small cigars/cigarillos, smokeless tobacco (e.g., snuff/dip/chew/snus), and waterpipe (e.g., hookah, shisha). Any use in the past 30 days was classified as current use of that product (0=No, 1=Yes).

2.3. Analytic plan

Analyses were conducted using M*plus* 8.1 (Muthén & Muthén, 1998–2002). Exploratory LCAs determined classes of tobacco use among emerging adults. LCA is a person-centered approach that identifies classes of individuals that exhibit similar patterns of scores across categorical indicators and estimates the probability of each participant belonging to each class (Nylund, 2007). The number of classes was determined empirically based on fit indexes, such as the Akaike Information Criterion (AIC; Akaike, 1974) and the Bayesian Information Criterion (BIC; Nylund, Asparouhov, & Muthén, 2007), for which lower scores represent better fit. The Vuong Lo-Mendal Rubin LRT test, which evaluates whether a model with *k* profiles provides a significant improvement in fit over a model with *k*-1 profiles, was used to determine the class solution that best fit the data (Lo, Mendell, & Rubin, 2001; Vuong, 1989). Models with high entropy were also given preference. Starting with a one-profile solution, models were estimated with increasingly more profiles until there was no further model improvement (i.e., fit indexes show no substantive change or additional profiles are small, conceptually unclear, or there are slight variations on already identified profiles; Nylund, 2007).

Once latent classes were identified, separate multinomial logistic regressions were examined to determine whether specific personality and impulsivity characteristics predicted class membership after accounting for demographics. Multinomial logistic regression compares multiple groups through a combination of binary logistic regressions in one model. Data met the assumptions for use of multinomial logistic regression, including the use of categorical dependent variables and continuous independent variables, independence of observations, and linear associations among predictors and tobacco variables at the bivariate level (see Table 1). Multicollinearity was not a concern, as all variance inflation factor (VIF) values were below 5 (Hair, Ringle, & Sarstedt, 2011; see Table 1). Models were built in a stepwise fashion. To ensure that findings from our final model were not due to suppression, we first

examined a model (Model 1) that included demographics only (i.e., gender, SES). Model 2 added each of the Big Five personality traits. Model 3 included demographics and impulsivity characteristics. The final model (Model 4) included demographic, personality, and impulsivity characteristics. Predictors of class membership were considered statistically significant when $p < .05$.

3. Results

3.1. Latent class descriptions

A LCA utilizing eight dichotomous indicators of nicotine/tobacco use (i.e., lifetime cigarette, lifetime ECIG, current cigarette, current ECIG, current smokeless tobacco, current small cigar/cigarillo, current large cigar, current waterpipe) indicated that a three-profile solution fit the data well (see Table 2). The three-profile solution was most valid conceptually, had high entropy, and included classes of sufficient sample size.

Fig. 1 displays variable probabilities for each latent class. Class 1 represents *Experimenters*; they showed the highest levels of lifetime cigarette use and high levels of lifetime ECIG use, but engaged in little current use of any product (9.9% of participants). Class 2 was named *Nonusers*; individuals in this group engaged in the lowest levels of lifetime and current use of each product (78.1% of participants). Finally, Class 3 was named *Polytobacco Users*; they reported relatively high levels of lifetime ECIG use as well as of current use of smokeless tobacco, large cigars, small cigars/cigarillos, and waterpipe (12.1% of participants). For each of these latent classes, means and standard deviations for measured personality and impulsivity variables are presented in Table 3.

3.2. Associations with latent classes

Statistical outcomes for differences in class membership based on demographics, personality, and impulsivity are shown in Table 4.

3.2.1. Demographic variables—Being female was associated with increased odds of being in the *Experimenters* and the *Nonusers* classes compared to the *Polytobacco Users* class. Higher SES was associated with increased odds of being in the *Nonusers* compared to the *Experimenters* class.

3.2.2. Big Five personality traits—After accounting for demographic variables, individuals with higher levels of agreeableness were at increased odds of being in the *Nonusers* and the *Experimenters* classes compared to the *Polytobacco Users* class, whereas individuals with higher levels of conscientiousness were at increased odds for belonging to the *Nonusers* class compared to both the *Experimenters* and *Polytobacco Users* classes. Additionally, individuals higher in extraversion were at increased odds of being in the *Polytobacco Users* than the *Nonusers* class and individuals higher in neuroticism were at increased odds for belonging to the *Experimenters* compared to the *Nonusers* class.

3.2.3. Impulsivity—Controlling for demographics, individuals with a greater lack of premeditation were at increased odds for belonging to the *Experimenters* and *Polytobacco Users* classes compared to the *Nonusers* class. Additionally, individuals with greater

negative urgency were at increased odds for belonging to the *Experimenters* class compared to the *Nonusers* class.

4. Discussion

This secondary data analysis was conducted to identify classes of tobacco users among emerging adults and to subsequently assess whether personality or impulsivity characteristics are associated with class membership. Consistent with prior work (Cooke et al., 2016; Erickson et al., 2014), a majority of the emerging adults in the current sample reported limited lifetime or current product use, and LCA combined these participants into the largest class (78.1% *Nonusers*). There was sufficient variability in product use patterns for the remaining 21.9% of the sample, leading to the identification of two discrete classes of users. The largest of these classes was *Polytobacco Users* (12.1%), followed by *Experimenters* (9.9%). High probabilities of lifetime ECIG use were evident in both classes, suggesting that experimentation with ECIGs is common among emerging adults (Best et al., 2017; Cooke et al., 2016; Mays et al., 2016). Notable is that cigarette use is declining among emerging adults accompanied by an increase in use of alternative products (Cullen et al., 2018; Evans-Polce et al., 2016). Indeed, lifetime cigarette use was more prevalent for *Experimenters* than *Polytobacco Users* in the current study, though current use of cigarettes was uncommon for both classes. Instead, those in the *Polytobacco Users* class engaged in higher rates of alternative product use, including use of smokeless tobacco, waterpipe, large cigars, and small cigars/cigarillos.

The three classes identified by LCA were also diverse in regard to demographic characteristics. Not surprisingly, males were at increased odds of being *Polytobacco Users* as compared to *Nonusers* and *Experimenters*. These findings replicate a large body of research demonstrating that males are more likely to use smokeless tobacco (Agaku & Alpert, 2016; Erickson et al., 2014) and cigars (Agaku & Alpert, 2016; Phillips et al., 2017), and also to engage in polytobacco use (Phillips et al., 2017; Soneji, Sargent, & Tanski, 2016), relative to their female counterparts. Participants of higher SES were also less likely to be *Experimenters* and more likely to be *Nonusers*, though other differences in SES between classes were not observed. Among adolescent samples, use of traditional tobacco products (cigarettes, smokeless tobacco) is associated reliably with lower SES (Wellman et al., 2016; Wellman et al., 2018). Findings for other products (little cigars, cigarillos, ECIGs) are mixed, however (Krishnan-Sarin et al., 2019; Simon et al., 2017). In contrast to this previous work, our measure of SES was subjective (Goodman et al., 2001). A myriad of assessments exist for SES (Shavers, 2007), and more objective measures, such as parental income, may have revealed differences between non- and current users. Still, emerging adults may not be the best reporters of parental income (Svedberg, Nygren, Staland-Nyman, & Nyholm, 2016).

After controlling for demographic factors, personality and impulsivity characteristics were associated significantly with class membership. With regard to personality, agreeableness, conscientiousness, neuroticism, and extraversion varied across classes, indicating that such individual-difference factors play a role in initiation and continuation of nicotine/tobacco product use (Foreyt et al., 1993). Consistent with studies using variable-centered analytic

approaches (Harakeh et al., 2006; Malouff et al., 2006; Terracciano & Costa Jr., 2004), individuals scoring lower on agreeableness were more likely to be in classes associated with current product use (*Polytobacco Users*) and less likely to be *Nonusers* or *Experimenters*. There are significant social pressures against experimenting with and continuing to use nicotine/tobacco products (Castaldelli-Maia, Ventriglio, & Bhugra, 2016), and individuals who score lower on agreeableness tend to be rebellious, with lower needs for social approval than those scoring higher on this trait (Terracciano & Costa Jr., 2004).

Arguably the most consistent finding in the personality/tobacco literature (Harakeh et al., 2006; Malouff et al., 2006; Zvolensky et al., 2015), individuals scoring higher on conscientiousness were more likely to be *Nonusers* than *Experimenters* or *Polytobacco Users* in the current study. Those that are more conscientious tend to take fewer health risks, engage in more beneficial health-related behaviors (e.g., healthy diet, regular exercise), and consequently live longer than their counterparts (Bogg & Roberts, 2004; Hampson & Friedman, 2008). Further, two facets of impulsivity were associated with tobacco class membership, with *Nonusers* scoring lower than *Experimenters* and *Polytobacco Users* on measures of negative urgency and lack of premeditation. Given that negative urgency and premeditation overlap with aspects of conscientiousness (Hofmann et al., 2009; Um et al., 2018), these results highlight the critical role of self-control in abstinence from nicotine/ tobacco use.

Higher levels of neuroticism and extraversion are consistently associated with cigarette smoking and smokeless tobacco use among adolescent, adult, and college student samples (Foreyt et al., 1993; Harakeh et al., 2006; Malouff et al., 2006; Zvolensky et al., 2015). In this vein, *Polytobacco Users* and *Experimenters* scored higher on measures of extraversion and neuroticism, respectively, compared to *Nonusers* in the current study. It is possible that those scoring higher on these traits experiment with or use nicotine/tobacco for stimulation or to reduce tension/anxiety (Eysenck, 2012; Gonzalez, Zvolensky, Vujanovic, Leyro, & Marshall, 2008). Of course, reasons for experimentation or use cannot be determined from the present data and future work will be needed to evaluate this possibility. Notably, openness to experience did not predict latent class membership in the present study. The relation between openness and nicotine/tobacco use may be unreliable (Terracciano & Costa Jr., 2004; Zvolensky et al., 2015), and thus requires further systematic study, especially with the availability of new tobacco products such as ECIGs.

Together, findings regarding personality and impulsivity highlight that distinct types of emerging adults belong to each tobacco use class. Given that individual-difference factors play an important role in the effectiveness of prevention and intervention efforts (Dierker et al., 2004), different classes of individuals may require different strategies. Although it was once thought that personality and impulsivity characteristics are stable across the lifespan (McCrae & Costa Jr., 1997; Odum, 2011), recent interventions were developed to change these directly in an effort to improve various health-related behaviors (e.g., Hudson & Fraley, 2015; Roberts et al., 2017; Stein et al., 2016). For instance, episodic future thinking asks individuals to imagine future events to increase the value of delayed consequences and reduce impulsivity (Atance & O'Neill, 2001). Such an intervention is successful in reducing cigarette consumption, at least in the short term (Stein et al., 2016). For personality, self-

directed goal setting may be adequate for those that want to change their personality traits, while others may require behavioral or cognitive intervention (Hudson & Fraley, 2015; Roberts et al., 2017). Indeed, the sociogenomic model of personality suggests that small modifications in behavioral, attitudinal, or emotional changes can eventually become habitual and lead to lasting change (Roberts & Jackson, 2008). Assuming that changes in personality/impulsivity translate to improvements in health-related behaviors, grouping individuals together into classes of tobacco use patterns may hold promise for tailoring interventions to tobacco use prevention. Thus, it may be important for colleges and universities to have different types of prevention and intervention programs in place to tailor treatment to specific types of emerging adults. There may also be utility in pre-testing college students and using this information to appropriately target tobacco prevention and intervention programs.

Although the current study provides valuable insight into the complexity of tobacco use behaviors among a sample of emerging adults, results must be interpreted in light of some important considerations. First, the sample included participants that were from a single large, public university and were predominantly white/Caucasian. However, the majority of participants came from areas of West Virginia, Ohio, and Pennsylvania that encompass the greater Appalachian region. This region is notable due to disproportionately high rates of cigarette and smokeless tobacco use (American Lung Association, 2015) as well as the substantial increases in ECIG, hookah, and polytobacco use since 2013 (WV DHHR, 2015). With the rate of tobacco industry marketing expenditures being nearly 12 times higher than the national rate (Campaign for Tobacco Free Kids, 2019), combined with annual funding for tobacco control efforts at only ~17.8% of the CDC-recommended amount (CDC, 2019), future studies need to further explore such at-risk populations to understand factors that predict initiation and continuation of tobacco use.[1] Moreover, the current study focused on the transition into college and thus, participants fell primarily on the lower end of the age range classified as emerging adults. Future research should examine preditors of tobacco use among a wider age range of university-attending and non-university-attending emerging adults, given that tobacco use of those who attend college may differ from those who do not (Lenk et al., 2012).

Although these data were collected relatively recently (2016), tobacco use patterns change quickly (Delk et al., 2019) and the cross-sectional nature of the data do not allow for assessing changes in class membership over time. In addition, a restricted number of product types and levels of use were assessed in the current study. For product types, the item used to assess smokeless tobacco (snuff/dip/chew/snus) use was aggregate in nature; what type(s) of smokeless tobacco products were more popular (traditional (snuff/chew) or newer (snus)) cannot be discerned from the present data. With regard to frequency, lifetime use was evaluated only for cigarettes and ECIGs whereby current use was assessed for all product types. However, as mentioned previously, this secondary data analysis included all available tobacco use items. Additional questions about lifetime use of other alternative products may further divide the *Experimenters* class into groups of individuals that experiment with

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[1]We did not have data detailed enough to determine whether participants were from Appalachia in the current study, but a follow-up sensitivity analysis by participants' state of origin revealed no differences.

specific products. In future studies, it will be important to tease apart more nuanced differences between classes.

Another consideration is that questions regarding ECIG use referred to such devices as "electronic cigarettes" and included example images of first- and second-generation devices only. It is possible that participants responded "no" to these questions based on their familiarity with alternative language (e.g., "vape"; Hinds 3rd et al., 2016) and/or newer devices (e.g., mods, Juul; Barrington-Trimis et al., 2018), leading to underestimation of lifetime/current ECIG use among the current sample. Moreover, these data were collected right before individuals started college; it is possible that tobacco use increased when individuals were out of their homes and exposed to settings where tobacco use is more likely to occur (Lipperman-Kreda, Paschall, Robert, & Morrison, 2018). Finally, relatively small mean and standard deviation values for several personality and impulsivity traits suggest that the majority of participants scored toward the lower end of the scales (e.g., range of 1.70 to 1.95 for negative urgency on a scale from 1 to 4) and that there was little variability between participants. Thus, it will be important to replicate these findings with participants that produce a wider range of values and score at the higher end of these scales. However, the fact that many of these characteristics still significantly predicted latent class membership, despite their restricted range, indicates that they are likely strong indicators of tobacco use patterns.

The present results describe an important role for personality and impulsivity in nicotine/ tobacco use behavior among emerging adults. Individuals that engage in use of multiple tobacco products are also at greater risk for use of other substances, such as marijuana and alcohol (Bernstein et al., 2015; Pulvers et al., 2018), and the associations between demographics, personality, or impulsivity and tobacco use observed here are consistent with those reported for other drugs (Chuang et al., 2017; Dash et al., 2019; Slade et al., 2016). Historically, focus has been toward preventing uptake of tobacco use among adolescents; however, given the relatively high prevalence of tobacco initiation during the transition from youth to emerging adulthood (Lipari & Van Horn, 2017; SAMHSA, 2017; Wang et al., 2018), prevention and intervention techniques need to be developed for emerging adults specifically. Because personality and impulsivity characteristics are amenable to change (Hudson & Fraley, 2015; Roberts et al., 2017), it is possible to tailor prevention to those that are most at risk for tobacco use.

Acknowledgments

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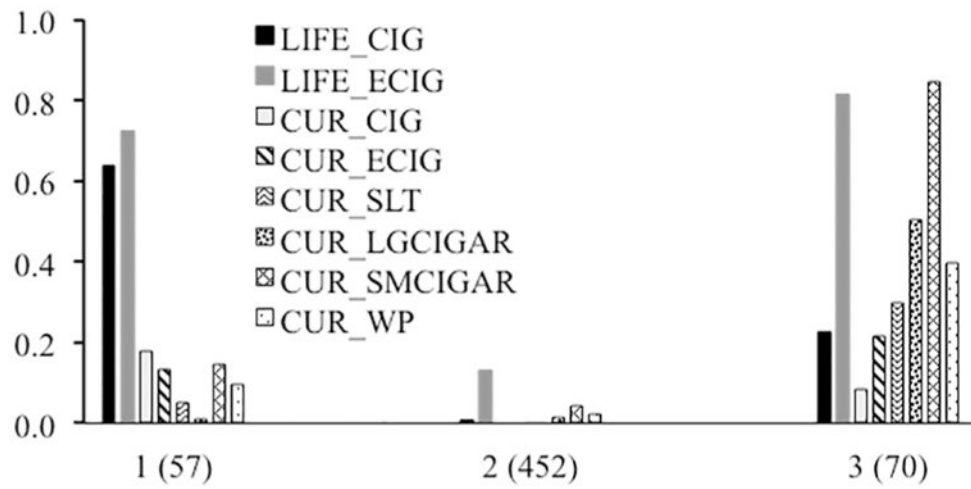
Fig. 1.
Conditional probabilities of endorsing the tobacco use items for the three latent classes.
Class 1 was labeled *Experimenters*, Class 2 was labeled *Nonusers*, and Class 3 was labeled
Polytobacco Users.

Table 1

Correlations, descriptive statistics, and VIFs for key study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Gender (male)	–																			
2. SES	0.01	–																		
3. Extraversion	-0.02	**0.19**	–																	
4. Agreeableness	**-0.14**	0.02	**0.20**	–																
5. Conscientiousness	**-0.13**	0.02	**0.20**	**0.41**	–															
6. Neuroticism	**-0.29**	**-0.13**	**-0.37**	**-0.36**	**-0.28**	–														
7. Openness	-0.07	-0.05	**0.19**	**0.22**	**0.11**	-0.04	–													
8. Negative Urgency	-0.05	-0.04	**-0.19**	**-0.44**	**-0.48**	**0.56**	**-0.20**	–												
9. Positive Urgency	**0.16**	0.02	-0.03	**-0.37**	**-0.47**	**0.18**	**-0.21**	**0.67**	–											
10. Lack of Premed.	0.05	-0.01	**0.11**	**-0.24**	**-0.48**	**0.09**	**-0.16**	**0.35**	**0.41**	–										
11. Lack of Persev.	0.01	**-0.10**	**-0.32**	**-0.29**	**-0.70**	**0.32**	**-0.21**	**0.45**	**0.39**	**0.50**	–									
12. Sensation Seeking	**0.18**	0.07	**0.32**	0.01	-0.03	**-0.26**	**0.11**	0.03	**0.23**	**0.12**	**-0.15**	–								
13. Life. Cigarette	0.01	-0.08	0.02	-0.08	**-0.12**	**0.14**	0.07	**0.13**	**0.11**	**0.20**	**0.09**	0.01	–							
14. Life. ECIG	0.04	-0.04	-0.02	**-0.10**	**-0.17**	**0.09**	0.01	**0.17**	**0.10**	**0.13**	**0.10**	**0.14**	**0.34**	–						
15. Cur. Cigarette	0.03	0.02	**0.09**	**-0.10**	**-0.09**	0.05	**0.08**	0.07	0.07	**0.13**	0.06	0.06	**0.39**	**0.18**	–					
16. Cur. ECIG	**0.10**	-0.01	0.03	**-0.15**	**-0.12**	0.03	0.05	**0.12**	**0.14**	**0.09**	0.03	**0.10**	**0.22**	**0.33**	**0.27**	–				
17. Cur. SLT	**0.25**	-0.02	0.02	**-0.11**	-0.04	-0.03	-0.04	-0.03	0.02	0.01	-0.04	0.03	**0.13**	**0.23**	**0.17**	**0.28**	–			
18. Cur. Large Cigar	**0.34**	0.02	0.05	**-0.17**	**-0.10**	-0.02	-0.01	0.01	0.08	**0.09**	-0.02	**0.13**	**0.10**	**0.27**	**0.11**	**0.29**	**0.36**	–		
19. Cur. Small Cigar	**0.13**	-0.05	0.02	**-0.16**	**-0.12**	-0.01	-0.06	0.08	**0.09**	**0.10**	0.06	**0.10**	**0.17**	**0.36**	**0.09**	**0.24**	**0.32**	**0.44**	–	
20. Cur. Waterpipe	0.03	-0.06	0.02	**-0.17**	**-0.14**	0.08	-0.06	**0.17**	**0.16**	**0.10**	**0.13**	0.08	**0.10**	**0.22**	**0.14**	**0.25**	**0.19**	**0.18**	**0.35**	–
M / % Users	30.2%	6.00	3.46	3.72	3.61	2.91	3.74	2.18	1.74	1.96	1.87	2.88	10.6%	28.1%	3.1%	4.0%	4.0%	7.1%	15.1%	7.5%
SD	–	1.66	0.72	0.61	0.66	0.81	0.61	0.59	0.60	0.46	0.48	0.59	–	–	–	–	–	–	–	–
VIF	1.26	1.06	1.51	1.49	2.46	2.14	1.19	2.99	2.34	1.67	2.56	1.33	–	–	–	–	–	–	–	–

Note. Bolded values denote statistical significance (*p* < .05). Some variable names have been shortened. Premed.=Premeditation; Persever.=Perseverance; Life.=Lifetime; Cur.=Current; SLT=smokeless tobacco use.

Table 2

Fit indices for latent class analyses.

Number of profiles	AIC	BIC	LRT Test (*p* value)	Entropy	Smallest profile (% of sample)
2	2378.734	2452.876	< .001	0.805	21.28%
3	2345.815	2376.669	.173	0.822	9.86%
4	2332.760	2484.760	.008	0.845	2.42%
5	2333.403	2525.300	.054	0.882	2.42%

Table 3

Descriptive statistics for key study variables by smoking class.

	Nonusers		Polytobacco Users		Experimenters	
	M	*SD*	*M*	*SD*	*M*	*SD*
Extraversion	3.45	0.75	3.54	0.53	3.43	0.73
Agreeableness	3.77	0.60	3.42	0.63	3.66	0.61
Conscientiousness	3.66	0.66	3.36	0.63	3.47	0.63
Neuroticism	2.88	0.81	2.89	0.78	3.16	0.80
Openness	3.74	0.61	3.66	0.65	3.83	0.60
Negative Urgency	2.13	0.59	2.29	0.57	2.39	0.61
Positive Urgency	1.70	0.58	1.95	0.67	1.80	0.63
Lack of Premeditation	1.91	0.45	2.09	0.47	2.15	0.45
Lack of Perseverance	1.84	0.48	1.95	0.46	1.97	0.47
Sensation Seeking	2.85	0.57	3.04	0.59	2.88	0.73

Note. Personality variables ranged from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*); impulsivity variables ranged from 1 (*Disagree Strongly*) to 4 (*Agree Strongly*).

Table 4

Multinomial logistic regressions predicting smoking classes from demographic characteristics, personality traits, and impulsivity variables with Nonusers and Polytobacco Users as referent groups.

	Exp (vs. Poly)		Non (vs. Poly)		Poly (vs. Exp)		Non (vs. Exp)		Exp (vs. Non)		Poly (vs. Non)	
	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR
Model 1												
Gender	**1.52 (0.41)**	**4.55**	**1.26 (0.27)**	**3.52**	**−1.44 (0.40)**	**0.24**	−0.19 (0.34)	0.83	0.26 (0.35)	1.30	**−1.26 (0.27)**	**0.28**
SES	−0.15 (0.11)	0.86	0.01 (0.08)	1.01	0.14 (0.11)	1.15	**0.15 (0.09)**	**1.16**	**−0.16 (0.09)**	**0.85**	−0.01 (0.08)	0.99
Model 2												
Gender	**1.28 (0.43)**	**3.59**	**1.15 (0.29)**	**3.15**	**−1.28 (0.43)**	**0.28**	−0.13 (0.36)	0.88	0.13 (0.36)	1.14	**−1.15 (0.29)**	**0.32**
SES	−0.11 (0.11)	0.90	0.05 (0.08)	1.05	0.11 (0.11)	1.12	0.16 (0.09)	1.17	−0.16 (0.09)	0.86	−0.05 (0.08)	0.95
Extraversion	−0.17 (0.26)	0.85	**−0.43 (0.18)**	**0.65**	0.17 (0.26)	1.18	−0.27 (0.22)	0.77	0.27 (0.22)	1.31	**0.43 (0.18)**	**1.54**
Agreeableness	**0.60 (0.33)**	**1.81**	**0.68 (0.23)**	**1.97**	**−0.60 (0.33)**	**0.55**	0.08 (0.28)	1.09	−0.08 (0.28)	0.92	**−0.68 (0.23)**	**0.51**
Conscientiousness	0.01 (0.30)	1.01	**0.42 (0.22)**	**1.52**	−0.01 (0.30)	0.99	**0.41 (0.24)**	**1.51**	**−0.41 (0.24)**	**0.66**	**−0.42 (0.22)**	**0.66**
Neuroticism	0.30 (0.27)	1.35	−0.07 (0.20)	0.93	−0.30 (0.27)	0.74	**−0.37 (0.20)**	**0.69**	**0.37 (0.20)**	**1.44**	0.07 (0.20)	1.07
Openness	0.30 (0.30)	1.34	0.11 (0.21)	1.11	−0.30 (0.30)	0.74	−0.19 (0.25)	0.83	0.19 (0.25)	1.21	−0.11 (0.21)	0.90
Model 3												
Gender	**1.30 (0.43)**	**3.66**	**1.16 (0.27)**	**3.19**	**−1.30 (0.43)**	**0.27**	−0.14 (0.37)	0.87	0.14 (0.37)	1.15	**−1.16 (0.27)**	**0.31**
SES	−0.14 (0.11)	0.87	0.02 (0.08)	1.02	0.14 (0.11)	1.15	0.16 (0.09)	1.17	−0.16 (0.09)	0.85	−0.02 (0.08)	0.98
Negative Urgency	0.41 (0.42)	1.51	−0.32 (0.33)	0.73	−0.41 (0.42)	0.66	**−0.73 (0.32)**	**0.48**	**0.73 (0.32)**	**2.08**	0.32 (0.33)	1.38
Positive Urgency	−0.51 (0.42)	0.60	−0.10 (0.32)	0.90	0.51 (0.42)	1.66	0.41 (0.34)	1.50	−0.41 (0.34)	0.67	0.10 (0.32)	1.11
Lack of Premeditation	0.61 (0.50)	1.84	**−0.62 (0.37)**	**0.54**	−0.61 (0.50)	0.54	**−1.23 (0.40)**	**0.29**	**1.23 (0.40)**	**3.42**	**0.62 (0.37)**	**1.86**
Lack of Perseverance	−0.35 (0.46)	0.71	−0.07 (0.36)	0.93	0.35 (0.46)	1.41	0.27 (0.36)	1.31	−0.27 (0.36)	0.76	0.07 (0.36)	1.08
Sensation Seeking	−0.28 (0.40)	0.76	−0.31 (0.27)	0.73	0.28 (0.40)	1.32	−0.04 (0.32)	0.96	0.04 (0.32)	1.04	0.31 (0.27)	1.37
Model 4												
Gender	**1.14 (0.45)**	**3.11**	**1.07 (0.30)**	**2.93**	**−1.14 (0.45)**	**0.32**	−0.06 (0.39)	0.94	0.06 (0.39)	1.06	**−1.07 (0.30)**	**0.34**
SES	−0.10 (0.11)	0.90	0.05 (0.08)	1.05	0.10 (0.11)	1.11	0.15 (0.09)	1.15	−0.15 (0.09)	0.86	−0.05 (0.08)	0.95
Extraversion	−0.25 (0.30)	0.78	**−0.29 (21)**	**0.65**	0.25 (0.30)	1.28	−0.04 (0.25)	0.96	0.04 (0.25)	1.05	**0.29 (0.21)**	**1.44**
Agreeableness	**0.68 (0.34)**	**1.98**	**0.67 (0.24)**	**1.95**	**−0.68 (0.34)**	**0.41**	−0.02 (0.28)	0.98	0.02 (0.28)	1.02	**−0.67 (0.24)**	**0.31**
Conscientiousness	0.14 (0.45)	1.15	**0.29 (0.34)**	**1.34**	−0.14 (0.45)	0.87	**0.15 (0.35)**	**1.54**	**−0.15 (0.35)**	**0.66**	**−0.29 (0.34)**	**0.45**
Neuroticism	0.08 (0.34)	1.09	−0.10 (0.23)	0.90	−0.08 (0.34)	0.92	**−0.19 (0.27)**	**0.53**	**0.19 (0.27)**	**1.41**	0.10 (0.23)	1.11

	Exp (vs. Poly)		Non (vs. Poly)		Poly (vs. Exp)		Non (vs. Exp)		Exp (vs. Non)		Poly (vs. Non)	
	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR	B (SE B)	OR
Openness	0.38 (0.35)	1.47	0.09 (0.23)	1.09	−0.38 (0.35)	0.68	−0.30 (0.28)	0.75	0.30 (0.28)	1.34	−0.09 (0.23)	0.92
Negative Urgency	0.60 (0.53)	1.83	0.01 (0.39)	1.01	−0.60 (0.53)	0.55	**−0.60 (0.41)**	**0.55**	**0.60 (0.41)**	**1.82**	−0.01 (0.39)	0.99
Positive Urgency	−0.35 (0.41)	0.71	−0.01 (0.33)	1.01	0.35 (0.41)	1.42	0.35 (0.34)	1.41	−0.35 (0.34)	0.71	0.01 (0.33)	1.01
Lack of Premeditation	0.83 (0.53)	1.30	**−0.37 (0.39)**	**0.69**	−0.83 (0.53)	0.44	**−1.21 (0.42)**	**0.30**	**1.21 (0.42)**	**3.34**	**0.37 (0.39)**	**1.45**
Lack of Perseverance	−0.29 (0.59)	0.75	0.07 (0.48)	1.07	0.29 (0.59)	1.34	0.36 (0.43)	1.44	−0.36 (0.43)	0.70	−0.07 (0.48)	0.93
Sensation Seeking	−0.28 (0.45)	0.76	−0.30 (0.31)	0.74	0.28 (0.45)	1.32	−0.02 (0.34)	0.98	0.02 (0.34)	1.02	0.30 (0.31)	1.35

Note. Bolded values denote statistical significance ($p < .05$). Some variable names have been shortened; Poly=Polytobacco Users; Non=Nonusers; Exp=Experimenters.