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Mostly Smokers: Identifying Subtypes of Emerging Adult Substance Users

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Abstract

Background—The concurrent use of marijuana and other substances among emerging adults (ages 18–25) is a major public health problem. This study examined if there are distinct subtypes of emerging adult marijuana users and if these are associated with demographic and substance use variables.

Methods—The design was a cross-sectional interview with a community sample of 1,503 emerging adults in the northeastern U.S. who reported last month marijuana use. We used latent class analysis (LCA) to identify distinct subtypes of emerging adults who used additional substances and examined predictors of the latent classes.

Results—We identified three distinct classes of emerging adults who use substances: “mostly smokers” (those who primarily use marijuana and nicotine), “moderate users” (those who primarily use marijuana and/or heavy episodic alcohol), and “polysubstance users.” Polysubstance users had higher probabilities of use of all assessed substances (e.g. cocaine, opiates, sleep

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medications, stimulants, synthetic marijuana, and inhalants) than the other two groups. Not being currently enrolled in school and male gender were associated with mostly smokers and polysubstance users group status.

Conclusions—We identified a distinct group of emerging adult marijuana users who primarily smoke marijuana and cigarettes, suggesting that there could be a shared vulnerability for risk of co-occurrence.

Keywords

Emerging adults; substance use; latent class analysis; marijuana; tobacco

Introduction

Emerging adults (ages 18–25) (Arnett, 2001) have the highest rates of marijuana use compared to other age cohorts, and substance use disorders peak during this period (SAMHSA, 2013; Johnston et al., 2015). By the time high school seniors enter this next developmental phase, the annual prevalence of marijuana use is 35%, and the prevalence of having experimented with any illicit drug other than marijuana is 15% (Johnston et al., 2016). Illicit substance use that emerges in this period can directly influence the risk of substance abuse and/or dependence in adulthood (Chassin et al., 2004).

Previous research has supported the high rates of co-occurrence of other illicit drug use among young people who use marijuana, as studies suggest that those who use marijuana are more likely to use other illicit drugs (Scherer et al., 2013; Smith et al., 2011). Marijuana use is also commonly elevated among tobacco users, particularly during emerging adulthood (Ramo et al., 2013). National survey results suggest the rate of current marijuana use among adolescents who smoked cigarettes in the past month was approximately 11 times the rate among youths who did not smoke cigarettes (49.5 vs. 4.6 percent) (SAMHSA, 2014). But whether the concurrent use of nicotine and marijuana represents a particular subgroup of emerging adult substance user remains understudied.

Substance use is thought to be heterogeneous and may be understood through a person-centered approach such as latent class analysis (LCA). Previous LCA studies of adolescents demonstrate the escalation of polysubstance use with increasing age during this period (Tomczyk et al., 2016), highlighting the need to examine substance use in emerging adults. LCA has been applied to characterize subgroups of adults, mostly in population-based alcohol and drug research, with research pointing to three main drug profiles: a limited range cluster which includes alcohol, tobacco, and marijuana; a moderate range cluster, including amphetamine derivatives; and an extended range cluster, which includes other illicit drugs as well as non-medical prescription drug use (Connor et al., 2014; Smith et al., 2011; Quek et al., 2013; White et al., 2013). A recent review paper summarized LCA studies that included both population-based and clinical samples of emerging adults (Connor et al., 2014). In a study of 3,333 young adults from a nationally representative Australian sample (Quek et al., 2013), most of the sample endorsed using either alcohol only (52%), or alcohol and tobacco (34%). In a study of 21,945 first-year American college students, four classes were identified, including a high-risk drinking and high prevalence drug use class (20%), which

primarily included marijuana (Chiauzzi et al., 2013). Similarly, a national survey of 12,544 college students in Brazil revealed that 26% of students endorsed concurrent polydrug use in the past year, and marijuana was most frequently used with alcohol (Oliveira et al., 2013). Connor and colleagues applied LCA to identify three classes of drug use patterns among 826 marijuana users referred for treatment in Australia – with the majority in the marijuana, alcohol, and tobacco class (567%) (Connor et al., 2013).

To our knowledge, no studies employing LCA have focused on the substance use patterns among non-treatment seeking, marijuana-using emerging adults exclusively, and in particular, examined the concurrent use of marijuana and nicotine. Given the limitations of previous studies, we employed LCA among non-treatment seeking emerging adults, 18–25 years old, recruited from the community. Because marijuana is the most commonly used illicit substance in this age group, we were interested in determining if distinct subtypes of emerging adults who use marijuana could be described by their use of other substances. Further, because social attitudes towards marijuana have led to legalization of its use for medical and recreational purposes in some U.S. states, the effect on behavior among young people will need to be monitored as it may affect prevalence rates. Given that patterns of substance misuse continue into young adulthood, we hypothesized that subtypes similar to those identified among adolescents and consistent with other studies of young adults would be characterized among emerging adults, including a polydrug using group (Tomczyk et al., 2016; Connell et al., 2009; Bohnert et al., 2013). Second, based on epidemiological data, we hypothesized that a subtype characterized by concurrent use of nicotine and marijuana would be found in our community sample. Our final aim was to evaluate demographic characteristics associated with each of the latent classes. If distinct subtypes of marijuana users exist, such classifications could inform intervention strategies for emerging adults who use substances.

Methods

Participants were recruited between January 2012 and March 2014 for a large study on health behaviors among “emerging adults, 18–25 years old, who use marijuana or alcohol” through advertisements online, in local college newspapers, on public transportation, and on commercial radio in Rhode Island. After an unpaid telephone screen, eligible individuals were invited for a compensated (\$40) in-person interview and free sexually transmitted infection testing. The study was approved by the Butler Hospital Institutional Review Board.

Measures

We included questions related to demographics, substance use, sexual activity, mental health and general health. Tobacco use was assessed with “In the last 30 days, how often did you smoke cigarettes?” and heavy episodic drinking with: “In the last 30 days, how often did you have (4 or 5) or more drinks in a row, that is, in a couple hours?” We defined binge alcohol use as 4 or more drinks for women, 5 or more for men. Frequency of marijuana use was measured with: “In the last 30 days, how often did you use marijuana?” Response options ranged from “Never” to “Monthly” to “More than Monthly” to “Weekly” to “Daily.” Use of substances was assessed with: “In the last 30 days, how often have you used (*substance*)?”

Because variability on these items was low (most participants reported no use of most other substances in the last 30-days) these measures were dichotomized to contrast recent users to non-users.

Analytical Methods—We report descriptive statistics to summarize the characteristics of the sample. We used latent class analysis (LCA) with covariates (Clark & Muthén, 2009) to identify distinct subtypes of substance users, and to evaluate the association of latent class membership with background characteristics. The objective of Latent Class Analysis (Lazarsfeld & Henry, 1968; McCutcheon, 1987) is to categorize subjects into a relatively small number of statistically distinct and heuristically useful classes based on observed input variables, and to identify variables that most clearly distinguish the classes (Nylund et al, 2007). Unlike traditional cluster analysis, LCA estimates the posterior probability that subjects are members of each class, item parameters (conditional means or item probabilities) describing the expected pattern of response within each class, and class probability parameters. We used the 1-step approach (Clark & Muthén, 2009) to evaluate the association of latent class membership with background characteristics; these associations were estimated as a multinomial logistic regression model.

There is not a universally accepted criterion for determining the number of latent classes (Nylund et al., 2007). In addition to evaluating the substantive and heuristic interpretability of alternative models, we report AIC, BIC, sample size adjusted BIC, the Lo-Mendell-Rubin test (LMR), and the bootstrap likelihood ratio test (BLRT) (Tofighi and Enders, 2008; Nylund et al. (2007). The LMR and BLRT are statistical tests that compare a model with k classes to a model with $k-1$ classes; a significant test is consistent with the hypothesis that the k -class model fits the observed significantly better. We used Mplus 5.1 (Muthén & Muthén, 2008) to estimate the LCA model with covariates.

Results

Model fit statistics presented some ambiguity in choosing between models with 3 and 4 latent classes (Table 1). The BIC, adjusted BIC, and LMR favored a 3-class model while the BLRT favored a model with 4 latent classes. A 6-class model did not converge. Based on both statistical and substantive considerations, we favored the more parsimonious model with 3 latent classes.

Participants ($n=1503$) averaged 21.3 (± 2.2) years of age, 837 (55.7%) were male, 867 (57.7%) were non-Latino White, 207 (13.8%) were African-American, 249 (16.6%) were Hispanic, and 180 (12.0%) were of other racial or ethnic origins; 690 (45.9%) were currently enrolled in school. Six hundred ninety-one (46.0%) reported daily marijuana use and an additional 552 (36.7%) used marijuana weekly. Seven hundred nineteen (47.8%) reported heavy episodic drinking at least 1 time per week. One hundred twenty-nine (8.6%) reported use of cocaine, 116 (7.7%) use of opiates, 300 (19.6%) use of sleep medications, 256 (17%) use of stimulants, 113 (7.5%) use of synthetic cannabinoids, 149 (9.9%) use of inhalants, and 549 (36.5%) were daily cigarette smokers. Descriptive statistics on substance use are presented in Table 2 which also summarizes results from the LCA.

We refer to Class I as *Polysubstance Users* (see Table 2). This class was characterized by the highest probability of using all illicit substances, high estimated probabilities of daily marijuana use and cigarette smoking, and also the highest estimated probabilities of weekly or more frequent binge drinking. This was the most likely latent class for 290 (19.3%) of the participants. We label Class II *Mostly Smokers*. This was the most likely latent class for 576 (38.3%) of participants. This class resembled the polysubstance users with respect to the high estimated probability (.645) of daily marijuana use and daily cigarette smoking (.515), but had far lower estimated probabilities weekly or daily binge drinking and of using all other substances. Class III, *Moderate Users*, had a lower probability of daily marijuana use than either Polysubstance Users or Mostly Smokers, but a relatively high probability (.495) of weekly binge drinking. Moderate users had a low estimated probability of using other substances or being a daily smoker.

Class III (Moderate Users) was defined as the reference category in the multinomial logistic regression model (Table 3) that included demographic variables. Relative to classification as a Moderate User, the likelihood of being classified as a Polysubstance User (OR = 1.02, 95%CI 1.00; 1.04, $p < .05$) or as a Mostly Smoker (OR = 1.02, 95%CI 1.00; 1.04, $p < .05$) increased with age. Compared to females, males were significantly more likely to be classified as Polysubstance Users (OR = 2.20, 95%CI 1.53; 3.16, $p < .01$) or as Mostly Smokers (OR = 2.02, 95%CI 1.36; 2.98, $p < .01$). African-Americans had a significantly lower likelihood of being classified as Polysubstance Users than non-Latino Whites (OR = 0.48, 95%CI 0.25; 0.93, $p < .05$) and a significantly higher likelihood of being classified as Mostly Smokers (OR = 1.85, 95%CI 1.07; 3.17, $p < .05$). Persons identifying other racial or ethnic origins also had a significantly higher likelihood (OR = 1.99, 95%CI 1.09; 3.64, $p < .01$) of being classified as Mostly Smokers. Directionally, non-Latino Whites had a slightly lower likelihood of being classified as a Mostly Smoker than Hispanics, though this difference was not statistically significant. Persons currently enrolled in school were significantly less likely to be classified as Polysubstance Users (OR = .27, 95%CI 0.18; 0.39, $p < .01$) or as Mostly Smokers (OR = 0.09, 95%CI 0.06; 0.14) than those not in school.

Discussion

From a community sample of emerging adults who answered an advertisement recruiting persons who smoke marijuana—the most commonly used illicit substance among emerging adults—we identified three distinct classes of substance users. *Polysubstance Users* had higher probabilities of use of all substances (e.g. cocaine, opiates, sleep medications, stimulants, synthetic marijuana, and inhalants) than the other groups, as well as high rates of heavy drinking and marijuana use. *Mostly Smokers* had the highest probability of daily marijuana use and daily cigarette smoking, but low probability of other substance use. A *Moderate User* group used marijuana and binge alcohol at rates similar to nationally representative samples.

The finding of a polysubstance-using group is similar to the majority of previously published LCA studies among adolescents as well as this age group (Connor et al., 2013; Quek et al., 2013; Oliveira et al., 2013; Chiauuzzi et al., 2013). Our study examined a broad range of drug use, including sleep medications and synthetic marijuana (Spice), compared to

previous studies. Of note, our results differ from most other latent class analysis profiles in adult samples in that we found a group of users who are primarily smokers of marijuana and cigarettes, similar to results of a recent study of marijuana users referred for treatment (Connor et al., 2013). These findings are also consistent with a growing number of recent studies highlighting a significant prevalence of co-occurring marijuana and tobacco use, with rates as high as 90% of adult marijuana users also reporting tobacco use (Agrawal et al, 2011; Ramo et al., 2013; Rabin & George, 2015). In addition to an increased public health burden, co-occurring smoking places greater risks on the user, including a higher likelihood of developing a marijuana use disorder, of reporting more psychosocial problems (e.g., greater psychiatric severity, and fewer years of education), and poorer marijuana cessation outcomes compared to individuals who only report marijuana use (Moore & Budney, 2001). The literature has identified several potential mechanisms that may underlie this association (Peters, Budney, Carroll, 2012). For example, there is a possibility of a shared genetic liability (Agrawal et al, 2011; Young et al., 2006), and environmental or personality influences (Creemers et al, 2009) which may contribute to or predispose individuals to a greater likelihood of co-occurring marijuana and tobacco use.

There are methodological differences across previous LCA studies, including the time frame for substance use assessment (e.g, lifetime vs. 1–12 months) that can affect prevalence rates and the confidence to make meaningful comparisons between studies (Connor et al., 2013). For example, we did not find a latent class defined primarily by alcohol use as did Quek et al, 2013, which unlike the current study, assessed both concurrent (use in the previous 12 months) and simultaneous (use at the same time, on at least one occasion) drug use. Instead, our Moderate User group was using both marijuana and alcohol. Further, our Moderate User group did not include tobacco, which is inconsistent with prior work suggesting its inclusion in the “moderate range cluster” (Connor et al., 2014). When examining demographic factors of the groups, consistent with the literature, we found that Polysubstance Users and Mostly Smokers were more likely to be male and not enrolled in school when compared to Moderate Users (Connor et al., 2014; Oliveira et al., 2013; SAMHSA, 2011; Lex, 1991; Quek et al., 2013).

The current study has important strengths. First, our sample of emerging adults was large and diverse with regard to gender, race/ethnicity, and non-school status (55% not currently enrolled in school). Few studies have considered school status in analyses, and here persons not in school were more likely to be Polysubstance Users. Second, our person-centered LCA analytic approach was uniquely applied to an age group in which substance use peaks, and focused on marijuana users, a group at the center of important policy changes in the United States. There are also limitations to the current study. First, the sample included only those emerging adults who endorsed last month marijuana use and was not drawn using a representative population-based sampling design, and therefore results may not be generalizable to other emerging adult samples. Second, although common in survey research, our assessment of drug use and frequency was limited to self-reported, single-item questions as used in the Addiction Severity Index drug use section (McLellan et al., 1980). Third, this cross-sectional study cannot determine the ordering of substance use initiation. Fourth, we did not assess for age of marijuana initiation, which may have implications for preventive strategies.

In the present study, we used LCA to identify three distinct groups of emerging adults who use marijuana. For clinicians, awareness of the diversity of drugs used by emerging adults who are Polysubstance Users is important. Prior LCA studies have identified a higher risk of co-occurring psychiatric symptomatology among wide-ranging substance users, making it an important target for intervention (Connor et al., 2013; Quek et al., 2013; White et al., 2013). There is strong empirical support for the effectiveness of brief interventions for alcohol use among young adults (Tanner-Smith et al., 2015; Patton et al., 2014). A multi-targeted brief intervention that address both alcohol and drug use, including marijuana, may be an effective strategy for those individuals who endorse both risks (Tanner-Smith et al., 2015).

Further, given the size of the Mostly Smoker class, our findings support clinical interventions that address marijuana use within the context of tobacco cessation interventions and vice versa. While cigarette smoking rates have continued to decline in national surveys of young adults, rates of alternate forms of tobacco use, including hookah and e-cigarettes, may continue to increase among this age group and warrant intervention (Johnston et al., 2015). Future research may benefit from designing interventions that are tailored to the needs of emerging adults based on their unique substance use profiles and associated risk behaviors, including risky sexual behaviors and poor academic performance, which are more prevalent among this age group (Andrade et al., 2013; Trezn et al., 2013; El Ansari et al, 2013). Finally, the identification of subtypes within the emerging adult population may direct prevention efforts during adolescence before the negative health consequences of more enduring substance use take place.

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Table 1

LCA Model Fit Statistics ($n = 1,503$).

Classes	AIC	BIC	Adj. BIC	LMR p = ^a	BLRT p = ^a
1	15860.1	15934.5	15890.1	NA	NA
2	15388.4	15542.5	15450.4	< .001	< .001
3	15274.9	15508.8	15369.0	.017	< .001
4	15251.3	15564.9	15377.5	.353	< .001
5	15239.8	15633.1	15398.0	.263	< .147

^aThe Lo-Mendall-Rubin (LMR) and bootstrap likelihood ratio (BLRT) statistics test the hypothesis that a model with k classes fits the observed data better than a model with k-1 classes.

Table 2

Estimated Posterior Probability of Class Membership, Classification by Most likely Latent Class, and Observed Distributions and Estimated Probabilities of Response for Input Variables in the Latent Class Measurement Model ($n = 1,503$)

		Class I	Class II	Class III
Class Probabilities and Counts		Polysubstance Users	Mostly Smokers	Moderate Users
Est. Posterior				
		.219 (<i>n</i> = 329)	.400 (<i>n</i> = 602)	.381 (<i>n</i> = 573)
Probabilities				
Most Likely				
		.193 (<i>n</i> = 290)	.383 (<i>n</i> = 576)	.432 (<i>n</i> = 637)
Latent Class				
INPUT VARIABLES	Observed n (%)	Estimated Probability of Response		
MJ Use Frequency				
1/Mo.	121 (8.1%)	.000	.052	.160
2–3/Mo.	139 (9.3%)	.072	.027	.175
Weekly	552 (36.7%)	.318	.276	.495
Daily	691 (46.0%)	.610	.645	.171
Binge Frequency				
Never	262 (17.4%)	.072	.264	.139
1/Mo.	209 (13.9%)	.074	.162	.153
2–3/Mo.	313 (20.8%)	.142	.199	.258
Weekly	684 (45.5%)	.658	.349	.448
Daily	35 (2.3%)	.054	.027	.025
Cocaine (Yes)	129 (8.6%)	.315	.015	.006
Opiates (Yes)	116 (7.7%)	.288	.026	.006
Sleep Medications (Yes)	300 (20.0%)	.433	.101	.165
Stimulants (Yes)	256 (17.0%)	.494	.019	.140
Spice (Yes)	113 (7.5%)	.181	.086	.000
Inhalants (Yes)	149 (9.9%)	.265	.054	.048
Daily Smoker (Yes)	549 (36.5%)	.693	.515	.009

Table 3

Multinomial Logit Regression Model Evaluating Demographic Predictors of Latent Class Membership ($n = 1,503$).

Background Characteristic	<i>Polysubstance Users v. Moderate Users</i>	<i>Mostly Smokers v. Moderate Users</i>
	OR (95%CI) ^a	OR (95%CI) ^a
Years Age	1.02 [*] (1.00; 1.04)	1.02 [*] (1.00; 1.04)
Gender (Male)	2.20 ^{**} (1.53; 3.16)	2.02 ^{**} (1.36; 2.98)
Race/Ethnicity		
African-American	0.48 [*] (0.25; 0.93)	1.85 [*] (1.07; 3.17)
Latino	0.92 (0.56; 1.50)	1.36 (0.76; 2.44)
Other Minority	1.10 (0.62; 1.95)	1.99 [*] (1.09; 3.64)
White [REF]	[1.00]	[1.00]
Enrolled in School (Yes)	0.27 ^{**} (0.18; 0.39)	0.09 ^{**} (0.06; 0.14)

^{*}
p < .05,

^{**}
p < .01