



Substance Use Profiles Among Urban Adolescents: The Role of Family-Based Adversities

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Abstract

The purpose of this study is to advance our understanding of family-based adversities and adolescent well-being by examining variability in substance use profiles among urban, low-income and predominantly African American adolescents ($n = 2858$). Latent class analysis and regressions were used to identify the nature and correlates of heterogeneity in substance use patterns among adolescents in the Mobile Youth Survey (MYS). Analyses revealed the presence of four underlying subgroups of youth: non-users (48.4%), alcohol users (17.6%), alcohol and marijuana users (31.6%), and polysubstance users (2.5%). Membership in classes varied by age and gender, with older youth and males being more likely to belong to groups characterized by the use of multiple substances. Youth who reported that someone in their household had been arrested were more likely to belong to one of the substance using groups than the non-use group, and youth who reported not having a father figure were more likely to belong to groups characterized by the use of multiple substances relative to the non-use group. Youth who reported living with two biological parents were less likely to belong to either the alcohol or the alcohol and marijuana classes than the non-use group. Results further indicated that youth in classes characterized by the use of multiple substances were more likely to exhibit externalizing problems and internalizing distress than other youth. Findings underscore the importance of identifying heterogeneity even in seemingly homogeneous samples and suggest a number of new directions for future research.

Keywords Adolescent substance use · Socioeconomic status · Family structure · Household member arrest · Latent class analysis

Highlights

- Analyses revealed the presence of four underlying substance use groups.
- Patterns of substance use varied by family structure and household member arrest.
- Polysubstance users appear to be at greatest risk for behavior problems.
- There is notable heterogeneity in substance use among youth in disadvantaged settings.

Several recent trends in substance use among American adolescents are encouraging, but there is also cause for continued concern. The most recent data from the Monitoring the Future study indicate, for instance, that cigarette smoking among adolescents is near an all-time low and that

use of many illicit substances remains well below the peak levels observed in the late 1990s (Johnston et al. 2018). These data also suggest, however, that annual marijuana use increased in 2017 and that the decline in alcohol use that began in the 1980s has tapered off. Moreover, risk for substance use is not uniformly distributed across racial groups or indicators of socioeconomic status. African American adolescents tend to report lower rates of alcohol and cigarette use than White youth, but have substantially higher rates of marijuana use than White adolescents. Monitoring the Future data further suggest that the decline in cigarette use has been steepest among youth from families with more highly educated parents, and that youth

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who do not identify as being college-bound report considerably higher rates of illicit substance use, heavy drinking, and smoking than their college-bound peers.

Research on profiles of adolescent substance use has further suggested that specific combinations or patterns of use may be particularly consequential. Latent class-based research has consistently revealed the presence of three to four underlying subgroups of youth that vary in the number and frequency of substances they use as well as their risk for other problem behaviors (Tomczyk et al. 2016). Poly-substance use is especially concerning, with several studies providing evidence of associations between concurrent or simultaneous use of multiple substances and other problematic behaviors such as truancy (Patrick et al. 2018), unsafe driving (Terry-McElrath et al. 2014), and antisocial and oppositional behaviors (Kulis et al. 2016). Although questions remain about the temporal patterning of these relationships, it is clear that there are statistically and practically meaningful subgroup differences among youth in terms of patterns of use across multiple substances.

A critical task from public health and developmental perspectives is determining who is at risk for belonging to the most problematic substance use classes. Several studies indicate that males, older youth, and White adolescents tend to be at greater risk for membership in groups characterized by the use or abuse of multiple substances (Choi et al. 2018; Göbel et al. 2016; Patrick et al. 2018; Tomczyk et al. 2016). Although youth-level demographic characteristics have been consistently related to substance use classes, we know comparatively little about how aspects of adolescents' family ecologies may heighten or mitigate risk. Family-based adversities are central to models of adolescent substance use (Chassin et al. 2009; Gray and Sqeglia 2018; Wills and Yaeger 2003) and include stressors related socioeconomic conditions, family structure, and negative life events (Patrick et al. 2012; Petraitis et al. 1995; Wellman et al. 2016; Wills et al. 2001) that warrant investigation in relation to patterns of use across substances.

A handful of studies point to the role that family socioeconomic status (SES) plays in profiles of adolescent substance use, although results have been mixed in terms of which end of the distribution is most at risk. Patrick et al. (2018) found that membership in their heaviest use class relative to the alcohol-only class was higher for students with parents who had completed at least some college compared to those with parents who had a high school degree or less. Similarly, Conway et al. (2013) reported that youth with parents who had bachelor's or graduate degrees were more likely to be in the alcohol or marijuana class relative to the non-use class than youth with parents who had lower levels of education. Whereas these studies suggest that higher levels of parent education may be associated with more problematic substance use, Kulis et al.

(2016) did not find evidence of significant differences across a variety of socioeconomic indicators including participation in the federal school lunch program and maternal education. Thus, while two studies suggest that more advantaged socioeconomic status may increase risk for problematic substance use, one study suggests that SES does not appear to affect risk. The divergence of these findings may reflect either differences in the measures used or samples studied, and underscore the need for continued investigation of socioeconomic disadvantage and related adversities.

Two family-based adversities that are often tied to economic disadvantage and may also be useful for identifying gradations of risk for polysubstance use are family structure and household member contact with the criminal justice system, a major life event that is at the nexus of multiple adversities. Previous research has indicated that risk for adolescent substance use varies by household composition, such that youth raised in households where neither parent was present are at greatest risk of developing a substance abuse problem, followed by their peers in step-parent and single parent families (e.g., Adalf and Ivis 1997; Aquilino and Supple 2001). Two-parent households, in contrast, appear to provide the greatest protection from the development of substance use problems among adolescents (Blum et al. 2000)—in part because of differences in household economic resources (Hawkins et al. 1992). However, socioeconomic status on its own explains only a limited portion of the variation in substance use across family structure types (Barrett and Turner 2006), suggesting the importance of family processes that may vary across household structure such as parental substance use, social support, and supervision (Barrett and Turner 2006; Breivik et al. 2009; Brown and Rinelli 2010). Further, family structure may result in differential exposure to social stressors—including household member contact with the criminal justice system—which may lead to substance use as a coping mechanism. This is consistent with research in the stress process tradition, which suggests that individuals often rely on different coping mechanisms to manage the impact of stress-provoking situations or circumstances (Pearlin et al. 1981).

Parental contact with the criminal justice system has been increasingly recognized as a significant source of family-based adversity for millions of American youth (Arditti 2016; Johnson and Easterling 2012; Rodriguez and Margolin 2015; Wildeman et al. 2018) that is tied to both SES and family structure. Several studies have suggested that parent contact with the criminal justice system is associated with increased frequency of substance use and drug-related problems among adolescents and young adults (Davis and Shlafer 2017; Grigsby et al. 2018; Kopak and Smith-Ruiz 2016; Mears and Siennick 2016), as well as accelerated

Table 1 Sample descriptive statistics

	Mean or %	Standard Deviation	Range
Youth Demographic Characteristics			
African American	94.3%		
Female	49.6%		
Age	14.39	2.55	9–19
Family-Based Adversities			
Household member arrested in the past year	26.7%		
Receiving free or reduced cost lunch	92.0%		
Living with two biological parents	26.2%		
No father figure	14.2%		
Substance Use			
Lifetime cigarette use	25.5%		
Lifetime alcohol use	46.3%		
Lifetime marijuana use	35.7%		
Lifetime crack or cocaine use	2%		
Lifetime amphetamine or methamphetamine use	3.7%		
Ever drunk or high	33.3%		
Externalizing and Internalizing Problems			
Ever been arrested	26.9%		
Suspended or expelled in the past year	50.3%		
Traumatic stress	6.23	3.25	0–14
Worry	5.64	3.81	0–18
Hopelessness	1.07	1.65	0–6

trajectories of use across the transition from adolescence to young adulthood (Roettger et al. 2011). These studies underscore the value of including criminal justice contact in conceptual and statistical models of substance use, especially given the prominence of substance use histories among individuals in the criminal justice system (Bronson et al. 2017). Existing studies on the link between adult criminal justice contact and youth substance use have examined indicators of substance use separately rather than considering whether there is underlying variability among youth in terms of patterns across multiple substances, however. Research on intergenerational effects of adult contact with the criminal justice system for youth would therefore benefit from the latent class based approaches that have proven valuable in the more general adolescent substance use literature.

The purpose of the current study is to merge these lines of inquiry by identifying the nature and sources of latent variability in profiles of substance use among an urban,

low-income and predominantly African American sample of adolescents. The focus on urban, low-income and predominantly African American youth addresses recent calls for research on substance use patterns in a broader variety of sociocultural settings (Kulis et al. 2016; Su et al. 2018; Tomczyk et al. 2016) and permits the identification of heterogeneity in substance use patterns within a relatively homogenous sample. In addition to considering whether class membership varies by youth demographic characteristics, we examine how indicators of family structure and household member contact with the criminal justice system relate to substance use profiles. Following previous research that has established relationships between substance use classes and functioning in other domains of development (e.g., Bohnert et al. 2014; Conway et al. 2013; Kulis et al. 2016; Patrick et al. 2018), we also examine how class membership relates to externalizing problems and internalizing symptoms.

Based on the typical number of classes identified in Tomczyk et al. (2016) review, we expect to identify at least three classes of substance users: a non-use group, an alcohol or marijuana group, and a polysubstance use group. We anticipate that boys and older youth will be more likely to belong to the polysubstance group than the non-use group, and that family-based adversities will also predict membership in the polysubstance use group. Specifically, we hypothesize that living in a single parent household and recent household member arrest will increase risk for membership in classes that are defined by the use of multiple substances. Finally, based on previous connections between polysubstance use and behavior problems (e.g., Kulis et al. 2016; Patrick et al. 2018), we also hypothesize that youth who report using multiple substance use will be more likely to exhibit externalizing and internalizing problems than other subgroups of youth.

Method

Sample

Data were derived from the Mobile Youth Survey (MYS; Bolland et al. 2016), a longitudinal, multiple-cohort study of youth in Mobile, Alabama and the neighboring town of Pritchard. The study began in 1998 and was conducted annually through 2011. In the summer of 1998, individuals between the ages of approximately 10 and 18 were recruited to participate from the 13 poorest neighborhoods in these two cities. To recruit participants, investigators randomly selected addresses and invited youth at those addresses to participate. Word of mouth was also used, and any individuals who were within the target age range and neighborhoods were permitted to participate. Parental consent was

obtained for all participants and youth were asked to affirm their willingness to participate prior to completing the survey. Surveys were administered annually in the summer during group data collection sessions of approximately 20 youth. Acceptance rates ranged from 59% to 82% across the study and retention rates across waves, particularly after the first two waves of data collection, were very good (see Bolland et al. 2016 for additional information on study recruitment and retention). Demographic and functional characteristics (e.g., achievement test scores, school code of conduct violations) of the MYS sample were comparable to students living in MYS neighborhoods who did not participate in the study, and these variables were also largely unrelated to sample attrition (Bolland et al. 2017).

Reflecting the demographic composition of the neighborhoods from which youth were recruited, the vast majority of MYS participants across waves were African American and reported receiving free or reduced-cost lunches (Bolland et al. 2016). At Wave 14, the most recent wave of data collection and focus of the current study ($n = 3,016$), 94.1% of the sample was African American. The average age of participants at this wave was 14.34 and just over half were boys (50.8%). For the purposes of the current study, only youth with complete data on the substance use variables of interest were included ($n = 2858$). The analytic sample closely mirrored the full sample in terms of race (94.3% African American), gender (50.4% male), and age (mean = 14.39). Descriptive statistics for all variables included in the current study are provided in Table 1.

Measures

Substance Use

Substance use variables were based on participants' responses to items that inquired about the frequency of cigarette, alcohol, crack or cocaine, marijuana, or amphetamines or methamphetamine use as well as one item that pertained to being drunk or high. Participants were given examples and/or slang terms for some of these substances (e.g., blunts, grass, herb, reefer; speed, uppers, ecstasy, crystal meth, MDMA; beer, wine, wine coolers, malt liquor, hard liquor). Additionally, with respect to alcohol, participants were instructed *not* to count times when they just took a few sips of alcohol. Responses to these items were recorded to arrive at six dichotomous variables that reflected whether or not participants had ever used a given substance or had ever been drunk or high. Five-week test-retest using a similar sample ($n = 48$) of low-income adolescents in Huntsville, AL was adequate for similar measures of substance use (Somer's D_s ranged from 0.346 to 0.384 and

were significant at $p < 0.05$ for cigarette, alcohol, and marijuana use as well as whether or not the participant had been drunk or high); cocaine/crack use, which produced the only non-significant coefficient, nonetheless showed a high level of agreement over the five week period (91.7% of respondents gave exactly the same response at both assessments). Nearly half of the participants reported having ever used alcohol (46.3%), just over one-third reported lifetime marijuana use (35.7%), and one quarter reported cigarette use (25.5%). Approximately 4% of youth (3.7%) reported lifetime amphetamine or methamphetamine use, and 2% reported lifetime crack or cocaine use. One-third (33.3%) reported having ever been drunk or high.

Family-based adversities

Disadvantaged economic status Disadvantaged economic status was operationalized in terms of participation in the school lunch program. To assess this variable, participants were asked to indicate whether they received free or reduced cost lunch. Consistent with the high poverty status of neighborhoods from which youth were recruited, 92% of participants reported receiving free or reduced cost lunch.

Family structure Household structure was measured via youth reports of whether or not they were living with both of their biological parents as well as one item that asked them to indicate whether or not they agreed with the statement, "I don't have anyone like a father figure to me". About one-quarter of youth (26.2%) reported living with both parents, and 14.2% reported that they did not have anyone in their life like a father figure.

Household member arrest Household member arrest was based on youth responses to the question, "During the past year (12 months), was anyone who lives in your apartment been arrested?" This variable was coded 0 "no" and 1 "yes". Approximately one-quarter of youth (26.7%) reported that someone in their household had been arrested in the past year.

Externalizing problems

Externalizing problems were operationalized in terms of school suspensions or expulsions and contact with the criminal justice system. To assess these variables, participants were asked to self-report whether or not they had been suspended, expelled, or arrested. Just over one-quarter of the participants (26.9%) reported that they had ever been arrested, and approximately half of the participants (50.3%) reported that they had been suspended or expelled in the past year.

Internalizing symptoms

Internalizing problems have been conceptualized as inwardly directed manifestations of distress that include sadness, worry, somatic complaints (c.f., Achenbach and McConaughy 1992). In the MYS, internalizing symptoms were operationalized and assessed in terms of traumatic stress, worry, and hopelessness.

Traumatic stress Seven items developed by the MYS staff were used to assess secondary traumatic stress or the stress that people feel when something bad happens to a friend or family member. Sample items include “I think about bad things that have happened to family member or friend, even when I don’t want to” and “I have had bad dreams about the bad things that have happened to a family member or friend”. For each statement, participants were asked to select from “almost never”, “sometimes”, or “very often”. Responses were summed into a single score that demonstrated good internal consistency ($\alpha = 0.78$) and ranged from 0 to 14 ($M = 6.23$, $SD = 3.25$), with higher scores reflecting greater traumatic stress.

Worry Nine questions adapted from Small and Rodgers (1995) were used to assess participants’ worries. Questions covered a variety of topics including family economic resources (“how much do you worry that your family has enough money to get by?”), peer relations (“how much do you worry about not fitting in with other kids in the neighborhood or at school?”) and neighborhood safety (“how much do you worry about gangs in your neighborhood?”). Participants were asked to indicate how much they worried about each of the topics and select “not at all”, “some” or “very much”. Responses were then summed to create a total worry score that demonstrated acceptable internal consistency ($\alpha = 0.73$). Scores ranged from 0 to 18 ($M = 5.64$, $SD = 3.81$), with higher scores indicating higher levels of worry.

Hopelessness The Brief Hopelessness Scale (Bolland et al. 2001), which is based on five questions from Kazdin and colleagues’ (1983) Hopelessness Scale for Children as well as one item created by the MYS staff to capture expectations for living a long life, was used to assess hopelessness. Sample items include “All I see ahead of me are bad things, not good things”, “I might as well give up because I can’t make things better for myself”, and “I do not expect to live a very long life”. Participants were asked to indicate whether they disagreed (0) or agreed (1) with each statement and their responses were summed into a single hopelessness score that demonstrated good internal consistency ($\alpha = 0.82$). Scores ranged from 0 to 6 ($M =$

1.07, $SD = 1.65$), with higher scores reflecting higher levels of hopelessness.

Statistical Analyses

The first phase of our analyses involved identifying latent subgroups of adolescents using latent class analysis (LCA; Collins and Lanza 2010; Goodman 1974; Lazarsfield and Henry 1968). LCA is predicated on the assumption that there is underlying, unobserved heterogeneity that separates populations into subgroups, and that membership in these latent classes can be inferred from a set of observed variables (Lanza and Rhoades 2013). It is ideally suited to the current study in that we anticipate that there is variability at the intersection of multiple substance use variables in our sample. In contrast to cluster analysis, which also groups individuals according to their scores on multiple variables, LCA is model based and yields fit indices that can be used to guide model selection. Decision-making involves comparative fitting and evaluation of models with different numbers of latent classes in terms of parsimony and goodness of fit (Lanza and Rhoades 2013; Linzer and Lewis 2011). The Bayesian information criterion (BIC; Schwartz 1978) and Akaike information criterion (AIC; Akaike 1987) are two commonly used tools for comparing models, and models that minimize the values of these criteria are preferred (Collins and Lanza 2010; Linzer and Lewis 2011). Our model selection strategy therefore involved noting where decreases in the AIC and BIC fit leveled off while also considering the conceptual integrity of each cluster solution. Given the range of classes observed in previous studies (Tomczyk et al. 2016) and our inclusion of six dichotomous categories of lifetime substance use, we requested up to five classes. Analyses were conducted using the *poLCA* package in R (Linzer and Lewis 2011). After selecting a theoretically and statistically-informed class solution, the second and third phases of analysis involved estimating a series of regression equations to examine predictors of class membership and associations between class membership and externalizing and internalizing problems.

Results

Substance Use Classes

We posited that at least three classes would emerge from the data and, consistent with our hypothesis, results suggested the presence of four underlying classes of substance users. The AIC and BIC improved steadily up to four classes, and then tapered off in terms of improvement in model fit (Table 2). In addition to strong statistical cues as to the appropriateness of the four class solution, it also fits well with what has been

Table 2 Summary of information for selecting number of latent classes of substance use

Classes	LogL	Residual df	AIC	BIC	G ²	Chi-square
1	−8002.988	57	16017.98	16053.72	4258.957	35736.2
2	−6055.455	50	12136.91	12214.36	363.8911	836.4796
3	−5976.159	43	11992.32	12111.48	205.3002	711.7196
4	−5924.856	36	11903.71	12064.58	102.6948	286.2537
5	−5894.833	29	11857.67	12060.23	42.64779	119.2484

Table 3 Conditional probabilities of substance use for four-class solution

	Class 1 Non-Users (48.4%)	Class 2 Alcohol (17.6%)	Class 3 Alcohol & Marijuana (31.6%)	Class 4 Polysubstance (2.5%)
Cigarettes	0.0274	0.3023	0.5570	0.9488
Alcohol	0.0949	0.9001	0.8420	1.0000
Marijuana	0.0312	0.0000	0.9787	0.9572
Crack or cocaine	0.0003	0.0293	0.0104	0.5965
Methamphetamines	0.0000	0.0108	0.0517	0.8988
Drunk or high	0.0000	0.3158	0.8293	1.0000

observed in previous studies of adolescent substance use (Tomczyk et al. 2016). Conditional probabilities of lifetime use of each substance are presented by latent class in Table 3. The first class is comprised predominantly of youth who have not used any substances (non-users; 48.4% of the sample). The second class is comprised primarily of youth who have used alcohol, but not marijuana or other drugs (ALC; 17.6% of the sample). The third class is comprised of youth who reported both alcohol and marijuana use (ALCM; 31.6% of the sample). About half of the youth in this class also reported lifetime cigarette use, and the majority of them reported having been drunk or high. The fourth class (POLY; 2.5% sample) had the highest rates of alcohol and cigarette use, as well as very high rates of marijuana use. All of the youth in this group reported having been drunk or high, and a significant proportion of them also reported lifetime use of crack/cocaine or methamphetamines. Descriptive information about each class is provided in Table 4.

Predictors of Substance Use Classes

Results of multinomial logistic regression analyses indicated that youth demographic characteristics and indicators of family-based adversity were significantly related to class membership (Table 5). Female youth were more likely to be represented in the ALC group than in the group characterized by non-use ($OR = 1.25$, $CI = 1.00–1.56$), but were less likely to be represented in the ALCM ($OR = 0.60$, $CI = 0.49–0.74$) and POLY groups ($OR = 0.23$, $CI = 0.11–0.47$) than boys. There were also significant differences for age, with older youth being more likely to be represented in all three substance use groups than in the non-use group. Regarding family-based adversities, results suggested that youth who reported that someone in their household had been arrested during the past year were

more likely to belong to one of the substance use groups than the non-use group, and the relative risk was highest for the ALCM ($OR = 2.66$, $CI = 2.12–3.35$) and POLY groups ($OR = 2.99$, $CI = 1.59–5.65$). They were also more likely to belong to the ALCM group relative to the ALC group ($OR = 1.50$, $CI = 1.15–1.95$), and there was evidence of greater likelihood of belonging to the POLY group relative to the ALC and ALCM groups, but these comparisons did not reach conventional levels of statistical significance. Youth who reported living with two biological parents were less likely to be in the ALC ($OR = 0.77$, $CI = 0.60–0.99$) and ALCM ($OR = 0.67$, $CI = 0.53–0.85$) classes than in the non-use group, whereas youth who reported not having a father figure were more likely to belong to the ALCM ($OR = 1.36$, $CI = 1.01–1.82$) and POLY ($OR = 2.72$, $CI = 1.28–5.78$) groups relative to the non-use group. Although results were generally consistent with hypotheses in showing that boys, older youth, and youth who experienced household member arrest or lived in single parent households were more likely to belong to one of the groups that used multiple substances relative to the no use group, family-based adversities did not distinguish between the alcohol and marijuana group and the polysubstance group. Race and receiving free or reduced cost lunch did not relate to class membership, likely reflecting the limited variability on these dimensions in our sample.

Substance Use Classes and Externalizing and Internalizing Problems

Results of the analyses that examined the relationship between substance use classes and outcome variables were generally consistent with hypotheses in showing that polysubstance users appear to be at greatest risk for externalizing (Table 6) and internalizing (Table 7) problems. Controlling for

Table 4 Descriptive information about latent classes

	Class 1 No Use (<i>n</i> = 1383)	Class 2 ALC (<i>n</i> = 502)	Class 3 ALCM (<i>n</i> = 902)	Class 4 POLY (<i>n</i> = 71)
Youth Demographic Characteristics				
African American	94%	94%	95%	88%
Female	52%	59%	42%	24%
Mean Age	13.4	14.5	15.7	15.4
Family-Based Adversities				
Household member arrested past yr.	20%	28%	35%	39%
Receiving free or reduced cost lunch	94%	93%	90%	86%
Living with two biological parents	32%	25%	19%	22%
No father figure	10%	11%	22%	28%
Externalizing and Internalizing Problems				
Suspended or expelled in past year	38%	49%	68%	74%
Ever been arrested	13%	21%	49%	71%
Mean traumatic stress	6.3	6.4	6.0	6.5
Mean worry	6.1	5.5	4.9	7.1
Mean hopelessness	1.1	0.9	1.0	2.4

ALC alcohol users, ALCM alcohol and marijuana users, POLY polysubstance users

sociodemographic characteristics, youth in the non-using ($OR = 0.23$, $CI = 0.11–0.47$) and alcohol-only ($OR = 0.36$, $CI = 0.17–0.76$) classes were less likely to report having been suspended/expelled or arrested in the past year than youth in the polysubstance use group. Although youth in the ALCM and POLY groups did not differ in terms of suspensions or expulsions, they did differ in their arrest histories. Youth in the ALCM class were significantly less likely to have ever been arrested than youth in the polysubstance group ($OR = 0.21$, $CI = 0.09–0.45$). In terms of internalizing symptoms, there were significant differences between the classes for worry and hopelessness, but not traumatic stress. Youth in the non-using ($B = -1.76$, $SE = 0.56$, $p < 0.01$), alcohol-only ($B = -2.02$, $SE = 0.57$, $p < 0.01$), and alcohol and marijuana classes ($B = -2.16$, $SE = 0.56$, $p < 0.01$) reported significantly less worry than youth in the polysubstance class. Youth in the non-using ($B = -1.11$, $SE = 0.24$, $p < 0.01$), alcohol-only ($B = -1.26$, $SE = 0.25$, $p < 0.01$), and alcohol and marijuana classes ($B = -1.97$, $SE = 0.24$, $p < 0.01$) also reported significantly less hopelessness than the polysubstance use class.

Discussion

Researchers have increasingly embraced the value of understanding latent variability in adolescent substance use patterns for both basic and applied reasons (e.g., Collins and

Lanza 2010; Lanza and Rhoades 2013; Patrick and Maggs 2009; Tomczyk et al. 2016). Recent studies have consistently suggested the presence of multiple underlying subgroups of adolescents that vary in demographic composition as well as the extent to which they report problems in other domains of well-being (Kulis et al. 2016; Patrick et al. 2018; Tomczyk et al. 2016), but there has been comparatively little attention to how aspects of adolescents' family ecologies may heighten or mitigate risk for problematic substance use patterns. The purpose of this study was to extend work in this area by identifying latent classes of substance use in an urban, low-income, and predominantly African American sample and by examining the roles of family-based adversities as well as linkages with externalizing problems and internalizing symptoms.

Results are consistent with past research in revealing the presence of four underlying subgroups of youth, with the majority of participants belonging to a non-use or single substance use group and a small minority belonging to a polysubstance use group (Tomczyk et al. 2016). Almost half of the sample (48.4%) belonged to the non-use group, suggesting that a significant portion of youth abstained from substance use in disadvantaged neighborhoods that are often thought to elevate risk. The distribution of youth across the substance use groups provides additional evidence of heterogeneity in risk behaviors within a sample that is relatively homogenous in terms of economic

Table 5 Predictors of class membership (odds ratios and confidence intervals)

	ALC vs. Non-Users	ALCM vs. Non-Users	POLY vs. Non-Users	ALCM vs. ALC	POLY vs. ALC	ALCM vs. POLY
Youth Demographic Controls						
African American	0.85 (0.54–1.34)	0.88 (0.56–1.39)	0.90 (0.21–3.90)	1.04 (0.61–1.76)	1.06 (0.24–4.72)	1.02 (0.23–4.45)
Female	1.25 (1.00–1.56)*	0.60 (0.49–0.74)**	0.23 (0.11–0.47)**	0.48 (0.38–0.62)**	0.18 (0.09–0.38)**	0.38 (0.18–0.78)**
Age	1.21 (1.15–1.27)**	1.50 (1.44–1.58)**	1.48 (1.28–1.72)**	1.24 (1.18–1.31)**	1.22 (1.06–1.43)**	0.99 (0.85–4.45)
Family-Based Adversities						
Household member arrested past year	1.77 (1.38–2.29)**	2.66 (2.12–3.35)**	2.99 (1.59–5.65)**	1.50 (1.15–1.95)**	1.69 (0.88–3.23)	1.13 (0.60–2.11)
Receiving free or reduced cost lunch	1.00 (0.65–1.55)	0.81 (0.56–1.18)	0.73 (0.27–1.96)	0.81 (0.52–1.26)	0.72 (0.26–2.01)	0.89 (0.34–2.37)
Living with two biological parents	0.77 (0.60–0.99)*	0.67 (0.53–0.85)**	1.09 (0.52–2.27)	0.87 (0.65–1.16)	1.40 (0.66–2.99)	1.62 (0.77–3.40)
No father figure	0.85 (0.59–1.23)	1.36 (1.01–1.82)*	2.72 (1.28–5.78)**	1.59 (1.11–2.28)*	3.19 (1.46–6.98)**	2.01 (0.96–4.20)

Results from multinomial logistic regressions

ALC alcohol-only users, ALCM alcohol and marijuana users, POLY polysubstance users

* $p < 0.05$; ** $p < 0.01$

disadvantage and race (Mustanski et al. 2013) and underscores the importance of investigating factors that heighten or mitigate risk in seemingly homogenous samples. Results are consistent with past research in showing that older youth and males were more likely to belong to groups characterized by the use of multiple substances. Girls, however, were more likely than boys to be represented in the alcohol group than the non-use group, a finding that is broadly consistent with recent trends in adolescent alcohol use. Gender differences in alcohol use have narrowed in the last several years and there is now evidence that 30-day prevalence of alcohol use is higher among girls than boys at certain ages (Johnston et al. 2018). Changes in alcohol use among girls and young women likely reflect an interplay of individual, family, and peer factors as well as societal-level changes pertaining to social roles and the marketing of alcohol products (Bolland et al. 2016; Patrick et al. 2019).

Findings also extend previous research by suggesting that family-based adversities increase the risk for membership in subgroups characterized by the use of multiple substances in a manner that is consistent with models of family stress (e.g., Arditto 2016; Conger et al. 1994, 2002) as well as adolescent substance use (Chassin et al. 2009; Gray and Sqeglia 2018). Youth who reported living with two biological parents were less likely to belong to the alcohol and alcohol and marijuana classes than to the non-use group; and youth who reported not having a father figure were more likely to belong to the two groups characterized by the use of multiple substances relative to the non-use group. Although Kulis et al. (2016) did not find evidence of significant differences across latent classes in terms of household structure in their analysis of a nationally representative sample of American Indian youth, our findings suggest that family structure plays a protective role in the urban, high poverty settings from which our participants were recruited. Results for absence of father figure complement this finding and underscore the value of considering both household structure and the presence of parent-figures in young people’s lives. It may be the case that differences in parental substance use (and related parental attitudes/beliefs) across household types are particularly stark in more disadvantaged contexts, such that youth raised with two biological parents are much less likely to be exposed to parental substance use or attitudes/beliefs consistent with the use of illicit substances as compared to their peers raised in other settings. Additional work is needed to further unpack these linkages, including the processes through which family structure transmits substance use risk to young people.

Household member contact with the criminal justice system also emerged as an important predictor of substance use classes. Youth who reported that someone in their household had been arrested during the past year were more

Table 6 Class membership and externalizing problems (unstandardized coefficients with standard errors and odds ratios with confidence intervals)

	Suspended or Expelled Past Year		Ever Arrested	
	<i>B (SE)</i>	<i>OR (CI)</i>	<i>B (SE)</i>	<i>OR (CI)</i>
Sociodemographic Controls				
African American	0.36 (0.20)	1.44 (0.98–2.11)	−0.20 (0.24)	0.82 (0.51–1.30)
Female	−0.54 (0.09)**	0.58 (0.49–0.69)	−0.65 (0.11)**	0.52 (0.42–0.65)
Age	0.04 (0.02)*	1.04 (1.00–1.08)	0.21 (0.03)**	1.23 (1.17–1.30)
Household member arrested past yr.	0.65 (0.10)**	1.92 (1.57–2.34)	0.95 (0.11)**	2.58 (2.07–3.23)
Receiving free or reduced cost lunch	0.48 (0.17)**	1.61 (1.16–2.23)	0.20 (0.19)	1.22 (0.84–1.78)
Living with two biological parents	−0.14 (0.10)	0.87 (0.72–1.07)	−0.14 (0.13)	0.87 (0.67–1.12)
No father figure	0.14 (0.14)	1.15 (0.88–1.50)	0.57 (0.15)**	1.77 (1.34–2.36)
Substance Use Classes^a				
Non-user class	−1.48 (0.37)**	0.23 (0.11–0.47)	−2.84 (0.40)**	0.06 (0.26–0.13)
Alcohol-only class	−1.02 (0.38)**	0.36 (0.17–0.76)	−2.46 (0.41)**	0.09 (0.04–0.19)
Alcohol & marijuana class	−0.34 (0.38)	0.72 (0.34–1.49)	−1.58 (0.40)**	0.21 (0.09–0.45)

Results from logistic regressions; $n = 2415$ with complete data for suspended/expelled analyses; $n = 2485$ with complete data for arrested analyses

* $p < 0.05$; ** $p < 0.01$

^aReference category is polysubstance use class

Table 7 Class membership and internalizing symptoms (unstandardized coefficients and standard errors)

	Traumatic Stress	Worry	Hopelessness
Sociodemographic Controls			
African American	−0.46 (0.28)	−0.75 (0.31)*	−0.33 (0.14)*
Female	0.47 (0.13)**	−0.69 (0.15)**	−0.35 (0.06)**
Age	−0.15 (0.03)**	−0.43 (0.03)**	−0.07 (0.01)**
Household member arrested past yr.	0.59 (0.15)**	0.63 (0.17)**	0.29 (0.07)**
Receiving free or reduced cost lunch	0.11 (0.24)	0.06 (0.27)	−0.34 (0.12)**
Living with two biological parents	−0.04 (0.15)	−0.27 (0.17)	0.05 (0.07)
No father figure	−0.64 (0.20)**	−0.32 (0.22)	0.16 (0.10)
Substance Use Classes^a			
Non-user class	−0.56 (0.49)	−1.76 (0.56)**	−1.11 (0.24)**
Alcohol-only class	−0.42 (0.51)	−2.02 (0.57)**	−1.26 (0.25)**
Alcohol & marijuana class	−0.52 (0.49)	−2.16 (0.56)**	−1.97 (0.24)**

Results from linear regressions. $n = 2510$ with complete data for traumatic stress analyses; $n = 2511$ with complete data for worry analyses; $n = 2503$ with complete data for hopelessness analyses

* $p < 0.05$; ** $p < 0.01$

^aReference category is polysubstance use class

likely to belong to one of the substance using groups than the non-use group. They were also more likely to belong to the alcohol and marijuana group relative to alcohol-only group. This pattern of findings fits with the elevated risk of substance use and drug-related problems that has been observed in previous studies of parental contact with the

criminal justice system (Davis and Shlafer 2017; Grigsby et al. 2018; Kopak and Smith-Ruiz 2016; Mears and Sienick 2016) and suggests the value of adopting a broader lens on the consequences of adult contact with the criminal justice system for children and youth. Importantly, our findings extend research on family criminal justice

involvement and youth substance use by illuminating an additional dimension of risk that appears at the intersection of multiple substances.

Although results were generally consistent with hypotheses in showing that family-based adversities increased risk for membership in classes characterized by substance use as opposed to no use, they did not distinguish youth who used alcohol and marijuana from youth in the polysubstance group. This raises important and intriguing questions about the potential value of considering the accumulation of adversities in future research rather than looking at family-based adversities independently, especially given the elevated risk of internalizing and externalizing problems among polysubstance users. Youth in the polysubstance class were more likely than youth in other substance use groups to have faced serious disciplinary action at school in the past year and to have histories of arrests controlling for sociodemographic characteristics. They also reported significantly higher levels of worry and hopelessness than other groups of substance users and non-users. These findings complement as well as extend past research (Conway et al. 2013; Kulis et al. 2016), and underscore the critical importance of continuing to investigate risk factors for polysubstance use in future research. In the current study, the only variable that distinguished between the alcohol and marijuana group and the polysubstance use group was female gender, with girls being less likely to be in the alcohol and marijuana class relative to the polysubstance use class. Substance use for a subset of girls therefore extends well beyond alcohol and into the use of multiple substances, a phenomenon that warrants greater attention in future research. Additionally, more research is needed to establish the temporal patterning of relationships between behavior problems and polysubstance use. In terms of directionality, one possibility is that youth who have been expelled from school or been arrested are aware of the implications for their futures and therefore experience heightened feelings of hopelessness or worry. It is also possible, however, that feelings of hopelessness and worry create feelings of disconnectedness that reduce incentives to desist from antisocial behavior.

Continuing to investigate sources of variability in future studies is critical, especially to the extent that they are sensitive to larger contextual and structural constraints on children and families in low-income environments. Research on “alternative reinforcers” in substance use broadly suggests the value of examining when and how individuals choose alternatives to substance use and underscores the importance of thinking beyond individuals to considering how access to employment, affordable housing, and mental health services relate to substance use (Hart et al. 2000; Hart and Hart 2019). Likewise, research suggests that indicators of family and

neighborhood economic hardship can lead to strain that may adversely impact parenting practices (Jocson and McLoyd 2015; McLoyd et al. 2016) and constrain parents’ availability to engage in certain forms of monitoring. Given that youth self-disclosure may be a more robust predictor of delinquency than parental surveillance (Stattin and Kerr 2000), it may be particularly instructive to focus on disclosure as opposed to surveillance in future research on substance use among youth from low-income families.

Recognizing these constraints, considering how family process variables such as parental substance use, warmth, and support relate to membership in latent classes is nonetheless important given the salience of these factors in conceptual models of adolescent substance use (Brook et al. 1990; Friedman et al. 2000; Simons et al. 1988). Coupled with the use of latent transition analysis, researchers could delineate if and how family process variables relate to the maintenance of low-risk substance use patterns or movement into more problematic classes. It would also be instructive to examine how family, peer, and neighborhood norms around substance use relate to class membership both cross-sectionally and longitudinally. Recent work by Reboussin et al. (2015) indicated that neighborhood disorder and neighborhood drug activity were associated with an increased risk of transitioning from no involvement with marijuana to use and problems in their sample and additional studies of this kind would significantly advance our understanding of risk and protective factors. Attention to family and household-level substance use behaviors and norms may be especially important in research on justice-involved families given the disproportionate prevalence of substance use among individuals who come into contact with the criminal justice system. Bronson et al. (2017) estimated, for instance, that the majority of state prisoners (58%) and jail inmates (63%) confined during 2007–2009 met the criteria for drug dependence or abuse—compared to just 5% of the general adult population. Understanding the extent to which youth are exposed to substance use in their households and how those map onto substance use beliefs and behaviors are critically important directions for future research.

Limitations

Although results complement and extend research on adolescent substance use classes, they should be interpreted relative to several methodological parameters. First, although the limited sociodemographic variability of the sample is a strength in that it reduces the effects of residual confounding associated with socioeconomic status (see Umlauf et al. 2015; Jaeger et al. 2017), it is a limitation from the perspective of generalizability.

Second, our analyses were based on dichotomized categories of lifetime substance use. There has been considerable variability in the timing and nature of substance use variables used to make inferences about latent heterogeneity (Tomczyk et al. 2016) and utilizing different variables may have revealed different configurations of subgroups. Third, our measure of household member contact with the criminal justice system does not specify who in the household was arrested. Researchers have increasingly expressed concern about an overemphasis on parents as opposed to other family or household members in the literature on the intergenerational consequences of incarceration (e.g., Nichols and Loper 2012; Phillips et al. 2010), and specifying whether nature of relationship matters is an important direction for future research. Finally, our measures were all based on youth self-report, and the inclusion of information from other reporters or data sources would increase the robustness of our findings. This may be especially true for substance use given inconsistencies that have been observed in clinical samples across assessment occasions and types (e.g., Dillon et al. 2005; Harris et al. 2008).

In conclusion, research on latent classes of adolescent substance use has suggested that youth are at varying degrees of risk for membership in the most problematic classes. Importantly, our results suggest that there is heterogeneity in substance use patterns even among what might be perceived as an “at-risk” population. Continuing to document factors that heighten or mitigate risk for membership in these classes both cross-sectionally and longitudinally will enhance efforts to target and inform the development of intervention efforts with youth and their families.

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Author Contributions EJ co-conceptualized the paper, analyzed the data, and drafted the manuscript. JC co-conceptualized the paper and collaborated in the writing and editing of the manuscript. AB and JB designed and executed the MYS study and contributed to the writing and editing of the manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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