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Longitudinal within- and between-person associations of substance use, social influences, and loneliness among adolescents and emerging adults who use drugs

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Abstract

Loneliness is a public health problem causing morbidity and mortality. Individuals with substance use problems are often lonelier than the general population. We evaluate the longitudinal associations between social influences, substance use, and loneliness among adolescents and young adults recruited from an urban Emergency Department (ED). We use secondary data from a natural history study of N=599 youth (ages 14–24) who used drugs at baseline and completed biannual assessments for 24 months; 58% presented to the ED for an assault-related injury and a comparison group comprised 42% presenting for other reasons. Measures assessed cannabis use, alcohol use, and loneliness. Using GEE models, we evaluated the relationships between social influences (peers, parents), substance use, and loneliness via longitudinal data, de-coupling within- and between-person effects. Men reported lower loneliness over time. At the between-person level, individuals with greater alcohol and cannabis use severity and negative peer influences had greater loneliness; positive parental influences were associated with less loneliness. At the within-person level, greater alcohol use severity, negative peer influences, and parental substance use corresponded to increases in loneliness; positive parental influences corresponded to decreases in loneliness. Youth with more severe alcohol and cannabis use had greater loneliness over

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time. Within individuals, peer and parental social influences were particularly salient markers of loneliness. An ED visit provides an opportunity for linkage to personalized, supportive interventions to curtail negative outcomes of substance use and loneliness.

Keywords

adolescents; emerging adults; loneliness; alcohol; cannabis; emergency department

Introduction

Loneliness, the emotional state reflecting a discrepancy between one's desired social/interpersonal relationships and perceptions of their achieved relationships, is a common, normative experience that is linked to the perceived quality and quantity of one's social relationships (Heinrich & Gullone, 2006; Perlman & Peplau, 1981). Social isolation (lack of social connections) is a distinct, yet closely inter-twined, construct that is often measured within loneliness assessments (Ingram et al., 2020). Loneliness is considered a public health issue (Lederman, 2021; Leigh-Hunt et al., 2017) given its association with increased morbidity and mortality (Bzdok & Dunbar, 2020; Leigh-Hunt et al., 2017). Further, loneliness early in life predicts long-term outcomes such as disability and lower income (von Soest et al., 2020).

A review of loneliness among people with substance use problems showed they are lonelier than the general population and those differences were greater among women and younger individuals (Ingram et al., 2020). Further research on loneliness is needed, particularly longitudinal studies (Ingram et al., 2020), and evaluations of predictors of loneliness during the transitional adolescent-young adult years (von Soest et al., 2020). This report focuses on loneliness among substance-using youth over a two-year period following an emergency department (ED) visit. The ED is a venue of interest because of the relationship between greater loneliness and emergency care utilization (Agarwal et al., 2019; Geller et al., 1999) and because of the increased likelihood of substance use and psychiatric distress among youth attending the ED (Wilson & Klein, 2000). Further, the ED visit provides an opportunity to initiate referrals to or to deliver psychosocial prevention interventions targeting substance use and mental health (Grupp-Phelan et al., 2012; Howard et al., 2019).

Longitudinal data can help identify characteristics of those more likely to experience loneliness (between-person effects), and factors that, when changed, correspond to changes in loneliness (within-person effects). Socio-ecological theory asserts that risk and promotive factors across individual, relational, and community-level variables jointly influence health outcomes, including loneliness (Bayly & Vasilenko, 2021; Masten, 2001). Consistent with this approach, we focus on variables from individual (e.g., substance use) and relational levels (i.e., peer and parent influences) of social ecology.

Youth substance use can be positively and negatively associated with loneliness and social isolation. Relationships among these constructs may be bi-directional and may depend on social exposures (Copeland et al., 2018). For example, deviant peers may expose youth to substance use, but youth may or may not experience loneliness given time spent with peers

with varying supportiveness or relationship quality. In some work, including a multi-year panel study of 16–17 year-olds, alcohol use was negatively associated with loneliness (Pedersen & von Soest, 2015), although this sample comprised youth attending school, who were, to some degree, socially-integrated. Others have found substance use positively associated with loneliness (Malta et al., 2018; Seidu, 2020). Alternatively, youth who spend time alone and feel lonely may self-medicate with substances; or lonely youth may experience social isolation via fewer social ties creating less exposure to peer substance use (Copeland et al., 2017; Niño et al., 2016; Osgood et al., 2014). Generally, peers are highly influential during youth development (Abadi et al., 2011), with positive peer influences (e.g., those involved in pro-social activities) serving as a protective factor, and negative or delinquent peers (e.g., those involved in substance use, violent behaviors) connoting risk for negative outcomes (Masten, 2001; Zimmerman et al., 2013). Thus, peer influences should be studied in relation to loneliness among substance-using youth.

Likewise, parents are social influences on youth development, that can exert less influence as youth age (Marschall-Lévesque et al., 2014), thus are important to incorporate in longitudinal studies. For teens, positive parental factors (e.g., understanding, sharing meals, parental warmth/caring) can be protective against loneliness (Antunes et al., 2021; von Soest et al., 2020) whereas risk factors such as parental emotional neglect are related to increased odds of loneliness. Similarly, youth reporting parental alcohol problems had higher odds of loneliness (Pengpid & Peltzer, 2020; Pisinger et al., 2016).

Examining within- and between-person effects using longitudinal data may clarify how substance use and peer and parent influences affect loneliness. Herein, from a socio-ecological lens, the present paper extends our understanding of the complex relationships between social influences, substance use, and loneliness in youth who use drugs. We use longitudinal data to de-couple within- and between-person effects which can aid in identifying individuals needing intervention, and specific intervention content by incorporating factors that correspond to changes in loneliness, which has inter- and intra-individual variation over time (Mund et al., 2020). Data come from youth in an under-resourced community, an underserved population with health disparities in access to health-related prevention services that could potentially benefit from ED-initiated interventions to decrease loneliness and substance use.

Methods

Setting and design

We used data from the Flint Youth Injury (FYI) study, a longitudinal cohort study of youth (baseline: ages 14–24) enrolled between 2009–2011 and followed for two years. The cohort comprised youth receiving care at a Level-1 trauma center in Flint, Michigan, USA. At study start, Flint was a medium-sized Midwestern city; in 2010, residents were primarily Black/African American (57%) and the median income was \$28,385 with 23.2% of residents unemployed (Bateson, 2011). Enrolled participants self-reported past-six-month drug use at eligibility screening (i.e., cannabis, other illicit drugs, misuse of prescription sedatives, stimulants, and/or opioids). The goal of FYI was to compare substance-using youth presenting to the ED with and without assault-related injury to inform violence and

substance use interventions. Prior work details procedures and inclusion/exclusion criteria (Bohnert et al., 2015; Cunningham et al., 2015; Goldstick et al., 2018). Institutional Review Boards provided approval.

Recruitment

Emergency Department-based research staff recruited participants. We followed youth presenting for an assault-related injury (N=349) and a comparison group of youth presenting for other reasons (N=250), proportionally-sampled by sex and age group. Assault-injury presentations included intentional injuries inflicted by another person or persons (e.g., assault via blunt mechanism, firearm injury, cut/pierced wounds) and visit reasons in the comparison group included unintentional injury or other medical complaints (e.g., motor vehicle crash, influenza).

Participants/parents provided informed consent/assent before eligibility screening (\$1 gift compensation). Those eligible (past six-month cannabis or other illicit drug use) and enrolled provided a second assent/consent and completed baseline assessments (\$20). At baseline, 97% of participants reported cannabis use and 11% reported other illicit drug use (Cunningham et al., 2015). Over half (57%) met criteria for drug use disorder and 20% met criteria for alcohol use disorder (Bohnert et al., 2015). Participants completed assessments at 6-, 12-, 18-, and 24-months (\$35-\$50 compensation) with high completion (83.7%–85.3%).

Measures

Demographics.—Sex, race, and baseline receipt of public assistance were measured based on national surveys (Bearman et al., 1997; United States Department of Health and Human Services, 2008).

Substance use (past 6-months).—Drug use eligibility was determined using items from the Alcohol Smoking and Substance Involvement Test (ASSIST; (WHO ASSIST Working Group, 2002)). Herein, we examined cannabis use severity (ASSIST subscale total) and alcohol use severity (Alcohol Use Disorders Identification Test total; (Babor et al., 2001)) as these are the most commonly reported substances used by the sample (Bohnert et al., 2015).

Social influences.—Peer measures come from the Flint Adolescent Study (Zimmerman et al., 2002). Positive peer influences (average of 4 items) queried how many friends (0=none to 4=all) attend church regularly, engage in school/community activities, got all As/Bs in school, and plan to go to/are in college. Negative peer influences averaged the same responses for 7 items (i.e., alcohol use, cannabis use, other drug use, getting in trouble for selling drugs, fighting, weapon carriage, and shoplifting/burglary/robbery). Positive parental support involved 6 items (Procidano & Heller, 1983) where participants rated statements about their parents (0=not true to 4=very true). Items assessed perceptions of parents enjoying hearing what the youth thinks, provision of emotional support, help with problem-solving, sharing deeply, moral support, and encouraging school attendance. Parental substance use involvement, based on the Flint Adolescent Study, included 4 items

querying (0=never to 4=very often) parents' drug and alcohol use, treatment, or substance-related legal problems.

Loneliness.—Loneliness was measured using an item from the Brief Symptom Inventory (Derogatis & Spencer, 1982) querying past-week loneliness on a scale from 0=not at all to 4=extremely.

Analyses

We computed descriptive information for variables of interest and reliability indices (Table 1). Then, we examined the within- and between-person covariate effects by person-mean-centering time-varying predictors (cannabis and alcohol use severity; peer and parental influences) and entering the person-level means as a static predictor to isolate the between-person effect, and the person-mean-centered variables to isolate the within-person effects (Curran & Bauer, 2011). We used generalized estimating equations (GEE) and Huber-White standard errors to give inference properly adjusted for within-person correlations; the model controlled for sex, age, race (Black, Other), time trends, and recruitment group (assault-injured vs. not). GEE provides the advantage that it does not require full specification of the error distribution and, in particular, provides robust inference, even when the variance/covariance structure of the errors is mis-specified. Note that the coefficients presented are interpreted similarly to traditional regression model and represent the mean change in the loneliness outcome for a one-unit increase in the predictor.

Results

Participants were $M=20.1$ years-old ($SD=2.4$) at baseline, 41.2% female, and 58.2% were Black; 73% received public assistance (demographics did not meaningfully differ between the assault-injured and comparison groups). Table 1 shows descriptive data for variables of interest over time. Note that at each assessment point, on average, participants met the moderate risk cut-off (scores 4–26) for cannabis severity, but means for alcohol use severity consistently fell below the standard cut-off for hazardous/harmful alcohol consumption (i.e., score 8).

In the longitudinal model (Table 2), there were several significant correlates of loneliness across time. Men (vs. women) consistently reported lower loneliness; other demographic factors were non-significant. At the between-person level: a) individuals with greater negative peer influences and alcohol and cannabis use severity had higher loneliness, and b) positive parental influences were associated with less loneliness over time. At the within-person level, greater alcohol use severity, negative peer influences, and parental substance use corresponded to increases in loneliness. More positive parental influences corresponded to decreases in loneliness.

Discussion

Loneliness remains a concern to the substance misuse field (Volkow, 2020). On average, our sample of youth and young adults was “a little” lonely over time; these reports varied, and, at times, many individuals were at least moderately lonely. In contrast to

prior international work finding that emotional reports of loneliness increased throughout youth and young adulthood (von Soest et al., 2020), on average our sample's self-reported loneliness decreased. This could reflect the unique sample, or possibly initial distress during the ED recruitment visit. Nonetheless, these results are novel because they can help identify between-persons factors that inform decisions about who might need supportive interventions, as well as the individual within-person factors to address within interventions focusing on risk and resiliency.

This sample involved ED patients who reported past 6-month drug use at baseline, and those with higher alcohol and cannabis use severity had greater loneliness. The within-person results are more nuanced. Escalating alcohol use severity corresponded to within-person increases in loneliness, but there was no analogous cannabis finding. Notably, drug use (>95% cannabis) was a study eligibility criterion, thus there may be a common person-level factor underlying loneliness and cannabis use, or ceiling effects may have prevented detection. Alcohol use was not an eligibility criterion, allowing for greater variability in severity. Greater alcohol use severity could reflect stronger coping motives for drinking related to managing loneliness, which could present intervention targets aligned with motivational models of substance use (Cooper, 1994) and cognitive-behavioral theories of loneliness (de Jong-Gierveld, 1987; Perlman & Peplau, 1981). Although drug use was the common inclusion criteria, and cannabis use was reported by nearly all, our inclusion of severity measures is a strength. There was variation in drug use severity and co-occurring alcohol use which could affect generalizability of results to specific sub-populations of substance using young people.

Considering relational influences, at the between-person level, individuals with greater negative peer influences were lonelier whereas positive parental influences were associated with lower loneliness, which is aligned with prior research and theory (Antunes et al., 2021; Masten, 2001; von Soest et al., 2020; Zimmerman et al., 2013). Consistently, at the within-person level when youth associated with negative peers, they were also lonelier, perhaps reflecting a lack of perceived social connection or supportive relationships. Positive peer influences were not significantly associated with loneliness, reflecting a potential asymmetry in the effects of peer relationships among substance-using youth (i.e., negative peers increase loneliness, but positive peers do not necessarily alleviate loneliness). It may be that youth already engaged in drug use have compromised resiliency and deviant peer exposures are more powerful influences on well-being compared to positive peer exposures, although such explanations require further research.

Additionally, at the within-person level, changes in parental substance use and positive parental support corresponded to changes in loneliness. At times when parents were perceived as supportive, participants may have felt less lonely as might be expected given associations between parenting factors and mental health conditions more broadly (Yap et al., 2014). Future research could explore parent interventions to increase consistency in parental support across development as well as cognitive-behavioral interventions to help youth address potentially maladaptive perceptions of their parents' supportiveness in order to mitigate loneliness.

Increases in parental substance use involvement corresponded with increases in youth's loneliness. When parents' substance use involvement or related consequences increases, they may become more distant from their children, increasing youth perceptions of loneliness. Given the relationship between parental substance use problems and children's mental health problems (Jääskeläinen et al., 2016), it could be that substance use treatment for parents positively benefits youth loneliness over time. Future research involving parent-child dyads could evaluate the impacts of parent substance use and treatment on youth loneliness.

In this study, men reported lower levels of loneliness; although when measures include the word "lonely," men are less likely to report this (Heinrich & Gullone, 2006). Given these exploratory secondary analyses, we were limited to a single item querying loneliness [similarly, much prior work relies on single items and items extracted from other scales (Ingram et al., 2020)]. Although this single item was efficient and such brief assessments are more scalable in healthcare settings, it reduces the ability to make comparisons to other studies or populations thus, this paper informs future, more thorough investigations that could be strengthened by multi-item or multi-dimensional scales (e.g., Loneliness and Aloneness Scale for Children and Adolescents (Marcoen & Brumagne, 1985; Marcoen et al., 1987); UCLA Loneliness Scale (Russell, 1996)). Future research could also be enhanced by including validated mental health screening measures (e.g., PHQ-9; GAD-7). Additional limitations include generalizability; findings are more representative of substance-using youth than a general population. Nonetheless, this study involves high-risk youth who may be most in need of services to address drug use and mental health factors including loneliness. Although our longitudinal design is a strength, future research could build from this by interrogating relationships between substance use, parent/peer influences, and youth loneliness using ecological momentary assessments closer to real-time, potentially helping to illuminate causal pathways.

Beyond limitations, this study involves a rare, longitudinal investigation of *both* within- and between-person relationships of substance use and social factors with loneliness in vulnerable youth. As young adults' cannabis use in particular increases (Substance Abuse and Mental Health Service Administration, 2019), we must elucidate factors signaling more severe use trajectories that can also influence psychiatric well-being, such as findings from this study suggesting that youth with greater cannabis use severity have more loneliness, which could be highlighted in prevention efforts. Negative peer influences are well known factors that increase risk for negative outcomes in youth, and findings herein help extend this risk clustering to loneliness in a potentially intervenable population. Among young people experiencing loneliness, clinically, worsening alcohol use may be a red flag indicating the need to bolster supports, particularly for youth with more negative peer influences and less parental support. The ED visit is ripe for initiating behavioral interventions (Suffoletto et al., 2012; Walton et al., 2010) to curtail substance use and future research could evaluate just-in-time approaches based on these findings which also underscore the need to implement evidence-based, scalable approaches. Given greater community-wide social isolation than ever before during COVID-19, combined with data suggesting pandemic-related increases in youth substance use (Bonar et al., 2021), it could be that the ED visit is a key touchpoint to engage youth on the brink of negative outcomes related to loneliness.

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Table 1.

Descriptive data for study variables at each assessment

	Baseline (N=599)	6 Months (N=512)	12 Months (N=502)	18 Months (N=505)	24 Months (N=512)
Initial ED visit for assault-injury (N, %)	349 (58.26%)	297 (58.01%)	294 (58.57%)	294 (58.22%)	298 (58.20%)
Age (<i>M,SD</i>)	20.05 (2.42)	20.05 (2.47)	20.97 (2.41)	21.54 (2.47)	22 (2.42)
Male sex (N,%)	247(41.24%)	223 (43.55%)	214 (42.63%)	222 (43.96%)	224 (43.75%)
Black race (N,%)	349 (58.26%)	314 (61.33%)	308 (61.35%)	309 (61.19%)	308 (60.16%)
Receives public assistance (N,%)	437 (72.95%)	381 (74.41%)	375 (74.70%)	380 (75.25%)	380 (74.22%)
Alcohol severity (<i>M,SD</i>) (α s=0.83-0.90) ^a	4.82 (6.66)	3.01 (5.78)	2.73 (4.93)	2.54 (4.67)	2.02 (3.87)
Cannabis severity (<i>M,SD</i>) (α s=0.70-0.76)	13.34 (9.02)	9.15 (7.95)	8.27 (7.78)	8.74 (8.21)	7.38 (7.65)
Positive peer influences (<i>M,SD</i>) (α s=0.75-0.80)	2.19 (0.75)	2.13 (0.70)	2.12 (0.73)	2.08 (0.71)	2.05 (0.73)
Negative peer influences (<i>M,SD</i>) (α s=0.80-0.83)	2.05 (0.69)	2.01 (0.67)	1.95 (0.66)	1.94 (0.66)	1.89 (0.66)
Positive parental support (<i>M,SD</i>) (α s=0.92-0.94)	3.12 (1.31)	3.04 (1.29)	3.08 (1.31)	3.12 (1.31)	3.15 (1.35)
Parental substance use (<i>M,SD</i>) (α s=0.68-0.75)	1.60 (0.81)	1.51 (0.73)	1.53 (0.78)	1.44 (0.65)	1.47 (0.73)
Loneliness (<i>M,SD</i>)	1.00 (1.24)	1.02 (1.24)	0.98 (1.24)	0.85 (1.16)	0.71 (1.10)
0 = Not at All (N,%)	285 (47.58%)	245 (47.85%)	240 (47.81%)	275 (54.46%)	309 (60.35%)
1 = A Little (N,%)	168 (28.05%)	128 (25.00%)	147 (29.28%)	113 (22.38%)	117 (22.85%)
3 = Moderately (N,%)	49 (8.18%)	52 (10.16%)	36 (7.17%)	58 (11.49%)	34 (6.64%)
4 = Quite a Bit (N,%)	57 (9.52%)	60 (11.72%)	43 (8.57%)	36 (7.13%)	29 (5.66%)
5 = Extremely (N,%)	40 (6.68%)	27 (5.27%)	36 (7.17%)	23 (4.55%)	23 (4.49%)

^aRanges for Cronbach's alpha across assessments are displayed.

Table 2. Between- and within-person predictors of loneliness over a two-year follow-up period

	Between-person			Within-person		
	Estimate	95% Confidence Interval	p-value	Estimate	95% Confidence Interval	p-value
<i>Demographics</i>						
ED assault-injury presentation (vs. comparison)	0.08	(-0.05, 0.21)	0.237		n/a	
Age	0.02	(-0.01, 0.05)	0.131		n/a	
Male sex (vs. female)	-0.49	(-0.62, -0.35)	<.0001		n/a	
Black (vs. other)	-0.10	(-0.25, -0.04)	0.155		n/a	
Receives public assistance (vs. does not)	0.07	(-0.08, 0.22)	0.379		n/a	
<i>Substance use</i>						
Cannabis severity	0.02	(0.01, 0.03)	0.008	0.00	(-0.00, 0.01)	0.250
Alcohol severity	0.02	(0.00, 0.04)	0.028	0.02	(0.00, 0.03)	0.048
<i>Social factors</i>						
Positive peer influences	0.07	(-0.07, 0.20)	0.315	0.00	(-0.09, 0.10)	0.924
Negative peer influences	0.28	(0.12, 0.44)	0.001	0.25	(0.14, 0.35)	<.0001
Positive parental support	-0.08	(-0.15, -0.02)	0.014	-0.10	(-0.15, -0.06)	<.0001
Parental substance use	-0.09	(-0.21, 0.02)	0.114	0.11	(0.03, 0.19)	.008

Note. Loneliness significantly decreased over time such that $\beta = -.05$ (95% CI: = -0.09, -0.02) and $p = .001$.