



Impact of the COVID-19 pandemic on substance use among adults without children, parents, and adolescents

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ABSTRACT

Impact of the COVID-19 pandemic on alcohol and illicit substance use among adults without children, parents, and adolescents was investigated through two studies with five samples from independent ongoing U.S. longitudinal studies. In Study 1, 931 adults without children, parents, and adolescents were surveyed about the pandemic's impact on personal behavior. 19–25% of adults without children, parents, and adolescents reported an increase in alcohol or illicit substance use. In Study 2, 274 adults without children, parents, and adolescents who had been interviewed prior to the pandemic onset about alcohol and illicit substance use problems were re-interviewed after the pandemic's onset to test within-person change. The rate of alcohol or illicit substance use problems increased from pre-pandemic to post-pandemic onset from 13% to 36% among the three groups. Increase in alcohol and illicit substance use problems was positively correlated with increased depression/anxiety and household disruption, suggesting possible mechanisms for increases in substance problems. Findings in both studies held across low- and middle-income families. Findings suggest the need for communitywide policies to increase resources for alcohol and illicit substance use screening and intervention, especially for adolescents.

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has had dramatic impact on population health and financial status, with over 33 million U.S. Americans diagnosed, over 700,000 deaths ([Centers for Disease Control and Prevention](#)), and 40 million adults filing unemployment claims ([U.S. Bureau of Labor Statistics May 28, 2020](#)). Less clear is the impact on alcohol and illicit substance use and possible psychological mechanisms for these effects. This report evaluates the impact of the pandemic onset on alcohol and illicit substance use in each of three subgroups within U.S. families: adults over age 30 without children, parents over age 30, and adolescents. Because each subgroup experiences different stressors during the pandemic that might mediate

substance use in different ways, separate estimates are necessary to guide intervention and public policy.

1.1. Impact of pandemic on alcohol and illicit substance use

The Kaiser Family Foundation ([March 15, 2021](#)) reported that in July of 2020, 53% of Americans worried the pandemic might have a negative impact on their mental health and behavior. Notwithstanding widespread assumptions that the pandemic must adversely affect mental health and well-being ([Brooks et al., 2020](#); [Pfefferbaum & North, 2020](#)), systematic evidence is scant and tempering. [Pollard et al. \(2020\)](#) reported a modest 12% increase in alcohol consumption in a sample of 1540 adults over age 30 surveyed pre-pandemic in 2019 and again

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following the pandemic onset in 2020.

Research on past health and economic adversities leads us to anticipate a larger impact. Surveys by Quinn et al. (2011) soon after the 2009 U.S. H1N1 influenza pandemic revealed widespread stressful reactions caused by fear of infection, inability to maintain work and childcare, and social distancing. Nagelhout et al.'s (2017) review found job loss during a population crisis was associated with increased psychological distress and drug use, even among persons still employed.

The World Health Organization (2020) reported that pandemic-related disruptions in the availability of substance use services worldwide impede accurate estimates of the population prevalence of these problems based on agency reports. Hence, the primary goal of this research was to evaluate the impact of the onset of the COVID-19 pandemic on alcohol and illicit substance use problems using self-reports.

1.2. Moderators of increases in alcohol and substance use during a population crisis

A correlational study by Dumas et al. (2020) suggested the impact of the COVID-19 pandemic might differ across age and demographic groups, with adolescents being at particularly high risk for substance misuse. Parents are a second group that might be at increased risk due to their unique challenges of managing work and children suddenly at home all day. Patrick et al. (2020) reported that 27% of parents experienced worsening mental health following the pandemic onset. Feinberg et al. (2021) found increased depressive symptoms during the first months of the pandemic in a sample of 129 parents. Neither of these studies assessed illicit substance use.

Pandemic impacts might be greater for disadvantaged groups, due to greater stress. Whereas just 13% of high-income households had lost jobs by May 2020, at the peak of the pandemic spread, 40% of households with income below \$40,000 had lost jobs (U.S. Bureau of Labor Statistics May 28, 2020). Quinn et al. (2011) found minority groups experienced higher levels of adverse impact of the H1N1 pandemic than majority groups. For these reasons, the secondary goal of this study was to test whether the impact was greater for adolescents and parents than for adults without children and for lower-income than middle-income families.

1.3. Correlates of increases in alcohol and substance use

Available research suggests two candidate mechanisms through which a population shock might increase substance use: increased depression/anxiety and disruption of routines. Demarest (2020) suggested the pandemic might increase depression among adolescents, leading to increased substance use, constituting an "epidemic hidden in a pandemic". Ingoglia (2020) suggested disruption in daily routines for adolescents (through canceled in-person classes, athletics, and extracurricular activities) might make them particularly vulnerable. He concluded, "We know little about the emerging threats of COVID-19 on our youth" (p. 1). This study's tertiary goal was to identify psychological correlates of increased substance use.

1.4. Hypotheses

We hypothesized that the COVID-19 pandemic onset would increase alcohol and illicit substance use among each of three groups: parents and non-parent adults over age 30 and adolescents aged 19–22. Second, we hypothesized larger adverse effects among low- than middle-income families and among older adolescents and parents than adults without children. Third, we hypothesized that, among all groups, increases in alcohol and substance use would be correlated with increased depression/anxiety symptoms and the experience of disruption and household chaos. Because measurement of increased depression/anxiety and disruption occurred at the same time as measurement of increased

substance use, we did not conduct mediation analyses but, rather, report correlational effects, noting the limit to causal explanation.

Estimating the impact of the pandemic onset is challenged by the fact that exposure is not randomly assigned. We report two complementary studies using different methods with participants from five samples of adults without children, parents, and adolescents. We contend these methods complement each other and the combination yields a robust estimate of impact.

2. Study 1: post pandemic-onset interviews

The most common source of information about impact of a community shock on individuals is self-report from surveys (e.g., "How has the pandemic affected you?"). This source has obvious ecological validity reflecting respondents' belief in the impact of the shock itself rather than an unrelated co-occurring event; albeit, scientific proof of cause is limited. However, access to samples is typically difficult during crises, lowering response rates and biasing representativeness of samples. We took advantage of the ready access to adults and adolescents afforded by ongoing prospective studies of community samples for which population-representativeness and trust had already been established.

2.1. Method

The COVID-19 pandemic is considered to have begun after public schools across the nation closed and governors issued lockdown orders, ranging from March 13, 2020, through April 2, 2020, depending on respondents' state of residence. Interviews began at local pandemic onset and ended June 17, 2020.

2.1.1. Participants

Participants were 202 adults over age 30 who did not have children, 654 adults over age 30 who were parents, and 75 older adolescents aged 19–22, drawn from five independent community-representative samples in ongoing longitudinal studies (See Table 1). Participants included in the present analyses were those whose pre-determined data collection schedules in these ongoing longitudinal studies aligned with the timing of the COVID pandemic.

The Child Development Project (CDP) ($n = 101$) (retention = 85%) included a community-representative sample originally recruited in 1987–88 at kindergarten matriculation from Knoxville, TN; Nashville, TN; and Bloomington, IN and now interviewed at ages 36–39 (35 adult non-parents, 66 parents) (Dodge et al., 1990).

Fast Track (FT) ($n = 287$) (retention = 85%) evaluated the impact of an intervention to prevent violence (Conduct Problems Prevention Research Group [CPPRG], 2019), within four geographic sites (Durham, NC; Nashville, TN; Seattle, WA; rural central PA). Three sub-samples of kindergarteners were recruited in 1991–93: conduct-problem children randomly assigned to intervention, conduct-problem children assigned as controls, and a community-representative sample representing the full range of conduct problems in the populations. FT participants were interviewed at ages 32–36 (78 adult non-parents, 209 parents).

The Great Smoky Mountain Study (GSMS) ($n = 348$) (retention = 82%) included a community-representative sample of 1,420 rural and urban children recruited in 1993 at ages 9, 11, and 13 in 11 western NC counties (Copeland et al., 2014; Costello et al., 1996). GSMS participants were surveyed at current ages 35–40 (90 adult non-parents, 258 parents).

The Prospective Study of Infant Development (PSID) ($n = 120$) (retention = 73%) evaluated impact of a communitywide postnatal home visiting intervention (Dodge et al., 2014). Mothers were initially interviewed at infant-age 6 months and were interviewed when their children were 10 years old (mothers age 26–59).

The Parenting Across Cultures (PAC) study ($n = 75$) (retention = 75%) included community-representative samples of adolescents from nine countries (Lansford et al., 2015). Data for the present study were

Table 1
Descriptive Statistics for Adults without Children, Parents, and Adolescent Samples.

	Adults without Children	Parents	Adolescents
STUDY 1			
Sample size	202	654	75
% Female	43.07%	66.21%	58.67%
% Minority	24.26%	31.65%	49.33%
% Pre-COVID Income <\$30,000	21.21%	26.35%	17.65%
Mean Age (SD)	36.4(2.0)	37.1 (3.7)	20.8 (0.6)
% Increased Alcohol Use since Pandemic Began	20.79%	18.63%	25.33%
% Increased Drug Use since Pandemic Began	3.96%	1.24%	9.33%
Mean Disruption Experienced due to the Pandemic (SD)	6.2(2.6)	6.4(2.6)	7.0(2.3)
Mean Increase in Depression/Anxiety since Pandemic Began (SD)	2.3(0.9)	2.2(0.9)	2.5(1.0)
Mean Weeks Since Pandemic Began (SD)	4.7(2.5)	5.6(3.0)	6.5(2.6)
STUDY 2			
Sample size	59	168	47
% Female	47.46%	68.45%	59.57%
% Minority	33.90%	39.29%	57.45%
% Pre-COVID Income <\$30,000	18.64%	25.15%	21.28%
Mean Age (SD)	36.7(1.8)	36.6 (1.8)	20.8(0.6)
% Increased Alcohol Use since Pandemic Began	22.03%	12.50%	36.17%
% Increased Drug Use since Pandemic Began	15.25%	7.74%	12.77%
Change in Disruption since Pandemic Began (SD)	-0.03(0.4)	0.06 (0.4)	na
Change in Depression since Pandemic Began (SD)	-0.22(8.7)	0.49 (7.6)	-0.94(5.5)
Mean Weeks Since Pandemic Began (SD)	10.73(0.7)	10.59 (0.8)	6.04(3.9)

available only from the U.S. (Durham, NC) adolescent sample, surveyed at ages 19–22.

2.1.2. Measures

2.1.2.1. Demographic variables. Using information from the most recently collected interview with participants, Household income was coded as 0 for low-income, if less than \$30,000 or receiving Medicaid or not insured, and 1 otherwise. Gender was coded as 0 for female and 1 for male. Race/ethnicity was coded as 0 for non-minority and 1 for minority. Age was coded in years and months. Whether the respondent is a parent for the adult samples was coded as 0 if no and 1 if yes. The FT analyses also include covariates for site, cohort, intervention status (0 = control; 1 = treatment), and 20 pre-intervention factors that historically have been included when evaluating effects (CPPRG, 1999). GSMS analyses included covariates for cohort. PSID analyses covaried single parent status (0 = no; 1 = yes) and intervention group (0 = control; 1 = treatment).

2.1.2.2. Experiences related to COVID-19 instrument. A novel 19-item Experiences Related to COVID-19 instrument (Skinner & Lansford, 2020) was created following a literature review on parent and adolescent stress responses to major traumatic events, including natural disasters and political violence, as well as in previous public health crises such as the SARS and H1N1 outbreaks. The measure was pilot-tested and revised based on initial responses. Participants reported how much change (“decreased a lot,” “decreased a little,” “stayed the same,” “increased a little,” “increased a lot,” “did not do before and haven’t started now”) occurred in their alcohol and drug use (including prescription drugs used in ways not prescribed) since the pandemic started.

Increased use was coded 1 if reported that use increased a little or a lot, and 0 otherwise. Participants also reported agreement (“strongly disagree” to “strongly agree”) with two statements capturing feeling more anxious and more sad/depressed since the pandemic began. These two items were averaged yielding a measure of increased depression/anxiety since the pandemic began. Participants reported how disruptive COVID-19 had been to them personally on a 10-point scale ranging from “not at all disruptive” to “extremely disruptive.” Participants were emailed or texted an online link to complete the measure via Qualtrics or by telephone. The number of weeks since public school closed in the participant’s state and the date of interview were recorded.

2.2. Analytic plan

Hypotheses were tested by one-sided binomial probability tests of whether the proportion of a sub-group (non-parent adults, parents, and adolescents) reporting increased alcohol use and illicit substance use was greater than or equal to 0.001. Correlates of substance use were evaluated within full information maximum likelihood (FIML) logistic regressions. Models were estimated separately for adults and adolescents. To determine whether correlates of increased substance use varied by parental status, a second model was estimated for adults that included the interactions between the correlates of interest and the indicator for being a parent. The exact specification of the models varied by study due to differences in samples and available measures.

FIML logistic regression models controlled for gender (0 = female, 1 = male), race/ethnicity (0 = non-minority, 1 = minority), age at interview (coded in months), and pre-COVID annual household income captured with a five-point scale collected in the most recent wave of data collection (ranging from 1 = less than \$10,000 to 5=\$50,000 or more). Models for adults included an indicator for being a parent and dummy variables for sample (CDP as the excluded category). Standard errors were clustered by sample.

2.3. Results

2.3.1. Effects on alcohol and illicit substance use

Consistent with the first hypothesis, 20.8%, 18.6%, and 25.3% of non-parent adults, parents, and adolescents, respectively, reported increased alcohol use following the pandemic onset (each p < 0.001; Table 2). 4.0%, 1.2%, and 9.3% of non-parent adults, parents, and older adolescents reported increased illicit substance use (each p < 0.01).

2.3.2. Correlates of increased alcohol and illicit substance use

2.3.2.1. Parent status and income. Among adults, higher pre-COVID

Table 2
One-sided Binomial Probability Tests evaluating whether Proportion ≥ 0.001.

	N	Proportion	z-statistic	p-value
STUDY 1				
<u>Increased Alcohol Use</u>				
Adults without Children	202	0.208	7.25	<0.0001
Parents	644	0.186	12.08	<0.0001
Adolescents	75	0.253	5.02	<0.0001
<u>Increased Drug Use</u>				
Adults without Children	202	0.040	2.813	0.003
Parents	645	0.012	2.617	0.004
Adolescents	75	0.093	2.749	0.003
STUDY 2				
<u>Increased Alcohol Use</u>				
Adults without Children	59	0.220	4.065	<0.0001
Parents	168	0.125	4.860	<0.0001
Adolescents	47	0.362	5.147	<0.0001
<u>Increased Drug Use</u>				
Adults without Children	59	0.153	3.238	0.001
Parents	164	0.077	3.705	0.0001
Adolescents	47	0.128	2.602	0.005

income was associated with a higher probability of increased alcohol use (Table 3: OR = 1.23) and illicit substance use (OR = 1.36) following the pandemic onset. Neither parent status nor income significantly moderated these relations. Among older adolescents, family income was not associated with the probability of increased alcohol or illicit substance use.

2.3.2.2. *Depression/anxiety.* Among adults, increased depression/anxiety following the pandemic onset was associated with a higher probability of increased alcohol use (OR = 1.83) and illicit substance use (OR = 2.44). These did not vary by parental status. Among older adolescents, depression/anxiety was not significantly correlated with increased alcohol or illicit substance use.

2.3.2.3. *Household disruption.* Among adults, increased household disruption during the pandemic was associated with increased alcohol use (OR = 1.14) but not illicit substance use, and these relations did not vary by parental status. Among older adolescents, household disruption was not significantly correlated with increased alcohol or illicit substance use.

2.4. Discussion

Post-onset pandemic interviews show clearly that all groups (non-parent adults, parents, and older adolescents) report increases in alcohol use during the pandemic at levels higher than previously estimated. Increases were also reported in all groups for illicit substance use but at levels not as large as those for alcohol use.

2.4.1. Adults

Contrary to hypotheses, increases in alcohol and illicit substance use were greater for adults with higher than lower pre-pandemic income. It is possible that higher-income adults experienced greater pandemic-related stress or had easier access and greatest affordability for substances than did lower-income adults. It is also possible that higher-income adults were more likely to be in jobs that enabled them to work from home, whereas lower-income adults were in jobs that required them to leave home, curtailing some alcohol and substance use.

Increased alcohol and illicit substance use were correlated with increased mental health symptoms (depression and anxiety). Personal pandemic-related household disruption was associated with increased alcohol use but not illicit substance use. The overall pattern was that increases in substance use were greatest among adults with higher income and greater mental health symptoms and sense of household disruption.

2.4.2. Older adolescents

Although alcohol use and illicit substance use increased robustly after the pandemic onset, increases were not correlated with mental health symptoms or sense of household disruption. The mechanisms of increased substance use in older adolescents were not identified here.

3. Study 2: pre- to post-pandemic onset change

Post-pandemic self-reports of change can inflate or mask actual impact because of biases and distorted retrospective perceptions, limiting causal inference. A promising complementary research design is to take advantage of ongoing studies of participants who had been assessed just prior to the outbreak and to re-interview them after the outbreak. Three studies qualified: FT, GSMS, and PAC. These participants were approached for re-assessment with structured clinical interviews within 90 days after the outbreak to estimate within-person change. These interviews had an advantage over the single-item self-reports in study 1 because they utilized structured interviews and validated scales to measure mental health, sense of disruption, and

Table 3
FIML Logistic Regression Results

	Adults		Moderation by Parent Status		Adolescents	
	OR	95% CI	OR	95% CI	OR	95% CI
INCREASED ALCOHOL USE						
Study 1						
Personal	1.14***	(1.09, 1.18)	1.06	(0.96, 1.17)	0.92	(0.69, 1.23)
Disruption due to the Pandemic						
Increased Depression/Anxiety since Pandemic	1.83***	(1.66, 2.01)	1.83***	(1.26, 2.65)	1.24	(0.48, 3.23)
Pre-COVID Household Income	1.23***	(1.10, 1.36)	1.28	(0.98, 1.67)	1.26	(0.63, 2.54)
Indicator for Minority	0.58	(0.29, 1.16)	0.57	(0.29, 1.13)	0.21	(0.04, 1.16)
Indicator for Male	1.12	(0.74, 1.71)	1.12	(0.72, 1.74)	2.5	(0.73, 8.58)
Indicator for Being a Parent	0.9	(0.59, 1.39)	0.63	(0.02, 16.93)		
Age	0.96***	(0.94, 0.98)	0.96***	(0.94, 0.99)	1.38	(0.52, 3.65)
Weeks since Pandemic Started	1.07***	(1.03, 1.12)	1.08***	(1.04, 1.12)	1.22	(0.96, 1.54)
GSMS Indicator	0.93	(0.85, 1.01)	0.93	(0.85, 1.01)		
PSID Indicator	1.12	(0.69, 1.81)	1.09	(0.67, 1.77)		
FT Normative Sample Indicator	0.81***	(0.71, 0.93)	0.82***	(0.70, 0.95)		
FT Control Sample Indicator	0.97	(0.78, 1.2)	0.96	(0.78, 1.20)		
FT Intervention Sample Indicator	0.65***	(0.54, 0.8)	0.64***	(0.52, 0.79)		
Parent*Disruption			1.1	(0.94, 1.28)		
Parent*Increased Depression/Anxiety			1.00	(0.65, 1.54)		
Parent*Income			0.94	(0.66, 1.34)		
Study 2						
Change in Disruption since Pandemic Began	1.09	(0.57, 2.09)	3.72	(0.47, 29.62)		
Change in Depression/Anxiety since Pandemic	1.06***	(1.02, 1.11)	1.06	(0.99, 1.14)	1.13	(0.95, 1.35)
Change in Household Income since Pandemic	1.36***	(1.13, 1.62)	1.29**	(1.02, 1.63)	0.40	(0.15, 1.06)
Indicator for Minority	2.66	(0.89, 7.95)	2.85	(0.82, 9.99)	2.03	(0.39, 10.6)
Indicator for Male	2.24***	(1.22, 4.11)	2.27**	(1.19, 4.35)	0.48	(0.09, 2.53)
Indicator for Being a Parent	0.37***	(0.20, 0.70)	0.38***	(0.23, 0.62)		
Post-COVID Age	0.6***	(0.54, 0.66)	0.61***	(0.57, 0.66)	0.59	(0.18, 1.96)
Years between Interviews	0.16***	(0.10, 0.26)	0.14***	(0.09, 0.22)	1.08	(0.06, 18.2)
Weeks since Pandemic Started	0.77	(0.39, 1.54)	0.76	(0.35, 1.64)	0.98	(0.80, 1.21)
FT Normative Sample Indicator	0.52***	(0.41, 0.68)	0.63**	(0.41, 0.97)		
	0.93		0.83			

(continued on next page)

Table 3 (continued)

	Adults		Moderation by Parent Status		Adolescents	
	OR	95% CI	OR	95% CI	OR	95% CI
FT Control Sample Indicator		(0.65, 1.32)		(0.58, 1.20)		
FT Intervention Sample Indicator	0.49	(0.20, 1.23)	0.54	(0.17, 1.74)		
Parent*Disruption			0.22	(0.03, 1.73)		
Parent*Increased Depression/Anxiety			1	(0.91, 1.09)		
Parent*Income			1.09	(0.90, 1.33)		
INCREASED DRUG USE						
Study 1						
Personal Disruption due to the Pandemic	0.95	(0.84, 1.08)	0.92	(0.78, 1.10)	1.17	(0.87, 1.57)
Increased Depression/Anxiety since Pandemic	2.44**	(1.21, 4.93)	1.28	(0.22, 7.40)	1.3	(0.45, 3.77)
Pre-COVID Household Income	0.93	(0.76, 1.14)	2.91**	(1.09, 7.83)	2.15	(0.97, 4.75)
Indicator for Minority	1.59	(0.33, 7.68)	1.25	(0.31, 4.99)	3.26	(0.33, 32.3)
Indicator for Male	0.76	(0.25, 2.36)	0.92	(0.30, 2.87)	1.28	(0.38, 4.29)
Indicator for Being a Parent	0.40***	(0.29, 0.55)	4.13	(0.09, 184.8)		
Age	0.73	(0.45, 1.17)	0.77	(0.50, 1.18)	0.45	(0.13, 1.58)
Weeks since Pandemic Started	1.05	(0.90, 1.22)	1.06	(0.94, 1.19)	0.85	(0.66, 1.08)
GSMS Indicator	0.28***	(0.19, 0.43)	0.28***	(0.16, 0.49)		
PSID Indicator	0.00	(0.00, 0.00)	0.00	(0.00, 0.00)		
FT Normative Sample Indicator	0.00	(0.00, 0.00)	0.00	(0.00, 0.00)		
FT Control Sample Indicator	0.27	(0.05, 1.50)	0.33	(0.06, 1.81)		
FT Intervention Sample Indicator	0.13**	(0.02, 0.89)	0.18**	(0.04, 0.93)		
Parent*Disruption			1.09	(0.81, 1.46)		
Parent*Increased Depression/Anxiety			3.7	(0.32, 42.8)		
Parent*Income			0.21	(0.04, 1.04)		
Study 2						
Change in Disruption since Pandemic Began	0.52	(0.12, 2.27)	0.08***	(0.02, 0.36)		
Change in Depression/Anxiety since Pandemic	1.08**	(1.02, 1.15)	1.04**	(1.00, 1.09)	1.07	(0.89, 1.28)
Change in Household Income since Pandemic	0.83***	(0.73, 0.94)	0.68**	(0.47, 1.00)	0.85	(0.37, 1.98)
Indicator for Minority	0.94	(0.23, 3.81)	0.75	(0.14, 3.89)	0.97	(0.08, 11.3)
Indicator for Male	1.57	(0.29, 8.41)	1.64	(0.32, 8.40)	1.73	(0.21, 14.3)
Indicator for Being a Parent	0.59	(0.25, 1.37)	0.69	(0.18, 2.74)		

Table 3 (continued)

	Adults		Moderation by Parent Status		Adolescents	
	OR	95% CI	OR	95% CI	OR	95% CI
Post-COVID Age	0.91	(0.83, 1.01)	0.83***	(0.72, 0.95)	0.92	(0.29, 2.95)
Years between Interviews	1.52	(0.21, 11.35)	1.34	(0.25, 7.18)	1.50	(0.05, 43.6)
Weeks since Pandemic Started	1.03	(0.30, 3.56)	0.95	(0.24, 3.85)	0.90	(0.77, 1.05)
FT Normative Sample Indicator	0.50	(0.22, 1.15)	0.43***	(0.30, 0.62)		
FT Control Sample Indicator	1.17	(0.79, 1.74)	1.65	(0.95, 2.88)		
FT Intervention Sample Indicator	0.79	(0.57, 1.10)	0.73	(0.32, 1.66)		
Parent*Disruption				15.98***		(2.70, 94.6)
Parent*Increased Depression/Anxiety				1.08**		(1.01, 1.15)
Parent*Income				1.33		(0.91, 1.95)

*** p < 0.01, ** p < 0.05.

substance use.

3.1. Method

3.1.1. Participants

274 participants completed structured mental health interviews during the 1–2 years prior to the pandemic onset and again within 3 months following the pandemic onset: 119 adults from FT, 108 adults from GSMS, and 47 older adolescents from PAC. Table 1 describes these groups: non-parent adults (n = 59), parents (n = 168), and older adolescents (n = 47).

3.1.2. Measures

3.1.2.1. Parents and non-parent adults. FT and GSMS adults completed identical interviews and were analyzed together. Participants reported the number of days each of the following substances was used in the past 30 days: 5 or more alcoholic drinks on one occasion, cannabis (times rather than days), heroin, prescription pain medication in ways not prescribed by doctor, and other drugs (excluding cannabis, heroin, prescription pain medication). Increased alcohol use was coded 1 if the number of days the participant binge drank post-COVID exceeded the number pre-COVID. Increased substance use was coded 1 if use of any of the four types of drugs post-COVID exceeded use prior to COVID. The Chaos, Hubbub, and Order scale (Matheny et al., 1995) measured perceptions of noise, lack of routines, clutter, and crowding in the household. Depression symptoms were measured using the 21-item Beck Depression Inventory (Beck et al., 1988) reported over the past 2 weeks. Income was measured on a 12-point scale ranging from less than \$5,000 to more than \$150,000. Change in household chaos, depression, and income was calculated by subtracting pre-COVID scores from post-COVID scores.

3.1.2.2. Older adolescents. PAC adolescents reported how often they drank beer or wine, drank hard liquor, or used drugs for non-medical purposes (0 = not at all, 1 = sometimes, 2 = often). Increased alcohol use was coded 1 if post-COVID use of beer/wine or hard liquor exceeded pre-COVID use. Increased illicit substance use was coded 1 if post-COVID use of drugs exceeded pre-COVID use. Depression/anxiety

problems (16 items coded 0 = not true to 2 = very/often true) were measured from the Youth Self-Report (Achenbach & Rescorla, 2001). Household income was reported on a 10-point scale ranging from less than \$5000 (coded 1) to greater than \$80,000 (coded 10). No measure of disruption/chaos was available. Change in depression/anxiety and income since the pandemic began were calculated by subtracting pre-COVID scores from post-COVID scores.

3.2. Analytic plan

Models controlled for gender, minority, age at post-COVID interview, time between pre-COVID and post-COVID interview in years, and weeks since public schools closed due to the pandemic, and included dummy variables for sample (GSMS as the excluded sample). Standard errors were clustered by sample.

3.3. Results

3.3.1. Main effects

Consistent with the hypotheses and findings in Study 1, reports of alcohol use were higher after the pandemic onset than before the pandemic for 22.0%, 12.5%, and 36.2% of adults without children, parents, and older adolescents, respectively (Table 2). In all cases, one-sided binomial probability tests indicated that these proportions were significantly greater than 0.001. Similarly, reports of illicit substance use were higher after the pandemic onset than before the pandemic for 15.3%, 7.7%, and 12.8% of adults without children, parents, and older adolescents, respectively, and these proportions were each significantly greater than 0.001.

3.3.2. Correlates of increased alcohol and substance use

3.3.2.1. Income. Among adults, the difference in income between post-pandemic-onset and pre-pandemic (i.e., higher scores indicate higher post-onset income than pre-onset income) was associated with a higher probability of increased alcohol use (Table 3: OR = 1.36) but a lower probability of increased use of other substances (OR = 0.83). These relations did not vary by parental status. Among older adolescents, higher difference scores were significantly correlated with decreased alcohol use but not substance use.

3.3.2.2. Depression/anxiety. Among adults, increased depression/anxiety between the pre-pandemic period and after the pandemic onset was associated with a higher probability of increased alcohol use (OR = 1.06), and this relation did not vary by parental status. Pandemic-timed increases in depression/anxiety were also associated with a higher probability of increased use of other substances (OR = 1.08) among both parents and non-parents; however, the relation was stronger among parents (OR = 1.12) than non-parents (OR = 1.04). Among older adolescents, changes in depression-anxiety were not significantly correlated with increased alcohol or other substance use.

3.3.2.3. Household disruption. The relation between increased household disruption and alcohol use was not significant. The relation between increased household disruption and increased substance use varied by parental status. Among adults without children, increased disruption was associated with a lower probability of increased substance use (OR = 0.08), whereas among parents the relation was not statistically significant (OR = 1.29).

4. General discussion

Robust findings across two studies indicate the onset of the COVID-19 pandemic was associated with increased alcohol and illicit substance use among adults without children, parents, and older

adolescents. These findings are consistent with observations by clinicians (e.g., Ornell et al., 2020) but are among the first reported through confidential self-reports.

For alcohol, the magnitude of impact was greatest for older adolescents, with increases between a quarter and a third in the two studies; next for adults without children, with increases of one fifth; and lowest for parents, with increases between an eighth and a fifth. These estimates are higher than previously reported by Pollard et al. (2020) and point toward the need for intervention attention.

The pandemic onset was also associated with increased illicit substance use among all three groups in both studies, although the magnitude of increase was not as great as for alcohol use. Among older adolescents, substance use increased by an average of 11 percent across the two studies. For adults without children, substance use increased by about 10 percent. For parents, the increase was smaller, at about 5 percent. These patterns held across both low- and middle-income adults.

Surprisingly, the hypothesis that adverse impacts on alcohol and other substance use would be greater among lower-income than middle-income families was not supported. Instead, among both adults without children and parents, higher pre-pandemic income and increases in income following the pandemic were associated with higher alcohol use following the pandemic onset. The magnitude of the impact of the pandemic was particularly strong among parents in study 2. Perhaps greater income afforded easier opportunity to purchase and consume alcohol during a stressful time.

Increased illicit substance use was associated with higher pre-pandemic income only among parents and not among adults without children. Decreases in income following the pandemic onset were associated with lower substance use among both adults without children and parents, and the relation was particularly strong among parents.

Increased depression and anxiety symptoms following the pandemic were related to increased alcohol and illicit substance use among both adults without children and parents, and this relation was stronger among parents. Whether increased substance use led to or was caused by increases in depression and anxiety symptoms is not clear, but their co-occurrence suggests reverberating impacts of the pandemic on adults' lives. These patterns are similar to the recent phenomenon of "diseases of despair" (Shanahan et al., 2019) in response to stressful contemporary cultural conditions.

Among older adolescents, alcohol and substance use were not related to pre-pandemic income or changes in income, or changes in depression and anxiety symptoms or personal disruption. Low statistical power to detect effects in the adolescent group may have limited detection of a relation between increased depression and anxiety symptoms and increased alcohol and substance use, as the direction of all odds ratios suggested a possible effect.

These findings are constrained by the circumstances of this study. Interviews were conducted an average of only 5 weeks after the pandemic shut down schools and led families to be homebound. It is plausible that this initial impact changed over time as families either became even more stressed or learned to adjust to new routines. The research designs and evaluation methods used, although as rigorous as could be implemented under the emergency circumstances, temper firm causal inference. Finally, the COVID-19 pandemic, while showing adverse impacts on increased alcohol and illicit substance use that were even stronger than those found for other population stressors, is unique, and its impacts might not generalize to other health crises.

5. Conclusions

The findings show replicated adverse impacts of the COVID-19 pandemic that merit intervention and policy attention. Most health policy attention has been placed on controlling the spread of the COVID-19 virus, but the current findings indicate a strong need also to address alcohol, substance use, and mental health problems among all members of pandemic-afflicted communities. We recommend mental health

resources be dramatically increased and deployed in pandemic-afflicted communities. Family members of individuals who experience the disease or job loss should be screened for mental health problems, especially substance misuse. Resources should be directed toward the entire community, not just those directly diagnosed with the disease or those who lost jobs.

The older adolescent population is at particularly high risk for increases in alcohol and other substance misuse and should be prioritized for screening, individual intervention, and policy. Increased alcohol and other substance use in older adolescents is likely to interfere with adherence to mask-wearing and social distancing guidelines.

Community-wide policy levers should also be prioritized, including ways to reduce stressful household disruption and increase attention to mental health needs. Communities should limit ready access to alcohol, other substances, and prescription drugs (including opioids) that can be used for non-prescription purposes, especially for older adolescents and young adults. Policy leaders should be aware that mandates to re-open unfettered opportunities for substance use (e.g., bars, liquor stores) could exacerbate increases in substance misuse.

CRedit authorship contribution statement

Kenneth A. Dodge: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft. **Ann T. Skinner:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Supervision, Writing – review & editing. **Jennifer Godwin:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing. **Yu Bai:** Formal analysis, Methodology, Software, Visualization, Writing – review & editing. **Jennifer E. Lansford:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Writing – review & editing. **William E. Copeland:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Writing – review & editing. **W. Benjamin Goodman:** Conceptualization, Data curation, Formal analysis, Writing – review & editing. **Robert J. McMahon:** Conceptualization, Funding acquisition, Writing – review & editing. **Natalie Goulter:** Project administration, Writing – review & editing. **Marc H. Bornstein:** Conceptualization, Writing – review & editing. **Gregory S. Pettit:** Conceptualization, Writing – review & editing. **John E. Bates:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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