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Alcohol use and the COVID-19 pandemic: Historical trends in drinking, contexts, and reasons for use among U.S. adults

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ARTICLE INFO

Keywords:

COVID-19 pandemic
Alcohol
Drinking context
Drinking reasons
College
Young adult

ABSTRACT

Objective: The current study used U.S. national data to examine drinking trends prior to and during the COVID-19 pandemic in 2020, focusing on changes in U.S. young- and middle-adult alcohol prevalence, frequency, and drinking contexts and reasons, and whether they differed by age and college status.

Methods: Data from 2015 to 2020 from 16,987 young adults (ages 19–30) and 23,584 middle adults (ages 35–55) in the national Monitoring the Future study were used to model historical trends and potential 2020 shifts (data collection April 1 to November 30, 2020) in prevalence (30-day, daily, binge drinking) and frequency (30-day, binge drinking). For young adults, data on drinking contexts and negative affect reasons for drinking were examined. Moderation by age and college status was also tested.

Results: 2020 was associated with (1) downward deviation in 30-day (young and middle adults) and binge drinking (young adults) prevalence; (2) upward deviation in daily drinking prevalence (middle adults); (3) among drinkers, upward deviation in frequency of 30-day (young and middle adults) and binge drinking (young adults); and (4) changes in drinking contexts and reasons among drinkers. Among college students, in particular, 2020 was associated with a downward deviation from expected historical trends in drinking prevalence. Upward deviations in daily prevalence and both binge and 30-day drinking frequency were stronger at ages 25–30 (vs. 19–24) and 35–45 (vs. 50–55).

Conclusions: Among U.S. young and middle adults, deviations from expected historical trends in population alcohol use that occurred during the pandemic included decreases in alcohol use prevalence, increases in alcohol use frequency, and increases in the use of alcohol to relax/relieve tension and because of boredom. These shifts were likely due, in part, to drinking while alone and at home—which increased during the pandemic.

1. Introduction

The global effects of the COVID-19 pandemic resulted in unprecedented societal change. During March 1–May 31, 2020 in the United States, mandatory stay-at-home orders were put in place in 42 states and territories, impacting more than 70% of U.S. counties (Moreland et al., 2020). While the mandatory stay-at-home orders were lifted at various times during the later months of 2020, most states continued to utilize a range of policies focused on lowering COVID-19 transmission risk, including public gathering limitations; occupancy limits for specific business types including restaurants, bars, and entertainment venues; and social distancing and masking requirements (National Academy for

State Health Policy, 2021).

Such dramatic social changes have the potential to impact a wide range of behaviors, including alcohol use. Past research on other large-scale events—such as hurricanes, infectious disease outbreaks, and terrorist attacks—found increases in alcohol consumption associated with the events. For example, mean drinks per day increased following Hurricane Katrina among African Americans aged 18+ in New Orleans (Beaudoin, 2011), both mean drinks per day and number of drinks per drinking day increased among adults associated with agencies affected by the World Trade Center attacks (North et al., 2013), and the number of problematic alcohol use indicators increased among adult hospital employees in Beijing following the SARS outbreak (Wu et al., 2008).

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<https://doi.org/10.1016/j.socscimed.2022.114887>

Received 21 October 2021; Received in revised form 16 February 2022; Accepted 9 March 2022

Available online 16 March 2022

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While most of these observed increases were time-limited (North et al., 2013), there appears to be a clear connection between large-scale social distress and change in alcohol use.

There are generally two hypotheses about such a connection as it relates to the COVID-19 pandemic, specifically. One hypothesis is that alcohol use will increase due to increased stress and social isolation because alcohol is used as a coping strategy (Bramness et al., 2021; Kilian et al., 2021; McPhee et al., 2020; Rehm et al., 2020). The other hypothesis is that alcohol use will decrease (at least in the short term) due to reduced economic resources (e.g., income reduction due to COVID-related job loss or reduced hours), physical access (e.g., reductions in the ability to buy alcohol at venues such as bars), and opportunities for socialization (Bramness et al., 2021; Kilian et al., 2021; Rehm et al., 2020). Furthermore, different associations are likely to be observed across specific alcohol use indicators and age groups (e.g., young adults aged 19–30 vs. middle adults aged 35–55).

1.1. Existing research on the COVID-19 pandemic and alcohol use

Recent systematic reviews have summarized the emerging body of research that has focused on alcohol use among adults during the COVID-19 pandemic (Roberts et al., 2021; Schmidt et al., 2021). Most studies from early in the pandemic examined self-reported behavior change or concurrent associations between experienced COVID-19 stressors and reported alcohol use outcomes (e.g., Boschuetz et al., 2020; Callinan et al., 2021; Lee et al., 2020; White et al., 2020). Such studies have provided important information on if and how adult respondents perceived their alcohol use behaviors were associated with or had changed due to COVID-19—but they have not allowed for prospective examination of whether or not population-based trends in a range of alcohol-related outcomes changed with the pandemic. Later studies have included cross-sectional panel or longitudinal methodology. Some of these key studies involved localized data (e.g., Bade et al., 2021; Charles et al., 2021; Evans et al., 2021; Fruehwirth et al., 2021; Graupensperger et al., 2021; Jackson et al., 2021; Lechner et al., 2021; Minhas et al., 2021; Ryerson et al., 2021; Salazar-Fernández et al., 2021; Ward et al., 2021), while others utilized national data. Of those using national data, some have included trend data (Schulenberg et al., 2021) but have not specifically examined changes during the pandemic while controlling for existing trends; others have included limited data points (i.e., one or two) preceding the COVID-19 pandemic (e.g., Barbosa et al., 2021; Daly and Robinson, 2021; Oksanen et al., 2021; Pollard et al., 2020), while others included only data points after pandemic onset (e.g., Irizar et al., 2021; Nordeck et al., 2021). These studies have provided critical longitudinal data on a range of measurable outcomes—but they do not account for pre-existing historical trends in alcohol use behaviors prior to the COVID-19 pandemic.

It is important to account for pre-existing historical trends in alcohol use because alcohol consumption among U.S. adults fluctuates over historical time (Gruza et al., 2018; SAMHSA, 2020; Schulenberg et al., 2021). Historical trends in alcohol use prior to 2020 indicated use among young adults—particularly early young adults—was decreasing (Jager et al., in press; Patrick et al., 2017; Schulenberg et al., 2021; SAMHSA, 2020), while use among adults was increasing (Han et al., 2017; Schulenberg et al., 2021). Thus, based solely on these pre-existing historical trends, alcohol consumption could be expected to be different in 2020 compared with 2019. Because of pre-existing historical trends, capturing changes in alcohol consumption that coincide with the onset of the COVID-19 pandemic requires more than just assessing whether alcohol consumption immediately prior to the pandemic differs from consumption immediately after the onset of the pandemic. Instead, it requires capturing pre-existing historical trends and then additionally disentangling any deviations from these pre-existing trends that coincide with the onset of the COVID-19 pandemic (Jager and Keyes, 2021). To our knowledge, only two studies have modeled pre-existing trends in selected adult alcohol use measures: one Australian college student

study using 4 time points from 2017 to 2020 (Clare et al., 2021), and one national adult United Kingdom study using 4 time points from 2015 to 2020 (Niedzwiedz et al., 2021).

1.2. Drinking contexts and reasons

Efforts to understand mechanisms behind change in alcohol use during the pandemic have included hypothesized changes in drinking contexts (Bonar et al., 2021). However, a fuller understanding requires modeling how drinking contexts and reasons for use may have shifted during the pandemic. These issues have not been examined in models controlling for pre-existing historical trends in each relevant outcome, but some studies have examined contexts and reasons using prospective data or multilevel modeling. Change in drinking locations and social settings during the pandemic has been examined only among college students; significant decreases were observed for drinking locations of parties, bars/restaurants, other's homes, and outdoors, and drinking decreased with friends/acquaintances, roommates, and strangers—but increased for alone and with parents or siblings (Jackson et al., 2021). Estimates of change in reasons for drinking during the pandemic based on prospective data have not been reported. Retrospective data from college students indicated boredom and/or newfound leisure time were both associated with perceived increased alcohol use (Clare et al., 2021; Jackson et al., 2021). One study examining change in drinking motives among the general population indicated COVID-related increases in depression and coping motives, as well as decreases in social, enhancement, and conformity motives (Graupensperger et al., 2021). Both general population and college student studies have found that increases in alcohol use during the pandemic were associated with drinking to cope (Fruehwirth et al., 2021; Irizar et al., 2021). National data are needed to better understand changes in drinking contexts and reasons during the pandemic (particularly those dealing with negative affect), controlling for pre-existing historical trends.

The work of documenting the impact of the COVID-19 pandemic on health behaviors is only beginning. National data are needed that can place any shifts that occurred during the pandemic in the context of pre-existing historical trends, including a focus on which indicators of alcohol use have shifted and how patterns of use have changed (including contexts and reasons for use). The current study examined if and how the early pandemic in 2020 was associated with shifts from overall pre-existing historical trends in alcohol use from 2015 to 2020 among U.S. adults via three research questions: (1) Did historical trends significantly change in 2020 for alcohol prevalence among all respondents (any 30-day, daily, binge drinking) or frequency among users (30-day, binge drinking) among those aged 19–30 and 35–55? (2) Did alcohol use contexts and reasons trends significantly change in 2020 among those aged 19–30? (3) Did age or college status moderate any changes during the pandemic?

2. Methods

2.1. Sample

Data were obtained from the Monitoring the Future (MTF) study (Schulenberg et al., 2021). Every year new nationally representative samples of 12th grade students in the U.S. (modal age [hereafter referred to simply as “age”] 18) have been drawn since 1976 (Miech et al., 2021). From each yearly 12th grade cohort approximately 2,450 individuals are selected for longitudinal follow-up which (until the 2019 cohort) has been randomized to begin one or two years after high school (i.e., ages 19 or 20; Schulenberg et al., 2021), with six biennial surveys collected between the ages of 19 and 30 (19/20, 21/22, 23/24, 25/26, 27/28, 29/30). Beginning with the 2019 12th grade cohort all individuals selected for the longitudinal study participate in follow-up surveys at ages 19 and 20, and are then randomized to staggered biennial surveys through age 30. After age 30 surveys are collected every five years (i.e.,

Table 1
Sample descriptives.

	Ages 19-30		Ages 35-55	
	%	(SE)	%	(SE)
Time invariant measures				
Sex				
Female	53.1	(0.47)	52.8	(0.39)
Male	46.9	(0.47)	47.2	(0.39)
Race/ethnicity				
Black	11.8	(0.36)	11.0	(0.32)
Hispanic	16.2	(0.35)	7.7	(0.25)
White	59.4	(0.45)	74.4	(0.39)
Other	12.6	(0.31)	6.9	(0.22)
Time-varying measures				
Age				
19-24	57.0	(0.38)	–	
25-30	43.0	(0.38)	–	
35-45	–		65.4	(0.33)
50-55	–		34.6	(0.33)
Marital status				
Married	17.5	(0.29)	70.0	(0.36)
Other	82.5	(0.29)	30.0	(0.36)
Employment status				
Employed full-time	46.0	(0.38)	72.4	(0.33)
Other	54.0	(0.38)	27.6	(0.33)
Parental status				
Live with own child/ren	13.4	(0.27)	62.1	(0.37)
Other	86.6	(0.27)	37.9	(0.37)
College status				
Currently attending 4-year college	22.4	(0.31)	–	
Other	77.6	(0.31)	–	
Year				
2015	15.7	(0.21)	16.7	(0.23)
2016	15.4	(0.20)	17.1	(0.27)
2017	15.6	(0.21)	17.1	(0.27)
2018	16.8	(0.21)	15.9	(0.27)
2019	16.2	(0.22)	16.1	(0.27)
2020	20.3	(0.24)	17.1	(0.24)

Notes: N(unwtd) for ages 19–30 = 29,940; for ages 35–55 = 26,465. All estimates obtained from weighted analyses. SE = standard error.

at ages 35, 40, 45, 50, 55, 60).

For the current study data were drawn from all age 19/20 to 55 follow-up surveys completed in 2015–2020, involving 12th grade cohorts from 1978 to 2003 for surveys at ages 35–55, and 2003–2019 cohorts for surveys at ages 19–30 (see Supplement Table 1 for sample details). Data were collected using both mailed and electronic questionnaires. For ages 19–30, 40,437 12th grade students were selected for follow-up; 18,011 (44.5%) responded to at least one of the age 19–30 surveys. For ages 35–55, 63,816 12th grade students were selected for longitudinal follow-up; 25,498 (40.0%) responded to at least one of the age 35–55 surveys in the relevant years. For 2020 follow-up surveys the dates on which either paper questionnaires were received or electronic surveys were submitted ranged from April 1 through November 30. No systematic variation in the timing of survey administration (or survey return) was observed across age. Information on attrition adjustments is provided in the Statistical Analysis section.

Cases with missing data on (a) all outcomes or (b) any covariates were removed (see Supplement Table 2); the final ages 19–30 analytic sample included 16,987 respondents (94.3% of the 18,011 responding) with 29,940 cases, and the final ages 35–55 analytic sample included 23,584 respondents (92.5% of the 25,498 responding) with 26,465 cases. Mean number of data collection waves per respondent was 1.76 (range 1–3) for ages 19–30, and 1.12 (range 1–2) for ages 35–55.

3. Measures

3.1. Outcomes

Alcohol prevalence and frequency data were obtained through three

survey questions asked of all respondents at each survey. Measures were consistent across time. For 30-day use respondents were asked, “On how many occasions (if any) have you had any alcoholic beverage to drink—more than just a few sips during the last 30 days?” with response options of 0 occasions, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more occasions. For binge drinking respondents were asked, “Think back over the last two weeks. How many times have you had five or more drinks in a row?” with response options of none, once, twice, 3–5 times, 6–9 times, and 10 or more times. For prevalence estimates three dichotomous prevalence measures were coded for analysis among all respondents: any 30-day use, any daily drinking (defined as use on 20+ occasions in the past 30 days), and any binge drinking. For frequency estimates two continuous frequency measures for 30-day and binge drinking were coded limited to those who reported any occasions of the relevant drinking outcome, with responses recoded to roughly represent the midpoints of each response category. For 30-day frequency responses were coded as 1.5, 4, 7.5, 14.5, 29.5, and 40. For binge drinking responses were coded as 1, 2, 4, 7.5, and 10.

Measures on alcohol use contexts and reasons were asked only of age 19–30 respondents who reported past 12-month alcohol use, and only on a random 1/6th of survey forms (assigned randomly at the 12th grade survey and retained throughout longitudinal follow-up). Again, measures were consistent across time. MTF includes a total of 8 location/context and 14 reason measures (e.g., Patrick et al., 2011b; Terry-McElrath et al., 2017). As the purpose of the current study was to examine in alcohol behaviors that occurred during the pandemic, analysis was limited to the 3 location/context and 5 negative affect reason measures that were hypothesized to be particularly relevant to the social and environmental changes resulting from the pandemic. For location/context measures respondents were asked, “When you used alcohol during the last year, how often did you use it in each of the following situations ... (a) when you were alone; (b) during the daytime (before 4:00 p.m.); (c) at your home (or apartment or dorm).” Response options (using a 5-point scale ranging from not at all to every time) were recoded into any/none indicators. For alcohol use reasons respondents were asked, “What have been the most important reasons for your drinking alcoholic beverages? (Mark all that apply.)” All reasons related to negative affect (Patrick et al., 2011a; Patrick and Schulenberg, 2011) were selected for analysis and coded as any/none dichotomies: (a) to relax or relieve tension; (b) to get away from my problems or troubles; (c) because of boredom, nothing else to do; (d) because of anger or frustration; (e) to get through the day.

3.2. Covariates

Analyses examining changes in alcohol outcomes during the pandemic should control for key covariates known to be associated with alcohol use overall. At the 12th grade survey, respondents reported their sex (male, female) and racial/ethnic identity, coded as Black, Hispanic, White, and Other (combined due to low sample sizes). All other covariates were time-varying. For analysis, year of data collection (2015–2020) was coded as a continuous measure ranging from 1 to 6, and a dichotomous 2020 indicator was coded. Sensitivity analyses were conducted by running alternative models testing for quadratic trends in survey year; no evidence of significant quadratic trends was observed and linear models were retained for presentation. Age was coded using dichotomies; for ages 19–30 the coding was 19–24 versus 25–30; for ages 35–55 the coding was 35–45 versus 50–55. The specific age group coding used was based on recognized life course transitions. The ages of 19–24 (vs. 25–30) are more likely to be characterized by college attendance, transitioning employment, and low marriage likelihood. The ages of 35–45 (vs. 50–55) are more likely to be characterized by active childrearing responsibilities. Marital status was coded as married versus other. Employment status was a dichotomy indicating one full-time job versus other. Parental status was a dichotomy indicating living with own child/ren versus other (including those without children and those

Table 2
Trends from 2015 to 2020 in alcohol use prevalence and frequency among U.S. young adults (ages 19–30) and middle adults (ages 35–55).

	Year Estimates						Regression Estimates ^a	
	2015	2016	2017	2018	2019	2020	Year ^b	Year 2020 indicator
	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	AOR (95% CI) p	AOR (95% CI) p
Prevalence^c								
Young adults (19–30)								
30-day use	66.3 (0.76)	67.4 (0.79)	66.1 (0.79)	65.3 (0.80)	66.1 (0.81)	61.9 (0.75)	0.99 (0.97, 1.01) 0.260	0.86 (0.79, 0.94) 0.001
Daily drinking	4.8 (0.31)	5.1 (0.34)	5.0 (0.34)	4.2 (0.31)	4.2 (0.32)	4.5 (0.29)	0.96 (0.92, 1.00) 0.034	1.11 (0.92, 1.35) 0.275
5+ drinking	31.0 (0.71)	31.1 (0.75)	30.6 (0.75)	29.5 (0.74)	29.9 (0.75)	26.4 (0.68)	0.98 (0.96, 1.00) 0.074	0.87 (0.79, 0.95) 0.003
Middle adults (35–55)								
30-day use	68.0 (0.81)	69.5 (0.80)	69.9 (0.80)	68.9 (0.84)	71.6 (0.80)	68.6 (0.82)	1.03 (1.01, 1.06) 0.011	0.87 (0.77, 0.98) 0.019
Daily drinking	9.6 (0.47)	9.3 (0.46)	9.6 (0.49)	9.4 (0.51)	9.3 (0.51)	12.1 (0.56)	0.99 (0.96, 1.03) 0.677	1.35 (1.14, 1.60) <.001
5+ drinking	22.9 (0.72)	23.8 (0.75)	23.8 (0.74)	23.4 (0.76)	25.6 (0.79)	24.0 (0.76)	1.03 (1.00, 1.06) 0.038	0.93 (0.82, 1.05) 0.246
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Est (SE) p	Est (SE) p
Frequency^d								
Young adults (19–30)								
30-day use	7.4 (0.16)	7.5 (0.16)	7.3 (0.17)	7.1 (0.16)	6.9 (0.17)	7.3 (0.16)	−0.138 (0.048) 0.004	0.514 (0.218) 0.019
5+ drinking	2.4 (0.05)	2.4 (0.06)	2.4 (0.06)	2.4 (0.06)	2.3 (0.05)	2.5 (0.06)	−0.034 (0.016) 0.035	0.205 (0.078) 0.009
Middle adults (35–55)								
30-day use	9.4 (0.21)	9.3 (0.20)	9.5 (0.21)	9.3 (0.23)	9.4 (0.21)	10.9 (0.23)	−0.001 (0.067) 0.983	1.548 (0.346) <.001
5+ drinking	2.9 (0.09)	2.9 (0.08)	3.0 (0.09)	2.9 (0.09)	3.1 (0.09)	3.3 (0.10)	0.030 (0.028) 0.284	0.254 (0.145) 0.081

Notes: Unweighted n across years ranged from 26,123 to 29,477 for prevalence and from 6,294 to 20,136 for frequency.

^a Models included both year and year 2020 indicator. Adjusted odds ratios (AORs) for dichotomous outcomes and CI = confidence interval; OLS regression estimates (Est.) for frequency outcomes. SE = standard error. Bold font indicates p < 0.05.

^b Linear year term ranging from 1 to 6 for years 2015–2020.

^c Among all respondents.

^d Among those who reported specified use level.

with children not living with them). *College status* was a dichotomy indicating currently attending a 4-year college versus not and was included only for ages 19–30.

3.3. Statistical Analysis

All analyses were conducted using SAS v.9.4 (SAS Institute Inc., Cary, NC) using survey commands accounting for the MTF 12th grade strata and clustering by respondent; variance was estimated using Taylor series linearization (alternative ways of estimating standard errors were explored; results were unchanged). Analyses incorporated MTF attrition weights based on extensive information available from 12th grade measures. Analyses for ages 19–30 (hereafter referred to as young adults) used weights calculated for age 19/20 participation, and ages 35–55 (hereafter referred to as middle adults) used weights calculated for age 35 participation. For analyses examining 2020 trend shifts for alcohol use prevalence and frequency and use contexts and reasons models were run separately for each outcome; predictors included year and 2020 indicator. Associations for prevalence, context, and reason outcomes were estimated using odds ratios obtained using PROC SURVEYLOGISTIC with maximum likelihood estimation. While odds ratios can overestimate risk ratios when outcomes are common (Zhang and Yu, 1998), sensitivity analyses indicated that when associations were estimated with risk ratios, results were in the same direction and were similar in magnitude; no substantive conclusions changed. Associations for frequency outcomes used PROC SURVEYREG. Sensitivity analyses were conducted by re-running each model while simultaneously controlling for age; sex; race/ethnicity; and marital, employment, parental, and college statuses. To examine potential moderation of the effects of any shifts associated with 2020 by age or college status full multivariable models including covariates were re-run including an interaction term of the year 2020 indicator and the relevant age or college term. Group-specific models were run (including all covariates) where significant interactions were observed to further examine associations.

4. Results

4.1. Prevalence and frequency trend changes in 2020

Table 1 describes the analytic sample. Table 2 presents year-specific estimates of alcohol use prevalence and frequency for the young adult and middle adult samples, as well as results of regression models examining evidence of 2020 change in observed trends prior to controlling for covariates. Overall historical trends are indicated by the continuous Year term, which captures linear change. Deviation from pre-existing trends is indicated by the dichotomous 2020 Indicator (see Sensitivity analyses below for multivariable associations).

4.2. Prevalence (all respondents)

In 2020 two young adult prevalence outcomes significantly deviated downward from what would have been predicted for 2020 based on pre-existing trends. Prevalence of young adult past 30-day drinking was generally stable from 2015 to 2019 (ranging between 65.3% and 67.4%), but dropped to 61.9% in 2020 (see Fig. 1). Following a similar pattern, prevalence of young adult binge drinking was generally stable from 2015 to 2019 (29.5%–31.1%), but dropped to 26.4% in 2020.

Among middle adults, prevalence of 30-day drinking significantly deviated downward in 2020 from pre-existing trends, and prevalence of daily drinking significantly deviated upward. Prevalence of middle adult 30-day drinking had generally increased from 2015 to 2019 (68.0%–71.6%), but dropped to 68.6% in 2020 (see Fig. 1). Prevalence of middle adult daily drinking was generally stable between 2015 and 2019 (ranging from 9.3% to 9.6%), but increased to 12.1% in 2020. Middle adult binge drinking trends did not deviate significantly from predicted trends in 2020.

4.3. Frequency (among users)

In 2020 both 30-day and binge drinking frequency among young

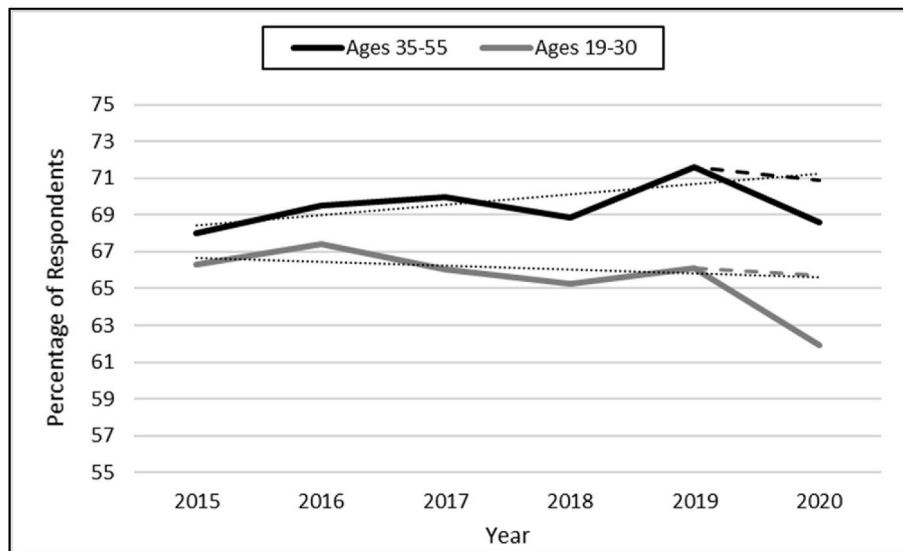


Fig. 1. Trends from 2015 to 2020 in past 30-day alcohol use prevalence among U.S. young adults (ages 19–30) and middle adults (ages 35–55).

adults deviated upward from pre-existing trends. Overall historical trends for these outcomes among young adults had shown significant decreases; in 2020 trends not only ceased to decrease, but frequency increased (See Fig. 2 for 30-day drinking trends.).

Among middle adults only the 2020 30-day frequency measure deviated from what was predicted based on ongoing trends. Middle adult 30-day frequency had been generally stable from 2015 to 2019 (ranging from 9.3 to 9.5 occasions), but rose to 10.9 occasions in 2020 (see Fig. 2).

4.4. Drinking context and reason changes among young adult drinkers in 2020

Year-specific estimates of drinking contexts and reasons among past 12-month young adult users are shown in Table 3, along with results of regression models examining evidence of 2020 change in observed trends prior to controlling for covariates. Again, overall historical trends are indicated by the continuous Year term; deviation from pre-existing trends is indicated by the 2020 Indicator (see Sensitivity analyses

below for multivariable associations).

4.5. Drinking contexts

Drinking alone and at home/apartment/dorm (hereafter referred to simply as home) deviated upwards from pre-existing trends in 2020. Overall historical trends for these contexts had been generally stable between 2015 and 2019. Prevalence of drinking alone had ranged from 42.2% to 45.9% between 2015 and 2019, but increased to 51.6% in 2020. Similarly, drinking at home had ranged from 80.5% to 83.7%, but then increased to 87.3%. Trends in drinking during the day, at a party, or with only 1–2 other people did not significantly deviate from pre-existing trends in 2020.

4.6. Drinking reasons

In 2020 drinking to relax/relieve tension and because of boredom both deviated upward from pre-existing trends. The overall historical trend for drinking to relax/relieve tension generally had been decreasing

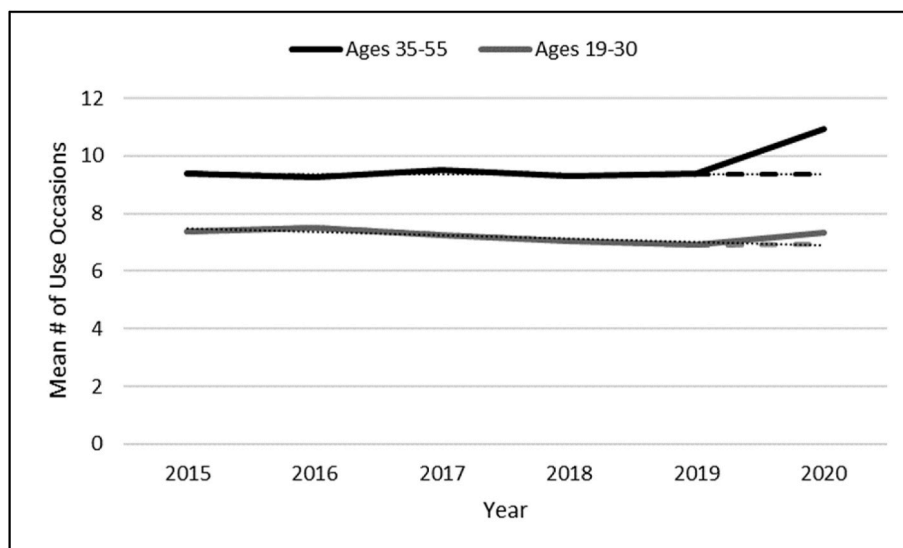


Fig. 2. Trends from 2015 to 2020 in past 30-day alcohol use frequency among U.S. young adults reporting any 30-day use (ages 19–30) and middle adults (ages 35–55).

Table 3

Trends from 2015 to 2020 in alcohol use context measures and negative affect reasons among U.S. young adults (ages 19–30) reporting alcohol use in the past 12 months.

	Year Estimates						Regression Estimates	
	2015 % (SE)	2016 % (SE)	2017 % (SE)	2018 % (SE)	2019 % (SE)	2020 % (SE)	Year ^a AOR (95% CI) p	Year 2020 indicator AOR (95% CI) p
Context measures								
When you were alone	42.2 (2.02)	44.1 (2.08)	45.9 (2.12)	43.3 (2.19)	44.9 (2.18)	51.6 (2.03)	1.02 (0.97, 1.07) 0.456	1.28 (1.02, 1.60) 0.032
During daytime	47.2 (2.03)	44.9 (2.06)	47.9 (2.13)	47.9 (2.21)	51.8 (2.20)	53.5 (2.01)	1.05 (1.00, 1.10) 0.044	1.08 (0.86, 1.35) 0.507
Home/apartment/dorm	80.9 (1.68)	83.7 (1.61)	81.9 (1.73)	80.7 (2.04)	80.5 (1.86)	87.3 (1.42)	0.97 (0.91, 1.04) 0.422	1.61 (1.16, 2.24) 0.005
At a party	82.4 (1.53)	78.5 (1.71)	82.7 (1.56)	82.3 (1.58)	81.1 (1.77)	79.1 (1.63)	1.01 (0.94, 1.08) 0.799	0.85 (0.63, 1.13) 0.255
With 1–2 other people	91.9 (1.09)	93.5 (1.09)	91.7 (1.21)	89.6 (1.42)	89.9 (1.49)	91.2 (1.15)	0.90 (0.82, 1.00) 0.042	1.34 (0.87, 2.06) 0.186
Use reasons								
Relax/relieve tension	68.0 (1.93)	70.4 (2.03)	65.5 (2.03)	66.7 (2.14)	63.7 (2.17)	71.1 (1.84)	0.95 (0.90, 1.00) 0.046	1.44 (1.12, 1.86) 0.005
Get away from problems/troubles	16.1 (1.53)	15.5 (1.52)	15.7 (1.57)	18.7 (1.75)	17.2 (1.66)	22.7 (1.75)	1.04 (0.98, 1.11) 0.235	1.31 (0.98, 1.74) 0.065
Boredom	15.5 (1.55)	12.3 (1.38)	15.9 (1.70)	13.5 (1.54)	16.7 (1.62)	29.0 (1.90)	1.03 (0.97, 1.10) 0.368	2.16 (1.62, 2.87) <.001
Anger/frustration	11.1 (1.34)	10.2 (1.26)	11.7 (1.40)	8.1 (1.19)	11.4 (1.47)	10.0 (1.35)	0.98 (0.91, 1.07) 0.702	1.00 (0.67, 1.51) 0.989
Get through the day	1.9 (0.55)	3.3 (0.74)	3.4 (0.76)	3.6 (0.86)	4.2 (0.97)	6.7 (1.22)	1.17 (1.02, 1.34) 0.023	1.35 (0.74, 2.47) 0.333

Notes: Ns(unwtd) context: 4191–4201; for use reasons: 4176. Models included both year (linear term ranging from 1 to 6 for years 2015–2020) and year 2020 indicator. Adjusted odds ratios (AORs) for dichotomous outcomes and CI = confidence interval; OLS regression estimates (Est.) for frequency outcomes. SE = standard error. Bold font indicates $p < 0.05$.

^a Linear year term ranging from 1 to 6 for years 2015–2020.

(dropping from 68.0% in 2015 to 63.7% in 2019) but rose to 71.1% in 2020. The overall trend for drinking because of boredom had been generally stable (ranging from 12.3% to 16.7%), but rose to 29.0% in 2020. Trends in drinking to get away from problems, because of anger/frustration, or to get through the day did not deviate from pre-existing trends in 2020.

4.7. Moderation of 2020 trend changes by age and college status

4.7.1. Age

Moderation by age (indicated by a Year, 2020 Indicator by age interaction term significant at $p < 0.05$) was observed for 3 of the 16 total young adult outcomes (30-day prevalence, daily drinking prevalence, and binge drinking frequency) and 2 of the 6 total middle adult outcomes (daily drinking prevalence and 30-day frequency); all analyses used full multivariable models including covariates.

Among young adults, group-specific models (not tabled) indicated a significant 2020 downward deviation from pre-existing trends in 30-day prevalence at ages 19–24 but not at ages 25–30. (Specifically, the Year, 2020 Indicator AOR was 0.79 [95% CI 0.70, 0.90], $p < 0.001$ for ages 19–24, versus 1.00 [0.87, 1.14], $p = 0.941$ for ages 25–30.) In contrast, no 2020 deviation from pre-existing trends in either daily prevalence or binge frequency was observed at ages 19–24, while these outcomes significantly deviated upward in 2020 at ages 25–30. Specifically, for daily prevalence, the Year 2020 Indicator AOR was 0.85 [0.61, 1.18], $p = 0.335$ for ages 19–24, versus 1.38 [1.08, 1.77], $p = 0.009$ for ages 25–30. For binge drinking, the Year 2020 Indicator est. was 0.069 (SE 0.108), $p = 0.522$ for ages 19–24, versus 0.345 (SE 0.114), $p = 0.003$ for ages 25–30.

Among middle adults, group-specific models (not tabled) indicated that significant 2020 upward deviations from pre-existing historical trends in daily prevalence and 30-day frequency were observed only at ages 35–45. Specifically, the Year 2020 Indicator was significant for both daily prevalence (AOR 1.56 [1.24, 1.96], $p < 0.001$) and 30-day frequency (Est 1.937 (SE 0.431), $p < 0.001$) for ages 35–45. In contrast, no significant deviation from pre-existing trends was observed at ages 50–55 for either outcome (AOR 1.10 [0.87, 1.40], $p = 0.430$ and Est. 0.834 (SE 0.519), $p = 0.108$, respectively).

4.7.2. College status

Moderation by college status was observed for 2 of the 16 outcomes among young adults: 30-day prevalence and binge prevalence. All analyses used full multivariable models including covariates. Group-specific models (not tabled) indicated 2020 was associated with downward deviations from pre-existing trends in both 30-day and binge drinking prevalence only among those currently attending a 4-year college (vs. others). Among those attending 4-year colleges, the Year 2020 Indicator AOR was 0.66 [95% CI 0.55, 0.80], $p < 0.001$ for 30-day prevalence and 0.65 [0.53, 0.80], $p < 0.001$ for binge drinking prevalence. Among those not attending, respective estimates were 0.94 [0.84, 1.04], $p = 0.241$, and 0.92 [0.82, 1.03], $p = 0.132$.

4.8. Sensitivity analyses

All models were re-run including covariates. Results were essentially unchanged from models reported above; estimate sizes remained consistent. Results are provided in Supplement Table 3–6. To explore how conclusions may have varied if models had not controlled for existing historical trends, data were limited to cases obtained in 2019 and 2020, and bivariate models were run regressing each outcome on a dichotomous 2020 indicator. When doing so, substantive differences in conclusions were observed for two outcomes compared to those reported above. For young adult 30-day alcohol use frequency no significant change was observed in models limited to 2019–2020 data ($p = 0.072$) compared with significant upward deviation in 2020 in models controlling for historical trends. For drinking to get away from problems/troubles, significant change was observed in models limited to 2019–2020 ($p = 0.026$), compared with no significant 2020 deviation in models controlling for historical trends.

5. Discussion

The ongoing COVID-19 pandemic has been pervasive in its influence on our daily lives. Except for immediate catastrophic events, historical change is typically more continuous than discrete, so the before-period cannot be viewed as static. Examining effects of the COVID-19 pandemic requires acknowledging that it is embedded in on-going historical change (Jager and Keyes, 2021). As illustrated here, simple pre-post comparisons of year-to-year change may have incorrectly attributed

all change to the pandemic; in fact, on-going historical trends also explain some of the effects. For the frequency outcomes, unless the models accounted for the prior on-going gradual declines over time, the 2020 upward deviations would not have been significant. In the case of drinking to get away from problems, unless the models were able to account for pre-2019 prevalence variability, differences between 2019 and 2020 would have been significant and thus incorrectly attributing differences to the pandemic. We found evidence to support both pandemic-related increases and reductions in alcohol use. Variations were observed by alcohol measure and age group; overall results suggest both period effects and age by period effects, such that the historical context affected individuals differently based on their life stage.

Alcohol use may have increased as a coping strategy for increased stress and social isolation during the pandemic (Bramness et al., 2021; Kilian et al., 2021; McPhee et al., 2020; Rehm et al., 2020). We documented upward deviation in (1) the prevalence of daily drinking (for middle adults); (2) the frequency of binge drinking (for young adults), and the frequency of 30-day use (for young and middle adults); and (3) the likelihood of drinking while alone, at one's house/apartment/dorm, to relax/relieve tension, and because of boredom (for young adults). These results in a national sample of U.S. adults align with prior research on the pandemic, which has suggested overall decreases in alcohol use but higher frequency—particularly among heavy users (Boschuetz et al., 2020; Graupensperger et al., 2021; Rossow et al., 2021; White et al., 2020)—as well as increases in drinking at home or while alone (Clare et al., 2021; Jackson et al., 2021; McPhee et al., 2020) and because of boredom (Clare et al., 2021; Jackson et al., 2021; Vanderbruggen et al., 2020).

At the same time, the pandemic onset may have been associated with decreased alcohol use because of reduced resources, access, and opportunities for socialization (Bramness et al., 2021; Kilian et al., 2021; Rehm et al., 2020). We identified downward deviation in the prevalence levels of any 30-day alcohol use (for young and middle adults) and binge drinking (for young adults). Alcohol availability and pricing are central drivers of alcohol use (Chaloupka et al., 2002; Gruenewald, 2011; Pulliainen and Valtonen, 2017), and alcohol availability shifted dramatically with the onset of the pandemic. On-premise access and consumption declined dramatically due to state-level lockdowns that mandated bar and restaurant closings. However, retail purchasing expanded at an equally dramatic pace, with increases in online purchasing, curbside pickup, and home delivery (Lindenberger, 2021; McIntyre, 2020). Overall alcohol purchasing in Great Britain remained stable when considering changes in both on-premise and retail purchasing (Anderson et al., 2021); U.S. alcohol volume increased (Lindenberger, 2021). Access to retail alcohol may be more sensitive to income than on-premise consumption. Weekly income is typically lowest during early young adulthood and highest during middle adulthood (U.S. Bureau of Labor Statistics, 2021). These forces may encourage age and college status differences in historical trend deviations in alcohol use, both of which were observed in the current study.

Downward deviations were particularly associated with younger age and college attendance. Regarding overall age, young adults had downward deviations in both 30-day and daily prevalence. Middle adults had a smaller downward deviation in 30-day prevalence, as well as upward deviations in daily prevalence and 30-day frequency. The 30-day frequency increase, in particular, was almost twice as strong for middle adults as for young adults. Some past research supports these findings, with the prevalence of any and heavy consumption among young adults generally decreasing (Graupensperger et al., 2021; Minhas et al., 2021; Schulenberg et al., 2021) or remaining stable (Minhas et al., 2021), while increases in both prevalence and frequency have been observed among adults in general (Barbosa et al., 2021; Nordeck et al., 2021; Pollard et al., 2020). Others studies have found conflicting results, showing that increased consumption was more likely during young adulthood than early middle age (Oksanen et al., 2021). Regarding more

detailed age differences, downward deviations in 30-day prevalence were observed among young adults only at ages 19–24 (ages most strongly associated with college attendance) and not ages 25–30. In terms of college attendance, downward deviations in 30-day and binge drinking prevalence were observed only among young adults who attended 4-year colleges (vs. non-attenders). These results are supported by prior research that found non-college young adults appeared to have evidenced less pandemic-related change in alcohol use than those enrolled in college (Evans et al., 2021; Fruehwirth et al., 2021; Jackson et al., 2021; Ryerson et al., 2021; Schulenberg et al., 2021). College attendance—particularly attending a 4-year college while not living with parents—is associated with higher intoxication and higher odds of binge and high-intensity drinking (Patrick and Terry-McElrath, 2017), and the developmental increase in binge and high-intensity drinking during the early young adult years is driven by college attenders (Patrick et al., 2016). In response to the COVID-19 pandemic, many colleges closed campuses and shifted to virtual classes. This resulted in dramatic changes in both living situations and drinking contexts for students. Students themselves ascribed lower alcohol use during lockdowns due to decreased in-person social interaction and drinking contexts such as large parties, as well as limited access to alcohol (Jackson et al., 2021). Some models have found COVID-related change in alcohol use as particularly strong for college students at or above legal drinking age who moved from college accommodations to living with family (Ryerson et al., 2021).

The current study's observed age differences in alcohol use trends during the pandemic may have significant public health implications. Recent historical trends in the U.S. have shown general declines in alcohol use among young adults (Schulenberg et al., 2021; SAMHSA, 2020), but increases among older adults (Han et al., 2017; Schulenberg et al., 2021). The COVID pandemic appears to be accelerating these age differences in some respects. Age-adjusted rates of alcohol-related deaths among U.S. adults have been increasing historically (Spencer et al., 2020), particularly during middle and later adulthood (Spillane et al., 2020). Additional increases in alcohol use during the pandemic among middle adults may only exacerbate the already heavy burden of alcohol-related morbidity and mortality among this age group.

The finding that 2020 prevalence deviated downward (young and middle adult 30-day use; young adult binge drinking), but frequency deviated upward (young and middle adult 30-day use; young adult binge drinking) may reflect two different forces. It is possible that the pandemic affected prevalence differentially based on pre-pandemic drinking. "Lighter" drinkers may have been more likely to discontinue in 2020 than heavier drinkers; observed upward deviations in frequency may be the result of having only heavier drinkers in the pool of remaining current drinkers. However, it may be just as likely that the pandemic was associated with upward deviations in frequency to varying degrees among drinkers across the consumption spectrum. Future research utilizing data that can examine within-person change in alcohol prevalence and frequency immediately before, during, and after the pandemic will be necessary to explain these patterns.

6. Strengths and limitations

The are several strengths and limitations of the present study that should be acknowledged while considering its implications. A primary strength is the use of U.S. national panel data covering ages 19–55 across years 2015 through 2020, using consistent procedures and measures over time. The use of annual assessments across 2015 through 2020 allows for examination of possible pandemic effects in 2020 in the context of pre-existing historical trends, an important design feature for accurately assessing possible pandemic effects (Jager and Keyes, 2021). Additional strengths include the consideration of age variation across young and middle adulthood, as well as the multi-indicator approach to alcohol use and the contexts of and reasons for use. One important limitation was attrition, particularly differential attrition with respect to

substance use, with attrition being higher among those who use substances (McCabe and West, 2016). However, the use of attrition weights helped mitigate this limitation (Keyes et al., 2020). Additional limitations and caveats include (1) the reliance on self-report data; (2) the exclusion of youth who dropped out or were not in high school; (3) the most recent time point being during the first year of the pandemic; and (4) lack of accounting for local differences in pandemic-related disease transmission and public health response.

7. Conclusions and future directions

Among U.S. young and middle-aged adults, shifts during the pandemic included decreases in alcohol use prevalence, increases in alcohol frequency, and increases in the use of alcohol to relax/relieve tension, and because of boredom. In particular, there were decreases in the prevalence of 30-day use among young and middle adults, as well as of binge drinking among young adults (particularly those in college). However, the prevalence of daily drinking increased among middle adults—and among drinkers the frequency of 30-day and binge drinking increased for young adults, and the frequency of 30-day drinking increased for middle adults. Thus, especially among young adults, prevalence decreased but frequency increased. These shifts during the pandemic were likely due, in part, to increased drinking while alone and at home. Our findings cover the beginning of the COVID-19 pandemic in 2020, and future research is needed to examine additional possible pandemic effects as it wears on, as well as the extent to which changes during the pandemic are temporary or long-term. Of particular interest is the extent to which subsequent trajectories of alcohol use and related problems may be affected by the pandemic and whether these are different for those who were young and middle adults when the pandemic began.

Credit author statement

Megan Patrick: Conceptualization, Writing – original draft, Supervision, Funding acquisition; Yvonne Terry-McElrath: Conceptualization, Writing – original draft, Formal analysis; Richard Miech: Writing – review & editing, Funding acquisition; Katherine Keyes: Writing – review & editing, Justin Jager: Writing – review & editing; John Schulenberg: Writing – review & editing, Funding acquisition

Acknowledgements

Data collection and manuscript preparation were supported by research grants from the National Institute on Drug Abuse (R01DA001411 and R01DA016575) and the National Institute on Alcohol Abuse and Alcoholism (R01AA023504 and R01AA026861). The study sponsors had no role in the study design, collection, analysis or interpretation of the data, writing of the manuscript, or the decision to submit the paper for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views of the study sponsor.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2022.114887>.

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