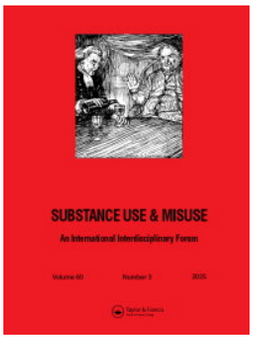

Taylor & Francis
Taylor & Francis Group

Substance Use & Misuse

ISSN: 1082-6084 (Print) 1532-2491 (Online) Journal homepage: www.tandfonline.com/journals/isum20

High in the Cloud: Alcohol-, Cannabis-, and Co-Use Before and During Remote Research Participation

Liana S. E. Hone, Shahar Almog, Abigail P. Masterson & Meredith S. Berry

To cite this article: Liana S. E. Hone, Shahar Almog, Abigail P. Masterson & Meredith S. Berry (2025) High in the Cloud: Alcohol-, Cannabis-, and Co-Use Before and During Remote Research Participation, Substance Use & Misuse, 60:3, 335-344, DOI: 10.1080/10826084.2024.2427170

To link to this article: https://doi.org/10.1080/10826084.2024.2427170

SUBSTANCE USE & MISUSE
2025, VOL. 60, NO. 3, 335–344
https://doi.org/10.1080/10826084.2024.2427170

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

High in the Cloud: Alcohol-, Cannabis-, and Co-Use Before and During Remote Research Participation

Liana S. E. Hone[a], Shahar Almog[a], Abigail P. Masterson[a] and Meredith S. Berry[a,b]

[a]Department of Health Education and Behavior, University of Florida, Gainesville, Florida, USA; [b]Department of Psychology, University of Florida, Gainesville, Florida, USA

ABSTRACT

Objective: The use of crowdsourcing for addiction research has increased exponentially in recent years, but the extent to which the populations we expect results to generalize to might be engaging in substance use while participating in remote research has not been formally quantified. Understanding rates of day-of-study substance use on crowdsourcing platforms may be especially relevant given immediately recent use can alter cognitive and behavioral decision-making processes (e.g., attention, behavioral economic drug purchase tasks) that are often the focus of online substance use research.

Method: The purpose of this study is to (1) characterize rates of substance use (i.e., alcohol, cannabis, or both) among 790 Prolific workers on the day of the study, within the past three hours, and since starting the study; (2) provide sample demographic descriptive statistics, typical substance use patterns, and their associations with day-of use; and (3) evaluate whether day-of use is associated with time taken to complete the study and performance on attention checks.

Results: Day-of use was greater than 10%, primarily consisted of cannabis use, and several general use patterns were associated with day-of use (e.g., past year binge drinking was associated with day-of cannabis use). Day-of use was not associated with longer study completion times; attention check analyses were inconclusive.

Conclusion: Considering these results, we provide suggestions for best practices when crowdsourcing data for addiction research and advocate for future studies that use naturalistic experiments to complement laboratory drug- and alcohol-administration studies.

KEYWORDS

Online study; Prolific; MTurk; Remote research; Crowdsource; Alcohol, Cannabis

The use of crowdsourcing generally—and for addiction research specifically (Mellis & Bickel, 2020)—has increased dramatically (Anderson et al., 2019; Mellis & Bickel, 2020; Strickland et al., 2022; Walter et al., 2019). Crowdsourcing platforms such as Prolific and Amazon Mechanical Turk (MTurk) increase studies' cost-efficiency, sample and geographic diversity, and access to hard-to-reach populations (Arditte et al., 2016; Buhrmester et al., 2011; Sassenberg & Ditrich, 2019; Strickland et al., 2022; Strickland & Stoops, 2019) largely without sacrificing data quality (Mellis & Bickel, 2020; Walter et al., 2019). Although several recent papers have underscored that high quality data collection on crowdsourcing platforms is possible (Mellis & Bickel, 2020), researchers must remain diligent with quality checks to flag nonsystematic or low-quality data, and some attention checks may be better suited for this task than others (Almog et al., 2023; Mellis & Bickel, 2020; Rung et al., 2022). Despite overall strengths, skepticism concerning validity of crowdsourced data, like inattention among online survey participants, is not unfounded (Ternovski et al., 2022). Given the exponential proliferation in use of these platforms, researchers have published general best practices for crowdsourced research to facilitate collection of high-quality data (e.g., screening recommendations, attention checks; Aguinis et al., 2021; Porter et al., 2019; Stewart et al., 2017), and guidance for addiction research (using MTurk specifically; Mellis & Bickel, 2020).

Given the consistently high rates of harmful substance use in the U.S. (Substance Abuse and Mental Health Services Administration, 2022), the increases in use during the COVID-19 pandemic (Roberts et al., 2021; Substance Abuse and Mental Health Services Administration, 2022), and difficulties in recruiting diverse groups who use substances for in-person research (Schick et al., 2020), there has been a push in addiction science to conduct research remotely (Englund et al., 2022). Crowdsourcing data collection has increased, including in fields of substance use and misuse (Mellis & Bickel, 2020). Researchers have described the utility of remote data collection specifically for substance use relevant research and called for additional work into the constraints of crowdsourcing platforms (Mellis & Bickel, 2020; Strickland & Stoops, 2019).

Remote crowdsourcing research could present complexities compared to research conducted in laboratory settings. For example, in a remote, uncontrolled setting, participants may experience emotions leading to substance use (Brown & Melas, 2024) during data collection, and subsequent effects on affect (Wycoff et al., 2018). Or, if they refrain, they may experience craving or withdrawal symptoms, all of which could influence study outcomes. Although such issues

CONTACT Liana S. E. Hone lhone@ufl.edu University of Florida.

including craving and withdrawal may influence laboratory outcomes, in-person, relative to remote sessions, allow the opportunity for more direct control, monitoring, and objective measurements related to substance use prior to or during research if relevant to the research questions. This may be especially relevant in substance administration studies, or studies in which recent substance use may interact with an experimental manipulation, or reduce attention to survey questions. For example, current carbon monoxide levels among smokers are often obtained in laboratory settings and participants must meet a reduced carbon monoxide value relative to baseline or the session is rescheduled (Johnson & Bickel, 2006), and such procedures may be more difficult to replicate remotely. Similarly, Breath Alcohol Concentration measures and urinalyses are frequently obtained in laboratory research among those who regularly use substances for biological and objective verification of recent substance use (e.g., Berry et al., 2022; Johnson et al., 2016). Other substance use measures that are commonplace in laboratory-based substance use research but may be more complex to deliver remotely include measures frequently facilitated or explained by a research assistant in the moment (e.g., Timeline Followback; Sobell & Sobell, 1992). Finally, in the laboratory, researchers can be trained to identify capacity to consent by asking questions about the consent procedure using the University of California, San Diego Brief Assessment of Capacity to Consent (UBACC; Jeste et al., 2007), and withdraw consent when appropriate (Davis, 2020) if participants are intoxicated, or, if in the field, they may obtain provisional consent, which may be confirmed within the next few days, giving participants the opportunity to opt out and have their data destroyed. Thus, collecting online data from intoxicated individuals presents issues not only with validity of data provided when intoxicated, but also with ethics regarding informed consent (Davis, 2020; Klein et al., 2016). Overall, a great deal of promise exists in remotely delivered substance use research; however, unique challenges may be present that require more explicit considerations to address recent substance use specifically, and a part of addressing these issues is ascertaining the extent to which participants might be engaging in substance use prior to or during remote research.

Moreover, recent substance use (or lack thereof among individuals with dependence) may influence cognition, performance on attention checks, influence response times, or alter decision-making on behavioral economic tasks frequently used in substance use research (Amlung et al., 2015; Johnson et al., 2016). Conversely, withdrawal from regularly used substances may influence decision-making (e.g., nicotine deprivation can affect delay discounting; Field et al., 2006; Grabski et al., 2016). Substance use, intoxication, or withdrawal may also interact with within-subject repeated measures or various experimental manipulations (e.g., behavioral measures, episodic future thinking, framing, cue-exposure, e.g., Berry et al., 2022; Johnson et al., 2016). Despite these threats to validity, no studies have yet examined whether (and to what extent) substance use may occur during online, remote studies. Such data are critical to the planning and execution of remote studies—researchers will likely need to experimentally or statistically control for current substance use and subjective intoxication or cravings and withdrawal symptoms, and perhaps alter instructions provided to participants.

The purpose of this pilot study, therefore, is to (1) characterize rates of substance use (i.e., alcohol, cannabis, or both) among a relatively higher use population of Prolific workers (i.e., age 18–34) on the day of the study, within the past three hours, and since starting the study; (2) provide sample demographic descriptive statistics, typical patterns of substance use, and their associations with day-of use; and (3) evaluate whether day-of substance use is associated with study completion time or performance on attention checks. We recommend best practices resulting from these findings and discuss the implications for future ethical research.

Method

Participants & procedure

U.S.-based participants ($N = 790$) aged 18–34 were recruited from Prolific for a study of women's alcohol-related sexual risk perception. Self-identified men completed the Sex and Commitment Contrast Instrument (Haselton & Buss, 2000) while women completed a version of the MacLeod Assessment of Risk Knowledge (MARK; Mitchell et al., 2017; data not reported here) and additional measures including two attention checks. Links to the study were posted on a mix of weekdays and a weekend day in 2023, including Saturday February 25th, Tuesday February 28th, Thursday March 2nd, Friday March 3rd, and Monday March 6th. Participants were free to participate at any time on these days and complete the study at their own pace. All participants completed the study between 10:22 AM and 6:34 PM. This study was approved by the University at Buffalo Institutional Review Board (STUDY00003556) and the consent form included the phrase, "You can agree to take part and later change your mind," along with the contact information for the study team.

Prolific is an online forum in which workers complete studies in exchange for money. Similar to Amazon Mechanical Turk, the platform enables researchers to recruit participants quickly, reliably, and promises high quality data. Researchers upload their study link (e.g., Qualtrics) alongside participant criteria. For this study a pre-screener asked participants about their age, country of residence, and whether they had previously completed our study. Only age and current country of residence were verified by Prolific. Prolific prevents duplicate participant accounts by requiring participants to verify their accounts *via* email and phone number, and they use IP address monitoring. We checked for duplicate IP addresses and Prolific ID numbers to ensure that participants did not complete the study more than once before deidentifying the data.

Potential participants saw a posting on Prolific stating: "This is a simple survey (about 1 h) that will ask you various questions about your drinking habits, personality, and risk perceptions." The study time in the instructions was based on an estimate from Qualtrics (63 min) and research

assistant pilot testing. Research assistants generally took approximately 35 min to complete the study, with some taking up to 60–70 min, so we informed Prolific participants that the study would take about 1 h (this was an overestimate—the actual average was approximately 24 min). Participants were paid $6 (approximately $20 per hour). Due to our high hourly rate, the sample size was achieved in five days of data collection. The analytic sample ($N = 790$) does not include suspicious entries (i.e., bots and not humans) that were removed prior to analyses for failing bot checks (i.e., could not identify a backpack in an image, solve a word puzzle, or identify an eggplant in an image; $n = 56$).

Measures

Demographics

Participants were asked to report their age, gender (i.e., "What is your current gender identity?" Response options: Woman/female; Man/male; Non-Binary [e.g., genderqueer, genderfluid]; Agender; Another identity (please describe); I choose not to respond), race/ethnicity, sexual orientation, and sexual identity (i.e., "Would you describe yourself as transgender?" Response options: Yes; No; I prefer not to respond).

Typical alcohol & cannabis use

Participants were presented with the National Institute on Alcohol Abuse and Alcoholism's (NIAAA) Recommended Alcohol Questions (NIAAA, 2003), including NIAAA's definition of a standard drink along with a visual. Questions included measures of past year frequency of drinking (times per week during the last 12 months), number of drinks (drinks per week during the last 12 months), maximum number of drinks in 24 h (drinks per day during the last 12 months), frequency of maximum drinks (times per week during the last 12 months), and frequency of binge drinking (times per week during the last 12 months), as well as lifetime maximum number of drinks (drinks within a 24-h period). If participants reported no lifetime alcohol use on the first question, and they confirmed their answer on a second page, skip logic allowed them to bypass the remaining alcohol-related questions.

Three of the six alcohol questions were adapted to measure cannabis use (past year frequency of use [times per week during the last 12 months] and grams used [grams per day during the last 12 months]; lifetime max [grams per day during the last 12 months]). Specifically, participants were first told, "The next set of questions will ask you about your cannabis use during the last 12 months and in your lifetime. Cannabis is also called marijuana, hashish, pot, grass, and weed. Cannabis is usually smoked, either in cigarettes, called joints, or in a pipe, or in a vape pen. It is sometimes cooked in food. Hashish is a form of cannabis that is also called 'hash.' It is usually smoked in a pipe. Another form of hashish is hash oil. Please use the image below to refer to various quantities of cannabis. The image is not to scale; the dollar bill is included to help provide size perspective," and presented with an image—from Cuttler & Spradlin (2017)—of a dollar bill next to amounts of cannabis in grams ranging from 0.125 grams to 1 gram. As with alcohol questions, if participants reported no lifetime cannabis use on the first question, and they confirmed their answer on a second page, skip logic allowed them to bypass the rest of the cannabis-related questions.

Day-of-study use

Participants were asked, "Have you had at least 1 full drink of alcohol… today?" "…in the past 3 h?" and "…since beginning this survey?" They were also asked, "Have you used cannabis… today?" "…in the past 3 h?" and "…since beginning this survey?" Positive responses were followed by measures of quantity (i.e., drinks or grams, respectively).

Study performance

Embedded in the study were timestamps and attention checks. One attention check given to all participants was an item that stated, "Do not enter a response to this question, please carefully read the question." For one of the aims of the larger study, participants who identified as women/female were given brief instructions (i.e., "*Please read the following 21 situations and imagine that you are the woman in the situation described. Please evaluate how risky the situation is in terms of you having an unwanted sexual experience. By unwanted, we mean a sexual experience in which you may be verbally or physically coerced into having sexual contact of any kind. Please make each evaluation as quickly as possible, because we are interested in your first impression of the situation's riskiness. You may begin in 15 s.*"). We timestamped when participants started the task to see how long they spent on the instruction page. We also gave them an attention check that asked them to "Click 'agree' for this item."

Transparency and openness

This study was not pre-registered, but, in line with JARS, we report how we determined our sample size, all data exclusions, no manipulations, and all measures (Kazak, 2018). All data on variables reported here, analysis code, and research materials are available by emailing the corresponding author. Data were analyzed using SPSS, version 29.0.0.0. Our sample size for the larger study was determined *via* G*Power a priori.

Planned analyses

We first characterized the whole sample by assessing the lifetime and past year prevalence of typical alcohol use and cannabis use. Next, we assessed prevalence of day-of-study alcohol use, cannabis use, and co-use (i.e., concurrent co-use, not simultaneous use)—including in the past three hours and since beginning the study—among participants who reported lifetime use of alcohol and/or cannabis. Then, as

validity checks, we ran logistic regression models with day-of-study use variables (0 = "no"; 1 = "yes") regressed on typical use variables. Because so few people reported day-of drinking, relationships between these variables and day-of-study drinking were not tested. We then tested whether day-of-study use was related to demographic variables, time to complete the study, study performance, and attention checks.

Results

Demographics

Participants were age 18–34 ($M = 25.11$, $SD = 3.41$, $n = 3$ chose not to respond) of whom 44.3% ($n = 350$) identified as woman/female, 49.2% ($n = 389$) identified as man/male, and 5.8% ($n = 46$) identified as another gender ($n = 5$ chose not to respond). The sample was predominantly cisgender (93.7%; $n = 740$), with 5.3% ($n = 42$) identifying as transgender ($n = 8$ chose not to respond). The racial and ethnic composition of the sample was 58.2% ($n = 460$) white, 12.4% ($n = 98$) Black/African American, 3.0% ($n = 24$) South Asian (Indian, Pakistani, etc.), 8.9% ($n = 70$) East Asian (Chinese, Japanese, etc.), 0.6% ($n = 5$) North American Indian, Alaskan Native, or Pacific Islander, 11.3% ($n = 89$) Hispanic or Latino, and 4.6% ($n = 36$) otherwise identified ($n = 8$ chose not to respond). Most of the sample identified as straight (61.6%; $n = 487$), with 18.7% ($n = 148$) identifying as bisexual, 5.6% ($n = 44$) as gay/lesbian, and 13.6% as either asexual ($n = 19$), aromantic ($n = 2$), pansexual ($n = 34$), demisexual ($n = 7$), queer ($n = 26$), multiple sexual orientations ($n = 1$), questioning/unsure ($n = 14$), or other sexual orientations ($n = 4$). Four participants preferred not to respond; see Table 1. Nearly all participants were native English speakers ($n = 769$); seventeen participants were not native English speakers, and four participants chose not to respond.

Typical alcohol & cannabis use

In this sample, 13.0% ($n = 103$) of participants reported no lifetime drinking (i.e., "I never drank any alcohol in my life"), 8.6% ($n = 68$) reported some lifetime drinking but no past year drinking (i.e., "I did drink in the past, but I did not drink any alcohol in the past year"), 77.6% ($n = 614$) reported some past year drinking (from "1 or 2 times in the past year" to "every day," $M = 1.17$ days per week, $SD = 1.41$ days; $M = 3.35$ drinks per occasion, $SD = 2.74$ drinks; scale range 1–18 drinks), and 0.6% ($n = 5$) chose not to respond (see Table 2). Moreover, 38.7% ($n = 306$) of participants in this sample reported no lifetime cannabis use (i.e., "I never used any cannabis in my life"), 19.6% ($n = 155$) reported some lifetime cannabis use but no past year use (i.e., "I did use cannabis in the past, but I did not use any cannabis in the past year"), 40.8% ($n = 322$) reported some past year cannabis use (from "1 or 2 times in the past year" to "every day," $M = 2.93$ days per week, $SD = 2.91$ days; $M = 0.53$ grams per day, $SD = 0.55$ grams; scale range 1/8 – 2 grams), and 0.9% ($n = 7$) chose not to respond (see Table 3).

Day-of-study use

Of the participants in this sample who reported lifetime use of alcohol and/or cannabis ($n = 697/790$), 11.5% ($n = 80$) participants reported use of either alcohol, cannabis, or both on the day of the study, with 7.7% ($n = 61$) reporting use in the past three hours, and 1.3% ($n = 10$) reporting use during the study. Most participants used *either* alcohol *or* cannabis *separately* (not concurrently) on the day of the study ($n = 76$), or in the past three hours ($n = 58$), and all 10 participants who reported use during the study used either alcohol ($n = 1$) or cannabis ($n = 9$) separately. That is, only four participants reported day-of-study co-use, with three of those reporting past 3-h co-use. No concurrent alcohol and cannabis use

Table 1. Participant Demographics.

	Full Sample ($N = 790$)
Age *M* (range, *SD*)	5.11 (18–34, 3.41)
Gender Identity	
Woman/female	350 (44.3)
Man/male	389 (49.2)
Another gender	46 (5.8)
Sexual Identity	
Cisgender	740 (93.7)
Transgender	42 (5.3)
Race/ethnicity	
White	460 (58.2)
Black or African American	98 (12.4)
South Asian (Indian, Pakistani, etc.)	24 (3.0)
East Asian (Chinese, Japanese, etc.)	70 (8.9)
North American Indian, Alaskan Native, or Pacific Islander	5 (0.6)
Hispanic or Latino	89 (11.3)
Otherwise Identified	36 (4.6)
Sexual Orientation	
Straight	487 (61.6)
Bisexual	148 (18.7)
Gay/Lesbian	44 (5.6)
Other Sexual Orientations[a]	107 (13.6)

*Values represent *n* (%) unless otherwise noted.
**Percentages may not add up to 100% due to missing values for those who chose not to respond (age $n = 9$; sex/gender $n = 5$; sexual identity $n = 8$; race/ethnicity $n = 8$; sexual orientation $n = 4$) and rounding.
[a]Other Sexual Orientations: asexual $n = 19$ (2.4); aromantic $n = 2$ (0.3); pansexual $n = 34$ (4.3); demisexual $n = 7$ (0.9); queer $n = 26$ (3.3); multiple sexual orientations $n = 1$ (0.1); questioning/unsure $n = 14$ (1.8); another identity $n = 4$ (0.5). Within "another identity," participants self-described: "voluntarily celibate bi" $n = 1$ (0.1); "romantically and sexually attracted to men and sexually attracted to women" $n = 1$ (0.1); "pansexual but more attracted to women than men or, you know, weird ambiguous genders" $n = 1$ (0.1); "asexual and greyromantic (= on the asexual spectrum)" $n = 1$ (0.1).

Table 2. Past Year Alcohol Use.

	n	%
I never drank any alcohol in my life	103	13.0
1 or 2 times in the past year	80	10.1
3 to 11 times in the past year	88	11.1
Once a month	68	8.6
2 to 3 times a month	120	15.2
Once a week	79	10.0
Twice a week	92	11.6
3 to 4 times a week	64	8.1
5 to 6 times a week	18	2.3
Every day	5	0.6
I did drink in the past, but I did not drink any alcohol in the past year	68	8.6
Missing	5	0.6

occurred during the study. Cannabis was overwhelmingly the substance of use reported (see Table 4).

Alcohol quantity

Only seven participants (equating to 3.7% of past year drinkers; $n = 1$ selected "I chose not to respond") reported day-of drinking ($M = 2.00$ drinks; $SD = 1.07$), six participants (1.4% of past year drinkers) reported past 3-h drinking ($M = 1.86$; $SD = 1.69$), and 1 participant (0.5% of past year drinkers) reported drinking during the study (1 drink; see Table 5). Of note, the eighth participant who chose not to respond to the question, "Have you had at least 1 full drink of alcohol today?" did respond to the question "How many drinks of alcohol have you had today?"

Cannabis quantity

Seventy-seven participants (equating to 23.9% of people who reported past year cannabis use; $n = 4$ selected "I chose not to respond") reported day-of cannabis use ($M = 0.63$ grams; $SD = 0.93$), 58 participants (18.0% of people who reported past year cannabis use) reported past 3-h use ($M = 0.81$ grams; $SD = 1.15$), and nine participants (2.8% of people who reported past year cannabis use) reported use during the study ($M = 0.86$ grams; $SD = 1.25$; see Table 6). Four participants chose not to respond to the cannabis frequency question and four participants also declined to answer the quantity question.

Validity checks

Past year drinking and cannabis use Quantity*Frequency. Past year drinking Quantity*Frequency (QF; Straus & Bacon, 1953) was related to day-of use, OR = 1.05 (95% CI 1.03, 1.08) but past year cannabis use QF was not related to day-of use, OR = 1.00 (95% CI 0.99, 1.00).

Past year max drinks, Quantity*Frequency, and binge drinking. Past year max drinks QF was related to day-of use, OR = 1.05 (95% CI 1.02, 1.08), as was past year binge drinking, OR = 1.64 (95% CI 1.28, 2.10). Finally, lifetime drinks max was related to day-of use, OR = 1.07 (95% CI 1.04, 1.11). For lifetime cannabis use max, 69 of 77 participants reported a lifetime max of 1 gram or more and 63 of 77 reported 2+ grams. Log-transformed lifetime cannabis use max was related to day-of use, OR = 5.25 (95% CI 3.32, 8.32).

Age, gender, race/ethnicity, and sexual orientation/identity

Age was not correlated with day-of use, $p = 0.844$. The total sample ($n = 790$) comprised 44.3% individuals who self-identified as woman/female, 49.2% who identified as man/male, and 5.8% who identified as another gender. In the subsample ($n = 80$) of those who reported day-of use, 41.3% identified as woman/female, 50.0% as man/male, and 8.8% as another gender. The racial and ethnic composition of the subsample of participants who reported day-of use somewhat mirrored that of the larger sample: The participants who reported day-of use were 63.7% (vs. 58.2% in the larger sample) white, 11.3% (vs. 12.4%) Black/African American, 2.5% (vs. 8.9%) East Asian, 13.8% (vs. 11.3%) Hispanic or Latino, and 6.3% (vs. 4.6%) otherwise identified. Similarly, straight individuals made up 61.6% of the larger sample and 60.0% of the subsample that reported day-of use. Bisexual people made up 18.7% of the larger sample and 20.1% of the subsample. There were only 34 pansexual people in the larger sample, however nearly one third (i.e., 10) reported day-of study use, which equated to 12.5% of those who reported such use. One of the 14 participants who identified as questioning/unsure reported day-of-use. There were only 26 queer people in the larger sample, but 3 (3.8%) reported day-of use. Similarly, transgender individuals made up 5.3% of the larger sample, but 8.8% of the subsample who reported day-of study use.

Study performance

The average time to complete the study was 23.01 min ($SD = 14.82$ min.; *range* = 4.5 min. – 1.89 hr.; *Quartiles 1–3* = 13.25 – 27.53 min.). The mean completion time for those who did not report any use on the day of the study

Table 3. Past Year Cannabis Use.

	n	%
I never used any cannabis in my life	306	38.7
I did use cannabis in the past, but I did not use any cannabis in the past year	155	19.6
1 or 2 times in the past year	49	6.2
3 to 11 times in the past year	49	6.2
Once a month	16	2.0
2 to 3 times a month	27	3.4
Once a week	17	2.2
Twice a week	15	1.9
3 to 4 times a week	37	4.7
5 to 6 times a week	29	3.7
Every day	83	10.5
Missing	7	0.9

Table 4. Day-of Alcohol and Cannabis Use.

	Yes	No	Did not see question	Chose not to respond
Have you had at least 1 full drink of alcohol today? [a]	7 (0.9)	679 (85.9)	103 (13.0)	1 (0.1)
Have you had at least 1 full drink of alcohol in the past 3 h?	6 (0.8)	1 (0.1)	782 (99.0)	1 (0.1)
Have you had at least 1 full drink of alcohol since beginning this survey?	1 (0.1)	6 (0.8)	783 (99.1)	0 (0.0)
Have you used cannabis today?	77 (9.7)	405 (51.3)	304 (38.5)	4 (0.5)
Have you used cannabis in the past 3 h?	58 (7.3)	21 (2.7)	709 (89.7)	2 (0.3)
Have you used cannabis since beginning this survey?	49 (6.2)	9 (1.1)	730 (92.4)	2 (0.3)

*Values represent *n* (% of 790).
[a] Percentages do not add up to 100% due to rounding.

Table 5. Day-of Alcohol Use Quantity.

	How many drinks of alcohol have you had today?		How many drinks of alcohol have you had in the past 3 h?		How many drinks of alcohol have you had since beginning this survey?	
	n	%	*n*	%	*n*	%
1 drink	3	0.4%	3	0.4%	1	0.1%
2 drinks	3	0.4%	3	0.4%	0	–
3 drinks	1	0.1%	0	–	0	–
4 drinks	1	0.1%	1	0.1%	0	–

Table 6. Day-of Cannabis Use Quantity.

	How much cannabis did you use today?		How much cannabis did you use in the past 3 h?		How much cannabis did you use since beginning this survey?	
	n	%	*n*	%	*n*	%
1/8 gram	38	4.8%	34	4.3%	6	0.8%
1/4 gram	18	2.3%	7	0.9%	0	–
1/2 gram	9	1.1%	12	1.5%	2	0.3%
3/4 gram	3	0.4%	1	0.1%	0	–
1 gram	8	1.0%	4	0.5%	1	0.1%
2 grams	1	0.1%	0	–	0	–

was 23.53 whereas the mean for those who did report any use on the day of the study was over a minute slower at 24.62, but the difference was not significant. All participants started the study during regular business hours, between 10:22 AM and 5:19 PM and finished the study between 10:48 AM and 6:34 PM. The range of start times for those who did not report day-of study use was 10:22 AM to 6:19 PM whereas for the range of start times for those who did began slightly later at 10:35 AM and ended earlier at 3:36 PM. The range of completion times for those who did not report day-of use was 10:48 AM to 6:34 PM, and—like start times—the window of completion times for those who did report day-of use began slightly later at 10:51 AM and ended earlier at 4:29 PM. The later opening/earlier closing windows of the start/completion time among those who reported day-of study use were not significantly different from windows of start/completion times among those who did not report day-of study use. However, there were day-of-the-week group differences. Participants who took the survey on Saturday were nearly five times more likely to report day-of use than those who took the survey on a weekday, OR = 4.92 (95% CI = 1.74, 13.93), though this should be interpreted with caution as data from only 19 participants were collected on Saturday.

Attention checks

Only $n = 4$ participants failed the "do not respond" attention check, so analyses were not conducted. Participants who identified as women/female were given brief instructions, which we timestamped to see how long they spent on the page after a 10 sec. mandatory timer. Women who did not report day of use spent an average of only 17.54 sec. ($SD = 26.14$) on the instruction page before advancing, whereas women who did report day-of use spent an average of 21.51 sec. ($SD = 30.80$) on the instruction page, though this difference was not significant. Finally, only one woman failed the "click agree" attention check, so analyses were not conducted.

Discussion

As online, remote research has proliferated, researchers seek to establish best practices for crowdsourced addiction research (Mellis & Bickel, 2020). Here, we take a first step toward improving the validity of our crowdsourced data by examining the extent to which substance use occurs during online, remote studies. Specifically, we found that (1) of the participants in this sample who reported lifetime use of alcohol and/or cannabis, 11.5% reported use of either alcohol, cannabis, or both on the day of the study, with 7.7% reporting use in the past three hours, and 1.3% reporting use during the study, but use was primarily of cannabis, and only four participants reported co-use. That is, 3.7% of past year drinkers reported day-of alcohol use, but 23.9% of people who reported past year cannabis use reported day-of cannabis use on the day of study completion. We further found (2) several drinking and cannabis use patterns are associated with day-of use; and (3) day-of use is not significantly associated with study performance, but some predictable patterns of means emerged.

Past year drinking QF, max drinks QF, binge drinking, and lifetime drinks max all predicted day-of use. Past year cannabis QF was not related to day-of use, but lifetime cannabis use max was. Age was not related to day-of use, but some demographics tended to be over-represented in the subsample of 80 participants who reported day-of use verses the whole sample of 790 participants. For example, 8.8% of the subsample (vs. 5.8% of the whole sample) identified as a gender other than woman/female or man/male, 20.1% of the subsample (vs. 18.7% of the larger sample) identified as bisexual, and 8.8% of the subsample (vs. 5.3% of the larger sample) identified as transgender. Moreover, nearly one third (i.e., 10) of the 34 pansexual people in the larger sample reported day-of study use, which equated to 12.5% of those who reported such use. With regard to the racial and ethnic composition of the subsample of participants who reported day-of use, notable differences were that there were slightly higher percentages of Hispanic or Latino (13.8% vs. 11.3%) and otherwise self-identified (6.3% vs. 4.6%) individuals in the subsample of those who reported day-of use. Additionally, the study start times and completion times for those who reported day-of use were slightly later, and earlier, respectively. That is, while all participants started the study after 10:22 AM and finished before 6:34 PM, those who reported day-of use started after 10:35 AM and finished before 4:29 PM. They were also five times more likely to complete the study on a Saturday. Finally, women who reported day-of use spent about 3 sec. longer on an instruction page than their peers, though this difference was not significant. Taken together, this is the first characterization of alcohol and cannabis use on the day of the study in an online sample of participants.

Regarding best practices, it will be imperative for addiction scientists to collect data on day-of study use, time since last use, route of administration, and dose, so that they

might statistically control for substance use and intoxication during remote research. This is especially important given variation in time course and peak effects of drugs that may be dose-dependent (Schlienz et al., 2020; Vena et al., 2020). To address potential interactive drug effects (Landry et al., 2022; Weathermon & Crabb, 1999), collecting information on prescribed or other medications taken may be helpful. Researchers may also pose a question regarding contents and time of the last meal or snack consumed, given food consumption effects on drug and alcohol absorption (Cederbaum, 2012; Clapp et al., 2006; Wilkinson et al., 1977a; 1977b). Similar questions (e.g., time since last use) are also relevant for in-person laboratory studies for informational purposes, especially when recent substance use could interact with an experimental manipulation or with attention required to complete the survey.

Another key consideration will be to provide explicit instructions to participants about not using substance(s) within a certain timeframe of participating in the study. If doing so, researchers should be aware of any craving or withdrawal effects that may ensue and ensure proper controls for these effects, especially for research delivered remotely. Although such issues including craving, withdrawal, and food consumed should also be accounted for in laboratory settings, in-person relative to remote sessions allow for increased monitoring, control, and objective measures. For example, current carbon monoxide levels among smokers are often obtained in laboratory settings (Johnson & Bickel, 2006), as are Breath Alcohol Concentration measures among those who use alcohol or other substance (Berry et al., 2022; 2023), and standardized low fat food is often served in laboratory sessions where controlled doses of drugs are administered (Berry et al., 2022; 2023). Such measures may be more difficult to obtain, and it may be more difficult to control consumption remotely, highlighting the importance of this research as an initial step.

Finally, researchers might consider including measures of subjective intoxication, sophisticated attention checks, or cognitive tasks that may be influenced by participants' substance use. They might also consider including measures of mood, affect, and personality, as recent reviews have noted that alcohol and cannabis use are tightly linked to emotion regulation and affect (Brown & Melas, 2024; Wycoff et al., 2018). Of note, future studies may consider testing whether participants who reported day-of use experience reductions in social anxiety and/or increases in social extraversion. This is in line with findings from Arditte et al. (2016) who report that online participants tend to be high in social anxiety, and Winograd et al. (2015) who found that those who evince low Extraversion when sober also evince above-average increases in Extraversion and below-average decreases in Conscientiousness when drunk.

Moreover, researchers might consider conducting longitudinal crowdsourced studies with repeated measures so that days with and without substance use may be compared within-subject. This leads to a logical next step and exciting avenue for natural experiments in which researchers may observe differences in study outcomes based on self-reported substance use during the remote research, which may serve as alternatives for—or adjuncts to—substance administration studies. With Institutional Review Board approval and consent obtained *via* video conferencing, instructions to use a controlled dose of participants' typical substance(s) before completing crowdsourced studies may offer ecologically valid methodological extensions that complement laboratory-based administration studies. As one step further, researchers have been called to conduct remote substance administration studies *via* video conferencing equipment. A recent unpublished qualitative study revealed that individuals eligible for alcohol administration studies are interested in participating in remote studies, and recently, the first remote alcohol administration study was approved by the University of Florida Institutional Review Board and the protocol can be found on OSF (Hone et al., 2024). To ensure that participants do not use alcohol or other substances that would interfere with the study prior to the session, over-the-counter urine tests can be sent to participants and taken at home and results shown on screen. To test that the alcohol being consumed is the correct alcohol by volume, hydrometers can also be sent to participants' homes to test the alcohol content of any beverages to be consumed on screen as part of a remote administration study (https://osf.io/ms2c6/).

Laboratory administration studies are vital for elucidating etiological aspects of misuse (e.g., subjective response; effects on cognition/inhibitory control). However, they are costly, require extensive regulatory approvals, and half of targeted individuals in the general population are typically excluded (e.g., alcohol clinical trials; Blanco et al., 2008), challenging inclusive recruiting (Moberg & Humphreys, 2017). Remote studies afford researchers with cost-efficiency, sample and geographic diversity, and access to hard-to-reach populations (Buhrmester et al., 2011; Sassenberg & Ditrich, 2019; Strickland et al., 2022; Strickland & Stoops, 2019). Supplementing administration studies with remote research may enable addiction scientists to account for some generalizability limitations. The data provided in this manuscript may facilitate planning and implementation of novel, remote addiction research, while simultaneously addressing some weaknesses of remote research.

However, collecting data from intoxicated individuals presents several issues including ethics regarding informed consent, and validity of data provided when intoxicated (Davis, 2020; Klein et al., 2016). During in-person research, researchers can identify capacity to consent by asking questions about the consent procedure using the University of California, San Diego Brief Assessment of Capacity to Consent (UBACC; Jeste et al., 2007), and withdraw consent when appropriate (Davis, 2020) while still paying participants for their time and providing safe passage home. They may obtain provisional consent, which may be confirmed within the next few days, giving participants the opportunity to opt out and have their data destroyed. Given 10% of this sample reported alcohol or cannabis use on the day of the study, similar ethics concerning consent of intoxicated participants must be considered in future crowdsourced studies. Fortunately, no participant in our study consumed more than four drinks in the past three hours (two participants consumed 4 drinks; everyone else who reported drinking

had one or two drinks, and two drinks should not result in significant problems even for people with low tolerance), so capacity to consent was likely not altered by alcohol as bodies can process approximately one drink per hour (Bondy et al., 1999). A handful of participants reported using up to one gram of cannabis in the past three hours, but it is impossible to know how this may have influenced capacity to consent as there is no equivalent to the UBACC for cannabis, Tetrahydrocannabinol (THC) levels are difficult to discern, and individual differences in tolerance may be at play. Capacity to consent might not be possible to assess in real time, but opportunities to opt out in the following days may be one option that could be offered to participants who reported day-of use. Indeed, we included the phrase, "You can agree to take part and later change your mind," along with the contact information for the study team in our consent form (no participants withdrew consent after the fact). These important concerns will need to be addressed in future survey research by researchers and IRBs together. Moreover, data quality checks and subjective intoxication measures could be used with attention checks, and extreme responses could be used to identify capacity to consent, according to pre-determined cutoffs as surveys are submitted and monitored by research staff.

Limitations

Our sample comprised Prolific participants aged 18–34, which is a higher use population that the general population, and our measures were limited to alcohol and cannabis use. The collection of data *via* a single crowdsource site at a single time point also limits the interpretation of these findings. Future studies of additional substances (e.g., nicotine) in both more targeted (e.g., samples of individuals who use substances) and general populations (e.g., older than 34) at multiple time points *via* other sites (e.g., MTurk) would be useful, especially given only eight of our participants reported day-of study drinking. That is, given over 10% of our sample reported day-of use, the percent of the sample who report day-of use will likely be higher in a targeted sample of those who drink or use cannabis more frequently. Moreover, due to the sensitive nature of the study topic, as an Institutional Review Board requirement, participants were always given an "I choose not to respond," response option, or, in some cases, participants could skip questions that they did not want to answer. Thus, there was substantial missing data. Finally, as with any self-report data, our results are subject to bias as measures of alcohol and cannabis use are subjective and not objective. However, a strength of this study may be the anonymity provided to participants, which may have encouraged honest responses. Overall, skepticism concerning validity of crowdsourced data is not unfounded (Ternovski et al., 2022), but several recent papers, including a review of using MTurk to study substance use (Mellis & Bickel, 2020), have noted that high quality data collection on crowdsourcing platforms is possible.

Finally, our attention checks failed to yield usable data for the purposes of this study. The attention check given to all participants was an item that stated, "Do not enter a response to this question, please carefully read the question," and this item could be passed if participants refrained from answering or if they skipped over the question. Moreover, participants who identified as men did not see the second attention check and we did not timestamp any of their instructions. Future studies should use more sophisticated attention checks to assess the effects of intoxication in remote research.

Conclusion

Rates of day-of study alcohol and cannabis use among participants using crowdsourcing platforms have been undocumented to date. This is the first study to report on day-of use in a crowdsourced sample of relatively higher use population of Prolific workers aged 18–34 on a range of weekdays and times: Rates greater than 10% were observed, and several use patterns were associated with day-of use (e.g., past year binge drinking was associated with day-of use). Day-of use was not associated with longer study completion times or time spent on instruction pages (though means were in the expected direction). Attention check analyses were inconclusive. Future studies should characterize rates in other crowdsource populations, especially given the high percentages of certain sex and gender diverse individuals in the subsample of individuals who reported day-of use relative to the whole sample of 790 individuals. This study potentially sets the stage for studies that use naturalistic experiments to complement laboratory drug- and alcohol-administration studies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research was supported from NIAAA by grants and contracts F32AA025830 and L30AA027013 (PI: LSEH), and R21DA056813 (MSB). MSB gratefully acknowledges that her time was also supported in part by NIDA grant K01DA052673. The funding sources had no role other than financial support.

References

Aguinis, H., Villamor, I., & Ramani, R. S. (2021). MTurk research: Review and recommendations. *Journal of Management*, *47*(4), 823–837. https://doi.org/10.1177/0149206320969787

Almog, S., Vásquez Ferreiro, A., Berry, M. S., & Rung, J. M. (2023). Are the attention checks embedded in delay discounting tasks a valid marker for data quality? *Experimental and Clinical Psychopharmacology*, *31*(5), 908–919. https://doi.org/10.1037/pha0000645

Amlung, M., McCarty, K. N., Morris, D. H., Tsai, C., & McCarthy, D. M. (2015). Increased behavioral economic demand and craving for alcohol following a laboratory alcohol challenge. *Addiction*, *110*(9), 1421–1428. https://doi.org/10.1111/add.12897

Anderson, C. A., Allen, J. J., Plante, C., Quigley-McBride, A., Lovett, A., & Rokkum, J. N. (2019). The MTurkification of social and personality psychology. *Personality & Social Psychology Bulletin*, *45*(6), 842–850. https://doi.org/10.1177/0146167218798821

Arditte, K. A., Çek, D., Shaw, A. M., & Timpano, K. R. (2016). The importance of assessing clinical phenomena in Mechanical Turk research. *Psychological Assessment*, *28*(6), 684–691. https://doi.org/10.1037/pas0000217

Berry, M. S., Bruner, N. R., Herrmann, E. S., Johnson, P. S., & Johnson, M. W. (2022). Methamphetamine administration dose effects on sexual desire, sexual decision making, and delay discounting. *Experimental and Clinical Psychopharmacology*, *30*(2), 180–193. https://doi.org/10.1037/pha0000398

Berry, M. S., Naudé, G. P., Johnson, P. S., & Johnson, M. W. (2023). The blinded-dose purchase task: Assessing hypothetical demand based on cocaine, methamphetamine, and alcohol administration. *Psychopharmacology*, *240*(4), 921–933. https://doi.org/10.1007/s00213-023-06334-6

Blanco, C., Olfson, M., Okuda, M., Nunes, E. V., Liu, S. M., & Hasin, D. S. (2008). Generalizability of clinical trials for alcohol dependence to community samples. *Drug and Alcohol Dependence*, *98*(1-2), 123–128. https://doi.org/10.1016/j.drugalcdep.2008.05.002

Bondy, S. J., Rehm, J., Ashley, M. J., Walsh, G., Single, E., & Room, R. (1999). Low-risk drinking guidelines: The scientific evidence. *Canadian Journal of Public Health = Revue Canadienne de Sante Publique*, *90*(4), 264–270. https://doi.org/10.1007/BF03404129

Brown, W. C., & Melas, M. T. (2024). A narrative review of emotion regulation abilities, strategy use, and their relationship to alcohol. *Current Addiction Reports*, *11*(2), 199–209. https://doi.org/10.1007/s40429-024-00553-3

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*(1), 3–5. https://doi.org/10.1177/1745691610393980

Cederbaum, A. I. (2012). Alcohol metabolism. *Clinics in Liver Disease*, *16*(4), 667–685. https://doi.org/10.1016/j.cld.2012.08.002

Clapp, J. D., Min, J. W., Shillington, A. M., Reed, M. B., Lange, J. E., & Holmes, M. R. (2006). Environmental and individual predictors of error in field estimates of blood alcohol concentration: A multilevel analysis. *Journal of Studies on Alcohol*, *67*(4), 620–627. https://doi.org/10.15288/jsa.2006.67.620

Cuttler, C., & Spradlin, A. (2017). Measuring cannabis consumption: Psychometric properties of the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU). *PLoS One*, *12*(5), e0178194. https://doi.org/10.1371/journal.pone.0178194

Davis, C. N. (2020). Guidelines and recommendations for training ethical alcohol researchers. *Training and Education in Professional Psychology*, *14*(1), 52–59. https://doi.org/10.1037/tep0000257

Englund, A., Sharman, S., Tas, B., & Strang, J. (2022). Could COVID expand the future of addiction research? Long-term implications in the pandemic era. *Addiction*, *117*(8), 2135–2140. https://doi.org/10.1111/add.15790

Field, M., Santarcangelo, M., Sumnall, H., Goudie, A., & Cole, J. (2006). Delay discounting and the behavioural economics of cigarette purchases in smokers: The effects of nicotine deprivation. *Psychopharmacology*, *186*(2), 255–263. https://doi.org/10.1007/s00213-006-0385-4

Grabski, M., Curran, H. V., Nutt, D. J., Husbands, S. M., Freeman, T. P., Fluharty, M., & Munafò, M. R. (2016). Behavioural tasks sensitive to acute abstinence and predictive of smoking cessation success: A systematic review and meta-analysis. *Addiction*, *111*(12), 2134–2144. https://doi.org/10.1111/add.13507

Haselton, M. G., & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology*, *78*(1), 81–91. https://doi.org/10.1037/0022-3514.78.1.81

Hone, L.S.E., Masterson, A.P., Rohleen, T.K., Leeman, R.F., Remote Alcohol Administration Research, 2024, Retrieved from osf.io/ms2c6

Jeste, D. V., Palmer, B. W., Appelbaum, P. S., Golshan, S., Glorioso, D., Dunn, L. B., Kim, K., Meeks, T., & Kraemer, H. C. (2007). A new brief instrument for assessing decisional capacity for clinical research. *Archives of General Psychiatry*, *64*(8), 966–974. https://doi.org/10.1001/archpsyc.64.8.966

Johnson, M. W., & Bickel, W. K. (2006). Replacing relative reinforcing efficacy with behavioral economic demand curves. *Journal of the Experimental Analysis of Behavior*, *85*(1), 73–93. https://doi.org/10.1901/jeab.2006.102-04

Johnson, P. S., Sweeney, M. M., Herrmann, E. S., & Johnson, M. W. (2016). Alcohol increases delay and probability discounting of condom-protected sex: A novel vector for alcohol-related HIV transmission. *Alcoholism, Clinical and Experimental Research*, *40*(6), 1339–1350. https://doi.org/10.1111/acer.13079

Kazak, A. E. (2018). Editorial: Journal article reporting standards. *The American Psychologist*, *73*(1), 1–2. https://doi.org/10.1037/amp0000263

Klein, L., Miner, J., Cole, J., Mack, K., Nystrom, P., Biros, M., & Martel, M. (2016). 218 acutely intoxicated patients' ability to provide informed consent to research in the emergency department. *Annals of Emergency Medicine*, *68*(4), S85. https://doi.org/10.1016/j.annemergmed.2016.08.232

Landry, I., Hall, N., Aluri, J., Filippov, G., Setnik, B., Dayal, S., Reyderman, L., & Moline, M. (2022). Effect of alcohol coadministration on the pharmacodynamics, pharmacokinetics, and safety of lemborexant: A randomized, placebo-controlled crossover study. *Journal of Psychopharmacology*, *36*(6), 745–755. https://doi.org/10.1177/02698811221080459

Mellis, A. M., & Bickel, W. K. (2020). Mechanical Turk data collection in addiction research: Utility, concerns and best practices. *Addiction*, *115*(10), 1960–1968. https://doi.org/10.1111/add.15032

Mitchell, J. C., MacLeod, B. P., & Cassisi, J. E. (2017). Modeling sexual assault risk perception among heterosexual college females: The impact of previous victimization, alcohol use, and coping style. *Violence Against Women*, *23*(2), 143–162. https://doi.org/10.1177/1077801216638767

Moberg, C. A., & Humphreys, K. (2017). Exclusion criteria in treatment research on alcohol, tobacco and illicit drug use disorders: A review and critical analysis. *Drug and Alcohol Review*, *36*(3), 378–388. https://doi.org/10.1111/dar.12438

Porter, C. O. L. H., Outlaw, R., Gale, J. P., & Cho, T. S. (2019). The use of online panel data in management research: A review and recommendations. *Journal of Management*, *45*(1), 319–344. https://doi.org/10.1177/0149206318811569

Roberts, A., Rogers, J., Mason, R., Siriwardena, A. N., Hogue, T., Whitley, G. A., & Law, G. R. (2021). Alcohol and other substance use during the COVID-19 pandemic: A systematic review. *Drug and Alcohol Dependence*, *229*(Pt A), 109150. https://doi.org/10.1016/j.drugalcdep.2021.109150

Rung, J. M., Almog, S., Vásquez Ferreiro, A., & Berry, M. S. (2022). Using crowdsourcing for alcohol and nicotine use research: Prevalence, data quality, and attrition on Amazon Mechanical Turk. *Substance Use & Misuse*, *57*(6), 857–866. https://doi.org/10.1080/10826084.2022.2046096

Sassenberg, K., & Ditrich, L. (2019). Research in social psychology changed between 2011 and 2016: Larger sample sizes, more self-report measures, and more online studies. *Advances in Methods and Practices in Psychological Science*, *2*(2), 107–114. https://doi.org/10.1177/2515245919838781

Schick, M. R., Spillane, N. S., & Hostetler, K. L. (2020). A call to action: A systematic review examining the failure to include females and members of minoritized racial/ethnic groups in clinical trials of pharmacological treatments for alcohol use disorder. *Alcoholism, Clinical and Experimental Research*, *44*(10), 1933–1951. https://doi.org/10.1111/acer.14440

Schlienz, N. J., Spindle, T. R., Cone, E. J., Herrmann, E. S., Bigelow, G. E., Mitchell, J. M., Flegel, R., LoDico, C., & Vandrey, R. (2020). Pharmacodynamic dose effects of oral cannabis ingestion in healthy adults who infrequently use cannabis. *Drug and Alcohol Dependence*, *211*, 107969. https://doi.org/10.1016/j.drugalcdep.2020.107969

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back. In *Measuring alcohol consumption* (pp. 41–72). Humana Press.

Stewart, N., Chandler, J., & Paolacci, G. (2017). Crowdsourcing samples in cognitive science. *Trends in Cognitive Sciences*, *21*(10), 736–748. https://doi.org/10.1016/j.tics.2017.06.007

Straus, R., & Bacon, S. D. (1953). *Drinking in college*. Yale University Press.

Strickland, J. C., Amlung, M., & Reed, D. D. (2022). Crowdsourcing methods in addiction science:emerging research and best practices. *Experimental and Clinical Psychopharmacology*, *30*(4), 379–380. https://doi.org/10.1037/pha0000582

Strickland, J. C., & Stoops, W. W. (2019). The use of crowdsourcing in addiction science research: Amazon Mechanical Turk. *Experimental and Clinical Psychopharmacology*, *27*(1), 1–18. https://doi.org/10.1037/pha0000235

Substance Abuse and Mental Health Services Administration. (2022). *Key Substance Use and Mental Health Indicators in the United States: Results from the 2021 National Survey on Drug Use and Health (HHS Publication No. PEP22-07-01-005, NSDUH Series H-57)*. https://www.samhsa.gov/data/report/2021-nsduh-annual-national-report

Ternovski, J., Orr, L., Kalla, J., & Aronow, P. (2022). A note on increases in inattentive online survey-takers since 2020. *Journal of Quantitative Description: Digital Media*, *2022*, 2. https://doi.org/10.51685/jqd.2022.002

Vena, A., Howe, M., Fridberg, D., Cao, D., & King, A. C. (2020). The feasibility, tolerability, and safety of administering a very high alcohol dose to drinkers with alcohol use disorder. *Alcoholism, Clinical and Experimental Research*, *44*(12), 2588–2597. https://doi.org/10.1111/acer.14478

Walter, S. L., Seibert, S. E., Goering, D., & O'Boyle, E. H. (2019). A tale of two sample sources: Do results from online panel data and conventional data converge? *Journal of Business and Psychology*, *34*(4), 425–452. https://doi.org/10.1007/s10869-018-9552-y

Weathermon, R., & Crabb, D. W. (1999). Alcohol and medication interactions. *Alcohol Research & Health*, *23*(1), 40–54.

Wilkinson, P. K., Sedman, A. J., Sakmar, E., Kay, D. R., & Wagner, J. G. (1977). Pharmacokinetics of ethanol after oral administration in the fasting state. *Journal of Pharmacokinetics and Biopharmaceutics*, *5*(3), 207–224. https://doi.org/10.1007/BF01065396

Wilkinson, P. K., Sedman, A. J., Sakmar, E., Lin, Y. J., & Wagner, J. G. (1977). Fasting and nonfasting blood ethanol concentrations following repeated oral administration of ethanol to one adult male subject. *Journal of Pharmacokinetics and Biopharmaceutics*, *5*(1), 41–52. https://doi.org/10.1007/BF01064808

Wycoff, A. M., Metrik, J., & Trull, T. J. (2018). Affect and cannabis use in daily life: A review and recommendations for future research. *Drug and Alcohol Dependence*, *191*, 223–233. https://doi.org/10.1016/j.drugalcdep.2018.07.001