Cross-sectional retrospective assessments versus longitudinal prospective assessments of substance use change among young adults during COVID-19: Magnitude and correlates of discordant findings

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Abstract

Significance.—Findings regarding changes in substance use since COVID-19 have been mixed, potentially due to differences in methods used to assess change. Thus, we compared changes in substance use per retrospective self-report at one time-point (March-May 2020) versus prospective, longitudinal self-report across 2 time-points (Sept-Dec 2019; March-May 2020), and identified predictors of discordance.

Methods.—We analyzed data from a longitudinal study of 1,082 young adults from 6 metropolitan areas. Across cigarettes, e-cigarettes, marijuana, and alcohol, participants were categorized as Increasers (increased based on both methods), Decreasers/Stable (decreased/ same per both methods), Over-reporters (decreased/same per longitudinal data/increased via retrospective report), or Under-reporters (increased per longitudinal data/decreased/same via retrospective report). We identified predictors (e.g., sociodemographics, pre-pandemic substance use levels) of Under-reporting.

Results.—In this sample (M_{age}=24.77; 45.7% male, 32.1% sexual minority, 4.0% Black, 12.4% Asian, 12.6% Hispanic), longitudinal data indicated that the proportions of cigarette, e-cigarette, marijuana, and alcohol users who increased their use were 43.3%, 41.7%, 52.6%, and 55.6%, respectively. Examining concordance/discordance groups, Under-reporters accounted for between

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17.7% (alcohol) and 26.8% (e-cigarette) of users; over-reporters comprised among the smallest proportions of each group (17.4% for alcohol to 22.2% for marijuana). Multivariable regression indicated that predictors of Under-reporting were less pre-pandemic use across substances; being older for e-cigarettes; and being older, male, and Asian for alcohol.

Conclusions.—Findings highlight methodological variability as a potential reason for mixed findings regarding pandemic-related substance use change and underscore the need for rigorously designed research to accurately assess the population impact of COVID-19 and other historical events.

Keywords

COVID-19; substance use; retrospective report; longitudinal change; young adults

INTRODUCTION

COVID-19 was characterized as a global pandemic on March 11, 2020; by the end of March 2020, over half of US states mandated stay-at-home orders.[1,2] Public health efforts to mitigate the spread of COVID-19 led to social and economic stressors potentially related to mental health problems[3] and coping-related substance use.[4]

Research regarding substance use change during COVID-19 has been mixed with some studies suggesting increases in substance use (i.e., tobacco, alcohol, marijuana)[5] and others suggesting stability.[6] With regard to specific substances, some studies suggest increases in tobacco (cigarettes,[7] e-cigarettes,[8] overall tobacco[9]), alcohol,[7,10–13] and marijuana,[10,12–14] some suggest decreases in tobacco (cigarettes,[12,13] e-cigarettes[10,15]) and marijuana,[16] and others suggest stable use of tobacco,[17] alcohol,[6] and marijuana.[7]

Differences in the assessment of substance use change across studies may explain inconsistencies. Whereas some research used prospective, longitudinal data to characterize change (before to during COVID-19),[11,13] a large proportion relied on retrospective cross-sectional survey data.[6,7,9,10,12,14,15,17] Because shorter recall periods of substance use produce more reliable estimates relative to longer periods (which often result in under-reporting use),[18–22] data from the latter approach may yield unreliable pre-COVID-19 use estimates.

To shed light on the implications of using retrospective recall to assess COVID-19 related substance use change and reasons for inconsistencies in the literature, the current study compared changes in substance use based on individual retrospective self-report at one time-period (March-May 2020) versus prospective, longitudinal self-report across 2 time-periods (Sept-Dec 2019; March-May 2020), and identified predictors of discordance.

METHODS

Study Overview

This study analyzed data from a 2-year, 5-wave longitudinal study of 3,006 young adults (aged 18–34 at Wave 1 [W1]) in 6 metropolitan statistical areas (MSAs; Atlanta, Boston,

Minneapolis, Oklahoma City, San Diego, Seattle), described elsewhere.[23] Participants were recruited via social media in Fall 2018, using purposive, quota-based sampling to target tobacco/e-cigarette users.[23] We analyzed data from W3 (Fall 2019) and W4, which launched in February 2020 but was interrupted in mid-March to add COVID-related items. The W4 sample was 2,159 (71.2% of W1 N=3,006); the number completing W4 after COVID-related items were added was 1,082 (69.4% of the 1,559 contacted after W4 was interrupted). See Figure 1 for details.

Measures

Outcomes: Substance Use Change and Concordance/Discordance.—Two sets of assessments were used to operationalize concordant versus discordant reports from prospective versus retrospective reports. First, at W3 and W4, participants reported frequency of past 30 day use of cigarettes, e-cigarettes, marijuana, and alcohol. Among those reporting any past-month use at W4 (cigarettes: n=233, e-cigarettes: n=288, marijuana: n=414, alcohol: n=818), we subtracted number of days used at W3 from W4 reports. We then categorized users as: 1) increasers (>0 days change) versus 2) decreasers/stable (0 days change); we collapsed decreasers/stable for parsimony, interpretability, and to focus on the high-risk behavior of increased use.

Second, at W4, participants were asked, "Compared to before COVID-19, are you doing more or less of the following: using tobacco (other than e-cigarettes)? vaping (nicotine)? using marijuana? drinking alcohol? much more, somewhat more, no different, somewhat less, much less, not applicable, refuse" – then categorized as: 1) increasers (i.e., much more, somewhat more) versus 2) decreasers/stable (i.e., somewhat less, much less, no different).

Participants were categorized as: 1) Increasers (concordant); 2) Decreasers/Stable (concordant); 3) Over-reporters (decreased/same per W3-W4 substance use but increased per W4 self-report); or 4) Under-reporters (increased per W3-W4 scores but decreased/same per W4 self-report). We excluded W4 nonusers, as ~50% of these participants across substances indicated N/A for the retrospective assessment.

Sociodemographics.—At W1, age, sex, sexual orientation, race, ethnicity, education level, marital status/living with partner, and children in the home were assessed.

Data Analysis

Analyses were conducted using SPSS 26. We characterized our sample using descriptive statistics and conducted multivariable regressions examining predictors of being an "Under-reporter" for each substance. Each model included sociodemographics (excluding education, employment, marital status, and children in the home, due to multicollinearity with age) and W3 substance use.

RESULTS

Table 1 presents participant characteristics. Supplementary Table 1 provides an overview of differences between W4 past-month users versus non-users for each substance. The percentage of participants who increased use based on prospective change scores ranged

from 41.7% (e-cigarettes) to 55.6% (alcohol), whereas those who increased use based on retrospective self-report change scores ranged from 31.2% (e-cigarettes) to 53.8% (alcohol; Table 2).

Participants using every day of the past 30 days at W3 ranged from 0.9% (alcohol) to 33.7% (e-cigarettes). Among W3 daily users, those also using daily at W4 ranged from 74.0% (cigarettes) to 86.5% (e-cigarettes). W3 daily users who decreased their number of days of W4 use ranged from 13.5% (e-cigarette users) to 26.0% (cigarette users).

Regarding *use change concordance/discordance,* the largest category was Decreasers/Stable (41.0%, 41.9%, and 31.4%, respectively) for cigarettes, e-cigarettes, and marijuana, and Increasers (38.7%) for alcohol (Table 2). The smallest category was Increasers (13.5% and 13.8%, respectively) for cigarettes and e-cigarettes, Under-reporters (21.1%) for marijuana, and Over-reporters (17.4%) for alcohol. Under-reporters accounted for 26.4% of cigarette users, 26.8% of e-cigarette users, and 17.7% of alcohol users. Over-reporters were among the smallest proportions of each group (17.4% of alcohol users to 22.2% of marijuana users).

Bivariate findings characterizing differences between Under-reporters versus others for each substance are also presented in Table 1. Multivariable regression (Table 3) indicated that predictors of being Under-reporters were: 1) cigarettes: less frequent W3 cigarette use; 2) e-cigarettes: older age and less frequent W3 e-cigarette use; 3) marijuana: less frequent W3 marijuana and alcohol use; and 4) alcohol: older age, male, Asian, and less frequent W3 alcohol use.

Sensitivity Analyses:

We also operationalized W3-W4 change based on frequency of past 30 day cigarette and e-cigarette use, respectively, multiplied by times used per day to create overall cigarette and e-cigarette use variables; the use per day items were not included for marijuana and alcohol. Participants were then designated into the Increasers, Decreasers/Stable, Over-reporters, or Under-reporters categorizations, which remained largely unchanged (i.e., generally within 5% differences in category size). In analyses using these categorizations, bivariate associations were similar, and multivariable regression consistently indicated that predictors of being cigarette and e-cigarette Under-reporters were less frequent W3 use, respectively.

DISCUSSION

Longitudinal data indicated that proportions of cigarette, e-cigarette, marijuana, and alcohol users who increased use were 43.3%, 41.7%, 52.6%, and 55.6%, respectively – highlighting the population impact of COVID-19 on substance use. The proportion who under-reported change per retrospective report ranged from 17% to 26%, with under-reporting particularly prominent among cigarette and e-cigarette users; over-reporters represented the smallest group of participants across all substances. Results underscore the importance of considering assessment methods when interpreting findings[18–22] and call into question findings based on retrospective reports that provide lower estimates of increased substance use.[6–10,14,15,17] To more accurately assess change and identify the temporal associations among variables, using longitudinal, as opposed to cross-sectional research is necessary.[24]

Being an Under-reporter was associated with lower levels of W3 substance use, which may reflect ceiling effects. Daily users at W3 and W4 would have been accurately categorized as Decreasers/stable, despite being high-risk overall (At W4, daily users represented 7% of cigarette users, 41.3% of e-cigarette users, 21.5% of marijuana users, and 1.7% of alcohol users). Moreover, less frequent users would be subject to recall bias, given the potential variability in their behavior over time.

Older participants were more likely to under-report increases in e-cigarette and alcohol use, whereas male and Asian participants were more likely to under-report increases in alcohol use. Findings are consistent with literature indicating that older young-adult men use tobacco and alcohol at higher rates,[25,26] which is associated with greater difficulty with retrospective recall,[22] and identifying as Asian is associated with under-reporting use to conform to cultural values.[27] Findings also have implications for research examining longitudinal associations among the use of various tobacco products (e.g., gateway effects of e-cigarettes), or among predictors and use. Research relying on retrospective reports of change may yield different findings than research utilizing longitudinal data, perhaps due to a broad range of factors (e.g., social desirability, inaccurate recall, or other biases) and may also lead to inaccurate interpretations of temporal associations or causality.

Limitations include generalizability to other young adults in these MSAs or the US. Use prevalence should not be interpreted as nationally representative, given the purposive sampling design.[23] Additionally, participants who were older, female, Asian (vs. other race), more educated, and reported less frequent substance use were more likely to complete the W4 survey, also limiting generalizability. As noted, we did not include assessments of frequency of use per day for marijuana and alcohol, preventing us from running sensitivity analyses for these substances.

Findings highlight measurement (i.e., cross-sectional retrospective versus longitudinal prospective reporting) as a potential reason for mixed findings regarding pandemic-related substance use change and underscore the need for rigorously designed research to accurately assess the population impact of COVID-19 and other historical events. It is critical to accurately understand substance use changes to identify risk/protective factors of such change to inform policy and intervention. Researchers must consider the potential for bias and inaccuracies in data to ensure appropriate interpretation and caution in generalizing.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding Sources

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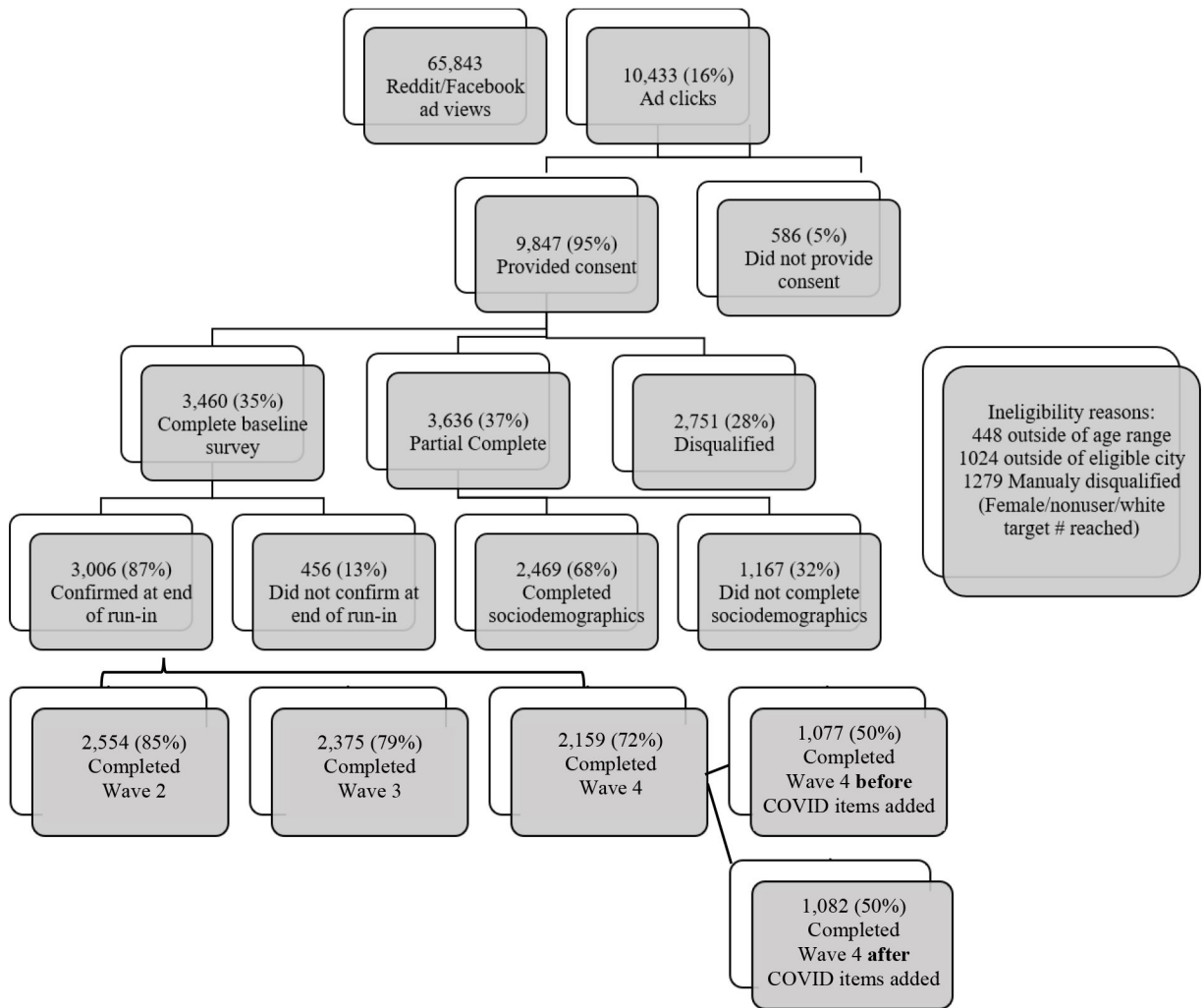
Figure 1. Participant recruitment flowchart

Note: See reference[23] for details on recruitment. This study analyzed data from W3 (Fall 2019) and W4, which was launched in Feb 2020 but was interrupted in mid-March to add COVID-19 related items. The W4 sample was 2,159 (71.2% of the baseline sample of 3,006); the number of participants who completed W4 after COVID-related items were added was 1,082 (69.4% of the 1,559 contacted after W4 was interrupted to add these items). W4 completers versus non-completers were older, more likely female, Asian [vs. other race], and college educated, and reported less frequent baseline use of cigarettes, e-cigarettes, and marijuana.

Table 1.

Participant characteristics and bivariate comparisons among under-reporters versus other categories per cross-sectional self-report of increase, decrease, same at W4 (versus self-reported levels of use at W3 and W4)

Variables	Total	Cigarette users		E-cigarette users		Marijuana users		Alcohol users	
		Under-reporters	Else	Under-reporters	Else	Under-reporters	Else	Under-reporters	Else
	N=1,082 (100%)	**N=47 (26.4%)**	**N=131 (73.6%)**	**N=66 (26.8%)**	**N=180 (73.2%)**	**N=78 (21.1%)**	**N=291 (78.9%)**	**N=132 (17.7%)**	**N=613 (82.3%)**
Sociodemographics									
Age, M (SD)	24.77 (4.68)	25.89 (5.36)	25.26 (4.75)	25.44 (4.89)	24.07 (4.82)	23.85 (4.75)	24.53 (4.75)	**25.88 (4.94)**	**24.58 (4.57)**
Female, N (%)	556 (51.4)	**12 (26.1)**	**70 (55.1)**	27 (40.9)	92 (53.2)	44 (57.9)	152 (54.1)	**54 (41.5)**	**334 (56.1)**
Sexual minority, N (%)	347 (32.1)	**10 (21.3)**	**50 (38.2)**	21 (31.8)	67 (37.2)	28 (35.9)	124 (42.6)	**33 (25.0)**	**210 (34.3)**
Race, N (%)									
White	793 (73.3)	31 (66.0)	101 (77.1)	47 (71.2)	125 (69.4)	56 (71.8)	220 (75.6)	94 (71.2)	477 (77.8)
Black	43 (4.0)	1 (2.1)	5 (3.8)	3 (1.7)	3 (4.5)	6 (7.7)	10 (3.4)	6 (4.5)	19 (3.1)
Asian	134 (12.4)	**10 (21.3)**	**9 (6.9)**	9 (13.6)	24 (13.3)	11 (14.1)	29 (10.0)	14 (10.6)	64 (10.4)
Other	112 (10.4)	5 (10.6)	16 (12.2)	7 (10.6)	28 (15.6)	5 (6.4)	32 (11.0)	18 (13.6)	53 (8.6)
Hispanic, N (%)	136 (12.6)	**15 (31.9)**	**20 (15.3)**	10 (15.2)	25 (13.9)	6 (7.7)	35 (12.0)	22 (16.7)	65 (10.6)
Education bachelor's degree, N (%)	822 (76.0)	32 (68.1)	80 (61.1)	40 (60.6)	120 (66.7)	54 (69.2)	202 (69.4)	105 (79.5)	485 (79.1)
Married/living with partner, N (%)	422 (39.0)	24 (51.1)	55 (42.0)	31 (47.0)	80 (44.4)	31 (39.7)	120 (41.2)	55 (41.7)	247 (40.3)
Children in the home, N (%)	216 (20.0)	14 (29.8)	40 (30.5)	17 (25.8)	33 (18.3)	17 (21.8)	55 (18.9)	**33 (25.0)**	**102 (16.6)**
W3 Substance Use									
Past 30-day cigarette use, M (SD)	3.02 (7.74)	**4.26 (5.81)**	**15.93 (12.18)**	8.64 (11.24)	6.00 (9.23)	3.32 (7.97)	4.17 (8.99)	3.08 (7.19)	2.73 (7.24)
Past 30-day e-cigarette use, M (SD)	4.69 (9.74)	7.53 (11.17)	10.21 (12.19)	**4.91 (7.75)**	**20.14 (11.71)**	6.47 (10.65)	6.30 (10.59)	3.58 (8.56)	4.67 (9.60)
Past 30-day marijuana use, M (SD)	5.54 (9.94)	8.36 (11.02)	9.44 (11.69)	8.88 (10.86)	9.44 (11.88)	**6.73 (9.67)**	**15.65 (12.11)**	5.12 (10.24)	5.55 (9.56)
Past 30-day alcohol use, M (SD)	5.75 (6.29)	5.43 (7.39)	7.06 (7.05)	6.50 (6.90)	6.42 (6.66)	5.86 (5.24)	7.53 (7.19)	**3.72 (4.64)**	**7.86 (6.46)**

Note: Bolded values denote statistical significance (per t-tests and Chi-square).

Table 2.

Descriptive statistics for change scores and discrepancies between W3-W4 prospective and W4 retrospective change scores, N=1,082

	Cigarettes	E-cigarettes	Marijuana	Alcohol
Continuous Prospective W3-W4 Change Score, M (SD)	0.51 (8.74)	1.96 (9.00)	2.24 (8.12)	2.20 (5.92)
Categorical Prospective W3-W4 Change, N (%)				
Increased	94 (43.3)	110 (41.7)	203 (52.6)	430 (55.6)
Decreased/Same	123 (56.7)	154 (58.3)	183 (47.4)	344 (44.4)
Categorical Retrospective Self-Report Change, N (%)				
Increased	62 (32.5)	84 (31.2)	212 (53.5)	440 (53.8)
Decreased/Same	129 (67.5)	185 (68.8)	184 (46.5)	348 (44.2)
Discrepancies in W3-W4 Prospective and Retrospective Change Scores, N (%)				
Increased W3-W4 and Retrospective Self-Report (Increaser)	24 (13.5)	34 (13.8)	116 (31.4)	288 (38.7)
Decreased/Same W3-W4 and Retrospective Self-Report (Decreaser)	73 (41.0)	103 (41.9)	93 (25.2)	195 (26.2)
Decreased/Same W3-W4 but Increased Retrospective Self-Report (Over-reporter)	34 (19.1)	43 (17.5)	82 (22.2)	130 (17.4)
Increased W3-W4 but Decreased/Same Retrospective Self-Report (Under-reporter)	47 (26.4)	66 (26.8)	78 (21.1)	132 (17.7)

Note: Analyses conducted among W4 users of respective substances (N=233 for cigarettes, N=288 for e-cigarettes, N=414 for marijuana, N=818 for alcohol).

Table 3.

Binary logistic regression analyses identifying correlates of under-reporting increases in substance use per retrospective self-report of increase, decrease, or same (versus self-reported levels of use at W3 and W4)

Sociodemographics	Under-reported increases in cigarette use (yes vs. no)			Under-reported increases in e-cigarette use (yes vs. no)			Under-reported increases in marijuana use (yes vs. no)			Under-reported increases in alcohol use (yes vs. no)		
	OR	CI	p	OR	CI	p	OR	CI	p	OR	CI	p
Age	1.07	0.98, 1.17	.157	**1.08**	**1.01, 1.17**	**.048**	0.97	0.92, 1.03	.355	**1.05**	**1.01, 1.10**	**.025**
Female	0.46	0.18, 1.13	.091	0.66	0.31, 1.40	.281	1.07	0.61, 1.87	.807	**0.55**	**0.36, 0.84**	**.006**
Sexual minority	0.81	0.29, 2.23	.682	0.91	0.40, 2.07	.817	0.72	0.40, 1.29	.263	0.64	0.39, 1.03	.065
Race (ref: White)												
Black	0.34	0.03, 4.11	.398	0.74	0.13, 4.33	.735	1.65	0.50, 5.48	.415	1.11	0.41, 2.96	.840
Asian	2.94	0.91, 9.45	.071	0.57	0.20, 1.59	.281	1.07	0.47, 2.43	.878	0.85	0.43, 1.68	.632
Other	0.81	0.20, 3.25	.768	0.76	0.26, 2.26	.619	0.67	0.24, 1.92	.458	**2.10**	**1.09, 4.04**	**.026**
Hispanic	2.20	0.80, 6.06	.128	0.86	0.32, 2.34	.772	0.50	0.19, 1.36	.177	1.01	0.56, 1.82	.987
W3 Substance Use												
Past 30-day cigarette use	**0.87**	**0.82, 0.93**	**<.001**	1.01	0.98, 1.05	.510	1.02	0.98, 1.06	.293	1.02	0.99, 1.05	.224
Past 30-day e-cigarette use	0.98	0.94, 1.02	.272	**0.88**	**0.84, 0.91**	**<.001**	1.02	0.99, 1.05	.207	0.99	0.96, 1.01	.315
Past 30-day marijuana use	1.02	0.98, 1.06	.269	1.01	0.98, 1.04	.586	**0.92**	**0.90, 0.95**	**<.001**	1.01	0.99, 1.03	.365
Past 30-day alcohol use	0.98	0.92, 1.05	.572	0.98	0.93, 1.04	.533	**0.94**	**0.90, 0.99**	**.022**	**0.83**	**0.79, 0.88**	**<.001**
Nagelkerke R-square	.423			.433			.204			.193		

Notes: Bolded values denote statistical significance.

Analyses conducted among W4 users of respective substances (N=233 for cigarettes, N=288 for e-cigarettes, N=414 for marijuana, N=818 for alcohol).