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Same-day use of cigarettes, alcohol, and cannabis among sexual minority and heterosexual young adult smokers

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Abstract

Objective: Sexual minority (SM) young adults have higher rates of substance use than heterosexuals, but little is known about daily use of multiple substances, which confer numerous health risk for this population. Using daily diary data from a smartphone-based study, we examined the associations between sexual identity (i.e., SM vs. heterosexual) and patterns of same-day multiple substance use (i.e., cigarettes and alcohol, cigarettes and cannabis, alcohol and cannabis, and all three substances).

Method: Young adult smokers (N=147, aged 18–26, 51.7% female, 41.5% SM, 40.8% White) reported consecutive daily assessments on substance use during 30 days. We used generalized estimating equations to examine associations between sexual identity and patterns of same-day multiple substance use, controlling for demographic factors and psychological distress.

Results: Of 2,891 daily assessments, 16.7% reported same-day use of cigarettes and alcohol, 18.1% cigarettes and cannabis, 1.5% alcohol and cannabis, and 15.0% use of all three substances. SM participants (vs. heterosexuals) had significantly greater odds of reporting days with use of cigarettes and cannabis [Adjusted Odds Ratio (AOR) = 2.05, 95% Confidence Interval (CI) =

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Contributors:

All authors have been involved in writing the manuscript. NN analyzed and interpreted the data, drafted the initial manuscript, and contributed to all subsequent drafts of the manuscript. PML and JT conceptualized the study, obtained funding, reviewed and revised the manuscript. JM, TBN, SSD, and LMH reviewed and revised the manuscript. All authors have read and approved the final manuscript for submission.

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1.04–4.01] and use of all three substances (AOR = 2.79, 95% CI = 1.51–5.14) than days with single substance use or no use.

Conclusions: These findings warrant tailored interventions addressing multiple substance use among SM young adults and temporally accurate measures of multiple substance use patterns.

Keywords

polysubstance use; daily diary data; emerging adults; LGBTQ+; health disparities

INTRODUCTION

Elevated rates of tobacco, alcohol, cannabis, and other substance use have been identified among sexual minority (SM) populations as compared to their heterosexual counterparts (Dermody, 2018; Dermody et al., 2016; Schuler, Stein, & Collins, 2019). SM individuals are approximately 2–4 times more likely than heterosexuals to use cigarettes or alcohol in the past month, and cannabis in the past year (Medley, 2016). Recent evidence suggests that SM individuals are also at increased risk for multiple substance use (i.e., the use of two or more substances) (Coulter, Ware, Fish, & Plankey, 2019; Dermody, 2018; Dermody et al., 2016; Kecojevic, Jun, Reisner, & Corliss, 2017). In the general population, the regular use of multiple substances compounds negative health effects (e.g., cancer, mental illness, drug dependence) associated with each individual substance (Cohn et al., 2018; Ramo, Liu, & Prochaska, 2012; Tucker et al., 2019). Thus, the risk of poor health outcomes may be even greater among SM people who exhibit higher risk of multiple substance use (Hingson, Assailly, & Williams, 2004; Mathers, Toumbourou, Catalano, Williams, & Patton, 2006; Volkow, Compton, & Weiss, 2014).

To date, research on multiple substance use among SMs has been conducted primarily with adolescents (Dermody, 2018; Dermody et al., 2016) or adults (Schuler et al., 2019), but not specifically with young adults (18–26 years old). SM young adults experience compounded risk for multiple substance use due to their particular life stage and sexual minority status. Young adulthood is a key risk period when substance use and misuse peak (Substance Abuse and Mental Health Services Administration, 2019). Factors contributing to this include transitional stressors that are common among young adults, such as those connected to financial independence or romantic relationships (Greene, 2012; Schuler et al., 2019). For SM young adults, additional transitional stressors during young adulthood may include those related to ‘coming out’ and finding a community that is accepting of SM people (Valentine & Skelton, 2003). SM individuals face minority stressors across the life course (e.g., victimization, discrimination) (Meyer, 2003). Not surprisingly, SM young adults report higher rates of mental health conditions (e.g., depression, psychological distress) than their heterosexual counterparts (Newcomb et al., 2019). These compounded stressors and mental health concerns may put SM young adults at an exceptionally high risk for multiple substance use (McQuoid, Thrul, Ozer, Ramo, & Ling, 2019; Parent, Arriaga, Gobble, & Wille, 2019), as substances may complement one another by serving different coping strategies in different situations (McQuoid, Thrul, & Ling, 2018). A more nuanced understanding of how SM young adults use multiple substances is warranted to inform efforts to reduce substance use disparities for this group.

Nonetheless, the way that multiple substance use disparities have been examined in the literature does not map directly onto suspected patterns that could cause the greatest harms. Most research among SM populations has examined use of each substance separately rather than use of multiple substances in combination (Kahle, Veliz, McCabe, & Boyd, 2019; D. Kerr, Ding, Burke, & Ott-Walter, 2015; D. L. Kerr, Ding, & Chaya, 2014). Furthermore, the extent to which SM individuals are using multiple substances within a short timeframe could impact patterns of use and associated health outcomes. Specifically, using multiple substances within the same day would provide opportunities for these substances to interact pharmacologically, which can result in greater use (Dermody & Hendershot, 2017). Furthermore, with recurring co-use of substances within a day, use of one substance can become a behavioral cue for the use of another (Shiffman, Balabanis, Fertig, & Allen, 1995), thereby increasing the risk of future same-day multiple substance use (Roche et al., 2019). Thus, it is important to establish if SM individuals are at risk of using multiple substances within the same day (as opposed to simply establishing co-use patterns over longer periods of time). The few studies that have examined multiple substance use among SMs have described patterns of co-use over the past month or year (Dermody, 2018; Dermody et al., 2016; Schuler et al., 2019). Using this type of evidence, it is impossible to establish if multiple substances were used contemporaneously (i.e., same moment or day).

Mobile data collection methods, such as daily diaries, have the potential to minimize retrospective recall bias and clarify the time course of substance use (Nguyen, Nguyen, & Thrul, 2020; Shiffman, 2009). To the best of our knowledge, there have been only two diary studies on substance use among SM women. One study among 67 young SM women found that drinking motives (e.g., social and enhancement motives) differently affected alcohol consumption (Dworkin, Cadigan, Hughes, Lee, & Kaysen, 2018). Another study among 246 female young adults found that SM participants reported a greater proportion of days with use of both cigarettes and alcohol than heterosexual participants (Hequembourg, Blayney, Bostwick, & Van Ryzin, 2020). However, no studies among SM young adults, particularly among SM young men, have examined different patterns of same-day use of the three most common substances for this age group, which are cigarettes, alcohol, and cannabis (Substance Abuse and Mental Health Services Administration, 2019).

To address the above gaps, we analyzed 2891 daily assessments collected from 147 young adult smokers (18–26 years old) in the San Francisco Bay Area. Previously, using ecological momentary assessment (EMA) data from this sample, we found that smoking behaviors among SM young adults were more influenced by external factors (e.g., being at bars or with other smoking people) than by internal factors (e.g., craving, mood) (Nguyen et al., 2018). We build upon this work here by comparing patterns of same-day use of cigarettes, alcohol, and cannabis between SM and heterosexual young adult smokers, including distinctly measuring the co-use of cigarettes and alcohol, cigarettes and cannabis, alcohol and cannabis, and all three substances together.

METHOD

Design

The current study is a secondary analysis of a smartphone-based study conducted in the San Francisco Bay Area, California, US, in 2016–2017. The original study procedure was described in detail elsewhere (McQuoid et al., 2019; Nguyen et al., 2018). At baseline, participants completed an online survey via Qualtrics including their demographics and substance use history. Each day for 30 days, participants were asked to complete a daily assessment (a daily diary) between 10–11AM regarding their substance use during the entire previous day via the study app on their own smartphone. We selected the morning in order to better capture substance use occasions that may have occurred late in the evening on the previous day. In addition, a maximum of 6 EMAs per day were sent to each participant to collect data on real-time predictors of cigarette smoking (Nguyen et al., 2018). Participants received a maximum of $120 in gift cards according to their level of data collection completion. Electronic informed consent was obtained from all participants. The study was approved by the University of California San Francisco Institutional Review Board.

Participants

Participants were recruited through advertisements on Facebook, Instagram, and via outreach to Bay Area organizations that serve sexual and gender minority young adults. Eligible participants were 18–26 years old, had smoked at least 100 cigarettes in their lifetime, and currently smoked at least one cigarette per day at least three days per week. Overall, 230 smokers were screened successfully and 184 completed the baseline assessments (79 or 43% were SMs, and 105 or 57% were heterosexuals). Of those, 147 participants completing at least one daily assessment were included in the analytic sample. There was no statistical difference between the analytic sample (n=147) and those were excluded from the analysis (n=37) regarding baseline characteristics (i.e., age, sex, gender identity, sexual identity, educational attainment, race/ethnicity, psychosocial distress, and past 30-day of use of cigarettes, alcohol, and cannabis).

Baseline characteristics of the study sample were described in Table 1. Of 147 participants, 42% (n=61) identified as SM, and the majority of these identified as bisexual cisgender women. The sample had a mean age of 22.7 years (SD = 2.4), 40.8% were non-Hispanic White, and 76.9% were currently in college or had a college degree or higher. At baseline, a majority of participants reported past 30-day use of both cigarettes and alcohol (91.2%), cigarettes and cannabis (64.0%), alcohol and cannabis (63.3%), and all three substances (61.9%). SM individuals did not differ from their heterosexual peers on nearly all baseline characteristics, except for a greater female proportion due to the oversampled SM women for a nested qualitative sub-study (McQuoid et al., 2019), and a higher average score of psychosocial distress.

Measures

Multiple substance use outcome variables—Every day for 30 days, participants separately reported their use of cigarettes, alcohol, and cannabis. Their responses were coded dichotomously (Yes vs. No). Using these responses, patterns of substance use on a

single day was categorized based on whether one, two, or all three individual substances were used. There were 8 exclusive patterns of using the three substances on a single day. Of these patterns, four separate binary outcomes were created: same-day use of cigarettes and cannabis, same-day use of cigarettes and alcohol, same-day use of cannabis and alcohol, and same-day use of all three substances. The reference group for each outcome was composed of the remaining four patterns (i.e., no substance use at all, use of cigarettes only, alcohol only, and cannabis only).

Independent variable—Sexual and gender identity were assessed with the question: "Do you think of yourself as (check all that apply)" with the answer options including "Straight", "Gay or Lesbian", "Bisexual", "Transgender, Transsexual, or gender non-conforming", and "Other" (The GenIUSS Group, 2014). Sexual identity was then dichotomized into two groups: SM (i.e., lesbian, gay, bisexual, other) and heterosexual (i.e., straight). It should be noted that all participants who selected "Transgender, Transsexual, or gender non-conforming" in this question (n=6) also selected a SM identity response (lesbian, gay, bisexual, other). All heterosexual participants were cisgender-identified, and all gender minority participants were SM-identified.

Baseline variables—Demographic characteristics were collected at baseline. Age was calculated based on self-reported date of birth. Sex assigned at birth was measured as "Female" and "Male". Gender identity was measured as "Male", "Female", and "Transgender and Other" (The GenIUSS Group, 2014). Race/ethnicity was measured by combining two items: race (White, Black, Asian, Hawaiian/Pacific Islander, American Indian/Alaskan Native, or More than one race) and ethnicity (Hispanic or not). Due to small numbers of Non-Hispanic Black, Hawaiian/Pacific Islander, American Indian/Alaskan Native participants, these subgroups were collapsed into "Other/Multi-race", resulting in only 4 race/ethnicity groups in the analysis (i.e., "Non-Hispanic White", "Non-Hispanic Asian", "Hispanic", and "Other/Multi-race"). Educational attainment was dichotomized as "Less than college" and "College or Higher") since having some college education was a documented predictor of substance use among young adults (Gunn et al., 2018; Lenk et al., 2012).

Mental health was measured once at baseline by the self-administered K6 scale, a 6-item screening instrument for nonspecific psychological distress (Kessler et al., 2003). Participants rated how often they felt nervous, hopeless, restless, so sad, everything was an effort, and worthless over the past 30 days. A response for each item ranged from "None of the time" (scored as 0) to "All of the time" (scored as 4). The six items were summed to yield a total score of 0–24. Regarding substance use at baseline, participants reported their past 30-day use of cigarettes, e-cigarettes, alcohol, and cannabis.

Analyses

Statistical analyses were performed using STATA version 15 (Stata Corp, 2017). Descriptive statistics of baseline characteristics and daily assessments were summarized for the total sample and for each sexual identity group (i.e., SM and heterosexual). For the primary analysis, we examined the associations between sexual identity and the four patterns of

same-day multiple substance use. We used generalized estimating equations (GEE) with the logit link function and exchangeable correlation to account for repeated observations nested within each participant (Bolger, 2013). The GEE method yields population average estimates and is generally robust to misspecification of the correlation structure (Zeger, Liang, & Albert, 1988), and is therefore commonly used for analyzing longitudinal data (Bolger, 2013; Crosby, Charnigo, Weathers, Caliendo, & Shrier, 2012; Kilwein & Looby, 2018). We fitted separate multivariable models for each of four patterns of same-day multiple substance use, controlling for demographic covariates and psychological distress at baseline. In each model, we examined potential interactions between sexual identity and other baseline variables. All tests were two-tailed with a significance level of α less than 0.05.

Only completed daily assessments from the 147 participants over the 30-day study period were analyzed in the primary analysis. To better understand the impact of missing data (participants who completed less than 30 daily assessments or had completion rate < 100%), we conducted a sensitivity analysis that included only participants reporting ≥15 daily assessments, indicating a completion rate ≥ 50% (104 participants, 2612 daily diary assessments). Then, we compared results of the sensitivity analysis with those of the primary analysis.

RESULTS

Daily assessments of substance use by sexual identity group

Table 2 describes the daily assessments of substance use for the total sample and for each sexual identity group. During the 30-day study period, 147 participants completed an average of 19.7 daily assessments (SD=9.6) with a completion rate of 65.6% (2891 completed assessments of 4410 prompted assessments). Of the total of 2891 daily assessments, 1237 (42.8%) were completed by SM participants and 1654 (57.2%) were completed by heterosexual participants. There was no statistical difference in completion rate by sexual identity as well as other baseline characteristics.

Among 8 exclusive patterns of substance use on a single day, the most common pattern was use of cigarettes only among all the participants (33.5%) and the heterosexual participants (41.5%); whereas among SM participants, it was same-day co-use of cigarettes and cannabis (23.4%). Notably, SM participants (vs. heterosexual participants) reported higher proportions of days with multiple substance use (62.8% vs. 42.7%) but lower proportions of days with single substance use (31.0% vs. 47.5%). Among the four patterns of multiple substance use, same-day use of alcohol and cannabis was the least common combination among both sexual identity groups.

Factors associated with patterns of same-day multiple substance use

Table 3 displays results from the multivariable GEE models. After controlling for baseline covariates, sexual identity was significantly associated with two of four patterns of same-day multiple substance use. Compared to their heterosexual peers, SMs had higher odds of engaging in same-day use of cigarettes and cannabis (AOR=2.05, 95%CI=1.04–4.01) and all

three substances (AOR=2.79, 95%CI=1.51–5.14) compared to no multiple-substance use (i.e., single substance use and no substance use at all). There were no significant associations for same-day use of cigarettes and alcohol, and same-day use of alcohol and cannabis.

Other significant factors were age and race/ethnicity. With increasing age, participants had increased odds of same-day use of cigarettes and alcohol (AOR=1.30, 95%CI=1.17–1.43) and decreased odds of same-day use of cigarettes and cannabis (AOR=0.85, 95%CI=0.74–0.97) compared to no multiple-substance use. Compared to their non-Hispanic White peers, non-Hispanic Asian (AOR=0.49, 95%CI=0.28–0.84) and Other/Multiracial participants (AOR=0.43, 95%CI=0.24–0.76) had lower odds of using both cigarettes and alcohol on the same day versus no multiple-substance use. Psychosocial distress was not significantly associated with patterns of multiple substance use. There were no significant interactions between sexual identity and other covariates. Since the interaction between sexual identity and sex assigned at birth is of interest, the results from the multivariate models with this interaction effect are presented in Supplemental Table 1.

Sensitivity analysis results (Supplemental Table 2)

The results from the sensitivity analyses were consistent with the primary results; however, the magnitude of associations tended to be larger for the associations between sexual identity and patterns of same-day multiple substance use. Sexual identity was still associated with same-day use of cigarettes and cannabis (AOR=2.87, 95%CI=1.30–6.35) and same-day use of all three substances (AOR=3.15, 95%CI=1.56–6.35), and was not associated with the other two patterns. Age was a significant factor for same-day use of cigarettes and alcohol, cigarettes and cannabis, and alcohol and cannabis; while race/ethnicity was significantly associated with same-day use of cigarettes and alcohol. There were also no significant interactions between sexual identity and other covariates. Unlike the primary analysis, psychological distress was significantly associated with same-day use of alcohol and cannabis in the sensitivity analysis (AOR=1.10, 95%CI=1.02–1.19, p=.02).

DISCUSSION

This study is among the first to examine sexual identity differences in patterns of same-day use of the most-commonly used substances (cigarettes, alcohol, cannabis) among young adult smokers. To accomplish this, we utilized intensive longitudinal data, including 2891 daily assessments among 147 young adult smokers over 30 days. We found that compared to their heterosexual counterparts, SM young adult smokers had a significantly increased odds of engaging in same-day use of both cigarettes and cannabis as well as same-day use of all three substances. This finding is consistent with the extant literature showing greater odds of multiple substance use among SM adolescents and young adults than their heterosexual counterparts; however, those studies focused on any co-use occurring within a large timeframe of 30 days or 1 year (Coulter et al., 2019; Dermody, 2018; Dermody et al., 2016; Kecojevic et al., 2017). Furthermore, SM participants in our study reported fewer days with single substance use and greater days with multiple substance use than their heterosexual peers. Therefore, our daily diary approach adds to this literature by establishing that these disparities are, in part, due to using multiple substances on a single day.

Interestingly, the most common pattern of same-day multiple substance use among SM participants and the total sample in our study was the combination of cigarettes and cannabis, with 23% of SM young adults' assessments and 18% of our overall sample's assessments reporting use of both substances on the same day. This finding may speak to the current trend of increasing tobacco and cannabis co-use among young people in the US population in general (Holmes, Popova, & Ling, 2016; Nguyen et al., 2019; Schauer, Berg, Kegler, Donovan, & Windle, 2015). Our study uniquely contributes to this nascent research area by revealing that SM young adults were at especially high risk of same-day cigarette and cannabis co-use compared to heterosexual young adults, and should therefore be considered a priority group for interventions. As our data were collected before the legalization of recreational cannabis in California in January 2018, future research is warranted to examine how this policy change impacts co-use of cigarettes and cannabis among SM young adults. Given the current expanding legalization of cannabis in the US (Zvonarev, Fatuki, & Tregubenko, 2019), our finding points to the need to address cannabis in polysubstance use behaviors in this vulnerable population in a timely fashion.

Since this study did not collect data on the drivers of SM young adults' same-day use of multiple substances, we could not examine potential mechanisms underlying these substance patterns. However, existing literature on substance use among SMs may help to explain our findings. According to the Minority Stress Model (Meyer, 2003), substance use behaviors among SMs may represent a coping strategy to deal with unique and chronic stressors related to marginalized social identities. These factors include everyday experiences of discrimination and micro-aggressions, victimization, harassment, and internalized homophobia (Meyer, 2003), which were not measured extensively in this study. Prior research indicated that psychological factors related to minority stress were common risk factors of substance use initiation and continued use among SMs (Blosnich, Lee, & Horn, 2013). In our primary analyses, we found no significant associations between psychological distress and patterns of same-day substance use. However, it should be noted that SM participants had higher average psychological distress at baseline and there was a significant association between psychological distress and same-day use of alcohol and cannabis among high compliant participants in the sensitivity analysis. In addition, while K6 is a well-validated and widely used screening instrument for psychosocial distress, it does not provide information on specific psychiatric disorders an individual may have, thereby limiting our investigation on the role of mental health on substance use. More research is warranted to explore the role of psychological distress, daily experience of discrimination, and other mental health problems on multiple substance use among young adult smokers in general and among SMs in particular.

The long-standing importance of bars and other nightlife venues for SM communities may provide another potential explanation for polysubstance use among SM young adults. Bars and nightclubs represent 'coming of age' spaces for many SM young adults and offer a sense of belonging to LGBTQ+ community and social support, while also exposing young people to a range of substance use practices (Greenwood et al., 2001; Valentine & Skelton, 2003). Use of cigarettes, alcohol, cannabis, and 'party drugs' is highly normative in LGBTQ + bars/nightclubs (Greenwood et al., 2001; Operario et al., 2006), which likely influences substance use practices for young people entering into these spaces in search of community.

While bar attendance data were available in EMA surveys of the original study, we did not include this predictor in the current analyses. There was a substantial amount of missing data in EMA surveys, and the numbers of completed surveys varied by day and participant. Moreover, days with greater numbers of completed EMA surveys were more likely to have reports of bar attendance. Thus, including this variable in the current analyses would potentially bias our findings. More importantly, bar attendance was reported in only 2.5% of total EMA surveys, with similar numbers across sexual identity groups (SMs: 2.9% vs. Heterosexuals: 2.3%). As such, bar attendance is unlikely to be responsible for the differences in substance use reported by sexual identity group in the current study. Future research should further explore the roles of bar attendance and other environmental factors on polysubstance use patterns to elucidate which factors contribute the most to driving same-day use of multiple substances among SM young adults.

Collectively, our findings underscore the need for interventions to address same-day use of multiple substances by SM young adults. The higher likelihood of same-day use of multiple substances places SM young adults at a greater risk for substance use disorders and adverse health outcomes (Boyd, Veliz, Stephenson, Hughes, & McCabe, 2019). Indeed, U.S. national data indicated that approximately 20% of SM young adults had any substance use disorder in the past year, corresponding to 659,000 individuals in need of treatment (Medley, 2016). Therefore, screening and treatment for multiple substances should be offered at healthcare settings for young adults in general, and for SMs in particular. This is particularly important given that, at least in the general population, use of multiple substances often corresponds with poorer substance use treatment outcomes (Hughes, 2019; Weinberger et al., 2019). Additionally, SM young adults may be reluctant to engage in or complete substance use treatment due to anticipated or experienced discrimination in treatment settings (Baptiste-Roberts, Oranuba, Werts, & Edwards, 2017; Lea, Reynolds, & de Wit, 2013). Tailored polysubstance use interventions should address these barriers.

Limitations

This study has limitations that could be addressed in future research. First, missing data due to participant non-compliance with daily assessments may reduce the validity of our findings. However, our sensitivity analysis among participants with high completion rates indicated the similar findings to the full sample analysis.

Second, the nature of our sample may limit the study generalizability. The small number of SMs in our sample coupled with uneven distribution of minority subgroups (SMs were mostly bisexual women with few gay men and transgender individuals) prevented a more nuanced examination of substance use patterns within sexual and gender identity subgroups. In addition, the rates of multiple substance use among our sample of young adult smokers likely do not reflect the rates of multiple substance use in the general young adult population. Furthermore, our sample was recruited from the San Francisco Bay Area and had few Black, Hawaiian/Pacific Islander, American Indian/Alaskan Native young adults. It is therefore unclear to what extent our findings are applicable to other samples with different race/ethnicity distributions or to young adults in other regions that differ in stigma toward

SMs, tobacco and cannabis control policies, and social norms with regards to cannabis use (Hatzenbuehler, Jun, Corliss, & Bryn Austin, 2015; Thiede et al., 2003).

Third, the limitations of the original study's measures prevented further investigation on other patterns and products of substance co-use in the current analysis of secondary data. Prior studies showed that closer temporal co-use of substances (e.g., on the same occasion vs. on separate occasions) was associated with worse physical and mental functioning (Linden-Carmichael, Van Doren, Masters, & Lanza, 2020; Roche et al., 2019; Tucker et al., 2019). However, we could not assess the temporal relation of same-day substance use (e.g., concurrent use, immediate sequential use, or lagged sequential use). Having further information on these usage patterns could clarify the contexts and mechanisms that promote multiple substance use as well as the potential harms that can arise from multiple substance use. In addition, this study focused on cigarettes and did not assess use of e-cigarettes as well as other tobacco products. Use of alternative tobacco products, particularly e-cigarettes, deserves more attention given their recent increased use among young adults in general, and among SM young adults in particular (McCabe et al., 2018; Olfson, Wall, Liu, Sultan, & Blanco, 2019).

In conclusion, the current study adds to the nascent literature of daily diary research on multiple substance use among SM young adult smokers by providing the first evidence on same-day use of the most common substances by this vulnerable group. Findings indicate that SM young adult smokers were more likely to use cigarettes, alcohol, and cannabis on the same day than their heterosexual peers. Future studies should measure substance use in narrower timeframes, such as within the same day, instead of during the past month or past year. Ultimately, given the disproportionate harms associated with using multiple substances, it is crucial that intervention efforts for SM young adults account for multiple use to reduce sexual identity-related health disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Public health significance:

This study indicates that SM young adult smokers were more likely to use cigarettes, alcohol, and cannabis on the same day than their heterosexual peers. Interventions addressing multiple substance use among SM young adults are needed to reduce sexual identity-related health disparities.

Table 1:

Baseline characteristics of the study participants by sexual identity

Characteristics	Total N=147 participants (100%)	Sexual minority N=61 participants (41.5%)	Heterosexual N=86 participants (58.5%)	t or χ^2	p-value
Demographics					
Age (years), Mean (SD)	22.7 (2.4)	22.8 (2.5)	22.7 (2.4)	−0.36	0.72
Gender identity					
Cisgender Male	71 (48.3%)	18 (29.5%)	53 (61.6%)		
Cisgender Female	70 (47.6%)	37 (60.7%)	33 (38.4%)	19.80	<0.01
Transgender and other	6 (4.1%)	6 (9.8%)	0 (0.0%)		
Sexual identity					
Straight		NA	86 (100.0%)		
Lesbian		11 (18.0%)			
Gay		3 (4.9%)			
Bisexual Male		13 (21.3%)	NA		
Bisexual Female		27 (44.3%)			
Pansexual/Queer		7 (11.5%)			
Participants' highest education					
< College	33 (22.5%)	13 (21.3%)	20 (23.3%)	1.47	0.48
>= College	113 (76.9%)	47 (77.1%)	66 (76.7%)		
Race					
Non-Hispanic White	60 (40.8%)	26 (42.6%)	34 (39.5%)		
Non-Hispanic Asian	30 (20.4%)	11 (18.0%)	19 (22.1%)		
Non-Hispanic Black	6 (4.08%)	3 (4.92%)	3 (3.49%)		
American Indian/Alaska Native	1 (0.68%)	0 (0.00%)	1 (1.16%)	3.69	0.72
Pacific Islander/Native Hawaiian	2 (1.36%)	0 (0.00%)	2 (2.33%)		
Hispanic	31 (21.1%)	12 (19.7%)	19 (22.1%)		
Other/Multi-race	17 (11.56%)	9 (14.75%)	8 (9.30%)		
Past 30-day substance use					
Any cigarettes	145 (98.6%)	61 (100.0%)	84 (97.7%)	1.44	0.23
Any e-cigarettes	47 (32.0%)	23 (37.7%)	24 (27.9%)	1.58	0.21
Any alcohol	136 (92.5%)	56 (91.8%)	80 (93.0%)	0.08	0.78
Any cannabis	96 (65.3%)	44 (72.1%)	52 (60.5%)	2.14	0.14
Cigarettes and alcohol	134 (91.2%)	56 (91.8%)	78 (90.7%)	0.05	0.82
Cigarettes and cannabis	94 (64.0%)	44 (72.1%)	50 (58.1%)	3.03	0.08
Alcohol and cannabis	93 (63.3%)	43 (70.5%)	50 (58.1%)	2.34	0.13
All three substances	91 (61.9%)	43 (70.5%)	48 (55.8%)	3.26	0.07
Mental health					
K6 score, Mean (SD)	8.65 (5.59)	9.87 (6.10)	7.78 (5.05)	−2.27	0.03

Table 2:

Daily assessments of substance use by sexual identity group

Daily assessments	Total sample N=2891 assessments (100%)	Sexual minority N=1237 assessments (42.8%)	Heterosexual N=1654 assessments (57.2%)
Average number of assessments (SD)	19.7 (9.6)	20.3 (9.1)	19.2 (10.1)
Any use of each substance			
Cigarettes	2407 (83.3%)	1032 (83.4%)	1375 (83.1%)
Alcohol	1032 (35.7%)	517 (41.8%)	515 (31.1%)
Cannabis	1136 (39.3%)	679 (54.9%)	457 (27.6%)
Exclusive patterns of daily substance use			
No use at all	232 (8.0%)	70 (5.7%)	162 (9.8%)
Any single substance use	**1169 (40.5%)**	**384 (31.0%)**	**785 (47.5%)**
Cigarette-only	967 (33.5%)	280 (22.6%)	687 (41.5%)
Alcohol-only	69 (2.4%)	28 (2.3%)	41 (2.5%)
Cannabis-only	133 (4.6%)	76 (6.1%)	57 (3.5%)
Any multiple substance use	**1483 (51.3%)**	**777 (62.8%)**	**706 (42.7%)**
Cigarettes and Alcohol	483 (16.7%)	177 (14.3%)	306 (18.5%)
Cigarettes and Cannabis	522 (18.1%)	290 (23.4%)	232 (14.0%)
Alcohol and Cannabis	44 (1.5%)	26 (2.1%)	18 (1.1%)
All three substances	434 (15.0%)	284 (23.0%)	150 (9.1%)

Table 3:

Factors associated with patterns of same-day multiple substance use

Variables	Same-day substance use AOR (95% CI)			
	Cigarettes and Alcohol	**Cigarettes and Cannabis**	**Alcohol and Cannabis**	**All three substances**
Sexual identity *(Sexual minority vs. Heterosexual)*	1.06 (0.68 – 1.63)	**2.05 (1.04 – 4.01)** **	1.73 (0.70 – 4.28)	**2.79 (1.51 – 5.14)** **
Demographics				
Age	**1.30 (1.17 – 1.43)** ***	**0.85 (0.74 – 0.97)** *	0.85 (0.71 – 1.01)	1.03 (0.91 – 1.17)
Sex (*Female* vs. *Male*)	1.02 (0.67 – 1.57)	0.87 (0.44 – 1.69)	1.00 (0.39 – 2.54)	0.92 (0.50 – 1.71)
Education *(≥College vs. <College)*	0.71 (0.41 – 1.23)	1.05 (0.47 – 2.35)	1.45 (0.39 – 5.43)	1.55 (0.68 – 3.52)
Race *(Ref = NH White)*				
NH Asian	**0.49 (0.28 – 0.84)** *	0.77 (0.33 – 1.80)	0.43 (0.12 – 1.53)	0.80 (0.36 – 1.82)
Hispanic	1.06 (0.60 – 1.88)	1.00 (0.41 – 2.43)	0.21 (0.04 – 1.25)	1.91 (0.88 – 4.15)
Other/Multiracial	**0.43 (0.24 – 0.76)** **	1.20 (0.52 – 2.74)	0.72 (0.25 – 2.08)	0.78 (0.35 – 1.75)
Psychological distress *(K6 score)*	1.02 (0.98 – 1.06)	1.00 (0.94 – 1.06)	1.07 (0.99 – 1.15)	1.01 (0.96 – 1.06)

Note:

*: p<0.05

**: p<0.01

***: p<0.001; AOR: Adjusted Odds Ratio, CI: Confidence Interval; NH: Non-Hispanic.

N=2891 daily diary assessments among 147 participants