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Concurrent Hookah (Waterpipe) and Substance Use among Sexual Minority Adults in the United States: Findings from the Population Assessment of Tobacco and Health Study

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Abstract: Despite higher rates of hookah (i.e., waterpipe) tobacco smoking among sexual minority (SM) adults, little is known on concurrent substance use, including alcohol or other drugs, among SM hookah smokers as compared to their heterosexual counterparts. Utilizing data from the Population Assessment of Tobacco and Health Study (2013–2015), weighted analyses compared concurrent substance use among current SM adult hookah smokers versus heterosexuals. Findings revealed that SM hookah smokers had a higher prevalence of concurrent alcohol, marijuana and other drug use, including stimulants and sedatives, than heterosexuals ($p < 0.05$). As compared to heterosexuals, SM women and young adult (18–24 years old) smokers had higher odds of marijuana use (Women: Wave 1 odds ratio (OR), 2.16, [95% CI = 1.30–3.60]; Wave 2 OR, 2.67 [95% CI = 1.36–5.25]); young adults: Wave 1 OR, 1.55, [95% CI = 0.99–2.43]; Wave 2 OR, 2.19, [95% CI = 1.22–3.94]). In this population-based, representative sample of U.S. adults, concurrent hookah smoking and substance use differed between SM and heterosexuals. Sexual minority women and young adult hookah tobacco smokers were at increased risk for concurrent marijuana use, increasing the risk for health-related consequences in this group vulnerable to tobacco and substance use.

Keywords: hookah; waterpipe; sexual minority; substance use; marijuana

1. Introduction

Tobacco and nicotine product use among sexual minority (SM)—lesbian, gay and bisexual—populations are higher than among heterosexuals [1–5]. In Wave 1 (W1; 2013–2014) of the nationally representative Population Assessment of Tobacco and Health (PATH) Study, current tobacco use was reported by 39.8% of gay/lesbian adults and 45.7% of bisexual adults, as compared to 27.3% of straight adults [6]. Hookah (i.e., waterpipe) tobacco smoking is a millennia-old tradition that has rapidly grown to become a major global tobacco epidemic in contemporary times, particularly among young adults aged 18–24 years of age [6,7]. Contributing to its popularity is the ritualistic nature of smoking fruit- and candy-flavored hookah tobacco and the unsubstantiated belief that hookah smoking is a safer alternative to traditional combustible cigarette smoking [8–10]. In W1 of the PATH study data (2013–2014) and compared to the 4.0% of straight adults who reported current hookah smoking, 11.3% of gay/lesbian adults and 12.5% of bisexual adults reported current hookah smoking [6].

While concurrent substance use, including alcohol or other drugs is common among heterosexual cigarette smokers, [11–14] little is known about substance use among SM hookah smokers. Indeed, relative to heterosexuals, SM individuals have a higher risk for concurrent substance use and smoking appears to contribute to the elevated risk [15,16].

Utilizing data from the U.S. cohort Growing Up Today Study 1, SM individuals had a 60% to more than two times greater risk for concurrent substance use compared to their heterosexual counterparts [15]. Specifically, among SM adult hookah smokers, our team utilized nationally representative U.S. data to demonstrate an increase in concurrent tobacco and nicotine product use from across two PATH waves (2013–2015) [17]. Among W2 SM hookah smokers, 70% reported using >2 tobacco and nicotine products, an increase from 63% reported in W1. However, this past work examined only tobacco and nicotine products, and the present study extends these previous findings to now focus on disparities in concurrent substance use among hookah smokers by examining concurrent use of substances, including alcohol, marijuana, and other drugs.

Previous work has demonstrated hookah smoking as a potential indicator of concurrent substance use. A study utilizing a sample of 1799 university students showed that, as compared with non-hookah smokers, hookah smokers were significantly more likely to use other substances, including alcohol (odds ratio (OR), 6.93 [95% CI, 3.39–14.81]), cigarettes (OR, 5.09 [95% CI, 3.83–6.78]), marijuana 4.75 [95% CI, 3.53–6.40]), cocaine 2.71 [95% CI, 1.83–4.01]), and other drugs [18]. Among 32,202 U.S. adults from the PATH study (2013–2014), when compared to non-current users, current tobacco users were more likely to report alcohol or drug use (adjusted odds ratio (AOR), 2.6 [95% CI, 2.3%–2.9%]), with a strong association observed for current hookah use (AOR, 4.0 [95% CI, 3.3–4.7]) [14].

Systematic reviews examining mental health among SM, as compared to heterosexuals, show that SM experience higher rates of poor outcomes (i.e., depression, anxiety, and suicide ideation) [19,20]. The minority stress model—a common conceptual framework used to guide the understanding of SM-related health disparities—[21,22] proposes that negative experiences, including discrimination, violence and stigma, experienced by SM, contributes to, not only poor mental health but also increased tobacco and nicotine use, as compared to heterosexuals [23–25]. While previous studies have shown that SMs have higher rates of hookah tobacco smoking; [6,17,26] and that hookah smokers are more likely to report concurrent substance use compared to their heterosexual peers, [16,26] a gap in our knowledge exists with regard to the concurrent substance use among SM hookah smokers. Emerging studies demonstrate acute and chronic harmful health effects stemming directly from hookah tobacco smoking, resulting not only from charcoal combustion but also flavored tobacco combustion, including pulmonary, cardiovascular and oral diseases, presumably from mutagenic, oxidative, and inflammatory changes resulting from smoke exposure [27]. Closing this literature gap is of significant importance as this information could help identify those at highest risk for adverse health effects resulting from smoking and concurrent substance use and thereby inform targeted interventions and treatment efforts specific to this disadvantaged population vulnerable to tobacco and substance use. Therefore, to address the aforementioned gap, the current study utilizes W1 (2013–2014) and W2 (2014–2015) survey data from the PATH Study—a nationally representative U.S. sample of adults 18 years of age and older—to compare SM adult current hookah smokers and their heterosexual counterparts on concurrent use of substances, including marijuana, painkillers, sedatives, tranquilizers, cocaine, stimulants (i.e., methamphetamines), and other drugs.

2. Materials and Methods

2.1. Study Design

Data were from the nationally representative, longitudinal cohort PATH study of non-institutionalized U.S. civilian youth and adults Public-Use Files. Analyses included W1 data (collected from September 2013 to December 2014) and W2 data (collected from October 2014 to October 2015). Details on PATH design and methodology are described in detail elsewhere [28,29]. PATH data included a total sample of 2182 SM and 29,366 heterosexual respondents at W1 and 1939 SM and 26,018 heterosexual respondents at W2. Westat Institutional Review Board (IRB) approved the PATH study; data collection was also approved

by the United States Office of Management and Budget. The University of California Los Angeles IRB approved secondary analysis of PATH data on 18 September 2020.

2.2. Measures

2.2.1. Socio-Demographic and Mental Health Characteristics

At each wave, demographic data included sex (female vs. male) and sexual orientation, age, education, race/ethnicity and income level. Sexual orientation was self-reported in answer to the following question: “Do you think of yourself as: (a) Lesbian or gay,” (b) Straight, that is, not lesbian or gay,” (c) Bisexual,” (d) “Something else.” For this paper, inclusion criteria included individuals who self-reported to be sexual minorities (SM), defined as lesbian or gay, bisexual, or something else. More granular categories were not available in the PATH public use data files. For descriptive purposes, other demographic variables were categorized as follows: age as 18–24, 25–34, 35–44, 45–54, 55+; race/ethnicity as white non-Hispanic, black non-Hispanic, other non-Hispanic, and Hispanic; education as no college vs. college; annual income as <\$25,000, \$25,000–49,999, \$50,000–99,999, and ≥\$100,000. Because mental health status is robustly linked to tobacco and substance use, [30,31] mental health was assessed using two items from the Patient-Reported Outcome Measurement Information System (PROMIS) mental health scale, a validated scale that measures general perceptions of mental health in patient-reported outcome studies, with higher scores representing poorer mental health [32]. Items of the scale have been used in previous PATH studies as indicators of self-perceived mental health status [33–35]. At each wave, participants were asked to answer the following questions: (1) “In general, how would you rate your mental health, which includes stress, depression, and problems with emotions?”, with answer options scored on a scale from 1 to 5: (a) 1 = Excellent; (b) 2 = Very good; (c) 3 = Good; (d) 4 = Fair; and (e) 5 = Poor; and (2) “In the past 7 days, how often have you been bothered by emotional problems such as feeling anxious, depressed, or irritable?”, with answer options including: (a) 1 = Never; (b) 2 = Rarely; (c) 3 = Sometimes; (d) 4 = Often; and (e) 5 = Very often. More granular categories for mental health questions were collapsed to ‘excellent/very good vs. good/fair/poor’ and ‘very often/often/sometimes vs. rarely/never, capturing major group differences among smokers.

2.2.2. Hookah Tobacco and Substance Use Characteristics

For descriptive purposes, inclusion criteria included those who self-reported being: (a) current hookah users, defined as currently smoking hookah every day or some days during the past 30 days; and (b) current (past 30-day) substance users of the following: alcohol, marijuana, Ritalin®/Adderall®, painkillers/sedatives, cocaine, methamphetamine, and other drugs (including heroin, inhalants, solvents or hallucinogens). Hookah users were not necessarily exclusive to hookah use. Participants who used hookah may also have used cigarettes and/or other tobacco products including e-cigarettes, cigars, traditional cigars, filtered cigars, cigarillos, pipe, smokeless tobacco (i.e., loose snus, moist snuff, dip, spit, or chewing tobacco), pipe tobacco, snus pouches, or dissolvable tobacco; concurrent use of tobacco products by this sample of hookah smokers is described elsewhere [17].

2.3. Statistical Analyses

Weighted percentages of concurrent substance prevalence with 95% confidence intervals (CI) were estimated for each type of substance, using replicate survey weights by SAS 9.4 balanced repeated replication method with Fay’s variant [28]. For each survey Wave, Rao-Scott chi-square tests were used to compare SM to heterosexuals on demographic variables. Survey weighted logistic regression models examined concurrent substance use predicted from sexual orientation (reference group being heterosexuals) adjusting for covariates gender, age, income, education level, race/ethnicity, and perceived past week emotional problems. Covariates with multiple categories (see Table 1) were dichotomized to minimize sparseness: age (18–24, 25+, to reflect the increasing prevalence of hookah use among young adults) [6], income (<\$25,000, ≥\$25,000), race/ethnicity (non-Hispanic white,

all other). The perceived mental health rating question was not included as a covariate because of overlap with perceived past week emotional problems. As a sensitivity analysis, the models were also run adjusting for only gender and perceived past week emotional problems. To provide additional detail, survey weighted logistic regression (unadjusted) examined SM vs. heterosexual group differences in concurrent substance use within each gender group and within younger and older age group categories. To inform appropriate interpretation of study findings and because of small cell sizes, no covariates were included in these comparisons and only substances with cell sizes greater than five were included.

Table 1. Demographic and personal characteristics of survey participants who currently smoke hookah.

Characteristic	Sexual Minority Adults		Heterosexual Adults		
	Wave 1 <i>n</i> = 144	Wave 2 <i>n</i> = 117	Wave 1 <i>n</i> = 910	Wave 2 <i>n</i> = 602	
Age					
	18–24 Yr	67.41 (57.85–76.97)	69.25 (59.04–79.47)	64.89 (60.96–68.82)	63.02 (57.66–68.37)
	25–34 Yr	24.97 (15.13–34.82)	23.33 (15.36–31.31)	27.75 (24.48–31.02)	29.52 (25.06–33.97)
	35–44 Yr	4.11 (0.32–7.91)	4.9 (0–10.58)	4.57 (3.05–6.09)	5.12 (3.18–7.07)
	45–54 Yr	2.14 (0–4.66)	2.51 (0–7.5)	2.00 (0.77–3.22)	1.66 (0.48–2.84)
	≥55 Yr	1.36 (0–3.95)	0 (0–0)	0.79 (0.12–1.46)	0.68 (0–1.51)
Gender ^a					
	Male	28.16 (19.05–37.27)	34.56 (25.21–43.91)	66.97 (64.17–69.77)	64.78 (60.79–68.76)
	Female	71.84 (62.73–80.95)	65.44 (56.09–74.79)	33.03 (30.23–35.83)	35.23 (31.24–39.21)
Race					
	White, non-Hispanic	58.22 (48.65–67.8)	55.02 (42.85–67.19)	55.47 (51.38–59.57)	48.90 (44.07–53.74)
	Black, non-Hispanic	11.21 (5.49–16.94)	12.98 (5.7–20.26)	11.17 (8.21–14.13)	12.63 (8.79–16.47)
	Other, non-Hispanic	6.81 (2.93–10.69)	9.14 (4.62–13.66)	11.19 (80.18–14.19)	15.60 (11.83–19.37)
	Hispanic	23.75 (14.76–32.73)	22.86 (12.13–33.59)	22.17 (18.8–25.53)	22.86 (18.70–27.02)
Education Level					
	No College	36.28 (26.49–46.06)	46.14 (34.05–58.23)	36.30 (33.19–39.41)	37.22 (32.72–41.73)
	Some College	63.72 (53.94–73.51)	53.86 (41.77–65.95)	63.70 (60.59–66.81)	62.78 (58.27–67.28)
Annual Household Income					
	<\$25,000	58.96 (48.67–69.26)	54.24 (44.53–63.94)	49.15 (45.7–52.59)	46.16 (41.72–50.6)
	\$25,000–49,999	24.74 (15.88–33.59)	25.35 (17.61–33.1)	22.8 (19.69–25.92)	18.08 (14.12–22.03)
	\$50,000–99,000	11.96 (4.27–19.64)	12.72 (6.32–19.13)	16.08 (13.24–18.93)	19.7 (16.03–23.37)
	≥\$100,000	4.34 (0.69–8)	7.69 (0.69–14.68)	11.97 (9.42–14.51)	16.06 (11.85–20.28)
Perceived Mental Health Ratings ^a					
	Good/Fair/Poor	62.18 (53.83–70.52)	65.97 (56.73–75.22)	46.25 (42.92–49.58)	48.24 (43.13–53.34)
	Excellent/Very Good	37.82 (29.48–46.17)	34.03 (24.78–43.27)	53.75 (50.42–57.08)	51.76 (46.66–56.87)
Perceived Past Week Emotional Problems ^a					
	Sometimes/Often/Very often	68.66 (60.67–76.65)	63.74 (54.42–73.06)	42.64 (39.21–46.07)	47.09 (42.40–51.77)
	Never/Rarely	31.34 (23.35–39.33)	36.26 (26.94–45.58)	57.36 (53.93–60.79)	52.91 (48.23–57.60)

Data represent weighted percent (95% CI). African American adults were oversampled and percentages were weighted to represent the U.S. adult populations. Data are shown as percent (95% CI). ^a *p* < 0.0001 for comparing between SM and heterosexuals within wave 1 and within wave 2.

3. Results

Prevalence, demographic and personal characteristics of current hookah users are reported in Table 1. Survey weighted percentages showed that SM current hookah use (W1: 3.58%; W2: 3.15%) was higher than heterosexual current hookah use (W1: 1.26%; W2: 1.01%; *p* < 0.05). Among SM individuals, there was a significant difference by gender within W1 and W2 for those with current use (*p* < 0.0001). SM hookah smokers were predominantly women (W1: 71.84% women vs. 28.16% men; W2: 65.44% women vs. 34.56% men, *p* < 0.05), as compared to heterosexuals being predominately men (W1: 33.03% women vs. 66.97% men; W2: 35.23% women vs. 64.78% men, *p* < 0.05). In both waves, perceived mental health ratings were significantly lower (i.e., good/fair/poor) among

SM hookah smokers as compared to heterosexuals (i.e., excellent/very good; $p < 0.0001$). Similarly, the frequency of perceived past week emotional problems was significantly higher (i.e., sometimes/often/very often) among SM hookah smokers as compared to heterosexuals (i.e., never/rarely; $p < 0.001$) in both waves. Age, race, education level, and annual household income did not differ between SM and heterosexuals.

Table 2 presents the prevalence of current substance use among current hookah users by sexual identity status. Alcohol and marijuana were the most commonly concurrent substances used among SM and heterosexual hookah users. SM hookah smoker respondents had a significantly higher prevalence of concurrent use of alcohol (W1; $p = 0.046$), marijuana (W1; $p = 0.002$ and W2; $p = 0.006$), Ritalin®/Adderall® (W2; $p = 0.002$), and painkillers/sedatives/tranquilizers (W2; $p = 0.0003$) than heterosexuals. Adjusted odds of concurrent substance use for SM vs. heterosexual hookah smokers are presented in Table 3. Adjusted for gender and perceived past week emotional problems and as compared to heterosexuals, SM individuals have higher odds of marijuana use (W1: odds ratio OR = 1.63, 95% CI = 1.06–2.50); W2: OR = 1.95, 95% CI = 1.05–3.61), Ritalin/Adderall® (W2: OR = 2.95, 95% CI = 1.04–8.34) and pain killers/sedatives (W2: OR = 3.19; 95% CI = 1.45–7.01).

The odds of substance use (unadjusted) for SM vs. heterosexual current hookah users by gender and age are displayed in Tables 4 and 5. SM women hookah smokers as compared to heterosexual women have higher odds of alcohol use (W1: OR = 2.22, 95% CI = 1.05–4.71), marijuana (W1: OR = 2.16, 95% CI = 1.30–3.60; W2: OR = 2.67 95% CI = 1.36–5.25), and pain killers/sedatives (W2: OR = 3.39; 95% CI = 1.30–8.82). Within the 18–24 years old age group, SM hookah smokers were significantly associated with higher odds of using marijuana (W1: OR = 1.55, 95% CI = 0.99–2.43; W2: OR = 2.19, 95% CI = 1.22–3.94) and pain killers/sedatives/tranquilizers (W2: OR = 2.72, 95% CI = 1.37–5.42), as compared to heterosexuals in this age group. In the older age group and as compared to heterosexuals, SM hookah smokers were significantly associated with higher odds of using marijuana (W1: OR = 2.79, 95% CI = 1.17–6.61) and pain killers/sedatives (W2: OR = 5.32; 95% CI = 1.52–18.56).

Table 2. Current substance use among current hookah users by sexual identity subgroup.

	Alcohol ^a		Marijuana ^b		Ritalin®/Adderall® ^c		Painkillers/Sedatives/ Tranquilizers ^d		Cocaine		Stimulants (i.e., Methamphetamines)		Other Drugs	
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
SM Adults	82.58 (74.55–90.61)	76.13 (67.45–84.80)	50.83 (40.92–60.75)	59.76 (47.50–72.03)	6.63 (2.06–11.21)	13.85 (6.15–21.56)	11.35 (5.98–16.71)	18.85 (10.13–27.56)	3.59 (0.59–6.59)	7.70 (1.65–13.76)	1.57 (0.00–3.47)	5.78 (0.00–11.84)	5.88 (1.81–9.95)	5.17 (1.02–9.32)
Heterosexual Adults	73.03 (69.66–76.39)	73.52 (69.45–77.59)	35.49 (32.03–38.94)	40.79 (36.13–45.45)	4.10 (2.72–5.48)	4.51 (2.47–6.56)	8.83 (6.45–11.21)	6.25 (3.81–8.69)	2.59 (1.41–3.77)	4.51 (2.44–6.59)	0.86 (0.24–1.48)	2.12 (0.80–3.44)	3.08 (1.91–4.26)	4.17 (2.42–5.92)

Data represent weighted percent (95% CI). ^a Comparing alcohol use between SM and heterosexuals in W1 $p = 0.046$; ^b Comparing marijuana use between SM and heterosexuals in W1 $p = 0.002$ and W2 $p = 0.006$; ^c Comparing Ritalin®/Adderall® use between SM and heterosexuals in W2 $p = 0.002$; ^d Comparing painkillers/sedatives use between SM and heterosexuals in W2 $p = 0.0003$; W1 indicates Wave 1 (2013–2014); W2 indicates Wave 2 (2014–2015).

Table 3. Odds of concurrent substance use for SM vs. heterosexual hookah users (Wave 1 and Wave 2).

Substance	Wave 1 SM vs. Heterosexual			Wave 2 SM vs. Heterosexual		
	OR	95% CI	p Value	OR	95% CI	p Value
Alcohol						
Adjusted for gender and emotional problems	1.66	0.89–3.10	0.11	0.90	0.51–1.59	0.70
Adjusted for all covariates	1.80	0.84–3.85	0.13	0.85	0.46–1.57	0.60
Marijuana						
Adjusted for gender and emotional problems	1.63	1.06–2.50	0.03	1.95	1.05–3.61	0.04
Adjusted for all covariates	1.30	0.74–2.28	0.36	1.65	0.74–3.68	0.22
Ritalin/Adderall®						
Adjusted for gender and emotional problems	1.73	0.72–4.13	0.22	2.95	1.04–8.34	0.04
Adjusted for all covariates	1.81	0.66–4.94	0.25	1.25	0.37–4.25	0.71
Pain Killers/sedatives/tranquilizers						
Adjusted for gender and emotional problems	0.94	0.50–1.76	0.85	3.19	1.45–7.01	<0.01
Adjusted for all covariates	1.22	0.61–2.42	0.58	2.10	0.74–5.95	0.16
Cocaine						
Adjusted for gender and emotional problems	1.30	0.42–4.03	0.65	1.99	0.61–6.48	0.25
Adjusted for all covariates	1.11	0.33–3.78	0.86	1.08	0.35–3.35	0.89
Other drugs						
Adjusted for gender and emotional problems	1.94	0.74–5.03	0.17	1.23	0.40–3.79	0.72
Adjusted for all covariates	1.95	0.72–5.26	0.19	1.20	0.32–4.54	0.78

All covariates include gender, age, race/ethnicity, education, income and perceived past week emotional problems. Reference category for sexual orientation is heterosexuals. Reference category for substance use is “no past 30-day use”.

Table 4. Odds of current substance use for SM vs. heterosexual current hookah users by gender.

Substance	Women SM (n = 105) vs. Heterosexual (n = 317)			Men SM (n = 39) vs. Heterosexual (n = 593)		
	OR	95% CI	p Value	OR	95% CI	p Value
Alcohol						
W1	2.22	(1.05–4.71)	0.04	1.12	(0.45–2.79)	0.81
W2	0.89	(0.45–1.76)	0.74	1.06	(0.35–3.16)	0.92
Marijuana						
W1	2.16	(1.30–3.60)	<0.01	1.40	(0.67–2.90)	0.37
W2	2.67	(1.36–5.25)	<0.01	1.38	(0.51–3.78)	0.52
Pain Killers/sedatives/tranquilizers						
W1	1.21	(0.61–2.40)	0.58	0.63	(0.13–2.97)	0.55
W2	3.39	(1.30–8.82)	0.01	3.47	(0.96–12.62)	0.06

Reference group is heterosexuals. W1 indicates Wave 1 (2013–2014); W2 indicates Wave 2 (2014–2015).

Table 5. Odds of current substance use for SM vs. heterosexual current hookah users by age (18–24 vs. 25+).

Substance	18–24 Years Old SM (n = 110) vs. Heterosexual (n = 675)			25+ Years Old SM (n = 34) vs. Heterosexual (n = 235)		
	OR	95% CI	p Value	OR	95% CI	p Value
Alcohol						
W1	1.32	(0.73–2.37)	0.35	3.78	(0.75–19.07)	0.11
W2	1.14	(0.58–2.23)	0.70	1.15	(0.42–3.13)	0.78

Table 5. Cont.

Substance	18–24 Years Old SM (<i>n</i> = 110) vs. Heterosexual (<i>n</i> = 675)			25+ Years Old SM (<i>n</i> = 34) vs. Heterosexual (<i>n</i> = 235)		
	OR	95% CI	<i>p</i> Value	OR	95% CI	<i>p</i> Value
Marijuana						
W1	1.55	(0.99–2.43)	0.05	2.79	(1.17–6.61)	0.02
W2	2.19	(1.22–3.94)	0.01	1.92	(0.69–5.36)	0.21
Pain killers/sedatives/tranquilizers						
W1	1.83	(0.90–3.74)	0.10	0.78	(0.21–2.83)	0.70
W2	2.72	(1.37–5.42)	<0.01	5.32	(1.52–18.56)	0.01

Reference group is heterosexuals. W1 indicates Wave 1 (2013–2014); W2 indicates Wave 2 (2014–2015).

4. Discussion

To date, much is known about the concurrence of cigarette smoking and substance use among heterosexuals. However, despite a higher prevalence of hookah tobacco use among SM individuals, and associated health risks, less is known about concurrent hookah and substance use [6,17,26]. Utilizing nationally representative U.S. data, the present study compared concurrent substance use among SM adult hookah smokers as compared to their heterosexual counterparts, with a particular focus on substances increasingly prevalent, including alcohol, marijuana, cocaine, stimulants and sedatives. The key findings from this study are as follows: (a) SM hookah smokers had a higher prevalence of concurrent marijuana and other drug use, including stimulants, and sedatives, even after adjusting for differences in gender and perceived emotional problems; and (b) SM women as well as young adults were more likely to report concurrent use of hookah tobacco and substance use, particularly marijuana use in 2013–2015, as compared to their heterosexual counterparts.

There are several reasons why the topic of concurrent tobacco and substance use is highly relevant to public health, particularly among sexual minorities. First, concurrent substance use is prevalent among tobacco users, and increasingly prevalent among SM populations, a disadvantaged group more vulnerable to tobacco use and dependence [14,36]. For example, data from Wave 1 of the PATH study show that 50% of adult tobacco users reported current marijuana use, [13] and in Wave 2, 20% of young adults reported concurrent use of marijuana and tobacco [37]. Second, tobacco and substance concurrent use increases the risk of psychological, psychosocial, and health-related consequences, and is associated with lower cessation outcomes, [38–41] especially in light of emerging evidence demonstrating the deleterious effects of hookah smoking [27,42]. Third, concomitant health effects associated with concurrent combustible tobacco and substance use, including marijuana, extend to bystander non-smokers through secondhand and thirdhand smoke exposure [43,44].

Prior analysis from the PATH Study (2013–2014) showed that women tobacco users were at increased risk of substance use [14] and that SM women were more likely to report persistent tobacco and marijuana use over time, as compared to their heterosexual counterparts [45]. Our findings corroborate previous ones demonstrating notable disparities among SM tobacco users, particularly SM women—a disadvantaged minority population with a higher prevalence of tobacco and substance use—compared to heterosexual women [4,45–47]. In our nationally representative sample, SM women have significantly higher rates of current hookah use than heterosexual women, and SM women hookah smokers were 2.2–2.7 more likely to report concurrent marijuana use in waves 1–2, as compared to their heterosexual counterparts. These findings provide new insight specific to SM hookah use disparities and necessitates future research to examine the potential mechanisms and unique factors that may influence specific patterns of substance use among SM women hookah smokers, as compared to heterosexuals.

In light of the rapidly evolving hookah smoking and vaping devices to allow for marijuana use, a notable finding of our study is that, as compared to heterosexuals, SM

hookah smokers, and particularly women and young adults 18–24 years of age, were more likely to report concurrent marijuana use. These findings may suggest hookah use as an indicator for marijuana and possibly other drugs as has been demonstrated among younger users, including university students [18]. Indeed, epidemiologic studies have demonstrated the reciprocal association between tobacco and marijuana use among heterosexuals. According to nationally representative data from the National Epidemiologic Survey on Alcohol and Related Conditions, combustible tobacco smoking (i.e., cigarettes, cigars or pipes) was associated with a 3.3 times increased risk for marijuana use [48] and a systematic review showed that concurrent tobacco and marijuana use was associated with a greater likelihood of psychosocial problems, as compared to isolated marijuana use [41]. These findings not only extend the literature that has been limited to concurrent cigarette smoking with substance use, but also highlight patterns of use that may require further focus, particularly associations of hookah smoking with marijuana and other drugs, which may increase the risk of health-related consequences and toxicant exposure among SM populations. While it is unclear if study respondents used a hookah pipe to smoke marijuana, previous studies showed that hookah smokers smoke marijuana from the same hookah pipe used to smoke the flavored hookah tobacco [49,50].

The observed concurrent hookah and substance use disparities among SM individuals may be influenced by several factors. Sexual minorities have a higher overall mortality rate and report higher odds of poor mental and physical health, including higher rates of depression and cardiovascular disease risk [51–55]. Internalized homophobia and social factors, including stigma, victimization and discrimination are risk factors associated with tobacco disparities among SM individuals [54,56,57]. Other factors may also contribute to the disparities among SM populations. There is a well-documented history of targeted tobacco and other drugs product advertisement particularly toward SM populations [58–60]. Sexual minority individuals are more likely to report exposure to tobacco advertisements and discounts than their heterosexual counterparts [58]. Our findings confirm existing studies that while mental health issues may be a more prevalent problem among SM individuals, sexual orientation differences in concurrent marijuana use among hookah smokers were maintained after adjusting for differences in perceived emotional problems, as compared to heterosexuals. Better understanding of concurrent hookah and substance use among SM is needed to help inform targeted prevention efforts addressing specific substances commonly used.

Our study findings should be interpreted in the context of several limitations. The PATH study questions did not allow for identification of gender identity beyond “male” or “female”. Additionally, because the PATH Study question pertaining to “Something else” category combined a highly heterogeneous group that may not adequately characterize the definition of “sexual minority” (i.e., gender queer), we were unable to assess distinctions between specific SM subgroup categories. Future studies should identify larger representations of SM individuals to better understand subgroup differences in concurrent hookah and substance use. Tobacco and substance use were based on participants’ self-report, and therefore subject to recall bias and misclassification [61,62]. PATH study data examining potential factors associated with tobacco use such as personal experiences of stigma, victimization and discrimination were not available. The historical nature of the analyzed data (2013–2015) may limit generalizability to current trends. Future work is warranted on subsequent PATH data to evaluate: (a) complex concurrent use patterns of hookah plus specific substances and other tobacco and nicotine products; and (b) substances significantly different in some of the subgroups, but not in others (i.e., SM women vs. heterosexual alcohol use (Wave 1) and painkillers/sedatives/tranquilizers (Wave 2)). Finally, because data were analyzed within each of two waves of data, causal relationships could not be addressed.

The present study had several notable strengths. First, we utilized a large nationally representative sample of U.S. SM and heterosexual adults. Second, we focused on inclusion of concurrent substance use among a vulnerable tobacco population. Finally,

in investigating concurrent substance use comparisons among sexual minority hookah smokers, the present study provides the impetus for the development of interventional approaches targeting SM individuals to reduce tobacco use inequities experienced by such a disadvantaged population.

5. Conclusions

Our study document novel findings and advance the existing paucity of knowledge regarding concurrent substance use among a nationally representative sample of U.S. adult SM hookah smokers, relative to heterosexuals. The study findings have research and practice implications. Given hookah's rapid growth and concurrent use of substances, particularly among SM women and young adults as compared with their heterosexual peers, our findings highlight the importance of further research to examine factors influencing concurrent hookah tobacco smoking and substance use, to inform effective hookah tobacco and substance use public education and health-related disease awareness. In practice, our findings support the generation and application of holistic and tailored cessation interventions that culturally incorporate sexual and gender-specific strategies and address health disparities experienced this population. Cessation interventions must take into account mental health symptomatology, which may complicate tobacco prevention and cessation.

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