A MULTIVARIATE APPROACH TO SUBSTANCE USE IN COLLEGE STUDENTS:

EXPLORING DIMENSIONS OF SEXUAL ORIENTATION AND SUBSTANCE USE

RELATED TRAITS AND BEHAVIORS

by

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ABSTRACT

Multilevel minority stressors have been associated with increased rates of substance use in sexual minority people (e.g., non-heterosexual, such as gay, lesbian, bisexual), with group specific processes underexplored in the current literature. This research attempts to provide a better understanding of the factors that influence the sexual orientation and substance use relationship, including an analysis of responses to stress and precursors to substance use, an aim which is necessary for informing any tailored intervention. The main hypothesis was that substance use relationships will differ between sexual orientation subgroups, suggesting group-specific differences to be further explored in future intervention. The participants in this study were recruited from introductory and upper-level psychology courses at Texas State (N = 1,191; Age: $M = 19.57$, $SD = 2.36$) and completed an anonymous online survey about demographic information, substance use frequency, and completed validated scales over coping responses, trait impulsivity, sexual risk-taking, and susceptibility to peer influence. Sexual orientation was measured with sexual identity and sexual attraction to produce a four-level variable of completely heterosexual, discordant heterosexual (e.g., people who identify as heterosexual though report same-sex attraction), bisexual attraction, and completely homosexual. A four-step statistical procedure found mediators that differed as a function of sexual attraction group membership and mediators fell into psychological and sexual domains. Mediators included substance use for coping, lack of perseverance, sensation seeking, risky sex acts, risky anal sex acts, and sexual risk-taking with

uncommitted partners. An attraction to both sexes appeared to be linked to the greatest prevalence of use, regardless of sexual identity. Overall, the mediated effects were strongest in the discordant heterosexual group and the bisexual attraction group, and after considering both mediators and demographics, the discordant heterosexual group was most at risk for substance use. Results of the study highlight the importance of measuring sexual orientation in multiple ways. These data could be used on college campuses in student health centers for informing health educators and health education efforts to reduce high risk behavior in undergraduate students. Suggestions for group specific risk reduction and directions for further study are discussed.

Literature Review

The 2010's in the United States can be characterized by progression in equality

for sexual minority (e.g., non-heterosexual, such as gay, lesbian, bisexual) people, while

a shifting political climate is a reminder that there is still progress to be made. Examples

are seen in recent historical events, such as the landmark 2015 case allowing nationwide

marriage equality for same-sex couples (Frost, 2015), to the 2019 Equality Act crossing

the US Congressional floor and into the US Supreme Court to decide whether

discrimination on the basis of sexual orientation and gender identity should be prohibited

(Congress, 2019). Without this act, it is legal for employers to fire employees in over half

of US states for being a sexual minority person. These decisions from the highest levels

of government trickle down into the daily lives of sexual minority people (Ogolsky,

Monk, Rice, & Oswald, 2019). At a macro-level from societal structures and at a micro-

level from family and peers, sexual minorities may experience pressures that are unique.

Scholars define minority stress as the consequence of being perceived as a member of a

minority group and enduring the stigma, exclusion, and prejudices associated with the

minority identity (Meyer, 2003). Researchers consistently cite minority stress as an

underlying determinant driving disparities in mental health and substance use between

heterosexual and sexual/gender minority groups (Mereish, Goldbach, Burgess, &

DiBello, 2017; Schuler, Rice, Evans-Polce, & Collins, 2018; Valentine & Shipherd,

2018), while other mechanisms remain less understood.

Meta-analyses reveal an 190% average greater odds of substance use for sexual

minority youth relative to heterosexuals (Marshal et al., 2008), with 1.5 times greater risk

for depression/anxiety disorders and substance dependence (King et al., 2008). Sex differences found among these groups generally suggests that when compared to heterosexual peers, sexual minority women are at greater risk for drug and alcohol use disorders, while sexual minority men are more at risk for illicit drug use (Green & Feinstein, 2012). Notably, sexual minority adults who experience racial, gender, and sexual orientation-based discrimination have four times greater odds of having a substance use disorder than sexual minorities that do not experience discrimination (McCabe, Bostwick, Hughes, West, & Boyd, 2010), further supporting the minority stress theory. The literature suggests other explanations for elevated rates of substance use in sexual minorities relating to minority stress, including identity disturbance (Talley, Tomko, Littlefield, Trull, & Sher, 2011), attachment styles (Rosario et al., 2014), and lack of social support (Rosario, Schrimshaw, & Hunter, 2009).

National survey results support the trend of higher rates of substance use in sexual minorities versus heterosexuals (Goldberg, Strutz, Herring, & Halpern, 2013; McCabe, Hughes, Bostwick, West, & Boyd, 2009), with subgroup differences within the sexual minority group (e.g., lesbian versus bisexual), suggesting the sexual minority group may not be a homogenous group (Schuler et al., 2018). This invites research to examine reasons for differences, other than minority stress, that may influence the sexual minority and substance use relationship. Moreover, it brings to question if factors manifest in sexual orientation groups differently. A logical next step is to examine substance use-related traits and behaviors to facilitate an understanding of potential differences that may exist among sexual minority groups that might contribute differently to substance use, including responses to stress and precursors to substance use. And these differences may

lead to tailored behavior treatments for sexual minorities. However, little work in the substance use treatment literature has tested tailored behavioral treatments for sexual minorities, with gay-specific cognitive behavioral therapy interventions for sexual minority men (Shoptaw et al., 2008; Shoptaw et al., 2005). Keeping tailored intervention in mind, it is important to consider how sexual orientation subgroups differ in behaviors that could be related to substance use, especially in college students with high-risk behavior and added academic stress.

Drawing from the framework of tension reduction and self-medication in emerging adulthood, the following factors were selected for the present study. Foremost, there is variability in how people cope with stress (Gregg, Haddock, Emsley, & Barrowclough, 2014), and there may be variability in how sexual minorities cope with sexual orientation-related minority stressors (Felner et al., 2019; Toomey, Ryan, Diaz, & Russell, 2018). As such, coping styles will be assessed to determine adaptive and maladaptive coping differences between sexual orientation groups, which includes substance use as coping behavior. This will be followed by trait impulsivity, mostly due to its role in addictive behaviors (e.g., drug use, gambling), with a focus on negative urgency and lack of perseverance (Dir, Karyadi, & Cyders, 2013; Romer Thomsen et al., 2018). Next, sexual risk-taking will be assessed as an addition to risk-taking as a coping tool (Pachankis et al., 2015). Last, the likelihood of young adult substance use can be generally predicted by peers' use (Andrews, Tildesley, Hops, & Li, 2002), thus levels of susceptibility to peer influence may differ among sexual minorities, perhaps having greater willingness to use substances as a means of peer acceptance (Gamarel et al., 2018) and to gain social support to reduce stress.

These factors alone may differ among groups, yet more interestingly will be how they will relate to each other, such as mediational processes that may exist in the sexual orientation and substance use relationship. Recent research finds difficulties in emotion regulation mediate minority stress and substance use, highlighting a novel target for intervention in sexual minority individuals (Rogers et al., 2017). This study will attempt to build on these findings, focusing on potential stress regulation processes that may differ among sexual orientation groups. Often when people experience emotional distress and have trouble regulating these emotions, theories on emotion regulation suggest that individuals act on immediate impulses which increases risk for addictive behaviors and substance use (Tice, Bratslavsky, & Baumeister, 2001).

Therefore, this research proposes trait impulsivity is likely a key mediating factor influencing substance use disparities and risk behavior (Magid, Maclean, & Colder, 2007), which include the other factors discussed above. Impulsivity is largely considered multidimensional and differential effects of impulsivity may exist among sexual orientation groups. Past research typically suggests that bisexual individuals experience greater mental health consequences and elevated substance use rates relative to gay and lesbian people, perhaps stemming from societal stigma from both heterosexual and gay counterparts (la Roi, Meyer, & Frost, 2019). As a whole, sexual minority people generally face more developmental challenges during late childhood and early adulthood (e.g., parental and peer rejection) (la Roi, Kretschmer, Dijkstra, Veenstra, & Oldehinkel, 2016), perhaps affecting impulsivity and coping responses, and relating to the proneness of substance use in efforts to alleviate stress. For these reasons, substance use-related traits may be inherently different for sexual minority people, especially bisexual

individuals. Possible mediational processes of stress linked to sexual orientation will be examined in this study as well as differential effects of sexual orientation subgroup membership. If there is evidence of processes that differ among groups, we will be able to speculate on why these differences exist and pose future research questions.

In addition, sexual orientation will be measured in two ways to evaluate the complexity of sexuality and to consider individuals who report sexual attraction that does not align with reported sexual identity (Green & Feinstein, 2012; McCabe, Hughes, Bostwick, & Boyd, 2005). By defining sexual orientation in two ways and examining processes that may vary across groups, valuable additions can be made to the substance use treatment literature. Each of the mentioned factors will be considered in the relationship with substance use, particularly with a variety of drug types including alcohol and marijuana, illicit drugs, and prescription drugs. Many studies on college student substance use include a narrow range of substances and largely focus on alcohol and marijuana use, which does not fully capture those that may experiment with other drugs or who use less conventional drugs.

Aims and Hypotheses

This study aims to first identify sexual orientation differences in substance use using two dimensions of sexual orientation (e.g., sexual identity and sexual attraction), and to examine how associated factors influence the sexual orientation and substance use relationship. To this end, the first aim will be achieved in univariate analyses, given sufficient sample sizes within each group. The second aim will be achieved in multivariate analyses with structural equation modeling and a series of statistical tests.

An initial theoretical model will be estimated simultaneously across sexual orientation

groups, with mediators consisting of the factors discussed above (see Figure 1).

Multivariate analyses will be used to evaluate subgroup heterogeneity to identify

differential effects among groups. Because the literature associates stress with sexual

identity minority status or non-completely heterosexual attraction status, it is predicted

that sexual orientation-linked stress regulation processes will differ in the sexual

orientation and substance use relationship. If the effects are different as a function of

sexual orientation subgroup membership, it may suggest those parameters are most

important to target in efforts to reduce substance use in a particular group.
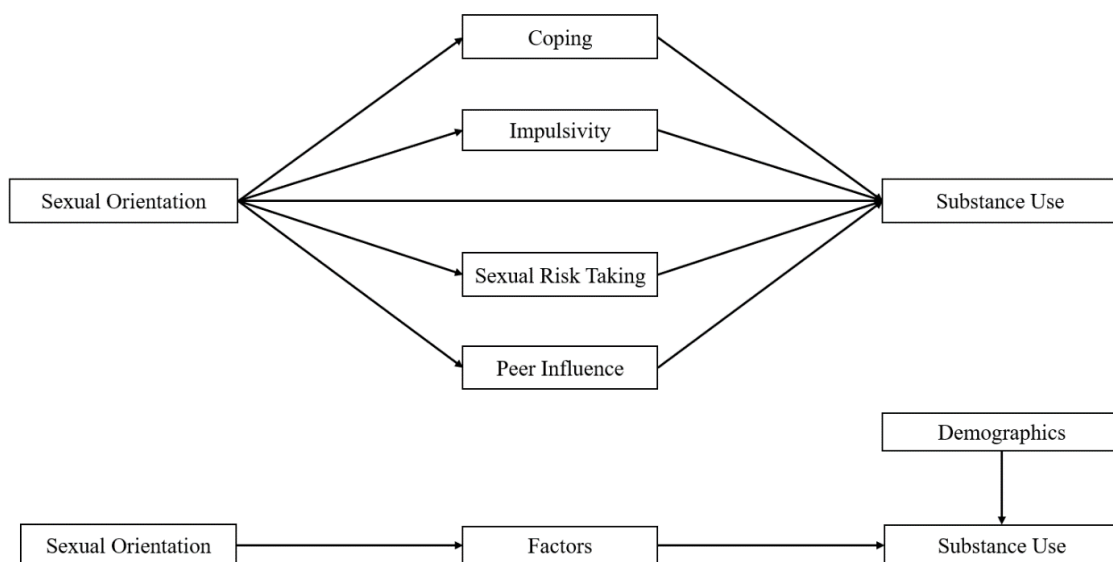
Figure 1. Proposed theoretical model of substance use by sexual orientation and related
factors, and planned mediation analytic strategy, controlling for demographics

The main hypothesis is that substance use relationships will differ between sexual

orientation subgroups (H1), suggesting group specific differences to be further explored

in future intervention. These data would be helpful in aiding behavioral treatment

approaches for sexual minority college students, especially if there are heterosexual

versus sexual minority differences, within-group sexual minority differences, and heterosexual versus discordant heterosexual differences. More specified hypotheses are that the sexual minority groups will report greater levels of maladaptive coping behaviors (H2), score higher on trait impulsivity such as negative urgency (H3), report more sexual risk-taking (H4), and score lower in resistance to peer influence (H5).

II. METHODS

Participants

The participants in this study were recruited from introductory and upper-level psychology courses at a large university in the southern region of the United States. Participants were compensated for their participation with either course credit or extra credit. Participants must have been 18 years or older to participate in this study. The sample consisted of 1,191 participants, including 985 heterosexuals, 44 gays/lesbians, 105 bisexuals, 4 queer, 17 questioning, 14 pansexual, 6 asexual, and 16 who preferred not to answer. The sample was 69.2% female, 21.9% male, and had a mean age of 19.57 (*SD* = 2.36). The sample was 39.7% White, 33.6% Hispanic/Latinx, 12.1% Black, 3.8% Asian/Pacific Islander, 0.5% Native American, and 1.8% of other race.

Measures and Procedures

Participants completed an anonymous online survey through Qualtrics. Upon giving informed consent, participants answered questions about demographic information, substance use frequency, and completed validated scales.

Demographics. Demographic data included age, biological sex, ethnicity, and religion. Four questions were included with religion to measure religiosity, or how religious beliefs play a role in participants' life. Items included frequency of attending religious services, the degree of importance religious beliefs are in life, how religious beliefs influence life decisions, and how important it is that friends share religious beliefs. The religiosity scale achieved a good alpha reliability of .838.

Sexual Orientation variables. Two questions measured sexual orientation. Participants were asked about sexual identity and asks how participants consider themselves to identify including heterosexual or straight, gay or lesbian, bisexual, queer, questioning, pansexual, and asexual. Two grouping methods were used with the sexual identity responses. First to examine all sexual identity data, a two-level categorical sexual identity variable was created to represent the sexual majority (e.g., heterosexual) and minority (e.g., included gay/lesbian, bisexual, queer, questioning, pansexual, and asexual) groups. Still using the sexual identity variable to examine subgroup sexual identity differences, a three-level categorical sexual identity variable was created with those that identified as heterosexual, gay/lesbian, and bisexual. Other identities were excluded from this variable due to the limited sample size in smaller subgroups.

In addition, participants were also asked to report on sexual attraction to other people and decide which best described their feelings out of eight responses. Example responses are, "only attracted to women," "equally attracted to women and men," and "I am still figuring out who I am attracted to." Based on respondents' response to sex, participants were first grouped in heterosexual, bisexual, and homosexual attraction groups. A coding procedure which entered syntax (a series of if else statements), used both sexual identity and sexual attraction responses. For example, if participants identified with both a heterosexual identity and a heterosexual attraction, they were grouped into a completely heterosexual group. If participants identified with a heterosexual identity but reported a bisexual or homosexual attraction, they were grouped into a discordant heterosexual group. Therefore, a four-level sexual attraction variable was created from this method, with a completely heterosexual group, a discordant

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heterosexual group, a bisexual attraction group, and a completely homosexual attraction group.

Substance Use variables. Substance use was measured using ten substances, including: past-month alcohol, past-month marijuana, past-year cocaine, past-year MDMA/ecstasy, past-year ketamine, past-year GHB, past-year LSD, past-year prescription opioids (such as OxyContin, Vicodin), past-year prescription stimulants (such as Ritalin, Adderall), and past-year prescription benzodiazepines (such as Valium, Xanax). Participants were asked to recall the past-month and past-year and self-report frequency of use for each substance by dragging a bar to an approximate number of days of consumption for each substance. Each substance had a binary outcome for use. A total substance use variable was calculated by adding six of the substance use outcomes to capture the number of substances each participant had used in the past-month/year. A larger value represents a greater variety of substance use and scores ranged from zero to six. Alcohol and Rx drug use were excluded from the total substance use variable because the variables measured general use and not misuse (binge drinking or problematic drinking, nonmedical use or medical misuse) of these substances. Due to measuring by the number of days of use, frequency is a loose term, as participants could have used a substance multiple times per day and the use would still count as one day. Therefore, participants were categorized as yes/no for use for parsimony.

Coping Responses. The Brief COPE (Carver, 1997) was used to assess coping responses, particularly to measure how people cope with stress in life. This measure includes 28 items measured on a 4-point Likert scale and is a valid and reliable assessment of 14 distinct coping strategies (Monzani et al., 2015). Specific coping

responses and example items include, active coping, "I've been concentrating my efforts on doing something about the situation I'm in," and for this sample achieved an acceptable alpha reliability of .635; denial, "I've been refusing to believe that it has happened," and for this sample achieved an alpha reliability of .724; substance use, "I've been using alcohol or other drugs to make myself feel better," and for this sample achieved a good alpha reliability of .897; use of emotional support, "I've been getting emotional support from others," and for this sample achieved an alpha reliability of .770; use of instrumental support, "I've been getting help and advice from other people," and for this sample achieved a good alpha reliability of .820; behavioral disengagement, "I've been giving up trying to deal with it," and for this sample achieved an alpha reliability of .705; positive reframing, "I've been trying to see it in a different light, to make it seem more positive," and for this sample achieved an alpha reliability of .731; planning, "I've been trying to come up with a strategy about what to do," and for this sample achieved an alpha reliability of .727; humor, "I've been making jokes about it," and for this sample achieved an alpha reliability of .791; acceptance, "I've been accepting the reality of the fact that it has happened," and for this sample achieved an acceptable reliability of .643; religion, "I've been trying to find comfort in my religion or spiritual beliefs," and for this sample achieved a good alpha reliability of .834; self-blame, "I've been blaming myself for things that happened," and for this sample achieved an alpha reliability of .746. Two subscales failed to achieve an acceptable alpha reliability and were excluded from further analysis: self-distraction (e.g., "I've been turning to work or other activities to take my mind off things"; Cronbach's alpha = .453) and venting (e.g., "I've been saying things to let my unpleasant feelings escape"; Cronbach's alpha = .492)

Trait Impulsivity. The Short UPPS-P (Cyders, Littlefield, Coffey, & Karyadi, 2014) assessed participants' impulsiveness. This measure has 20 items measured on a 4-point Likert scale and consists of five internally consistent scales that measure subcomponents of impulsivity. Four items assess each subcomponent and include negative urgency, "sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse," and for this sample achieved an alpha reliability of .759; lack of perseverance, "unfinished tasks really bother me," and for this sample achieved an acceptable alpha reliability of .676; lack of premeditation, "I like to stop and think things over before I do them," and for this sample achieved an alpha reliability of .783; sensation seeking, "I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional," and for this sample achieved an alpha reliability of .680; and positive urgency, "I tend to lose control when I'm in a great mood," and for this sample achieved an alpha reliability of .799.

Sexual Risk-Taking. The Sexual Risk Survey (Turchik & Garske, 2009) is a measure developed to assess sexual risk behaviors in college students. The scale evidences high test-retest reliability and high to adequate internal consistency (Cronbach's alpha = .88). This measure includes 23 items and asks participants to reflect on their behavior over the past six months and report the number of times each behavior occurred. This scale consists of five subscales, including eight items assessing sexual risk-taking with uncommitted partners, "how many times have you had sex with someone you don't know well or just met," and for this sample achieved excellent reliability of .901; five items assessing risky sexual acts, "how many times have you had vaginal intercourse without a latex or polyurethane condom," and for this sample achieved an

alpha reliability of .806; five items assessing impulsive sexual behaviors, "how many times have you had an unexpected and unanticipated sexual experience," and for this sample achieved an alpha reliability of .781; two items assessing intent to engage in risky sexual behavior, "how many times have you gone out to bars/parties/social events with the intent of hooking up and having sex with someone," and for this sample achieved an alpha reliability of .747; and three items that assess risky anal sex acts, "how many times have you had anal sex without a condom," and for this sample achieved an acceptable alpha reliability of .625.

Susceptibility to Peer Influence. The Resistance to Peer Influence scale (Steinberg & Monahan, 2007) was used to assess participants' resistance or susceptibility to peer influence. This measure includes 10 pairs of statements and participants are instructed to choose the statement out of each pair that best describes them and provide a Likert rating on the degree the chosen statement applies to them. An example pair of statements from the scale is, "some people think it's better to be an individual even if people will be angry at you for going against the crowd" and "other people think it's better to go along with the crowd than to make people angry at you." Out of the two, participants decide if the chosen statement is really true for them or sort of true for them. This scale has demonstrated adequate reliability across samples (Cronbach's alpha >= .70) and for this sample achieved an alpha reliability of .732.

Statistical Analysis

All statistical analyses were conducted using SPSS version 24.0 (Armonk, NY: IBM Corp). Demographic information of the sample was evaluated first using the

crosstabs and frequencies functions, including age, sex, ethnicity, sexual orientation, and religion/religiosity. The ten substance use variables were treated as categorical (yes/no) for use, therefore chi-square tests of independence were used to establish prevalence rates among groups. The sexual orientation variable was treated in three ways. First, by making a heterosexual group and a sexual minority group (e.g., any non-heterosexual identity), the traditional tactic to make sexual majority and minority comparisons. Second, groups were examined for subgroup differences in sexual identity, particularly between heterosexuals, gay/lesbians, and bisexuals. Third, the sexual attraction variable was used to establish differences between heterosexuals, discordant heterosexuals (e.g., those that identify as heterosexual yet report same sex attraction), gay/lesbians, and bisexuals. This method of grouping participants allowed for initial examination of sexual orientation subgroup differences that are often lost when making simple majority versus minority comparisons and not accounting for sexual attraction. The sexual attraction grouping method captured the most subgroup heterogeneity in substance use and was used for the rest of the analyses. One-way ANOVAs evaluated subgroup differences in sexual orientation subgroups on the validated scales discussed in Measures.

Multivariate analyses were conducted using a four step procedure. An initial theoretical model was developed with the measured variables as seen in Figure 1, consisting of the sexual orientation variable as the independent variable, related factors as mediators, and substance use as the dependent variable, while controlling for demographics. Demographic variables age, sex, and race/ethnicity, were controlled for. First, an ANCOVA was used to confirm sexual orientation had an impact on substance use while controlling for other demographics. Second, a MANCOVA was used to

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confirm sexual orientation had an impact on mediators. Some mediators were deleted in this process. Third, a linear regression was used to confirm mediators had an effect on substance use, with the mediators as the independent variables and substance use as the dependent variable. Last, an ANCOVA was used with sexual orientation as the independent variable and substance use as the dependent variable, with the demographic and mediator covariates.

III. RESULTS

Data were initially screened for missing data, normality, outliers, and were tested for reliability on the validated scales. Preliminary analysis of the sexual orientation variables showed that data were sufficient for analyses with the operationalization of sexual orientation through sexual attraction, such that of those with valid sexual identity and attraction data, of 978 that identified as heterosexual, 127 reported some type of same-sex attraction. Thus, a four-level sexual attraction variable was created with completely heterosexual, discordant heterosexual, bisexual attraction, and completely homosexual. The demographic breakdown of the sample based on sexual attraction subgroup membership is seen in Table 1. The groups were similar in age and consisted of mostly females, though there were more males than females in the completely homosexual group. Approximately one-third of participants in each group were Hispanic/Latinx. While within Whites, there were much higher rates in the completely heterosexual/homosexual groups than the discordant heterosexual and bisexual attraction groups. Christian Catholic was the leading religion in most groups besides completely homosexuals. When totaling branches of Christianity, the completely heterosexual group was 73% Christian, discordant heterosexual group was 56.8%, the bisexual attraction group was 47.5%, and the completely homosexual group was 40%. An Agnostic religious belief was more prevalent as participants trend towards homosexual attraction and similarly mean religiosity scores decreased in the same direction.

Table 1. Descriptive Statistics by Sexual Attraction (n=1120)

Variable	Completely Heterosexual n=851	Discordant Heterosexual n=127	Bisexual Attraction n=107	Completely Homosexual n=35
Age, mean (SD)	19.6 (2.5)	19.7 (2.4)	19.5 (1.6)	19.4 (1.9)
Sex, %				
Female	73.2	87.4	88.8	45.7
Male	26.8	12.6	11.2	54.3
Race/Ethnicity, %				
Asian/Pacific Islander	3.4	6.3	4.7	0.0
Black/African American	11.4	18.9	17.8	17.1
Hispanic/Latinx	36.4	37.8	39.3	31.4
Native American/Indian	0.5	0.8	0.9	0.0
White/Caucasian	46.3	34.6	36.4	48.6
Other	2.0	1.6	0.9	2.9
Religion, %				
Agnostic	5.3	14.2	16.8	20.0
Atheist	4.0	3.1	5.6	8.6
Buddhist	0.2	1.6	2.8	0.0
Christian Baptist	25.2	20.5	14.0	20.0
Christian Catholic	34.1	27.6	21.5	11.4
Christian Lutheran	3.2	0.8	3.7	2.9
Christian Methodist	8.7	4.7	3.7	5.7
Christian Mormon	0.0	0.8	0.0	0.0
Christian Presbyterian	1.8	2.4	0.9	0.0
Deist	0.1	0.0	0.9	0.0
Hindu	0.1	0.0	0.0	0.0
Jewish	0.4	0.8	0.9	0.0
Muslim	0.8	0.8	0.0	0.0
Pagan	0.0	0.0	1.9	0.0
Secular	0.1	0.8	0.0	0.0
Spiritual but not religious	4.8	6.3	12.1	8.6
No response/prefer not to answer	11.2	15.8	14.9	22.9
Religiosity, mean (SD)	2.7 (1.0)	2.2 (0.1)	2.2 (0.8)	1.9 (0.8)

Substance Use Outcomes

Substance use prevalence rates are found in Table 2. When making sexual majority and minority comparisons, significant differences were found in past-month marijuana use ($p=.001$) and past-year LSD use ($p=.035$) with the sexual minority group reporting more use. Similarly, sexual identity subgroup differences were found in the past-month marijuana use variable ($p=.013$) with the bisexual identity group reporting the greatest marijuana use. Yet, sexual attraction subgroups evidenced the most differences, as seen in past-month marijuana use ($p=.002$), past-year cocaine use ($p=.053$), past-year ketamine use ($p=.024$), and past-year LSD use ($p=.031$). The discordant heterosexual group had comparable substance use prevalence to the bisexual attraction group and in some cases had the highest prevalence and clearly exceeded the completely heterosexual group across most substances. Surprisingly, the completely homosexual group had most of the lowest prevalence of substance use, likely due to the smaller sample size.

Table 2. Substance Use Prevalence by Multiple Methods of Measuring Sexual Orientation

Variable	Heterosexual n=985 Sexual Minority* n=190	Sexual Identity Subgroups Heterosexual n=985 Gay/Lesbian n=44 Bisexual n=105	Sexual Attraction Subgroups Comp. Heterosexual n=851 Disc. Heterosexual n=127 Bisexual Attraction n=107 Comp. Homosexual n=35
Past-month alcohol, %	78.3 77.0	78.3 72.1 77.2	78.0 80.5 78.6 64.7
Past-month marijuana, %	**46.4** **60.5**	**46.6** **51.2** **62.2**	**44.9** **57.6** **62.2** **50.0**
Past-year cocaine, %	11.9 15.9	11.9 8.6 19.8	**10.8** **17.1** **18.6** **6.9**
Past-year MDMA, %	10.5 14.8	10.5 16.7 14.5	9.6 15.0 13.4 12.9

Table 2. Continued

Past-year ketamine, %	2.7 4.2	2.7 0.0 4.8	**1.9** **6.7** **2.5** **0.0**
Past-year GHB, %	2.3 2.1	2.3 0.0 2.5	1.9 3.8 1.3 0.0
Past-year LSD, %	**10.3** **16.2**	10.3 9.1 15.7	**8.8** **17.4** **13.6** **6.9**
Past-year Rx opioids, %	8.3 6.3	8.3 0.0 8.5	8.4 6.8 5.0 0.0
Past-year Rx stimulants, %	15.9 13.5	15.9 14.3 15.3	15.9 15.0 16.3 10.3
Past-year Rx benzodiazepines, %	7.5 12.1	7.5 11.8 10.6	6.6 12.1 9.6 13.3

*Includes every non-heterosexual identity measured in this study: Boldface indicates statistical significance ($p<.05$)

Univariate Results of Validated Measures

Results of the univariate comparisons between sexual attraction subgroups on the validated measures used in this study are found in Table 3. No significant differences were found for active coping ($p=.524$), use of emotional ($p=.240$) and instrumental support ($p=.750$), planning ($p=.539$), humor ($p=.094$), and acceptance ($p=.546$). The bisexual attraction group scored higher on denial than both heterosexual groups ($p=.002$). The discordant and bisexual group scored higher on substance use for coping over the completely heterosexual and homosexual groups ($p<.001$). Additionally, the bisexual group scored higher on behavioral disengagement ($p=.005$) and self-blame ($p=.001$) over the completely heterosexual group. The completely homosexual group scored higher than the bisexual attraction group on positive reframing ($p=.048$), while the completely

heterosexual group scored higher on religion for coping over the other three groups ($p<.001$). Despite the general lack of differences in impulsivity scores at the univariate level, the bisexual group did score higher on negative urgency relative to the completely heterosexual group ($p=.002$), while the discordant heterosexual group scored higher on lack of perseverance compared to the completely heterosexual group ($p=.004$). For sexual risk-taking subscales, the completely homosexual group scored lowest on the general risky sex acts scale ($p=.007$), however they scored higher on risky anal sex acts relative to the completely heterosexual group ($p<.001$). Last, no differences were found in the resistance to peer influence between sexual attraction groups ($p=.721$).

Table 3. Univariate Comparisons between Sexual Attraction Groups

Variable	Completely Heterosexual n=851	Discordant Heterosexual n=127	Bisexual Attraction n=107	Completely Homosexual n=35	*p* value
Coping Responses					
Active coping	5.5 (1.5)	5.5 (1.6)	5.3 (1.6)	5.5 (1.7)	.524
Denial	**3.1 (1.4)**	**3.1 (1.4)**	**3.6 (1.8)**	3.1 (1.4)	.002
Substance use for coping	**3.3 (1.7)**	**3.8 (1.9)**	**4.0 (2.1)**	**3.1 (1.4)**	<.001
Use of emotional support	5.1 (1.8)	5.3 (1.9)	5.2 (1.9)	5.6 (1.9)	.240
Use of instrumental support	5.0 (1.9)	4.9 (1.9)	4.9 (1.9)	5.3 (2.1)	.750
Behavioral disengagement	**3.4 (1.5)**	3.5 (1.5)	**3.9 (1.7)**	3.3 (1.3)	.005
Positive reframing	5.7 (1.7)	5.6 (1.7)	**5.4 (1.7)**	**6.3 (1.5)**	.048
Planning	5.5 (1.7)	5.4 (1.6)	5.4 (1.8)	5.8 (1.6)	.539
Humor	4.8 (2.0)	4.8 (2.0)	5.3 (2.1)	5.2 (1.7)	.094
Acceptance	5.6 (1.7)	5.6 (1.6)	5.3 (1.6)	5.6 (1.7)	.546
Religion	**4.8 (2.2)**	**4.2 (2.1)**	**3.8 (1.7)**	**3.6 (1.8)**	.001
Self-blame	**4.8 (1.9)**	5.1 (1.8)	**5.5 (1.9)**	5.4 (1.7)	.001
Trait Impulsivity					
Negative urgency	**2.3 (0.7)**	2.4 (0.7)	**2.6 (0.8)**	2.4 (0.8)	.002
Lack of perseverance	**1.7 (0.5)**	**1.8 (0.4)**	1.8 (0.5)	1.6 (0.5)	.004
Lack of premeditation	1.7 (0.5)	1.8 (0.5)	1.8 (0.5)	1.7 (0.6)	.049

Table 3. Continued

Sensation seeking	2.7 (0.7)	2.6 (0.6)	2.7 (0.7)	2.7 (0.7)	.682
Positive urgency	2.0 (0.7)	2.0 (0.7)	2.1 (0.7)	1.8 (0.7)	.627
Sexual Risk-Taking					
Sexual risk-taking with uncommitted partners	0.6 (0.8)	0.7 (0.8)	0.8 (0.9)	0.8 (0.7)	.133
Risky sex acts	**1.0 (0.9)**	**1.2 (1.1)**	**1.1 (0.9)**	**0.6 (0.6)**	.007
Impulsive sexual behaviors	0.7 (0.8)	0.7 (0.8)	0.7 (0.7)	0.8 (0.7)	.872
Intent to engage in risky sexual behavior	0.3 (0.7)	0.3 (0.7)	0.4 (0.7)	0.3 (0.5)	.714
Risky anal sex acts	**0.2 (0.5)**	0.3 (0.6)	0.3 (0.6)	**0.8 (1.2)**	.001
Susceptibility to Peer Influence					
Resistance to peer influence	2.8 (0.5)	2.8 (0.5)	2.7 (0.5)	2.8 (0.6)	.721

Boldface indicates statistical significance ($p<.05$) on post-hoc tests; Tukey HSD when equal variances assumed; Dunnett's T3 when equal variances not assumed

Multivariate Results

The multivariate procedure and results are captured in Tables 4 through 6. From the initial ANCOVA, there was a significant effect of sexual attraction status on the total drug use outcome variable after controlling for age, sex, and race/ethnicity, $F(3, 846) = 7.371$, $p<.001$. There was also a significant effect of sex, such that males had greater use than females on the substance use outcome. The initial model was significant and explained 4.1% of the variance of the outcome.

Table 4. First ANCOVA Results

Step 1: ANCOVA					
DV: Substance Use					
Independent Variables	SS	df	F	*p* value	Partial η^2
Age	.839	1	.725	.395	.001
Sex	19.543	1	16.894	**<.001**	.020
Race/Ethnicity	.317	1	.274	.601	.000
Sexual attraction	25.581	3	7.371	**<.001**	.025

Table 4. Continued

Post-Hoc Comparisons			
Variable	Mean difference	*p* value	Comparisons
Sexual attraction	.423	**<.001**	b > a
	.381	**.003**	c > a
	.680	**.004**	b > d
	.637	**.008**	c > d

Boldface indicates statistical significance ($p<.05$); Note: mean values of DV for each group are a) Completely Heterosexual: .656, b) Discordant Heterosexual: 1.079, c) Bisexual Attraction: 1.037, d) Completely Homosexual: .399; R Squared = .041

Next, a MANCOVA model was used to examine the effects of the sexual attraction independent variable on the (DV) mediators, while controlling for demographics. There were statistically significant differences in mediators based on sexual attraction subgroup membership, $F(69, 2868.823) = 3.160$, p<.001; Wilk's Λ = .803, $\eta2 = .07$. An alpha correction was needed to account for the tests of between-subjects effects and to adjust for multiple comparisons, so a Bonferroni correction was used. Additional effects on the mediators were found at the multivariate level while controlling for demographics, as seen in Table 5. Although the Bonferroni adjustment is a conservative test, Post-Hoc comparisons reveal significant differences in coping and sexual risk-taking subscales and trends towards significance on impulsivity subscales.

Table 5. MANCOVA Results

Step 2: MANCOVA					
IV: Sexual Attraction					
Dependent Variables	**SS**	**df**	**F**	***p* value**	**Partial η^2**
Active coping	.831	3	.118	.949	.000
Denial	34.180	3	5.452	**.001**	.016
Substance use for coping	90.870	3	9.802	**<.001**	.029
Use of emotional support	17.261	3	1.725	.160	.005
Use of instrumental support	8.449	3	.805	.491	.002
Behavioral disengagement	33.782	3	4.658	**.003**	.014
Positive reframing	14.086	3	1.702	.165	.005

Table 5. Continued

Planning	5.303	3	.619	.603	.002
Humor	32.405	3	2.762	**.041**	.008
Acceptance	4.024	3	.506	.678	.002
Religion	155.103	3	11.663	**<.001**	.034
Self-blame	59.336	3	5.542	**.001**	.017
Negative urgency	9.200	3	5.551	**.001**	.017
Lack of perseverance	2.667	3	3.574	**.014**	.011
Lack of premeditation	1.915	3	2.294	.076	.007
Sensation seeking	3.891	3	2.919	**.033**	.009
Positive urgency	6.196	3	4.026	**.007**	.012
Sexual risk-taking with uncommitted partners	5.796	3	3.119	**.025**	.009
Risky sex acts	11.019	3	4.197	**.006**	.013
Impulsive sexual behaviors	.677	3	.361	.781	.001
Intent to engage in risky sexual behaviors	1.090	3	.809	.489	.002
Risky anal sex acts	8.915	3	9.065	**<.001**	.027
Resistance to peer influence	.518	3	.655	.580	.002

Post-Hoc Comparisons			
Variable	Mean difference	*p* value	Comparisons
Denial	.632	**<.001**	c > a
	.676	**.005**	c > b
Substance use for coping	.552	**.011**	b > a
	.887	**<.001**	c > a
	1.240	**.005**	c > d
Behavioral disengagement	.633	**.001**	c > a
Humor	.604	**.035**	c > a
Religion	.690	**.007**	a > b
	1.049	**<.001**	a > c
	1.208	**.012**	a > d
Self-blame	.806	**.001**	c > a
	.675	.062	c > b
Negative urgency	.326	**<.001**	c > a
Lack of perseverance	.127	.068	b > a
Sensation seeking	.190	.061	c > a
	.345	.083	c > d
Positive urgency	.384	**.054**	b > d
	.498	**.006**	c > d
Sexual risk-taking with uncommitted partners	.244	**.031**	c > a

Table 5. Continued

Risky sex acts	.439	.067	a > d
	.650	**.004**	b > d
	.521	**.049**	c > d
Risky anal sex acts	.513	**<.001**	d > a
	.405	**.003**	d > b
	.416	**.003**	d > c

Boldface indicates statistical significance (*p*<.05); Controlled for age, sex, race/ethnicity; Bonferroni adjustment for multiple comparisons; a) Completely Heterosexual, b) Discordant Heterosexual, c) Bisexual Attraction, d) Completely Homosexual

The significant mediators from Step 2 were used in a regression model to predict the total drug use outcome variable, found in Table 6. The results indicate substance use (beta= .187, SE= .023, *p*<.001), lack of perseverance (beta= .156, SE= .073, *p*=.032), sensation seeking (beta =.174, SE =.055, *p*=.002), sexual risk-taking with uncommitted partners (beta= .234, SE= .051, *p*<.001), risky sex acts (beta= .104, SE= .042, *p*=.014), and risky anal sex acts (beta= .198, SE= .062, *p*=.002) were significant predictors in the model.

Table 6. Linear Regression Results

Step 3: Linear Regression					
DV: Substance Use					
Independent Variables	**B**	**SE**	**t**	***p* value**	**95% CI**
Denial	-.016	.029	-.542	.588	-.073, .042
Substance use for coping	.187	.023	8.005	**<.001**	.141, .232
Behavioral disengagement	-.025	.031	-.811	.417	-.085,.035
Humor	-.013	.019	-.663	.507	-.050, .025
Religion	-.007	.016	-.436	.663	-.039, .025
Self-blame	-.034	.022	-1.519	.129	-.078, .010
Negative urgency	.070	.060	1.163	.245	-.048, .188
Lack of perseverance	.156	.073	2.153	**.032**	.014, .299
Sensation seeking	.174	.055	3.184	**.002**	.067, .281
Positive urgency	.000	.065	-.002	.998	-.127, .127
Sexual risk-taking with uncommitted partners	.234	.051	4.632	**<.001**	.135, .334
Risky sex acts	.104	.042	2.452	**.014**	.021, .187
Risky anal sex acts	.198	.062	3.170	**.002**	.075, .320

Boldface indicates statistical significance (*p*<.05)

In the last step, the effects of sexual attraction were examined on the substance use dependent variable, with mediators and demographics as covariates. The effect was significant, $F(3, 762) = 2.935$, p=.033, and the overall model explained 25.4% of the variance of the substance use outcome. After controlling for mediators and demographics, the sexual attraction and substance use relationship was still significant, and the discordant heterosexual group had greater substance use relative to both the completely heterosexual and completely homosexual groups. Thus, a partial mediation model was supported from these results.

Table 7. Second ANCOVA Results

Step 4: ANCOVA					
DV: Substance Use					
Variables/Covariates	**SS**	**df**	**F**	**p value**	**Partial η^2**
Age	.923	1	1.059	.304	.001
Sex	3.494	1	4.011	**.046**	.005
Race/Ethnicity	.434	1	.498	.480	.001
Substance use for coping	45.800	1	52.576	**<.001**	.065
Lack of perseverance	4.074	1	4.677	**.031**	.006
Sensation seeking	6.440	1	7.393	**.007**	.010
Sexual risk-taking with uncommitted partners	18.912	1	21.710	**<.001**	.028
Risky sex acts	6.030	1	6.922	**.009**	.009
Risky anal sex acts	7.804	1	8.959	**.003**	.012
Sexual attraction	7.669	3	2.935	**.033**	.011
Post-Hoc Comparisons					
Variable	Mean difference	*p* value	Comparisons		
Sexual attraction	.292	**.006**	b > a		
	.414	**.052**	b > d		

Boldface indicates statistical significance (*p*<.05); Note: mean values of DV for each group are a) Completely Heterosexual: .667, b) Discordant Heterosexual: .959, c) Bisexual Attraction: .802, d) Completely Homosexual: .544; R Squared = .254

At last, the final mediation model is illustrated in Figure 2. The letters denote subgroups most at risk for each parameter in the mediating process. Overall, the mediated effects were strongest in the discordant heterosexual group and the bisexual attraction group, and after considering both mediators and demographics, the discordant heterosexual group was most at risk for substance use. There was a direct effect of sexual attraction on the substance use outcome, especially with discordant heterosexuals. There was an indirect effect of substance use for coping, particularly for discordant heterosexuals and bisexuals. Two impulsivity subscales made it into the final mediation model, with indirect effects of lack of perseverance and sensation seeking on substance use. Three of the sexual risk-taking subscales mediated the sexual attraction and substance use relationship, as seen in risky sex acts for non-homosexual groups, risky anal sex acts for homosexuals, and risk-taking with uncommitted partners for bisexuals. Age and race did not have an effect on the substance use outcome, however sex was still a significant predictor after including the covariate mediators in the model with males having greater use than females.

The change in the effect of sexual attraction on the substance use outcome variable in ANCOVA results reveal key takeaways of this research. From the original effect of sexual attraction of 25.581 (Table 4), to 7.699 (Table 7) left over, about 70% of the original variance is taken away by the mediators. These findings may be useful for future intervention strategies.
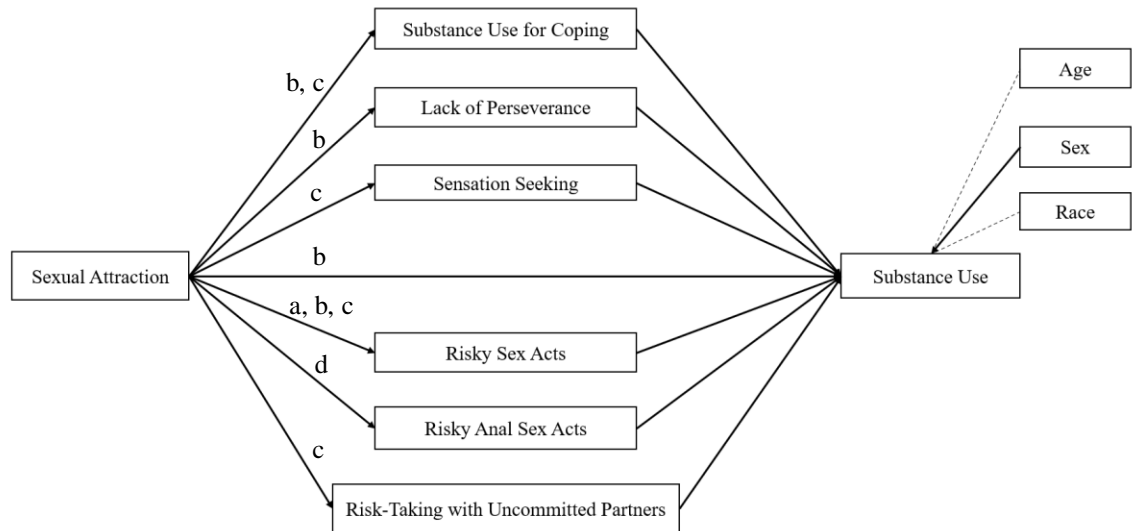
Figure 2. Final mediation model

Note: Letters represent sexual attraction subgroups most at risk: a) Completely Heterosexual, b) Discordant Heterosexual, c) Bisexual Attraction, d) Completely Homosexual

IV. DISCUSSION

This research evaluated the link between sexual orientation and substance use by examining mediating mechanisms that differ in sexual orientation subgroups. Results generally supported hypotheses, such that substance use relationships differed between sexual orientation subgroups based on the final model (H1). Several steps were taken to achieve analyses of the sexual orientation and substance use relationship. In short, step 1 confirmed there was an impact of sexual orientation on substance use while controlling for demographics. Step 2 found effects of sexual orientation on mediating factors. Step 3 confirmed the mediators that predicted the substance use outcome, including substance use for coping, lack of perseverance, sensation seeking, risky sex acts, risky anal sex acts, and sexual risk-taking with uncommitted partners. Step 4 established the sexual orientation and substance use relationship was still significant after controlling for demographics and significant mediators, supporting a partial mediation and revealed the discordant heterosexual group was most at risk for substance use in this study. Not only were the discordant heterosexual group most at risk for the direct effect on substance use, but also had the strongest indirect effects on most mediators.

The original effect of sexual attraction on substance use was decreased by including the mediators into the model. This suggests the majority of the effect of sexual attraction on substance use can be explained by the mediators. Therefore, if researchers can design interventions based on decreasing or treating the mediators, then researchers, college health educators, and counseling centers can greatly reduce the risk of substance use among sexual attraction at-risk groups in college students. Targeted efforts for substance use reduction in the college student population should consider developing

strategies to minimize substance related coping strategies, encourage resisting impulsive

behaviors, and limit sexual risk-taking, especially for at-risk groups. Further research and

intervention implications are discussed.

Analysis of Substance Use with Varying Methods

First, by measuring sexual orientation through both sexual identity and sexual

attraction, a comprehensive analysis of sexual orientation-based differences in substance

use showed interesting patterns emerge when focusing on the method which grouped

participants on sexual attraction. Many studies operationalize sexual orientation with

sexual identity and this study highlights the need to consider multiple ways of measuring

sexual orientation. When looking at substance use prevalence between self-identifying

heterosexuals and sexual minority groups, bisexuals often have higher prevalence of use

than heterosexuals. Yet when looking at the sexual attraction subgroups, substance use

for the discordant heterosexual group is not only similar to and sometimes greater than

bisexual attraction use, but at times is two-fold greater than completely heterosexual use.

An attraction to both sexes appeared to be linked to the greatest prevalence of use,

regardless of sexual identity (Dodge et al., 2016; Friedman et al., 2014). There were clear

differences in prevalence of past-month marijuana use across methods of measuring

sexual orientation. Marijuana use was generally high across groups, though was highest

in non-heterosexual/non-completely heterosexual groups, which is consistent with prior

research (L. A. Drabble, Mericle, Karriker-Jaffe, & Trocki, 2020; Kuyper & Bos, 2016;

Schauer, Berg, & Bryant, 2013). These prevalence rates closely trail past-month alcohol

use, perhaps from recent marijuana liberalization trends and growing acceptance of

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marijuana use across states in the US (Bae & Kerr, 2019; Philbin, Mauro, Greene, & Martins, 2019). However, some research suggests heavy marijuana use is problematic for college students and relates to increased absenteeism and lower GPAs (Arria et al., 2013; Suerken et al., 2016).

Of greatest concern are the discordant heterosexual and bisexual attraction groups showing the greatest use of club drugs (i.e., cocaine, MDMA, ketamine, and LSD). Ecstasy users often report significant polydrug use, especially with cocaine and LSD (Wish, Fitzelle, O'Grady, Hsu, & Arria, 2006), while sexual identity minority undergraduates have been found to have higher rates of illicit substance use (McCabe, Boyd, Hughes, & d'Arcy, 2003). It is an important addition to include discordant heterosexuals among these at-risk groups. Illicit drug use is related to negative academic and health consequences of college students, raising concern for poor academic performance, dropout, and adverse side effects (Rimsza & Moses, 2005). When not accounting for sexual attraction, discordant heterosexuals are ignored in analyses that only focus on people that identify as heterosexual, which can obscure differences not often found when solely focusing on sexual identity. These results may suggest that using both sexual orientation sub-measures is a better way of assessing sexual orientation, relative to a one-sided measure. Further, breaking down sexual orientation to a four-level sexual attraction variable was used for the rest of the analyses.

Differing Effects of Sexual Attraction on Mediators

The mediators from these results can be broken into two domains: psychological and sexual. The effects of the psychological mechanisms appear to be strongest for the

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two groups that endorse bisexual attraction (i.e., discordant heterosexual and bisexual attraction groups), as seen in substance use as a coping response to stress. Of course, multilevel minority stressors may be shaping substance use behavior (Felner et al., 2019; Krueger, Fish, & Upchurch, 2020). It could be interpreted that these two groups experience differential, but similar, stressors that influence substance use as a coping response, such as proximal and distal stressors. Previous literature suggests that bisexuals may be most at-risk for psychopathology and substance use from external and internal stressors, such as experiencing structural stigma and prejudices from both heterosexual and homosexual groups, and the pressure to choose an identity that is either completely heterosexual or completely homosexual (Hatzenbuehler & Pachankis, 2016; Katz-Wise, Mereish, & Woulfe, 2017; la Roi et al., 2019; Taylor, Power, Smith, & Rathbone, 2019).

Whereas discordant heterosexuals may be experiencing more identity disturbance, or an unstable sense of self (Talley et al., 2011), choosing to identify as heterosexual and not admitting to being bisexual or homosexual, perhaps from self-stigma and internalized homophobia (Lee, Operario, Yi, Choo, & Kim, 2019; Oginni, Mapayi, Afolabi, Obiajunwa, & Oloniniyi, 2019). Another explanation could stem from identity concealment for purposes of preservation of relationships and greater expectations of rejection from friends/family (Xu, Zheng, Xu, & Zheng, 2017). There is an incongruence with discordant heterosexuals that seem to be significantly related to substance use which warrants further study. Other coping subscales showed more maladaptive strategies for the bisexual group over the heterosexual group (e.g., denial, behavioral disengagement, self-blame) which roughly supported hypotheses (H2), however those did not make it into the final model.

In addition, impulsive personality traits were included in the final mediation model, which does support the hypotheses (H3). Lack of perseverance was highest for discordant heterosexuals, whereas sensation seeking was highest for bisexuals. This compliments previous research examining personality factors of sexual orientation groups, such that bisexuals are greater in openness to experiences in comparison to heterosexuals (Bogaert, Ashton, & Lee, 2018). The substance use outcome variable was based on participants' variety of substances used in the past-month/year, so maybe greater prevalence of substance use among bisexual attraction groups can be attributed to a mix of openness and experimentation in conjunction with use to cope with stress. Rather, impulsive traits such as lack of perseverance may interact with stressful experiences, with impaired ability to control impulses after experiencing loss (Romer Thomsen et al., 2018). There was a significant effect of negative urgency for bisexuals in the second step, though contrary to predictions, it was not included in the final model for predicting the substance use outcome, perhaps from suppressive effects of the substance use for coping measure in the regression model. Openness and impulsivity are associated with greater marijuana use in college students (Phillips, Phillips, & Duck, 2018), and also may be a point of focus in future research in decreasing problematic use in bisexual attraction groups.

Sexual risk-taking subscales were most present in the final mediation model, supporting the strong relationship of sexual risk behavior and substance use in young adults (Patrick, O'Malley, Johnston, Terry-McElrath, & Schulenberg, 2012; Wells, Kelly, Golub, Grov, & Parsons, 2010). Casual sexual experiences in college students are common (Trieu, Bratton, & Hopp Marshak, 2011; Turchik, Garske, Probst, & Irvin,

2010), therefore understanding how groups vary in sexual behaviors is necessary for better identifying which groups pose the most risk. Results mostly supported hypotheses, such that sexual minority groups reported more sexual risk-taking, except for one subscale (H4).

The non-completely homosexual groups were most associated with general risky sex acts on sexual risk behaviors such as vaginal sex without a condom or birth control, intercourse under the influence of substances, and fellatio/cunnilingus without protection. Meanwhile, the completely homosexual group was most at risk for anal sex acts such as unprotected anal penetration and analingus (i.e., oral stimulation of anal area) without protection. Although differing in specific actions, the association of risky sexual behaviors to substance use among groups is noteworthy since each group may be exposed to specific consequences following sexual risk-taking. Vaginal sex without a condom or birth control could lead to unintended pregnancy, posing significant challenges to students beginning undergraduate studies. Most concerning to sexual and overall health are the possibility of contracting STIs/HIV without proper protection during sex, which could lead to years of costs for treatment and challenges to future relationships. This is especially concerning for the completely homosexual group, since unprotected anal sex could involve tearing of the anal walls, bleeding, and is considered the most efficient passage of transmitting HIV (Kelly & Kalichman, 2002).

The bisexual attraction group was highest in sexual risk-taking with uncommitted partners, adding to previous research (Oswalt & Wyatt, 2013), and includes items over having sex with someone they do not know well, having sex with untested partners or partners they did not trust, and having sex with partners with other current partners.

Altogether, college students that engage in multiple health risk behaviors have poorer mental health (Kwan, Arbour-Nicitopoulos, Duku, & Faulkner, 2016), showing multiple indicators of concern towards the discordant heterosexual and bisexual attraction groups when looking at the final model.

Variables Not in the Final Model

Though there were effects of sexual attraction on factors found in step two, many were not included in the final model from not predicting the substance use outcome. Religion was an obvious contender for a negative relationship with the substance use outcome per past research (Ford & Hill, 2012; Hearld, Badham, & Budhwani, 2017; Parenteau, 2017), however it was not significant in the regression model. The tables showed that within Christianity branches, most fell in the heterosexual group and that there were strong effects of religion for coping between sexual attraction groups having greater scores in completely heterosexuals over the other three groups. Results from national surveys show religion, sexual orientation, sex, and substance use to all interact in complex ways (Hughes, Szalacha, & McNair, 2010; Rostosky, Danner, & Riggle, 2010), while it is mostly accepted that religion is a protective factor to substance use for heterosexuals but not always for other groups (L. Drabble, Trocki, & Klinger, 2016; Rostosky, Danner, & Riggle, 2007).

Finally, no effects were found on the resistance to peer influence scale and hypotheses were not supported (H5). It was initially speculated that sexual attraction groups would differ, such as the discordant heterosexual group for having a mismatch in identity and attraction, and possibly being more susceptible to peers for peer acceptance.

Other demographic factors may be better indicators of susceptibility to peer influence. Recent research suggests ethnicity is an important factor for peer-related influences, such that Hispanic college students may be more susceptible to peer influences on substance use variables than non-Hispanic Whites (Edwards, Witkiewitz, & Vowles, 2019). Although the mean age of the sample was relatively young, perhaps these types of effects can be found in younger populations of sexual orientation subgroups, such as adolescents (Gardner & Steinberg, 2005).

Limitations

This research used a cross-sectional survey design and is correlational in nature, so no causal inferences can be drawn from the results. The substance use outcome variable only used six of the ten substance use variables. Future research may expand on substance misuse outcomes such as problematic drinking and prescription drug misuse rather than general use. With less conventional substances, there was missingness in the data from listwise deletion, which decreased sample size. The homosexual attraction group was lacking in power and not many effects were found for this group. Some participants were excluded from final analyses such that only valid data on sexual orientation variables (both sexual identity and sexual attraction) were used, while other identities (e.g., pansexual) and those who were not sure about sexual attraction (e.g., "still figuring out who I am attracted to") were not analyzed due to limited sample sizes. This study was based on a college student sample and results may differ for young adults who are not in college, as seen in educational differences on substance use outcomes (Schepis, Teter, & McCabe, 2018).

The sex variable assessed biological sex and did not fully assess other aspects of gender identity. One major limitation is that this study did not directly measure stress or anxiety/depression and assumed stress was associated with the sexual attraction group membership. A limitation could be the young mean age of the sample, considering the transitional period from home beliefs to college campus norms, it is likely 19 year-old students have an unstable sense of self based on the developmental period regardless of sexual orientation. The young mean age may also benefit as a strength of the study, by capturing students in this transitional period and recognizing that exploring sexual orientation at a young age may also involve consequences.

Conclusion

This research employed two measures of sexual orientation to evaluate mechanisms of substance use differences in a sample of college undergraduates and found differences in coping responses, impulsivity traits, and sexual risk-taking behaviors. These data could be used on college campuses in student health centers for informing health educators and health education efforts to reduce high-risk behavior in undergraduate students. Regarding group specific risk reduction, future intervention practices may consider teaching affirmative coping skills or alternatives to substance-related coping and impulse control to those with bisexual attraction (Craig et al., 2019). Overall, sexual risk-taking in the general college student population should be addressed with education on the consequences of unprotected sex, how to discuss risk factors before engaging in sex with partners, and the importance of getting tested for STIs/HIV (Dodge,

Sandfort, Yarber, & de Wit, 2005; Seangpraw, Somrongthong, Choowanthanapakorn, & Kumar, 2017; Sun et al., 2013).

The results of this study introduce the challenge of reaching discordant heterosexuals, who were the most at risk for substance use in this study. These students do not identify as a sexual minority and may not seek social support from sexual minority student organizations on campus. Future research may study differential stressors this group may experience, such as the fear of identifying as a sexual minority as a means of avoiding being ostracized from friends or the challenges discordant heterosexuals may face in romantic relationships.

Since the mean age of the sample was approximately 19 years, it is likely many students are living on campus, thus resident assistants and staff on college campus should promote a welcoming atmosphere for questioning students and provide resources to student health and counseling centers. Organizations on college campuses that are designed to aid students in the transition from high school to college would be improved by increasing awareness of the challenge of reaching discordant heterosexuals and providing support. In addition, sexual minority organizations on college campuses may also consider incorporating inclusive language of uncertain students to join clubs and promote bisexual inclusive policies (van Lisdonk & Keuzenkamp, 2017). Development in young adulthood can be accompanied by confusing times, especially when establishing a sense of sexual self and exploring dimensions of sexual orientation. It is necessary college campuses are prepared for the health and mental health needs of students at all stages of sexual exploration and identity development.

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