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Exposure to Stigma Elicits Negative Affect and Alcohol Craving among Young Adult Sexual Minority Heavy Drinkers

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Abstract

Background: Sexual orientation disparities in alcohol use disorder are thought to be explained by stigma specific to sexual minorities. Despite the importance of negative affect and craving in addiction, research has yet to test the effects of stigma on affect and alcohol craving among sexual minorities. This laboratory study examined the effects of three novel mood inductions (stigma, general unpleasant, and neutral) on affect and alcohol craving among heavy drinking sexual minority young adults. We also paired these mood inductions with an established alcohol cue reactivity paradigm to explore the effects of stigma on cue-elicited craving.

Methods: Sexual minority participants (N = 20; 55% female), ages 18 to 27 years (M = 21.80, SD = 2.65), were recruited from the community. Participants completed three mood induction and cue reactivity trials counterbalanced over three visits on different days: stigma, general unpleasant, and neutral mood inductions. A structured interview assessed criteria for DSM-5 alcohol use disorder (AUD) and self-report measures assessed lifetime adverse experiences.

Results: Most participants met criteria for past year AUD (75%). Exposure to stigma produced more negative affect and greater alcohol craving than the neutral and general unpleasant mood induction conditions. The general unpleasant mood induction did not predict greater alcohol craving than the neutral mood induction. Stigma enhanced alcohol cue reactivity effects, as measured with a single-item craving measure, compared to the general unpleasant mood condition, and this effect remained significant while controlling for covariates.

Conclusions: Findings are the first to demonstrate how stigma uniquely predicts negative affect and alcohol craving among sexual minorities. This study suggests that being exposed to stigma, specifically heterosexism, elicits negative mood and alcohol craving among sexual minority young adults who are heavy drinkers.

Keywords

stigma; sexual minorities; alcohol craving; alcohol cues

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Introduction

Sexual minorities (e.g., lesbian, gay, bisexual, or queer) are increasingly targets of hate crimes and heterosexist legislation and federal policies. For example, hate-based homicides targeting sexual and gender minorities have increased by 86% since 2016 (Waters et al., 2018). Additionally, 129 heterosexist and transphobic state legislative bills were introduced across 30 states in 2017, which attempted to legalize discrimination against sexual and gender minorities and limit their civil rights in the United States (e.g., adopting children; Warbelow and Diaz, 2017). These acts perpetuate and reinforce stigma toward sexual minorities (i.e., sexual stigma; Herek, 2000), and, even if sexual minorities are not direct targets of sexual stigma, they are likely exposed to it vicariously (e.g., social media). Exposure to vicarious stigma is similar to direct experience of stigma in that it threatens perceptions of personal safety and wellbeing (Noelle, 2002; Ramirez, Gonzalez, & Paz Galupo, 2018; Stults et al., 2017). Although correlational and quasi-natural experimental studies document that stigma has deleterious effects on sexual minorities' health and contributes to health disparities (Hatzenbuehler, 2016), research has yet to examine the direct effects of exposure to sexual stigma among sexual minorities in a controlled laboratory setting.

One particular health disparity facing sexual minorities is hazardous drinking and alcohol use disorder (AUD). Sexual minority young adults are at greater risk for hazardous drinking and AUD than their heterosexual counterparts (Marshal et al., 2008, Meyer, 2003, Hughes et al., 2016). Given the myriad acute and lasting adverse consequences of hazardous drinking among sexual minority young adults, including economic, mortality, and morbidity burdens, research to address this health disparity is a national and federal public health priority (Institute of Medicine, 2011, U.S. Department of Health and Human Services, 2010). Yet, despite the magnitude of this public health concern, little is known about the etiology and mechanisms of sexual minority young adults' alcohol use and misuse (Green and Feinstein, 2012, Hughes et al., 2016).

Leading theories purport that sexual stigma specific to sexual minorities (e.g., heterosexism) drives the increased risk for hazardous drinking and AUD among this vulnerable subgroup. Most notably, the minority stress model posits that sexual minorities experience stigma-related stressors that are socially-evaluative, unique, and persistent, which are related to their stigmatized sexual minority identity, and uniquely predict poor health outcomes (Meyer, 2003). Correlational studies document these stigma-based stressors are associated with increased alcohol use and misuse among sexual minorities (Hatzenbuehler, 2009, Kuerbis et al., 2017, Kidd et al., 2018, Goldbach et al., 2014). A major limitation of research examining the minority stress model, however, is a dearth of controlled or experimental paradigms that manipulate stigma or minority stress. Within the extant laboratory studies examining minority stress (e.g., Hatzenbuehler & McLaughlin, 2013), none have directly tested the unique effects of minority stress and how it may differ from other general stressors. Moreover, to our knowledge, there is no laboratory work focusing on the unique experiences of sexual minority heavy drinkers.

In addition to the need for a laboratory paradigm to assess sexual stigma, it is important to examine the mechanisms by which stigma-based stressors relate to addiction among sexual minorities. Stigma-based stressors are associated with increased negative affect (Herek et al., 1999, Mays and Cochran, 2001, Mereish and Poteat, 2015). However, despite the importance of negative affect in motivational processes of addiction (Baker et al., 2004), research has yet to test the effects of stigma-induced affect on alcohol-related mechanisms.

Craving is another foundational mechanism of addiction (Drummond, 2000, Monti et al., 2000, Sayette, 2016), and numerous studies have leveraged cue reactivity and mood induction laboratory paradigms to examine this construct in the human laboratory (Plebani et al., 2012). On the whole, studies show that exposure to alcohol cues reliably elicits subjective craving among adolescent, young adult, and longstanding heavy drinkers, and that craving elicited in the human laboratory predicts real-world craving and drinking behavior (Plebani et al., 2012, Ramirez and Miranda, 2014). Similarly, several studies document that exposure to negative or stressful mood inductions is associated with increased alcohol cue-elicited craving (Snelleman et al., 2014, Plebani et al., 2012). Although this research advanced our understanding of mechanisms associated with AUD pathology in a variety of populations, no study to our knowledge has applied these methods to help elucidate mechanisms that may underlie AUD among sexual minorities. Research has yet to test the effects of sexual stigma-based mood inductions on alcohol craving and explore whether sexual stigma continues to have an effect on craving when alcohol cues are present. Elucidating effects of stigma-based mood inductions on alcohol craving would provide support for the uniqueness of sexual stigma and its clinical implications. This is critical given that stress-induced craving is related to poorer alcohol treatment outcomes (Higley et al., 2011).

In this initial study, we developed a novel mood induction paradigm to assess exposure to vicarious sexual stigma among heavy drinking sexual minorities in a controlled laboratory setting. We then examined the effects of sexual stigma, as compared to neutral and general unpleasant mood conditions, on negative affect and alcohol craving among heavy drinking sexual minority young adults. We hypothesized sexual stigma would elicit more negative affect than general unpleasant and neutral mood inductions, even while accounting for participants' lifetime adverse experiences and alcohol use disorder symptoms. In addition, we hypothesized that exposure to sexual stigma would elicit greater alcohol craving as compared to both general unpleasant and neutral mood inductions. As an exploratory aim, we also paired this stigma laboratory paradigm with an established alcohol cue reactivity paradigm to examine the effects of sexual stigma on alcohol craving even when alcohol cues are present. We hypothesized that sexual stigma would have unique effects on *in vivo* alcohol cue-elicited craving compared to neutral and unpleasant mood inductions. As a second exploratory aim, we also explored the effect of negative affect on craving.

Materials and Methods

Participants

Participants.—Sexual minority young adults ($N = 20$; 55% cisgender women; 85% White; 20% Latinx; 45% bachelor's degree) ages 18 to 27 years ($M = 21.80$ years old; $SD = 2.65$)

were recruited from the community. Participants identified as bisexual (35%), gay (35%), queer (25%), and lesbian (5%). Inclusion criteria were: self-identification as lesbian, gay, bisexual, queer, or other sexual minority identity; age 18 to 29 years old; and recent heavy drinking defined as having: 1) consumed > 7 drinks for women and > 14 drinks for men over one week during the past 30 days, and 2) at least two heavy drinking episodes in the past 30 days (≥ 4 for females or ≥ 5 drinks for males over the course of 2 hours), which is consistent with established heavy drinking criteria (National Institute on Alcohol Abuse and Alcoholism, 2005, National Institute on Alcohol Abuse and Alcoholism, 2009). Exclusion criteria were: actively psychotic or actively suicidal; history of traumatic brain injury; or hearing difficulties. The latter two exclusion criteria were needed because participants also completed a psychophysiological portion of the study upon completion of all procedures described below.

Procedures

Study design and sample size.—This study leveraged a within-subjects design to compare the effects of three mood conditions (i.e., neutral, general unpleasant, and stigma) on alcohol craving both before and after *in vivo* alcohol cue exposure. Participants underwent all three mood induction conditions in counterbalanced order over three visits separated by at least one day ($M_{\text{Days}} = 6.03$, $SD = 4.98$) to mitigate possible carryover effects. Variability in the duration between study visits permitted flexibility in scheduling sessions. Procedures were identical across experimental sessions, except for the type of mood induction administered. An a priori power analysis in G*Power (Erdfelder et al., 1996) for our primary hypothesis, which focused on detecting within-person differences across the three mood conditions, indicated a sample size of 20 participants would afford adequate power (0.80) to detect small to medium magnitude effects ($\beta = 0.30$). The Brown University Institutional Review Board approved all study procedures.

Recruitment and schedule of assessments.—Participants were recruited from the community through advertisements and flyers posted at public venues (e.g., coffee shops) and online (i.e., craigslist). Prospective participants completed a brief telephone screening to determine provisional eligibility criteria. Tentatively eligible individuals were invited to complete an in-person interview to confirm eligibility. Breath alcohol content (BAC) on each laboratory visit was collected using a Q3 AlcoHAWK ABI Breath Alcohol Screener to ensure participants tested negative for alcohol use prior to each session. To standardize the influence of nicotine withdrawal on mood, tobacco smokers had a cigarette 60 minutes before the cue reactivity. Over the course of three laboratory visits, participants completed structured clinical interviews, a self-report baseline battery, and experimental procedures. At the end of the third laboratory visit, participants viewed each photograph from all three mood induction conditions a second time to rate it for valence and arousal as well as sexual stigma content. Participants received monetary compensation of $100 for participating in the entire study.

Mood induction procedures.—Participants viewed a total of 84 color photographs for the mood induction trials, with 28 images for each stimuli category in 14 pictures per trial. Similar image categories were displayed in the same set for each trial and two trials were

conducted per mood induction. Examples of stigma images included hate crime scenes (e.g., vandalized property with heterosexist graffiti) or victims (e.g., a screenshot of TV news reports describing "gay couple attacked" with an image of the victims) as well as individuals holding heterosexist signs. Pictures across mood induction categories were balanced to ensure that each mood induction condition had an equal number of faces, news reports, signs, scenes, and human interactions. Some neutral and negative images were obtained from the International Affective Picture System (Lang et al., 1999), but most were obtained online, typically from news or social media outlets.

At the beginning of each trial, participants were instructed by the research assistant to sit quietly and to view each picture the entire time it is on the screen. They were also instructed to imagine that they were victims of the acts of violence in the scenes they viewed for the two unpleasant conditions. Participants did not receive this instruction for the neutral stimuli because they did not depict acts of violence and thus the instructional set was not applicable to this condition. Participants viewed a slide providing context for each trial to clearly delineate its content (e.g., stigma: "*The following pictures show real life events that involved discrimination, harassment, or violence against lesbian, gay, bisexual, and queer people.*"; general unpleasant: "*The following pictures show real life events that involved negative events, harassment, or violence against heterosexual people.";* neutral: "*The following pictures show real life events that involve everyday people.*"). Participants sat in a darkened room and each image was displayed for 10 seconds on a computer. Upon watching an image block, participants rated their craving and mood. Participants completed two trials for the respective mood induction, each followed by two *in vivo* alcohol cue exposures (see below).

Alcohol cue reactivity procedures.—The cue reactivity protocol mirrored prior mood-induction and *in vivo* cue reactivity procedures (Mason et al., 2008). Consistent with prior research (Rubonis et al., 1994), participants were first presented with a glass of water accompanied by its commercially labeled bottle brought by a tray by a research assistant. This water cue reactivity trial occurred prior to any mood induction or alcohol cue exposure to control for general reactivity to a potable beverage, which provided specificity regarding alcohol beverage cue effects. Following each mood induction trial, participants underwent *in vivo* exposure to their most commonly consumed alcoholic beverage. Each alcohol trial involved two consecutive alcoholic beverage cue exposures. Alcohol cue exposure trials were identical to the water cue exposure except the glass contained an alcoholic beverage accompanied by its commercially labeled alcohol bottle. During all *in vivo* cue exposure trials (i.e., water and alcohol), audio recorded prompts instructed participants to sniff the glass when high tones signaled and stop sniffing when low tones signaled. During each trial, thirteen 5-second olfactory exposures occurred in variable intervals.

Measures

Baseline self-report measures: Demographics.—Participants' age, gender, education, race/ethnicity, sex, and sexual orientation identity were assessed. Sexual orientation identity ("how would you describe your sexual orientation?") was assessed with the following response options: bisexual, gay, heterosexual/straight (not gay), lesbian, queer, don't know, unsure/questioning, and other. Sex assigned at birth ("what sex were you

assigned at birth, meaning on your original birth certificate?") was assessed with the following response options: male or female. Gender identity ("what is your current gender identity?") was assessed with the following response options: male, female, trans male/trans man, trans female/trans woman, genderqueer/gender non-conforming, and different identity. **Lifetime adverse stressors** were assessed with an inventory of 13-items from the Stressful Life Events Screening Questionnaire – Revised (e.g., "Were you ever in a life-threatening accident?"; 0 = No and 1 = Yes; Goodman et al., 1998).

Image ratings of valence, arousal, and sexual stigma content.—Ratings of valence and arousal were assessed with the Self-Assessment Manikin (SAM; Bradley & Lang, 1994), which consists of humanlike figures that graphically depict the dimensions of valence (sad to happy) and arousal (calm to excited) on separate 9-point rating scale (1 = sad/calm to 9 = happy/excited). Participants also rated the sexual stigma content of each photograph (1 = *not at all* to 9 = *extremely*) using one item.

AUD.—Participants completed a baseline Structured Clinical Interview for the DSM-5 (SCID-5; First, 2014) to assess their symptoms for lifetime and past year AUD.

Alcohol craving.—We captured alcohol craving at baseline and before and after each mood induction and *in vivo* alcohol cue exposure. Craving following mood inductions was measured (0 = *no urge* to 10 = *strongest ever*) using a well-established one-item visual analog slider scale ("How strong is your urge to drink alcohol right now?"; Fox et al., 2007). We relied on the single-item measure to capture craving following mood inductions to mitigate the effects of introspection on subsequent cue-elicited alcohol craving. To directly compare craving responses to mood conditions and *in vivo* alcohol cue exposure, this one-item measure also captured craving to *in vivo* water and alcohol cue exposures.

In addition to this one-item measure of participants' overall strength of craving, we also assessed alcohol craving following *in vivo* water and alcohol cue exposures using the mean score of the 8-item Alcohol Urge Questionnaire (AUQ; Bohn et al., 1995). The AUQ captures broader dimensions of craving, which span the overall strength of craving, positive expectancies, and perceived ability to abstain (MacKillop, 2006). Specifically, four items capture desire to drink (e.g., "I crave alcohol right now"), two items assess expectations of positive effects from drinking (e.g., "Having a drink right now would make things seem perfect"), and two items record the inability to avoid drinking if alcohol were present (e.g., "It would be difficult to turn down a drink this minute"). Response options ranged from 0 = *strongly disagree* to 6 = *strongly agree*. Studies indicate the AUQ is comprised of a single-factor structure (MacKillop, 2006). Both the single-item craving strength question and the AUQ were included to more rigorously assess alcohol craving. Only the single-item question was administered between mood inductions and *in vivo* alcohol beverage cue exposures, however, due to concerns that greater introspection about momentary craving might influence our ability to detect mood effects on *in vivo* cue reactivity. Both measures were highly correlated with each other at all time points of the study (r's = 0.796 to 0.867, p's < .01).

Negative affect.—We assessed negative affect with 4-items (*distressed, upset, afraid, hostile*), which were the top four item loadings on the Negative Affect subscale of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). Participants were asked "Indicate how you feel right now; that is at the present moment" (0 = *very slightly or not at all* to 4 = *extremely*). A mean score was computed.

Data Analytic Plan

We first examined descriptive characteristics of the sample (e.g., lifetime adverse stressors and AUD severity). As a manipulation check, we examined participants' ratings of valence, arousal, and sexual stigma content for each mood induction condition using repeated measures ANOVA; post-hoc analyses utilized a Bonferroni adjustment. Due to the non-independence of the data for examining within person effects, we tested our main hypotheses with generalized estimating equation (GEE) models, which control for autocorrelation without biasing results. All models used an autoregressive covariance matrix structure and assumed a normal link function; an exchangeable covariance matrix structure produced the same pattern of results. Given our primary interest in within-person effects across the three mood conditions (i.e., neutral, general unpleasant, stigma), we initially entered each mood condition as a nominal predictor in each model with the stigma condition as the reference. This approach tests whether the neutral or general unpleasant conditions' means significantly differ from the reference (stigma) condition's mean. To test for differences between the general unpleasant and neutral conditions, the neutral mood condition served as the reference category in follow-up analyses. Consistent with prior work (Esposito-Smythers et al., 2012) and to estimate effect sizes, continuous variables were standardized ($M = 0$, $SD = 1$); model coefficients represent differences in standard deviation units associated with the predictors. Beta (β) can be interpreted as the expected mean-level change in standard deviation units when comparing within-person, self-rated negative affect or craving in the reference condition to the comparison condition.

All models were tested with and without person-level covariates (i.e., sex, AUD severity, subjective picture valence ratings, counterbalance order, and lifetime adverse experiences) and all models controlled for baseline negative affect or craving. Analyses were performed using SPSS, version 25 (IBM, Armonk, NY).

To test whether stigma elicited greater negative affect and alcohol craving than the neutral or general unpleasant mood induction conditions, we examined participants' affect and subjective alcohol craving captured immediately following the first mood induction procedure on each day prior to any exposure to *in vivo* alcohol cues. Isolating mood condition effects allowed us to evaluate whether exposure to stigma alone, independent from *in vivo* alcohol cue exposure, potentiates alcohol craving. In addition to aforementioned person-level covariates, we controlled for baseline negative affect in the GEE model for negative affect. Similarly, we controlled for craving captured during the resting baseline period to disentangle the effects of the mood induction from basal craving levels in the GEE model for alcohol craving.

To test whether exposure to stigma potentiates alcohol cue-elicited craving, we examined participants' subjective alcohol craving following alcohol cue exposure using two measures,

the multi-item AUQ and the commonly used single-item measure of craving. To ensure saturation of exposure to affective stimuli and *in vivo* cues, we administered two cue exposure trials, one after each mood induction each experimental day. Thus, we examined whether participants experienced differential alcohol craving across the three mood-induction conditions by testing effects following all picture and *in vivo* cue presentations each day, thereby ensuring the fullest saturation of mood and alcohol cue exposures. In addition to aforementioned person-level covariates, we controlled for participants' alcohol craving reported during the water beverage cue exposure to provide specificity regarding alcohol beverage cue-induced craving.

For exploratory purposes, we also examined the effects of negative affect on alcohol craving across conditions captured immediately following the first mood induction procedure on each day prior to any exposure to *in vivo* alcohol cues. In addition to aforementioned person-level covariates, we controlled for participants' negative affect and alcohol craving captured during the resting baseline period. Moreover, we examined the effects of negative affect on alcohol beverage cue-elicited alcohol craving across conditions. We controlled for person-level covariates as well as negative affect and craving during the water beverage cue exposure for this model.

Results

Alcohol Use Disorder.

Most participants met criteria for past year AUD: 55% met criteria for a mild AUD (2–3 symptoms); 15% met criteria for severe AUD (6 or more symptoms); 5% met criteria for moderate AUD (4–5 symptoms); and 25% met criteria for subthreshold AUD (i.e., one or no symptoms). The majority of the sample also met criteria for lifetime AUD: 40% met criteria for a mild AUD; 20% met criteria for moderate AUD; 10% met criteria for severe AUD; and 30% met criteria for subthreshold AUD. Participants' AUD age of onset was, on average, 14.75 years old ($SD = 8.88$).

Picture Ratings for Valence, Arousal, and Sexual Stigma Content

A repeated measures ANOVA (Wilks's $\Lambda = 0.10$, $F(2, 18) = 80.29$, $p < .001$, $\eta_p^2 = .90$) indicated that both stigma ($M = 2.16$; $SD = 0.87$) and general unpleasant ($M = 2.64$; $SD = 0.82$) mood inductions had lower valence than the neutral mood induction ($M = 5.52$; $SD = 0.45$; ps $< .001$) and the stigma mood induction had a lower valence than the general unpleasant mood condition ($p < .01$). Results for arousal (Wilks's $\Lambda = 0.10$, $F(2, 18) = 80.29$, $p < .001$, $\eta_p^2 = .60$) indicated that both stigma ($M = 5.32$; $SD = 1.73$) and general unpleasant ($M = 5.06$; $SD = 1.80$) mood inductions had higher arousal than the neutral mood induction ($M = 3.31$; $SD = 1.53$; ps $< .001$). Both unpleasant mood inductions had similar arousal ratings ($p = 0.60$). Results for sexual stigma content (Wilks's $\Lambda = 0.10$, $F(2, 18) = 80.29$, $p < .001$, $\eta_p^2 = .94$) indicated that the stigma ($M = 6.96$; $SD = 1.54$) mood induction had higher sexual stigma content than the general unpleasant ($M = 1.64$; $SD = 1.40$, $p < .001$) and neutral ($M = 1.03$; $SD = 0.12$, $p < .001$) mood inductions. General unpleasant and neutral mood inductions had similar sexual stigma content ratings ($p = .20$). Due to

differences in valence ratings, GEE analyses included valence ratings as a control variable to rigorously test the effects of mood induction on affect and craving over and above any differences in valence.

Effects of Mood Condition on Negative Affect and Alcohol Craving

Negative affect.—Prior to exposure to any alcohol cues, stigma elicited more negative affect than the general unpleasant and neutral mood conditions (ps < .001). The effect sizes were medium for general unpleasant (β = −0.658) and large for neutral (β = −1.88). Table 1 presents descriptive statistics across mood conditions and Table 2 reports GEE model results with stigma as the reference point. A follow-up GEE model showed that the general unpleasant mood condition produced more negative affect than the neutral mood condition (β = 1.226; SE = 0.166; 95% CI = 0.901, 1.550; p < .001). Results were consistent when covariates were included in the model, including similar effect sizes.

Alcohol craving.—Findings from the model without covariates indicated that, prior to exposure to any alcohol cues, stigma produced more alcohol craving than the general unpleasant mood condition (p < .001) and there was a marginal difference between stigma and the neutral condition (p = .053). These effects were small for both conditions (β = −0.261 and −0.224, respectively). Table 1 presents descriptive statistics across mood conditions and Table 2 reports GEE model results with stigma as the reference point. A follow-up GEE model showed that the general unpleasant mood induction did not elicit more alcohol craving than the neutral mood induction (β = − 0.037; SE = 0.083; 95% CI = − 0.201, 0.127; p = .657). As shown in Table 2, results were consistent when covariates were included in the model, except the marginal difference between stigma and the neutral condition became significant (p = .017). The effect sizes increased when covariates were included in the model but remained small for general unpleasant (β = −0.325) and small to medium for neutral (β = −0.437).

Effects of Mood Condition on Alcohol Cue Reactivity—Results from analyses with the AUQ showed that participants' alcohol cue-elicited craving was higher in the stigma condition compared to the neutral condition (p = .001). This effect was small to medium in size (β = −0.467). The stigma and the general unpleasant mood conditions did not significantly differ from each other (p = .206). Table 1 presents descriptive statistics across mood conditions and Table 3 reports GEE model results with stigma as the reference point. A follow-up GEE model showed that the general unpleasant mood condition produced marginally more cue-elicited craving than the neutral mood induction (β = 0.274; SE = 0.146; 95% CI = − 0.013, 0.561; p = .061). As shown in Table 3, findings were no longer significant when covariates were included in the model.

For the single-item alcohol craving measure, results showed that alcohol cue-elicited craving was higher in the stigma condition compared to the general unpleasant condition (p = .033); this effect was small (β = −0.252). The difference between the stigma and neutral conditions was not significant (p = .081). Table 1 presents descriptive statistics across mood conditions and Table 3 reports GEE model results with stigma as the reference point. A follow-up GEE model showed that the difference in alcohol cue-elicited craving between the general

unpleasant mood and neutral conditions was not significant (β = 0.001; *SE* = 0.167; 95% CI = − 0.325, 0.328; *p* = .995). As shown in Table 3, differences in alcohol cue-elicited craving between the stigma and general unpleasant mood conditions remained significant (*p* = .019) when covariates were included in the model. The effect size remained small.

Effects of Mood Condition on Negative Affect and Alcohol Craving

As presented in Table 4, results from our exploratory analyses of the associations between negative affect and alcohol craving demonstrated that negative affect predicted alcohol craving following the mood induction across conditions. We also found that negative affect predicted cue-elicited craving following alcohol cues for both the single-item measure and the AUQ across conditions. Results were similar when covariates were included in the models. The effect sizes were small for models without covariates; they increased when covariates were included in the model but remained small.

Discussion

This study presents a novel human laboratory paradigm to investigate the effects of vicarious sexual stigma exposure among sexual minority participants and test its effects on negative affect and alcohol craving. The paradigm induced negative affect among participants, with the stigma condition producing more negative affect than the general unpleasant and neutral conditions. As we hypothesized, following mood induction the sexual stigma produced greater alcohol craving compared to the general unpleasant condition and marginally (*p* = .05) higher craving than the neutral condition. When covariates were included in the model, such as lifetime adverse experiences and AUD severity, stigma produced significantly greater craving than both the general unpleasant and neutral conditions. In addition, we paired mood inductions with *in vivo* alcohol cue exposure and tested whether sexual stigma enhances *in vivo* alcohol cue-elicited craving compared to neutral and unpleasant conditions. We found preliminary evidence that exposure to sexual stigma enhanced alcohol cue reactivity effects; however, the pattern of these effects differed between the single- and multi-item (i.e., AUQ) craving measures. Furthermore, we found that negative affect across conditions was associated with increased alcohol craving, even when alcohol cues were present. On the whole, our findings show that sexual stigma elicits alcohol craving, and to some extent even when alcohol cues are present, among sexual minority young adults who are heavy drinkers in a controlled laboratory setting, which carry implications for future research and clinical interventions.

Effects of Stigma on Negative Affect

To our knowledge, this study is the first to develop and test a novel mood induction paradigm to assess exposure to sexual stigma among sexual minorities in a controlled laboratory setting. Our findings provide the first experimental evidence that sexual stigma has significant effects on negative affect for sexual minorities with a large effect size when compared to neutral and a medium effect size when compared to general unpleasant. These findings provide support and extend the minority stress model (Hatzenbuehler, 2009, Meyer, 2003), by testing the effects of minority stress in a controlled setting. Our findings build on this model by demonstrating that vicarious exposure to sexual stigma may play an important

part in understanding mechanisms (i.e., affect and craving) that may lead to poor health outcomes, such as AUD, among sexual minorities. Additional research is needed to replicate our findings as well as leverage this laboratory paradigm to advance stigma and minority stress models in understanding sexual minority health. Although our study demonstrated the unique effects of sexual stigma on mood even when accounting for lifetime adverse experiences, future larger-scale work is needed to examine individual differences in this association. For example, future work should consider individual differences in sexual orientation identity, such as how salient, important, or central one's sexual identity is to them and how that may impact their response to stigma.

Effects of Stigma on Alcohol Craving

This study provides the first experimental evidence that sexual stigma elicits alcohol craving among sexual minority young adults who are heavy drinkers. Specifically, after accounting for important covariates, exposure to stigma was associated with greater alcohol craving than the neutral and general unpleasant mood inductions. These results underscore the effects of stigma in driving alcohol craving, an important mechanism of alcohol addiction (Drummond, 2000, Monti et al., 2000, Sayette, 2016), that may underlie AUD risk among sexual minorities. It is important to emphasize the size of the effects in our study were modest to medium for alcohol craving. Given that these effects were documented for a small sample, our findings provide promise for future work replicating this mood induction paradigm.

Effects of Stigma on Cue-Elicited Alcohol Craving

In addition, we found preliminary evidence that exposure to stigma, but not generally unpleasant stimuli, boosts alcohol cue reactivity effects, even when accounting for key covariates. This effect was demonstrated for the single-item craving measure but not the multi-item AUQ. Although we found differences in effects of cue-elicited craving based on how alcohol craving was measured, the effects were small for the general unpleasant condition and the other effects were not significant when covariates were included in the models. These disparate findings may be explained by the two different measures by which alcohol craving was assessed (single-item and multi-item measures). Although single-item measures are recommended for exploratory studies with small sample sizes like our study (Diamantopoulos et al., 2012), multi-item measures can capture multi-dimensions of craving (Rosenberg, 2009). Therefore, one possibility for the disparate findings is that the AUQ captures broader dimensions of craving, such as overall strength of craving, positive expectancies, and perceived ability to abstain (MacKillop, 2006), as compared to the single-item craving strength measure. Additionally, this finding might also suggest that measuring strength of craving is more sensitive to the effects of stigma than other dimensions of craving.

An alternative explanation for the mostly non-significant results for cue-elicited craving and small effect for general unpleasant condition is that alcohol cues may be especially potent in eliciting craving and may override the effects of negative mood inductions. In fact, prior work has found null findings for the effects of negative mood on cue-elicited craving (Mason et al., 2008). Thus, it is plausible that sexual stigma elicits initial craving absent of alcohol

cues, as evidenced by our main results, and then the presence of alcohol cues may maintain and reinforce this craving. Nonetheless, our work was exploratory and given the significant but small finding of stigma eliciting greater cue-elicited craving than general unpleasant stimuli, future work should examine both measures with larger sample sizes to better understand these effects.

Effects of Negative Affect on Alcohol Craving

Our study also demonstrated that negative affect across conditions was associated with greater alcohol craving. Despite these effects being small, this finding is noteworthy as it underscores the potential role of affect as a mechanism in understanding the effects of stigma on craving. Although it was not the goal of the study to conduct mediation analyses nor was it powered to do so, future research with larger and more powered studies should consider testing the mediating effects of negative affect on the relationship between sexual stigma and alcohol craving. Future work should examine the varying dimensions of negative affect in both laboratory and real time (e.g., ecological momentary assessment) studies.

Implications for Future Work and Limitations of the Study

Given the link between sexual stigma and alcohol craving, our findings have implications for clinical intervention and prevention efforts at the individual and structural levels. There are currently no empirically tested clinical interventions specifically for AUD among sexual minorities; thus, our results demonstrate the importance of incorporating assessment and understanding of sexual stigma in AUD treatment among sexual minorities. Clinicians can help their clients to attempt to limit their vicarious exposure to stigma and minority stress (e.g., exposure to stigma over social media) as well as capitalize on their existing strengths to build affective and cognitive skills to be resilient against exposure to stigma. In order to reduce sexual minorities' greater health burdens, interventions should target sexual stigma at all levels, especially structural systems (e.g., laws and policies). Researchers and clinicians must utilize psychological science to advocate against heterosexist legislative efforts; this is especially important given increases in legislators introducing anti-sexual minority bills that attempt to legalize discrimination against sexual minorities (Warbelow and Diaz, 2017). Moreover, the media must also reconsider how to carefully and sensitively cover acts of sexual stigma, such as hate crimes, to mitigate against their vicarious harms given that they can have negative effects on sexual minorities (see for examples based on the Pulse Nightclub shooting in Orlando: Hancock and Haldeman, 2017).

Despite its contribution to the literature, this study has important limitations. Although we utilized a rigorous within-subjects study design, our sample was small and predominately White; as such, it is not representative of all sexual minority young adults who are heavy drinkers. Future research is needed to examine the effects of stigma under controlled laboratory conditions with larger and more racially diverse samples of sexual minorities, specific subgroups of sexual minorities who are at greater risk for hazardous drinking (e.g., lesbian women, bisexual individuals), as well as sexual minorities who are not heavy drinkers. Our sample size also made it difficult to discern our pattern of findings for cue-elicited craving as the neutral and general negative conditions had nearly identical means for cue-elicited craving, but stigma only differed from the general negative condition. Future

research with larger samples may provide greater variability in response which can better explain these findings. Although a strength of our study is the heterogeneous sexual orientation composition of the sample, future work should examine differences in sexual orientation identification. We also did not examine individual differences in factors related to craving and drinking; future research, for example, should examine the contributions of drinking motivations and how they may impact craving or drinking to alleviate negative affect.

Our laboratory paradigm is limited as it only captures vicarious exposure to stigma but not actual or direct experiences with stigma. Although our protocol is a strength as it allows for the examination of stigma in a method that does not threaten the safety of participants, future research should consider developing other paradigms that examine the effects of direct exposure to stigma among sexual minorities. Moreover, our laboratory paradigm examined sexual stigma toward sexual minorities more generally; future research should examine the specific and unique forms of stigma that subgroups of sexual minorities experience (e.g., biphobia experienced by bisexual and pansexual individuals). Similarly, future work needs to consider intersectional forms of stigma that sexual minorities who are also racial or ethnic minorities may experience (i.e., racism). Moreover, participants' craving was slightly higher at baseline on days on which participants completed the stigma trials; however, we accounted for this spurious finding by controlling for resting baseline craving and affect to account for these concerns. The two unpleasant mood conditions differed in their valence ratings. Although this limits our ability to attribute differences in craving to stigma-related stimuli as opposed to stimuli that carry a negative valence more generally, we were still able to find effects for stigma even when controlling for valence ratings in all of our models. Additionally, the instructions for the general unpleasant condition indicated that the scenes involving acts of violence were against heterosexual individuals, whereas the stigma condition involved acts of violence against sexual minorities. Even though both conditions elicited greater negative affect than the neutral condition, participants might have felt more personally connected to the stigma condition as it was part of their in-group. Similarly, participants also rated the stigma pictures as containing more sexual stigma content than both general unpleasant and neutral pictures. As with other experimental studies, a limitation of the study is the potential for demand characteristics. Finally, our results are limited to the laboratory. Although the experimental control afforded by this human laboratory paradigm is a strength of this work, it is imperative to examine the associations between sexual stigma and minority stressors among sexual minorities in more ecologically valid real-world settings in participants' daily lives.

Despite the study's limitations, our study contributes the first novel laboratory evidence documenting the effects of vicarious exposure to sexual stigma on negative affect and alcohol craving among young adult sexual minority heavy drinkers. Specifically, this study suggests that being exposed to stigma, specifically heterosexism, elicits negative mood and alcohol craving among sexual minority young adults who are heavy drinkers. These results are noteworthy given recent increases in hate crimes and heterosexist legislation and federal policies. Translational research, development of empirically-based interventions, and advocacy efforts are urgently needed to address sexual minorities' hazardous drinking.

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Table 1.

Means for Negative Affect, Alcohol Craving, and Cue-Elicited Alcohol Craving by Mood Induction Condition.

	Negative Affect		Alcohol Craving (Single-Item measure)		Cue-Elicited Alcohol Craving (Single-item Measure)		Cue-Elicited Alcohol Craving (AUQ)	
Condition	**Resting**	**Mood Inductions**	**Resting**	**Mood Inductions**	**Water Cue**	**Alcohol Cues**	**Water Cue**	**Alcohol Cues**
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Stigma	1.03 (0.77)	2.70 (0.61)	1.85 (2.78)	2.75 (3.02)	1.90 (2.83)	4.43 (2.92)	2.15 (1.26)	3.53 (1.59)
General Unpleasant	1.19 (0.56)	2.13 (0.72)	1.05 (1.85)	1.25 (2.34)	1.20 (2.17)	3.32 (3.07)	1.98 (0.87)	3.09 (1.67)
Neutral	1.04 (0.09)	1.03 (0.11)	1.15 (1.95)	1.45 (2.65)	1.10 (2.25)	3.28 (2.92)	2.05 (1.36)	2.71 (1.41)

Note. AUQ = Alcohol Urge Questionnaire; *M* = mean; *SD* = standard deviation.

Table 2.

Summary of GEE Models Predicting Negative Affect and Alcohol Craving as a Function of Mood Condition

	Negative Affect					Single-Item Alcohol Craving Measure				
			95% CI					95% CI		
Predictor	**β**	***SE***	***LL***	***UL***	***p***	**β**	***SE***	***LL***	***UL***	***p***
Pre-Mood Induction	0.236	0.105	0.030	0.442	.025	0.806	0.033	0.742	0.870	< .001
Mood Condition										
General Unpleasant	− 0.658	0.181	− 1.014	− 0.303	< .001	− 0.261	0.063	− 0.385	− 0.137	< .001
Neutral	− 1.880	0.145	− 2.168	− 1.599	< .001	− 0.224	0.116	− 0.451	− 0.003	.053
Stigma *	–	–	–	–	–	–	–	–	–	–
Model with Covariates										
Pre-Mood Induction	0.271	0.104	0.068	0.474	.009	0.702	0.069	0.567	0.838	< .001
Mood Condition										
General Unpleasant	− 0.609	0.194	− 0.988	− 0.229	.002	− 0.325	0.075	− 0.471	− 0.178	< .001
Neutral	− 1.531	0.543	− 2.596	− 0.466	.005	− 0.437	0.183	− 0.795	− 0.079	.017
Stigma *	–	–	–	–	–	–	–	–	–	–
Person-Level Covariates										
Picture valence rating	− 0.174	0.233	− 0.630	0.283	.456	0.089	0.092	− 0.091	0.269	.331
Sex (female)	0.029	0.149	− 0.263	0.321	.846	− 0.132	0.130	− 0.388	0.123	.310
AUD severity	− 0.052	0.087	− 0.222	0.118	.549	0.255	0.154	− 0.046	0.556	.097
Counterbalance	− 0.038	0.045	− 0.127	0.051	.404	0.051	0.034	− 0.015	0.117	.132
Lifetime adverse experiences	−0.066	0.080	−0.223	0.091	.412	−0.136	0.118	−0.367	0.094	.247

Note. Continuous measures are standardized; the reported coefficients for these variables represent standardized effects (effect size d).

*Reference category. GEE = generalized estimating equation; *SE* = standard error; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 3.

Summary of GEE Models Predicting Alcohol Craving Following Alcohol Cue Exposure as a Function of Mood Condition

	Alcohol Urge Questionnaire					Single-Item Alcohol Craving Measure				
			95% CI					95% CI		
Predictor	**β**	***SE***	***LL***	***UL***	***p***	**β**	***SE***	***LL***	***UL***	***p***
Water Cue Exposure	0.593	0.073	0.450	0.736	< .001	0.408	0.117	0.179	0.636	< .001
Mood Condition										
General Unpleasant	− 0.193	0.153	− 0.492	0.106	.206	− 0.252	0.119	− 0.485	− 0.020	.033
Neutral	− 0.467	0.144	− 0.748	− 0.185	.001	− 0.252	0.145	− 0.536	0.031	.081
Stigma *	–	–	–	–	–	–	–	–	–	–
Models with Covariates										
Water Cue Exposure	0.542	0.097	0.352	0.733	< .001	0.310	0.144	0.028	0.591	.031
Mood Condition										
General Unpleasant	− 0.149	0.159	− 0.462	0.163	.349	− 0.246	0.105	− 0.451	− 0.041	.019
Neutral	− 0.121	0.352	− 0.810	0.569	.732	− 0.043	0.280	− 0.590	0.505	.879
Stigma *	–	–	–	–	–	–	–	–	–	–
Person-Level Covariates										
Picture valance rating	− 0.173	0.177	− 0.521	0.174	.328	− 0.120	0.170	− 0.453	0.213	.481
Sex (female)	0.192	0.248	− 0.294	0.678	.438	0.140	0.286	− 0.420	0.701	.624
AUD severity	0.051	0.125	− 0.194	0.295	.685	0.297	0.260	− 0.212	0.805	.253
Counterbalance	− 0.085	0.070	− 0.222	0.051	.220	− 0.055	0.084	− 0.219	0.109	.513
Lifetime adverse experiences	0.067	0.110	−0.150	0.283	.546	− 0.171	0.183	− 0.530	0.188	.351

Note. Continuous measures are standardized; the reported coefficients for these variables represent standardized effects (effect size d).

*Reference category. GEE = generalized estimating equation; *SE* = standard error; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 4.

Summary of GEE Models with Negative Affect Predicting Alcohol Craving Following Mood Induction and Alcohol Cue Exposure

	Craving Following Mood Induction Prior to Any Alcohol Cue Exposures				
	Single-Item Alcohol Craving Measure				
			95% CI		
Predictor	**β**	***SE***	***LL***	***UL***	***p***
Resting Craving	0.850	0.031	0.790	0.911	< .001
Pre-Mood Induction Negative Affect	− 0.001	0.051	− 0.101	0.098	.977
Post-Mood Induction Negative Affect	0.105	0.047	0.012	0.197	.027
Models with Covariates					
Resting Craving	0.817	0.057	0.705	0.930	< .001
Pre-Mood Induction Negative Affect	− 0.067	0.058	− 0.181	0.047	.247
Post-Mood Induction Negative Affect	0.178	0.046	0.089	0.267	< .001
Person-Level Covariates					
Picture valance rating	0.086	0.066	− 0.043	0.216	.192
Sex (female)	− 0.168	0.129	− 0.421	0.084	.191
AUD severity	0.189	0.135	− 0.076	0.454	.163
Counterbalance	0.064	0.032	0.001	0.127	.046
Lifetime adverse experiences	− 0.091	0.088	− 0.263	0.082	.302

	Craving Following Alcohol Cue Exposures									
	Single-Item Alcohol Craving Measure					Alcohol Urge Questionnaire				
			95% CI					95% CI		
Predictor	**β**	***SE***	***LL***	***UL***	***p***	**β**	***SE***	***LL***	***UL***	***p***
Water Cue Exposure	0.451	0.126	0.204	0.698	< .001	0.660	0.060	0.542	0.778	< .001
Pre-Mood Induction Negative Affect	− 0.084	0.042	− 0.167	− 0.001	.046	− 0.145	0.053	− 0.248	− 0.042	.006
Post-Mood Induction Negative Affect	0.162	0.081	0.004	0.320	.045	0.283	0.069	0.149	0.418	< .001
Models with Covariates										
Water Cue Exposure	0.365	0.161	0.050	0.680	.023	0.654	0.086	0.485	0.824	< .001

Craving Following Mood Induction Prior to Any Alcohol Cue Exposures										
	Single-Item Alcohol Craving Measure									
			95% CI					95% CI		
Predictor	**β**	***SE***	***LL***	***UL***	***p***					
Pre-Mood Induction Negative Affect	− 0.125	0.051	− 0.225	− 0.025	.014	− 0.183	0.055	− 0.291	− 0.075	.001
Post-Mood Induction Negative Affect	0.221	0.081	0.062	0.380	.006	0.352	0.087	0.181	0.523	< .001
Person-Level Covariates										
Picture valance rating	0.060	0.064	− 0.067	0.186	.354	0.077	0.091	− 0.101	0.254	.396
Sex (female)	0.078	0.268	− 0.447	0.604	.770	0.083	0.200	− 0.308	0.474	.677
AUD severity	0.290	0.257	− 0.213	0.793	.259	0.035	0.102	− 0.165	0.235	.733
Counterbalance	− 0.040	0.080	− 0.195	0.116	.619	− 0.052	0.061	− 0.171	0.067	.391
Lifetime adverse experiences	− 0.126	0.164	− 0.446	0.195	.443	0.140	0.085	− 0.027	0.307	.101

Note. Continuous measures are standardized; the reported coefficients for these variables represent standardized effects (effect size d). GGE = generalized estimating equation; *SE* = standard error; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit.