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A Prospective Study of Predictors and Consequences of Hooking Up for Sexual Minority Women

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Abstract

Hooking up, which refers to a sexual encounter (ranging from kissing to penetrative sex) between individuals who are not in a committed relationship, is an increasingly normative form of sexual exploration among emerging adults. Past research has focused on hookups within a heteronormative context, and some of this work has examined hookups as a way to cope with distress. Building on this work, we examined the role of hookups as a means for lesbian and bisexual women to cope with minority stress through increasing connection and engagement with the LGBTQ (lesbian/gay/bisexual/transgender/queer or questioning) community. A nationally recruited sample of 520 lesbian and bisexual women ages 18 to 25 completed questionnaires regarding their hookup behaviors as part of a longitudinal study. Childhood sexual abuse, posttraumatic stress symptoms, alcohol use, minority stress, and involvement and connectedness with the LGBTQ community were also assessed. First, regression analyses were used to examine baseline predictors of hookup behaviors reported at a 12-month follow-up. Findings revealed that alcohol use was associated with a greater likelihood of any subsequent hookups, and individuals reporting more minority stress subsequently hooked up with more partners. Second, hookup behaviors at 12 months were examined as predictors of outcomes at a 24-month follow-up, after controlling for baseline variables. Findings revealed that hookup behaviors were associated with reduced minority stress as well as increased involvement with and connectedness to the LGBTQ community, suggesting hookups may serve a protective function. Overall, findings

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Compliance with Ethical Standards

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

support the notion that for sexual minority women, hookups may operate as a means of coping and connection.

Keywords

hooking up; sexual behavior; casual sex; friends with benefits; perceived heterosexism

Emerging adulthood is a developmental time period from ages 18 to 25 that involves exploration and change in identity, romantic relationships, and sexual behavior (Arnett, 2000, Arnett, 2005). Hooking up – a sexual encounter that involves any sexual activity between two people who are not in a committed relationship – is common in emerging adulthood. In fact, upwards of 80% of emerging adults in college have ever hooked up (Lambert, Kahn, & Apple, 2003; Paul, McManus, & Hayes, 2000), with 46% reporting a hookup in the past three months (Napper, Kenney, & LaBrie, 2015). These increasingly normative sexual encounters often occur with friends or casual acquaintances (Fielder & Carey, 2010; Lewis, Granato, Blayney, Lostutter, & Kilmer, 2012) and are typically facilitated by alcohol use (Fielder & Carey, 2010; Owen et al., 2010; Paul & Hayes, 2002).

Existing research on hookup behaviors and consequences has been limited in two main respects. First, there has been a focus on hookup activities as a risky sexual behavior with negative consequences, such as regret, embarrassment, emotional distress, and/or unwanted sexual experiences (Bachtel, 2013; Eshbaugh & Gute, 2008; Flack et al., 2007; Lewis et al., 2012). This continues despite evidence that hookups are now normative behaviors for which most emerging adults report benefits or positive reactions (Olmstead, Norona, & Anders, 2019; Paul & Hayes, 2002; Shepardson, Walsh, Carey, & Carey, 2016; Snapp, Ryu, & Kerr, 2015; Stinson, 2010). Second, much of the hookup research to date has focused either on sexual interactions between heterosexual college students (for exceptions, see James-Kangal, Weitbrecht, Francis, & Whitton, 2018; Olmstead et al., 2019) or on casual sex as a HIV risk behavior among sexual minority men (i.e., gay and bisexual men) as well as other men who have sex with men (Bauermeister, 2012; Prestage et al., 2015; Vosburgh, Mansergh, Sullivan, & Purcell, 2012; Watson, Snapp, & Wang, 2017). Thus, the experiences of emerging adult lesbian and bisexual women have been left out of both the college-oriented hookup literature and the male-oriented literature on sexual risk behavior. To address these substantial gaps, we examined hookups among sexual minority women with a focus on the potentially positive role of hookups, even after accounting for distress-related predictors of hookup behaviors.

Hookups as a Risky Sexual Behavior

Although hookups are now considered normative sexual encounters among emerging adults (Stinson, 2010), casual sexual encounters with multiple sexual partners, especially without the use of a condom or other contraceptives, can increase risk for unwanted pregnancy, sexually transmitted infections, and HIV. In this way, hookups have often been combined with risky sexual behaviors in the research literature (Paul et al., 2000). Alcohol use is one of the most consistent predictors of hooking up (Fielder & Carey, 2010) as well as risky behavior during hookups (e.g., condomless sex; Cooper, 2002; Ritchwood, Ford, DeCoster,

Sutton, & Lochman, 2015; Scott-Sheldon, Carey, & Carey, 2010). Acute alcohol intoxication interferes with cognitive processing and narrows one's attentional focus to cues that are most salient in the environment (Steele & Josephs, 1990). As such, alcohol intoxication can exacerbate one's focus on the salient cue of sexual arousal to the exclusion of more distal consequences (e.g., risk of sexually transmitted infections, pregnancy, sexual assault; Davis, Hendershot, George, Norris, & Heiman, 2007), contributing to both greater engagement in sexual hookups and risky behavior during hookups (Griffin, Umstattd, & Usdan, 2010).

Another consistent predictor of risky sexual behavior is childhood sexual abuse (CSA). As conceptualized by Finkelhor and Browne (1985), CSA can involve traumatic sexualization, betrayal, powerlessness, and stigmatization, which can in turn have lasting effects on interpersonal and sexual functioning (see DiLillo, 2001). Whereas some individuals may respond to CSA with increased fear and distrust of others, retreating from sexual encounters, other CSA survivors may have misconceptions about sexual norms and engage in heightened sexual behavior (Davis & Petretic-Jackson, 2000). For example, emerging adults with (vs. without) a history of CSA tend to perceive fewer risks and more benefits in sexual behaviors (Smith, Davis, & Fricker-Elhai, 2004), engage in riskier sexual behaviors (e.g., early age at first sex, unprotected sex, sex with strangers; Abajobir, Kisely, Maravilla, Williams, & Najman, 2017; Batten, Follette, & Aban, 2002), have a greater likelihood of unwanted pregnancy (van Roode, Dickson, Herbison, & Paul, 2009), report more sexual partners (Green et al., 2005; Roemmele & Messman-Moore, 2011; van Roode et al., 2009; see for exception Batten et al., 2002), and endorse greater participation in the hookup scene (Ford & Soto-Marquez, 2016). Thus, there is a large literature suggesting associations between CSA and risky sexual behavior among primarily heterosexual samples.

Individuals with a history of CSA may engage in heightened sexual behavior in an effort to cope with abuse-related distress. Indeed, following CSA, trauma-related anxiety has been associated with intended engagement in risky sexual behavior (Smith et al., 2004), and trauma-related intrusions have been associated with sex with uncommitted partners (Walsh, Latzman, & Latzman, 2014). Recent research in trauma-exposed emerging adult women revealed posttraumatic stress disorder (PTSD) symptoms were prospectively associated with the number of vaginal sex partners 16 months later (Weiss, Walsh, DiLillo, Messman-Moore, & Gratz, 2019). Difficulties with emotion regulation contributed to this pattern (Weiss et al., 2019), supporting the notion that heightened sexual activity might serve as a form of coping with dysregulated emotions and PTSD after an initial trauma, particularly CSA.

The focus on hooking up as a risky sexual behavior has serious limitations as it neglects the importance of these normative sexual encounters in emerging adults' sexual exploration and identity development. In fact, most emerging adults experience benefits from hooking up, including sexual pleasure, clarification of feelings, connectedness to a sexual partner, verification of relationship potential, and exploration of one's sexuality (Anders, Goodcase, Yazedjian, & Toews, 2020; Bradshaw, Kahn, & Saville, 2010; Paul et al., 2000; Shepardson et al., 2016; Snapp et al., 2015; Stinson, 2010). Considering a positive sexuality approach can provide a more nuanced understanding of what motivates and reinforces emerging adults to hookup. This is especially important when examining "hidden" populations that are not

typically the focus of research, but who may use hooking up to cope with marginalized identities and to forge connections within their communities.

Hookups in Sexual Minority Women

Sexual minority women (i.e., lesbian and bisexual women) represent an understudied group at elevated risk for CSA, distress, and alcohol misuse (Schneeberger, Dietl, Muenzenmaier, Huber, & Lang, 2014). Sexual minority women experience CSA at higher rates when compared to sexual minority men (Rothman, Exner, & Baughman, 2011) and heterosexual women (Balsam, Rothblum, & Beauchaine, 2005). Sexual minority women also report more severe forms of victimization during childhood like rape (28% of lesbians, 24% of bisexuals, 17% of heterosexuals; Balsam et al., 2005). Substantial research suggests that, relative to heterosexual women, sexual minority women are also more likely to report psychological distress and are at elevated risk for mental health disorders, including PTSD (Cochran, 2001; Meyer, 2003; Niles, Valenstein-Mah, Bedard-Gilligan, & Kaysen, 2017). Moreover, sexual minority women report heavier drinking than heterosexual women (Gonzales, Przedworski, & Henning-Smith, 2016; Kerr, Ding, Burke, & Ott-Walter, 2015; McCabe, Hughes, Bostwick, West, & Boyd, 2009). However, the degree to which CSA, PTSD, and alcohol use are associated with hookup behaviors specifically among sexual minority women remains unknown.

There are also unique stressors associated with the lived experiences of sexual minority women. Chronic stigma and discrimination experienced by members of a minority group can contribute to increased social stress and emotional dysregulation (Hatzenbuehler, 2009; Meyer, 2003). As such, minority stress might draw sexual minority women to hook up as a form of coping. However, prior research also suggests that individuals of stigmatized groups frequently respond to minority stress with resiliency and positive coping (Asakura, 2017; Clark, Anderson, Clark, & Williams, 1999; Meyer, 2003). Meyer (2003) proposed that personal- and group-level resources (e.g., supportive friendships, community) may ameliorate the negative mental health impacts of minority stress. Indeed, recent work found that meaningful supportive relationships, safer spaces, and involvement with LGBTQ (lesbian/gay/bisexual/transgender/queer or questioning) communities were related to increased resiliency among sexual minority youth and emerging adults (Asakura, 2017). Further, connection to the LGBTQ community has also been associated with decreased internalized homophobia (Szymanski, Kashubeck-West, & Meyer, 2008) and the coming out process, which in turn are linked to increased self-esteem, more social relationships, and decreased distress (Corrigan & Matthews, 2003; Kosciw, Palmer, & Kull, 2015). Hookups may be an adaptive way to combat minority stress, as hookups with women and/or men can allow sexual minority women the opportunity to explore and confirm their sexual identity (Rupp, Taylor, Regev-Messalem, Fogarty, & England, 2014). Given that motives for hooking up include a desire for pleasure, intimacy, and increased confidence in heterosexual samples (Cooper, Shapiro, & Powers, 1998; Garcia & Reiber, 2008), hooking up may also reduce distress for sexual minority women through increased intimacy and social connection with others.

Despite indications that there are unique considerations for hookups among sexual minorities, existing research within this population has focused almost exclusively on casual sexual encounters as HIV risk behaviors (i.e., condomless anal sex) among sexual minority men and men who have sex with men (see Watson et al., 2017). This research area, which developed largely in response to the HIV/AIDS epidemic, has used a variety of terms to examine penetrative hookups (e.g., cruising, anonymous sex, casual sex). Sexual minority men, including men who have sex with men, report typically meeting casual partners from the Internet (e.g., online groups or apps like Grindr), in mainstream gay venues like bars, or other public spaces (e.g., gyms, bathrooms, parks; Dragowski, Halkitis, Moeller, & Siconolfi, 2013; Seage et al., 1997). Alcohol, as well as other drugs, are commonly used in conjunction with penetrative hookups in this population (Boyer et al., 2019; Mustanski, Newcomb, Du Bois, Garcia, & Grov, 2011). Compared to sexual minority women, sexual minority men endorse more satisfaction – both emotional and sexual – from casual encounters (Mark, Garcia, & Fisher, 2015), although other studies with sexual minority men suggest that motivations to hookup include the potential for a romantic relationship to emerge (Barrios & Lundquist, 2012; Pingel, Bauermeister, Johns, Eisenberg, & Leslie-Santana, 2013). With the focus on sexual minority men's penetrative hookups, the prevalence and function of hooking up among sexual minority women continues to be overshadowed, leaving a substantial gap in the literature.

Of the handful of hookup studies that included sexual minority women, findings indicate that sexual minority women hook up at rates similar to, if not higher than, their heterosexual peers (Galperin et al., 2013; Kuperberg & Padgett, 2016; Rupp et al., 2014). In a recent study designed to understand hookup experiences of sexual minority individuals, Watson, Shahin, and Arbeit (2019) interviewed 4 lesbian women and 3 bisexual women. Both lesbian and bisexual women reported that their hookups normally occurred in the context of alcohol use after meeting hookup partners in-person (vs. online) and at social gatherings (e.g., bars, house parties). These sexual minority women also reported their hookups tended to result in more positive than negative outcomes, including physical fulfillment and emotional connectedness, with emotional outcomes being most important to them. This qualitative research highlights the potential role of social connections and intimacy in motivating sexual minority women to engage in hookups. However, no quantitative research to our knowledge has investigated the predictors or consequences of hooking up among sexual minority women.

Current Study

Answering a call to research hookups among sexual minority women through a lens of positive sexuality (Watson et al., 2017), we investigated associations with hookup behaviors in a national sample of lesbian and bisexual women to explore the adaptive and maladaptive aspects of hookups. First, we examined prospective predictors of hookup behaviors. Consistent with research in predominantly heterosexual samples (e.g., Ritchwood et al., 2015; Roemmele & Messman-Moore, 2011; Weiss et al., 2019), we hypothesized that CSA, PTSD, and alcohol use would be associated with more hookup behaviors (any hookups, number of hookup partners, hookup frequency) reported at a 12-month follow-up. We also hypothesized that sexual minority women reporting more minority stress, as well as

less connection and involvement with the LGBTQ community at baseline, would engage in more hookups in an effort to cope with this stress and disconnection. Second, we examined whether hookup behaviors reported at 12 months were associated with subsequent alcohol use, PTSD, minority stress, connection with the LGBTQ community, and involvement with the LGBTQ community at the 24-month follow-up, after controlling for baseline values. Based on past work indicating hookups may be associated with subsequent distress (Fielder & Carey, 2010; Grello, Welsh, & Harper, 2006), we examined whether hookups were associated with exacerbations in alcohol use and PTSD symptoms, which would suggest maladaptive consequences of hookups. However, we also hypothesized engagement in hookups to have positive effects, in that hookups would be associated with reduced minority stress as well as increased connection and involvement with the LGBTQ community. Finally, because age, relationship status, and sexual identity have been associated with hookup behaviors in past work (Galperin et al., 2013; Kuperberg & Padgett, 2016; Lewis et al., 2012), we included these demographic covariates in all analyses.

Methods

Participants and Procedures

Lesbian and bisexual women were recruited online via Facebook and Craigslist to participate in a larger online study (see Kaysen et al., 2014; Litt, Lewis, Rhew, Hodge, & Kaysen, 2015), advertised as either research specific to sexual minority women (e.g., "*LGB women needed for an online study on partying*") or a general health survey (e.g., "*We need you for an online study on health behaviors*"). A total of 4,119 individuals responded to the ads and completed an online screening to determine eligibility. Of those, 1,877 (45.6%) met criteria by self-identifying as lesbian or bisexual women ages 18–25 who lived in the United States and had a valid email address. A total of 1,083 (57.7%) eligible participants then provided informed consent and completed a 45-minute baseline survey (Wave 1). A small percentage (2.4%, $n = 26$) appeared to provide invalid data (e.g., inconsistent birth date and age) and were removed from the dataset, resulting in a sample of 1,057 women. Participants were then followed for two years (Wave 2 at 12-months; Wave 3 at 24-months). To reduce participant burden, select measures of secondary interest – including the hookups measure – were only administered at one time point to two-thirds of participants who completed that wave. Thus, of the 854 (80.8%) participants who initiated the Wave 2 survey, nearly two-thirds ($n = 534$) were randomly assigned to complete the hookups measure. Given the focus on hookup behaviors in current analyses, only the 534 participants assigned to complete the hookups measure were included (regardless of other missing data). Fourteen participants who completed the hookups measure had inconsistent data (e.g., reported they had 1 hookup partner but hooked up 0 times) and were excluded from analyses. Of the remaining 520 participants, 435 (83.7%) completed the Wave 3 survey.

Therefore, the current sample consisted of 520 women, including 204 (39.2%) lesbians and 316 (60.8%) bisexuals. At Wave 1, participants were on average 20.94 years old ($SD = 2.06$) and 41.5% indicated they were currently an undergraduate student at a university. With regard to race, 77.1% identified as White/Caucasian, 9.0% as Black/African American,

3.7% as Asian/Asian American, 3.8% as multiracial, and 6.3% as other/missing. In addition, 10.5% identified as Hispanic/Latina.

Measures

Sexual identity (Wave 1).—Current sexual identity was assessed with the question, "*Understanding that sexual identity can be complex, which one category best describes your sexual identity now*?" Response options included: *lesbian, gay, bisexual, queer, two-spirit, straight/heterosexual, questioning, other (please specify)*, and *prefer not to answer*. Participants who chose a category other than lesbian, bisexual, or heterosexual were then asked "*If you had to choose one, would you say you are: lesbian, bisexual, heterosexual, prefer not to answer*" (Meyer, Rossano, Ellis, & Bradford, 2002). Only participants who identified as lesbian or bisexual on one of these two questions were included in the larger longitudinal study.[1] For analyses, responses were dummy-coded as lesbian = 0 and bisexual = 1.

Relationship status (Wave 1).—Participants were asked to indicate their current relationship. Response options were: *single (not currently in any sexual relationships), dating one person, dating more than one person, in a committed relationship with one partner, in a committed relationship with more than one partner, other (please describe)*, or *prefer not to answer*. Participants who indicated they were in a committed relationship with one or more partner(s) were coded as committed relationship = 1; all other responses were coded as 0.

Childhood sexual abuse (Wave 1).—Participants completed an adapted version of the Traumatic Life Events Questionnaire (Kubany et al., 2000), including two questions about sexual abuse experiences in childhood (before age 13). Specifically, participants were asked, "*Before your 13th birthday, did anyone who was at least 5 years older than you touch or fondle your body in a sexual way or make you touch or fondle their body in a sexual way*?" and "*Before your 13th birthday, did anyone close to your age touch sexual parts of your body or make you touch sexual parts of their body against your will or without your consent*?" Response options for both questions ranged from 0 (*never*) to 6 (*more than 5 times*). Participants who reported experiencing either of these events one or more times were coded as having a history of CSA (CSA = 1); those who responded "never" on both items were coded as CSA = 0.

Alcohol use (Waves 1 & 3).—The Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985) was used to assess typical drinking behavior over the past 12 months. Participants were given a definition of standard drink amounts, then were asked to indicate

[1]Of the 520 participants in the analytic sample, 84 (16.2%) initially chose a sexual identity other than lesbian or bisexual. Four initially identified as gay (all subsequently identified as lesbian), 42 as queer (of which 25 identified as bisexual and 17 as lesbian), 3 as two-spirit (all of which identified as bisexual), 14 as questioning (of which 13 identified as bisexual and 1 as lesbian), and 21 as other (of which 18 identified as bisexual and 3 as lesbian). Text responses for those who initially identified as "other" included identities of pansexual, asexual, fluid, gender-blind, and detailed descriptions of sexual preferences. Comparing the women who did (n = 436) and did not (n = 84) initially identify as lesbian or bisexual, there were no significant differences in demographics (age, race/ethnicity, relationship status), hookup behaviors, or any other study variables – with one exception; women who first selected an identity other than lesbian or bisexual reported more involvement in the LGBTQ community at Wave 1.

how many drinks, on average, they have on each day of a typical week. Total drinks per week were computed.

Posttraumatic stress symptoms (Waves 1 & 3).—Participants reported past-month PTSD symptoms using the PTSD Checklist–Specific version (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993), consistent with the fourth edition text revision of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*; American Psychiatric Association [APA], 2000). Each of 17 PTSD symptoms were assessed on a scale from 1 (*not at all*) to 5 (*extremely*). Scores were summed and centered at 0 (possible range: 0 to 68) to facilitate model interpretations, with higher scores indicating greater severity of PTSD symptomology. Past work has supported the validity (Weathers et al., 1993) and internal consistency of this measure (Cronbach's α = .94; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). In this study, Cronbach's α was .95 for both Waves 1 and 3.

Minority stress (Waves 1 & 3).—Past-year experiences of minority stress were assessed using an adapted version of the Daily Heterosexist Experiences Questionnaire (Balsam, Beadnell, & Molina, 2013). Specifically, participants reported the frequency of marginalization related to sexual identity on a 6-point scale ranging from 0 (*never*) to 5 (*almost every day*). Consistent with past work (Dworkin et al., 2018), our assessment did not include questions about HIV-related stressors given that these items are less relevant for sexual minority women than men (Balsam et al., 2013), and parenting-specific stressors were not examined given these questions would only be applicable for a subset of participants. Instead, we examined 34 questions assessing perceptions of heterosexism with regard to discrimination/harassment, family of origin, gender expression, isolation, vicarious trauma, and vigilance. Sample items include "*Having very few people you can talk to about being LGBTQ*," and "*Hearing someone make jokes about LGBTQ people*." Mean scores were computed with higher scores indicating more frequent experiences of daily heterosexism. Past work has supported the validity of this measure (Balsam et al., 2013), and in this sample, Cronbach's α was .88 for Wave 1 and .92 for Wave 3.

Involvement in LGBTQ community (Waves 1 & 3).—Participants completed the Involvement in Gay-Related Activities Scale (Rosario, Hunter, Maguen, Gwadz, & Smith, 2001). This 10-item measure assessed whether participants engaged in specific LGBTQ activities (e.g., "*Gone to an annual LGBTQ Pride March*," "*Gone to LGBTQ dance clubs, bars, discos, or hung around these places*") ever (at Wave 1) or in the past 12 months (at Wave 3). Response options were 0 (*no*) and 1 (*yes*). Scores were summed, with higher scores indicating more involvement in the LGBTQ community.

Connectedness to LGBTQ community (Waves 1 & 3).—Participants completed the Connectedness to the LGBTQ Community Scale (Frost & Meyer, 2012), a measure of community belongingness that has been validated with sexual minority men and women. The scale consists of 8 questions (e.g., "*I feel a bond with the LGBTQ community*," "*I am proud of the LGBTQ community*") with response options ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Mean scores were computed with higher scores indicating greater

feelings of connectedness. In the current sample, Cronbach's α was .87 for Wave 1 and .88 for Wave 3.

Hookup behaviors (Wave 2).—Participants were first given a definition of hooking up: "*an event in which you were physically intimate (any of the following: kissing, touching, fingering, oral sex, vaginal sex, anal sex) with someone whom you were not dating or in a romantic relationship with at the time, and in which you understood there was no mutual expectation of a romantic commitment*" (adapted from Fielder & Carey, 2010). In an initial screening question, participants were asked whether they had ever hooked up with a man and/or a woman (response options: *yes* or *no*). Participants who responded "no" were coded as having had no hookups (partners or frequency) in the past 3 months. Participants who responded "yes" were asked to provide more details on hookup behaviors in the past 3 months (which were the focus of analyses), including how many male or female hookup partners they had, and how many times they had hooked up with a man or a woman during that time (responses were open-ended). Because relatively few participants (n = 56) reported partners of both genders in the past three months, we considered hookups with either female or male partners. Specifically, responses were then recoded to represent: (1) any hookups in the past 3 months (0 = no, 1 = yes); (2) number of hookup partners in the past 3 months (open-ended); and (3) number of times hooked up in the past 3 months (open-ended).

Analytic Approach

Preliminary analyses were conducted; descriptive statistics were examined to characterize the sample and bivariate associations were examined to determine unadjusted relationships between study variables. Regression models were then estimated using maximum likelihood with standard errors robust to non-normality (MLR) in M*plus* version 8.0 (Muthén & Muthén, 2017). All 520 participants with valid data on the hookup measure were retained in analyses regardless of missing data by estimating covariances between exogenous variables, therefore utilizing full information maximum likelihood.

We first examined Wave 1 predictors of Wave 2 hookup behaviors, which were represented by three variables modeled in a piecewise format, akin to a hurdle model: (1) any vs. no hookup behaviors in the past 3 months (any hookup was indicated by at least 1 partner or 1 hookup time, whereas no hookups was indicated by 0 partners and 0 times in the past 3 months, or never hooking up before); and among those with any hookups in the past 3 months: (2) total number of hookup partners and (3) total frequency or number of hookups. For this first model, the outcome variables were specified such that participants with no hookups in the past 3 months had missing values on the partners and frequency variables. A binary distribution and logit link were used to estimate any vs. no hookups, whereas a zero-truncated count distribution and log link were used to model hookup partners and frequency. For each count outcome, dispersion parameters were examined, with significant values suggesting a negative binomial distribution fit better than a Poisson distribution (which does not include a dispersion parameter and assumes the mean and variance of the distribution are equal).

Second, we examined Wave 3 outcomes as predicted by Wave 2 hookup behaviors, after controlling for all Wave 1 variables (age, sexual identity, relationship status, CSA history, drinks per week, PTSD severity, minority stress, involvement, connectedness).[2] We again considered three summary variables for Wave 2 hookup behaviors: (1) any vs. no hookups, (2) number of hookup partners, and (3) hookup frequency in the past 3 months. All Wave 3 outcomes—drinks per week, PTSD severity, minority stress, involvement, and connectedness—were allowed to covary.

Results

Descriptive Statistics and Bivariate Associations

Of the 520 participants, 47.3% (n = 246) hooked up at least one time in the past 3 months. As indicated in Table 1, bivariate associations revealed that, compared to those who reported no hookups, participants who reported any hookups in the past 3 months at Wave 2 reported more drinks per week and more severe PTSD symptoms at Wave 1. There were no significant bivariate associations between any hookups and age, sexual identity, relationship status, CSA history, minority stress, involvement, or connectedness (Table 1). Among the 246 participants who reported any hookups, the average number of partners was 2.20 (SD = 2.12; range = 1 to 20) and the average number of times hooking up was 8.75 (SD = 16.18; range = 1 to 99) in the past 3 months. Hookup partners and frequency were not correlated among those with any hookups, r = −.002, p = .976. Of those with any hookups in the past 3 months and complete data on hookup partners by gender (n = 239), hookups with only men were reported by 10.1% of lesbians and 49.3% of bisexuals, hookups with only women were reported by 80.9% of lesbians and 18.7% of bisexuals, and hookups with both men and women in the past 3 months were reported by 9.0% of lesbians and 32.0% of bisexuals. Correlations between Wave 1 variables and Wave 2 hookup partners and frequency are displayed in Table 2. The only significant bivariate associations indicated individuals in a committed relationship at Wave 1 reported fewer subsequent hookup partners at Wave 2 than those not in a committed relationship at Wave 1, r = −.17, p = .007, and higher levels of minority stress were associated with more subsequent hookup partners, r = .13, p = .038.

Unique Predictors of Hookup Behaviors

Results of the piecewise model predicting hookup behaviors can be seen in Table 3. Neither negative binomial dispersion parameter was statistically significant, and therefore, zero-truncated Poisson distributions were approximated in Mplus by fixing the dispersion parameter to 0.001 for both hookup partners and frequency outcomes. The only significant conditional predictors of any hookups were age and alcohol use. That is, each year increase in age was associated with a 9% reduction in the likelihood of reporting any hookups and each additional drink per week was associated with a 3% increase in the likelihood of hookups one year later, after controlling for all other covariates (age, sexual identity, relationship status, CSA history, PTSD severity, minority stress, involvement, connectedness). Among women who reported hookups, bisexual women reported 57%

[2]We also considered a model in which the association between Wave 2 hookup behaviors and Wave 3 outcomes were allowed to differ by sexual identity. However, there were no significant interactions between hookup behaviors and lesbian vs. bisexual identity on any Wave 3 outcome, after controlling for Wave 1 variables. Thus, the simpler model without interactions is presented.

more hookup partners than lesbian women, and women in committed relationships at Wave 1 reported 36% fewer hookup partners one year later than those not in committed relationships, after controlling for all other covariates (age, sexual identity, CSA history, drinks per week, PTSD severity, minority stress, involvement, connectedness). In addition, women who reported more minority stress at Wave 1 reported more hookup partners at Wave 2, with a one-unit increase in minority stress corresponding to 32% more hookup partners after controlling for all other Wave 1 covariates (age, sexual identity, relationship status, CSA history, drinks per week, PTSD severity, involvement, connectedness). There were no unique predictors of hookup frequency among those with any hookups.

Potential Consequences of Hookup Behaviors

See Table 4 for results of the multivariate model examining Wave 2 hookup behaviors as predictors of Wave 3 outcomes, after controlling for Wave 1 values. Each Wave 1 measure was a significant predictor of the respective Wave 3 measure. In addition, Wave 1 minority stress was associated with fewer drinks per week, $B = -1.23$, $SE = 0.61$, $p = .045$, and greater PTSD severity, $B = 2.73$, $SE = 1.07$, $p = .011$, at Wave 3. Wave 1 PTSD severity was associated with less Wave 3 connectedness, $B = -0.01$, $SE < .01$, $p = .017$. Involvement and connectedness were also related, with Wave 1 connectedness predicting Wave 3 involvement, $B = 0.39$, $SE = 0.17$, $p = .022$, and Wave 1 involvement predicting Wave 3 connectedness, $B = 0.04$, $SE = 0.02$, $p = .010$.

After controlling for all Wave 1 variables, Wave 2 hookup behaviors were not uniquely associated with subsequent Wave 3 drinking or PTSD severity. However, hookup behaviors were associated with less minority stress, more involvement, and more connectedness at Wave 3. Specifically, greater hookup frequency was associated with less minority stress, $B = -0.01$, $SE < 0.01$, $p = .010$. Any hookups, $B = 0.64$, $SE = 0.30$, $p = .030$, and greater hookup frequency, $B = 0.02$, $SE = 0.01$, $p = .007$, were also associated with greater subsequent involvement in the LGBTQ community. Finally, having more hookup partners was associated with greater subsequent connectedness to the LGBTQ community, $B = 0.05$, $SE = 0.02$, $p = .007$. As indicated by R^2, the model accounted for 37.2% of the variance in drinks per week, 28.5% in PTSD severity, 24.9% in minority stress, 33.4% in involvement, and 36.6% in connectedness at Wave 3.

Discussion

This study is among the first to quantitatively examine predictors and consequences of hookups among sexual minority women. Nearly half (47.3%) of all sexual minority women in the current sample reported at least one hookup in the past 3 months, which is similar to the hookup rates for predominantly heterosexual college students over a similar timeframe (46%; Napper et al., 2015). However, bivariate associations revealed no significant differences in hookup behavior based on sexual identity (i.e., self-identification as lesbian or bisexual) within our sample, consistent with prior work (Kuperberg & Padgett, 2016) and supporting our examination of sexual minority women as a combined group (lesbians and bisexuals) rather than separately (lesbians vs. bisexuals) in this study. Overall findings revealed that alcohol use was associated with a greater likelihood of any subsequent

hookups, and individuals reporting more minority stress subsequently hooked up with more partners. Hookups were associated with positive outcomes one year later, including reductions in minority stress, and increases in involvement and connectedness with the LGBTQ community. Thus, findings were consistent with the notion that sexual hookups can be adaptive for sexual minority women. Each finding is discussed in detail below.

Alcohol use has been consistently linked with hookups in primarily heterosexual samples (Blayney, Lewis, Kaysen, & Read, 2018; Fielder & Carey, 2010) and participants in qualitative research report alcohol is also a “social lubricant” for hookups among sexual minority women (Watson et al., 2019; p. 940). Adding to this work, we found that sexual minority women reporting more alcohol use at baseline were more likely to report recent hookups one year later. However, among individuals reporting any hookups, alcohol use was not associated with number of subsequent hookup partners or frequency, which is in contrast to cross-sectional research indicating such associations (Fielder et al., 2013; Lewis et al., 2012). Taken in the context of prior qualitative work (Watson et al., 2019), sexual minority women may meet hookup partners in settings where alcohol use is common, such as bars and house parties. Therefore, alcohol use in sexual minority women may be associated with involvement in hookup culture, but the amount of alcohol consumption once in these drinking contexts may not be the primary driver of hookup frequency in sexual minority women. Instead, other factors such as expectations about whether alcohol use will lead to sex (i.e., sex-related alcohol expectancies) could be important determinants of hookups in drinking contexts (Patrick, Maggs, & Lefkowitz, 2015). Alternatively, it is possible that alcohol use at the time of the hookups is an important proximal predictor of hookup behaviors in sexual minority women, but we could not examine alcohol use and hookup behaviors concurrently in this study. Although alcohol use at baseline was strongly associated with alcohol use 2 years later, drinking patterns may have fluctuated, along with other predictors of hookups, such as relationship status. Additional longitudinal and event-level research is encouraged to better understand the role of alcohol use in hookups for sexual minority women. In addition, we considered whether hookup behaviors were associated with changes in drinking behaviors, which we anticipated might have increased to facilitate ongoing involvement in the hookup scene or cope with any hookup-related distress. However, results did not support this possibility.

Contrary to expectations, we observed no significant associations between CSA history and hookup behaviors. This is somewhat inconsistent with prior work showing associations between CSA and number of sexual partners in heterosexual women (Green et al., 2005; Roemmele & Messman-Moore, 2011; van Roode et al., 2009). However, these studies examined number of sexual partners over longer periods of time (e.g., lifetime, past year), and other work did not find significant associations between CSA and sexual partners over shorter timeframes (e.g., 30 days, 4 months; Batten et al., 2002). Therefore, the 3-month time period may not sufficiently represent how sexual behavior across the lifespan can be affected by CSA. Alternatively, it is possible that CSA may affect sexual functioning differently in sexual minority women than in heterosexual women, or may depend on the gender of the sexual partner. For example, some prior studies of sexual minority women have not found a history of CSA to be associated with sexual functioning (Henderson, Levahot, & Simoni, 2009) or risky sex in adulthood (Persson, Pfaus, & Ryder, 2015).

Another possibility is that CSA may lead to different patterns of behavior for different people (Davis & Petretic-Jackson, 2000), leading to more hookups in some women and fewer hookups in others, resulting in no average effect.

In contrast, there was some indication in our sample that sexual minority women engaged in hookups to cope with distress. Individuals with more severe PTSD symptoms at baseline were more likely to report having engaged in any recent hookups at the first follow-up, consistent with past work suggesting individuals may attempt to cope with trauma-related distress and emotional dysregulation through sex (Walsh et al., 2014; Weiss et al., 2019). However, this association was no longer significant after controlling for other factors such as age and alcohol use. It is therefore possible that the association between trauma-related distress and engaging in hookups is not direct, but instead may be due to heightened alcohol use in individuals with more severe PTSD symptoms (Debell et al., 2014). Surprisingly, PTSD symptoms were not associated with hookup frequency or partners, inconsistent with Weiss and colleagues' (2019) finding that PTSD was prospectively associated with number of vaginal sex partners in trauma-exposed emerging adult women. This could reflect differences in population (majority heterosexual women vs. sexual minority women) or differences in methodology for assessing recent sexual partners between the two studies.

Based on research indicating prospective associations between hookups and distress (Fielder & Carey, 2010; Owen, Fincham, & Moore, 2011), we examined whether PTSD symptoms were exacerbated by hookup patterns. Contrary to expectations, we observed no such association, suggesting that although some individuals might engage in hookups to cope with distress, these efforts neither exacerbated nor ameliorated persistent trauma-related distress. This finding is also consistent with Fielder, Walsh, Carey, and Carey (2014), who found cross-sectional associations between hookups and depression, but no associations between hookups and subsequent depression over time. Taken together with the current findings, hookups may be a response to proximal distress in some individuals, but may not lead to stable changes in long-term trauma-related distress. Another possibility is that long-term distress following hookups could vary depending on an individual's initial functioning (Owen et al., 2011) or the nature of the specific hookup encounters. More research is needed to disentangle these possibilities.

Although there was only modest indication that sexual minority women may have engaged in hookups to cope with PTSD symptoms, there was stronger support for the notion that sexual minority women engaged in hookups to cope with minority stress. Specifically, although minority stress was not associated with engaging in any (vs. no) hookups, more minority stress was associated with more hookup partners. This suggests sexual minority women who are open to engaging in hookups may respond to minority stress by seeking intimate sexual encounters. Given that attraction is strongly associated with similarity (Montoya, Horton, & Kirchner, 2008), it is possible that sexual minority women were attracted to hookup partners who had similar experiences of minority stress related to their sexual identity. Although sexual identity of hookup partners was not assessed in this study, past work revealed bisexual women were more willing to have sex with a bisexual partner than lesbian and heterosexual women (Feinstein, Dyar, Bhatia, Latack, & Davila, 2014), pointing to a possible preference for match in sexual identity. Moreover, bisexual women

experience unique stressors, referred to as binegativity, including discrimination from both heterosexuals and other sexual minorities (Brewster & Moradi, 2010; Hequembourg & Brallier, 2009), perceptions that bisexuality is not a stable, authentic orientation (Yost & Thomas, 2012), and invisible or mistaken sexual identity, which is often assumed based on partner gender (Dyar, Feinstein, & London, 2014). Among bisexual women, hookups might serve to affirm their sexual identity and reduce the loneliness that has been associated with bisexual minority stress (Mereish, Katz-Wise, & Woulfe, 2017). Indeed, sexual minority women who hooked up more frequently reported less subsequent minority stress, indicating that hookups contributed to effective coping with minority stress. Interestingly, hookup frequency – not number of partners – was most associated with reductions in minority stress after accounting for all other study variables, indicating more time spent by sexual minority women hooking up may have contributed to decreased minority stress. These findings provide quantitative support for notions suggested in qualitative research (Watson et al., 2019) that hookups may be a way to cope with minority stress, thereby contributing to positive sexuality research in sexual minority women.

Moreover, although initial involvement and connectedness in the LGBTQ community were not associated with subsequent hookup behaviors, those who did engage in hookups reported subsequent increases in involvement and connectedness to the LGBTQ community. Specifically, any hookups and hookup frequency were associated with more subsequent involvement, whereas more hookup partners were associated with greater subsequent connectedness. Consistent with past work (Rupp et al., 2014), this suggests that sexual minority women may use hookups as a way to explore and confirm their sexual identity, as well as build connections and potentially meet new friends or romantic partners within the LGBTQ community.

Limitations and Future Directions

Current findings should be interpreted in light of the study limitations. Importantly, hookups were of secondary interest in the larger longitudinal study, and therefore were not assessed at Waves 1 or 3. Although this means changes in hookup behaviors could not be examined in this study, we encourage future research examining sexual minority women's hookup patterns and related positive and negative outcomes over time. An additional limitation is that a small subset of participants reported recent hookups with both men and women and much of the variability in partner gender overlapped with sexual identity. As a result, hookups were examined in terms of quantity and frequency for all hookups and hookup partners rather than quantity and frequency of same-sex or opposite-sex hookups and hookup partners. Future research should consider examining positive and negative outcomes in regard to hookup partner gender when examining hookups among sexual minority women. Additional research with larger samples of sexual minorities may consider whether the gender or sexual identity of hookup partners is a more important predictor of positive and negative outcomes than the number of partners or frequency. Further, results were limited to women who indicated their identities could be characterized as lesbian or bisexual, and future research is needed to understand hookups in women whose sexual identity does not fit within these categories. In addition, dispositional factors (e.g., personality, self-esteem, religiosity) that have been linked to engagement in hookups in past

research (Fielder, Walsh, Carey, & Carey, 2013; Kuperberg & Padgett, 2016; Owen et al., 2010; Paul et al., 2000) were not assessed in this study. Moreover, this study examined distal outcomes associated with hooking up. Additional research is needed to examine between-person and within-person proximal outcomes following a hookup to examine if there are differences by hookup partner type or sexual behavior that impact positive and negative outcomes of hooking up in sexual minority women.

Conclusions

Prior research has shown that hooking up among college women can lead to positive outcomes, such as social connection and sexual intimacy (Shepardson et al., 2016). The present findings contribute to the literature by demonstrating that, for sexual minority women, hookups may serve as an adaptive means of coping with minority stress and connecting with the LGBTQ community. Gaining a better understanding of how hooking up leads to both positive and negative consequences can guide prevention efforts for young adult sexual minority women to make healthy decisions regarding their sexual behavior.

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Table 1

Descriptive Statistics

Variable	Observed Range	Full Sample (*N* = 520)	W2: No hookups (*n* = 274)	W2: Any hookups (*n* = 246)	Significance Test
		***n* (%)**	***n* (%)**	***n* (%)**	
W1: Bisexual (vs. lesbian)	0, 1	316 (60.8%)	161 (58.8%)	155 (63.0%)	$\chi^2(1) = 0.98$, $p = .322$
W1: Committed relationship	0, 1	224 (43.1%)	128 (46.7%)	96 (39.0%)	$\chi^2(1) = 3.13$, $p = .077$
W1: CSA history	0, 1	198 (38.1%)	95 (34.7%)	103 (41.9%)	$\chi^2(1) = 2.85$, $p = .091$
		M (SD)	*M (SD)*	*M (SD)*	
W1: Age	18 to 25	20.94 (2.06)	21.05 (1.97)	20.82 (2.15)	$t(518) = 1.27$, $p = .205$
W1: Drinks per week	0 to 84	8.21 (11.38)	**6.46 (9.87)**	**10.15 (12.59)**	**$t(515) = -3.72$, $p < .001$**
W1: PTSD severity	0 to 67	20.26 (16.87)	**18.32 (16.22)**	**22.41 (17.35)**	**$t(503) = -2.73$, $p = .007$**
W1: Minority stress	0.00 to 3.69	1.55 (0.69)	1.53 (0.68)	1.57 (0.69)	$t(518) = -0.56$, $p = .573$
W1: Involvement	0 to 10	5.60 (2.47)	5.45 (2.50)	5.76 (2.42)	$t(518) = -1.44$, $p = .151$
W1: Connectedness	0.25 to 4.00	2.99 (0.73)	3.01 (0.71)	2.96 (0.76)	$t(518) = 0.81$, $p = .420$

Note. W = wave; CSA = childhood sexual abuse; PTSD = posttraumatic stress disorder. Involvement refers to the Involvement in Gay-Related Activities Scale. Connectedness refers to the Connectedness to the LGBTQ (lesbian/gay/bisexual/transgender/queer or questioning) Community Scale. Bolded values are significantly different ($p < .05$) between participants reporting no vs. any hookups. Three participants had missing values for drinks per week; fifteen participants had missing values for PTSD severity.

Table 2

Correlations between Wave 1 Variables and Wave 2 Hookup Behaviors among Participants with Any Hookups

Variable	W2: Hookup partners		W2: Hookup frequency	
	r	*p*	*r*	*p*
W1: Bisexual (vs. lesbian)	.11	.076	−.05	.416
W1: Committed relationship	**−.17**	**.007**	.03	.622
W1: CSA history	−.03	.587	−.04	.529
W1: Age	−.04	.558	.07	.256
W1: Drinks per week	.06	.369	.03	.606
W1: PTSD severity	−.03	.605	−.05	.398
W1: Minority stress	**.13**	**.038**	−.05	.392
W1: Involvement	.04	.528	.00	.960
W1: Connectedness	.03	.609	−.07	.249

Note. $n = 246$. W = wave; CSA = childhood sexual abuse; PTSD = posttraumatic stress disorder. Bolded values are statistically significant at $p < .05$.

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Table 3

Predictors of Hookup Behaviors in Past 3 Months

Term	W2: Any hookups			W2: Hookup partners (if any hookups)			W2: Hookup frequency (if any hookups)		
	B (SE)	*p*	*OR*	*B (SE)*	*p*	*CR*	*B (SE)*	*p*	*CR*
W1: Bisexual (vs. lesbian)	0.23 (0.20)	.251	1.26	**0.45 (0.18)**	**.014**	**1.57**	−0.27 (0.23)	.242	0.77
W1: Committed relationship	−0.25 (0.18)	.170	0.78	**−0.45 (0.18)**	**.011**	**0.64**	0.03 (0.23)	.891	1.03
W1: CSA history	0.21 (0.20)	.298	1.23	−0.11 (0.16)	.505	0.90	−0.10 (0.24)	.688	0.91
W1: Age (centered at 18)	**−0.10 (0.05)**	**.043**	**0.91**	−0.02 (0.06)	.692	0.98	0.05 (0.06)	.407	1.05
W1: Drinks per week	**0.03 (0.01)**	**.010**	**1.03**	0.01 (0.01)	.353	1.01	0.00 (0.01)	.643	1.00
W1: PTSD severity	0.01 (0.01)	.094	1.01	−0.01 (0.01)	.121	0.99	0.00 (0.01)	.584	1.00
W1: Minority stress	−0.14 (0.14)	.318	0.87	**0.28 (0.11)**	**.012**	**1.32**	−0.08 (0.17)	.627	0.92
W1: Involvement	0.07 (0.04)	.073	1.08	0.02 (0.04)	.697	1.02	0.00 (0.04)	.964	1.00
W1: Connectedness	−0.18 (0.14)	.219	0.84	0.12 (0.14)	.412	1.12	−0.21 (0.12)	.074	0.81
Threshold or Intercept	0.05 (0.54)	.928		−0.25 (0.59)	.678		**2.97 (0.51)**	**<.001**	

Note. W = wave; OR = odds ratio; CR = count ratio; CSA = childhood sexual abuse; PTSD = posttraumatic stress disorder. Unstandardized estimates for “any hookups” are reported in logits. Unstandardized estimates for hookup partners and frequency are report in log units. Count ratios are exponentiated estimates and represent the proportion increase in hookup behavior corresponding to a one-unit increase in the predictor. Bolded values are statistically significant at $p < .05$.

Table 4

Hookup Behaviors as Predictors of Subsequent Outcomes, After Controlling for Pre-Hookup Values

Term	W3: Drinks per week		W3: PTSD severity		W3: Minority stress		W3: Involvement		W3: Connectedness	
	B (SE)	*p*	*B (SE)*	*p*	*B (SE)*	*p*	*B (SE)*	*p*	*B (SE)*	*p*
W2: Any hookups	0.39 (1.00)	.692	−0.88 (1.74)	.616	−0.05 (0.08)	.505	**0.64 (0.30)**	**.030**	−0.03 (0.08)	.732
W2: Hookup partners	0.24 (0.30)	.441	0.16 (0.46)	.719	0.01 (0.01)	.378	0.12 (0.08)	.147	**0.05 (0.02)**	**.007**
W2: Hookup frequency	−0.01 (0.03)	.614	0.00 (0.05)	.939	**−0.01 (0.00)**	**.010**	**0.02 (0.01)**	**.007**	0.00 (0.00)	.180
W1: Bisexual (vs. lesbian)	−1.40 (0.89)	.116	1.15 (1.43)	.420	0.01 (0.07)	.879	−0.21 (0.24)	.380	0.02 (0.07)	.812
W1: Committed relationship	−0.05 (0.73)	.943	1.20 (1.36)	.376	0.03 (0.07)	.629	0.12 (0.23)	.600	0.01 (0.06)	.863
W1: CSA history	−0.30 (0.85)	.728	1.78 (1.47)	.226	−0.10 (0.07)	.141	0.20 (0.24)	.406	0.06 (0.06)	.365
W1: Age (centered at 18)	−0.16 (0.21)	.433	−0.37 (0.34)	.272	0.01 (0.02)	.783	−0.07 (0.06)	.227	−0.01 (0.02)	.378
W1: Drinks per week	**0.48 (0.09)**	**<.001**	0.02 (0.07)	.791	0.00 (0.00)	.746	−0.02 (0.01)	.141	0.00 (0.00)	.298
W1: PTSD severity	−0.03 (0.03)	.321	**0.43 (0.05)**	**<.001**	0.00 (0.00)	.368	0.00 (0.01)	.925	**−0.01 (0.00)**	**.017**
W1: Minority stress	**−1.23 (0.61)**	**.045**	**2.73 (1.07)**	**.011**	**0.50 (0.06)**	**<.001**	0.05 (0.19)	.777	0.02 (0.06)	.735
W1: Involvement	−0.08 (0.18)	.653	−0.12 (0.32)	.702	0.01 (0.01)	.620	**0.55 (0.05)**	**<.001**	**0.04 (0.02)**	**.010**
W1: Connectedness	−0.37 (0.53)	.485	−1.27 (0.95)	.179	0.06 (0.05)	.182	**0.39 (0.17)**	**.022**	**0.57 (0.05)**	**<.001**
Intercept	**7.14 (2.85)**	**.012**	**8.54 (3.76)**	**.023**	0.10 (0.18)	.583	−0.31 (0.63)	.624	**0.84 (0.21)**	**<.001**

Note. W = wave; CSA = childhood sexual abuse; PTSD = posttraumatic stress disorder. Bolded values are statistically significant at $p < .05$. Shaded cells represent associations for the same measure at Waves 1 and 3.