Alcohol use as a risk factor for bidirectional intimate partner violence among college students: Results from a daily diary study

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ABSTRACT

Background. Decades of research have found alcohol and negative affect (NA) are global and proximal risk factors for psychological and physical intimate partner violence (IPV), especially among college students. Despite recognition as the most common form of IPV, bidirectional psychological and physical IPV (i.e., instances where both partners are perpetrating and experiencing victimization) remains an understudied topic. Clarifying alcohol and NA's influences on bidirectional IPV may inform the development of intervention programs. We hypothesized that the association between alcohol use (number of daily drinks and Heavy Episodic Drinking [HED]) and IPV would vary as a function of NA.

Methods. Dating college students (N = 232; 67.7% women; 83.89% white) who drink alcohol completed daily surveys for 60 consecutive days assessing daily alcohol use, NA, and IPV perpetration and victimization. Generalized linear mixed models (GLMMs) tested the within- and between-person associations and interactions between alcohol use, NA, and psychological and physical unidirectional and bidirectional IPV.

Results. A significant interaction between NA and the number of drinks before unidirectional psychological IPV perpetration emerged, such that the alcohol-IPV association was weaker at lower levels of NA. A main effect of NA emerged as a proximal antecedent of unidirectional psychological victimization and bidirectional psychological IPV. Main effects of within- and between-person alcohol use were insignificant across other models.

Conclusion. On days of low NA, college students were less likely to perpetrate psychological IPV after drinking. Future research should clarify whether positive affect weakens the alcohol-IPV association and assess additional moderators of this link.

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GENERAL AUDIENCE ABSTRACT

Decades of research support alcohol consumption and negative affect (NA; feelings of anger, jealousy, sadness, etc.) are directly related to psychological and physical intimate partner violence (IPV; psychological and physical aggression in a romantic relationship) perpetration. However, limited research exists surrounding bidirectional IPV, which is when both partners in a relationship are perpetrating and experiencing IPV. In order to better understand bidirectional IPV and how alcohol use and NA directly relate to it, the present study tests whether the link between IPV perpetration and victimization and bidirectional IPV and alcohol use fluctuates when adding in NA. We used data from 232 college students who previously drank alcohol. They filled out a short survey every day for 60 days asking about their daily use of alcohol, IPV, and NA before seeing their partner and prior to IPV occurring. Our statistical analyses tested whether the daily link between IPV and alcohol use fluctuated based on daily NA. On days of low NA, the relationship between alcohol use and psychological IPV perpetration was *weaker*. Our results indicated that daily NA alone was a significant antecedent to psychological IPV perpetration, victimization and bidirectional IPV. This study highlights that, for college students who are not heavy drinkers or who have not previously perpetrated violence, NA may be a more important treatment target than alcohol use to prevent IPV. Future studies should seek to replicate our findings to better understand the link between NA and IPV perpetration/victimization and bidirectional IPV.

DEDICATION

I would like to first thank my advisor and committee chair, Dr. Meagan J. Brem, for her support in formulating and executing this thesis. Across 14 drafts and 545 days (and counting), Dr. Brem has gracefully supported and mentored me through the challenging process of executing my second independent research project. I'd like to thank Dr. Brem for giving me the independence to learn a new statistical approach to analyze these data, and for her patience as a I hone my writing skills. I extend my thanks to my committee members, Dr. Heather Davis and Dr. John Richey, for their feedback on my proposal and for pushing to test a more rigorous research question. I owe many thanks to my partner for her love, patience, and support throughout this entire process, particularly during instances when "just a few more minutes" of writing or analyses stretched into hours. I'd like to thank my two lab sisters, Allison Tobar and Lindsay Mongan for their friendship and support throughout my first two years in this program. I must also acknowledge the unintentional contributions of my two cats, Tyson and Raven, whose knack for walking across my keyboard provided many needed moments of laughter. Finally, I'd like to dedicate this thesis to my parents, specifically my mom. She continues to inspire and teach me the power of kindness, bravery, and love, even in the face of tremendous obstacles.

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Table of Contents

Chapter 1: Introduction

Alcohol use and intimate partner violence (IPV; i.e., psychological and physical partner-directed aggression) perpetration and victimization peak between ages 18-25, a time when many young adults are in college (W. L. Johnson et al., 2015; Leonard & Quigley, 2017; Patrick et al., 2019). Annually, an alarming number of college students report experiencing psychological (79.1% perpetration; 86.9% victimization) and physical IPV (30.7% perpetration; 47.9% victimization; Dardis et al., 2017). Similarly, 54.3% of 18–25-year-old young adults endorsed past-year alcohol consumption, and 34.3% engaged in past-year heavy episodic drinking (HED; i.e., 4/5+ drinks in a single sitting; (Center for Behavioral Health Statistics and Quality, 2015; National Institute of Alcohol Abuse and Alcoholism [NIAAA], 2018). Decades of research support alcohol use as a global and proximal risk factor for IPV (Leonard, 2005; Leonard & Quigley, 2017). Daily diary data across several studies have revealed that IPV perpetration and victimization were more likely to occur after alcohol use relative to no alcohol use (Moore et al., 2011; Parks et al., 2008; Shorey, Stuart, McNulty, et al., 2014; Shorey et al., 2016). Further, studies also showed that negative affect (NA; i.e., a subjectively negative emotional state marked by unpleasant emotions such as anger) increased the odds of IPV, especially when combined with proximal alcohol use (Crane & Eckhardt, 2013; Elkins et al., 2013; Shorey et al., 2015; Shorey, Stuart, Moore, et al., 2014). Although previous studies have contributed to investigators' understanding of how alcohol use may contribute to college students' subsequent, same-day unidirectional IPV perpetration *or* victimization, bidirectional IPV, the most common presentation of IPV among college students (Langhinrichsen-Rohling et al., 2012), remains understudied at the daily level. Thus, it is unclear whether alcohol use, NA, or alcohol use *and* NA on a given day increases the likelihood of college students experiencing *only* IPV victimization (i.e., unidirectional IPV victimization), *only* IPV perpetration (i.e., unidirectional

IPV perpetration), or *both* IPV perpetration and victimization (i.e., bidirectional IPV). Using daily diary data collected from dating college students who drink alcohol, the current study examined the within- and between- person effects of alcohol use and NA on likelihood of subsequent bidirectional and unidirectional IPV.

Several theories elucidate potential causal mechanisms for alcohol's proximal risk for IPV. With regard to IPV perpetration, I^3 theory (Finkel & Eckhardt, 2013) posits that alcohol acts as a proximal disinhibiting factor, that, when paired with other "impelling" factors (e.g., aggressogenic traits) and contextual "instigating" factors (e.g., an argument, NA), increases likelihood of subsequent IPV. Alcohol's disinhibiting effect is accompanied by alcohol myopia, a process by which an intoxicated person's attention is restricted to the most salient environmental cues at the expense of aggression-inhibiting cues (e.g., problem solving, compromise, de-escalation; Steele & Josephs, 1990). If the most salient environmental cue includes NA (e.g., anger, stress), alcohol myopia theory and I^3 theory purport that alcohol use will increase the likelihood of IPV (Finkel & Eckhardt, 2013; Steele & Josephs, 1990).

In recent years, daily diary studies emerged as a methodology well-suited to examine theory-informed proximal associations between alcohol use and IPV within college students' naturalistic settings. Consistent with alcohol-related IPV theories (Finkel & Eckhardt, 2013; Steele & Josephs, 1990), daily diary studies drawn from undergraduate samples revealed that college men's and women's psychological IPV perpetration increased as the number of drinks consumed on a given day increased (Moore et al., 2011). College women were more likely to perpetrate psychological and physical IPV as the number of drinks consumed increased, but only on days in which higher levels of angry affect were also present (Shorey, Stuart, Moore, et al., 2014). However, other data suggest that negative affect is a more robust proximal antecedent of college students' IPV perpetration above and beyond alcohol use (Crane & Eckhardt, 2013).

Whereas I^3 provided researchers with a structural framework to study alcohol's proximal association with IPV perpetration, theories that explain the proximal association between alcohol use and subsequent IPV victimization are less clear (Finkel & Eckhardt, 2013). Perpetrators may target intoxicated victims due to their vulnerability (Sween & Reyns, 2017). Intoxication may also impair recognition of warning signs that a conflict is escalating, and the ability to mediate the conflict or disengage from the situation (Testa et al., 2003). Further, if both partners are intoxicated, the likelihood that one or both will perpetrate IPV increases (Testa et al., 2019; Testa & Derrick, 2014; W. Wang et al., 2022). Discrepant drinking patterns among partners (i.e., differences in frequency and amount of alcohol consumed among partners) may also enhance conflict because one partner's drinking may be a source of contention for the other partner, increasing the odds of IPV victimization (Holden & Rollins, 2019; Levitt & Cooper, 2010; Testa et al., 2019).

Few studies have examined the proximal associations between alcohol use and subsequent IPV victimization among college students. College women's odds of experiencing psychological or physical IPV were greater on heavy drinking days (relative to non-heavy-drinking days), on days involving any alcohol use, and as the number of drinks consumed increased (Parks et al., 2008; Shorey et al., 2016). Similarly, community couples-based research suggested that one partner's alcohol use associated with greater likelihood of experiencing physical and verbal IPV from their partner within the next four hours (Testa & Derrick, 2014; Wang et al., 2022). Collectively, these studies suggest alcohol confers proximal risk for college students' IPV perpetration and victimization. However, alcohol-related IPV victimization studies predominantly sampled women, and IPV perpetration and victimization were examined as separate outcomes. As such, conclusions cannot speak to whether alcohol use associates with increased likelihood of experiencing *both* perpetration and victimization during an IPV episode

(i.e., bidirectional IPV). While some theory and data supported the proximal associated between alcohol use and IPV victimization, no previous theory or study examined the proximal effects of NA as an antecedent of IPV victimization. Thus, it remains unknown whether proximal NA alone or proximal NA and drinking associate with increased likelihood of experiencing unidirectional IPV perpetration, victimization, or bidirectional IPV. Because of this gap in the literature, our hypotheses related to NA as a proximal moderator of the association between alcohol use and IPV victimization were exploratory.

Extant literature has a number of limitations that preclude clinical scientists' abilities to target proximal antecedents to IPV among college students. First, few daily diary studies of college students examined proximal antecedents to bidirectional IPV among college students despite bidirectional IPV being the most commonly-reported IPV presentation among this age group (Langhinrichsen-Rohling et al., 2012). Among college women, alcohol use (measured via estimated blood alcohol content) did not significantly associate with odds of bidirectional IPV (Neavins et al., 2020). However, this study used a small sample of women which limits generalizability. Second, prior research has not examined college students' bidirectional IPV within the context of both alcohol use and NA despite both alcohol and NA being critical to alcohol-related IPV theories (e.g., I^3; Finkel & Eckhardt, 2013). Understanding whether the association between unidirectional and bidirectional IPV and alcohol use varies as a function of NA carries significant clinical implications; for example, identification of NA prone college students could be addressed through individual or couple psychoeducation which may prevent bidirectional IPV and the progression to a unidirectionally violent relationship (Bates, 2016).

Using daily diary data collected from college students who drink alcohol, we aim to address gaps in prior research by (1) testing the proximal associations between alcohol use (number of drinks, HED) and bidirectional and unidirectional IPV (psychological and physical),

and (2) examining whether higher levels of proximal NA (i.e., anger, stress, sadness, jealousy) strengthen the likelihood of IPV (bidirectional and unidirectional) after drinking. We hypothesize that, controlling for sex assigned at birth, the odds of bidirectional IPV, unidirectional IPV victimization, and unidirectional IPV perpetration will be greater as the number of drinks consumed on a given day increases (within-person effect; Hypothesis 1) and greater on a HED day relative to a day that does not involve HED (within-person effect; Hypothesis 2). We also hypothesize that negative affect will moderate the proximal association between drinking and IPV (bidirectional and unidirectional perpetration) such that the alcohol-IPV link will be stronger on days of high, but not low, daily NA (Hypothesis 3). We also hypothesize that the odds of daily IPV perpetration (bidirectional and unidirectional) will positively associate with average alcohol use (between-person effect; Hypothesis 4). Finally, we formed an exploratory hypothesis that negative affect will moderate the proximal association between drinking and IPV (unidirectional victimization) such that the alcohol-IPV victimization link will be stronger on days of high, but not low, daily NA (Exploratory Hypothesis).

Chapter 2: Methods

Participants & Procedure

Data were collected as part of a 60-day daily diary study of 236 undergraduate college students who drink alcohol (Brem et al., 2022). Demographic information is presented in Table 1. Participants were recruited from a large, public, southeastern university via flyers posted throughout campus, campus listserv advertisements, and announcements in undergraduate psychology courses. Interested participants were invited to partake in a brief online screener on Qualtrics.com to determine their eligibility. To be eligible for the larger study, participants had to (1) be at least 18 years of age, (2) be in a current dating relationship that lasted for at least one month in duration, (3) have a dating partner who was 18 years of age or older, (4) have consumed alcohol in the past month, and (5) have a minimum of two contact days with their dating partner each week (e.g., face-to-face contact or technology-facilitated contact). Participants were not dating each other (i.e., data were collected from individuals and not couples). Full study procedures are reported in the parent study (Brem et al., 2022).

Participants who were eligible for the study first completed a baseline questionnaire on Qualtrics.com. Participants would receive partial course credit (if they were enrolled in an eligible introductory psychology course) or $20.00 monetary compensation after completing the baseline questionnaire. Following the baseline questionnaire, participants were delivered a once-daily Qualtrics.com survey to their smartphone at 6:00 AM for 60 consecutive days. Reminder emails were sent at 12:00 PM and 5:00 PM if their daily survey was not completed by 12:00 PM or 5:00 PM. Participants were compensated $1.00 per daily survey completed. Participants who completed all seven surveys in a week were compensated an additional $5.00. Thus, participants could earn up to $120.00 for participating in the study. Participants who did not complete at least three daily surveys during the 60-day daily diary flow were not included in the analytic sample

as consistent with daily diary analytic procedures (Shorey, Stuart, McNulty, et al., 2014). All study procedures were approved by the University of Tennessee Institutional Review Board.

Baseline Measures

Demographic Measures

Demographic measures including age, sex assigned at birth, gender, sexual orientation, race and ethnicity, relationship status and duration, and income, were collected as part of the larger study.

Daily Measures

Relationship Status and Partner Contact

Participants were probed as to their current relationship status and whether they were still in a relationship with the same partner they reported at baseline. Participants were asked if they had a) seen their partner in the past 24 hours, or b) been in contact with their partner via technology (i.e., texting, calling on the phone, etc.). Because IPV can continue after a relationship dissolves (Anderson, 2003; Bell et al., 2007), participants were asked to report IPV even if their relationship terminated (Shorey, Stuart, McNulty, et al., 2014).

Intimate Partner Violence

With regard to psychological IPV, participants were asked if they perpetrated, were victimized, or both perpetrated and were victimized by psychological IPV during the previous day (defined as the time they awoke to the time they went to sleep) using questions from the Revised Conflict Tactics Scales' (CTS2; Straus et al., 1996; Straus & Douglas, 2004) Psychological Aggression subscale, and questions from the Psychological Maltreatment of Women Inventory (PMWI; Tolman, 1999). Psychological IPV acts assessed various forms of verbal and emotional abuse, harassment, humiliation, intimidation, and threatening that occur as part of psychological IPV. With regard to physical IPV, participants were asked if they

perpetrated, were victimized, or both perpetrated and were victimized by physical IPV by a dating partner during the previous day using questions from the CTS2 Physical Assault subscale. Physical IPV acts assessed physical abuse acts (e.g., “I pushed or shoved my partner”, “I slapped my partner”, etc.). All items included gender-neutral wording. The CTS2 and PMWI have evidenced good psychometric properties within undergraduate populations (Reed et al., 2016; Straus et al., 1996).

Items from the same subscale (i.e., psychological or physical IPV) were aggregated into single questions (e.g., “Called my partner names [e.g., fat, ugly, asshole, etc.]; insulted/swore at partner; yelled/screamed at partner” were combined into a single item to assess psychological IPV; “Grabbed, pushed/shoved, slapped, or threw something that could hurt at partner” were combined into a single item to assess physical IPV). Psychological aggression was measured with three items and physical assault was measured with two items. For all IPV items presented, participants were presented with the following options: (a) “This did not happen”; (b) “I did this to my partner”; (c) “My partner did this to me”; (d) “I did this to my partner and my partner did this to me.” If participants selected option “d”, their responses were coded as experiencing bidirectional IPV on that day, whereas participants who endorsed “b” or “c” on the same day had their responses coded as experiencing unidirectional IPV perpetration or unidirectional victimization, respectively. For example, if “d” was endorsed for *any* of the three psychological IPV items, then bidirectional psychological IPV was coded as “1” for that day. However, if “d” was not endorsed, but “b” was endorsed on at least one of the three items assessing psychological IPV, then unidirectional psychological IPV perpetration was coded as “1” for that day. The measures and coding strategy are based on prior daily diary research assessing psychological and physical IPV (Shorey, Stuart, McNulty, et al., 2014; Shorey, Stuart, Moore, et al., 2014; Taft et al., 2006).

Alcohol Use

Participants were asked if they consumed alcohol during the previous day (defined as the time they woke up to the time they went to sleep). If they answered affirmatively, participants were asked how many standard drinks of alcohol they consumed, as well as what time they started and stopped drinking. If the participant reported any IPV, they were asked how many standard drinks they consumed prior to the event occurring.

Consistent with prior research (e.g., Brem et al., 2022; Shorey et al., 2014; Shorey et al., 2014), daily alcoholic drink count depended on whether alcohol was consumed before or after an occurrence of IPV. That is, if drinking only occurred *after* the IPV event, the alcoholic drink count variable was be recoded to "0" to better approximate drinking that occurred before IPV. For example, if a participant reported consuming four standard drinks altogether on a given day but reported consuming only two standard drinks of alcohol *before* a reported IPV perpetration event, the standard drink count was coded "2" to approximate alcohol that occurred before IPV. If a participant reported consuming four drinks on a given day, but all were consumed after IPV occurred, their drink count was coded "0." If a participant reported consuming four drinks on a given day, and all were consumed prior to IPV occurring, their drink count was coded as "4." Finally, if a participant reported consuming no standard drinks in a given day, their drink count was coded as "0."

HED was calculated by examining gender and the number of drinks consumed before the first IPV event. For example, participants were coded "1" if they consumed 4 or more (for women) or 5 or more (for men and non-binary participants; (Flentje et al., 2020) drinks in one sitting prior to the psychological or physical IPV event; participants were coded "0" if they consumed less that 4 (for women and non-binary participants) or 5 (for men) drinks in one sitting

prior to the psychological or physical IPV event. If HED occurred after an IPV event, it was coded as "0."

Negative Affect

Daily NA was assessed using a modified version of the Positive and NA Scale (PANAS; Watson et al., 1988). To capture NA proximal to IPV, participants were only presented with the items if they reported they had seen their dating partner *in-person* the previous day. Participants were asked to rate how they felt *prior* to seeing their dating partner the previous day and were presented with the options the following: Angry; Frustrated; Mad; Irritated; Jealous; Happy; Sad; Depressed; Hostile; Calm; Excited;

Anxious. If a participant endorsed IPV the previous day, they were presented with the NA items again, asking how they felt about their partner *prior* to IPV occurring. Each were rated on a scale from (1 = very slightly; 5 = extremely). Scores were averaged prior to modeling.

Congruent with the coding strategy for alcohol use prior to IPV, if a participant reported IPV on a given day, then their NA score before IPV items was used as their NA score for that day. If a participant endorsed several different IPV behaviors on a given day (e.g., participants reported both psychological and physical IPV occurred, such that they would be presented with NA items after each reported type of IPV), then the NA before IPV scores were averaged across each type of IPV. For example, if a participant reported yelling/screaming and being monitored by their partner, the NA scores for both questions were averaged for their NA before psychological IPV score. If a participant did not report IPV on a given day, their NA score before seeing their partner was used for that day.

Data Analytic Strategy

All descriptive analyses and hypothesis testing was conducted using R (R Core Team, 2023). We used the lme4 package for computing mixed-effects models (Bates et al., 2015).

Consistent with the parent study, compliance rates were calculated by computing the percentage of missing surveys relative to the number of total surveys offered (Brem et al., 2022). A complete list of packages used can be found in Supplemental Table 8.

We first completed a missing data analysis to determine whether data were missing completely at random (MCAR), missing at random (MAR), or missing not at random (MNAR) using the tableone (Yoshida et al., 2022) and finalfit packages (Harrison et al., 2023). Analyses demonstrated that all variables of interest were MCAR or MAR. Next, prior to fitting full models, random effects models were fit to determine the amount of between- and within-person variance for each of the six IPV outcomes. Consistent with best practices for mixed-effects modeling, at least 10% of the variance (i.e., intraclass correlation; ICC) was required to be attributable to within-person variance to proceed with further model specification (Hedeker & Gibbons, 1997; Mroczek & Griffin, 2007).

For hypothesis testing, we used generalized linear mixed-effects modeling (GLMMs) specifying random intercepts for each participant. We specified a logit-link function with a binomial sampling distribution and used maximum likelihood estimation. For models testing the moderating effect of NA, we included an interaction term between the alcohol predictor (number of daily drinks and HED), and NA for each IPV outcome. Significant interactions were decomposed using simple slopes and the Johnson-Neyman technique (Johnson & Fay, 1950). This approach was chosen (1) because of the dichotomous nature of each outcome variable (e.g., "1" if bidirectional psychological IPV occurred, "0" if bidirectional psychological IPV did not occur), and (2) to account for the correlated errors associated with individuals' repeated reports. All participants who completed more than three daily surveys were used in analyses despite some missing data due to attrition and noncompliance. All available data were used, including

days when IPV did not occur, days when alcohol use did not occur, and days when participants did not see their partner in person (i.e., days with no reported NA prior to seeing their partner).

Separate analyses were executed for the number of drinks consumed and HED. Similarly, separate analyses were conducted for each type of IPV outcome (i.e., unidirectional psychological IPV perpetration/victimization, unidirectional physical IPV perpetration/victimization, bidirectional psychological IPV, bidirectional physical IPV). Two-level models were employed. In each model, alcohol use (a time-varying predictor; i.e., number of drinks consumed, HED) was entered to yield Level 1 within-person effects. The number of drinks variable was centered on each individual's overall mean (i.e., person-mean centered) and the HED variable was uncentered due to the dichotomous nature of the variable (i.e., "1" indicates HED occurred whereas "0" indicates that HED did not occur) when entered in Level 1. NA (a time-varying predictor) scores prior to each form of IPV (e.g., unidirectional psychological IPV perpetration) were entered as interaction terms with number of drinks and HED for each model. Each individual's overall mean daily alcohol use across the 60-day study was computed, centered on the grand mean, and included in Level 2 of each model to provide between-person effects for alcohol use. This approach allowed us to examine within-person effects controlling for between-person effects to better estimate proximal associations between alcohol use and IPV. Sex assigned at birth was uncentered and entered into each model in Level 2 to control for the effects of sex assigned at birth.

Hypotheses were tested by estimating (1) the within-person effects of alcohol use (number of drinks consumed, HED), NA, and their interaction on repeated measures of IPV (bidirectional psychological/physical IPV, unidirectional psychological/physical IPV victimization, unidirectional psychological/physical IPV perpetration), and (2) the between-person effects of average alcohol use, entered in Level 2, on repeated measures of IPV.

Chapter 3: Results

Descriptive Statistics

Compliance rates. Participants (N = 232) completed 9,993 daily surveys out of 13,290 (overall compliance rate of 75.19%). On average, participants completed 43.04 surveys (out of 60; SD = 19.59). Participants did not differ on the number of surveys submitted on account of sex assigned at birth. Women submitted an average of 44.36 (SD = 19.27) surveys, and men submitted an average of 40.52 (SD = 19.86) surveys).

Daily data descriptive statistics. Of the total number of daily surveys completed (N = 9,993), participants reported unidirectional psychological IPV perpetration on 83 days and unidirectional physical IPV perpetration on two days. Unidirectional psychological and physical IPV victimization were reported on 92 and 14 days, respectively. Bidirectional psychological IPV was reported on 98 days, while bidirectional physical IPV was reported on five days. Of the 232 participants, 52 (22.4%) reported unidirectional psychological perpetration, 46 (19.8%) reported unidirectional psychological victimization, and 47 (20.3%) reported bidirectional psychological IPV. Of the 232 participants, two (0.86%) reported unidirectional physical perpetration, eight (3.4%) reported unidirectional physical victimization, and four (1.7%) reported bidirectional physical IPV.

Overall, 84.9% of participants endorsed at least one drinking day during the study. Of days when participants completed surveys, 15.1% of these were drinking days. On average, participants reported 6.45 (SD = 8.20) drinking days throughout the study, but it is important to note that participants completed different numbers of surveys. On drinking days, participants reported consuming an average of 3.37 (SD = 2.78). Of the drinking days reported, 152 were HED drinking days, and participants reported consuming an average of 7.89 (SD = 3.59) on HED days.

Out of the 232 participants, 209 (90.1% of participants) submitted at least one survey that indicated NA > 0. Of the 9,993 surveys submitted, participants reported NA > 0 on 2,703 days (27.0% of days). Overall, participants reported an average NA of .87 (*SD* = .71) with a range of .25 to 6.

Co-occurrence of alcohol use and IPV. Participants reported drinking on 1,496 days; 689 days of drinking (46.06% of all drinking days) occurred on days when participants had face-to-face contact with their partner. For occasions where alcohol use preceded psychological or physical IPV (unidirectional perpetration, unidirectional victimization, and bidirectional), please see Table 2.

Hypothesis Testing

Initial Random Effects Models. Initial random effects models for five of the six IPV outcomes demonstrated satisfactory variability (i.e., >10% of the variance [ICC] was attributable to within-person effects) for further testing. ICCs from all random effects models can be found in Table 3. All final model parameters can be found in Tables 4 and 5. Model parameters for interaction models can be found in supplemental Tables 6 and 7.

Unidirectional Psychological IPV Perpetration. For unidirectional psychological IPV perpetration, the model testing the number of drinks and HED preceding IPV converged without issue. We observed a significant interaction between the number of drinks and NA prior to unidirectional psychological IPV perpetration. Decomposing the interaction, it was revealed that low levels of NA prior to IPV significantly *decreased* the odds of unidirectional psychological perpetration aggression among participants who experienced NA that was 1 SD below the mean, but was not related to unidirectional psychological IPV perpetration odds at high levels of NA. Overall, participants who experienced low levels of NA and drank alcohol were *less* likely to perpetrate unidirectional psychological IPV (see Table 5. for simple slopes analysis). For the

HED model, the association between HED and subsequent unidirectional psychological IPV perpetration did not vary as a function of daily NA. The interaction term was removed before re-running the model. A main effect of NA prior to IPV (within-person effect) was significantly and positively associated with unidirectional psychological perpetration.

Unidirectional Psychological IPV Victimization. In contrast to hypotheses, the association between number of drinks and HED and subsequent unidirectional psychological IPV victimization did not vary as a function of daily NA. The interaction term was removed from both models before running the final models. Across both main effects models for the number of drinks and HED, greater daily NA (within-person effect) significantly and positively associated with unidirectional psychological IPV victimization. Average alcohol use (between-person effect) and sex assigned at birth did not associate with unidirectional psychological IPV victimization in either model. Of note, although the HED model converged, it also demonstrated a non-positive semi-definite Hessian matrix, which indicates the variance-covariance matrix may be less reliable (Lee et al., 2012; Wang et al., 2022). This model may be interpreted, but with caution (Bates et al., 2015, 2018).

Bidirectional Psychological IPV. The association between number of drinks and HED and subsequent bidirectional psychological IPV did not vary as a function of NA. The interaction term was removed from both models before running the final models. The number of drinks main effect model converged and indicated a significant main effect of NA (within-person effect) on the odds of bidirectional psychological IPV. The HED main effects model demonstrated a significant main effect of NA (within-person effect) on odds of bidirectional psychological IPV. Average alcohol use (between-person effect) and sex assigned at birth did not associate with unidirectional psychological IPV victimization in either model.

Unidirectional Physical IPV Perpetration. Unidirectional physical IPV perpetration was only reported on two days and therefore demonstrated a singular fit; this indicated the potential for overfitting with additional parameters (Bates et al., 2018; Matuschek et al., 2017). Given the *a priori* criteria, I did not proceed with further model specification for unidirectional physical IPV perpetration.

Unidirectional Physical IPV Victimization. The association between number of drinks and subsequent unidirectional physical IPV victimization did not vary as a function of NA, nor did the association between HED and unidirectional physical IPV victimization. The interaction term was removed from both models before running the final main effects models. For the number of drinks main effects model, the number of drinks, NA, average alcohol use and sex assigned at birth did not significantly associate with unidirectional physical victimization. For the HED main effects model, HED, NA, average alcohol use and sex assigned at birth did not significantly associate with unidirectional physical victimization. While the HED model converged, it demonstrated a numerically singular Hessian matrix. While a singularity may indicate overfitting, we established the most parsimonious model possible (e.g., minimal parameters and random effects structures), indicating that power may be the true issue (Oberpriller et al., 2021).

Bidirectional Physical IPV. The association between number of drinks and subsequent bidirectional physical IPV did not vary as a function of NA. The HED model was not specified, as there were no instances of HED prior to bidirectional physical IPV. The interaction term was removed from the number of drinks model before running the final main effects model. For the number of drinks main effects model, the number of drinks, NA, average alcohol use and sex assigned at birth did not significantly associate with bidirectional physical IPV. While the number of drinks model converged, it demonstrated a numerically singular Hessian matrix.

While a singularity may indicate overfitting, we established the most parsimonious model possible (e.g., minimal parameters and random effects structures), indicating that power may be the true issue (Oberpriller et al., 2021).

Chapter 4: Discussion

This study aimed to determine whether alcohol use among college students was a proximal risk factor for bidirectional psychological and physical IPV, and whether daily alcohol use varying as a function of daily NA conferred greater daily risk for IPV. Hypotheses were partially supported. One significant interaction emerged wherein the proximal association between the number of drinks and unidirectional psychological IPV perpetration was *weaker* on days of low NA. Drinking more drinks than usual on a given day and HED (within-person alcohol use) did not associate with odds of IPV (bidirectional, unidirectional, perpetration, and victimization), nor did greater than average drinking (between-person alcohol use). In partial support of hypotheses, as daily NA increased beyond an individual's typical daily level of NA (within-person effect), so too did the odds of unidirectional psychological victimization and bidirectional psychological IPV. This study highlights the salience of NA as a proximal risk factor for psychological intimate partner violence, above and beyond the effects of proximal alcohol use.

We found that on days on lower-than-average NA, the link between the number of drinks consumed and unidirectional psychological IPV became *weaker*. While this did not support our hypothesis stating the alcohol-IPV link would become *stronger* in the presence of high levels of NA, it is also logical and explainable through theory and previous literature (Berkowitz, 1993; Finkel & Eckhardt, 2013; Steele & Josephs, 1990). Specifically, if people are low in NA and consume alcohol, they lack the impelling factor that increases the odds of IPV. In other words, while alcohol alone can potentiate IPV, it is less likely in the absence of negative affect (Eckhardt et al., 2015; Giancola, 2015; Parrott & Eckhardt, 2018). Further, a recent meta-analysis found that across 69 ecological studies of college student drinking found that college students reported drinking in the presence of elevated *positive* affect as opposed to NA (Dora et

al., 2022). This also aligns with previous review studies that found that college students specifically are most likely to report enhancement and social drinking motives (Bresin & Mekawi, 2021; Kuntsche et al., 2005). While the finding from the present study can be understood in the context of these and other previous findings, future studies should seek to test whether *positive affect* proximal to drinking and IPV lowers the odds of IPV occurring, as our findings cannot speak to this association. Further, examining day-level drinking motives in conjunction with ecological affective data may aid in assessing which college students are motivated to consume alcohol for social/enhancement vs. coping motives. This may provide further direction for targeted momentary intervention in future studies.

The present study highlights that proximal NA increased the odds of subsequent unidirectional psychological IPV perpetration and victimization, and bidirectional psychological IPV, adding further evidence that NA is an important proximal determinant of IPV. However, its emergence as a significant main effect across unidirectional IPV victimization, and bidirectional IPV is also unexpected. While NA is well-implicated in IPV perpetration (Birkley & Eckhardt, 2015; Elkins et al., 2013; Shorey et al., 2015; Shorey, Stuart, Moore, et al., 2014), this is the first study to have examined its proximal role in IPV victimization. It is plausible that people did perpetrate IPV on occasions of reported victimization, but did not report it, highlighting the need for couple-level ecological momentary assessment (i.e., multiple surveys per day; EMA) data. Further, NA's emergence as a determinant of bidirectional psychological IPV suggests the possibility that concurrent or discrepant NA could underly this mechanism. Concurrent NA refers to occasions when both partners are experiencing NA, while discrepant NA highlights occasions when only one member of the dyad is experiencing NA. It is possible that college couples may both find themselves in negative affective states, lack the relationship experience or interpersonal skills to support themselves and their partner, subsequently leading to conflict

(either unidirectionally or bidirectionally). While the present study cannot comment on these mechanisms, previous studies support the theory that couple-level affective dynamics may play a role in the proliferation of IPV (McNulty & Hellmuth, 2008; Tiberio & Capaldi, 2019). To elucidate these mechanisms, couple-level EMA data is needed to better understand individual and couple-level cognitive and affective moderators of unidirectional and bidirectional IPV.

Specifically regarding NA's role in potentiating bidirectional psychological IPV, our findings build upon previous studies that found NA was a salient proximal antecedent for unidirectional IPV (i.e., Crane & Eckhardt, 2013). The current study built on these results by finding that NA proximally associated with greater odds of bidirectional psychological IPV. While Crane & Eckhardt. 2013 sampled college women who drank alcohol and had a history of IPV, the present study had no IPV requirement, which be more representative of college students in relationships. Further, our sample (while predominantly female) included men, which demonstrates these processes may occur regardless of sex. We also tested the interaction between alcohol use and negative affect, and while this hypothesis was not supported, future studies may consider testing this interaction again with a higher-risk sample given the strong theoretical and empirical link between these constructs.

Clinical Implications

The current study further highlights that NA may be a robust intervention target for college students experiencing psychological IPV perpetration and/or victimization (Shorey et al., 2015). Leveraging existing cognitive-behavioral and mindfulness-based techniques, clinicians working with college student may inquire about NA prior to IPV to help college students establish the relationship between their emotions and their actions, thereby promoting self-awareness for when conflict is escalating. Further, clinicians may provide psychoeducation regarding healthy relationship communication strategies to help college students communicate

their feelings with their partner before a conflict escalates to psychological IPV. Prevention efforts may also focus on highlighting awareness for healthy relationship communication, and recognizing when healthy conflict has escalated to psychological IPV. In accordance with Shorey et al. 2015's recommendations, clinicians may also focus on providing college students with adaptive emotion regulation techniques to help self-sooth during times of high NA.

Directions for Future Research

Future research may investigate the feasibility of just-in-time interventions for NA among college students who drink alcohol using EMA data. Specifically, while questions related to NA do establish temporality by asking participants how they felt about their partner prior to IPV, this question was likely skewed by recall bias if IPV occurred the previous day. EMA studies provide a solution to this problem by offering multiple timepoints to truly capture NA prior to IPV occurring. Future studies should also seek to replicate these findings using couple-level daily data, as true bidirectional IPV can best be determined from a dyad's reporting of behavior. Further, couple-level data would capture dyadic NA, which may offer support for existing research that IPV may increase during periods of concurrent or discrepant negative affect. Finally, our finding that the main effect of NA preceded and positively related to psychological IPV victimization has not been tested in any other daily study of college students. Given the exploratory nature of this hypothesis, future studies should seek to replicate this finding.

Limitations

The current study must be considered in light of several limitations. The sample consisted of predominantly white, heterosexual, cisgender, and middle-lower-class college women. Thus, these findings may not generalize to more diverse groups (i.e., on the basis of race, sexual orientation/gender identity, income). Future studies should seek to recruit representative samples

on bases of race, gender, sexual orientation, and income. Second, as reported in the parent study, these data were collected during the height of the #MeToo movement, which may have impacted daily reporting (Brem et al., 2022). Third, while daily diary data is well-suited for identifying proximal associations between alcohol use and IPV, participants reported on their prior day's drinking and IPV, which may have created recall bias, particularly after heavy drinking episodes. Relatedly, it is well-established that college students struggle with accurately estimating drinking (Clapp et al., 2009; Craig & Perkins, 2018). Future studies may consider objective measurement (e.g., blood or breath alcohol content) or multiple forms of measuring alcohol use to minimize this limitation. Fourth, we used individual-level data to assess dyadic processes of IPV, which is subject to underreporting, especially in the case of IPV perpetration. To establish *true* bidirectional IPV, future studies should employ couple-level daily or EMA data collection. Fifth, although this study evidences adequate compliance and number of alcohol-related IPV instances for analyses, some of our events were underpowered (e.g., HED and unidirectional physical IPV). Thus, future studies may aim to recruit from higher-risk, heavier drinking samples of college students to achieve greater power for similar analyses. Extending this limitation, a number of our models demonstrated variance-covariance instability and/or rank deficiency, indicating issues with model estimation. While some of this may be attributed to multicollinearity among our explanatory variables (namely alcohol use and NA; Bahçecitapar & Aktaş, 2017; Yu et al., 2015), which is unavoidable, future studies with larger samples, more timepoints (i.e., EMA), or higher risk samples with more instances of alcohol use and NA may produce more stable estimates.

Chapter 6: Conclusion

The present study highlighted that on days of lower-than-average NA, the link between alcohol use and unidirectional psychological IPV perpetration became weaker, and that proximal NA potentiated unidirectional psychological victimization and bidirectional psychological IPV above and beyond the proximal effects of alcohol use. While not consistent with theory, this finding offers important considerations for future studies that may seek to test whether positive affect weakens the alcohol-IPV link in low-risk college samples. Future research should also prioritize the exploration of within-person variables (e.g., NA, trait anger, jealousy, etc.), among higher-risk samples and among couples to identify malleable mechanisms for alcohol-related IPV.

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Table 1.

Participant Characteristics (*N* = 232)

Characteristics	%
Sex Assigned At Birth	
Female	75.10
Male	24.90
Gender	
Cisgender woman	67.7
Cisgender man	22.5
Other	9.8
Race	
white	83.89
Black and/or African American	5.51
Hispanic	4.24
Asian	2.97
Other	3.38
Sexual orientation	
Straight or Heterosexual	78.81
Bisexual	13.56
Gay or Lesbian	2.54
Other	5.09
Relationship Status	
Dating Seriously or Casually	92.79
Married or Engaged	7.29
Living Circumstances	
Roommates or Friends	50.85
Partner	24.15
Alone	15.68
Other	9.32
Income	
< $50,000	39.83
$50,000 – $100,000	22.88
$100,000 – $150,000	13.13
> $150,000	14.83
Other	9.32
Characteristics	*M* (*SD*)
Age (years)	20.53 (3.31)
Average relationship length (months)	18.83 (18.04)

Table 2.

Descriptive Statistics of Alcohol Use Preceding IPV Outcomes

	Unidirectional Psychological Perpetration	Unidirectional Psychological Victimization	Bidirectional Psychological	Unidirectional Physical Perpetration	Unidirectional Physical Victimization	Bidirectional Physical
Variable	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
Number of Drinks	11 (13.4%)	18 (19.6%)	23 (23.5%)	1 (50%)	1 (7.1%)	2 (40%)
HED	3 (3.7%)	4 (4.3%)	6 (6.1%)	1 (50%)	0 (*NA*)	0 (*NA*)

*Note** *N* = number of days where alcohol use preceded IPV; HED = Heavy Episodic Drinking

Table 3.

Initial Random Effects Model Results

	Unidirectional Psychological Perpetration	Unidirectional Psychological Victimization	Bidirectional Psychological	Unidirectional Physical Perpetration	Unidirectional Physical Victimization	Bidirectional Physical
ICC	0.504	0.606	0.743	0	0.947	0.953

*Note** ICC = Intraclass correlation coefficient

Table 4.

Final Parameters of Generalized Linear Mixed Models Predicting Odds of Unidirectional and Bidirectional Psychological IPV

	Unidirectional Psychological Perpetration				Unidirectional Psychological Victimization				Bidirectional Psychological IPV			
	Number of Drinks Model				Number of Drinks Model				Number of Drinks Model			
Variable	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI
Level 2 (between-person effects)												
M alcohol use	1.68	1.04	5.37	(-0.35, 3.71)	2.84	1.11	17.11	(-0.17, 4.18)	0.38	.74	1.38	(-1.07, 1.83)
Sex	0.04	3.00	0.61	(-6.39, 5.40)	-6.62	-6.95	0.001	(-17.12, 3.22)	-3.72	2.20	0.02	(-8.04, 0.59)
Level 1 (within-person effects)												
# drinks × NA	-0.36**	0.12	0.70	(-0.59, -0.13)	-7.61	0.34	0.0005	(-0.89, 0.45)	0.26	.19	1.30	(-0.12, 0.62)
					4.43***	0.90	83.93	(2.66, 6.20)	3.21***	.49	24.78	(2.24, 4.17)
	HED Model				HED Model				HED Model			
Level 2 (between-person effects)												
M alcohol use	1.62	0.99	5.05	(-0.33, 3.57)	2.01	1.14	7.46	(-0.22, 4.25)	.68	.74	1.97	(-0.78, 2.14)
Sex	-0.89	3.00	0.41	(-6.78 4.99)	-7.05	5.44	0.0008	(-17.72, 3.62)	-3.94	2.26	0.01	(-8.38, 0.50)
Level 1 (within-person effects)												
HED	-10.67	7.39	-2.32e5	(-25.18, 3.78)	-1.27	1.75	0.28	(-4.71, 2.16)	0.27	1.42	1.31	(-2.51, 3.05)
NA	5.60***	1.15	270.43	(3.34, 7.86)	4.46***	0.97	86.49	(2.66, 6.25)	3.23***	0.49	25.28	(2.27, 4.20)

Note. M alcohol use = overall average alcohol use, grand-mean centered; # drinks = number of drinks consumed on a given day; *a*OR = Adjusted Odds Ratio; HED = Heavy Episodic Drinking; NA = Negative Affect; "e" denotes scientific notation (e.g., 4.5e6).
* $p < .05$., ** $p < .01$., *** $p < .001$.

Table 5.

Final Parameters of Generalized Linear Mixed Models Predicting Odds of Unidirectional and Bidirectional Physical IPV

	Unidirectional Physical Victimization				Bidirectional Physical IPV			
	Number of Drinks Model				Number of Drinks Model			
Variable	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI
Level 2 (between-person effects)								
M alcohol use	0.09	4.54	1.09	(-8.81, 9.00)	4.06	7.07	57.97	(-9.80, 17.92)
Sex	7.10	9.84	1211.97	(-12.19, 26.39)	-41.43	1.5e6	0	(-3.0e6, 3.0e6)
Level 1 (within-person effects)								
# drinks	-0.91	3.58	0.40	(-7.92, 6.10)	-1.03	1.15	0.35	(-3.27, 1.21)
NA	4.31	2.35	74.44	(-0.48, 8.74)	3.31	2.69	27.39	(-1.96, 8.58)
	HED Model							
Level 2 (between-person effects)								
M alcohol use	0.24	18.82	1.27	(-36.85, 37.32)				
Sex	8.56	20.47	5218.68	(-31.55, 48.68)				
Level 1 (within-person effects)								
HED	-148.77	3.61e6	0	(-7.1e6, 7.1e6)				
NA	4.53	3.40	92.76	(-2.13, 11.20)				

Note. M alcohol use = overall average alcohol use, grand-mean centered; # drinks = number of drinks consumed on a given day; *a*OR = Adjusted Odds Ratio; HED = Heavy Episodic Drinking; NA = Negative Affect; "e" denotes scientific notation (e.g., 1.6e12).
* $p < .05$., ** $p < .01$., *** $p < .001$.

Table 6.

Simple Slopes Analysis for Number of Drinks × NA Interaction for Unidirectional Psychological IPV Perpetration

	Unidirectional Psychological IPV			
	Number of Drinks Model – Simple Slopes			
Level of NA	*B*	*SE*	*a*OR	95% CI
-1 *SD*	-.56**	.26	.57	(-1.07, -.04)
+1 *SD*	.32	.31	1.38	(-.28, .93)

Supplemental Table 7.

Parameters of Generalized Linear Mixed Models Predicting Odds of Unidirectional and Bidirectional Psychological IPV – Interaction Term Included

	Unidirectional Psychological Perpetration				Unidirectional Psychological Victimization				Bidirectional Psychological IPV			
	Number of Drinks Model				Number of Drinks Model				Number of Drinks Model			
Variable	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI
Level 2 (between-person effects)												
M alcohol use	0.75	.97	2.12	(-1.14, 2.65)	2.84*	1.30	17.12	(0.30, 5.38)	-13.14	.78	2.0e-6	(-1.28, 1.78)
Sex	0.04	3.11	1.04	(-6.07, 6.15)	-6.62	5.43	.001	(-17.3, 4.02)	0.25	2.20	1.28	(-7.68, 0.95)
Level 1 (within-person effects)												
# drinks × NA	-0.36**	0.12	0.70	(0.55, 0.87)	-7.61	4.80	.004	(-17.0, 1.80)	-0.08	.38	.92	(-0.84, 0.67)
					6.68***	1.86	796.32	(3.03, 10.32)	3.21***	.49	24.78	(2.23, 4.17)
					3.51	2.18	33.45	(-0.75, 7.77)	.23	.20	1.26	(-0.16, 0.63)
	HED Model				HED Model				HED Model			
Level 2 (between-person effects)												
M alcohol use	1.57	1.03	4.85	(-0.44, 3.61)	2.86	3.02	17.46	(-3.05, 8.78)	.58	.78	1.78	(-0.94, -9.05)
Sex	-0.61	3.03	0.54	(-6.55, 5.33)	-9.04	10.00	.0001	(-28.55, 10.47)	-3.62	2.22	0.03	(-7.98, 0.72)
Level 1 (within-person effects)												
HED	0.01	3.83	1.01	(-7.51, 7.53)	-1714.91	3.54e6	0	(-6.9e6, 6.9e6)	-4.47	5.27	0.01	(-14.80, 5.86)
NA	5.71***	1.24	301.87	(3.27, 8.15)	5.65***	1.18	259.82	(3.34, 7.96)	3.18***	0.50	24.05	(2.19, 4.16)
HED × NA	-3.12	2.29	0.04	(-7.60, 1.39)	703.21	2.87e6	2.5e305	(-5.6e6, 5.6e6)	2.79	2.70	16.28	(-2.51, 8.09)

Note. M alcohol use = overall average alcohol use, grand-mean centered; # drinks = number of drinks consumed on a given day; *a*OR = Adjusted Odds Ratio; HED = Heavy Episodic Drinking; NA = Negative Affect; "e" denotes scientific notation (e.g., 5.8e10).
* $p < .05$., ** $p < .01$., *** $p < .001$.

Supplemental Table 8.

Parameters of Generalized Linear Mixed Models Predicting Odds of Unidirectional and Bidirectional Physical IPV – Interaction Term Included

	Unidirectional Physical Victimization				Bidirectional Physical IPV			
	Number of Drinks Model				Number of Drinks Model			
Variable	*B*	*SE*	*a*OR	95% CI	*B*	*SE*	*a*OR	95% CI
Level 2 (between-person effects)								
M alcohol use	-.30	33.12	0.74	(-65.22, 64.62)	5.20	10.53	181.27	(-15.45, 25.83)
Sex	18.43	37.07	1.01e8	(-54.23, 91.10)	-2.1e4	1.5e6	0	(-3.0e6, 3.0e6)
Level 1 (within-person effects)								
# drinks	-1642.07	464926.72	0	(-9.2e5, 9.0e5)	-0.038	2.51	0.96	(-4.95, 4.87)
NA	157.37	42014.1	2.2e68	(-8.2e4, 8.3e4)	4.61	4.95	100.48	(-5.09, 14.30)
# drinks × NA	294.47	833550.42	7.7e127	(1.6e-5, 1.6e5)	-0.63	1.51	0.53	(-3.59, 2.33)
	HED Model							
Level 2 (between-person effects)								
M alcohol use	-0.37	33.38	0.69	(-65.79, 65.05)				
Sex	18.78	37.73	1.4e8	(-55.17, 92.73)				
Level 1 (within-person effects)								
HED	-1207.18	3.6e6	0	(-7.1e6, 7.1e6)				
NA	9.07	7.21	8690.62	(-5.07, 23.20)				
HED × NA	-257.246	5.5e6	0	(-1.1e6, 1.1e6)				

Note. M alcohol use = overall average alcohol use, grand-mean centered; # drinks = number of drinks consumed on a given day; *a*OR = Adjusted Odds Ratio; HED = Heavy Episodic Drinking; NA = Negative Affect; "e" denotes scientific notation (e.g., 3.6e6).
* $p < .05$., ** $p < .01$., *** $p < .001$.

Supplemental Table 9.

R Packages Used and Associated Purpose

Package	Version	Purpose
tidyverse	1.3.1	General utility (e.g., data wrangling, filtering, etc.)
lme4	1.1-35.1	Generalized linear mixed-effects models
lmerTest	3.1-3	*p*-values from generalized linear mixed-effects models
mlmhlpr	0.1.0	Computing ICC coefficients
finalfit	1.0.6	Missing data analyses
tableone	0.13.2	Summarizing data
broom.mixed	0.2.9.4	Tidying generalized linear mixed-effects modeling results
misty	0.5.2	Centering multilevel data

Note. All packages were loaded using R version 4.2.3 (R Core Team, 2023). Analyses were performed in R Studio version 2023.9.1.494 (RStudio Team, 2023).