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**AN IN-DEPTH EXAMINATION OF PROTECTIVE BEHAVIORAL
STRATEGIES TO REDUCE ALCOHOL-RELATED CONSEQUENCES**

A Dissertation in

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by

Nichole Marie Sell

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The dissertation of Nichole Marie Sell was reviewed and approved* by the following:

Rob Turrisi
Professor of Biobehavioral Health
Dissertation Adviser
Chair of Committee

Laura Cousino Klein
Professor of Biobehavioral Health

Patricia Koch
Professor Emeritus of Biobehavioral Health

Michael Russell
Assistant Professor of Biobehavioral Health

Jennie Noll
Professor of Human Development and Family Studies

Thomas J. Gould
Jean Phillips Shibley Professor of Biobehavioral Health
Department Head of Biobehavioral Health

*Signatures are on file in the Graduate School

ABSTRACT

Numerous studies have revealed protective behavioral strategies (PBS; e.g., setting drink limits, walking home with a friend) show promise in helping to reduce risky drinking and associated consequences in college students. However, most studies have examined the frequency of PBS use, which tends to account for about 6% of the variance in drinking or consequences. There is a sizeable gap in the literature concerning two aspects of PBS that may account for unexplained variance: how well drinkers implement them (quality) and how reliably drinkers implement them (consistency). This dissertation consists of three empirical papers that systematically examined the effects of the quality and consistency of PBS implementation for common harm reduction PBS (e.g., communicating sexual intentions; walking home with friends). Paper One used a combination of qualitative and quantitative methods to develop and psychometrically test the PBS-IQ, a measure of steps drinkers take to implement PBS in a high-quality manner. Paper One results suggest that the PBS-IQ is a reliable and valid measure of PBS implementation quality that accounts for unique variance in alcohol-related sexual consequences when controlling for the frequency of PBS use. Paper Two utilized a 12-day diary design to examine between-person (average) and within-person (daily) associations between quality or consistency and total, risk, social, or physical consequences. Paper Two results suggest that individuals who implement certain PBS in a higher quality or more consistent manner are less likely to experience consequences. This is especially true for the PBS communicating sexual intentions, which showed effects for both average quality and consistency. Paper Two results also suggest individuals are less likely to experience consequences on days when they communicate about sexual intentions at a higher quality level than usual. Paper Three expanded upon Paper Two by examining sex as a moderator of average associations between quality or consistency and consequences. Paper Three results suggest that sex does not moderate these associations, but females

are more susceptible to experiencing consequences after accounting for their implementation of PBS. Interventions to reduce alcohol-related consequences (e.g., brief motivational interviews) may benefit from including content that teaches drinkers how to improve their implementation of PBS. Future research can aid in the development of this content by extending the examination of quality and consistency to additional PBS and examining a wider range of consequences.

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CHAPTER ONE: INTRODUCTION

The reduction of college student risky drinking and associated harms is a national public health priority (Larimer & Cronce, 2007; Mallett, Marzell, & Turrisi, 2011; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2018). Each year, risky student drinking results in an estimated 1,500 deaths, 600,000 serious injuries, 700,000 physical assaults, and 97,000 sexual assaults (Hingson, Zha, & Smyth, 2017; Hingson, Zha, & Weitzman, 2009; NIAAA, 2018). College student risky drinking is also associated with a range of negative physical, social, academic, sexual, and legal consequences (Perkins, 2002; Read, Kahler, Strong, & Colder, 2006). Despite widespread efforts to raise awareness about the potential for these harms, the prevalence of binge drinking (consuming four or more drinks in two hours if female, and five or more drinks in two hours if male) remains at nearly 40% in college students (NIAAA, 2018).

College drinking prevention and intervention programs have increasingly promoted protective behavioral strategies (PBS) such as leaving social events at a predetermined time and walking home with friends (Borsari & Carey, 2005; Dimeff, Baer, Kivlahan, & Marlatt, 1999; Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990; Larimer & Cronce, 2007; Walters & Baer, 2006). Studies have tended to assess specific PBS with a single item that asks about the frequency of using the PBS. For example, a survey might ask, "How often do you watch your drinks being made?" (never, rarely, sometimes, usually, always). Using these methods, the majority of studies have found that drinkers who use PBS more frequently, on average, consume less alcohol and experience fewer consequences (e.g., Borsari & Carey, 2005; Martens et al., 2004; Pearson, 2013). However, a comprehensive review of the literature noted that findings have not been entirely consistent. Some studies have linked PBS use to *increased* drinking or consequences, and others have found no association (Prince, Carey, & Maisto, 2013).

The frequency of PBS use tends to account for about 6% of the variance in drinking or consequences (DeMartini et al., 2013; Ehret, Ghaidarov, & LaBrie, 2013; LaBrie, Lac, Kenney, & Mirza, 2011; Lewis, Rees, & Lee, 2009; Martens, Martin, Littlefield, Murphy, & Cimini, 2011). This suggests there is unexplained variance that is available to examine. There are sizeable gaps in the literature concerning two plausible determinants of PBS' efficacy in reducing drinking or consequences: how well drinkers implement them (quality) and how reliably drinkers implement them across a given number of days (consistency). My dissertation attempts to address these gaps and inform future prevention and intervention efforts by: 1) developing and psychometrically testing a measure of PBS implementation quality, 2) examining associations between the quality or consistency of implementation and negative alcohol-related consequences, and 3) examining sex as a moderator of these associations.

Each of the three papers presented in my dissertation is designed to be a standalone paper including its own introduction and discussion. Certain areas of the papers, such as the hypotheses, are elaborated on for the purposes of the dissertation and may be trimmed before submission to journals. A general discussion that draws conclusions and future directions from all three manuscripts follows the third paper. The current chapter provides a brief overview of each paper and a glossary of important terms and abbreviations.

PAPER ONE: Development and Psychometric Testing of the PBS-IQ

To date, the most commonly used measure of PBS has been the Protective Behavioral Strategies Survey (PBSS; Martens et al., 2007). The PBSS asks respondents to indicate how frequently they typically use each PBS (e.g., setting drink limits; going home with a friend), on a 6-point scale from *never* to *always*. The PBSS and similar measures (e.g., Strategy Questionnaire, Sugarman & Carey, 2007; Protective Behavioral Strategies Measure, Novik & Boekeloo, 2011) have moved the field forward by offering insight into

which PBS college students use most frequently, and how frequency of PBS use relates to alcohol use and consequences. However, existing measures have not assessed implementation quality. It is plausible that individuals implement PBS at varying levels of quality and that high-quality implementation is better than low-quality implementation. For example, a focus group found that some students set more conservative drink limits than others. Limits ranged from 1-2 drinks per day to the highest amount possible without vomiting (Barry & Goodson, 2011). Setting a lower limit is likely more protective than setting a higher limit. Had students simply been asked how often they limited their drinks, researchers would not have obtained any information on the methods they used to implement this PBS.

Paper One expanded upon previous research by using qualitative methods (focus groups and an online open-ended survey) to develop the PBS-IQ, a measure of PBS implementation quality. The PBS-IQ assesses specific steps college students take to implement PBS meant to reduce the harms associated with drinking (harm reduction PBS; e.g., communicating sexual intentions) in a high-quality manner. Reviews have been critical that the majority of PBS measures have not undergone psychometric testing to establish their reliability and validity (Pearson, 2013; Prince et al., 2013). To address this concern, Paper One also used quantitative, longitudinal methods (test-retest reliability; construct, criterion, and discriminant validity) to psychometrically test the PBS-IQ.

Paper One's examination of criterion-related validity was focused on sexual consequences. The study assessed whether PBS-IQ scales predicted sexual consequences when controlling for the frequency of PBS use. Paper One extends my work published in *Addictive Behaviors* which found that PBS frequency alone generally did not influence sexual consequences (Sell, Turrisi, Scaglione, Hultgren, & Mallett, 2016). Thus, I plan to submit Paper One for consideration at *Addictive Behaviors*.

PAPER TWO: Daily Diary Study of PBS Implementation and Consequences

The majority of PBS studies have used cross-sectional or longitudinal designs to obtain retrospective reports of PBS, drinking, and consequences (e.g., past 30 days; Pearson, 2013). This design enables researchers to examine variability in PBS use between individuals (i.e., between-person or average variability) and its association with drinking or consequences. Recently, studies have begun to utilize the daily diary design to obtain daily reports of PBS use (e.g., Lewis et al., 2012; Pearson, D'Lima, & Kelley, 2013; Sell, Turrisi, Scaglione, Cleveland, & Mallett, 2018). Diary designs minimize recall bias and enable researchers to examine variability in PBS use that occurs both between people and within individuals across days (i.e., within-person or daily variability). For example, two diary studies examined the total number of harm reduction PBS used (e.g., going home with a friend; knowing where your drink has been) and its association with total consequences. They found no association between average use and consequences. They reported a positive association between daily use and consequences, such that individuals experienced more consequences on days when they used more PBS than usual (Lewis et al., 2012; Pearson et al., 2013).

Although the field has moved toward a more nuanced examination of PBS, no published quantitative studies have examined variability in the quality or consistency of implementation. Paper Two used a 12-day, diary design to examine average and daily variability in implementation of specific harm reduction PBS and its association with consequences. The PBS-IQ was used to measure quality. Consistency was operationalized as the number of days participants used specific PBS out of the number of days they had opportunities to use them. Consequences were examined as a composite score, and the most prevalent consequence types were also examined as separate subscales (risk, social, physical). I have published diary studies of college student drinking and consequences in *Psychology of Addictive Behaviors* (Mallett et al., 2017; Mallett, Turrisi, Trager, Sell, &

Linden-Carmichael, 2019) and *Psychology of Women Quarterly* (Sell et al., 2018). I plan to submit Paper Two for consideration at *Psychology of Addictive Behaviors*.

PAPER THREE: Examination of Sex as a Moderator of Associations Between PBS Implementation and Consequences

Research suggests that sex is an important risk factor for experiencing alcohol-related harm. Due to physiological differences, females achieve higher blood alcohol concentrations (BACs) than males when consuming a given dose of alcohol over a set amount of time. This leads to greater cognitive and motor impairment and places them at increased risk for physical consequences such as vomiting and blacking out (Julien, Advokat, & Comaty, 2014; Nolen-Hoeksema, 2004). Females are also disproportionately affected by alcohol-related sexual consequences (e.g., Abbey, 2002; Orchowski, Mastroleo, & Borsari, 2012).

Considering that they are more susceptible to alcohol-related harm, it is plausible that females have a greater need to use PBS. Numerous studies have shown females use PBS more frequently than males (e.g., Benton et al., 2004; Nguyen, Walters, Wyatt, & DeJong, 2011). One qualitative study concluded that females were more planful and vigilant when using PBS than males (Howard, Griffin, Boekeloo, Lake, & Bellows, 2007). However, a review by Pearson (2013) reported that limited research has been done to examine sex differences in the association between PBS use and consequences. Three studies found more frequent PBS use was associated with fewer consequences for females, but there was no significant relationship between frequency of PBS use and consequences for males (Delva et al., 2004; Lewis et al., 2010; Sutfin et al., 2009). These studies did not examine sex differences in the effects of the quality or consistency of implementation.

Paper Three expanded upon previous research by examining whether sex moderated the associations between the quality or consistency of PBS implementation and

consequences that were found in Paper Two. Analyses focused on sex differences in average associations because the majority of the associations that were observed in Paper Two were at the between-person level. I plan to submit Paper Three as a brief report for consideration at *Addictive Behaviors*.

Table 1.1. Glossary of Terms by Paper.

Construct	Paper(s)	Definition
PBS	1, 2, 3	Protective behavioral strategy/strategies
Harm reduction PBS	1, 2, 3	Protective behavioral strategies that are meant to reduce the harms associated with drinking (i.e., consequences), rather than the amount of alcohol consumed
PBSS	1, 2	Protective Behavioral Strategies Survey, a measure of the frequency of PBS use developed by Martens et al. (2007)
SQ	1	Strategy Questionnaire, a measure of the frequency of PBS use developed by Sugarman and Carey (2007)
PBS-IQ	1, 2, 3	A measure of steps drinkers take to implement harm reduction PBS in a high-quality manner, developed for this dissertation
Quality	1, 2, 3	How well drinkers implement protective behavioral strategies
Consistency	2, 3	How reliably drinkers implement protective behavioral strategies
Walking with friends	1, 2, 3	Walking home with a trusted friend or group of friends
Going home	1, 2, 3	Making sure to go home at a designated time
Communicating sexual intentions	1, 2, 3	Communicating sexual intentions directly and assertively
Knowing drink location	1, 2, 3	Knowing where your drink has been at all times
Learning drink content	1, 2	Obtaining knowledge of drink content
Not consuming unwatched drinks	1, 2	Not consuming drinks you did not open yourself or watch being made
Having an exit strategy	1, 2, 3	Having an exit strategy in case trouble or fights break out
Being uninvolved	1, 2	Being uninvolved in trouble or fights
ALC+ use	1, 2, 3	Combining alcohol and other substances so that their effects overlap

CHAPTER TWO: PAPER ONE

Development and Psychometric Testing of the PBS-IQ, a Measure of Protective Behavioral Strategies Implementation Quality

College student risky drinking is a significant public health issue. Estimates suggest two in five college students frequently binge drink (defined as consuming four or more drinks in two hours for females, and five or more drinks in two hours for males) (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2018). Reports indicate risky student drinking results in approximately 1,500 deaths, 600,000 unintentional injuries, 700,000 physical assaults, and 97,000 sexual assaults annually (Hingson, Zha, & Smyth, 2017; Hingson, Zha, & Weitzman, 2009; NIAAA, 2018). It is also associated with risky sexual behaviors such as unprotected sex, which may result in acquiring sexually transmitted infections or unplanned pregnancies (Cooper, 2002).

The promotion of protective behavioral strategies (PBS) has been increasingly recommended as a necessary component for prevention and intervention programs aimed at reducing college student drinking and related problems (Borsari & Carey, 2005; Dimeff, Baer, Kivlahan, & Marlatt, 1999; Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990; Larimer & Cronce, 2007; Walters & Baer, 2006). PBS are frequently defined as behaviors performed on drinking occasions with the goal of reducing alcohol consumption and/or related harm, such as setting drink limits and using a designated driver (Martens, Ferrier, & Cimini, 2007; Martens et al., 2005; Prince, Carey, & Maisto, 2013). The majority of studies support a negative association between PBS and drinking and related consequences (Pearson, 2013; Prince et al., 2013). Studies have also identified predictors of PBS use that may be amenable to change, including drinking motives (Ebersole, Noble, & Madson, 2012; LaBrie, Lac, Kenney, & Mirza, 2011; Linden, Lau-Barraco, & Milletich, 2014; Martens et al., 2007; Osberg et al., 2010), peer norms about PBS (Benton, Downey, Glider, & Benton,

2008; Lewis, Rees, & Lee, 2009), and perceived PBS effectiveness or self-efficacy about using PBS (Ray, Turrisi, Abar, & Peters, 2009).

Despite the benefits of PBS, the correlation between PBS use and drinking or consequences tends to be around 0.25 (DeMartini et al., 2013; Ehret, Ghaidarov, & LaBrie, 2013; LaBrie et al., 2011; Lewis et al., 2009; Martens, Martin, Littlefield, Murphy, & Cimini, 2011). This suggests PBS use accounts for only about 6% of the variance in these outcomes, leaving unexplained variance that is available to examine. Implementation quality, or how well drinkers implement PBS, could account for variance in drinking or consequences that is not explained by PBS use alone. For example, it seems plausible that individuals implement PBS at varying levels of quality and that high-quality implementation is better than low-quality implementation. Research on PBS implementation quality may enhance prevention efforts by providing insight on how to maximize the efficacy of PBS in reducing drinking or consequences.

Limitations of Existing Measures of Protective Behavioral Strategies

Several measures of PBS use currently exist, including the Self-Control Questionnaire (SCQ; Werch & Gorman, 1986), Protective Strategies Questionnaire (PSQ; Palmer, 2004), Protective Behavioral Strategies Survey (PBSS; Martens et al., 2007), Strategy Questionnaire (SQ; Sugarman & Carey, 2007), and Protective Behavioral Strategies Measure (PBSM; Novik & Boekeloo, 2011). A review of the literature noted that while the PBSS, the most frequent measure of PBS, has undergone psychometric testing to establish its validity, the majority of measures have not (Prince et al., 2013). Measures have also tended to assess specific PBS with a single item that asks about the frequency of using the PBS. For example, the PBSS measures three types of PBS that can be used to drink more safely. Subscales include stopping/limiting drinking (e.g., setting drink limits), drinking in a manner that discourages intoxication (e.g., not consuming liquor), and serious harm reduction (e.g., going home with a friend). Respondents are asked to indicate how often

they typically use each behavior when drinking (never, rarely, occasionally, sometimes, usually, always). The SQ measures three types of strategies to control drinking itself. These include selective avoidance of heavy drinking situations and activities (e.g., refusing drinks), strategies used while drinking to limit intoxication (e.g., drinking slowly), and alternatives to drinking (e.g., identifying other ways to reduce stress). Respondents are asked to indicate how often they used each strategy over a two-week period (never, once, 2-3 times, 4-5 times, 6-10 times, over 10 times).

Existing measures have moved the field forward by offering insight into which PBS college students use most frequently, and how frequency of PBS use relates to alcohol use and consequences. However, the prevailing approach to measuring PBS does not take implementation quality into consideration. For example, Sell, Turrisi, Scaglione, Hultgren, and Mallett (2016) asked female drinkers to report how often they used each of eight PBS designed to prevent unwanted sexual experiences (never, rarely, sometimes, usually, always). Findings suggested that “talking to people who know one’s potential dating or sexual partner to find out what s/he is like” was the only PBS that lessened drinking’s impact on unwanted sex. As in almost all studies of PBS use, participants were not asked about the manner of implementation (e.g., who their referent was, what information they sought), so individual differences in implementation quality could not be examined.

A focus group on responsible drinking practices found that individuals’ definitions of “limiting drinks” ranged from “not exceeding 1-2 drinks per day” to “drinking to avoid vomiting” (Barry & Goodson, 2011). Setting a lower limit on drinking is likely more protective than setting a higher limit. Had students simply been asked how often they limited their drinks, researchers would not have obtained any information on the methods they used to implement this PBS. Taken together, these examples illustrate that examination of implementation quality has the potential to provide more precise information about PBS’ efficacy in reducing drinking and related consequences.

Current Study

The current study's purpose was to move the field forward by developing and psychometrically testing the PBS-IQ, a measure of PBS implementation quality. There were several innovative features of the research. First, to ensure the scale development used an at-risk sample, participants were traditional undergraduate students (ages 18-23) who reported consuming alcohol within the past three months and combining alcohol with at least one other substance during the past year. Combining alcohol and other substances so that their effects overlap (ALC+ use) is a highly prevalent behavior in college students, and students who engage in ALC+ use experience more consequences than students who consume alcohol alone (Mallett et al., 2017). Second, the study utilized a combination of qualitative methods (focus groups and an online open-ended survey) and quantitative, longitudinal methods (test-retest reliability; construct, criterion-related, and discriminant validity). Third, whereas previous studies have tended to assess criterion-related validity by examining associations between PBS and total alcohol-related consequences (e.g., Martens et al., 2005), the current study examined PBS' associations with sexual consequences. Finally, the PBS-IQ was designed to be short (i.e., 2-3 items per factor) for use in a variety of research designs, including intensive longitudinal studies (e.g., daily diary).

PBS Examined. A review by Prince et al. (2013) found existing measures of the frequency of PBS use range in length from six to 51 items (*M* length = 16 items). To enable a more in-depth examination of PBS and minimize participant burden, data collection focused on eight PBS that were the most frequently endorsed (i.e., highly prevalent) in recent longitudinal studies of college student drinkers (e.g., Mallett et al., 2015; Sell et al., 2016). These were harm reduction PBS, which by definition focus on reducing the harms associated with drinking (e.g., sexual consequences), as opposed to reducing the quantity of alcohol consumed (Prince et al., 2013). They included: 1) walking home with a trusted friend or group of friends (walking with friends), 2) watching drinks being made (watching

drinks), 3) arranging not to drive (not driving), 4) making sure to go home at a designated time (going home), 5) communicating sexual intentions directly and assertively (communicating sexual intentions), 6) staying with friends at all times (staying with friends), 7) knowing where one's drink has been at all times (knowing drink location), and 8) leaving parties when trouble or fights break out (leaving troublesome parties).

Phase 1: Development of PBS-IQ. The current study had two parts. In the first phase, qualitative methods were used to assist in the development of an initial pool of items reflecting a range of implementation quality for each of the eight PBS. Twenty-two students (77.3% female) meeting the criteria described previously participated in either focus groups or an online open-ended survey. They were asked to list the steps they would take to implement PBS at a high quality level.

The principal investigator compiled a comprehensive pool of implementation quality items. Four trained research assistants reviewed the initial item pool and offered suggestions on improving item clarity. The principal investigator revised the items, and a team of three researchers reviewed the changes and made further adjustments until they reached unanimous approval on the wording of the items. Finally, the principal investigator identified sets of highly similar items, and retained the item from each set that seemed to have the clearest wording. This process resulted in a total of 65 items (6-10 items per PBS-IQ scale). The recruitment and data collection procedures, sample, and analyses for the first phase are described in greater detail in Appendix A. The final pool of items can be found in Appendix B.

Phase 2: Psychometric Testing. The second phase of the study will be the focus of Paper One. This phase used quantitative, longitudinal methods to psychometrically test the PBS-IQ scales on a separate sample of 101 students (63.4% female; described below in the Method section). Students completed two surveys of PBS use, implementation quality, alcohol use, and sexual consequences spaced two weeks apart. There were four aims.

Aim 1. The first aim was to conduct principal components factor analyses (PCAs) on the PBS-IQ scales to identify distinct factors (subscales) and reduce the number of items. The most salient dimensions of PBS implementation quality were hypothesized to be planning, complexity of plans, autonomy for executing plans, and vigilance of plans. The first three dimensions were extrapolated from the Theory of Planned Behavior (TPB). The TPB suggests individuals are more likely to implement behaviors for which they have established plans. Plans that involve fewer steps (i.e., less complex) are more likely to be implemented than plans having more steps (i.e., more complex). Plans are easier to implement when an individual has greater autonomy for executing the steps of the plans. The greater the degree to which carrying out the steps of a plan depends on factors outside the individual's control (i.e., autonomy), such as cooperation or assistance from other people, the more likely it is the individual will be unable to perform the planned behavior (Fishbein & Ajzen, 1975).

Although it is not part of the TPB, vigilance of plans was hypothesized to be another important aspect of PBS implementation quality. Qualitative research suggests there is considerable variation in how careful students are when implementing PBS. For example, Howard, Griffin, Boekeloo, Lake, and Bellows (2007) found some individuals were more cautious in implementing the PBS "knowing what is in one's drink" than others. For some students, this meant refusing all drinks from strangers, whereas for others it meant refusing only those drinks known to contain hard liquor. This example illustrates that some drinkers may be more alert to possible dangers than others.

Hypothesis:

1a. Factors will include plans for implementing PBS and specific characteristics of those plans, such as complexity of plans, autonomy for executing plans, and vigilance of plans.

Aim 2. The second aim was to establish the psychometric properties of the PBS-IQ scales, including test-retest reliability, construct validity, discriminant validity, and criterion-related validity.

Hypotheses:

2a. PBS-IQ scores obtained on separate assessments spaced two weeks apart will be positively correlated (test-retest reliability).

2b. PBS-IQ scores will be moderately, positively correlated with scores on the PBSS (Martens et al., 2007), due to the measures' common focus on harm reduction. PBS-IQ scores will exhibit small, positive correlations with scores on the SQ (Sugarman & Carey, 2007), due to the SQ's focus on reducing the quantity of alcohol consumed (construct validity).

2c. PBS-IQ scores will *not* be significantly correlated with social desirability (discriminant validity).

2d. PBS-IQ scores will be negatively correlated with alcohol use and sexual consequences. Given the PBS-IQ's focus on harm reduction, its scales will be more strongly associated with sexual consequences than alcohol use (criterion-related validity).

Aim 3. The third aim was to determine whether PBS implementation quality accounted for independent, unique variance in sexual consequences when controlling for the frequency of PBS use.

Hypothesis:

3a. PBS-IQ scales will predict sexual consequences when controlling for the PBSS subscales, which measure the frequency of PBS use.

Aim 4. The fourth aim was to provide normative data for females and males. Prior research has shown females use PBS more often than males (e.g., Benton et al., 2004; LaBrie et al., 2011; Lewis, Rees, Logan, Kaysen, & Kilmer, 2010; Nguyen, Walters, Wyatt, &

DeJong, 2011) and thus have more practice implementing PBS. No published quantitative studies have examined sex differences in PBS implementation quality.

Hypothesis:

4a. Females will score higher than males on the PBS-IQ scales.

Method

Procedure

Students ($N = 1988$) were randomly selected from the registrar's list at a large, northeastern university during the Spring 2018 semester. They were sent an emailed pre-notification, followed by an invitation email describing the study and providing a URL and PIN for accessing a consent form and brief screening survey. Up to seven email reminders were sent to students who did not complete initially. Students who logged on were directed to an informed consent page. If they indicated willingness to continue, they were routed to a screening survey. Eligible participants: 1) were between the ages of 18 and 23; 2) were currently enrolled as traditional freshmen, sophomores, juniors, or seniors; 3) reported consuming alcohol at least once in the past 90 days; and 4) reported ALC+ use at least once during the past year. Eligible participants were routed directly to the baseline (T1) survey, while ineligible individuals were directed to a page that thanked them for their time. Approximately two weeks after completion of the first survey, eligible participants were sent an emailed invitation to complete the follow-up (T2) survey. Students who did not initially complete the second survey received up to five email reminders and five text message reminders. Participants were paid \$20 for the first survey, plus a \$5 bonus if they completed it within 48 hours. To incentivize retention, payment was higher for the second survey. Those who completed the second survey received \$25. Again, a \$5 bonus was awarded for completion within 48 hours. Thus, participants could earn up to \$55.

At baseline, approximately 22% of the invited students ($n = 432$) consented to study participation. Of those who provided consent, 54.9% ($n = 237$) met eligibility criteria.

Retention from T1 to T2 was 89.5% ($n = 212$). No differences were found in regards to age, sex, race, ethnicity, or class year when comparing those who did and did not complete T2. Of the 212 participants who completed the survey at both time points, 111 participants (52.4%) displayed inconsistent reporting (e.g., reported history of ALC+ use at T1 but not T2). Consistency of reporting was not significantly correlated with sex, class year, social desirability, or alcohol use (typical or heavy drinking). These participants were dropped from further consideration, resulting in a final analytic sample of 101 participants.

The analytic sample's mean age at T1 was 20.33 ($SD = 1.24$) years old. The majority identified as female (63.4%), the same gender as their birth sex (i.e., female/woman; male/man; 97.0%), and heterosexual (90.1%). Racial/ethnic groups represented in the sample included Caucasian (84.2%), multiracial (7.0%), Asian (6.9%), Hispanic (4.0%), and African American (2.0%). All class years were represented, including freshmen (15.8%), sophomores (22.8%), juniors (38.6%), and seniors (22.8%). A minority of participants were involved in athletics (26.8%) and social Greek organizations (sororities or fraternities; 15.8%). At screening, participants reported combining alcohol with marijuana (62.4%), energy drinks (57.4%), nicotine (56.4%), ADHD medications (9.9%), cocaine (7.9%), sedatives (5.0%), ecstasy (2.0%), hallucinogens (2.0%), and other drugs (2.0%) during the past year.

Measures

Frequency of PBS Use (T1 and T2). Two established measures were administered to assess the frequency of PBS use. At T1, participants completed the PBSS (Martens et al., 2007). They were asked to indicate the degree to which they engage in each of 15 PBS when drinking or partying, on a 6-point scale ranging from *never* (0) to *always* (5). Sample items include "use a designated driver" and "leave the bar/party at a predetermined time". Item responses were averaged to obtain a composite score for each subscale of the PBSS, including stopping/limiting drinking (7 items; $\alpha = 0.78$), manner of drinking (5 items; $\alpha = 0.69$),

and serious harm reduction (3 items; $\alpha = 0.56$).

At T2, participants completed the SQ (Sugarman & Carey, 2007). They were asked to indicate how often they used each of 21 PBS in the past two weeks, on a 6-point scale ranging from *never* (0) to *more than 10 times* (5). Sample items include “chose not to pre-game” and “alternated alcoholic and nonalcoholic beverages”. Item responses were averaged to obtain a composite score for each subscale of the SQ, including selective avoidance (7 items; $\alpha = 0.85$), strategies used while drinking (10 items; $\alpha = 0.90$), and alternatives to drinking (4 items; $\alpha = 0.81$).

PBS-IQ (T1 and T2). Participants were asked to indicate how often they typically use each of the eight PBS examined in the focus groups and online open-ended surveys (e.g., “I walk home with a trusted friend or group of friends”), on a 5-point scale including *never* (0), *rarely* (1), *sometimes* (2), *usually* (3), and *always* (4). For each PBS they endorsed using *rarely* to *always*, they received a series of follow-up questions asking about the steps they use to implement the PBS. For example, participants who indicated walking home with a trusted friend or group of friends were asked, “How often do you... Stay out until your friends are ready to leave so you can leave together? and Text friends if you get separated to make sure they have not left without you?” Participants were asked to respond to these items on the same 5-point scale. Scale items and alphas can be found in Table 2.1.

Alcohol Use (T2). Participants were asked to report on both typical and heavy drinking during the past month. Typical drinking was assessed with the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985), which asks respondents to estimate how many drinks they consume on each day of a typical week. To assist with drink estimates, a standard drink was defined as 12 oz of beer, 8-9 oz of malt liquor, 5 oz of table wine, or a 1.5 oz shot of distilled spirits (NIAAA, 2016). Item responses were summed to obtain an estimate of typical weekly drinking ($\alpha = 0.75$). Heavy drinking was assessed with an item adapted from the Quantity, Frequency, Peak Scale (QFP; Dimeff et al., 1999).

Participants were asked to estimate the number of times they have gotten drunk or very high from alcohol in the past month, using a 6-point scale ranging from *never* (0) to *9 or more times* (5).

Alcohol-Related Sexual Consequences (T2). Participants were asked to indicate the number of times during the past six months that they experienced each of 2 alcohol-related sexual consequences adapted from the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong, & Colder, 2006), using a 9-point scale ranging from *never* (0) to *40 or more times* (8). Items were “I neglected to protect myself or my partner from a sexually transmitted disease (STD) or an unwanted pregnancy” and “I got into sexual situations I later regretted”. Table 2.5 includes item means and standard deviations.

Social Desirability (T1). Social desirability was assessed with six items from the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1991) and four items from the Good Impression Scale (GIS; Gough, 1952). Sample items include “I never swear” and “I have never deliberately told a lie”. Participants were asked to indicate their level of agreement with each statement, using a 5-point scale ranging from *strongly disagree* (1) to *strongly agree* (5). Item responses were averaged to compute a composite social desirability score ($\alpha = 0.55$).

Screening Items and Demographic Questionnaire (T1). The screening survey included items used to assess study eligibility (i.e., age, current enrollment, year in school, alcohol use, ALC+ use). Participants were also asked to report demographics, including birth sex, gender identity, sexual orientation, race, ethnicity, and involvement in extracurricular activities.

Data Analyses

Preliminary analyses. Patterns of missing data were examined, and outliers were detected by examining variable skews and kurtoses. Missingness was minimal (< 2%) on all variables and was handled with pairwise deletion in SPSS (version 24). Variables containing

outliers (skew > 2 and/or kurtosis > 5) were adjusted so that outlying values equaled 3.29 standard deviations from the mean (Tabachnick & Fidell, 2013).

Aim 1. To conduct principal components factor analyses (PCAs) on PBS-IQ scales to identify distinct factors (subscales) and reduce the number of items. PCAs were performed separately for each PBS-IQ scale. A total of eight PCAs were performed: 1) walking with friends (9 items), 2) watching drinks (7 items), 3) not driving (8 items), 4) going home (6 items), 5) communicating sexual intentions (8 items), 6) staying with friends (10 items), 7) knowing drink location (7 items), and 8) leaving troublesome parties (10 items). Oblimin rotation was used to allow correlations between factors to the extent they existed.

To encourage good internal consistency for each identified factor, conservative criteria were utilized in the retention of items. First, items had to have factor loadings of 0.70 or higher (either on the pattern matrix, if multiple factors were extracted, or the component matrix, if a single factor was extracted). Second, inter-item correlations within a factor had to be 0.50 or greater. Last, coefficient alphas were examined to identify and remove items whose inclusion weakened the reliability of the scale (i.e., $\alpha < 0.70$).

Some PBS-IQ scales were found to contain two factors. Items that were retained loaded on only one of the two factors, and correlations between the factors were moderate (< 0.40). These approaches were informed by Gorsuch (2015) and McDonald (1985) and prior studies of college student drinking (e.g., Mallett et al., 2015). To ensure the final scales were short enough for use in intensive longitudinal research designs (e.g., daily diary) or other types of designs, the 2-3 highest loading items were retained for each factor. Item scores were averaged to obtain a composite score for each factor.

Aim 2. To establish the psychometric properties of the PBS-IQ scales. This aim examined: 1) correlations between PBS-IQ scores at T1 and T2 (test-retest reliability), 2) cross-sectional correlations between scores on the PBS-IQ scales and scores on the PBSS or SQ subscales (construct validity), 3) cross-sectional correlations between PBS-IQ scores

and social desirability (discriminant validity), and 4) correlations among PBS-IQ scales and PBSS subscales at T1 and alcohol use and sexual consequences at T2 (criterion-related validity).

Aim 3. To determine whether PBS-IQ scales predicted sexual consequences when controlling for PBSS subscales. Hierarchical linear regression was used. In Step 1, a sexual consequence (e.g., unprotected sex) was regressed onto a single PBSS subscale (e.g., serious harm reduction). In Step 2, a single PBS-IQ scale (e.g., communicating sexual intentions) was added to the model. Analyses were repeated for each possible combination of PBSS and PBS-IQ scales and were performed separately for each sexual consequence.

Aim 4. To provide normative data for females and males. Descriptive analyses included means, standard deviations, and ranges for the PBS-IQ scales and other study variables by sex. Bootstrapped t-tests were performed to assess if mean differences between females and males were statistically significant ($p < 0.05$).

Results

Table 2.6 at the end of this section provides a summary of support for all hypotheses. Results are described below by aim.

Aim 1

The first aim included identification of factors and item reduction. PCAs were performed separately for each of the eight PBS-IQ scales. For example, a PCA was performed on the pool of nine items in the scale walking with friends. Analyses resulted in a single factor being extracted. The three highest loading items meeting the retention criteria described earlier (e.g., factor loadings of 0.70 or greater; correlations of 0.50 or higher with the other items) were retained (T1 $\alpha = 0.88$). The same procedure was used to perform PCAs for the other seven scales. When possible, three items were retained per factor. If only two items met retention criteria, then two items were retained. The scale not driving was

removed from the final measure due to poor internal consistency (i.e., alpha less than 0.70; inter-item correlations within a factor less than 0.50).

Other scales for which a single factor was extracted included going home (3 items; T1 $\alpha = 0.86$), communicating sexual intentions (3 items; T1 $\alpha = 0.90$), staying with friends (3 items; T1 $\alpha = 0.87$), and knowing drink location (2 items; T1 $\alpha = 0.75$). Two factors were extracted for the scales watching drinks and leaving troublesome parties. Factors for watching drinks included learning drink content (3 items; T1 $\alpha = 0.84$) and not consuming unwatched drinks (2 items; T1 $\alpha = 0.70$). For leaving troublesome parties, factors reflected having an exit strategy (2 items; T1 $\alpha = 0.87$) and being uninvolved (2 items; T1 $\alpha = 0.87$). The final scales with item loadings are shown in Table 2.1.

Aim 2

The second aim was to examine the psychometric properties of the PBS-IQ scales, including test-retest reliability (2a), construct validity (2b), discriminant validity (2c), and criterion-related validity (2d).

2a: As expected, T1 scores were positively correlated with T2 scores. Correlation coefficients ranged from 0.53 to 0.77 (see Table 2.1).

Table 2.1. Factor Loadings, Alphas, and Test-Retest Correlation Coefficients for the PBS-IQ Scales.

Scale	Factor Loading	Alpha (T1)	Alpha (T2)	Test-Retest Correlation
Walking with friends (<i>3 items</i>)		0.88	0.86	0.77*
Make sure there is at least one person in your group who is willing to walk home with you	0.84			
Leave with someone you feel certain is reliable (e.g., boyfriend, roommate)	0.84			
Text friends if you get separated to make sure they have not left without you	0.83			
Going home (<i>3 items</i>)		0.86	0.72	0.53*
Make sure to set a time to go home that would allow you to do everything you have planned for the next day	0.89			
Make sure you have a way to get home at your designated time	0.86			
Have a schedule in mind before you go out	0.86			
Communicating sexual intentions (<i>3 items</i>)		0.90	0.90	0.67*
Learn your partner's sexual intentions while they are sober	0.91			
Obtain your partner's consent while they are sober	0.87			
Communicate your sexual intentions while you are sober	0.87			
Staying with friends (<i>3 items</i>)		0.87	0.82	0.72*
Not split up or leave without notifying the group	0.82			
Ask friends not to leave a party/location without you	0.80			
Check up on any friends who wander off via calls, texts, etc.	0.79			
Knowing drink location (<i>2 items</i>)		0.75	0.80	0.77*
Get a new drink if you misplace your drink	0.81			
Throw out any drink that has been unattended	0.77			
Learning drink content (<i>3 items</i>)		0.84	0.87	0.70*
Ask the person making drinks what is going into your drink	0.91			
Ask the person making drinks how strong your drink is	0.88			
Ask the person making drinks to pour your drink in front of you	0.78			
Not consuming unwatched drinks (<i>2 items</i>)		0.70	0.77	0.60*
Not drink from containers you did not open yourself	0.88			
Not drink from premixed bowls (e.g., jungle juice)	0.80			
Having an exit strategy (<i>2 items</i>)		0.87	0.74	0.67*
Keep an eye on the party throughout the night to determine if it is getting too wild	0.80			
Make sure you know the location of the closest exit	0.77			
Being uninvolved (<i>2 items</i>)		0.87	0.88	0.60*
Not get involved	0.91			
Not try to break up fights	0.87			

Note. Factor loadings are for T1. * $p < 0.01$.

2b: All of the PBS-IQ scales were positively correlated with the stopping/limiting drinking and manner of drinking subscales of the PBSS. With the exception of being uninvolved, the PBS-IQ scales were also positively correlated with the serious harm reduction subscale of the PBSS. Correlation coefficients ranged from 0.20 to 0.68 (see Table 2.2). Going home and not consuming unwatched drinks were positively correlated with all three subscales of the SQ. Walking with friends and staying with friends were positively correlated with the alternatives to drinking subscale of the SQ. Correlation coefficients ranged from 0.21 to 0.34 (see Table 2.3).

2c: The majority of the PBS-IQ scales were uncorrelated with social desirability, as predicted. Two PBS-IQ scales had a small, positive correlation with social desirability. These were communicating sexual intentions ($r = 0.23$) and having an exit strategy ($r = 0.29$; see Table 2.2).

2d: Six PBS-IQ scales were negatively correlated with alcohol use. Going home, not consuming unwatched drinks, having an exit strategy, and being uninvolved were correlated with both typical and heavy drinking. Communicating sexual intentions and learning drink content were correlated with heavy drinking. Correlations ranged from -0.21 to -0.30 (see Table 2.2). Five PBS-IQ scales were negatively correlated with sexual consequences. Going home and communicating sexual intentions were correlated with both unprotected and regretted sex. Having an exit strategy was correlated with unprotected sex. Learning drink content and not consuming unwatched drinks were correlated with regretted sex. Correlations ranged from -0.21 to -0.38 (see Table 2.2). As a secondary analysis, a composite PBS-IQ score was computed by averaging items across the five scales that were correlated with sexual consequences. The composite score was more strongly associated with unprotected ($r = -0.46$) and regretted sex ($r = -0.39$) than scores on the individual scales.

Table 2.2. Correlations Among PBS Scales (T1), Social Desirability (T1), Alcohol Use (T2), and Sexual Consequences (T2).

	1	2	3	4	5	6	7	8	9	10	11	12
1. Walking with friends	1.00											
2. Going home	.355**	1.00										
3. Communicating sexual intentions	.177	.397**	1.00									
4. Staying with friends	.704**	.530**	.382**	1.00								
5. Knowing drink location	.567**	.337**	.334**	.511**	1.00							
6. Learning drink content	.321**	.391**	.310**	.384**	.348**	1.00						
7. Not consuming unwatched drinks	.237*	.320**	.389**	.156	.402**	.306**	1.00					
8. Having an exit strategy	.354**	.477**	.488**	.459**	.327**	.442**	.364**	1.00				
9. Being uninvolved	.240*	.393**	.104	.267**	.178	.178	.273**	.237*	1.00			
10. Stopping/limiting drinking (PBSS)	.351**	.576**	.422**	.518**	.268**	.448**	.381**	.440**	.328**	1.00		
11. Manner of drinking (PBSS)	.308**	.379**	.277**	.459**	.239*	.273**	.317**	.287**	.266**	.556**	1.00	
12. Serious harm reduction (PBSS)	.681**	.278*	.203*	.580**	.495**	.254*	.221*	.373**	.150	.314**	.242*	1.00
13. Social desirability	-.002	.177	.228*	.156	.046	.128	.026	.286**	.099	.123	.159	.085
14. Typical drinking	-.178	-.219*	-.128	-.065	-.089	-.174	-.217*	-.209*	-.244*	-.253*	-.318**	-.131
15. Heavy drinking	-.098	-.258*	-.254*	-.095	-.106	-.225*	-.299**	-.236*	-.247*	-.290**	-.399**	-.117
16. Unprotected sex	-.057	-.366**	-.382**	-.134	-.122	-.174	-.194	-.269**	.013	-.200*	-.182	.002
17. Regretted sex	-.124	-.215*	-.359**	-.095	-.177	-.212*	-.262**	-.166	-.028	-.211*	-.198*	.061

Note. ** $p < 0.01$. * $p < 0.05$.

Table 2.3. Correlations Among PBS-IQ Scales (T2) and SQ Subscales (T2).

	1	2	3	4	5	6	7	8	9
1. Walking with friends	1.00								
2. Going home	.261*	1.00							
3. Communicating sexual intentions	.351**	.477**	1.00						
4. Staying with friends	.755**	.378**	.300**	1.00					
5. Knowing drink location	.488**	.299**	.341**	.473**	1.00				
6. Learning drink content	.389**	.490**	.369**	.452**	.478**	1.00			
7. Not consuming unwatched drinks	.273**	.483**	.412**	.496**	.414**	.409**	1.00		
8. Having an exit strategy	.501**	.461**	.482**	.493**	.399**	.346**	.408**	1.00	
9. Being uninvolved	.173	.200	.094	.231*	.186	.024	.063	.170	1.00
10. Selective avoidance (SQ)	.154	.343**	.186	.180	.108	.048	.273**	.129	-.032
11. Strategies while drinking (SQ)	.187	.237*	.058	.181	.139	.124	.209*	.109	-.163
12. Alternatives to drinking (SQ)	.233*	.291**	.143	.240*	.167	.006	.283**	.026	.089

Note. ** $p < 0.01$. * $p < 0.05$.

Aim 3

The third aim was to determine whether PBS-IQ scales accounted for unique variance in sexual consequences when controlling for the frequency of PBS use (i.e., PBSS subscales). Table 2.4 shows the significant changes in fit that occurred when PBS-IQ scales were added to the hierarchical regression models in Step 2. The top panel shows results for unprotected sex and the bottom panel shows results for regretted sex. The grey headings denote the PBSS subscales that were controlled. As an example, the first row of data shows the improvements in R^2 and F that occurred when both serious harm reduction and communicating sexual intentions were regressed onto unprotected sex (Step 2) rather than just serious harm reduction (Step 1). The change in R^2 was 0.15, suggesting that communicating sexual intentions accounted for an additional 15% of the variability in unprotected sex that serious harm reduction could not account for. The change in F was 16.35 and its significance level was $p = .000$. This indicates that communicating sexual intentions accounted for a significant proportion of the variability in unprotected sex, above the variability accounted for by serious harm reduction.

To summarize Table 2.4, analyses suggested communicating sexual intentions predicted both unprotected and regretted sex above all PBSS subscales. Going home and having an exit strategy predicted unprotected sex above all PBSS subscales and predicted regretted sex above serious harm reduction. Not consuming unwatched drinks predicted regretted sex above both serious harm reduction and manner of drinking. Three additional PBS-IQ scales predicted regretted sex above serious harm reduction, including knowing drink location, learning drink content, and walking with friends.

Table 2.4. Significant Changes in Fit When Adding PBS-IQ Scales to the Hierarchical Regression Models.

Unprotected Sex	ΔR^2	ΔF	df	<i>p</i>
Serious harm reduction				
Communicating sexual intentions	0.15	16.35	1, 91	.000
Going home	0.15	14.01	1, 82	.000
Having an exit strategy	0.09	8.86	1, 96	.004
Manner of drinking				
Communicating sexual intentions	0.12	12.75	1, 91	.001
Going home	0.10	9.81	1, 82	.002
Having an exit strategy	0.05	5.37	1, 96	.023
Stopping/limiting drinking				
Communicating sexual intentions	0.11	11.35	1, 90	.001
Going home	0.09	8.84	1, 81	.004
Having an exit strategy	0.04	4.20	1, 95	.043
Regretted Sex	ΔR^2	ΔF	df	<i>p</i>
Serious harm reduction				
Communicating sexual intentions	0.14	15.33	1, 91	.000
Not consuming unwatched drinks	0.08	8.25	1, 95	.005
Knowing drink location	0.06	5.75	1, 95	.018
Learning drink content	0.06	5.59	1, 95	.020
Walking with friends	0.05	5.21	1, 96	.025
Going home	0.06	5.09	1, 82	.027
Having an exit strategy	0.04	4.18	1, 96	.044
Manner of drinking				
Communicating sexual intentions	0.10	10.56	1, 91	.002
Not consuming unwatched drinks	0.04	4.56	1, 95	.035
Stopping/limiting drinking				
Communicating sexual intentions	0.09	9.18	1, 90	.003

Note. PBS-IQ scales that did not predict sexual consequences when controlling for PBSS subscales are not shown.

Aim 4

The fourth aim was to provide normative data for females and males. Table 2.5 displays means, standard deviations, *t*-values, and bootstrapped confidence intervals comparing females and males on all study variables. Sex differences were found on two established subscales of PBS use. Females used serious harm reduction PBS (from the PBSS) and strategies while drinking PBS (from the SQ) more often than males. There were also sex differences on four PBS-IQ scales. Females scored higher on walking with friends, staying with friends, knowing drink location, and being uninvolved. There were no sex differences on alcohol use, but females reported having unprotected sex more often than males.

Table 2.5. Outlier Adjusted Ranges, Means, *t*-values, and Asymmetric Bootstrapped Confidence Intervals for All Variables.

Variable	Range	Overall <i>M</i> (<i>SD</i>)	Females <i>M</i> (<i>SD</i>)	Males <i>M</i> (<i>SD</i>)	<i>t</i> -value	Bootstrapped 95% CI
Frequency of PBS Use						
Stopping/limiting drinking (PBSS)	0.29 to 4.43	2.08 (0.97)	2.20 (0.97)	1.87 (0.94)	1.65	-0.09 to 0.73
Manner of drinking (PBSS)	0.00 to 4.20	2.20 (0.93)	2.30 (0.98)	2.03 (0.82)	1.38	-0.10 to 0.63
Serious harm reduction (PBSS)	0.33 to 5.00	3.96 (1.01)	4.31 (0.77)	3.35 (1.10)	4.67**	0.59 to 1.36
Selective avoidance (SQ)	0.00 to 4.43	1.29 (0.92)	1.42 (0.87)	1.05 (0.99)	1.99	-0.01 to 0.72
Strategies while drinking (SQ)	0.00 to 4.60	1.72 (1.04)	1.96 (0.94)	1.30 (1.09)	3.23**	0.22 to 1.07
Alternatives to drinking (SQ)	0.00 to 5.00	1.86 (1.29)	1.99 (1.28)	1.65 (1.31)	1.27	-0.17 to 0.89
PBS-IQ Scales (T1)						
Walking with friends	0.67 to 4.00	3.18 (0.96)	3.51 (0.72)	2.57 (1.05)	4.71**	0.57 to 1.31
Going home	0.00 to 4.00	2.29 (1.01)	2.34 (1.05)	2.21 (0.95)	0.57	-0.29 to 0.57
Communicating sexual intentions	0.00 to 4.00	2.79 (1.15)	2.77 (1.24)	2.83 (0.98)	-0.23	-0.50 to 0.42
Staying with friends	0.00 to 4.00	2.91 (1.03)	3.23 (0.80)	2.35 (1.15)	4.05**	0.46 to 1.30
Knowing drink location	0.00 to 4.00	2.79 (1.08)	3.05 (0.97)	2.28 (1.10)	3.60**	0.36 to 1.23
Learning drink content	0.00 to 4.00	1.64 (1.19)	1.75 (1.26)	1.44 (1.05)	1.22	-0.15 to 0.79
Not consuming unwatched drinks	0.00 to 4.00	1.95 (1.15)	2.08 (1.17)	1.71 (1.10)	1.53	-0.08 to 0.84
Having an exit strategy	0.00 to 4.00	2.23 (1.23)	2.32 (1.28)	2.08 (1.14)	0.95	-0.24 to 0.70
Being uninvolved	0.00 to 4.00	3.38 (0.96)	3.53 (0.95)	3.12 (0.92)	2.10*	0.03 to 0.79
Alcohol Use and Sexual Consequences						
Typical drinking	0.00 to 39.99	10.04 (8.18)	10.11 (8.20)	9.92 (8.24)	0.11	-3.07 to 3.51
Heavy drinking	0.00 to 5.00	2.07 (1.41)	2.23 (1.46)	1.78 (1.29)	1.56	-0.09 to 1.01
Unprotected sex	0.00 to 3.65	0.26 (0.81)	0.40 (0.99)	0.03 (0.16)	2.94*	0.15 to 0.66
Regretted sex	0.00 to 3.23	0.37 (0.77)	0.43 (0.85)	0.27 (0.61)	1.02	-0.15 to 0.45
Social Desirability						
Scale composed of selected items from BIDR and GIS	1.40 to 4.10	2.90 (0.47)	2.85 (0.43)	2.97 (0.52)	-1.28	-0.32 to 0.08

Note. ** $p < 0.01$. * $p < 0.05$.

Table 2.6. Summary of Support for Paper 1 Hypotheses.

Hypothesis	Result
1a.	
Factors will include plans for implementing PBS and specific characteristics of those plans, such as complexity of plans, autonomy for executing plans, and vigilance of plans.	Not Supported
2a.	
PBS-IQ scores obtained on separate assessments spaced two weeks apart will be positively correlated.	Supported (Table 2.1)
2b.	
PBS-IQ scores will be moderately, positively correlated with scores on the PBSS and will exhibit small, positive correlations with scores on the SQ.	Mostly Supported. Exceptions: Being uninvolved was uncorrelated with the serious harm reduction subscale of the PBSS. (Table 2.2) Communicating sexual intentions, knowing drink location, learning drink content, having an exit strategy, and being uninvolved were uncorrelated with SQ subscales. (Table 2.3)
2c.	
PBS-IQ scores will <i>not</i> be significantly correlated with social desirability.	Mostly Supported. Exceptions: Communicating sexual intentions and having an exit strategy had small, positive correlations with social desirability. (Table 2.2)
2d.	
PBS-IQ scores will be negatively correlated with alcohol use and sexual consequences. Given the PBS-IQ's focus on harm reduction, its scales will be more strongly associated with sexual consequences than alcohol use.	Mostly Supported. Exceptions: Walking with friends, staying with friends, and knowing drink location were uncorrelated with both alcohol use and sexual consequences. Being uninvolved was uncorrelated with sexual consequences. (Table 2.2)
3a.	
PBS-IQ scales will predict sexual consequences when controlling for the PBSS subscales, which measure the frequency of PBS use.	Mostly Supported. Exceptions: Staying with friends and being uninvolved did not account for unique variance over the frequency of PBS use. (Table 2.4)
4a.	
Females will score higher than males on the PBS-IQ scales.	Partially Supported. Exceptions: There were no sex differences on going home, communicating sexual intentions, learning drink content, not consuming unwatched drinks, and having an exit strategy. (Table 2.5)

Discussion

Previous studies have elucidated which PBS college student drinkers use most frequently, and how frequency of PBS use relates to alcohol use and consequences. However, PBS implementation quality has generally not been examined, with the exception of a few qualitative studies (e.g., Barry & Goodson, 2011; Howard et al., 2007). The current study extended previous research by devising implementation quality scales for common PBS and showing that implementation quality accounts for variance in sexual consequences that is not explained by frequency of use alone.

Implementation quality was hypothesized to consist of multiple dimensions, including complexity of plans to use PBS, autonomy in carrying out the steps of one's plans, and vigilance of plans. Results revealed items for walking with friends, going home, communicating sexual intentions, staying with friends, and knowing drink location reduced to one factor, suggesting implementation quality was unidimensional for these PBS-IQ scales. Nevertheless, factors provided details regarding specific steps students took to implement the PBS. For example, steps in walking with friends included making sure there was at least one person in the group who was willing to walk home with them, texting friends if they became separated to make sure their friends had not left without them, and leaving with someone they felt certain was reliable.

Although implementation quality was unidimensional for most PBS-IQ scales, two PBS factored into subscales. Factors offered insight regarding related behaviors students performed when they implemented the PBS. Watching drinks consisted of two factors which generally reflected learning drink content (e.g., asking the bartender how strong the drink is) and not consuming unwatched drinks (e.g., pre-opened or pre-made beverages). Leaving troublesome parties also included two factors, which were having an exit strategy (e.g., identifying the nearest exit) and being uninvolved (e.g., not trying to break up fights).

Psychometric analyses provided good support for the construct validity of the new scales. PBS-IQ scales were positively correlated with PBSS subscales. Four of the nine PBS-IQ scales, including going home, not consuming unwatched drinks, walking with friends, and staying with friends, were also positively correlated with SQ subscales. Correlations were small to moderate, suggesting that the scales measured associated, yet distinct constructs. Where associations were not found, logical explanations can be offered. Being uninvolved in fights was uncorrelated with the serious harm reduction subscale of the PBSS. However, it seems likely that the serious harm reduction behaviors measured on the PBSS, which include using a designated driver, going home with a friend, and knowing where one's drink has been, bear little relation to staying out of fights. It was anticipated that several of the PBS-IQ scales would be uncorrelated with the SQ, considering that the PBS-IQ emphasizes harm reduction (i.e., drinking more safely) and the SQ measures strategies to control drinking itself (i.e., abstaining from alcohol use or consuming a lower quantity of alcohol).

There was also consistent support for the discriminant validity of the PBS-IQ. The majority of the scales were uncorrelated with social desirability. Social desirability accounted for about 5% of the variance in communicating sexual intentions and 8% of the variance in having an exit plan. This suggests it played a small role in self-report of implementation quality for these PBS. Future studies on the effects of PBS implementation can ameliorate any concerns about potential bias by controlling for social desirability.

Test-retest reliabilities have generally not been reported for measures of PBS use (see Prince et al., 2013 for a review). The current study examined test-retest reliability for all PBS-IQ scales. Without exception, baseline and follow-up scores were positively correlated. The scales walking with friends, staying with friends, knowing drink location, and learning drink content demonstrated test-retest correlations of 0.70 or higher, suggesting that scores were stable over time (e.g., Nunnally & Bernstein, 1994). Communicating sexual intentions

and having an exit strategy achieved test-retest correlations just below 0.70. Additional research seems warranted to clarify why test-retest correlations were lower for going home, not consuming unwatched drinks, and being uninvolved. Previous studies have found that drug and ALC+ users provide unreliable self-reports of their substance use (e.g., Levine et al., 2006; Sheehan, Sheehan, Torres, Coppola, & Francis, 1991; Sumnall, Tyler, Wagstaff, & Cole, 2004). To the extent these findings may generalize to reports of PBS implementation, it is plausible that reliability coefficients may have been influenced by the high-risk sample. Future studies may benefit from examining the test-retest reliability of the PBS-IQ scales for drinkers who do not use other substances.

Criterion-related validity analyses suggested implementation quality mattered for preventing unprotected and regretted sex. Five PBS-IQ scales, including going home, communicating sexual intentions, having an exit strategy, learning drink content, and not consuming unwatched drinks, were negatively associated with one or both sexual consequences. The composite PBS-IQ score was moderately, negatively correlated with both consequences. Further, PBS-IQ scales predicted sexual consequences when controlling for PBSS subscales, suggesting that implementation quality accounted for independent, unique variance over the frequency of use.

Although each of the abovementioned scales showed benefits, communicating sexual intentions was particularly efficacious, predicting both unprotected and regretted sex above all PBSS subscales. The central requirement for implementing this PBS well was engaging in sexual communication when sober. The current study did not collect data on what, specifically, students communicated regarding their sexual intentions. Obtaining this information is a logical next step. It would then be possible to draw upon communication theory to develop intervention content that teaches individuals what specific information to communicate, and how to communicate it more effectively, prior to engaging in alcohol use.

This content could be adapted for a variety of dating contexts (e.g., casual dating; committed relationship).

It is also noteworthy that having an exit strategy and going home predicted unprotected and regretted sex when controlling for most PBSS subscales. It is plausible that individuals obtain practice with the steps involved in implementing these PBS prior to their first drinking episode. For example, travelers and moviegoers routinely hear announcements that encourage them to identify the nearest exit in case of an emergency, which was a step in having an exit strategy. Secondary schools customarily teach schedule setting, which was a necessary step in going home at a designated time. To the extent they have prior experience with these behaviors, students may feel comfortable implementing them and may be open to receiving feedback on how to perform them better.

It was expected that the PBS-IQ scales would be associated with alcohol use to a lesser degree than consequences, due to the measure's focus on harm reduction. Contrary to expectations, all scales except walking with friends, staying with friends, and knowing drink location were negatively correlated with typical or heavy drinking. Findings suggested students who implemented PBS better also tended to drink less. It is plausible that high-quality PBS implementation (e.g., taking steps to go home at a designated time) caused students to drink less. Another possible explanation is that a third variable explains this association (e.g., self-regulation; D'Lima, Pearson, & Kelley, 2012). Additional longitudinal research is needed to understand the mechanisms underlying associations between PBS implementation quality and alcohol use.

The study's final aim was to provide normative data on the PBS-IQ scales by sex. Findings extended prior research that has found females use PBS more frequently by showing that females may also implement certain PBS better. However, females scored higher on the scales that were not correlated with sexual consequences, which included walking with friends, staying with friends, knowing drink location, and being uninvolved. Sex

differences in associations between implementation quality and consequences were not explored due to low endorsement of consequences in males (unprotected sex, $n = 1$; regretted sex, $n = 7$). Future research may benefit from exploring sex differences.

Implications for Future Research

The current study's findings have important implications for future research. First, results provide initial support for the reliability (test-retest) and validity (construct, discriminant, and criterion-related) of the PBS-IQ. The scales were informative about specific steps students took to implement PBS, and the majority were uniquely associated with sexual consequences after accounting for the frequency of PBS use. Additional refinement and testing of the scales that were not associated with sexual consequences or alcohol use may clarify whether they can still add value to the measure. For example, it would be beneficial to cross-validate the scales for a wider range of consequence types. Other consequences (e.g., physical fights; driving under the influence) had low endorsement rates, and there was not enough variability to explore whether they were related to implementation quality. Another possible future direction is to develop implementation quality scales for PBS that are beyond the scope of the current study, such as PBS related to marijuana (Pedersen, Hummer, Rinker, Traylor, & Neighbors, 2016) and club drugs (Akbar et al., 2011; Fernández-Calderón et al., 2014).

Second, longitudinal research is needed to examine the causal effects of PBS implementation quality on alcohol use and consequences. It may be particularly revealing to examine implementation quality at the event-level. This would enable researchers to gain an understanding of how variability in implementation quality across events or days influences drinking and related consequences. Toward this end, the PBS-IQ was designed to be short (i.e., 2-3 items per factor) to minimize response burden when used as a measurement tool in daily diary or ecological momentary assessment (EMA) research designs (Stone, Kessler, & Haythomthwatte, 1991).

Limitations

Despite the strengths of the current study, some limitations should be noted. The extent to which findings generalize to all college student drinkers is unclear. Although the analytic sample was demographically similar to the general student population at the university of study, it was predominantly comprised of Caucasian females. Participants reported ALC+ use during the past year. Given the high prevalence of ALC+ use in college students, past studies of PBS have likely included some ALC+ users despite not explicitly screening for them. However, it is unknown how the current study's findings may have differed if students with less risky drinking styles (e.g., alcohol-only users) had participated. Additionally, confirmatory factor analyses were not performed on the PBS-IQ scales because of power concerns (e.g., MacCallum, Browne, & Sugawara, 1996). Best practice suggests the psychometric properties of a new measure should be replicated in a second sample (Cabrera-Nguyen, 2010; Worthington & Whittaker, 2006). These recommendations have generally been followed to develop scales of PBS use (e.g., Martens et al., 2007; Prince et al., 2013). Future studies are encouraged to replicate the factor structures and psychometric properties of the PBS-IQ scales in other samples. It may also be advantageous to test for measurement invariance across different subgroups of the population (e.g., volunteer versus mandated students; Barnett et al., 2004; Merrill, Carey, Lust, Kalichman, & Carey, 2014).

Conclusion

The current study developed and psychometrically tested the PBS-IQ, a measure of PBS implementation quality. Results provided details on specific steps students performed when implementing PBS. Several of the scales were negatively correlated with sexual consequences or alcohol use, and predicted sexual consequences after controlling for the frequency of PBS use. Potential directions for future research were discussed.

References

- Akbar, T., Baldacchino, A., Cecil, J., Riglietta, M., Sommer, B., & Humphris, G. (2011). Poly-substance use and related harms: A systematic review of harm reduction strategies implemented in recreational settings. *Neuroscience & Biobehavioral Reviews*, *35*(5), 1186-1202.
- Barnett, N. P., Tevyaw, T. O. L., Fromme, K., Borsari, B., Carey, K. B., Corbin, W. R., ... & Monti, P. M. (2004). Brief alcohol interventions with mandated or adjudicated college students. *Alcoholism: Clinical and Experimental Research*, *28*(6), 966-975.
- Barry, A. E., & Goodson, P. (2011). How college students conceptualize and practice responsible drinking. *Journal of American College Health*, *59*(4), 304-312.
- Benton, S. L., Downey, R. G., Glider, P. J., & Benton, S. A. (2008). College students' norm perception reported use of protective behavioral strategies for alcohol consumption. *Journal of Studies on Alcohol and Drugs*, *69*(6), 859-865.
- Benton, S. L., Schmidt, J. L., Newton, F. B., Shin, K., Benton, S. A., & Newton, D. W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol*, *65*(1), 115-121.
- Borsari, B., & Carey, K. B. (2005). Two brief interventions for mandated college students. *Psychology of Addictive Behaviors*, *19*(3), 296-302.
- Cabrera-Nguyen, P. (2010). Author guidelines for reporting scale development and validation results in the Journal of the Society for Social Work and Research. *Journal of the Society for Social Work and Research*, *1*(2), 99-103.
- Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology*, *53*(2), 189-200.

- Cooper, M. L. (2002). Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol*, (Suppl. 14), 101-117.
- DeMartini, K. S., Palmer, R. S., Leeman, R. F., Corbin, W. R., Toll, B. A., Fucito, L. M., & O'Malley, S. S. (2013). Drinking less and drinking smarter: Direct and indirect protective strategies in young adults. *Psychology of Addictive Behaviors*, 27(3), 615-626.
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach*. New York, NY: The Guilford Press.
- D'Lima, G. M., Pearson, M. R., & Kelley, M. L. (2012). Protective behavioral strategies as a mediator and moderator of the relationship between self-regulation and alcohol-related consequences in first-year college students. *Psychology of Addictive Behaviors*, 26(2), 330-337.
- Ebersole, R. C., Noble, J. J., & Madson, M. B. (2012). Drinking motives, negative consequences, and protective behavioral strategies in lesbian, gay, bisexual, and transgender college students. *Journal of LGMT Issues in Counseling*, 6(4), 337-352.
- Ehret, P. J., Ghaidarov, T. M., & LaBrie, J. W. (2013). Can you say no? Examining the relationship between drinking refusal self-efficacy and protective behavioral strategy use on alcohol outcomes. *Addictive Behaviors*, 38(4), 1898-1904.
- Fernández-Calderón, F., Lozano-Rojas, Ó., Rojas-Tejada, A., Bilbao-Acedos, I., Vidal-Giné, C., Vergara-Moragues, E., & González-Saiz, F. (2014). Harm reduction behaviors among young polysubstance users at raves. *Substance Abuse*, 35(1), 45-50.
- Fishbein, M. & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Massachusetts: Addison-Wesley Publishing Company.
- Gorsuch, R. L. (2015). *Factor Analysis: Classic Second Edition*. New York, NY: Routledge.

- Gough, H. G. (1952). On making a good impression. *The Journal of Educational Research, 46*(1), 33-42.
- Hingson, R., Zha, W., & Smyth, D. (2017). Magnitude and trends in heavy episodic drinking, alcohol-impaired driving, and alcohol-related mortality and overdose hospitalizations among emerging adults of college ages 18–24 in the United States, 1998–2014. *Journal of Studies on Alcohol and Drugs, 78*(4), 540-548.
- Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs, July(Suppl 16)*, 12-20.
- Howard, D. E., Griffin, M., Boekeloo, B., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health, 56*(3), 247-254.
- Kivlahan, D. R., Marlatt, G. A., Fromme, K., Coppel, D. B., & Williams, E. (1990). Secondary prevention with college drinkers: Evaluation of an alcohol skills training program. *Journal of Consulting and Clinical Psychology, 58*(6), 805-810.
- LaBrie, J. W., Lac, A., Kenney, S. R., & Mirza, T. (2011). Protective behavioral strategies mediate the effect of drinking motives on alcohol use among heavy drinking college students: Gender and race differences. *Addictive Behaviors, 36*(4), 354–361.
- Larimer, M. E. & Crouce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999-2006. *Addictive Behaviors, 32*(11), 2439-2468.
- Levine, A. J., Hardy, D. J., Miller, E., Castellon, S. A., Longshore, D., & Hinkin, C. H. (2006). The effect of recent stimulant use on sustained attention in HIV-infected adults. *Journal of Clinical and Experimental Neuropsychology, 28*(1), 29-42.

- Lewis, M. A., Rees, M., & Lee, C. M. (2009). Gender-specific normative perceptions of alcohol-related protective behavioral strategies. *Psychology of Addictive Behaviors, 23*(3), 539–545.
- Lewis, M. A., Rees, M., Logan, D. E., Kaysen, D. L., & Kilmer, J. R. (2010). Use of drinking protective behavioral strategies in association to sex-related alcohol negative consequences: The mediating role of alcohol consumption. *Psychology of Addictive Behaviors, 24*(2), 229-238.
- Linden, A. N., Lau-Barraco, C., & Millettich, R. J. (2014). Protective behavioral strategies, alcohol expectancies, and drinking motives in a model of college student drinking. *Psychology of Addictive Behaviors, 28*(4), 952–959.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130-149.
- Mallett, K. A., Turrisi, R., Cleveland, M., Scaglione, N. M., Reavy, R., Sell, N. M., & Varvil-Weld, L. (2015). A dual process examination of alcohol-related consequences among first-year college students. *Journal of Studies on Alcohol and Drugs, 76*(6), 862-871.
- Mallett, K. A., Turrisi, R., Hultgren, B. A., Sell, N. M., Reavy, R., & Cleveland, M. J. (2017). When alcohol is only part of the problem: An event-level analysis of negative consequences related to alcohol and other substance use. *Psychology of Addictive Behaviors, 31*(3), 307-314.
- Martens, M. P., Ferrier, A. G., & Cimini, M. D. (2007). Do protective behavioral strategies mediate the relationship between drinking motives and alcohol use in college students? *Journal of Studies on Alcohol and Drugs, 68*(1), 106–114.

- Martens, M. P., Ferrier, A. G., Sheehy, M. J., Corbett, K., Anderson, D. A., & Simmons, A. (2005). Development of the protective behavioral strategies survey. *Journal of Studies on Alcohol*, *66*(5), 698-705.
- Martens, M. P., Martin, J. L., Littlefield, A. K., Murphy, J. G., & Cimini, M. D. (2011). Changes in protective behavioral strategies and alcohol use among college students. *Drug and Alcohol Dependence*, *118*(2-3), 504-507.
- McDonald, R. P. (1985). *Factor analysis and related methods*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Merrill, J. E., Carey, K. B., Lust, S. A., Kalichman, S. C., & Carey, M. P. (2014). Do students mandated to intervention for campus alcohol-related violations drink more than nonmandated students? *Psychology of Addictive Behaviors*, *28*(4), 1265-1270.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA) (2018). Fall semester – A time for parents to discuss the risks of college drinking. Retrieved 30 April 2019, from https://www.niaaa.nih.gov/sites/default/files/publications/NIAAA_BacktoCollege_Fact_sheet.pdf
- National Institute on Alcohol Abuse and Alcoholism (NIAAA) (2016). Rethinking Drinking. Retrieved 20 February 2018, from https://pubs.niaaa.nih.gov/publications/RethinkingDrinking/Rethinking_Drinking.pdf
- Nguyen, N., Walters, S. T., Wyatt, T. M., & DeJong, W. (2011). Use and correlates of protective drinking behaviors during the transition to college: Analysis of a national sample. *Addictive Behaviors*, *36*(10), 1008-1014.
- Novik, M. G., & Boekeloo, B. O. (2011). Dimensionality and psychometric analysis of an alcohol protective behavioral strategies scale. *Journal of Drug Education*, *41*(1), 65-78.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.

- Osberg, T. M., Atkins, L., Buchholz, L., Shirshova, V., Swiantek, A., Whitley, J., ...Oquendo, N. (2010). Development and validation of the College Life Alcohol Salience Scale: A measure of beliefs about the role of alcohol in college life. *Psychology of Addictive Behaviors, 24*(1), 1-12.
- Palmer, R. S. (2004). *Efficacy of the Alcohol Skills Training Program in mandated and non-mandated heavy drinking college students*. Unpublished doctoral dissertation, Seattle: University of Washington.
- Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. R. Shave, & L. S. Wrightsman (Eds.), *Measures of personality and social psychology attitudes* (pp. 17-59). New York: Academic Press.
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review, 33*, 1025-1040.
- Pedersen, E. R., Hummer, J. F., Rinker, D. V., Traylor, Z. K., & Neighbors, C. (2016). Measuring protective behavioral strategies for marijuana use among young adults. *Journal of Studies on Alcohol and Drugs, 77*(3), 441-450.
- Prince, M. A., Carey, K. B., & Maisto, S. A. (2013). Protective behavioral strategies for reducing alcohol involvement: A review of the methodological issues. *Addictive Behaviors, 38*(7), 2343-2351.
- Ray, A. E., Turrisi, R., Abar, B., & Peters, K. E. (2009). Social-cognitive correlates of protective drinking behaviors and alcohol-related consequences in college students. *Addictive Behaviors, 34*(11), 911-917.
- Read, J. P., Kahler, C. W., Strong, D. R., & Colder, C. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol, 67*(1), 169-177.

- Sell, N. M., Turrisi, R., Scaglione, N. M., Hultgren, B. A., & Mallett, K. A. (2016). Examining the effects of drinking and interpersonal protective behaviors on unwanted sexual experiences in college women. *Addictive Behaviors, 54*, 40-45.
- Sheehan, M. F., Sheehan, D. V., Torres, A., Coppola, A., & Francis, E. (1991). Snorting benzodiazepines. *The American Journal of Drug and Alcohol Abuse, 17*(4), 457-468.
- Stone, A. A., Kessler, R. C., & Haythomthwatte, J. A. (1991). Measuring daily events and experiences: Decisions for the researcher. *Journal of Personality, 59*(3), 575-607.
- Sugarman, D. E., & Carey, K. B. (2007). The relationship between drinking control strategies and college student alcohol use. *Psychology of Addictive Behaviors, 21*(3), 338-345.
- Sumnall, H. R., Tyler, E., Wagstaff, G. F., & Cole, J. C. (2004). A behavioural economic analysis of alcohol, amphetamine, cocaine and ecstasy purchases by polysubstance misusers. *Drug and Alcohol Dependence, 76*(1), 93-99.
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics 6*. Boston, MA: Pearson.
- Walters, T., & Baer, J. (2006). *Talking with college students about alcohol: Motivational strategies for reducing abuse*. New York, NY: The Guilford Press.
- Werch, C. E., & Gorman, D. R. (1986). Factor analysis of internal and external self-control practices for alcohol consumption. *Psychological Reports, 59*(3), 1207-1213.
- Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*(6), 806-838.

CHAPTER THREE: PAPER TWO

A Daily Diary Study of Protective Behavioral Strategies Implementation and Alcohol-Related Consequences in College Students

Risky drinking contributes to a variety of negative consequences in college students, which range in severity from social problems (e.g., embarrassment; interpersonal conflict) to bodily harm (e.g., injury; death) (Hingson, Zha, & Weitzman, 2009). Protective behavioral strategies (PBS) are behaviors that can be used to reduce alcohol consumption or associated consequences, such as pacing drinks and using a designated driver (Martens, Ferrier, & Cimini, 2007; Martens et al., 2005; Prince, Carey, & Maisto, 2013). PBS have been a cornerstone of prevention and intervention efforts for decades and have received much attention in the college drinking literature (e.g., Borsari & Carey, 2005; Dimeff, Baer, Kivlahan, & Marlatt, 1999; Kivlahan et al., 1990; Larimer & Cronce, 2007; Walters & Baer, 2006).

The majority of studies have utilized cross-sectional, between-subjects designs to examine associations between the frequency of PBS use and alcohol consumption or consequences (Pearson, 2013). Researchers often measure PBS use with the Protective Behavioral Strategies Survey (PBSS), which asks respondents to indicate how often they typically use each of 15 PBS when drinking or partying, on a scale from *never* to *always* (Martens et al., 2007). Another common approach to assessing PBS has been to examine average use over a set period of time (e.g., 30 days) and its relation to drinking or consequences (Pearson, 2013). For example, a survey might ask, "How often in the past 30 days have you watched your drinks being made?" (not at all, rarely, sometimes, usually, always). These designs enable researchers to make generalizations based on individual differences in PBS use. Many studies have found that individuals who use PBS more

frequently, on average, drink less and experience fewer alcohol-related consequences than individuals who use PBS less frequently (Pearson, 2013; Prince et al., 2013).

Studies of PBS have recently begun to utilize the daily diary design, which asks participants to provide daily reports of their PBS use, alcohol use, and consequences (e.g., Lewis et al., 2012; Pearson, D'Lima, & Kelley, 2013; Sell, Turrisi, Scaglione, Cleveland, & Mallett, 2018). Daily reporting minimizes the potential for recall bias because there is a shorter interval between the occurrence and reporting of behaviors. Diary analyses focus on examining between- and within-person variability in PBS use and their associations with drinking or consequences. Between-person variability refers to differences between people in the average number of PBS used (i.e., average variability). Within-person variability refers to an individual's differences in use from day to day (i.e., daily variability).

Relative to studies that do not use daily assessments, diary studies have reported inconsistent findings. For example, Lewis et al. (2012) found that on days when students used more harm reduction PBS (e.g., going home with friends) or more PBS to limit their drinking (e.g., stopping at a predetermined time) than they typically used, they experienced more negative alcohol-related consequences. However, people who used more limiting drinking PBS, on average, actually experienced fewer consequences. There was no association between average use of harm reduction PBS and consequences. Pearson et al. (2013) replicated Lewis et al.'s findings on serious harm reduction PBS, but found no associations between average or daily use of limiting drinking PBS and negative consequences. Given these inconsistencies and the relatively small number of diary studies that have been done, additional research seems warranted to improve our understanding of how average and daily variability in PBS relate to consequences.

The current study extended the examination of variability in PBS to include two facets of PBS implementation that have not been examined in any published quantitative studies: quality and consistency. First, quality was defined as how well drinkers implement

PBS. Qualitative studies have identified individual differences in implementation quality (Barry & Goodson, 2011; Howard, Griffin, Boekeloo, Lake, & Bellows, 2007) that could plausibly impact the efficacy of PBS. Previous diary studies presented participants with a list of PBS and asked them to select the PBS they used on a given drinking day. Endorsed PBS were summed by subscale. For example, three behaviors from the serious harm reduction subscale of the PBSS (using a designated driver, going home with a friend, knowing where your drink has been; Martens et al., 2007) were summed to obtain a single score for harm reduction PBS (Lewis et al., 2012; Pearson et al., 2013). The current study expanded upon this research by asking participants to complete daily reports of steps they took to implement specific PBS (e.g., communicating sexual intentions). Response options (i.e., steps) were generated in prior focus groups and open-ended surveys where participants were asked to list the steps they would take to perform each PBS at the highest quality level (see Paper One). Quality was operationalized as the total number of steps taken to implement a given PBS. A greater sum was assumed to reflect higher quality implementation of that PBS.

Second, consistency was operationalized as the number of days participants used specific PBS out of the number of days they had opportunities to use them. Some PBS are not applicable on all drinking occasions. For example, participants do not have the opportunity to leave the setting of a fight on occasions when no fights break out. Existing measures of the frequency of PBS use have tended to lack detail regarding how many drinking events occurred, for how many of those events each PBS was applicable, and for how many applicable events each PBS was actually used. The current study's definition of consistency addresses these limitations.

Current Study

The current study used a longitudinal, daily diary design to systematically examine associations between implementation (quality, consistency) of specific harm reduction PBS (e.g., going home at a designated time) and negative alcohol-related consequences. By

definition, the goal of harm reduction PBS is to reduce the harms associated with drinking (i.e., consequences) rather than the quantity of alcohol consumed (Prince et al., 2013). Therefore, alcohol consumption was not an outcome in the current study. Consistent with prior diary research (Lewis et al., 2012; Pearson et al., 2013), consequences were examined as a composite score. Additionally, the most prevalent consequence subtypes were examined as separate subscales (risk, social, physical).

The study had three innovative features. First, it assessed PBS implementation quality using a diary version of the PBS-IQ. Prior to its use in the current study, the PBS-IQ underwent psychometric testing and was found to be reliable and valid (see Paper One). Second, surveys were administered across 12 days over four weekends (Thursdays, Fridays, and Saturdays). Weekends were selected to coincide with home football games, which are high-risk periods for college student heavy drinking (e.g., Neal & Fromme, 2007). Third, it utilized a high-risk sample. Participants were current drinkers who reported combining alcohol and another substance(s) so that their effects overlapped (ALC+ use) during the past year. Recent findings suggest ALC+ use is highly prevalent among college students, and ALC+ users experience more consequences than drinkers who do not use other substances (Mallett et al., 2017).

Aim 1. The first aim of the current study was to examine between-person (average) associations of PBS implementation quality or consistency and alcohol-related consequences. Associations between each implementation construct (quality, consistency) and consequences were examined when controlling for the effects of the other construct.

Hypotheses

1a. Individuals who implement PBS at a higher quality level, on average, will have a lower likelihood of experiencing consequences following drinking episodes than those who implement PBS at a lower quality level.

1b. Individuals who implement PBS more consistently, on average, will have a lower likelihood of experiencing consequences following drinking episodes than those who implement PBS less consistently.

Aim 2. The second aim of the current study was to examine within-person (daily) associations between PBS implementation quality and alcohol-related consequences. Again, associations between quality and consequences were examined when controlling for consistency.

Hypotheses

2a. On days when individuals report implementing PBS at a higher quality level than they typically do, they will have a lower likelihood of experiencing consequences following drinking episodes.

Aim 3. The third aim of the current study was to determine whether relationships between average or daily PBS implementation quality and consequences were moderated (i.e., strengthened or weakened) by the consistency of PBS use. These analyses were exploratory.

Method

Procedure

Students from a large, northeastern university ($N = 2000$) were randomly selected from the registrar's database at the beginning of the Fall 2018 semester. They were sent an emailed pre-notification which explained the study and included a URL to access the study's website for more information. The pre-notification was followed by an invitation email that provided a URL and PIN for accessing a consent form and brief screening survey. Students who did not initially complete the screening survey were sent up to seven reminder emails. Individuals who logged on were directed to an informed consent page. Those who indicated willingness to continue were routed to the screening survey. Eligible individuals: 1) were between ages 18 and 23, 2) were currently enrolled as traditional undergraduate students,

3) reported consuming alcohol in the past 90 days, 4) reported combining alcohol with another substance (e.g., nicotine; marijuana) during the past year, and 5) did not participate in the efforts to develop measures for the current study (i.e., focus groups, online open-ended survey, or psychometric testing; see Paper One). Eligible individuals were routed directly to the baseline survey, while ineligible individuals were directed to a page that thanked them for their time. At the close of the baseline survey, participants were reminded that they had qualified to continue in the study and would be contacted again in a few weeks.

There were 12 daily diary assessments across four weekends of data collection, lasting approximately three months. Three days prior to each weekend, a pre-notification email and text message were sent to alert participants of the start date for the upcoming data collection. Each survey asked participants to report their behaviors for the previous day (e.g., report Thursday behaviors on Friday survey). An invitation email containing a link and unique PIN was sent on Friday, Saturday, and Sunday morning of each weekend. Participants received up to two text messages reminding them to complete each survey before 11:59pm. Surveys were disabled after 11:59pm to reduce the possibility for memory decay (Mohr et al., 2005; Park, Armeli, & Tennen, 2004). Participants were paid \$20 for completing the baseline survey and \$5 for each event-level survey. Bonuses were offered to encourage compliance and retention. Participants who completed all four weekends (12 surveys) received a \$25 bonus, while participants who completed three weekends (9 surveys) earned a \$10 bonus. Thus, participants could earn up to \$105. These methods mirror those of previous diary studies (e.g., Mallett et al., 2017; Sell et al., 2018).

Approximately 30% of the invited students ($n = 597$) consented to study participation, and 52.9% of consenting students ($n = 316$) met eligibility criteria and completed the baseline survey. Of the baseline participants, 88.6% ($n = 280$) completed at least one diary survey. Response rates for diary surveys ranged from 57.3% to 78.5%. Diary participation

was significantly associated with sex, $X^2(1) = 6.21, p = 0.01$, and typical alcohol consumption, $t(314) = -2.58, p = 0.01$. A lower percentage of males than females participated in the diary surveys. Individuals who completed a diary survey reported consuming fewer drinks per week at baseline ($M = 11.44, SD = 8.11$) than those who did not continue in the study ($M = 15.22, SD = 9.56$). There were no differences on age, race, ethnicity, or class year.

The final analytic sample consisted of 267 students who reported drinking on at least 1 of the 12 days. The mean age at baseline was 19.58 ($SD = 1.15$) years old. Participants primarily identified as female (67.0%), the same gender as their birth sex (i.e., female/woman; male/man; 99.6%), and heterosexual (89.5%). The racial/ethnic composition of the sample included Caucasian (84.6%), Hispanic (7.6%), Asian (7.5%), multiracial (4.1%), and African American (2.3%). All class years were represented, including freshmen (22.8%), sophomores (21.0%), juniors (37.8%), and seniors (18.4%). A minority of participants reported involvement in athletics (32.6%) and social Greek organizations (sororities or fraternities; 20.2%). Participants reported combining alcohol with nicotine (67.8%), marijuana (63.3%), energy drinks (47.4%), ADHD medications (13.1%), cocaine (10.2%), sedatives (6.0%), hallucinogens (2.2%), ecstasy (1.9%), opioids (1.5%), and other drugs (2.3%) during the past year. On average, they consumed 11.78 ($SD = 8.09$) drinks per week in the past month.

Measures

Consistency of PBS Use. Participants who indicated using alcohol on the previous day were asked whether they used each of five PBS, including: 1) walking home with a trusted friend or group of friends (walking with friends), 2) making sure to go home at a designated time (going home), 3) leaving when trouble or fights broke out (leaving troublesome parties), 4) watching their drinks being made (watching drinks), and 5) knowing where their drink was at all times (knowing drink location). Participants who reported

“hooking up” or engaging in sexual activities on the previous day were also asked whether they communicated their sexual intentions directly and assertively (communicating sexual intentions). Response options were *yes* (1) and *no* (0). Walking with friends and going home included a third response option for participants who drank at home (“I did not go out”). Leaving troublesome parties included an additional response option for participants who were not in that situation (“there was not trouble or fights”).

Consistency of use was calculated for each PBS by dividing the total number of days the PBS was used by the total number of drinking days the participant indicated it was applicable. Scores ranged from 0 (never used) to 1 (used on 100% of days). Because division by zero is undefined, participants who indicated that a PBS was not applicable on any of their drinking days did not receive a consistency score for that PBS.

PBS-IQ. For each PBS they endorsed using on the previous day, participants received follow-up items asking about specific steps they took that would have enabled them to implement the PBS at a higher quality level. For example, participants who indicated going home were asked, “On Thursday, did you also... Have a schedule in mind before you went out? and Make sure you had a way to get home at your designated time?”. Response options were *yes* (1) and *no* (0). Endorsed items were summed to obtain the total number of steps performed for each PBS on each drinking day. Subscale scores were computed for the PBS leaving troublesome parties (having an exit strategy, being uninvolved) and watching drinks (learning drink content, not consuming unwatched drinks). Subscales were informed by prior factor analyses (see Paper One).

Alcohol-Related Consequences. Participants were asked to indicate whether they experienced each of 19 alcohol-related consequences on the previous day. Items were adapted from the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong, & Colder, 2006) and the Young Adult Alcohol Problem Screening Test (YAAPST; Hurlbut & Sher, 1992; Larimer, Lydum, Anderson, & Turner, 1999; Wood,

Johnson, & Sher, 1992). Response options were *yes* (1) and *no* (0). Endorsed items were summed to obtain a composite consequence score and scores on established YAACQ subscales for each drinking day. Risk consequences consisted of taking foolish risks, doing impulsive things, driving under the influence, and getting into a physical fight. Social consequences included saying or doing embarrassing things, becoming rude, obnoxious, or insulting, and experiencing relationship problems. Physical consequences were vomiting, passing out, blacking out, and waking up in an unexpected place.

Screening and Demographic Items. The screening survey assessed study eligibility (i.e., age, current enrollment, year in school, alcohol use, ALC+ use). Participants were also asked to report demographics, including birth sex, gender identity, sexual orientation, race, ethnicity, and involvement in extracurricular activities.

Data Analyses

Data were characterized by repeated observations of daily events, which were nested within each participant. Analyses used multilevel modeling (MLM) as implemented in SAS (version 9.4; SAS Institute Inc., 2014). MLM accommodates nested data, which violates the OLS assumption of independence. It also readily handles unbalanced data, such as when participants provide varying numbers of daily observations (i.e., events). Because outcomes (i.e., consequences) were positively skewed count variables, the PROC GLIMMIX procedure was used to model overdispersed Poisson distributions (SAS Institute Inc., 2009; Snijders & Bosker, 1999). The log estimates of the intercept and coefficients were exponentiated to obtain incident rate ratios (IRRs), which enabled results to be interpreted in terms of the likelihood of experiencing consequences.

Preliminary Analyses. Descriptive statistics were calculated for study variables. Unconditional means (i.e., empty) models were examined to estimate the intraclass correlation coefficient (ICC), or the proportion of the total variance that was attributable to

between-person (Level 2) and within-person (Level 1) differences, for each event-level outcome and predictor.

Centering Procedures. Prior to modeling, consistency constructs were grand mean-centered. Centering procedures were also performed for each PBS-IQ construct to assist with parsing out between- and within-person effects (Raudenbush & Bryk, 2002).

Observations were first centered on the grand-mean (i.e., mean of all observations). Next, the grand mean-centered version of the variable was used to calculate person-means (i.e., individuals' means across days). Finally, person-means were subtracted from the grand mean-centered variable to obtain person mean-centered variables.

Aims 1 and 2: To examine between- and within-person associations between PBS implementation (quality, consistency) and consequences. A total of 8 PBS were assessed: 1) walking with friends, 2) going home, 3) having an exit strategy, 4) being uninvolved in trouble or fights, 5) learning drink content, 6) not consuming unwatched drinks, 7) knowing drink location, and 8) communicating sexual intentions. Each PBS was examined in 4 separate models, predicting total, risk, social, and physical consequences. Thus, there were a total of 32 models.

Within each model, Level 2 variables included average (person-mean) implementation quality and grand mean-centered consistency. These were used to answer the questions of whether the likelihood of experiencing consequences is lower for individuals who: 1) have higher mean implementation quality or 2) use the PBS more consistently, on average (Aim 1; between-person associations). At Level 1, daily (person mean-centered) implementation quality was used to answer the question of whether individuals are less likely to experience consequences on days when they report higher implementation quality (Aim 2; within-person associations). To control for the fixed effect of time, a dummy coded variable representing the weekend of data collection (1, 2, 3, or 4) was included in all models as a Level 1 covariate.

Aim 3: To determine whether relationships between PBS implementation quality and consequences are moderated by the consistency of PBS use. If a significant between-person association of quality and consequences was found in Aim 1, a product term for average quality \times consistency (Level 2 \times Level 2 interaction) was added to the model. If a significant within-person association of quality and consequences was found in Aim 2, a product term for daily quality \times consistency (Level 1 \times Level 2 interaction) was added to the model. There was only one model where both between- and within-person associations were found. In that model, interactions were examined one at a time.

Results

Preliminary Analyses

A total of 1,334 drinking events were observed across participants over the four weekends. Each participant reported between 1 and 12 drinking days ($M = 5.02$; $SD = 2.73$). Table 3.1 provides descriptive statistics for study variables. The top panel includes information on the consistency of PBS use, which was calculated for each PBS by dividing the total number of days the PBS was used by the total number of drinking days it was applicable. On average, participants used knowing drink location, walking with friends, and communicating sexual intentions on over 80% of days and watched their drinks on 70% of days. They were less consistent in their use of leaving troublesome parties (49% of days) and going home (35% of days). The bottom panel of Table 3.1 provides information on the PBS-IQ and consequence scales. Across PBS, at least one PBS-IQ step was endorsed on the majority of events. At least one consequence was reported on 44.5% of the drinking events. Risk consequences were reported most often (26.2% of events), followed by social and physical consequences (23.1% and 21.1% of events, respectively).

Table 3.1. Descriptive Statistics for Study Variables.

	Total People	<i>M</i>	<i>SD</i>
Consistency of PBS Use			
Walking with friends	251	0.87	0.22
Going home	252	0.35	0.37
Leaving troublesome parties (Having an exit strategy, being uninvolved)	113	0.49	0.46
Watching drinks (Learning drink content, not consuming unwatched drinks)	267	0.70	0.31
Knowing drink location	267	0.88	0.24
Communicating sexual intentions	112	0.84	0.33
	Total Events	Number of Events Endorsed	% of Events Endorsed
PBS-IQ			
Walking with friends	965	945	97.9%
Going home	368	343	93.2%
Having an exit strategy	97	86	88.7%
Being uninvolved	97	93	95.9%
Learning drink content	929	642	69.1%
Not consuming unwatched drinks	929	782	84.2%
Knowing drink location	1172	1097	93.6%
Communicating sexual intentions	190	161	84.7%
Alcohol-Related Consequences			
Total	1334	594	44.5%
Risk	1334	349	26.2%
Social	1334	308	23.1%
Physical	1334	281	21.1%

Note. A total of 1,334 drinking events were observed across 267 participants. Participants who indicated that a PBS was not applicable on any of their drinking days did not receive a consistency score. The number of events varied across PBS-IQ scales because participants were not asked about implementation quality on days they did not use the PBS.

Table 3.2 includes estimated variability for consequences and PBS-IQ scales at each level of assessment. All variables had substantial within-person variability, ranging from 46.7% to 89.4% of the total variance.

Table 3.2. Estimated Variability for Outcomes and Predictors at Each Level of Assessment.

Outcomes (Consequences)	Between-Person Variability	Within-Person Variability
Total	28.9%	71.1%
Risk	26.3%	73.7%
Social	22.9%	77.1%
Physical	17.9%	82.1%
Predictors (PBS-IQ Scales)	Between-Person Variability	Within-Person Variability
Walking with friends	42.3%	57.7%
Going home	34.8%	65.2%
Having an exit strategy	52.1%	47.9%
Being uninvolved	10.6%	89.4%
Learning drink content	53.3%	46.7%
Not consuming unwatched drinks	25.9%	74.1%
Knowing drink location	14.1%	85.9%
Communicating sexual intentions	27.9%	72.1%

Multilevel Models Predicting Consequences

Tables 3.3 to 3.6 present the results of 14 multilevel models where significant effects were found for quality or consistency, organized by consequence type and PBS-IQ scale. Eighteen models where no significant effects were found are not shown. Table 3.7 at the end of this section provides a summary of support for each hypothesis.

Table 3.3. Fixed Effects and Incident Rate Ratios (IRRs) for Multilevel Models Predicting Total Consequences.

Fixed Effects	Communicating sexual intentions			Going home			Knowing drink location			Walking with friends		
	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR
Intercept	0.80 (0.18)	<.0001	2.23	-0.26 (0.23)	.257	0.77	-0.12 (0.10)	.223	0.89	0.001 (0.10)	.995	1.00
Level 2												
Average Quality	-0.28 (0.10)	.006	0.76	-0.46 (0.14)	.002	0.63	0.08 (0.19)	.668	1.08	-0.19 (0.14)	.153	0.83
Consistency	-1.72 (0.64)	.009	0.18	0.19 (0.42)	.646	1.21	-1.28 (0.39)	.001	0.28	-1.14 (0.39)	.004	0.32
Level 1												
Daily Quality	-0.25 (0.10)	.015	0.78	-0.15 (0.12)	.239	0.86	0.01 (0.09)	.900	1.01	-0.04 (0.09)	.623	0.96
Weekend of Data Collection												
2	-0.39 (0.20)	.061	0.68	-0.21 (0.22)	.344	0.81	-0.07 (0.11)	.542	0.93	-0.10 (0.11)	.350	0.90
3	-0.37 (0.22)	.097	0.69	-0.24 (0.21)	.256	0.79	-0.25 (0.12)	.028	0.78	-0.19 (0.11)	.088	0.83
4	-0.39 (0.24)	.105	0.68	-0.77 (0.29)	.008	0.46	-0.24 (0.13)	.054	0.79	-0.25 (0.14)	.064	0.78
1	Ref			Ref			Ref			Ref		

Table 3.4. Fixed Effects and Incident Rate Ratios (IRRs) for Multilevel Models Predicting Risk Consequences.

	Communicating sexual intentions			Going home			Having an exit strategy			Knowing drink location		
Fixed Effects	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR
Intercept	-0.23 (0.19)	.226	0.79	-1.80 (0.32)	<.0001	0.17	-0.65 (0.34)	.056	0.52	-1.31 (0.12)	<.0001	0.27
Level 2												
Average Quality	-0.23 (0.10)	.024	0.79	-0.42 (0.19)	.029	0.66	-0.46 (0.21)	.036	0.63	0.12 (0.24)	.626	1.13
Consistency	-1.82 (0.63)	.005	0.16	0.62 (0.55)	.257	1.86	-0.10 (0.66)	.878	0.90	-1.37 (0.47)	.004	0.25
Level 1												
Daily Quality	-0.26 (0.14)	.078	0.77	-0.08 (0.17)	.624	0.92	0.05 (0.40)	.912	1.05	0.04 (0.13)	.761	1.04
Weekend of Data Collection												
2	-0.29 (0.26)	.258	0.75	-0.19 (0.28)	.495	0.83	0.32 (0.35)	.358	1.38	-0.15 (0.14)	.306	0.86
3	-0.46 (0.29)	.114	0.63	-0.46 (0.29)	.109	0.63	0.13 (0.34)	.717	1.14	-0.38 (0.15)	.014	0.68
4	-0.79 (0.34)	.024	0.45	-0.75 (0.37)	.043	0.47	-0.21 (0.57)	.718	0.81	-0.36 (0.17)	.031	0.70
1	Ref			Ref			Ref			Ref		

Table 3.5. Fixed Effects and Incident Rate Ratios (IRRs) for Multilevel Models Predicting Social Consequences.

Fixed Effects	Communicating sexual intentions			Going home			Having an exit strategy			Knowing drink location		
	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR
Intercept	-0.68 (0.30)	.025	0.51	-1.63 (0.32)	<.0001	0.20	-0.97 (0.41)	.021	0.38	-1.50 (0.14)	<.0001	0.22
Level 2												
Average Quality	-0.13 (0.16)	.405	0.88	-0.59 (0.17)	.001	0.55	-0.67 (0.26)	.014	0.51	0.19 (0.27)	.481	1.21
Consistency	-1.64 (0.96)	.092	0.19	0.26 (0.53)	.630	1.30	-0.51 (0.78)	.524	0.60	-1.43 (0.52)	.007	0.24
Level 1												
Daily Quality	-0.37 (0.16)	.027	0.69	-0.23 (0.17)	.175	0.79	0.46 (0.47)	.336	1.58	-0.25 (0.14)	.069	0.78
Weekend of Data Collection												
2	-0.41 (0.32)	.211	0.66	-0.34 (0.32)	.293	0.71	0.84 (0.43)	.061	2.32	-0.29 (0.16)	.078	0.75
3	-0.47 (0.37)	.208	0.63	-0.01 (0.29)	.977	0.99	0.02 (0.44)	.961	1.02	-0.12 (0.16)	.475	0.89
4	-0.51 (0.39)	.198	0.60	-0.66 (0.39)	.095	0.52	-0.08 (0.69)	.907	0.92	-0.46 (0.19)	.017	0.63
1	Ref			Ref			Ref			Ref		

Table 3.6. Fixed Effects and Incident Rate Ratios (IRRs) for Multilevel Models Predicting Physical Consequences.

Fixed Effects	Communicating sexual intentions			Walking with friends		
	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR
Intercept	-1.15 (0.33)	.001	0.32	-1.64 (0.16)	<.0001	0.19
Level 2						
Average Quality	-0.34 (0.15)	.027	0.71	-0.07 (0.19)	.715	0.93
Consistency	-1.71 (0.97)	.083	0.18	-1.32 (0.53)	.012	0.27
Level 1						
Daily Quality	-0.03 (0.18)	.857	0.97	-0.08 (0.15)	.587	0.92
Weekend of Data Collection						
2	-0.36 (0.39)	.357	0.70	-0.003 (0.18)	.988	0.99
3	-0.01 (0.38)	.985	0.99	-0.03 (0.18)	.877	0.97
4	0.41 (0.38)	.276	1.51	0.18 (0.20)	.382	1.20
1	Ref			Ref		

Aim 1: Between-Person Associations

The first aim examined between-person associations of PBS implementation (quality, consistency) and consequences.

Quality. When controlling for the effects of consistency and time, individuals who scored higher on quality of communicating sexual intentions, on average, had a lower likelihood of experiencing total, risk, and physical consequences (range IRRs = 0.71-0.79). Individuals who had a higher mean score on quality of going home had a reduced likelihood of reporting total, risk, and social consequences (range IRRs = 0.55-0.66). A higher mean score on quality of having an exit strategy was associated with a lower likelihood of risk and social consequences (range IRRs = 0.51-0.63).

Consistency. After accounting for the effects of quality and time, individuals who communicated their sexual intentions more consistently had a lower likelihood of

experiencing total and risk consequences (range IRRs = 0.16-0.18). Individuals who used the PBS knowing drink location more consistently had a reduced likelihood of total, risk, and social consequences (range IRRs = 0.24-0.28). Individuals who used the PBS walking with friends more consistently were less likely to experience total and physical consequences (range IRRs = 0.27-0.32).

Aim 2: Within-Person Associations

The second aim examined within-person associations between implementation quality and consequences. Within-person associations were found for communicating sexual intentions, after controlling for the effects of consistency and time. As shown in Tables 3.3 and 3.5, on days when individuals took a greater number of steps to communicate their sexual intentions, they had a reduced likelihood of experiencing total and social consequences. Examination of the IRRs suggests that each step performed above one's mean was associated with a 22% decrease in the likelihood of experiencing any consequence (IRR = 0.78) and a 31% decrease in the likelihood of experiencing a social consequence (IRR = 0.69) on that day.

Aim 3: Quality x Consistency Interactions

Consistency did not moderate any of the between- or within-person associations between quality and consequences that were reported above. For the sake of parsimony, the final models do not include interactions.

Table 3.7. Summary of Support for Paper 2 Hypotheses.

Hypothesis	Result
1a.	
Individuals who implement PBS at a higher quality level, on average, will have a lower likelihood of experiencing consequences following drinking episodes than those who implement PBS at a lower quality level.	Supported for the PBS communicating sexual intentions (total, risk, and physical consequences); going home (total, risk, and social consequences); and having an exit strategy (risk and social consequences). (Tables 3.3-3.6)
1b.	
Individuals who implement PBS more consistently, on average, will have a lower likelihood of experiencing consequences following drinking episodes than those who implement PBS less consistently.	Supported for the PBS communicating sexual intentions (total and risk consequences); knowing drink location (total, risk, and social consequences); and walking with friends (total and physical consequences). (Tables 3.3-3.6)
2a.	
On days when individuals report implementing PBS at a higher quality level than they typically do, they will have a lower likelihood of experiencing consequences following drinking episodes.	Supported for the PBS communicating sexual intentions (total and social consequences). (Tables 3.3 & 3.5)

Discussion

Most studies of PBS have utilized cross-sectional or longitudinal, non-diary designs to examine variability in PBS use between individuals (i.e., between-person or average variability) and its association with drinking or consequences (Pearson, 2013). Recent studies have expanded upon this work by utilizing daily diary designs to examine variability in PBS use within individuals across days (i.e., within-person or daily variability), as well as between people (e.g., Lewis et al., 2012; Pearson et al., 2013; Sell et al., 2018). Although diary studies have moved the field toward a more nuanced examination of PBS, they have reported inconsistent associations between PBS use and consequences relative to non-diary studies. Further research examining average and daily variability in PBS may help to clarify these associations.

The current study extended the examination of variability in PBS to include the manner of implementation. Using a daily diary design, it examined associations between the quality and consistency of PBS implementation for specific harm reduction PBS and negative alcohol-related consequences. The study had three aims. The first aim was to examine average associations between quality or consistency and consequences. Regarding quality, it was hypothesized that individuals who implemented PBS at a higher quality level, on average, would be less likely to experience consequences following drinking episodes than those who implemented PBS at a lower quality level. This hypothesis was supported for communicating sexual intentions, going home, and having an exit strategy. After accounting for the effect of consistency, having a higher mean score on any of these PBS was associated with a reduced likelihood of experiencing risk consequences, such as driving under the influence and getting into physical fights. Higher average scores on going home and having an exit strategy were associated with a lower likelihood of social consequences, including embarrassment and interpersonal problems. Individuals who scored higher on communicating sexual intentions were less likely to report physical consequences like vomiting and blacking out. Examination of consequences as a total score revealed that individuals who scored higher on communicating sexual intentions or going home were less likely to experience any consequence.

Regarding consistency, it was hypothesized that individuals who implemented PBS more consistently, on average, would be less likely to experience consequences following drinking episodes than those who implemented PBS less consistently. This hypothesis was supported for communicating sexual intentions, knowing drink location, and walking with friends. When controlling for the effect of quality, more consistent use of any of these PBS was associated with a lower likelihood of experiencing any consequence. Individuals who communicated their sexual intentions or knew the location of their drink on a more consistent basis were less likely to experience risk consequences. Consistency scores for

knowing drink location and walking with friends were also negatively associated with social or physical consequences, respectively.

These findings have important implications for prevention and intervention. First, they build upon prior research by suggesting specific areas of PBS implementation students can work on to help them avoid consequences. Communicating sexual intentions was the only PBS that showed effects for both average quality and consistency. Although students benefited from more consistent use of knowing their drink's location and walking with friends, those who tended to implement these PBS at a higher quality level were not any less likely to experience consequences. The opposite was observed for going home and having an exit strategy. Students who tended to implement these PBS better were less likely to experience certain consequences, but there was no association between consistency and consequences. Thus, efforts to promote the latter PBS may achieve greater benefits from focusing more on one aspect of implementation than the other.

Findings also suggest it would be helpful to assess which consequence types students have experienced in the past and which consequence types they are motivated to avoid in the future, before making specific recommendations for PBS implementation. As summarized in Table 3.8, students who wish to avoid risk consequences may benefit from improving their typical implementation quality for communicating sexual intentions, going home, and having an exit strategy. Benefits may also be gained from more consistently communicating their sexual intentions or knowing their drink's location. If the goal is to avoid social consequences, students may benefit from improving their typical implementation of going home and having an exit strategy, as well as knowing their drink's location more consistently. The likelihood of physical consequences can be reduced with improved implementation of communicating sexual intentions and more consistent use of walking with friends. Students who wish to experience fewer consequences in general could benefit from improving their implementation of communicating sexual intentions and going home and

being more consistent in their communication of sexual intentions, knowing their drink's location, and walking with friends.

The second aim of the study was to examine daily associations between implementation quality and consequences. It was expected that, controlling for consistency of use, individuals would be less likely to experience consequences following drinking episodes on days when they implemented PBS at a higher quality level than usual. Results revealed individuals were less likely to experience a social consequence or any consequence from the total scale on days when they scored higher on communicating sexual intentions. More specifically, performing just one additional step beyond one's typical number of steps was associated with a 31% reduction in the likelihood of experiencing a social consequence and a 22% reduction in the likelihood of experiencing any consequence. This suggests that prevention and intervention efforts could ask students to reflect on how well they typically communicate their sexual intentions (e.g., by having them check off steps they usually take). Students could then be encouraged to monitor their communication on days when sexual situations arise to determine if it falls short of their usual implementation quality and they need to "step it up".

Table 3.8. Summary of Associations Between PBS Implementation and Consequences.

Protective Behavioral Strategy	Total Consequences			Risk Consequences			Social Consequences			Physical Consequences		
	Quality		Consist.	Quality		Consist.	Quality		Consist.	Quality		Consist.
	Avg.	Daily		Avg.	Daily		Avg.	Daily		Avg.	Daily	
Communicating sexual intentions	✓	✓	✓	✓		✓		✓		✓		
Going home	✓			✓				✓				
Having an exit strategy				✓				✓				
Knowing drink location			✓			✓			✓			
Walking with friends			✓									✓

Note. Avg. = Average; Consist. = Consistency. The presence of a check mark means that an association was observed between implementation and consequences. All associations were negative, such that a higher implementation score predicted a lower likelihood of experiencing consequences.

The third aim was to determine whether consistency of use moderated associations between implementation quality and consequences. Although no significant interaction effects were found, future research may benefit from examining the combined effects of different levels of quality and consistency on the efficacy of PBS. Understanding how quality and consistency collectively influence efficacy would enable prevention and intervention efforts to be tailored based on PBS users' strengths and weaknesses. For example, assuming that a given PBS is found to be most effective in reducing consequences when it is implemented at the highest quality level and most consistently, students who do neither could be trained on how to improve both aspects of implementation. Students who already implement the PBS at the highest quality level but use it inconsistently could be reinforced for their high-quality implementation and encouraged to engage in more consistent use. Students who already implement the PBS consistently but at a low-quality level could be reinforced for their consistent use and taught how to implement the PBS in a higher quality manner.

Previous research has shown that personality traits such as impulsivity predict frequency of PBS use (e.g., Pearson, Kite, & Henson, 2012). It is plausible that stable individual differences influence the quality and consistency of PBS implementation. To the extent this is true, it could pose some challenges for intervention. However, the current study found consistent findings when controlling for impulsivity and excluded it from the final models for parsimony. Future research should explore other possible third variables that may be associated with quality and consistency. It would be especially valuable to examine predictors that are amenable to change and thus would make good entry points for intervention (e.g., drinking motives; normative beliefs about PBS; see Pearson, 2013 for a review).

Limitations and Future Directions

The current study expanded on prior diary research examining variability in harm reduction PBS and its association with consequences. Previous diary studies have examined variability in PBS use, defined as the total number of harm reduction PBS endorsed, and its association with total consequences. These studies found no association between average use of harm reduction PBS and consequences. They reported positive associations between daily use of harm reduction PBS and consequences, such that individuals experienced more consequences on days when they used more harm reduction PBS than usual (Lewis et al., 2012; Pearson et al., 2013).

In contrast, the current study examined variability in the quality and consistency of implementation for specific harm reduction PBS and its association with a variety of consequence types. Using these more nuanced methods, the current study obtained more consistent findings than those reported in prior diary studies. It found negative associations between average implementation of PBS and consequences, such that people who scored higher on quality or consistency of implementing certain PBS, on average, were less likely to experience certain consequences. It also found negative associations between daily implementation of the PBS communicating sexual intentions and consequences, such that individuals were less likely to experience social consequences or any of the consequences from the total consequence scale on days when they took a greater number of steps to communicate their sexual intentions.

Despite the current study's strengths, there were some limitations that should be addressed in future research. First, quality scores were computed by summing the number of steps taken to implement a given PBS. It was assumed that completing more steps reflected higher quality implementation, but there are other possible ways to assess quality. Individual steps could be examined to assess whether some steps are more strongly associated with consequences than others. For the PBS that consist of more than two steps,

specific combinations of steps could be examined to determine whether some combinations are more strongly associated with consequences than others. For example, communicating sexual intentions had three steps to be implemented when sober, which included learning your partner's sexual intentions, obtaining your partner's consent, and communicating your sexual intentions. Future research should examine which individual step and which of the possible combinations of steps are most important to implement. This knowledge would enable health professionals to make specific recommendations (e.g., "Obtaining your partner's consent will be the most critical step in reducing your likelihood of experiencing a consequence").

Next, the current study defined consistency as the number of times one used a PBS across a specific number of applicable drinking events. This approach to measuring consistency is more precise than assessing the frequency of use (e.g., rarely to always), but it did not account for the consistency of using individual steps. For example, consistency calculations accounted for the number of times individuals reported communicating about sexual intentions in general. Consistency was not calculated separately for learning their partner's sexual intentions, obtaining their partner's consent, and communicating their own sexual intentions. Future research should examine associations between the consistency of individual steps and consequences to determine whether it is more important to use some steps consistently than others. Recommendations could then be made regarding specific steps that should be taken more consistently to reduce one's likelihood of experiencing consequences.

Finally, sexual and academic consequences were included in the calculation of total consequences but were not examined as separate subscales due to low endorsement across the 12 study days. This limitation is more germane to diary designs in general than to the present study in particular. Although some consequences have high base rates (e.g., vomiting), others occur less frequently and are more likely to be reported when assessments

cover a greater length of time than is feasible for most diary studies, given respondent burden and cost (e.g., sexual assault; Sell et al., 2018). To the extent resources allow, future diary studies may benefit from examining PBS quality, consistency, and consequences over a slightly longer time period (e.g., 30 days). It would also be informative to examine associations between implementation of PBS designed to reduce alcohol consumption (e.g., limiting drinking PBS) and quantity of alcohol consumed (e.g., number of drinks; estimated BAC). Alcohol consumption was not an outcome in the current study due to its focus on harm reduction PBS meant to reduce alcohol-related consequences rather than drinking itself.

Conclusion

The current study examined between-person (average) and within-person (daily) associations between the quality and consistency of PBS implementation and alcohol-related consequences, using a 12-day diary design. Higher implementation scores (quality and/or consistency) were associated with a lower likelihood of experiencing consequences. Most of the observed associations were between people, referring to differences in typical implementation. Communicating sexual intentions was most reliably associated with consequences. Effects were observed for quality (both average and daily) and consistency of communicating sexual intentions. Implications for prevention/intervention and future research directions were discussed.

References

- Barry, A. E., & Goodson, P. (2011). How college students conceptualize and practice responsible drinking. *Journal of American College Health, 59*(4), 304-312.
- Borsari, B., & Carey, K. B. (2005). Two brief interventions for mandated college students. *Psychology of Addictive Behaviors, 19*(3), 296-302.
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach*. New York, NY: The Guilford Press.
- Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs, July(Suppl 16)*, 12-20.
- Howard, D. E., Griffin, M., Boekeloo, B., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health, 56*(3), 247-254.
- Hurlbut, S. C., & Sher, K. J. (1992). Assessing alcohol problems in college students. *Journal of the American College Health, 41*(2), 49-58.
- Kivlahan, D. R., Marlatt, G. A., Fromme, K., Coppel, D. B., & Williams, E. (1990). Secondary prevention with college drinkers: Evaluation of an alcohol skills training program. *Journal of Consulting and Clinical Psychology, 58*(6), 805-810.
- Larimer, M. E. & Cronce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999-2006. *Addictive Behaviors, 32*(11), 2439-2468.
- Larimer, M. E., Lydum, A. R., Anderson, B. K., & Turner, A. P. (1999). Male and female recipients of unwanted sexual contact in a college student sample: Prevalence rates, alcohol use, and depression symptoms. *Sex Roles, 40*(3-4), 295-308.

- Lewis, M. A., Patrick, M. E., Lee, C. M., Kaysen, D. L., Mittman, A., & Neighbors, C. (2012). Use of protective behavioral strategies and their association to 21st birthday alcohol consumption and related negative consequences: A between- and within-person evaluation. *Psychology of Addictive Behaviors, 26*(2), 179-186.
- Mallett, K. A., Turrisi, R., Hultgren, B. A., Sell, N. M., Reavy, R., & Cleveland, M. J. (2017). When alcohol is only part of the problem: An event-level analysis of negative consequences related to alcohol and other substance use. *Psychology of Addictive Behaviors, 31*(3), 307-314.
- Martens, M. P., Ferrier, A. G., & Cimini, M. D. (2007). Do protective behavioral strategies mediate the relationship between drinking motives and alcohol use in college students? *Journal of Studies on Alcohol and Drugs, 68*(1), 106–114.
- Martens, M. P., Ferrier, A. G., Sheehy, M. J., Corbett, K., Anderson, D. A., & Simmons, A. (2005). Development of the protective behavioral strategies survey. *Journal of Studies on Alcohol, 66*(5), 698-705.
- Mohr, C. D., Armeli, S., Tennen, H., Temple, M., Todd, M., Clark, J., & Carney, M. A. (2005). Moving beyond the keg party: A daily process study of college student drinking motivations. *Psychology of Addictive Behaviors, 19*(4), 392-403.
- Neal, D. J., & Fromme, K. (2007). Hook 'em horns and heavy drinking: Alcohol use and collegiate sports. *Addictive Behaviors, 32*(11), 2681-2693.
- Park, C. L., Armeli, S., & Tennen, H. (2004). The daily stress and coping process and alcohol use among college students. *Journal of Studies on Alcohol, 65*, 126-135.
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review, 33*, 1025-1040.
- Pearson, M. R., D'Lima, G., & Kelley, M. L. (2013). Daily use of protective behavioral strategies and alcohol-related outcomes among college students. *Psychology of Addictive Behaviors, 27*(3), 826-831.

- Pearson, M. R., Kite, B. A., & Henson, J. M. (2012). Unique direct and indirect effects of impulsivity-like traits on alcohol-related outcomes via protective behavioral strategies. *Journal of Drug Education, 42*(4), 425-446.
- Prince, M. A., Carey, K. B., & Maisto, S. A. (2013). Protective behavioral strategies for reducing alcohol involvement: A review of the methodological issues. *Addictive Behaviors, 38*(7), 2343-2351.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Read, J. P., Kahler, C. W., Strong, D. R., & Colder, C. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol, 67*(1), 169-177.
- SAS Institute Inc. (2009). *SAS/STAT 9.2 User's Guide Mixed Modeling*. Retrieved from https://support.sas.com/documentation/cdl/en/statug/63347/HTML/default/viewer.htm#statug_glimmix_sect028.htm
- SAS Institute Inc. (2014). *Base SAS 9.4 Procedures Guide*. Cary, NC: SAS Institute Inc.
- Sell, N. M., Turrisi, R., Scaglione, N. M., Cleveland, M. J., & Mallett, K. A. (2018). Alcohol consumption and use of sexual assault and drinking protective behavioral strategies: A diary study. *Psychology of Women Quarterly, 42*(1), 62-71.
- Snijders, T. A. B., & Bosker, R. J. (1999). *An introduction to basic and advanced multilevel modeling*. London: Sage.
- Walters, T., & Baer, J. (2006). *Talking with college students about alcohol: Motivational strategies for reducing abuse*. New York, NY: The Guilford Press.
- Wood, M. D., Johnson, T. J., & Sher, K. J. (1992). Characteristics of frequent drinking-game participants in college: An exploratory study [Abstract]. *Alcoholism: Clinical and Experimental Research, 16*, 417.

CHAPTER FOUR: PAPER THREE

Examination of Sex as a Moderator of Associations Between Protective Behavioral Strategies Implementation and Alcohol-Related Consequences

College student risky drinking is a major public health problem (Hingson, Zha, & Weitzman, 2009; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2018). Although students of both sexes are at risk for a range of negative alcohol-related consequences, females are particularly vulnerable to alcohol-related harm. Females reach higher blood alcohol concentrations (BACs) than males when consuming equivalent amounts of alcohol. This leads to greater cognitive and motor impairment and places them at increased risk for physical consequences such as vomiting and blacking out (Julien, Advokat, & Comaty, 2014; Nolen-Hoeksema, 2004). Females are also disproportionately affected by alcohol-related sexual consequences, such as sexual assault (e.g., Abbey, 2002) and regretted sexual experiences (Orchowski, Mastroleo, & Borsari, 2012).

Considering their heightened vulnerability to alcohol-related harm, it seems plausible that females have a greater need to use PBS than males. A comprehensive review by Pearson (2013) found sex is one of the most commonly examined predictors of PBS use. The majority of studies have found that female drinkers use more PBS than male drinkers (e.g., Benton et al., 2004; LaBrie, Lac, Kenney, & Mirza, 2011; Lewis, Rees, Logan, Kaysen, & Kilmer, 2010; Nguyen, Walters, Wyatt, & DeJong, 2011). However, the same review noted that research on sex differences in the ability of PBS to reduce consequences is scarce (Pearson, 2013). A few studies have examined sex differences in associations between the frequency of PBS use and consequences. These studies reported that more PBS use was associated with fewer consequences for females, but there was no significant relationship between PBS use and consequences for males (Delva et al., 2004; Lewis et al., 2010; Sutfin et al., 2009).

Quantitative research has yet to explore whether sex differences in the frequency of PBS use generalize to the quality (i.e., how well drinkers use PBS) and consistency of implementation (i.e., how many times drinkers use PBS across a specific number of drinking events). However, qualitative research by Howard, Griffin, Boekeloo, Lake, and Bellows (2007) provided evidence for some sex differences in PBS implementation. The authors found females were more inclined to establish plans for PBS before going out. Their plans typically included strategies for taking care of friends throughout the night (e.g., monitoring friends' alcohol consumption) and getting everyone in the group home safely (e.g., interfering if a friend tried to leave with someone she just met). Females also reported greater vigilance for knowing what was in their drinks. They emphasized the importance of declining drinks from strangers and avoiding "jungle juice" (a slang term for alcoholic punch containing a mixture of liquors that is prepared for group consumption).

In contrast, Howard et al. (2007) found males were less planful about using PBS. While they expressed willingness to help a friend who drank too much, they reported an inclination to deal with these situations as they arose rather than planning ahead for them. Males agreed that it was wise for drinkers to walk home with trusted friends, but tended to believe getting home safely was a more important consideration for females. They demonstrated less concern for drink content, although they mentioned it was advisable to avoid consuming liquor.

Current Study

Paper Two found evidence that individuals who implement harm reduction PBS better and/or use them more consistently have a lower likelihood of experiencing certain consequences. A logical next step is to assess whether these associations are stronger for females than for males. The current study is a brief report that expands upon Paper Two by examining sex as a moderator of between-person (average) associations of PBS implementation (quality or consistency) and consequences.

Aim 1. The first aim of the current study is to examine sex as a moderator of associations between average quality and consequences. These analyses will focus on the three PBS-IQ scales that were found to be associated with consequences in Paper Two: 1) communicating sexual intentions directly and assertively (communicating sexual intentions), 2) going home at a designated time (going home), and 3) having an exit strategy in case trouble or fights break out (having an exit strategy).

Hypotheses

1a. There will be a stronger negative relationship between quality of communicating sexual intentions and consequences for females than for males.

1b. There will be a stronger negative relationship between quality of going home and consequences for females than for males.

1c. There will be a stronger negative relationship between quality of having an exit strategy and consequences for females than for males.

Aim 2. The second aim of the current study is to examine sex as a moderator of associations between consistency and consequences. These analyses will focus on the three consistency constructs that were found to be associated with consequences in Paper Two: 1) communicating sexual intentions directly and assertively (communicating sexual intentions), 2) knowing where one's drink is at all times (knowing drink location), and 3) walking home with friends (walking with friends).

Hypotheses

2a. There will be a stronger negative relationship between consistency of communicating sexual intentions and consequences for females than for males.

2b. There will be a stronger negative relationship between consistency of knowing drink location and consequences for females than for males.

2c. There will be a stronger negative relationship between consistency of walking with friends and consequences for females than for males.

Method

Paper Three utilized the same sample and measures as Paper Two. Methods are described briefly here. For a more detailed description, see Paper Two.

Procedure and Participants

Students from a large, northeastern university ($N = 2000$) were randomly selected from the registrar's database and invited to complete a brief screening survey. The response rate was approximately 30% ($n = 597$), and 52.9% of respondents ($n = 316$) met eligibility criteria. These included: 1) being between ages 18 and 23; 2) being currently enrolled as a traditional freshman, sophomore, junior, or senior; 3) consuming alcohol in the past 90 days; and 4) combining alcohol with another substance (ALC+ use; e.g., nicotine; marijuana) during the past year. Eligible participants were asked to complete a baseline survey and 12 daily diary surveys across four weekends. The current study used the diary surveys. Each diary survey collected data on students' implementation (quality, consistency) of PBS and any alcohol-related consequences that were experienced during the previous day. Over 88% ($n = 280$) of baseline participants completed at least one diary survey. Significantly more females than males participated in the diary surveys ($X^2(1) = 6.21, p = 0.01$). The final sample consisted of 267 students who reported drinking on at least 1 of the 12 days. The mean age at baseline was 19.58 ($SD = 1.15$) years old. Participants primarily identified as female (67.0%), Caucasian (84.6%), and heterosexual (89.5%). Less than 1% of participants identified as transgender.

Measures

Consistency of PBS Use. Consistency of use was calculated for each PBS by dividing the total number of days it was used by the total number of drinking days the participant indicated it was applicable. Scores ranged from 0 (never used) to 1 (used on 100% of days).

PBS-IQ. For each PBS they endorsed using on the previous day, participants were asked to select specific steps they took that would have enabled them to implement the PBS at a higher quality level. Endorsed items were summed to obtain the total number of steps performed for each PBS on each day.

Alcohol-Related Consequences. Participants were asked to indicate whether they experienced each of 19 alcohol-related consequences on the previous day. These were adapted from the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong, & Colder, 2006) and the Young Adult Alcohol Problem Screening Test (YAAPST; Hurlbut & Sher, 1992; Larimer, Lydum, Anderson, & Turner, 1999; Wood, Johnson, & Sher, 1992). Endorsed items were summed to obtain a composite consequence score and scores on established YAACQ subscales for each day. Subscales included risk (e.g., taking foolish risks), social (e.g., experiencing relationship problems), and physical consequences (e.g., vomiting).

Data Analyses

Analyses used multilevel modeling (MLM) in SAS (version 9.4; SAS Institute Inc., 2014) to account for the nested nature of the data. Because consequences were positively skewed count variables, the PROC GLIMMIX procedure was used to model overdispersed Poisson distributions (SAS Institute Inc., 2009; Snijders & Bosker, 1999). Log estimates were exponentiated to obtain incident rate ratios (IRRs), which enabled results to be interpreted in terms of the likelihood of experiencing consequences.

Preliminary Analyses. T-tests were conducted to compare females and males on mean PBS consistency. Event frequencies for implementing PBS-IQ steps and experiencing alcohol-related consequences were examined by sex.

Aims 1 and 2: Moderation Analyses. There were a total of 13 models where a between-person association was found between PBS implementation quality and/or consistency and consequences in Paper Two. Table 4.1 summarizes these associations.

Table 4.1. Summary of Between-Person (Average) Associations of PBS Implementation and Consequences Reported in Paper Two.

	Total Consequences	Risk Consequences	Social Consequences	Physical Consequences
Communicating sexual intentions	Quality, Consistency	Quality, Consistency		Quality
Going home	Quality	Quality	Quality	
Having an exit strategy		Quality	Quality	
Knowing drink location	Consistency	Consistency	Consistency	
Walking with friends	Consistency			Consistency

Note. Table summarizes which implementation constructs were associated with each consequence type. All associations were negative, such that a higher implementation score predicted a lower likelihood of experiencing consequences.

First, sex was added to each of the models as a Level 2 (between-person) variable. Males were selected as the reference group. Models controlled for average quality and consistency (Level 2; between-person variables), as well as daily quality and weekend of data collection (Level 1; within-person variables). Next, a product term for implementation \times sex (Level 2 \times Level 2 interaction) was added to each model. A product term for average quality \times sex was added to the 6 models where quality, but not consistency was associated with consequences. A product term for consistency \times sex was added to the 5 models where consistency, but not quality was associated with consequences. There were 2 models where both quality and consistency (i.e., communicating sexual intentions) were associated with consequences. Those models were run twice, once using a product term for average quality \times sex and once using a product term for consistency \times sex, so that interactions could be examined one at a time. Thus, a total of 15 possible interactions were assessed, including 8 quality \times sex interactions and 7 consistency \times sex interactions.

Results

Preliminary Analyses

Mean consistency scores by sex are shown in Table 4.2. There were no significant sex differences on consistency of PBS use.

Table 4.2. Results of *t*-tests Comparing Females and Males on Mean PBS Consistency.

Consistency of PBS Use	Overall		Females		Males		<i>t</i> -value	95% CI
	<i>n</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>M</i> (<i>SD</i>)	<i>n</i>	<i>M</i> (<i>SD</i>)		
Knowing drink location	267	0.88 (0.24)	179	0.90 (0.22)	88	0.84 (0.28)	1.70	-0.01 to 0.12
Walking with friends	251	0.87 (0.22)	169	0.88 (0.21)	82	0.84 (0.25)	1.08	-0.03 to 0.10
Going home	252	0.35 (0.37)	169	0.35 (0.36)	83	0.34 (0.38)	0.22	-0.09 to 0.11
Communicating sexual intentions	112	0.84 (0.33)	79	0.86 (0.30)	33	0.79 (0.40)	0.93	-0.08 to 0.23
Having an exit strategy	113	0.49 (0.46)	78	0.54 (0.46)	35	0.39 (0.47)	1.57	-0.04 to 0.33

Note. Of the 267 participants, 67.0% ($n = 179$) were female and 33.0% ($n = 88$) were male. Because division by zero is undefined, participants who indicated that a PBS was not applicable on any of their drinking days did not receive a consistency score for that PBS.

The top panel of Table 4.3 shows the number of events on which participants endorsed at least one PBS-IQ item (score > 0), broken down by PBS-IQ scale and sex. Both females and males endorsed PBS-IQ items on the majority of events. The bottom panel of Table 4.3 shows the number of events on which participants endorsed at least one consequence (score > 0), broken down by consequence scale and sex. Females endorsed each consequence type at a higher rate than males, although consequences were not endorsed on the majority of events.

Table 4.3. Event Frequencies by Sex.

	Female			Male		
	Number of Events Endorsed	Total Events	% of Total Events Endorsed	Number of Events Endorsed	Total Events	% of Total Events Endorsed
PBS-IQ						
Knowing drink location	748	793	94.3%	349	379	92.1%
Walking with friends	675	683	98.8%	270	282	95.7%
Going home	246	269	91.4%	97	99	98.0%
Communicating sexual intentions	115	140	82.1%	46	50	92.0%
Having an exit strategy	61	72	84.7%	25	25	100.0%
Alcohol-Related Consequences	Female			Male		
	Number of Events Endorsed	Total Events	% of Total Events Endorsed	Number of Events Endorsed	Total Events	% of Total Events Endorsed
Total	427	895	47.7%	167	439	38.0%
Risk	255	895	28.5%	94	439	21.4%
Social	240	895	26.8%	68	439	15.5%
Physical	217	895	24.2%	64	439	14.6%

Note. The total number of events varied for PBS-IQ scales because participants were not asked about implementation quality on days they did not use the PBS.

Aims 1 and 2: Moderation Analyses

None of the quality \times sex or consistency \times sex interactions were significant. For the sake of parsimony, the final models do not include interaction terms. The results focus on main effects, which were evaluated without any product terms in the models.

Table 4.4 presents the results of 5 multilevel models where main effects were found for sex, organized by PBS-IQ scale and consequence type. Eight models where there were no significant effects for sex are not shown.

Table 4.4. Fixed Effects and Incident Rate Ratios (IRRs) for Multilevel Models Where Sex had Unique Effects on Consequences.

PBS	Knowing drink location						Walking with friends						Communicating sexual intentions		
Outcome	Total Consequences			Social Consequences			Total Consequences			Physical Consequences			Physical Consequences		
Fixed Effects	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR	Estimate (S.E.)	<i>p</i>	IRR
Intercept	-0.40 (0.14)	.007	0.67	-1.87 (0.21)	.000	0.15	-0.26 (0.15)	.093	0.77	-2.14 (0.24)	.000	0.12	-1.78 (0.47)	.000	0.17
Level 2															
Average Quality	0.03 (0.19)	.890	1.03	0.11 (0.26)	.673	1.12	-0.27 (0.14)	.051	0.76	-0.21 (0.20)	.298	0.81	-0.25 (0.15)	.088	0.78
Consistency	-1.31 (0.38)	.001	0.27	-1.45 (0.51)	.005	0.23	-1.14 (0.39)	.004	0.32	-1.36 (0.53)	.011	0.26	-1.60 (0.95)	.095	0.20
Sex															
Female	0.40 (0.15)	.007	1.49	0.56 (0.21)	.008	1.75	0.37 (0.16)	.020	1.45	0.70 (0.23)	.002	2.01	0.91 (0.44)	.039	2.48
Male	Ref			Ref			Ref			Ref			Ref		
Level 1															
Daily Quality	0.01 (0.09)	.896	1.01	-0.25 (0.14)	.066	0.78	-0.04 (0.09)	.620	0.96	-0.08 (0.15)	.599	0.92	-0.03 (0.18)	.864	0.97
Weekend of Data Collection															
2	-0.07 (0.11)	.549	0.93	-0.29 (0.16)	.074	0.75	-0.10 (0.11)	.366	0.90	0.002 (0.18)	.991	1.00	-0.43 (0.39)	.265	0.65
3	-0.25 (0.12)	.030	0.78	-0.12 (0.16)	.471	0.89	-0.19 (0.11)	.091	0.83	-0.03 (0.18)	.881	0.97	-0.09 (0.37)	.819	0.91
4	-0.23 (0.13)	.067	0.79	-0.45 (0.19)	.020	0.64	-0.25 (0.14)	.070	0.78	0.19 (0.20)	.348	1.21	0.35 (0.37)	.356	1.42
1	Ref			Ref			Ref			Ref			Ref		

Main Effects

Sex. Although sex did not moderate associations between PBS quality or consistency and consequences, it had significant, unique effects on consequences after accounting for the quality and consistency of implementation.

Females had a higher likelihood of experiencing consequences than males when accounting for implementation of the PBS knowing drink location, walking with friends, or communicating sexual intentions. When implementation of knowing drink location was controlled, females were more likely than males to report experiencing social consequences (IRR = 1.75) and consequences from the total consequence scale (IRR = 1.49). When controlling for their implementation of walking with friends, females were more likely than males to experience physical consequences (IRR = 2.01) and any of the total consequences (IRR = 1.45). After accounting for their implementation of communicating sexual intentions, females were more likely than males to experience physical consequences (IRR = 2.48).

Quality and Consistency. Although Paper Two found average quality of communicating sexual intentions was associated with physical consequences, this effect was no longer significant after adding sex to the model ($p = 0.09$). All other quality and consistency effects reported in Paper Two were consistent when controlling for sex.

Discussion

Previous studies have concurred that females use PBS more frequently than males (Pearson, 2013). Although limited research has been done to examine sex differences in the association between PBS use and consequences, three studies found this association was stronger for females than for males (Delva et al., 2004; Lewis et al., 2010; Sutfin et al., 2009). The current study expanded upon prior research by examining whether sex moderated associations between the quality or consistency of PBS implementation and consequences. Based on the aforementioned quantitative studies and a qualitative study by Howard et al. (2007) which found females tended to be more planful and vigilant about

implementing PBS than males, it was hypothesized that associations between PBS-IQ scales (i.e., communicating sexual intentions, going home, having an exit strategy) and consequences would be stronger for females. It was also hypothesized that associations between consistency of PBS use (i.e., communicating sexual intentions, knowing drink location, walking with friends) and consequences would be stronger for females.

Results indicated that sex did not moderate associations between PBS implementation and consequences. There are notable methodological differences between prior studies and the current study which may help to explain why the hypotheses were not supported. First, previous studies have tended to examine the frequency of PBS use, rather than the quality and consistency of implementation. Second, previous studies have used cross-sectional methods (Delva et al., 2004; Howard et al., 2007) or non-diary, longitudinal designs (Lewis et al., 2010; Sutfin et al., 2009). Finally, previous studies have used lower risk samples. Howard et al. (2007) included non-drinkers in their focus groups. The other studies required that participants be current drinkers, but did not screen them for ALC+ use (Delva et al., 2004; Lewis et al., 2010; Sutfin et al., 2009).

Importantly, sex had unique effects on consequences. Findings suggested female drinkers were more susceptible to consequences even when their implementation of PBS was considered. The strongest sex effects were observed in the models predicting physical consequences. After accounting for implementation of the PBS walking with friends or communicating sexual intentions, females were more than twice as likely as males to experience physical consequences. Females were also more likely than males to experience social consequences when controlling for their implementation of knowing drink location, and to experience any of the total consequences when controlling for their implementation of walking with friends or knowing drink location. Regarding the unique effects of PBS, quality of communicating sexual intentions was not uniquely associated with physical consequences. However, all other effects previously reported in Paper Two

remained significant when controlling for sex, suggesting that quality and consistency of PBS implementation accounted for unique variance in consequences.

Limitations and Future Research Directions

The current study used a rigorous, 12-day diary design to examine sex differences in associations between two novel aspects of PBS, the quality and consistency of implementation, and consequences. Despite its strengths, some limitations should be acknowledged. First, the current sample was homogeneous with respect to age, race, sexual orientation, and gender identity. All participants identified as either male or female, and less than 1% of participants identified as transgender. Future research should assess whether the findings generalize to more diverse samples (e.g., sexual minority groups). Second, significantly more females than males who completed the baseline survey went on to complete at least one diary survey. Future longitudinal or diary studies of sex differences may benefit from oversampling males. Third, because the majority of PBS-IQ scales examined in Paper Two (i.e., 7 of 8) were not associated with consequences at the within-person (daily) level, the current study did not explore possible sex differences in within-person associations. Research is needed to examine these before they can be ruled out. Finally, sexual consequences disproportionately affect females, but were not examined as a separate subscale due to low endorsement across the 12 days. Future research should examine sex differences in associations between PBS quality or consistency and sexual consequences. This could be done using traditional cross-sectional or longitudinal designs, as well as diary designs that follow participants over a longer time period (e.g., 30 days) in order to capture consequences with lower base rates.

Conclusion

The current study examined whether sex moderated associations between PBS implementation and negative alcohol-related consequences. Although sex did not moderate these associations, it had unique effects on consequences. After controlling for the quality

and consistency of PBS implementation, females were more susceptible to certain consequences than males. Potential directions for future research were discussed.

References

- Abbey, A. (2002). Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol*, (Suppl. 14), 118-128.
- Benton, S. L., Schmidt, J. L., Newton, F. B., Shin, K., Benton, S. A., & Newton, D. W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol*, 65(1), 115-121
- Delva, J., Smith, M. P., Howell, R. L., Harrison, D. F., Wilke, D., & Jackson, D. L. (2004). A study of the relationship between protective behaviors and drinking consequences among undergraduate college students. *Journal of American College Health*, 53(1), 19-27.
- Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs*, July(Suppl. 16), 12-20.
- Howard, D. E., Griffin, M., Boekeloo, B., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health*, 56(3), 247-254.
- Hurlbut, S. C., & Sher, K. J. (1992). Assessing alcohol problems in college students. *Journal of the American College Health*, 41(2), 49-58.
- Julien, R. M., Advocat, C. D., & Comaty, J. E. (2014). *Julien's primer of drug action* (13th ed.). New York, NY: Worth Publishers.
- LaBrie, J. W., Lac, A., Kenney, S. R., & Mirza, T. (2011). Protective behavioral strategies mediate the effect of drinking motives on alcohol use among heavy drinking college students: Gender and race differences. *Addictive Behaviors*, 36(4), 354–361.
- Larimer, M. E., Lydum, A. R., Anderson, B. K., & Turner, A. P. (1999). Male and female recipients of unwanted sexual contact in a college student sample: Prevalence rates, alcohol use, and depression symptoms. *Sex Roles*, 40(3-4), 295-308.

- Lewis, M. A., Rees, M., Logan, D. E., Kaysen, D. L., & Kilmer, J. R. (2010). Use of drinking protective behavioral strategies in association to sex-related alcohol negative consequences: The mediating role of alcohol consumption. *Psychology of Addictive Behaviors, 24*(2), 229-238.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA) (2018). Fall semester – A time for parents to discuss the risks of college drinking. Retrieved 30 April 2019, from https://www.niaaa.nih.gov/sites/default/files/publications/NIAAA_BacktoCollege_Fact_sheet.pdf
- Nguyen, N., Walters, S. T., Wyatt, T. M., & DeJong, W. (2011). Use and correlates of protective drinking behaviors during the transition to college: Analysis of a national sample. *Addictive Behaviors, 36*(10), 1008-1014.
- Nolen-Hoeksema, S. (2004). Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review, 24*(8), 981-1010.
- Orchowski, L. M., Mastroleo, N. R., & Borsari, B. (2012). Correlates of alcohol-related regretted sex among college students. *Psychology of Addictive Behaviors, 26*(4), 782-790.
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review, 33*, 1025-1040.
- Read, J. P., Kahler, C. W., Strong, D. R., & Colder, C. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol, 67*(1), 169-177.
- SAS Institute Inc. (2009). *SAS/STAT 9.2 User's Guide Mixed Modeling*. Retrieved from https://support.sas.com/documentation/cdl/en/statug/63347/HTML/default/viewer.htm#statug_glimmix_sect028.htm
- SAS Institute Inc. (2014). *Base SAS 9.4 Procedures Guide*. Cary, NC: SAS Institute Inc.

- Snijders, T. A. B., & Bosker, R. J. (1999). *An introduction to basic and advanced multilevel modeling*. London: Sage.
- Sutfin, E. L., Light, L. S., Wagoner, K. G., McCoy, T. P., Thompson, M. P., Rhodes, S. D., & Spittler, H. D. (2009). Protective behaviors and high-risk drinking among entering college freshman. *American Journal of Health Behaviors*, 33(5), 610-619.
- Wood, M. D., Johnson, T. J., & Sher, K. J. (1992). Characteristics of frequent drinking-game participants in college: An exploratory study [Abstract]. *Alcoholism: Clinical and Experimental Research*, 16, 417.

CHAPTER FIVE: GENERAL DISCUSSION

Over the past several decades, research on PBS has made invaluable contributions to the literature on the prevention of risky college student drinking and related problems. Measures have been developed to assess the frequency of PBS use (Prince, Carey, & Maisto, 2013). Studies have identified amenable predictors of PBS use, explored relationships between the frequency of PBS use and alcohol use or negative alcohol-related consequences, and provided data on sex differences in rates of PBS use (Pearson, 2013). Recent studies have used longitudinal, daily diary designs to examine variability in PBS use that occurs both between people (i.e., between-person or average variability) and within individuals across days (i.e., within-person or daily variability), and its association with drinking or consequences (e.g., Lewis et al., 2012; Pearson, D'Lima, & Kelley, 2013; Sell, Turrisi, Scaglione, Cleveland, & Mallett, 2018).

My dissertation extended previous work by examining two novel aspects of PBS: how well college students implement PBS (quality) and how reliable they are at implementing PBS across a given number of days (consistency). Paper One developed and psychometrically tested the PBS-IQ, a measure of implementation quality. Paper Two examined associations between quality or consistency and consequences. Paper Three expanded upon Paper Two by examining sex as a moderator of these associations. This chapter will summarize the most important findings of each paper, discuss implications for prevention/intervention, and offer suggestions for future research directions.

Paper One used qualitative methods (focus groups and an online open-ended survey) to develop the PBS-IQ and quantitative, longitudinal methods (test-retest reliability; construct, criterion-related, and discriminant validity) to psychometrically test it. Focus groups and the open-ended survey offered insight regarding specific steps students took to implement PBS in a high-quality manner. Results did not support theoretically-based

hypotheses that implementation quality would consist of specific characteristics of students' plans to use PBS, including the complexity of their plans, their autonomy in carrying out the steps of their plans, and the vigilance of their plans. Rather, implementation quality was unidimensional for most PBS-IQ scales, including walking with friends, going home, communicating sexual intentions, staying with friends, and knowing drink location. Two scales factored into subscales. These were watching drinks (learning drink content, not consuming unwatched drinks) and leaving troublesome parties (having an exit strategy, being uninvolved). Psychometric analyses provided support for the validity and reliability of the PBS-IQ. The PBS-IQ scales were moderately, positively correlated with PBSS subscales, suggesting they measured related, but distinct constructs (construct validity). They tended to be uncorrelated with social desirability (discriminant validity). Baseline scores were positively correlated with follow-up scores (test-retest reliability).

Paper One's examination of criterion-related validity was focused on sexual consequences (i.e., unprotected and regretted sex). Five PBS-IQ scales, including going home, communicating sexual intentions, having an exit strategy, learning drink content, and not consuming unwatched drinks, were negatively associated with sexual consequences. Three PBS-IQ scales, including communicating sexual intentions, having an exit strategy, and going home, predicted both unprotected and regretted sex when controlling for the frequency of PBS use. These data extend my previous findings on the effects of PBS use on sexual consequences (Sell, Turrisi, Scaglione, Hultgren, & Mallett, 2016) by providing evidence that implementation quality accounts for independent, unique variance over frequency of use.

Considering that previous studies generally have not validated PBS scales for specific consequence types, Paper One's focus on sexual consequences is a strength. However, risky drinkers are vulnerable to a range of other serious consequences. It would

be prudent for future work to cross-validate the PBS-IQ for additional consequences (e.g., sexual assault; physical fights; injuries).

Paper Two utilized a 12-day diary design to examine between-person (average) and within-person (daily) associations between quality or consistency and consequences. Analyses focused on total, risk, social, and physical consequences. There were three key findings. First, individuals who implemented PBS at a higher quality level, on average, had a lower likelihood of experiencing consequences. This was supported for three PBS-IQ scales: communicating sexual intentions (when predicting total, risk, and physical consequences), going home (when predicting total, risk, and social consequences), and having an exit strategy (when predicting risk and social consequences). Notably, these are the same scales that were found to predict both types of sexual consequences when controlling for the frequency of PBS use in Paper One. Although the diary study included sexual consequences in the calculation of total consequences, they were not examined as a separate subscale due to low endorsement across the 12 days. Future work examining associations between average implementation quality and sexual consequences would help to corroborate Paper One's findings. This could be done by conducting a diary study that follows participants over a longer time period, or by using other methods such as cross-sectional or non-diary, longitudinal designs.

The second key finding in Paper Two was that individuals who implemented PBS more consistently, on average, had a lower likelihood of experiencing consequences. This was supported for three PBS: communicating sexual intentions (when predicting total and risk consequences), knowing drink location (when predicting total, risk, and social consequences), and walking with friends (when predicting total and physical consequences). Finally, Paper Two found that individuals had a reduced likelihood of experiencing social consequences or any of the total consequences on days when they communicated about sexual intentions at a higher quality level than usual. Within-person

associations were not observed for the other PBS-IQ scales, although all scales showed ample within-person variability.

It is noteworthy that average quality, daily quality, and consistency of communicating sexual intentions were all associated with experiencing fewer total consequences. Findings suggest it would be highly beneficial to coach students on how to communicate about sexual intentions in a higher quality and more consistent manner. They also suggest specific aspects of PBS implementation (i.e., either quality or consistency) students can improve upon when using the other PBS to help them avoid consequences.

Paper Three expanded upon Paper Two by examining sex as a moderator of associations between quality or consistency and consequences. Analyses focused on sex differences in average associations because the majority of the associations observed in Paper Two were between people. Based on prior research (Delva et al., 2004; Lewis, Rees, Logan, Kaysen, & Kilmer, 2010; Sutfin et al., 2009), it was expected that associations between quality and consequences or consistency and consequences would be stronger for females. However, results indicated sex did not moderate any of the associations. There are notable methodological differences between my diary study and previous studies. More research is needed to examine possible sex differences.

Although sex did not moderate associations between PBS implementation and consequences, it had main effects on consequences. After accounting for implementation of the PBS knowing drink location, female drinkers were more likely to experience social consequences and any of the total consequences than male drinkers. When accounting for their implementation of walking with friends, females were more likely to experience physical consequences and any of the total consequences. Females were also more likely to experience physical consequences when controlling for their implementation of communicating sexual intentions. Paper Three adds to an existing body of literature that shows sex is an important, unique risk factor for experiencing alcohol-related consequences.

Prevention Implications and Future Research Directions

A major theme that emerged in my dissertation was that individuals who implemented PBS better (i.e., in a higher quality manner or more consistently) were less likely to experience consequences. It follows that existing interventions to reduce alcohol-related consequences may benefit from incorporating content that teaches drinkers how to improve their implementation of PBS. One potential application is the brief motivational interview, which elicits behavior change by meeting drinkers where they are and helping them to overcome ambivalence (e.g., Borsari & Carey, 2005; Dimeff, Baer, Kivlahan, & Marlatt, 1999). For example, I envision an intervention where drinkers are interviewed about the safety concerns they have when they go out and which PBS they use to prevent alcohol-related harm. The interviewer reinforces their use of PBS, provides empirically-based suggestions regarding ways to improve implementation, and asks them to rate how willing they would be to adopt each suggested behavioral modification. The interviewer then further gauges their feelings toward the suggestions by providing lower ratings and asking why they did not select those ratings. Finally, the interviewer asks them to identify possible barriers to behavior change and ways to overcome these barriers. The interview concludes with a summary of what was discussed.

There are a number of exciting possibilities for future studies. First, future research can aid in the development of PBS implementation content for brief motivational interviews and other types of interventions by continuing to probe the steps required to implement PBS well. For example, individuals who participated in the qualitative data collection for Paper One indicated that they do the best job with communicating their sexual intentions when they are sober. Future studies should explore what specific information needs to be communicated for this PBS to achieve maximum efficacy. This knowledge could be used to develop content that teaches individuals not only when to communicate their sexual intentions, but also what information to communicate and how to relay it more effectively. In

addition to probing harm reduction PBS further, future studies could examine the steps involved in implementing PBS that are outside the scope of my dissertation. Examples include PBS used to reduce alcohol consumption, such as setting drink limits and pacing drinks.

Second, while my dissertation used a total score for each PBS-IQ scale, it may be informative to examine how individual steps or different combinations of steps relate to specific types of consequences. Future studies may also benefit from examining how the consistency of use for individual steps or various step combinations differentially affects consequences. This knowledge would enable practitioners to make tailored recommendations based on the types of consequences for which students are most at risk.

Finally, future studies should assess whether findings generalize to different subgroups of the population. As in nearly all studies of PBS, my dissertation examined college students (Pearson, 2013). College students tend to drink more heavily than their noncollege peers (Carter, Brandon, & Goldman, 2010). However, noncollege adults have been found to experience more alcohol-related consequences (Quinn & Fromme, 2011). This suggests it would be beneficial to examine associations among quality, consistency, and consequences in noncollege samples. Research is also needed to examine whether these associations are consistent between alcohol-only users and different types of ALC+ users (e.g., combined alcohol and marijuana users).

Conclusion

In summary, the papers presented in my dissertation suggest: 1) The PBS-IQ is a reliable and valid measure of PBS implementation quality that accounts for unique variance in sexual consequences when controlling for the frequency of PBS use; 2) Individuals who implement PBS in a higher quality or more consistent manner are less likely to experience alcohol-related consequences; and 3) Sex does not moderate associations between quality or consistency and consequences, but females are more susceptible to experiencing

consequences after accounting for their implementation of PBS. Interventions may benefit from including content that teaches drinkers how to improve their implementation of PBS. There are several possible directions future research can take to aid in the development of this content.

References for General Introduction and Discussion

- Abbey, A. (2002). Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol*, (Suppl. 14), 118-128.
- Barry, A. E., & Goodson, P. (2011). How college students conceptualize and practice responsible drinking. *Journal of American College Health*, 59(4), 304-312.
- Benton, S. L., Schmidt, J. L., Newton, F. B., Shin, K., Benton, S. A., & Newton, D. W. (2004). College student protective strategies and drinking consequences. *Journal of Studies on Alcohol*, 65(1), 115-121.
- Borsari, B., & Carey, K. B. (2005). Two brief interventions for mandated college students. *Psychology of Addictive Behaviors*, 19(3), 296-302.
- Carter, A. C., Brandon, K. O., & Goldman, M. S. (2010). The college and noncollege experience: A review of the factors that influence drinking behavior in young adulthood. *Journal of Studies on Alcohol and Drugs*, 71, 742-750.
- Delva, J., Smith, M. P., Howell, R. L., Harrison, D. F., Wilke, D., & Jackson, D. L. (2004). A study of the relationship between protective behaviors and drinking consequences among undergraduate college students. *Journal of American College Health*, 53(1), 19-27.
- DeMartini, K. S., Palmer, R. S., Leeman, R. F., Corbin, W. R., Toll, B. A., Fucito, L. M., & O'Malley, S. S. (2013). Drinking less and drinking smarter: Direct and indirect protective strategies in young adults. *Psychology of Addictive Behaviors*, 27(3), 615-626.
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach*. New York, NY: The Guilford Press.

- Ehret, P. J., Ghaidarov, T. M., & LaBrie, J. W. (2013). Can you say no? Examining the relationship between drinking refusal self-efficacy and protective behavioral strategy use on alcohol outcomes. *Addictive Behaviors, 38*(4), 1898-1904.
- Hingson, R., Zha, W., & Smyth, D. (2017). Magnitude and trends in heavy episodic drinking, alcohol-impaired driving, and alcohol-related mortality and overdose hospitalizations among emerging adults of college ages 18–24 in the United States, 1998–2014. *Journal of Studies on Alcohol and Drugs, 78*(4), 540-548.
- Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs, July(Suppl 16)*, 12-20.
- Howard, D. E., Griffin, M., Boekeloo, B., Lake, K., & Bellows, D. (2007). Staying safe while consuming alcohol: A qualitative study of the protective strategies and informational needs of college freshmen. *Journal of American College Health, 56*(3), 247-254.
- Julien, R. M., Advocat, C. D., & Comaty, J. E. (2014). *Julien's primer of drug action* (13th ed.). New York, NY: Worth Publishers.
- Kivlahan, D. R., Marlatt, G. A., Fromme, K., Coppel, D. B., & Williams, E. (1990). Secondary prevention with college drinkers: Evaluation of an alcohol skills training program. *Journal of Consulting and Clinical Psychology, 58*(6), 805-810.
- LaBrie, J. W., Lac, A., Kenney, S. R., & Mirza, T. (2011). Protective behavioral strategies mediate the effect of drinking motives on alcohol use among heavy drinking college students: Gender and race differences. *Addictive Behaviors, 36*(4), 354–361.
- Larimer, M. E. & Crouce, J. M. (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999-2006. *Addictive Behaviors, 32*(11), 2439-2468.

- Lewis, M. A., Rees, M., & Lee, C. M. (2009). Gender-specific normative perceptions of alcohol-related protective behavioral strategies. *Psychology of Addictive Behaviors, 23*(3), 539–545.
- Lewis, M. A., Rees, M., Logan, D. E., Kaysen, D. L., & Kilmer, J. R. (2010). Use of drinking protective behavioral strategies in association to sex-related alcohol negative consequences: The mediating role of alcohol consumption. *Psychology of Addictive Behaviors, 24*(2), 229-238.
- Lewis, M. A., Patrick, M. E., Lee, C. M., Kaysen, D. L., Mittman, A., & Neighbors, C. (2012). Use of protective behavioral strategies and their association to 21st birthday alcohol consumption and related negative consequences: A between- and within-person evaluation. *Psychology of Addictive Behaviors, 26*(2), 179-186.
- Mallett, K. A., Marzell, M., & Turrisi, R. (2011). Is reducing drinking always the answer to reducing consequences in first-year college students? *Journal of Studies on Alcohol and Drugs, 72*, 240-246.
- Mallett, K. A., Turrisi, R., Hultgren, B. A., Sell, N. M., Reavy, R., & Cleveland, M. J. (2017). When alcohol is only part of the problem: An event-level analysis of negative consequences related to alcohol and other substance use. *Psychology of Addictive Behaviors, 31*(3), 307-314.
- Mallett, K. A., Turrisi, R., Trager, B. M., Sell, N., & Linden-Carmichael, A. N. (2019). An examination of consequences among college student drinkers on occasions involving alcohol-only, marijuana-only, or combined alcohol and marijuana use. *Psychology of Addictive Behaviors, 33*(3), 331-336.
- Martens, M. P., Ferrier, A. G., & Cimini, M. D. (2007). Do protective behavioral strategies mediate the relationship between drinking motives and alcohol use in college students? *Journal of Studies on Alcohol and Drugs, 68*(1), 106–114.

- Martens, M. P., Martin, J. L., Littlefield, A. K., Murphy, J. G., & Cimini, M. D. (2011). Changes in protective behavioral strategies and alcohol use among college students. *Drug and Alcohol Dependence, 118*(2-3), 504-507.
- Martens, M. P., Taylor, K. K., Damann, K. M., Page, J. C., Mowry, E. S., & Cimini, M. D. (2004). Protective behavioral strategies when drinking alcohol and their relationship to negative alcohol-related consequences in college students. *Psychology of Addictive Behaviors, 18*(4), 390-393.
- National Institute on Alcohol Abuse and Alcoholism (NIAAA) (2018). Fall semester – A time for parents to discuss the risks of college drinking. Retrieved 30 April 2019, from https://www.niaaa.nih.gov/sites/default/files/publications/NIAAA_BacktoCollege_Fact_sheet.pdf
- Nguyen, N., Walters, S. T., Wyatt, T. M., & DeJong, W. (2011). Use and correlates of protective drinking behaviors during the transition to college: Analysis of a national sample. *Addictive Behaviors, 36*(10), 1008-1014.
- Nolen-Hoeksema, S. (2004). Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review, 24*(8), 981-1010.
- Novik, M. G., & Boekeloo, B. O. (2011). Dimensionality and psychometric analysis of an alcohol protective behavioral strategies scale. *Journal of Drug Education, 41*(1), 65-78.
- Orchowski, L. M., Mastroleo, N. R., & Borsari, B. (2012). Correlates of alcohol-related regretted sex among college students. *Psychology of Addictive Behaviors, 26*(4), 782-790.
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review, 33*, 1025-1040.

- Pearson, M. R., D'Lima, G., & Kelley, M. L. (2013). Daily use of protective behavioral strategies and alcohol-related outcomes among college students. *Psychology of Addictive Behaviors, 27*(3), 826-831.
- Perkins, H. W. (2002). Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol, 14*(s14), 91-100.
- Prince, M. A., Carey, K. B., & Maisto, S. A. (2013). Protective behavioral strategies for reducing alcohol involvement: A review of the methodological issues. *Addictive Behaviors, 38*(7), 2343-2351.
- Quinn, P. D., & Fromme, K. (2011). Alcohol use and related problems among college students and their noncollege peers: The competing roles of personality and peer influence. *Journal of Studies on Alcohol and Drugs, 72*, 622-632.
- Read, J. P., Kahler, C. W., Strong, D. R., & Colder, C. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on Alcohol, 67*(1), 169-177.
- Sell, N. M., Turrisi, R., Scaglione, N. M., Cleveland, M. J., & Mallett, K. A. (2018). Alcohol consumption and use of sexual assault and drinking protective behavioral strategies: A diary study. *Psychology of Women Quarterly, 42*(1), 62-71.
- Sell, N. M., Turrisi, R., Scaglione, N. M., Hultgren, B. A., & Mallett, K. A. (2016). Examining the effects of drinking and interpersonal protective behaviors on unwanted sexual experiences in college women. *Addictive Behaviors, 54*, 40-45.
- Sugarman, D. E., & Carey, K. B. (2007). The relationship between drinking control strategies and college student alcohol use. *Psychology of Addictive Behaviors, 21*(3), 338-345.
- Suffin, E. L., Light, L. S., Wagoner, K. G., McCoy, T. P., Thompson, M. P., Rhodes, S. D., & Spittler, H. D. (2009). Protective behaviors and high-risk drinking among entering college freshman. *American Journal of Health Behaviors, 33*(5), 610-619.

Walters, T., & Baer, J. (2006). *Talking with college students about alcohol: Motivational strategies for reducing abuse*. New York, NY: The Guilford Press.

APPENDIX A

Development of the PBS-IQ

Procedure

Focus Groups. Two focus groups were conducted during the Fall 2017 semester. Students ($N = 225$) were randomly selected from the registrar's list at a large, northeastern university. They were sent an email describing the study, inviting their participation, and providing a URL and PIN for accessing a consent form and brief screening survey. Up to seven email reminders were sent to students who did not complete initially. Students who logged on were directed to an informed consent page. Those who indicated their willingness to continue were routed to the screening survey. Thirty-two students (14.2%) consented and completed the screening. Eleven students (34.4%) met the inclusion criteria of: 1) being between the ages of 18 and 23; 2) being currently enrolled as a traditional freshman, sophomore, junior, or senior; 3) consuming alcohol at least once in the past 90 days; and 4) combining alcohol with another substance (e.g., nicotine; marijuana) at least once during the past year. Eligible individuals were sent an email with the URL to register for a focus group session. Participants who did not initially register received up to four reminder emails and two phone call reminders. Students received a reminder email the day before and a text message the day of their scheduled session. Seven students (63.6%) attended a focus group. They were given the option to handwrite or type their responses to discussion items and were paid \$25 for their time.

Online Open-Ended Survey. A second wave of recruitment occurred in the Spring 2018 semester, using the same procedures. To reduce participant burden, an online qualitative survey was administered instead of holding focus groups. Forty-three of 125 randomly selected students (34.4%) consented and completed the screening. Of these, sixteen (37.2%) qualified. Eligible individuals were sent an email with the URL to complete the survey. Individuals who did not initially complete received up to four reminder emails and two text message reminders. Fifteen students (93.8%) completed the survey and were paid \$25.

Participants

A total of 22 students participated in the focus groups and online open-ended survey. The sample was 20.32 ($SD = 1.21$) years old, on average. The majority identified as female (77.3%; $n = 17$), White (90.9%; $n = 20$), and non-Hispanic (100%; $n = 22$). All class years were represented, including eight sophomores (36.4%), seven seniors (31.8%), six juniors (27.3%), and one freshman (4.5%).

Measures

The same measures were used for the focus group discussion items and the online open-ended survey. Data collection was focused on the eight most frequently endorsed PBS in recent longitudinal studies of college student drinkers (e.g., Mallett et al., 2015; Sell, Turrisi, Scaglione, Hultgren, & Mallett, 2016) (see Appendix B). Participants were asked to list the steps they would take to implement each PBS at a high quality level. To enable in-depth examination of each PBS, the list of PBS was split in half. The first focus group discussed the first four PBS, and the second focus group discussed the last four PBS. Participants who completed the online survey were randomized to receive either the first four PBS or the last four PBS.

Data Analyses

I compiled a comprehensive list of implementation quality items for each PBS. Across the eight PBS, this process yielded a total of 148 items. Two undergraduate research assistants independently reviewed the initial item pool. They were instructed to point out any items that seemed confusing or unclear and offer suggestions on improving item clarity. Two additional research assistants (one master's level and one bachelor's level) reviewed the items together and generated their own suggestions. The master's level research assistant then organized all of the feedback by item and compiled it into a single document. I independently examined the compiled feedback and revised the flagged items, by either adopting the suggested wording or tweaking the suggested wording to further

improve clarity (e.g., correcting awkward or grammatically incorrect language). I then met with a doctoral level researcher and the master's level research assistant to review the changes. If an item still seemed unclear to at least one of us, our team discussed why it was ambiguous and how it might be improved. Further adjustments were made to the item's wording until unanimous approval of the item was achieved.

Finally, at the recommendation of my dissertation committee, I reduced the total number of items. My strategy was to identify sets of two or more items that seemed highly similar or redundant, and retain the item that seemed least ambiguous from each set. For example, I retained "make sure there is at least one person in your group who is willing to walk home with you" and removed "make sure there is a mutual understanding that you and your friends will walk home together". This process reduced the item total from 148 to 65 (see Appendix B for the final list of items).

References

- Mallett, K. A., Turrisi, R., Cleveland, M., Scaglione, N. M., Reavy, R., Sell, N. M., & Varvil-Weld, L. (2015). A dual process examination of alcohol-related consequences among first-year college students. *Journal of Studies on Alcohol and Drugs, 76*(6), 862-871.
- Sell, N. M., Turrisi, R., Scaglione, N. M., Hultgren, B. A., & Mallett, K. A. (2016). Examining the effects of drinking and interpersonal protective behaviors on unwanted sexual experiences in college women. *Addictive Behaviors, 54*, 40-45.

APPENDIX B

Psychometric Testing Measures

Frequency of Protective Behavioral Strategies Use

Instructions for Protective Behavioral Strategies section: The following questions ask about your use of behaviors *when you consume alcohol*. Some of these items may seem repetitive. We apologize for any redundancies. Please answer to the best of your ability to help us understand how you use these behaviors.

Protective Behavioral Strategies Survey (PBSS; Martens et al., 2007)

*SHR = Serious Harm Reduction; SLD = Stopping/Limiting Drinking; MOD = Manner of Drinking

Please indicate the degree to which you engage in the following behaviors when using alcohol or “partying”.						
Never	Rarely	Occasionally	Sometimes	Usually	Always	
1. Use a designated driver (SHR)						
2. Determine not to exceed a set number of drinks (SLD)						
3. Alternate alcoholic and nonalcoholic drinks (SLD)						
4. Have a friend let you know when you have had enough to drink (SLD)						
5. Avoid drinking games (MOD)						
6. Leave the bar/party at a predetermined time (SLD)						
7. Make sure that you go home with a friend (SHR)						
8. Know where your drink has been at all times (SHR)						
9. Drink shots of liquor (reverse-scored; MOD)						
10. Stop drinking at a predetermined time (SLD)						
11. Drink water while drinking alcohol (SLD)						
12. Put extra ice in your drink (SLD)						
13. Avoid mixing different types of alcohol (MOD)						
14. Drink slowly, rather than gulp or chug (MOD)						
15. Avoid trying to “keep up” or “out-drink” others (MOD)						

Strategies Questionnaire (SQ; Sugarman & Carey, 2007)

*SA = Selective Avoidance; SWD = Strategies while Drinking; AD = Alternatives to Drinking

Please indicate how often you have used each behavior in the past 2 weeks.						
Never	Once	2-3 times	4-5 times	6-10 times	more than 10 times	
1. Chose not to participate in drinking games when given the opportunity (SA)						
2. Refused drinks (SA)						
3. Chose not to “pre-game” (i.e., drinking before going out) (SA)						
4. Chose not to do shots when available (SA)						
5. Chose not to funnel, shotgun beers, or do keg stands when those activities were available (SA)						
6. Chose to avoid situations where heavy drinking was likely (SA)						
7. Alternated alcoholic and nonalcoholic beverages when I was drinking (SA)						
8. Ate before and while I was drinking (SWD)						
9. Drank slowly (SWD)						
10. Was aware of internal body sensations that indicated I was getting intoxicated (SWD)						
11. Limited cash before going out to drink (SWD)						
12. Drank beer with a lower alcohol content (light beer) instead of stronger alcoholic						

beverages (SWD)
13. Engaged in activities while drinking to space out drinks (e.g., dancing, playing pool, darts) (SWD)
14. Kept track of how many drinks I had (SWD)
15. Spaced drinks over time (SWD)
16. Limited drinking to certain days of the week (SWD)
17. Avoided carrying credit cards or ATM cards when going out to drink (SWD)
18. Chose to participate in enjoyable activities that did not include alcohol consumption (AD)
19. Practiced ways to be more comfortable in social settings without using alcohol (AD)
20. Found other ways besides drinking to reduce stress (AD)
21. Was prepared with effective coping strategies in situations where I thought heavy drinking was likely (AD)

Implementation Quality for Specific Protective Behavioral Strategies

When drinking alcohol, how often do you...?
Never Rarely Sometimes Usually Always
1. Walk home with a trusted friend or group of friends
2. Watch your drinks being made
3. Arrange not to drive
4. Make sure to go home at a designated time
5. Communicate your sexual intentions directly and assertively
6. Stay with friends at all times
7. Know where your drink has been at all times
8. Leave parties when trouble or fights break out

*****For each PBS endorsed as “rarely” to “always” used in the previous question, participants were asked the corresponding follow-up questions*****

#1 Walking home

When walking home with a trusted friend or group of friends, how often do you...?
Never Rarely Sometimes Usually Always
1. Have a few friends in mind as people you could leave with
2. Make sure there is at least one person in your group who is willing to walk home with you
3. Text friends if you get separated to make sure they have not left without you
4. Leave with someone you feel certain is reliable (e.g., boyfriend, roommate)
5. Identify someone who isn't drinking heavily to walk home with
6. Remind yourself of your plan to leave with friends while you are out
7. Watch friends to get a sense of when they are planning to leave
8. Stay out until your friends are ready to leave so you can leave together
9. Remind friends to let you know if you are not with them at the time they are leaving
10. Other (please describe below)

In the above question you indicated that you do another behavior when walking home with a trusted friend or group of friends. Please specify the other behavior(s).

#2 Watching drinks being made

When watching your drinks being made, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Ask the person making drinks to pour your drink in front of you				
2. Ask the person making drinks what is going into your drink				
3. Ask the person making drinks how strong your drink is				
4. Pay attention to whether the person making your drink appears to be adding anything suspicious				
5. Not look away or become distracted while your drink is being made				
6. Not drink from premixed bowls (e.g., jungle juice)				
7. Not drink from containers you did not open yourself				
8. Other (please describe below)				

In the above question you indicated that you do another behavior when watching your drinks being made. Please specify the other behavior(s).

#3 Arranging not to drive

When arranging not to drive under the influence of alcohol, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Take an Uber, Lyft, cab, or bus				
2. Arrange for pickup by someone who hasn't been drinking (e.g., friends, siblings, parents, other trusted adults)				
3. Keep your phone charged so you can call for a ride				
4. Have a designated driver at the bar/party				
5. Walk to and from the bar/party				
6. Stay at the bar/party until you sober up				
7. Ask someone to take your keys because you are drinking				
8. Not take your car to places where alcohol will be served				
9. Other (please describe below)				

In the above question you indicated that you do another behavior when arranging not to drive under the influence of alcohol. Please specify the other behavior(s).

#4 Making sure to go home at designated time

When making sure to go home at a designated time, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Have a schedule in mind before you go out				
2. Make sure to set a time to go home that would allow you to do everything you have planned for the next day (e.g., classes, homework, time with friends)				
3. Have a good excuse prepared to leave the bar/party early				
4. Tell friends your plan so they will hold you accountable				

5. Make sure you have a way to get home at your designated time
6. Set an alarm on your phone or watch
7. Other (please describe below)

In the above question you indicated that you do another behavior when making sure to go home at a designated time. Please specify the other behavior(s).

#5 Communicating sexual intentions

When communicating your sexual intentions directly and assertively, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Decide in advance what sexual activities you want to engage in that night				
2. Verbally communicate how far you want to go sexually				
3. Tell your partner if something makes you uncomfortable				
4. Communicate your sexual intentions while you are sober				
5. Consent to sexual activities while you are sober				
6. Learn your partner's sexual intentions while they are sober				
7. Obtain your partner's consent while they are sober				
8. Ask friends to check in with you to help prevent a sexual interaction you hadn't intended				
9. Other (please specify below)				

In the above question you indicated that you do another behavior when communicating your sexual intentions directly and assertively. Please specify the other behavior(s).

#6 Staying with friends at all times

When staying with friends at all times, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Discuss a game plan for staying with friends at all times before going out				
2. Meet up with friends when you arrive at the bar/party				
3. Go with your friends when getting/refilling drinks instead of going alone				
4. Ask friends to look for you if you go missing				
5. Make sure to have phone numbers for everyone in the group				
6. Check up on any friends who wander off via texts, calls, etc.				
7. Have a "designated buddy" to stay with				
8. Stay with at least one friend at all times, even when using the bathroom				
9. Not split up or leave without notifying the group				
10. Ask friends not to leave a party/location without you				
11. Other (please describe below)				

In the above question you indicated that you do another behavior when staying with friends at all times. Please specify the other behavior(s).

#7 Knowing where drink is

When knowing where your drink has been at all times, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Keep your drink in your hand				
2. Take your drink to the bathroom with you				
3. Throw out any drink that has been unattended				
4. Get a new drink if you misplace your drink				
5. Dump your drink out if you suspect something happened to it				
6. Not share drinks				
7. Ask trusted friend(s) to watch your drink				
8. Other (please describe below)				

In the above question you indicated that you do another behavior when knowing where your drink has been at all times. Please specify the other behavior(s).

#8 Leaving parties when trouble/fights break out

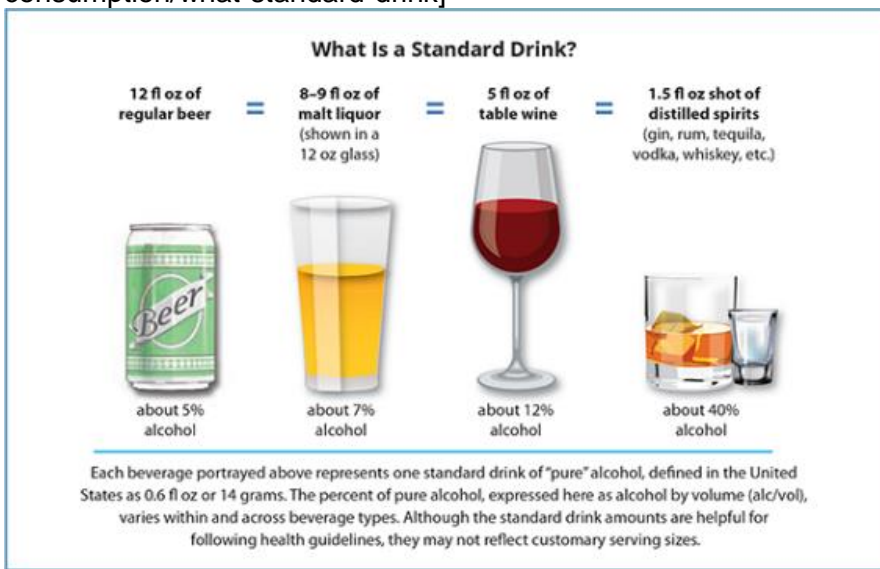
When leaving parties when trouble or fights break out, how often do you...?				
Never	Rarely	Sometimes	Usually	Always
1. Establish a designated meeting place with friends before going out in case you need to leave abruptly				
2. Make sure you know the location of the closest exit				
3. Keep an eye on the party throughout the night to determine if it is getting too wild				
4. Leave at the earliest sign that a fight/violence might break out				
5. Leave when you think you see something illegal or police might get involved				
6. Have someone who is sober let you know when you need to leave				
7. Leave with friends at the closest exit				
8. Text any friends who have not left with you to let them know they should leave				
9. Not get involved				
10. Not try to break up fights				
11. Other (please describe below)				

In the above question you indicated that you do another behavior when leaving parties when trouble or fights break out. Please specify the other behavior(s).

Alcohol Use

Instructions for Alcohol use section: The following questions ask about your current use of alcohol during the PAST MONTH. Please remember that your responses are confidential, and that there are no right or wrong answers. Please provide honest answers to the best of your ability.

PLEASE NOTE: [*this is from* <https://niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/what-standard-drink>]



1) Daily Drinking Questionnaire

Consider a typical week during the PAST MONTH.

How much alcohol, on average (measured in number of drinks), do you drink on each day of a typical week? (Please enter '0' if you do not typically drink on that day.)

1. On a typical **MONDAY**, I have...
2. On a typical **TUESDAY**, I have...
3. On a typical **WEDNESDAY**, I have...
4. On a typical **THURSDAY**, I have...
5. On a typical **FRIDAY**, I have...
6. On a typical **SATURDAY**, I have...
7. On a typical **SUNDAY**, I have...

2) During the past 30 days (about one month), how many times have you gotten drunk or very high from alcohol? (Please make your best estimate).

- a. Never
- b. 1 to 2 times
- c. 3 to 4 times
- d. 5 to 6 times
- e. 7 to 8 times
- f. 9 or more times

Alcohol-Related Consequences

Below is a list of things that sometimes happen to people either during, or after they are under the influence of alcohol or drugs. Please indicate the **number of times** you have had each experience while under the influence of alcohol or drugs **DURING THE PAST SIX MONTHS**.

Never 1 time 2 times 3 times 4-6 times 7-11 times 12-20 times 21-39 times
40 or more times

1. I said or did embarrassing things.
2. I had a hangover (headache, sick stomach) the morning after drinking.
3. I felt very sick to my stomach or threw up.
4. I passed out.
5. I did impulsive things that I later regretted.
6. I got into sexual situations I later regretted.
7. I became very rude, obnoxious, or insulting.
8. I started a serious argument or fight with someone.
9. I made inappropriate sexual advances toward someone.
10. I drove a car when I knew I had too much to drink to drive.
11. I drank more than I originally had planned.
12. I had a blackout (i.e., could not remember hours at a time).
13. I neglected to protect myself or my partner from a sexually transmitted disease (STD) or an unwanted pregnancy.
14. I did not sleep properly.
15. I got into a physical fight.

Social Desirability

Please indicate your level of agreement with each of the following statements.

Strongly disagree Moderately disagree Neither disagree nor agree Moderately agree Strongly agree

1. I never take things that don't belong to me.
2. I have said something bad about a friend behind his or her back. (<i>reverse-scored</i>)
3. I never swear.
4. I don't gossip about other people's business.
5. My first impressions of people usually turn out to be right.
6. I always know why I like things.
7. I have never deliberately told a lie.
8. I do not mind taking orders and being told what to do.
9. I always try to consider the other person's feelings before I do something.
10. I like to boast about my achievements every now and then. (<i>reverse-scored</i>)

Screening Items

- 1) Are you currently enrolled at the Penn State University Park campus?
 - a. Yes
 - b. No
- 2) Age (today): _____ years old
- 3) Birth Sex:
 - a. Male
 - b. Female
 - c. Other (Please specify: _____)
- 4) Racial background:
 - a. Caucasian/White
 - b. Black or African American
 - c. Asian
 - d. Native Hawaiian or other Pacific Islander
 - e. American Indian or Alaska Native
 - f. Multiracial
 - g. Other (Please specify: _____)
- 5) Ethnic background:
 - a. Not Hispanic/Latino
 - b. Hispanic/Latino
- 6) What year in school are you?
 - a. Freshman (1st year)
 - b. Sophomore (2nd year)
 - c. Junior (3rd year)
 - d. Senior (4th year)
 - e. Other (please specify: _____)
- 7) During the past 90 days (3 months), have you had more than a few sips of an alcoholic beverage?
 - a. Yes, I have had an alcoholic drink
 - b. No, I have not had an alcoholic drink
- 8) During the past year, **when you were drinking alcohol**, did you use alcohol in combination with... _____ (that is, so that their effects overlapped)? (YES/NO)
 - a. Nicotine (cigarettes, hookah, chewing tobacco, cigars, vaping, etc.)
 - b. Marijuana (or hashish)
 - c. Cocaine (Coke, crack, etc.)
 - d. Amphetamines (Speed, meth, etc.)
 - e. Energy Drinks (e.g., Red Bull, Monster, etc.)
 - f. Ecstasy, MDMA, Molly
 - g. Sedatives or sleeping pills not prescribed to you or more than prescribed to you (Xanax, Valium, etc.)
 - h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)
 - i. Opioids (Heroin, prescription pain killers not prescribed to you or more than prescribed to you such as Vicodin, OxyContin, oxycodone, etc.)
 - j. ADHD medications not prescribed to you or more than prescribed to you (Adderall, Ritalin, etc.)
 - k. Other drugs (please specify: _____)

DISQUALIFY: Thank you so much for taking the time to answer some questions for us!
Please click "next" to end the survey.

QUALIFY: Congratulations! You have been selected to continue in the study! Please click
"next" to answer some additional questions in this survey. In approximately 2 weeks, you will
be invited to participate in a second survey!

Additional Demographics

- 1) Sexual Orientation
 - a. Straight
 - b. Gay/Lesbian
 - c. Bisexual
 - d. Questioning
 - e. Other (Please specify: _____)
 - f. I prefer not to answer
- 2) Gender Identity:
 - a. Man
 - b. Woman
 - c. Both
 - d. Neither
 - e. Other (Please specify: _____)
 - f. I prefer not to answer
- 3) Height: ____feet ____inches
- 4) Weight: _____ lbs.
- 5) Relationship status
 - a. Single
 - b. Casually dating one person
 - c. Casually dating more than one person
 - d. In a committed relationship
 - e. Engaged
 - f. Married
 - g. Divorced
 - h. Widowed
- 6) If you're CURRENTLY involved in any extracurricular activities, which ones? (please check all that apply)
 - a. I do not participate in any activities
 - b. Academic groups (academic sororities/fraternities, etc.)
 - c. Social Greek organizations (i.e., fraternities/sororities)
 - d. Other social groups (other than sororities/fraternities)
 - e. Volunteer groups (Red Cross, EMT, etc.)
 - f. Religious groups
 - g. Varsity sports
 - h. Intramural sports/Club sports
 - i. Other (please specify: _____)

APPENDIX C

Daily Diary Measures

Alcohol Use

Instructions: The following questions will ask about your alcohol use on [Thursday/Friday/Saturday]. Please remember that your responses are confidential, and that there are no right or wrong answers. Please provide honest answers to the best of your ability. Your responses will help inform efforts to keep students safe.

- 1) Did you drink alcohol on [Thursday/Friday/Saturday]? YES/NO
- 2) Think back to the time you spent under the influence of alcohol on [Thursday/Friday/Saturday]. How many drinks containing alcohol did you consume?
_____ drink(s)

PLEASE NOTE: [*this is from* <https://niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/what-standard-drink>]



- 3) On average, over how many hours were you drinking? _____ hour(s)

PBS Use and Implementation Quality

Instructions: The remaining items will ask about behaviors you may have used to help you be safe when using alcohol on [Thursday/Friday/Saturday]. Some items may seem repetitive, but it is important to provide thoughtful and honest responses to help inform public health efforts. Remember that there are no right or wrong answers. Please answer honestly to help us understand how you use these behaviors.

- 1) When using alcohol on [Thursday/Friday/Saturday], did you walk home with a trusted friend or group of friends? YES/NO/I DID NOT GO OUT
 - a. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Make sure there was at least one person in your group who was willing to walk home with you
2	Make sure your friends had not left without you

3	Leave with someone you felt certain was reliable (e.g., boyfriend or girlfriend, roommate)
---	--

- 2) When using alcohol on [Thursday/Friday/Saturday], did you make sure to go home at a designated time? YES/NO/I DID NOT GO OUT

- a. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Have a schedule in mind before you went out
2	Make sure to set a time to go home that would allow you to do everything you had planned for the next day (e.g., classes, homework, time with friends)
3	Make sure you had a way to get home at your designated time

- 3) When using alcohol on [Thursday/Friday/Saturday], did you leave when trouble or fights broke out? YES/NO/THERE WAS NOT TROUBLE OR FIGHTS

- a. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Make sure you knew the location of the closest exit
2	Keep an eye on the party/location throughout the night to determine if it was getting too wild
3	Not get involved with trouble or fights
4	Not try to break up trouble or fights

- 4) On [Thursday/Friday/Saturday], did you "hook up" or engage in any type of sexual activity? YES/NO

- a. If YES, ask "On [Thursday/Friday/Saturday], did you communicate your sexual intentions directly and assertively?" YES/NO

- i. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Communicate your sexual intentions while you were sober
2	Learn your partner's sexual intentions while they were sober
3	Obtain your partner's consent while they were sober

- 5) On [Thursday/Friday/Saturday], did you watch your drinks being made? YES/NO

- a. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Ask the person making drinks to pour your drink in front of you
2	Ask the person making drinks what was going into your drink
3	Ask the person making drinks how strong your drink was
4	Not drink from premixed bowls (e.g., jungle juice)
5	Not drink from containers you did not open yourself

- 6) On [Thursday/Friday/Saturday], did you know where your drink was at all times?
YES/NO

a. If YES, ask "On [Thursday/Friday/Saturday], did you also...?" YES/NO

1	Not leave your drink unattended
2	Not misplace your drink

Alcohol-Related Consequences

Instructions: The following questions ask about consequences you may have experienced related to your alcohol and/or drug use on [Thursday/Friday/Saturday]. Please remember that your responses are confidential, and that there are no right or wrong answers. Please provide honest answers to the best of your ability. Your responses will help inform efforts to keep students safe.

Below is a list of things that sometimes happen to people either during or after they are under the influence of alcohol and/or drugs. Please indicate whether or not each experience listed below occurred as a result of using alcohol and/or drugs on [Thursday/Friday/Saturday].

As a result of using alcohol and/or drugs on [Thursday/Friday/Saturday]... YES/NO

1	I said or did embarrassing things.
2	I felt very sick to my stomach or threw up.
3	I took foolish risks.
4	I passed out.
5	I did impulsive things.
6	I could not remember large stretches of time.
7	I drove a car when I knew I had too much to drink to drive/when I was high.
8	I did not go to work or missed classes at school.
9	I got into sexual situations I later regretted.
10	I became very rude, obnoxious, or insulting.
11	I woke up in an unexpected place.
12	My alcohol/substance use created problems between myself and my boyfriend/girlfriend/friends, parents.
13	I was in a physical fight.
14	I neglected obligations to family, work, or school.
15	I neglected to use birth control or protect myself from a sexually transmitted infection.

16	I had sex when I really didn't want to.
17	I had sex with someone I wouldn't ordinarily have sex with.
18	I was pressured or forced to have sex with someone because I was too drunk/high to prevent it.
19	I pressured or forced someone to have sex with me after I had been drinking/using drugs.

Screening Items

- 9) Are you currently enrolled at the Penn State University Park campus?
 - a. Yes
 - b. No
- 10) Age (today): _____ years old
- 11) Birth sex:
 - a. Male
 - b. Female
 - c. Other (Please specify: _____)
- 12) Racial background:
 - a. Caucasian/White
 - b. Black or African American
 - c. Asian
 - d. Native Hawaiian or other Pacific Islander
 - e. American Indian or Alaska Native
 - f. Multiracial
 - g. Other (Please specify: _____)
- 13) Ethnic background:
 - a. Not Hispanic/Latino
 - b. Hispanic/Latino
- 14) What year in school are you?
 - a. Freshman (1st year)
 - b. Sophomore (2nd year)
 - c. Junior (3rd year)
 - d. Senior (4th year)
 - e. Other (Please specify: _____)
- 15) During the past 90 days (3 months), have you had more than a few sips of an alcoholic beverage?
 - a. Yes, I have had an alcoholic drink
 - b. No, I have not had an alcoholic drink
- 16) During the past year, **when you were drinking alcohol**, did you use alcohol in combination with _____ (that is, so that their effects overlapped)? (YES/NO)
 - a. Nicotine (cigarettes, hookah, chewing tobacco, cigars, vaping, etc.)
 - b. Marijuana (or hashish)
 - c. Cocaine (Coke, crack, etc.)
 - d. Amphetamines (Speed, meth, etc.)
 - e. Energy drinks (e.g., Red Bull, Monster, etc.)

- f. Ecstasy, MDMA, Molly
- g. Sedatives or sleeping pills not prescribed to you or more than prescribed to you (Xanax, Valium, etc.)
- h. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)
- i. Opioids (Heroin, prescription pain killers not prescribed to you or more than prescribed to you such as Vicodin, OxyContin, oxycodone, etc.)
- j. ADHD medications, not prescribed to you or more than prescribed to you (Adderall, Ritalin, etc.)
- k. Other drugs (Please specify: _____)

DISQUALIFY: Thank you so much for taking the time to answer some questions for us, however, you did not qualify for the study. Please click “next” to end the survey.

QUALIFY: Congratulations! You have been selected to continue in the study! Please click “Next” to answer some additional questions in this survey. You will then be invited to participate in 12 additional surveys over approximately 3 months.

Demographics

- 1) Weight: _____ lbs. (we need this to estimate your BAC)
- 2) Sexual Orientation:
 - a. Straight
 - b. Gay/Lesbian
 - c. Bisexual
 - d. Questioning
 - e. Other, please specify
 - f. I prefer not to answer
- 3) Gender Identity
 - a. Man
 - b. Woman
 - c. Both
 - d. Neither
 - e. Other, please specify
 - f. I prefer not to answer
- 4) What is your academic major? _____
- 5) If you're involved in any extracurricular activities, which ones? (please check all that apply)
 - a. Academic groups (academic sororities/fraternities, etc.)
 - b. Social Greek organizations (i.e., fraternities/sororities)
 - c. Other social groups (other than sororities/fraternities)
 - d. Volunteer groups (Red Cross, EMT, etc.)
 - e. Religious groups
 - f. Varsity sports
 - g. Intramural sports/Club sports
 - h. I do not participate in any activities
 - i. Other (Please specify: _____)

Curriculum Vitae Nichole Marie Sell

Education

2019	Ph.D.	Biobehavioral Health, The Pennsylvania State University
2015	M.S.	Biobehavioral Health, The Pennsylvania State University
2008	M.Ed.	Counseling and Human Services, Lehigh University
2006	B.A.	Psychology, Cedar Crest College

Professional Experience

2013 – 2019	Graduate Research Assistant, PRO Health Lab, Penn State University
2008 – 2013	Adjunct Instructor, Department of Psychology, Northampton Community College & Lehigh Carbon Community College

Selected Awards

2019	Alumni Association Dissertation Award
2017 – 2019	NIH National Research Service Award (NRSA)
2016 – 2018	Hintz Graduate Education Enhancement Fellowship
2016, 2017	Graduate Student Teaching Award
2015 – 2019	Research Society on Alcoholism Student Merit Award
2013	Excellence in Graduate Recruitment Award

Selected Publications

Linden-Carmichael, A. N., Mallett, K. A., **Sell, N. M.**, & Turrisi, R. (in press). Are co-users of alcohol and marijuana more willing to experience consequences from drinking? A longitudinal examination among first-year college students. *Alcoholism: Clinical and Experimental Research*.

Mallett, K. A., Turrisi, R., Trager, B. M., **Sell, N. M.**, & Linden-Carmichael, A. N. (2019). An examination of consequences among college student drinkers on occasions involving alcohol-only, marijuana only, or combined alcohol and marijuana use. *Psychology of Addictive Behaviors*, 33(3), 331-336.

Sell, N. M., Turrisi, R., Scaglione, N. M., Cleveland, M. J., & Mallett, K. A. (2018). Alcohol consumption and use of sexual assault and drinking protective behavioral strategies: A diary study. *Psychology of Women Quarterly*, 42(1), 62-71.

Mallett, K. A., Turrisi, R., Hultgren, B. A., **Sell, N. M.**, Reavy, R., & Cleveland, M. J. (2017). When alcohol is only part of the problem: An event-level analysis of negative consequences related to alcohol and other substance use. *Psychology of Addictive Behaviors*, 31(3), 307-314.

Sell, N. M., Turrisi, R., Scaglione, N. M., Hultgren, B. A., & Mallett, K. A. (2016). Examining the effects of drinking and interpersonal protective behaviors on unwanted sexual experiences in college women. *Addictive Behaviors*, 54, 40-45.