

A Comprehensive Review of Measures of Protective Behavioral Strategies Across Various Risk Factors and Associated PBS-Related Interventions

Roselyn Peterson, Matthew P. Kramer, Daniel Pinto, Ardhys N. De Leon, Angelina V. Leary, Armando A. Marin, Jessica L. Cora, and Robert D. Dvorak
Department of Psychology, University of Central Florida

Harm reduction is a framework that places substance use on a spectrum from total abstinence to continued controlled use. Protective behavioral strategies (PBS) are a set of individually implemented harm reduction strategies that have shown to reduce the rate of use and severity of consequences from risky behaviors. Previous research has shown that PBS use effectively reduces negative consequences. The present study provides an overview of the literature on PBS measures for various risk behaviors, and common interventions used in conjunction with PBS. Of the articles reviewed, 15 validated PBS measures were found and eight distinct categories of PBS interventions. The 15 measures reviewed included risk factors such as alcohol use/consequences ($n = 8$), dating and sexual behaviors ($n = 4$), gambling ($n = 1$), cannabis ($n = 1$), and condom use ($n = 1$). A survey of the literature produced eight distinct categories of interventions with varying degrees of effectiveness: (a) Brief Motivational Interventions, (b) Personalized Normative Feedback, (c) PBS Skills Training, (d) PBS Instruction, (e) Deviance Regulation Theory Interventions, (f) Behavioral Economic Based Interventions, (g) Counterfactual Thinking and (h) Episodic Future Thinking. Findings from the present study corroborate the notion that PBS effectively reduce negative consequences associated with behaviors, such as negative alcohol-related consequences, harmful cannabis use, and adverse sexual outcomes. Research on interventions targeting PBS is lacking in areas outside of alcohol use. Within alcohol use, the utility of interventions varies widely. Understanding the reason for this discrepancy is an important area for future research.

Public Health Significance

Protective behavioral strategies (PBS) reduce negative consequences associated with risk behaviors; including both pharmacological (i.e., alcohol use/consequences, cannabis) and non-pharmacological (i.e., dating and sexual behaviors, gambling, condom use) behaviors. Eight intervention categories are reviewed, including: (a) Brief Motivational Interventions, (b) Personalized Normative Feedback, (c) PBS Skills Training, (d) PBS Instruction, (e) Deviance Regulation Theory Interventions, (f) Behavioral Economic Based Interventions, (g) Counterfactual Thinking and (h) Episodic Future Thinking.

Keywords: harm reduction, protective behavioral strategies, risk behaviors, consequences of risk behaviors

Roselyn Peterson  <https://orcid.org/0000-0002-0432-186X>

Matthew P. Kramer  <https://orcid.org/0000-0002-2056-5872>

Daniel Pinto  <https://orcid.org/0000-0002-0122-1097>

Robert D. Dvorak  <https://orcid.org/0000-0002-0613-1277>

This Article is dedicated to the first author's grandfather, Maurice W. "Bud" Saffle.

The authors have no disclosures or acknowledgments to report.

This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. 2035702 to Angelina V. Leary. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. In addition, preparation of this manuscript was supported in part by grant 1R15AA026420-01A1 to Robert D. Dvorak.

Correspondence concerning this article should be addressed to Roselyn Peterson, Department of Psychology, University of Central Florida, 4111 Pictor Lane; Suite 323, Orlando, FL 32816, United States. Email: roselyn.peterson@ucf.edu

The term *Harm Reduction* is defined as "... a set of compassionate and pragmatic approaches for reducing harm associated with high-risk behaviors and improving quality of life" (Collins, Clifasefi, Logan, et al., 2012, p. 5). Harm reduction is often conceptualized on a continuum, with total abstinence on one end, and non-harmful continued substance use and behaviors on the other end. Examples of harm reduction approaches include low-barrier supportive housing (e.g., eliminating barriers for those seeking housing; Collins, Clifasefi, Dana, et al., 2012; Collins, Malone, et al., 2012), needle and syringe programs (e.g., safe needle exchange; Friedman et al., 2007; Grund et al., 1991, 1992), and drinking and driving prevention programs (e.g., how often participants drove after drinking; Monti et al., 1999), resulting in a shift from conceptualizing drug use as a "war on drugs" to "both a public safety and public health problem" (Kerlikowske, 2010, p. 4).

Responsible alcohol consumption is often placed in the broader harm reduction framework (Larimer et al., 1998). Many college student drinking interventions focus specifically on reducing, not

eliminating, consumption as a mechanism for reducing harm (Dimeff et al., 1999). In order to reduce potential harm, college students are steered away from behaviors that might result in more severe negative consequences (e.g., injury and death) toward less harmful effects (e.g., missing class, abstinence). Any step toward less severity of harmful consequences is considered an improvement (Dimeff et al., 1999). This is in contrast to abstinence-based models of treatment. While the goal of both harm reduction and abstinence-based models is ideally abstinence, abstinence-based models typically *require* abstinence in order to receive treatment, whereas harm reduction models do not.

Protective Behavioral Strategies as a Function of Harm Reduction

Protective behavioral strategies (PBS) are a set of individually implemented harm reduction strategies that effectively reduce both the rate of use and severity of consequences from behaviors (Martens et al., 2004). PBS research has primarily focused on targeting negative alcohol-related outcomes (Martens et al., 2005; Pearson, D'Lima, et al., 2013). By motivating individuals to increase their use of PBS, the negative effects experienced from alcohol consumption decrease (Marlatt et al., 1995). However, this relationship is more complex than originally expected.

To demonstrate the nuances of PBS, alcohol PBS can be used as an example. Specifically, three subtypes of PBS exist for alcohol use: (a) Serious Harm Reduction [SHR], for example, knowing where your drink is at all times, (b) Stopping/Limiting Drinking [SLD], for example, stopping drinking at a predetermined time, and (c) Manner of Drinking [MD], for example, avoiding mixing different types of alcohol (Martens et al., 2005). The relationship between PBS use leading to decreased negative consequences has been examined using a variety of different target behaviors including dating and sexual behaviors, gambling, and cannabis use (Drawson et al., 2017; Gilmore et al., 2018; Pedersen et al., 2016). The current article briefly explores each behavior in relation to PBS use, identifying individual measures of assessment and key indicators of use.

Study Overview

The purpose of the present study is twofold: (a) to provide an overview of PBS measures for different risk behaviors and (b) to highlight the interventions used in conjunction with these strategies. Different risk behaviors include alcohol use, dating and sexual behaviors, gambling, cannabis use, and condom use. Common interventions used in conjunction with PBS include eight distinct intervention categories: (a) Brief Motivational Interventions, (b) Personalized Normative Feedback, (c) PBS Skills Training, (d) PBS Instruction, (e) Deviance Regulation Theory Interventions, (f) Behavioral Economic Based Interventions, (g) Counterfactual Thinking and (h) Episodic Future Thinking.

Method

Article Selection

A number of different measures exist for assessing risk behaviors that could be modified using PBS. The most prominent risk factor assessed using PBS is alcohol use/consequences ($n = 8$). In contrast, for dating and sexual behaviors, we only see $n = 4$ validated

measures, and even fewer for gambling ($n = 1$), cannabis ($n = 1$), and condom use ($n = 1$) behaviors. Keywords used to search for articles included: protective behavioral strategies, PBS interventions, PBS measurement, and PBS measurement development. Additional articles were added to the search which were found by examining articles cited that did not appear in the initial search in the articles originally identified. An examination of the articles indicates 15 measurement articles across 5 domains and 34 seminal intervention articles that contained some overlap across 8 different domains (see Figure 1, Tables 1 and 2 for details). For brevity, we summarize the seminal articles within each domain. Articles that deviate from the seminal findings are also included. For measurement articles, inclusion criteria consisted of standardized measures with adequate reliability and validity. The measures section is concluded with a brief discussion of psychometric issues related to the assessment of PBS.

For interventions used in conjunction with PBS, a search was conducted on all interventions that either specifically targeted PBS and/or targeted other behaviors but had significant effects on PBS-related outcomes. The search revealed eight different intervention approaches, with varying degrees of overlap. These included (a) Brief Motivational Interventions, (b) Personalized Normative Feedback, (c) PBS Skills Training, (d) PBS Instruction, (e) Deviance Regulation Theory Interventions, (f) Behavioral Economics Based Interventions, (g) Counterfactual Thinking and (h) Episodic Future Thinking.

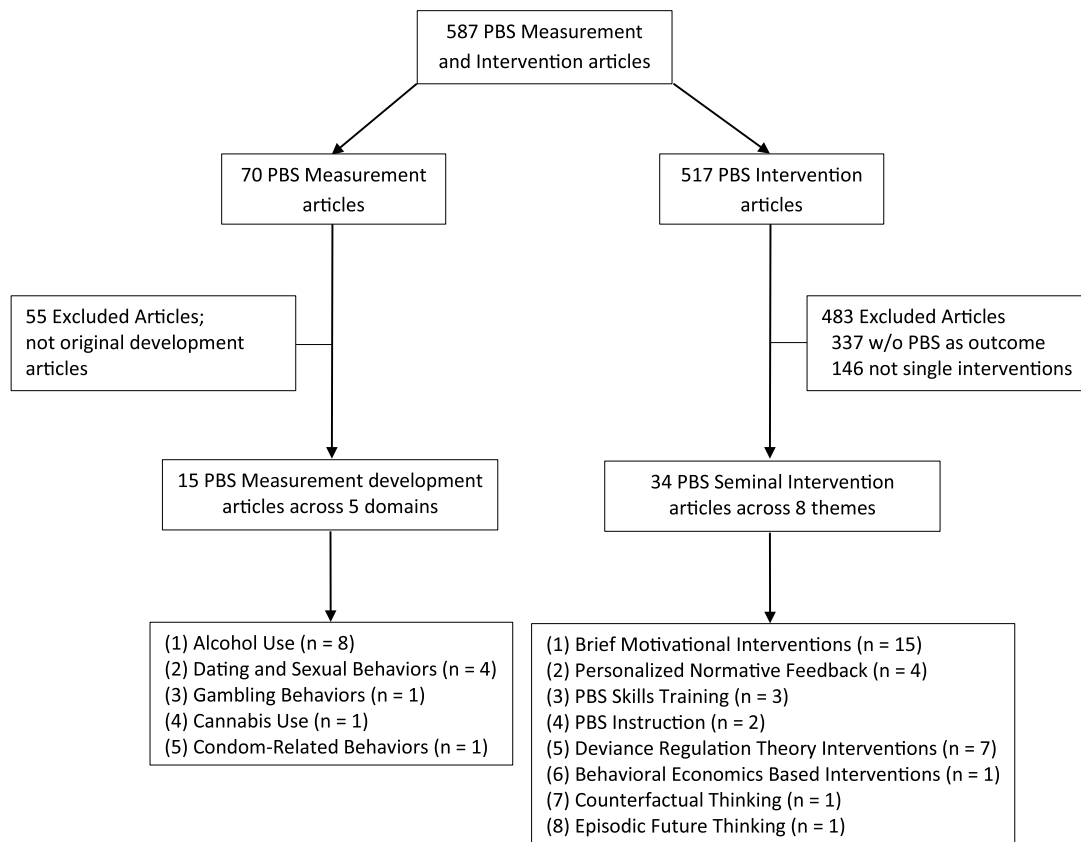
Results

Alcohol Protective Behavioral Strategies

Alcohol use is arguably the most researched behavior targeted in relation to PBS use. The following eight alcohol PBS measures have been identified as standard measures in previous literature: the Self-Control Questionnaire (SCQ; Werch, 1990), the Protective Strategies Questionnaire (PSQ; Palmer, 2004), the Protective Behavioral Strategies Scale (PBSS; Martens et al., 2005), the Strategy Questionnaire (Sugarman & Carey, 2007), the Protective Behavioral Strategies Measure (PBSM; Novik & Boekeloo, 2011), the Protective Behavioral Strategies Scale-Revised (PBSS-R; Madson & Zeigler-Hill, 2013), the Protective Behavioral Strategies Scale-20 (Treloar et al., 2015), and the Protective Behavioral Strategies for Pregaming (PBSP; Pedersen et al., 2020). For each of the alcohol PBS measures listed, adequate construct validity and reliability exist, especially when employed in a college student sample; see Table 1 (Martin et al., 2020). Alcohol use and alcohol-related problems are largely correlated in that individuals who drink more alcohol experience greater alcohol-related problems (Martin et al., 2020; Pearson, 2013; Prince et al., 2013). The PBSS-20, which yielded the greatest number of article returns (Treloar et al., 2015), has been widely used in research and contains improved content coverage and internal consistency, as well as criterion-related validity over the PBSS (Martens et al., 2005). The PBSS-20 expands on the PBSS and encompasses a total of eight items in the SHR subscale, seven items in the SLD subscale, and five items in the MD subscale (Treloar et al., 2015).

A wealth of research has found that students who implement PBS while drinking alcohol avoid or reduce negative alcohol-related outcomes, as PBS are a robust protective factor against

Figure 1
Article Selection Diagram



Note. Additional articles were added to the search which were found by examining articles cited that did not appear in the initial search in the articles originally identified.

alcohol-related consequences (Bravo et al., 2015, 2016; Pearson, 2013; Prince et al., 2013). These effects have been found to be most robust among heavy drinkers, who are often most at-risk of experiencing alcohol-related consequences (Pearson, 2013). Negative associations between PBS and drinking behaviors have been highlighted in both cross-sectional and longitudinal research. It is often the case that college students who report implementing alcohol-related PBS also report lower alcohol consumption and fewer negative alcohol-related outcomes (Cronce & Larimer, 2011; Lewis et al., 2010; Pearson, D'Lima, et al., 2013; Prince et al., 2013; Treloar et al., 2015). This remains true for students who implement protective behavioral strategies during pregaming events, in that each of the four subscales (safety and familiarity, setting drink limits, pacing strategies, and minimizing intoxication) negatively and significantly correlated with measures of alcohol use and consequences (Pedersen et al., 2020). Moreover, PBS have been found to mediate various alcohol-related risk behaviors, including self-regulation (Bravo et al., 2016), self-control (Pearson, Kite, et al., 2013), conscientiousness (Martens et al., 2009), sensation seeking (Pearson et al., 2012), and unplanned drinking (Pearson & Henson, 2013). Additionally, PBS have been found to be effective in reducing both alcohol consumption and alcohol-related consequences among female college student drinkers with lower mental health and/or higher social health

(LaBrie et al., 2009). These findings suggest that the impact of PBS on alcohol outcomes may vary by one's health status (LaBrie et al., 2009).

To further understand the relationship between PBS and alcohol outcomes, it is important to consider the impact of each PBS subtype. Previous research has found MD PBS and SLD PBS to be associated with lower alcohol consumption, while SHR has been negatively associated with alcohol-related consequences (Pearson, Kite, et al., 2013). Similarly, Martens et al. (2005) found a stronger relationship between MD PBS and alcohol consumption and alcohol-related problems, than with SLD or SHR PBS. It is posited that this may be due to MD items being related to the frequency of alcohol consumption, which could impact both consumption and consequences (Martens et al., 2005). As a result, it is suggested that SHR PBS items are more strongly associated with consequences rather than consumption, while SLD PBS items may have a less dramatic impact on alcohol consumptions and consequences (Martens et al., 2005).

Furthermore, a recent study by Linden-Carmichael et al. (2019) found that the effects of each PBS subtype may vary by the type of drinking day. For instance, college students were found to be less likely to use MD PBS on heavy intensity drinking days (HID; 8+/10+ drinks per occasion for women/men) and moderate drinking days,

Table 1
Protective Behavioral Strategy Measures for Different Risk Behaviors

Risk behavior/measure name	Number of items in measure	Internal consistency	Number of factors	Citation
Alcohol use (<i>n</i> = 8)				
1. Self-Control Questionnaire (SCQ)	51	.96	7	Werch (1990)
2. Protective Strategies Questionnaire (PSQ)	16	.84	2	Palmer et al. (2004)
3. PBS Scale (PBSS)	15	.77	3	Martens et al. (2005)
4. Strategy Questionnaire (SQ)	27	.80	3	Sugarman and Carey (2007)
5. PBS Measure (PBSM)	17	.83	2	Novik and Boekeloo (2011)
6. PBS Scale-Revised (PBSS-R)	18	.94	2	Madson and Zeigler-Hill (2013)
7. PBS Scale-20 (PBSS-20)	20	.79	3	Treloar, Martens, and McCarthy (2015)
8. Protective Behavioral Strategies for Pregaming (PBSP)	19	.76	4	Pedersen et al. (2020)
Dating and sexual behaviors (<i>n</i> = 4)				
1. Protective behavioral strategies for sexual aggression and risky sex	23	.90	2	Treat, Corbin, and Viken (2021)
2. Risky Sex Scale	14	.93	3	O'Hare et al. (2001)
3. Dating Self-Protection against Rape Scale	15	.86	1	Moore and Waterman (1999)
4. Dating Behavior Survey	15	.63	1	Hanson and Gidycz (1993)
Gambling behaviors (<i>n</i> = 1)				
1. Gambling PBS Scale (GPBSS)	16	.81	2	Lostutter et al. (2014)
Cannabis use (<i>n</i> = 1)				
1. PBS for Marijuana (PBSM) Scale	39	.95	1	Pedersen et al. (2016, 2017)
Other behaviors (<i>n</i> = 1)				
1. Condom-related PBS Scale	6	.89	1	Lewis et al. (2009)

compared to heavy episodic drinking days (HED; 4+/5+ drinks per occasion for women/men). Additionally, students used fewer SHR PBS on moderate drinking days and were equally likely to use SHR PBS on HID, compared to HED (Linden-Carmichael et al., 2019). It is suggested that these students may be less likely to use MD PBS because this strategy involves actively modifying drinking behavior (e.g., drink more slowly), which may be seen as interfering with drinking goals more on HID days. In contrast, SHR PBS may be easier to implement (e.g., having a designated driver), however, it is suggested that students may be more likely to use this strategy as long as they consume 4+/5+ drinks (Linden-Carmichael et al., 2019). Another study evaluated the effectiveness of each individual

PBS item across a general population of drinkers (Dekker et al., 2018). Counting drinks was the only item associated with lower alcohol use over time, which is an item of MD PBS, although the effect size was small.

Additional factors contributing to alcohol PBS use include whether or not individuals have a history of sexual regret. Recent research has found that sexual regret is associated with decreased engagement in alcohol PBS, increased alcohol use, higher past month symptoms of anxiety, depression, and trauma, as well as suicidal ideation (Peterson et al., 2021). In a separate study, PBS were associated with lower rates of sexual regret, and attenuated the association between alcohol use and regretted sex for females

Table 2
Protective Behavioral Strategy Interventions

Intervention category	Primary target	Citations
1. Brief motivational interviewing (BMI)	Reduce alcohol consumption and consequences via multiple avenues (normative feedback, values clarification, goal setting, increased use of protective behavioral strategies)	Barnett et al. (2007); Dimeff et al. (1999); Dumas et al. (2017); Dunn, Deroo, Rivara (2001); Field et al. (2005); Larimer and Cronce (2002), (2007); Magill et al. (2017); Miller and Rollnick (1991); Murphy et al. (2012); Prince et al. (2020); Richards et al. (2019); Riggs et al. (2018); Terlecki et al. (2021); Walthers et al. (2019)
2. Personalized normative feedback	Reduce normative misperceptions of protective behavioral strategy use and alcohol use	Larimer and Cronce (2007); Leavens et al. (2020); Leeman et al. (2016); Martens et al. (2013)
3. PBS skills training	Increase protective behavioral strategy use and reduce alcohol consumption	Baer et al. (1999); Kenney et al. (2014); LaBrie et al. (2015)
4. PBS instruction	Protective behavioral strategy use and alcohol use	O'Donnell et al. (2019); Sugarman and Carey (2009)
5. Deviance regulation theory interventions	Increase protective behavioral strategy use, norms, and intentions	Dvorak, Kramer, and Stevenson (2018); Dvorak, Troop-Gordon, et al. (2018); Dvorak et al. (2015), (2016), (2017); Leary and Dvorak, 2019; Sargent et al. (2018)
6. Behavioral economic based interventions	Increase protective behavioral strategy use	Murphy et al. (2012)
7. Counterfactual thinking	Increase protective behavioral strategy use intentions	De Leon et al. (in press)
8. Episodic future thinking	Motivation to achieve personal goals	Voss et al. (2021)

(Peterson et al., 2020). This study also found MD and SLD PBS to be negatively associated with alcohol use, while SHR PBS was inversely related to regretted sex (Peterson et al., 2020). Thus, another behavior often paired with alcohol use is dating and sexual behaviors.

Dating and Sexual Protective Behavioral Strategies

Dating and sexual PBS focus on reducing the likelihood of being a target of sexual victimization. Assessment of dating and sexual behaviors include: the Risky Sex Scale (RSS; O'Hare, 2001), the Dating Self-Protection against Rape Scale (DSPARS; Moore & Waterman, 1999), the Dating Behavior Survey (DBS; Hanson & Gidycz, 1993), and the Protective Behavioral Strategies for Sexual Aggression and Risky Sex measure (Treat et al., 2021). The RSS was created two decades ago and identifies sexual behaviors in relation to alcohol use. Breitenbecher found good internal consistency and convergent validity for the DSPARS, with expected correlations to risk-related dating behavior, (delayed) risk perception, and sexual victimization history. Similarly, the DBS identifies ways individuals can engage in safe dating behaviors (Breitenbecher, 2008; Hanson & Gidycz, 1993). Breitenbecher found that the internal consistency of the DBS was adequate, and the convergent validity showed expected correlations to self-protective dating behavior, delayed risk perception, and sexual victimization history.

Initial research on the relationship between sexual assault PBS and sexual assault is inconsistent. One study found that individuals with sexual assault history were less likely to use PBS than those without a history (Breitenbecher, 2008). Two earlier studies did not find a relationship between sexual assault PBS and sexual assault victimization (Hickman & Muehlenhard, 1997; Moore & Waterman, 1999). However, both studies had several limitations. In these studies, the definition of sexual assault was forced or incapacitated oral, anal, or vaginal intercourse, excluding those who experienced unwanted sexual contact and sexual coercion. The measure of sexual assault severity did not account for multiple victimizations through multiple tactics (Davis et al., 2014) and these studies were largely cross-sectional in nature. Other studies have investigated whether drinking PBS, in conjunction or in place of sexual PBS, may be a protective factor against sexual assault (Neilson et al., 2015; Sell et al., 2018). In particular, Neilson et al. (2015) suggest that PBS may be an important factor in the prevention of sexual assault, however, the authors caution that findings are limited, and further research is needed. It was also posited that multiple experiences of sexual violence reduce the likelihood of using sexual PBS, especially for women who engaged in sexual and drinking PBSs and were still victimized (Neilson et al., 2015). It is important to note that the responsibility of sexual assault is on the perpetrator alone, and sexual PBS, while reducing the likelihood of sexual victimization, do not prevent sexual assault. In particular to alcohol PBS, Sell et al. (2018) found that women who use more SLD or MD PBS tend to drink less. These findings indicate that sexual assault and alcohol PBSs have different associations with alcohol consumption among women. Nevertheless, it is recommended that women are encouraged to use drinking PBS in conjunction with sexual assault PBS (Sell et al., 2018).

One study examined use of sexual assault PBS, which was negatively correlated with incapacitated, attempted, or completed rape, use of alcohol before sex, and sexual assault severity

(Gilmore et al., 2015). This study also found that those with any history of sexual assault were less likely to use SHR PBS (Gilmore et al., 2015). In a subsequent study, use of sexual assault PBS at baseline was correlated with less severe sexual assault victimization after a 3-month follow-up (Gilmore et al., 2018). Other studies found that alcohol consumption increases with use of sexual assault PBS, which is notable considering heavy drinking is a risk factor for sexual assault in college women (Abbey et al., 2004, 2012; Sell et al., 2018). It is posited that women may increase their use of sexual assault PBS in anticipation of heavy drinking (Sell et al., 2018). Despite promising findings, further research is needed to fully understand the possibility of sexual PBS as effective protective behaviors, and how to integrate these strategies within sexual assault risk reduction programs. Future research would benefit from a revised DSPARS with more college-specific sexual assault PBS utilized (Gilmore et al., 2018).

In addition, the Protective Behavioral Strategies for Sexual Aggression and Risky Sex was recently developed (Treat et al., 2021). This measure was created using data collected from a sample of undergraduate men ($n = 567$) who endorsed sexual attraction toward women. Two factors, including sexual aggression (e.g., explicitly asking a potential sexual partner for consent to engage in sexual behavior) and risky sex (e.g., avoiding having sex in situations where I might later regret my behavior), were identified. However, a sizeable number indicated that they seldom or never used these strategies. A call for future research to incorporate cognitive skills training into prevention efforts such as ongoing tracking of partner's changing emotional reactions throughout a sexual encounter was presented (Treat et al., 2021). Thus, future research is needed to continue to develop optimal measurement of dating and sexual PBS use. In addition, another risk-behavior targeted by use of PBS, is engagement in gambling behaviors.

Gambling Protective Behavioral Strategies

As PBS have continued to gain empirical attention in both alcohol and non-alcohol domains, the use of PBS was eventually examined in the context of gambling. Past gambling research has focused on harm reduction in a variety of ways, including strategies utilized by gambling venues and harm-minimization tools (Harris & Griffiths, 2017; Tanner et al., 2017). Additionally, while research has reviewed harm reduction broadly (McMahon et al., 2019) as well as elements of PBS (Bagot et al., 2020), there has been less focus specifically on PBS, or studies using PBS scales, in relation to gambling. Rather, focus has been largely given to problematic gambling outcomes instead of protective strategies that could help curb those negative outcomes. Thus, it is important to take stock in what is known specifically about gambling PBS.

As noted, PBS represent specific harm reduction behaviors one can take toward a particular activity (Drawson et al., 2017). Lostutter et al. (2014) developed the first PBS measure designed specifically for gambling behaviors. The Gambling Protective Behavioral Strategies (GPBSS) consist of 16 items, including two overarching types of strategies: harm reduction and avoidance strategies (Lostutter et al., 2014). Several of the avoidance subtype items closely mimic elements of stopping/limiting drinking PBS in the alcohol literature (e.g., "I determine in advance a set amount of time I will spend gambling"), while others are more novel to gambling specifically (e.g., "I avoid gambling when I feel bored").

While harm reduction items consist of some avoidance strategies as well (e.g., “I avoid borrowing money to gamble”), the items listed all point to more explicit connections between gambling and negative outcomes, a goal of [Lostutter et al. \(2014\)](#). Overall, results suggested that PBS strategies were more effective for men than women, though this could be due to men engaging in higher rates of gambling overall ([Lostutter et al., 2014](#)).

[Drawson et al. \(2017\)](#) later conducted a review of gambling protective strategies and identified four broad categories: self-exclusion, time limit setting, monetary limit setting, and cashless, card-based gambling. A key strength of the [Drawson et al. \(2017\)](#) review is that all four categories are behaviors an individual can engage in, rather than a policy at a gambling venue. Findings suggest that self-exclusion provided the most promise in reducing gambling harm and other negative consequences ([Drawson et al., 2017](#)), though both [Drawson et al. \(2017\)](#) and [Livingstone et al. \(2014\)](#) noted that the methodology of many of the studies reviewed were of “poor” quality. Self-exclusion, while only effective in the short term, as most self-excluders have been found to return to gambling ([Cohen et al., 2011](#)), has been associated with improved self-confidence, perceived control, work-related performance, quality of life, and reductions in problem gambling status ([Drawson et al., 2017](#)). Setting a time limit, although findings are inconsistent, is reported to be most used by problem gamblers, with many reporting reduced time spent gambling and theoretical loss; as well as setting a monetary limit, leading to a reduction in overall gambling activity, although not in overall amount wagered per bet ([Drawson et al., 2017](#)). Overall, it is reported that many use PBS while gambling, with problem gamblers being significantly more likely to utilize most strategies than non-problem gamblers ([Drawson et al., 2017](#)). However, information regarding who would benefit most from these strategies is limited. It is suggested, however, that gambling PBS may be less effective for individuals who gamble to manage their emotions ([Drawson et al., 2017](#)).

Most recently, a review by [McMahon et al. \(2019\)](#) identified harm reduction strategies as consisting of pre-commitment and limit setting, self-exclusion, youth prevention programs, and machine feedback. Of those, only pre-commitment/limit setting and self-exclusion take a bottom-up approach, originating from the individual ([McMahon et al., 2019](#)). Additionally, a recent study found that engaging in more drinking PBS was associated with less risk of gambling consequences ([Granato et al., 2018](#)). However, this was only found for SHR PBS, indicating a lower risk of lifetime gambling consequence among those who endorsed higher levels of SHR PBS ([Granato et al., 2018](#)). The authors indicate that this is suggestive of crossover effects of drinking PBS on gambling ([Granato et al., 2018](#)).

Collectively, there has been a large body of research focusing on harm reduction within the gambling body of research. However, much of this has focused on institutional/policy measures that venues can institute. Furthermore, whereas the PBS scale for alcohol has undergone iterative updates, there is only one PBS scale for gambling protective strategies ([Lostutter et al., 2014](#)). While the GPBSS is promising, further updates including interventions using these strategies are needed to continue to grow this important area of research. It is also posited that while gambling PBS do reduce harm, it may not reach those at risk for the greatest level of harm ([Drawson et al., 2017](#)). As a result, future research should strive to investigate this pattern and determine for whom gambling PBS are most beneficial ([Drawson et al., 2017](#)).

Cannabis Protective Behavioral Strategies

Along with alcohol, another substance that has received attention in the PBS literature is cannabis. Individual state laws that govern the possession, production, and use of cannabis have recently undergone significant changes throughout the United States. Since the 1996 Compassionate Use Act (which legalized cannabis for medical use in California), to date, six states (Idaho, Wyoming, Kansas, Tennessee, Alabama, and South Carolina) have yet to legalize the use of cannabis in one form or another (i.e., medical or recreational) with cannabis being fully legal in 16 states and the District of Columbia ([Defense Information Systems Agency, 2021](#), Global Solutions, Last updated February 2021). This nationwide and systematic shift toward the legalization of cannabis coincides with increased use among the nation’s young adults.

According to the Monitoring the Future Study ([Johnston et al., 2016](#)), 59% of 19–28-year-olds reported using cannabis at least once on their lifetime. Moreover, this same age group was found to perceive cannabis as the least harmful illicit drug. Yet, according to various studies, cannabis use is consistently associated with cognitive ([Ramaekers et al., 2009](#)), physiological ([Ramaekers et al., 2009](#)), psychomotor ([Bondallaz et al., 2016](#)), and psychological ([Leadbeater et al., 2019](#)) consequences. Additionally, college students who use cannabis have been found to experience up to 19 distinct consequences in a given month, with an average of 5.8% near daily use (20+ days in the past month) in a study of $N = 8,141$ students ([Pearson et al., 2017](#)). Furthermore, a recent review of changes in cannabis potency ([EISOhly et al., 2016](#)) found that the change in ratio of tetrahydrocannabinol (THC) increased by ~600% from 1995 to 2014. This increase in potency poses a substantially higher risk for heavy users, particularly among adolescents and young adults. Together, considering the trends in state legislation, increased cannabis potency, and underestimated perceptions of harm, effective strategies, and interventions that mitigate both heavy use and routinely experienced consequences are warranted.

Given the extensive research that highlights the effectiveness of PBS as a protective factor against alcohol-related consequences ([Bravo et al., 2015, 2016](#); [Pearson, 2013](#); [Prince et al., 2013](#)), cannabis researchers began to study cannabis-related negative consequences in relation to PBS. For example, a series of studies were conducted to develop the Protective Behavioral Strategies for Marijuana (PBSM) scale ([Pedersen et al., 2016, 2017](#)). In its final form, this 36-item (17-item short version) questionnaire includes strategies that are aimed at limiting consumption (e.g., “Having a set amount of times you take a hit of a marijuana joint”), avoiding higher than desired intoxication (e.g., “Avoiding mixing marijuana with other drugs”), and avoiding serious cannabis related harms (e.g., “Using a designated driver after using marijuana”).

A follow-up study ([Bravo et al., 2017](#)) further examined the relationship between distal antecedents, cannabis-related negative consequences, and cannabis PBS (i.e., PBSM; [Pedersen et al., 2016](#)). According to the results, cannabis PBS was negatively associated with both frequency and cannabis-related consequences. Unsurprisingly, frequency was positively associated with consequences ([Bravo et al., 2017](#)). This suggests that cannabis-use frequency mediates the association between PBS and cannabis-related consequences, and highlights the potential function of PBS. Interestingly, the authors noted that PBS mediated the relationship between biological sex (i.e., females reported higher PBS) and

cannabis-use frequency; and the relationship between sex and cannabis-related consequences (Bravo et al., 2017). This study also suggests that cannabis PBS use can be utilized to both mitigate risk factors and enhance protective factors among cannabis users (Bravo et al., 2017). A more recent study (Prince et al., 2019) sought to expand upon the efficacy of the PBSM by analyzing both qualitative and quantitative data from a community sample of heavy cannabis users. Results of the qualitative analyses revealed participants' motivations for using PBS (e.g., health, legal, interpersonal problems). Quantitative results aligned with past findings, indicating a negative association between PBS and negative consequences. Together, these add valuable knowledge on the utility of PBS for cannabis-use.

Additional studies have examined the extent to which PBS mediates the relationship between sensation seeking and cannabis-related consequences (Neugebauer et al., 2019), insomnia symptoms and problematic cannabis-use (Wong et al., 2019), cannabis-use status and condom use (Buckner et al., 2018), and sexual orientation (Parnes et al., 2018). In all, PBS was found to significantly mediate the hypothesized relationships; a finding that continues to guide research and inform clinical practice. Moreover, cannabis PBS is suggested to attenuate the elevated risk of negative consequences among those most at risk, including college students who report high levels of sensation seeking, negative urgency, and/or use cannabis for enhancement and expansion motives (Bravo et al., 2017). Nevertheless, despite these preliminary findings on the efficacy of PBS use for cannabis-related consequences, the nascence of cannabis-related PBS research necessitates additional lines of inquiry to fully understand the mechanisms, mediators, and moderators implicated in cannabis-use, PBS, and associated consequences.

Other Factors Influencing Protective Behavioral Strategies Use

Other PBS-related behaviors exist that are important to consider when attempting to decrease health-compromising behaviors and subsequently increase engagement in healthier behaviors. For instance, in the context of sexual risk behaviors, recent studies found that condom-related PBS has the potential to increase condom use, both among college student drinkers (Gilmore et al., 2013) as well as cannabis users (Buckner et al., 2018). In these studies, condom-related PBS was assessed using the Condom-Related PBS Scale (Lewis et al., 2009) which is a six-item measure adopted from previous research (Bryan et al., 2002). Six sex-related protective behaviors are asked prior to, or during, drinking episodes. Questions such as, "How much did you engage in carrying a condom and keeping it handy?" are measured using a Likert scale ranging from 1 (*no, never*) to 5 (*always*). Based on this, it is recommended that interventions target the high-risk sexual behavior that are associated with the substance (i.e., condom-related PBS), in addition to the specific substance use behaviors (i.e., alcohol PBS or cannabis PBS; Gilmore et al., 2013).

An additional study on individuals who use cannabis and exhibit symptoms of PTSD was conducted (Jordan et al., 2019). The underutilization of cannabis PBS contributed to the association between higher PTSD symptoms and heightened cannabis use disorder symptoms, as well as negative consequences (Jordan et al., 2019). Thus, targeting cannabis PBS among cannabis users with PTSD symptoms could decrease reliance on this health-compromising

behavior and perhaps increase healthier coping behaviors (Jordan et al., 2019). As a result, given the underutilization of PBS by different subsets of college student drinkers and cannabis users, it is pertinent to develop tailored interventions that can improve PBS use among high-risk individuals.

Psychometric Issues in the Assessment of Protective Behavioral Strategies

The literature on PBS use has a number of inconsistencies and problematic associations. For example, arguably the most important form of alcohol PBS, serious harm reduction (SHR), is consistently linked to greater alcohol use and greater alcohol-related problems. It has been suggested that SHR PBS may represent a set of reactive approaches that are implemented after drinking has reached an excess or after problems have already occurred (Pearson, D'Lima, et al., 2013). An alternative is that our traditional PBS factor structure should not align with behavioral groupings (e.g., manner of drinking, serious harm reduction, etc.) but with implementation groupings (i.e., direct versus indirect implementation). Direct PBS are linked to specific quantifiable behaviors meant to affect consumption (e.g., alternating alcohol and non-alcohol drinks). In contrast, indirect PBS are linked to behaviors that do not overtly affect consumption, but that may be directly linked to problems (e.g., having a designated driver). DeMartini et al (2013) found that direct strategies were related to alcohol consumption, but not problems; while indirect strategies were related to alcohol problems, but not consumption (DeMartini et al., 2013). Re-evaluating the factor structure may help resolve seeming inconsistencies.

A second issue is the response scale used to assess PBS. Braitman et al. (2015) examined contingent responses based on frequency of use PBS (e.g., never to always) versus quantity of PBS use (e.g., not at all, once, two to three, etc.). Quantity of PBS use can conflate the use of PBS with the number of drinking occasions, giving the appearance of positive associations between PBS and alcohol use/problems (Braitman et al., 2015). Indeed, in a test of this, Kite et al. (2013) found that assessing SHR using a quantity response scale produced positive associations with both use and problems while assessing SHR with a frequency response scale resulted in theoretically consistent associations (Kite et al., 2013). To correct this issue, in a separate study by Braitman et al. (2015), direct PBS were divided by the number of drinking days over the last 2 weeks to provide a proportional PBS value. This still produced good internal consistency, but removed antithetical and curvilinear associations. While this seems to fix the issue at the between-subject level, this problem persists at the within-subject (daily or weekly level, see; Leary & Dvorak, 2019) and has not yet been addressed in the literature.

Interventions Used in Conjunction With Protective Behavioral Strategies

Despite consistently showing inverse associations between PBS use and negative outcomes, the historical record for PBS-based interventions does not inspire confidence in PBS as an intervention mechanism, at least in single component PBS-targeted interventions (LaBrie et al., 2015; Martens et al., 2013; O'Donnell et al., 2019). This has prompted a number of studies seeking to clarify how to effectively harness PBS as a mechanism of change. A survey of the

literature has produced eight fairly distinct categories of interventions with varying degrees of effectiveness: (a) Brief Motivational Interventions, (b) Personalized Normative Feedback, (c) PBS Skills Training, (d) PBS Instruction, (e) Deviance Regulation Theory Interventions, (f) Behavioral Economic Based Interventions, (g) Counterfactual Thinking and (h) Episodic Future Thinking. Below we discuss these interventions, providing examples from the literature for each. While not an exhaustive list, the examples below represent the seminal and/or only interventions for each category.

Perhaps the most frequently used harm reduction-based approach across all behaviors is the use of Brief Motivational Interventions (Field et al., 2005; Larimer & Crounce, 2002). BMIs integrate the application of healthy behavioral strategies (i.e., PBS) for reducing problematic outcomes and the opportunity to examine one's own engagement in these outcomes, which, historically, has reduced risky behaviors (Barnett et al., 2007; Walthers et al., 2019). These interventions tend to be multicomponent, often incorporating aspects of Personalized Normative Feedback (PNF) and skills training while taking a Motivation Enhancement (Miller & Rollnick, 1991) approach to achieve behavior change. BMIs are known to broadly include assessments of quantity, frequency, and consequences; while PNF and motivational strategies are used in the reduction of high risk habits and behaviors (Dimeff et al., 1999; Dunn et al., 2001). Early research has shown that multicomponent BMIs are relatively effective at increasing PBS use, and that these increases lead to subsequent decreases in use and problems (Barnett et al., 2007; Larimer & Crounce, 2007; Murphy et al., 2012). To date, these approaches have been used to increase PBS use for alcohol (Barnett et al., 2007; Dumas et al., 2017; Larimer & Crounce, 2007; Magill et al., 2017; Richards et al., 2019; Terlecki et al., 2021) and cannabis (Prince et al., 2020; Riggs et al., 2018) use which has generally resulted in decreases in adverse outcomes. However, multicomponent interventions have a number of drawbacks. They are often resource intensive, requiring face-to-face contact. Computer-based BMIs tend to be (a) less effective and (b) more variable in efficacy, making wide dissemination difficult. This has led to a number of alternative approaches.

Personalized Normative Feedback is perhaps the second most frequently used approach to increase PBS. Martens et al (2013) compared PNF for alcohol to PNF for PBS. They concluded that PNF for alcohol use was the more efficacious intervention (Martens et al., 2013). However, it is worth noting that PNF for PBS was the only condition to result in significant increases in PBS use and exerted the most robust effect on alcohol-related consequences. Leavens et al (2020) found that PNF could be used to increase PBS norms, but that this did not translate into increased PBS use, nor to changes in alcohol outcomes (Leavens et al., 2020). Understanding why changes in PBS norms do not result in subsequent changes in behaviors remains a challenge. One way to address this, is to take a different conceptualization of PBS. Rather than focusing on the various subtypes of PBS as they relate to behaviors (e.g., manner of drinking vs. stopping/limiting drinking), Leeman et al. (2016) sought to differentiate PBS relative to their drinking outcomes. They define PBS as either *direct* or *indirect* (Leeman et al., 2016). In a comparison of direct, indirect, and combined conditions using a PNF approach, they found that indirect and combined had significant effects on alcohol outcomes while direct did not, suggesting the active component was harnessing indirect PBS. They hypothesized that indirect approaches may be easier to implement during drinking

occasions and may also be more effective in extremely brief (i.e., computer-based) assessments. Alternatively, indirect approaches may involve more personally relevant behaviors that have intrinsic value to the drinker (e.g., keep my drink in eyesight at all times, only drink with people you trust).

Skills training is also often incorporated in multicomponent BMIs. The goal of skills training is to teach a set of behaviors and ways to implement those behaviors (Baer et al., 1999). Kenney et al. (2014) found that PBS based skills training, implemented in a group format, resulted in greater PBS use and subsequently lower alcohol consumption and fewer alcohol-related consequences (Kenney et al., 2014). LaBrie et al. (2015), using a similar skills training approach, found that skills training was no different from control in reducing alcohol outcomes (LaBrie et al., 2015). However, PBS use was significantly higher at 1 and 6 months in the intervention condition. Furthermore, while both the control and intervention conditions showed decreases in alcohol outcomes across time, the decreases in the intervention condition were mediated by changes in PBS use. This may result in diminished relapse rates for those that were able to learn the skills and implement these new behaviors, though, this has yet to be examined.

Similar to skills training, simple instruction to use PBS has shown some modest effects. Sugarman and Carey (2009) found that simply asking participants to use 50% more PBS (with no training on actual types of PBS). They found that these individuals increased all forms (*direct* and *indirect*) of PBS but showed no changes in consumption. Instructing individuals to reduce alcohol use by 50% (but not addressing PBS use) resulted in (a) more *direct* PBS use and (b) a reduction in alcohol use. As has been noted above, *indirect* PBS use is proximally linked to alcohol-related problems; unfortunately, alcohol-related problems were not assessed in this study (Sugarman & Carey, 2009). In similar vein, a small feasibility study by O'Donnell et al. (2019) found that suggesting PBS use in the moment resulted in increases in both *direct* and *indirect* PBS use, but did not affect either alcohol use or alcohol-related problems (O'Donnell et al., 2019). Thus, providing prompts to use more PBS does appear to increase PBS use, but there is little effect on primary alcohol outcomes. This may suggest that increased PBS use is a necessary, but not sufficient, approach to reducing alcohol-related outcomes.

A series of recent studies has begun trying to produce increases in PBS via targeted messaging based on individual perceived norms. Rather than try to change PBS norms, Deviance Regulation Theory (DRT) posits that norms can be used to guide positively or negatively framed messages about individuals that use PBS. According to this theory, if an individual believes that a behavior is uncommon (i.e., low PBS norms), a positive message about PBS use and/or users will increase motivation to engage in PBS as a way to stand out in positive and meaningful ways. In contrast, if individuals believe that PBS is common (i.e., high PBS use norms), a negative message about PBS non-use and/or non-users will increase motivation to engage in PBS as a way to avoid standing out in negative ways (Blanton et al., 2001). Furthermore, this approach seems to also increase PBS norms across time (Dvorak, Kramer, et al., 2018; Leary & Dvorak, 2019), providing guidance on how messaging can transition to increase the intervention effects. A series of studies have shown support for this idea, however, the results frequently indicate that the intervention has an effect on PBS use and alcohol-related consequences, but little effect on consumption (Dvorak et al., 2015, 2016, 2017; Dvorak, Troop-Gordon, et al., 2018;

Sargent et al., 2018). Interestingly, this may indicate that individuals are primarily engaging in *indirect* PBS; though, this has yet to be tested. While promising, most of these studies suffer from small sample sizes, low statistical power, and are conducted among typical college student drinkers that lack serious alcohol-related problems.

In contrast to approaches that utilize norms in some fashion, Murphy et al. (2012) sought to increase PBS through a behavioral economics approach. In this study, all participants received a BMI. Some of the participants then received a supplemental intervention that focused on increasing substance free reinforcement. This intervention was designed to increase engagement in substance-free alternative activities. Though not specifically designed to increase PBS, this intervention did result in an increase in PBS use, which partially mediated the effect between the substance free reinforcement condition and alcohol-related consequences (Murphy et al., 2012). Unfortunately, there are no published replications of this approach for PBS use.

Recently, De Leon et al. (in press) have examined the effects of counterfactual thinking as an approach to increase PBS use intentions. Counterfactual thinking is a form of post-mortem thinking that involves identifying a past problem and developing solutions to address this problem. In their study, De Leon et al. (in press) had participants identify a particularly adverse outcome linked to alcohol consumption. They then asked participants to engage in *if-then* thinking as a way to cement PBS as a personally relevant approach to reducing future alcohol-related consequences (e.g., *if* I would have had a designated driver, *then* I would not have gotten a DUI). This was compared to individuals that (a) just related having a problem, (b) related having a problem, and then further described the problem in greater detail, and (c) an attention control. Only the Counterfactual Thinking intervention group produced greater PBS use intentions. Unfortunately, they did not have follow-ups to examine changes in PBS use or alcohol outcomes. Nonetheless, making PBS more personally relevant is consistent with the notion that simply increasing PBS is insufficient and that gaining a level of “buy-in” may offer more efficacy (De Leon et al., in press). An alternative to counterfactual post-mortem thinking, Episodic Future Thinking, is a form of pre-mortem thinking that involves imagining a future in which individuals are able to successfully achieve their personal goals. In a small feasibility study, Voss et al. (2021) asked heavy drinking college students to imagine future academic goals they would like to achieve. They then received weekly reminders of these goals. Interestingly, this approach resulted in within-subject increases in PBS ($d_w = 0.58$) and decreases in alcohol use ($d_w = 0.56$) and consequences ($d_w = 0.30$). Perhaps most intriguing is that the intervention here focused on academic goals and did not mention PBS at all (Voss et al., 2021).

In summary, there have been a number of approaches aimed at engaging PBS use as an intervention target to reduce alcohol outcomes. Interventions that focus mainly on increasing direct PBS and/or increasing PBS without making them personally relevant appear to serve the purpose of increasing PBS, but these effects do not generally translate into reductions in alcohol outcomes. In contrast, interventions that target *indirect* PBS and/or making PBS more personally relevant appear to have effects on both PBS use as well as alcohol-related problems (though not necessarily consumption related outcomes). As multicomponent interventions appear to offer the most efficacy, it may be beneficial to develop multicomponent interventions that leverage multiple aspects of personally

relevant approaches that target *indirect* PBS use. For example, a stepped multicomponent approach may be to increase *indirect* PBS use norms via PNF, followed by an EFT exercise to enhance personal relevance and brief skills training in which individuals engage in counterfactual thinking to identify individual approaches to increase PBS implementation. Then, weekly reminders of personally relevant *indirect* PBS mixed with targeted messages about non-users, ala DRT.

A Summary of Pharmacological and Non-Pharmacological Protective Behavioral Strategies Use

Protective behavioral strategies targeting pharmacological (e.g., alcohol) and non-pharmacological (e.g., gambling) risk behaviors are presented in the current article. This presents two distinct issues: (a) effects on the risk behavior (e.g., drug consumption for pharmacological; gambling or engagement in risky sex for non-pharmacological) and (b) effects on the outcomes of those behaviors (e.g., drug-related consequences for pharmacological; gambling related-consequences or adverse sexual outcomes for non-pharmacological). Regarding effectiveness of PBS in relation to pharmacological risk behaviors, we see a reduction in negative use and consequences for both alcohol (Bravo et al., 2016; Crounce & Larimer, 2011; LaBrie et al., 2009; Lewis et al., 2010; Martens et al., 2009; Pearson, D’Lima, et al., 2013; Pearson et al., 2012; Pearson & Henson, 2013; Pearson, Kite, et al., 2013; Prince et al., 2013; Treloar et al., 2015) and cannabis (Bravo et al., 2017; Pedersen et al., 2016, 2017) through the use of protective behavioral strategies. Regarding PBS-related interventions targeting alcohol use, effect sizes for the interventions are in the small range [Cohen’s $d = 0.08$ – 0.14] (Leavens et al., 2020), small to large range [Cohen’s $d = 0.18$ – 0.97] (Martens et al., 2013), [Cohen’s $d = 0.30$ – 1.05] (Richards et al., 2019), and medium to large range [CI = 0.513 – 4.194] (Terlecki et al., 2021). Regarding PBS-related interventions targeting cannabis use, effect sizes are in the very small to medium range (Riggs et al., 2018), with Bayesian credible intervals not containing zero [CI = 0.10 – 0.77] (Prince et al., 2020).

Regarding measurement of PBS in relation to non-pharmacological risk behaviors, we see negative consequences are reduced for gambling behaviors and condom use through protective behavioral strategy use (Drawson et al., 2017; Lewis et al., 2009). While the literature was mixed for dating and sexual behaviors, overall the findings revealed fewer negative consequences in association with the use of PBS (Gilmore et al., 2018; Neilson et al., 2015; Sell et al., 2018). Regarding PBS-related interventions targeting non-pharmacological risk behaviors, future research should focus on the nuances of targeting non-pharmacological risk behaviors through the use of PBS-related inventions for dating and sexual behaviors, gambling, and condom use (Drawson et al., 2017; Gilmore et al., 2013; Lewis et al., 2009). Thus, PBS-related interventions appear to effectively target behaviors that are related to both pharmacological risk behaviors and non-pharmacological risk behaviors. The findings outlined in the current review indicate that the use of protective behavioral strategies is versatile, in that negative behavioral engagement (whether that be use related behavior or risk related behavior) and negative consequences from those behaviors can be effectively mitigated for both pharmacological or non-pharmacological risk,

and that PBS are not necessarily more or less effective when applied to either pharmacological or non-pharmacological behaviors, but rather show effectiveness in both realms.

Discussion

The aim of this article is to provide a systematic overview of the many distinct applications involving protective behavioral strategies across several different behavioral contexts (e.g., substance use and sexual behaviors). Subsequently, the current review evaluated the effectiveness of these strategies while highlighting the interventions used in conjunction with PBS. In summary, this brief review broadly describes the different behaviors assessed using PBS measurement, as well as the interventions used in conjunction with PBS.

Although alcohol PBS have consistently mitigated risky alcohol use and alcohol-related consequences, there has historically been less focus on influences that may impact this association (LaBrie et al., 2009). This is important when considering mental health, as recent findings indicate that the implementation of PBS may vary as a function of mental health (LaBrie et al., 2009). Further understanding the association between PBS and alcohol outcomes may be mitigated is warranted (Landry et al., 2014). Recent research has found increased psychopathology symptoms to be associated with an underutilization of PBS use, heavier alcohol consumption, and more alcohol-related consequences across individuals with depressive symptoms (Linden-Carmichael et al., 2015), generalized anxiety disorder (Litt et al., 2013), social anxiety disorder (Terlecki et al., 2020, 2021), and disordered eating (Landry et al., 2014). Specific to PTSD, utilization of PBS was found to be more salient in women, with the association between PTSD symptoms and alcohol-related consequences found to be weaker at higher levels of PBS use (Jordan et al., 2019). Similarly, alcohol outcomes were found to be attenuated at high levels of PBS use for individuals exhibiting primary psychopathy (Kramer et al., 2017) and narcissistic traits (Kramer et al., 2019). Thus, this showcases how alcohol PBS can be differentially effective for certain types of mental health problems, thereby warranting further consideration when investigating and building interventions in combination with PBS.

Moreover, it is important to further understand how the association between PBS and outcomes may be differentially impacted by psychological constructs. For instance, guilt-proneness (Treeby et al., 2018), premeditation and perseverance impulsivity traits (Pearson et al., 2012), behaviorally oriented problem-focused coping (Walker & Stephens, 2014), high self-esteem (Zeigler-Hill et al., 2012), high levels of self-regulation (D'Lima et al., 2012), and adaptive perfectionism (Watson et al., 2019) have been associated with more PBS use and subsequent reductions on various alcohol outcomes (consumption and negative consequences). In contrast, sensation seeking and impulsivity (Pearson et al., 2012), cognitive oriented problem-focused coping (Watson et al., 2019), being a male with low self-esteem (Zeigler-Hill et al., 2012), and low levels of social pressure and emotional regulation self-efficacy (Ehret et al., 2013), have been associated with less PBS use and increases in alcohol-related negative outcomes. Yet, shame-proneness (Treeby et al., 2018), positive urgency (Pearson et al., 2012) high levels of social and emotional self-efficacy (Ehret et al., 2013), and maladaptive perfectionism (Watson et al., 2019) were unrelated to PBS use. Additionally, PBS was found to be a protective factor by limiting adverse alcohol outcomes among individuals

with negative urgency traits (Weaver et al., 2012) as well as those with low levels of self-regulation (D'Lima et al., 2012). These findings showcase how distinct psychological constructs can exhibit unique effects on PBS use and the importance of continuing to evaluate these constructs when delivering interventions.

Clinical Implications

The current article serves two overarching implications for clinical practice. First, a comprehensive list of PBS measures for a variety of risk behaviors is provided. These measures are useful both in the research domain (as evidenced throughout this review) and in the clinical domain for tracking behavioral change. As clinical work continues to focus on patient goals and strengths (Peterson, 2006), so too must self-report measures assess areas of positive behaviors and growth. Protective strategies are often why patients typically seek treatment. Second, this review highlights interventions that can be implemented both at the individual level (e.g., traditional psychotherapy) and broadly to entire groups (e.g., university-wide programs). While more research is necessary, the interventions outlined in this review suggest positive steps forward for reducing unwanted consequences and embracing a harm-reduction approach.

Limitations

Despite the potential contribution this brief review offers to the field at-large in regard to PBS, it is not without its limitations. Specifically, after excluding the articles that failed to meet inclusion criteria, the present review was limited by the number of viable remaining studies. Similarly, related to the search protocols employed herein, it is possible that relevant research was omitted from the final analysis. Subjectivity inevitably exists throughout the screening process for a review paper. An additional and all too common limitation inherent to systematic reviews by-and-large is the potential for overestimating the efficacy of the studies reviewed. Ultimately a discrete form of publication bias, failing to include unpublished studies can lead reviewers to present an overly sanguine estimate of intervention efficacy.

Conclusion

The literature reviewed in this brief review suggests PBS can be a useful tool for mitigating the negative consequences associated with risky behaviors. While much of the literature on PBS has focused on alcohol use, there is promise in its effectiveness broadly among other risk behaviors. Future research should focus on refining the measurements of PBS and the interventions within which PBS are employed.

References

- Abbey, A., Wegner, R., Pierce, J., & Jacques-Tiura, A. J. (2012). Patterns of sexual aggression in a community sample of young men: Risk factors associated with persistence, desistance, and initiation over a one year interval. *Psychology of Violence*, 2(1), 1–15. <https://doi.org/10.1037/a0026346>
- Abbey, A., Zawacki, T., Buck, P. O., Clinton, A. M., & McAuslan, P. (2004). Sexual assault and alcohol consumption: What do we know about their relationship and what types of research are still needed? *Aggression and*

- Violent Behavior*, 9(3), 271–303. [https://doi.org/10.1016/S1359-1789\(03\)00011-9](https://doi.org/10.1016/S1359-1789(03)00011-9)
- Baer, J. S., Kivlahan, D. R., & Donovan, D. M. (1999). Integrating skills training and motivational therapies. Implications for the treatment of substance dependence. *Journal of Substance Abuse Treatment*, 17(1–2), 15–23. [https://doi.org/10.1016/S0740-5472\(98\)00072-5](https://doi.org/10.1016/S0740-5472(98)00072-5)
- Bagot, K. L., Cheetham, A., Lubman, D., & Rodda, S. N. (2020). Predictors of strategy engagement for the prevention and reduction of gambling harm: A prospective application of the theory of planned behaviour. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00265-5>
- Barnett, N. P., Murphy, J. G., Colby, S. M., & Monti, P. M. (2007). Efficacy of counselor vs. computer-delivered intervention with mandated college students. *Addictive Behaviors*, 32(11), 2529–2548. <https://doi.org/10.1016/j.addbeh.2007.06.017>
- Blanton, H., Stuart, A. E., & Van den Eijnden, R. J. J. M. (2001). An introduction to deviance-regulation theory: The effect of behavioral norms on message framing. *Personality and Social Psychology Bulletin*, 27(7), 848–858. <https://doi.org/10.1177/0146167201277007>
- Bondallaz, P., Favrat, B., Chtioui, H., Fornari, E., Maeder, P., & Giroud, C. (2016). Cannabis and its effects on driving skills. *Forensic Science International*, 268, 92–102. <https://doi.org/10.1016/j.forsciint.2016.09.007>
- Braitman, A. L., Henson, J. M., & Carey, K. B. (2015). Clarifying observed relationships between protective behavioral strategies and alcohol outcomes: The importance of response options. *Psychology of Addictive Behaviors*, 29(2), 455–466. <https://doi.org/10.1037/adb0000024>
- Bravo, A. J., Prince, M. A., & Pearson, M. R. (2015). Does the how mediate the why? A multiple replication examination of drinking motives, alcohol protective behavioral strategies, and alcohol outcomes. *Journal of Studies on Alcohol and Drugs*, 76(6), 872–883. <https://doi.org/10.15288/jasad.2015.76.872>
- Bravo, A. J., Prince, M. A., & Pearson, M. R. (2016). A multiple replication examination of distal antecedents to alcohol protective behavioral strategies. *Journal of Studies on Alcohol and Drugs*, 77(6), 958–967. <https://doi.org/10.15288/jasad.2016.77.958>
- Bravo, A. J., Prince, M. A., Pearson, M. R., & the Marijuana Outcomes Study Team. (2017). Can I use marijuana safely? An examination of distal antecedents, marijuana protective behavioral strategies, and marijuana outcomes. *Journal of Studies on Alcohol and Drugs*, 78(2), 203–212. <https://doi.org/10.15288/jasad.2017.78.203>
- Breitenbecher, K. H. (2008). The convergent validities of two measures of dating behaviors related to risk for sexual victimization. *Journal of Interpersonal Violence*, 23(8), 1095–1107. <https://doi.org/10.1177/0886260507313974>
- Bryan, A., Fisher, J. D., & Fisher, W. A. (2002). Tests of the mediational role of preparatory safer sexual behavior in the context of the theory of planned behavior. *Health Psychology*, 21(1), 71–80. <https://www.ncbi.nlm.nih.gov/pubmed/11846347>. <https://doi.org/10.1037/0278-6133.21.1.71>
- Buckner, J. D., Lewis, E. M., Shah, S. M., & Walukevich, K. A. (2018). Risky sexual behavior among cannabis users: The role of protective behavioral strategies. *Addictive Behaviors*, 81, 50–54. <https://doi.org/10.1016/j.addbeh.2018.01.039>
- Cohen, I. M., McCormick, A. V., & Corrado, R. R. (2011). *BCLC's Voluntary Self-Exclusion Program: Perceptions and experiences of a sample of program participants*. <https://www.gaming.gov.bc.ca/reports/docs/rpt-bclc-self-exclusion-program.pdf>
- Collins, S. E., Clifasefi, S. L., Dana, E. A., Andrasik, M. P., Stahl, N., Kirouac, M., Welbaum, C., King, M., & Malone, D. K. (2012). Where harm reduction meets housing first: Exploring alcohol's role in a project-based housing first setting. *The International Journal on Drug Policy*, 23(2), 111–119. <https://doi.org/10.1016/j.drugpo.2011.07.010>
- Collins, S. E., Clifasefi, S. L., Logan, D. E., Samples, L. S., Somers, J. M., & Marlatt, G. A. (2012). Current status, historical highlights, and basic principles of harm reduction. In G. A. Marlatt (Ed.), *Harm reduction: Pragmatic strategies for managing high-risk behaviors* (2nd ed., pp. 3–35). Guilford Press.
- Collins, S. E., Malone, D. K., Clifasefi, S. L., Ginzler, J. A., Garner, M. D., Burlingham, B., Lonczak, H. S., Dana, E. A., Kirouac, M., Tanzer, K., Hobson, W. G., Marlatt, G. A., & Larimer, M. E. (2012). Project-based Housing First for chronically homeless individuals with alcohol problems: Within-subjects analyses of 2-year alcohol trajectories. *American Journal of Public Health*, 102(3), 511–519. <https://doi.org/10.2105/AJPH.2011.300403>
- Cronce, J. M., & Larimer, M. E. (2011). Individual-focused approaches to the prevention of college student drinking. *Alcohol Research & Health*, 34(2), 210–221.
- 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. <https://doi.org/10.1037/a0026942>
- Davis, K. C., Gilmore, A. K., Stappenbeck, C. A., Balsan, M. J., George, W. H., & Norris, J. (2014). How to score the Sexual Experiences Survey? A comparison of nine methods. *Psychology of Violence*, 4(4), 445–461. <https://doi.org/10.1037/a0037494>
- Defense Information Systems Agency. (2021). Global solutions. *Map of marijuana legality by state*. <https://disa.com/map-of-marijuana-legality-by-state>
- De Leon, A. N., Dvorak, R. D., Smallman, R., Arthur, K., & Perry, C. (in press). Using counterfactual thinking theory to change alcohol protective behavioral strategies use intentions. *British Journal of Health Psychology*. <https://doi.org/10.1111/bjhp.12535>
- Dekker, M. R., Jongenelis, M. I., Wakefield, M., Kypri, K., Hasking, P., & Pettigrew, S. (2018). A longitudinal examination of protective behavioral strategies and alcohol consumption among adult drinkers. *Addictive Behaviors*, 87, 1–7. <https://doi.org/10.1016/j.addbeh.2018.06.017>
- 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. <https://doi.org/10.1037/a0030475>
- 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*. The Guilford Press.
- Doumas, D. M., Esp, S., Johnson, J., Trull, R., & Shearer, K. (2017). The eCHECKUP TO GO for High School: Impact on risk factors and protective behavioral strategies for alcohol use. *Addictive Behaviors*, 64, 93–100. <https://doi.org/10.1016/j.addbeh.2016.08.030>
- Drawson, A. S., Tanner, J., Mushquash, C. J., Mushquash, A. R., & Mazmanian, D. (2017). The use of protective behavioural strategies in gambling: A systematic review. *International Journal of Mental Health and Addiction*, 15(6), 1302–1319. <https://doi.org/10.1007/s11469-017-9754-y>
- Dunn, C., Deroo, L., & Rivara, F. P. (2001). The use of brief interventions adapted from motivational interviewing across behavioral domains: A systematic review. *Addiction*, 96, 1725–1742. <https://doi.org/10.1046/j.1360-0443.2001.96121725.x>
- Dvorak, R. D., Kramer, M. P., & Stevenson, B. L. (2018). An initial examination of the effects of deviance regulation theory on normative perceptions. *Journal of Substance Use*, 23(6), 567–573. <https://doi.org/10.1080/14659891.2018.1459900>
- Dvorak, R. D., Kramer, M. P., Stevenson, B. L., Sargent, E. M., & Kilwein, T. M. (2017). An application of deviance regulation theory to reduce alcohol-related problems among college women during spring break. *Psychology of Addictive Behaviors*, 31(3), 295–306. <https://doi.org/10.1037/adb0000258>
- Dvorak, R. D., Pearson, M. R., Neighbors, C., & Martens, M. P. (2015). Fitting in and standing out: Increasing the use of alcohol protective

- behavioral strategies with a deviance regulation intervention. *Journal of Consulting and Clinical Psychology*, 83(3), 482–493. <https://doi.org/10.1037/a0038902>
- Dvorak, R. D., Pearson, M. R., Neighbors, C., Martens, M. P., Stevenson, B. L., & Kuvaas, N. J. (2016). A road paved with safe intentions: Increasing intentions to use alcohol protective behavioral strategies via Deviance Regulation Theory. *Health Psychology*, 35(6), 604–613. <https://doi.org/10.1037/hea0000327>
- Dvorak, R. D., Troop-Gordon, W., Stevenson, B. L., Kramer, M. P., Wilborn, D., & Leary, A. V. (2018). A randomized control trial of a deviance regulation theory intervention to increase alcohol protective strategies. *Journal of Consulting and Clinical Psychology*, 86(12), 1061–1075. <https://doi.org/10.1037/ccp0000347>
- 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. <https://doi.org/10.1016/j.addbeh.2012.12.022>
- ElSohly, M. A., Mehmedic, Z., Foster, S., Gon, C., Chandra, S., & Church, J. C. (2016). Changes in Cannabis potency over the last 2 decades (1995–2014): Analysis of current data in the United States. *Biological Psychiatry*, 79(7), 613–619. <https://doi.org/10.1016/j.biopsych.2016.01.004>
- Field, C., Hungerford, D. W., & Dunn, C. (2005). Brief motivational interventions: An introduction. *The Journal of Trauma*, 59(3, Suppl), S21–S26. <https://doi.org/10.1097/01.ta.0000179899.37332.8a>
- Friedman, S. R., de Jong, W., Rossi, D., Touzé, G., Rockwell, R., Des Jarlais, D. C., & Elovich, R. (2007). Harm reduction theory: Users' culture, micro-social indigenous harm reduction, and the self-organization and outside-organizing of users' groups. *The International Journal on Drug Policy*, 18(2), 107–117. <https://doi.org/10.1016/j.drugpo.2006.11.006>
- Gilmore, A. K., Granato, H. F., & Lewis, M. A. (2013). The use of drinking and condom-related protective strategies in association with condom use and sex-related alcohol use. *Journal of Sex Research*, 50(5), 470–479. <https://doi.org/10.1080/00224499.2011.653607>
- Gilmore, A. K., Lewis, M. A., & George, W. H. (2015). A randomized controlled trial targeting alcohol use and sexual assault risk among college women at high risk for victimization. *Behaviour Research and Therapy*, 74, 38–49. <https://doi.org/10.1016/j.brat.2015.08.007>
- Gilmore, A. K., Maples-Keller, J. L., Pinsky, H. T., Shepard, M. E., Lewis, M. A., & George, W. H. (2018). Is the use of protective behavioral strategies associated with college sexual assault victimization? A prospective examination. *Journal of Interpersonal Violence*, 33(17), 2664–2681. <https://doi.org/10.1177/0886260516628808>
- Granato, H., Luk, J. W., Paves, A., Geisner, I. M., Cronce, J. M., Kilmer, J. R., Lostutter, T. W., & Larimer, M. E. (2018). Crossover effects of protective behavioural strategies for drinking on gambling consequences among college gamblers with alcohol or drug abuse. *Journal of Gambling Issues*, 38, 190–202. <https://doi.org/10.4309/jgi.2018.38.10>
- Grund, J. P., Kaplan, C. D., & Adriaans, N. F. (1991). Needle sharing in The Netherlands: An ethnographic analysis. *American Journal of Public Health*, 81(12), 1602–1607. <https://doi.org/10.2105/AJPH.81.12.1602>
- Grund, J. P., Stern, L. S., Kaplan, C. D., Adriaans, N. F., & Drucker, E. (1992). Drug use contexts and HIV-consequences: The effect of drug policy on patterns of everyday drug use in Rotterdam and the Bronx. *British Journal of Addiction*, 87(3), 381–392. <https://doi.org/10.1111/j.1360-0443.1992.tb01939.x>
- Hanson, K. A., & Gidycz, C. A. (1993). Evaluation of a sexual assault prevention program. *Journal of Consulting and Clinical Psychology*, 61(6), 1046–1052. <https://doi.org/10.1037/0022-006X.61.6.1046>
- Harris, A., & Griffiths, M. D. (2017). A critical review of the harm-minimisation tools available for electronic gambling. *Journal of Gambling Studies*, 33(1), 187–221. <https://doi.org/10.1007/s10899-016-9624-8>
- Hickman, S. E., & Muehlenhard, C. L. (1997). College women's fears and precautionary behaviors relating to acquaintance rape and stranger rape. *Psychology of Women Quarterly*, 21(4), 527–547. <https://doi.org/10.1111/j.1471-6402.1997.tb00129.x>
- Johnston, L., O'Malley, P., Miech, R., Bachman, J., & Schulenberg, J. (2016). *Monitoring the Future national survey results on drug use, 1975–2015: Overview, key findings on adolescent drug use*. <http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2015.pdf>
- Jordan, H. R., Madson, M. B., Nicholson, B. C., Bravo, A. J., Pearson, M. R., & Protective Strategies Study Team. (2019). Posttraumatic stress disorder symptoms and problematic alcohol use in college students: The moderating role of alcohol protective behavioral strategies and gender. *Psychological Trauma*, 11(3), 247–255. <https://doi.org/10.1037/tra0000417>
- Kenney, S. R., Napper, L. E., LaBrie, J. W., & Martens, M. P. (2014). Examining the efficacy of a brief group protective behavioral strategies skills training alcohol intervention with college women. *Psychology of Addictive Behaviors*, 28(4), 1041–1051. <https://doi.org/10.1037/a0038173>
- Kerlikowske, G. (2010). *Release of the Obama administration's national drug control policy* (Foreign Press Center briefing with Gil Kerlikowske, Director), Office of National Drug Control Policy.
- Kite, B. A., Pearson, M. R., & Henson, J. M. (2013). The assessment of protective behavioral strategies: Comparing the absolute frequency and contingent frequency response scales. *Psychology of Addictive Behaviors*, 27(4), 1010–1018. <https://doi.org/10.1037/a0031366>
- Kramer, M. P., Stevenson, B. L., & Dvorak, R. D. (2017). Primary psychopathy and alcohol pathology in college students: The role of protective behavioral strategies. *The American Journal of Drug and Alcohol Abuse*, 43(6), 719–726. <https://doi.org/10.1080/00952990.2016.1278222>
- Kramer, M. P., Wilborn, D. D., Spencer, C. C., Stevenson, B. L., & Dvorak, R. D. (2019). Protective behavioral strategies moderate the association between narcissistic traits and alcohol pathology in college student drinkers. *Substance Use & Misuse*, 54(5), 863–867. <https://doi.org/10.1080/10826084.2018.1547909>
- LaBrie, J. W., Kenney, S. R., Lac, A., Garcia, J. A., & Ferraiolo, P. (2009). Mental and social health impacts the use of protective behavioral strategies in reducing risky drinking and alcohol consequences. *Journal of College Student Development*, 50(1), 35–49. <https://doi.org/10.1353/csd.0.0050>
- LaBrie, J. W., Napper, L. E., Grimaldi, E. M., Kenney, S. R., & Lac, A. (2015). The efficacy of a standalone protective behavioral strategies intervention for students accessing mental health services. *Prevention Science*, 16(5), 663–673. <https://doi.org/10.1007/s1121-015-0549-8>
- Landry, A. S., Moorer, K. D., Madson, M. B., & Zeigler-Hill, V. (2014). Protective behavioral strategies and alcohol use outcomes among college women drinkers: Does disordered eating and race moderate this association? *Journal of Drug Education*, 44(3–4), 95–115. <https://doi.org/10.1177/0047237915573525>
- Larimer, M. E., & Cronce, J. M. (2002). Identification, prevention and treatment: A review of individual-focused strategies to reduce problematic alcohol consumption by college students. *Journal of Studies on Alcohol*, 5(4), 148–163. <https://doi.org/10.15288/jsas.2002.s14.148>
- 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. <https://doi.org/10.1016/j.addbeh.2007.05.006>
- Larimer, M. E., Marlatt, G. A., Baer, J. S., Quigley, L. A., Blume, A. W., & Hawkins, E. H. (1998). Harm reduction for alcohol problems: Expanding access to and acceptability of prevention and treatment services. In G. A. Marlatt (Ed.), *Harm reduction: Pragmatic strategies for managing high-risk behaviors* (pp. 69–121). Guilford Press.
- Leadbeater, B. J., Ames, M. E., & Linden-Carmichael, A. N. (2019). Age-varying effects of cannabis use frequency and disorder on symptoms of psychosis, depression and anxiety in adolescents and adults. *Addiction*, 114(2), 278–293. <https://doi.org/10.1111/add.14459>

- Leary, A. V., & Dvorak, R. D. (2019). How many and how much: Examining norm type in a deviance regulation theory intervention for college freshmen. *Alcoholism: Clinical and Experimental Research*, *43*, 128A.
- Leavens, E. L. S., Miller, M. B., Brett, E. I., Baraldi, A., & Leffingwell, T. R. (2020). Influencing college students' normative perceptions of protective behavioral strategies: A pilot randomized trial. *Addictive Behaviors*, *104*, Article 106256. <https://doi.org/10.1016/j.addbeh.2019.106256>
- Leeman, R. F., DeMartini, K. S., Gueorguieva, R., Nogueira, C., Corbin, W. R., Neighbors, C., & O'Malley, S. S. (2016). Randomized controlled trial of a very brief, multicomponent web-based alcohol intervention for undergraduates with a focus on protective behavioral strategies. *Journal of Consulting and Clinical Psychology*, *84*(11), 1008–1015. <https://doi.org/10.1037/ccp0000132>
- Lewis, M. A., Logan, D. E., & Neighbors, C. (2009). Examining the role of gender in the relationship between use of condom-related protective behavioral strategies when drinking and alcohol-related sexual behavior. *Sex Roles*, *61*(9–10), 727–735. <https://doi.org/10.1007/s11199-009-9661-1>
- 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. <https://doi.org/10.1037/a0018361>
- Linden-Carmichael, A. N., Braitman, A. L., & Henson, J. M. (2015). Protective behavioral strategies as a mediator between depressive symptom fluctuations and alcohol consumption: A longitudinal examination among college students. *Journal of Studies on Alcohol and Drugs*, *76*(1), 80–88. <https://doi.org/10.15288/jsad.2015.76.80>
- Linden-Carmichael, A. N., Calhoun, B. H., Patrick, M. E., & Maggs, J. L. (2019). University students use fewer protective behavioural strategies on high-intensity drinking days. *Drug and Alcohol Review*, *38*(3), 302–305. <https://doi.org/10.1111/dar.12913>
- Litt, D. M., Lewis, M. A., Blayney, J. A., & Kaysen, D. L. (2013). Protective behavioral strategies as a mediator of the generalized anxiety and alcohol use relationship among lesbian and bisexual women. *Journal of Studies on Alcohol and Drugs*, *74*(1), 168–174. <https://doi.org/10.15288/jsad.2013.74.168>
- Livingstone, C., Rintoul, A., & Francis, L. (2014). What is the evidence for harm minimisation measures in gambling venues? *Evidence Base*, *2*, 1–24. <https://doi.org/10.4225/50/558112A877C5D>
- Lostutter, T. W., Lewis, M. A., Crouce, J. M., Neighbors, C., & Larimer, M. E. (2014). The use of protective behaviors in relation to gambling among college students. *Journal of Gambling Studies*, *30*(1), 27–46. <https://doi.org/10.1007/s10899-012-9343-8>
- Madson, M. B., & Zeigler-Hill, V. (2013). Protective behavioral strategies, alcohol consumption, and negative alcohol-related consequences: Do race and gender moderate these associations? *Journal of Ethnicity in Substance Abuse*, *12*(3), 242–258. <https://doi.org/10.1080/15332640.2013.798848>
- Magill, M., Colby, S. M., Orchowski, L., Murphy, J. G., Hoadley, A., Brazil, L. A., & Barnett, N. P. (2017). How does brief motivational intervention change heavy drinking and harm among underage young adult drinkers? *Journal of Consulting and Clinical Psychology*, *85*, 447–458. <https://doi.org/10.1037/ccp0000200>
- Marlatt, G. A., Baer, J. S., & Larimer, M. (1995). Preventing alcohol abuse in college students: A harm-reduction approach. In J. H. G. M. Boyd & R. A. Zucker (Eds.), *Alcohol problems among adolescents: Current directions in prevention research* (pp. 147–172). Lawrence Erlbaum.
- 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. <https://doi.org/10.15288/jsa.2005.66.698>
- Martens, M. P., Karakashian, M. A., Fleming, K. M., Fowler, R. M., Hatchett, E. S., & Cimini, M. D. (2009). Conscientiousness, protective behavioral strategies, and alcohol use: Testing for mediated effects. *Journal of Drug Education*, *39*(3), 273–287. <https://doi.org/10.2190/DE.39.3.d>
- Martens, M. P., Smith, A. E., & Murphy, J. G. (2013). The efficacy of single-component brief motivational interventions among at-risk college drinkers. *Journal of Consulting and Clinical Psychology*, *81*(4), 691–701. <https://doi.org/10.1037/a0032235>
- 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. <https://doi.org/10.1037/0893-164X.18.4.390>
- Martin, J. L., Colvin, K. F., Madson, M. B., Zamboanga, B. L., & Paziienza, R. (2020). Optimal assessment of protective behavioral strategies among college drinkers: An item response theory analysis. *Psychological Assessment*, *32*(4), 394–406. <https://doi.org/10.1037/pas0000799>
- McMahon, N., Thomson, K., Kaner, E., & Bamba, C. (2019). Effects of prevention and harm reduction interventions on gambling behaviours and gambling related harm: An umbrella review. *Addictive Behaviors*, *90*, 380–388. <https://doi.org/10.1016/j.addbeh.2018.11.048>
- Miller, W. R., & Rollnick, S. (1991). *Motivational interviewing: Preparing people to change addictive behaviors*. Guilford Press.
- Monti, P. M., Colby, S. M., Barnett, N. P., Spirito, A., Rohsenow, D. J., Myers, M., Woolard, R., & Lewander, W. (1999). Brief intervention for harm reduction with alcohol-positive older adolescents in a hospital emergency department. *Journal of Consulting and Clinical Psychology*, *67*(6), 989–994. <https://doi.org/10.1037/0022-006X.67.6.989>
- Moore, C. D., & Waterman, C. K. (1999). Predicting self-protection against sexual assault in dating relationships among heterosexual men and women, gay men, lesbians, and bisexuals. *Journal of College Student Development*, *40*(2), 132–140.
- Murphy, J. G., Dennhardt, A. A., Skidmore, J. R., Borsari, B., Barnett, N. P., Colby, S. M., & Martens, M. P. (2012). A randomized controlled trial of a behavioral economic supplement to brief motivational interventions for college drinking. *Journal of Consulting and Clinical Psychology*, *80*(5), 876–886. <https://doi.org/10.1037/a0028763>
- Neilson, E. C., Gilmore, A. K., Pinsky, H. T., Shepard, M. E., Lewis, M. A., & George, W. H. (2015). The use of drinking and sexual assault protective behavioral strategies: Associations with sexual victimization and revictimization among college women. *Journal of Interpersonal Violence*, *33*(1), 137–158. <https://doi.org/10.1177/0886260515603977>
- Neugebauer, R. T., Parnes, J. E., Prince, M. A., Conner, B. T., & Marijuana Outcomes Study Team. (2019). Protective behavioral strategies mediate the relation between sensation seeking and marijuana-related consequences. *Substance Use and Misuse*, *54*(6), 973–979. <https://doi.org/10.1080/10826084.2018.1555256>
- 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. <https://doi.org/10.2190/DE.41.1.d>
- O'Donnell, R., Richardson, B., Fuller-Tyszkiewicz, M., & Staiger, P. K. (2019). Delivering personalized protective behavioral drinking strategies via a smartphone intervention: A pilot study. *International Journal of Behavioral Medicine*, *26*(4), 401–414. <https://doi.org/10.1007/s12529-019-09789-0>
- O'Hare, T. O. (2001). Substance abuse and risky sex in young people: The development and validation of the risky sex scale. *The Journal of Primary Prevention*, *22*(2), 89–101. <https://doi.org/10.1023/A:1012653717412>
- Palmer, R. S. (2004). *Efficacy of the Alcohol Skills Training Program in mandated and non-mandated heavy drinking college students* (Unpublished doctoral dissertation). University of Washington.
- Parnes, J. E., Prince, M. A., Conner, B. T., & Marijuana Outcomes Study, T. (2018). A mediated multigroup model examining marijuana use consequences by sexual orientation in us college students. *Addictive Behaviors*, *87*, 86–91. <https://doi.org/10.1016/j.addbeh.2018.06.021>
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review*, *33*(8), 1025–1040. <https://doi.org/10.1016/j.cpr.2013.08.006>

- Pearson, M. R., D'Lima, G. M., & 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. <https://doi.org/10.1037/a0032516>
- Pearson, M. R., & Henson, J. M. (2013). Unplanned drinking and alcohol-related problems: A preliminary test of the model of unplanned drinking behavior. *Psychology of Addictive Behaviors*, 27(3), 584–595. <https://doi.org/10.1037/a0030901>
- 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. <https://doi.org/10.2190/DE.42.4.d>
- Pearson, M. R., Kite, B. A., & Henson, J. M. (2013). Predictive effects of good self-control and poor regulation on alcohol-related outcomes: Do protective behavioral strategies mediate? *Psychology of Addictive Behaviors*, 27(1), 81–89. <https://doi.org/10.1037/a0028818>
- Pearson, M. R., Liese, B. S., Dvorak, R. D., & Marijuana Outcomes Study, T. (2017). College student marijuana involvement: Perceptions, use, and consequences across 11 college campuses. *Addictive Behaviors*, 66, 83–89. <https://doi.org/10.1016/j.addbeh.2016.10.019>
- Pedersen, E. R., Davis, J. P., Hummer, J. F., DiGuiseppi, G., Sedano, A., Rodriguez, A., & Clapp, J. D. (2020). Development of a measure to assess protective behavioral strategies for pre-gaming among young adults. *Substance Use & Misuse*, 55(4), 534–545. <https://doi.org/10.1080/10826084.2019.1686025>
- Pedersen, E. R., Huang, W., Dvorak, R. D., Prince, M. A., & Hummer, J. F., & The Marijuana Outcomes Study Team. (2017). The protective behavioral strategies for Marijuana Scale: Further examination using item response theory. *Psychology of Addictive Behaviors*, 31(5), 548–559. <https://doi.org/10.1037/adb0000271>
- 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. <https://doi.org/10.15288/jsad.2016.77.441>
- Peterson, C. (2006). *A primer in positive psychology*. Oxford Press.
- Peterson, R., Dvorak, R. D., Woerner, J., & Lewis, M. A. (2021). Internalizing symptoms, alcohol use, and protective behavioral strategies: Associations with regretted sexual experiences of college students. *Journal of Affective Disorders*, 283, 363–372. <https://doi.org/10.1016/j.jad.2021.01.077>
- Peterson, R. S., Dvorak, R. D., Stevenson, B. L., Kramer, M. P., Pinto, D. A., Mora, E. T., & Leary, A. V. (2020). Protective behavioral strategies and alcohol-related regretted sex among college students. *Experimental and Clinical Psychopharmacology*, 28(1), 6–12. <https://doi.org/10.1037/pha0000291>
- 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. <https://doi.org/10.1016/j.addbeh.2013.03.010>
- Prince, M. A., Collins, R. L., Wilson, S. D., & Vincent, P. C. (2020). A preliminary test of a brief intervention to lessen young adults' cannabis use: Episode-level smartphone data highlights the role of protective behavioral strategies and exercise. *Experimental and Clinical Psychopharmacology*, 28(2), 150–156. <https://doi.org/10.1037/pha0000301>
- Prince, M. A., Jenzer, T., Brown, W., Hetelekides, E. M., Mumm, R. A., & Collins, R. L. (2019). Examining cannabis protective behavioral strategy use using multiple methods. *Drugs and Alcohol Today*, 19(4), 295–305. <https://doi.org/10.1108/DAT-10-2018-0061>
- Ramaekers, J. G., Kauert, G., Theunissen, E. L., Toennes, S. W., & Moeller, M. R. (2009). Neurocognitive performance during acute THC intoxication in heavy and occasional cannabis users. *Journal of Psychopharmacology (Oxford, England)*, 23(3), 266–277. <https://doi.org/10.1177/0269881108092393>
- Richards, D. K., Pearson, M. R., Morera, O. F., & Field, C. A. (2019). Protective behavioral strategies predict alcohol-related problems among injured patients following a brief intervention. *Drug and Alcohol Dependence*, 205, Article 107535. <https://doi.org/10.1016/j.drugalcdep.2019.06.037>
- Riggs, N. R., Conner, B. T., Parnes, J. E., Prince, M. A., Shillington, A. M., & George, M. W. (2018). Marijuana eCHECKUPTO GO: Effects of a personalized feedback plus protective behavioral strategies intervention for heavy marijuana-using college students. *Drug and Alcohol Dependence*, 190, 13–19. <https://doi.org/10.1016/j.drugalcdep.2018.05.020>
- Sargent, E. M., Kilwein, T. M., Dvorak, R. D., Looby, A., Stevenson, B. L., & Kramer, M. P. (2018). Deviance regulation theory and drinking outcomes among Greek-life students during spring break. *Experimental and Clinical Psychopharmacology*, 26(4), 366–376. <https://doi.org/10.1037/pha0000204>
- Sell, N. M., Turrissi, 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. <https://doi.org/10.1177/0361684317744198>
- 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. <https://doi.org/10.1037/0893-164X.21.3.338>
- Sugarman, D. E., & Carey, K. B. (2009). Drink less or drink slower: The effects of instruction on alcohol consumption and drinking control strategy use. *Psychology of Addictive Behaviors*, 23(4), 577–585. <https://doi.org/10.1037/a0016580>
- Tanner, J., Dawson, A. S., Mushquash, C. J., Mushquash, A. R., & Mazmanian, D. (2017). Harm reduction in gambling: A systematic review of industry strategies. *Addiction Research and Theory*, 25(6), 485–494. <https://doi.org/10.1080/16066359.2017.1310204>
- Terlecki, M. A., Buckner, J. D., & Copeland, A. L. (2021). Protective behavioral strategies underutilization mediates effect of a brief motivational intervention among socially anxious undergraduate drinkers. *Psychology of Addictive Behaviors*, 35(1), 73–84. <https://doi.org/10.1037/adb0000701>
- Terlecki, M. A., Ecker, A. H., & Buckner, J. D. (2020). The role of underutilization of protective behavioral strategies in the relation of social anxiety with risky drinking. *Addictive Behaviors*, 100, Article 106122. <https://doi.org/10.1016/j.addbeh.2019.106122>
- Treat, T. A., Corbin, W. R., & Viken, R. J. (2021). Protective behavioral strategies for sexual aggression and risky sexual behavior. *Aggressive Behaviors*, 47(3), 284–295. <https://doi.org/10.1002/ab.21949>
- Treeby, M. S., Rice, S. M., Cocker, F., Peacock, A., & Bruno, R. (2018). Guilt-proneness is associated with the use of protective behavioral strategies during episodes of alcohol use. *Addictive Behaviors*, 79, 120–123. <https://doi.org/10.1016/j.addbeh.2017.12.027>
- Treloar, H., Martens, M. P., & McCarthy, D. M. (2015). The protective behavioral strategies scale-20: Improved content validity of the Serious Harm Reduction subscale. *Psychological Assessment*, 27(1), 340–346. <https://doi.org/10.1037/pas0000071>
- Voss, A. T., Jorgensen, M. K., & Murphy, J. G. (2021). Episodic future thinking as a brief alcohol intervention for heavy drinking college students: A pilot feasibility study. *Experimental and Clinical Psychopharmacology*. Advance online publication. <https://doi.org/10.1037/pha0000451>
- Walker, R., & Stephens, R. S. (2014). Protective behavioral strategies mediate problem-focused coping and alcohol use in college students. *Addictive Behaviors*, 39(6), 1033–1037. <https://doi.org/10.1016/j.addbeh.2014.02.006>
- Walters, J., Janssen, T., Mastroleone, N. R., Hoadley, A., Barnett, N. P., Colby, S. M., & Magill, M. (2019). A sequential analysis of clinician skills and client change statements in a brief motivational intervention for young

- adult heavy drinking. *Behavior Therapy*, 50(4), 732–742. <https://doi.org/10.1016/j.beth.2018.11.003>
- Watson, T. L., Jordan, H. R., & Madson, M. B. (2019). Perfectionism and alcohol use outcomes in college students: The moderating role of alcohol protective behavioral strategies. *Addiction Research & Theory*, 28(5), 379–386. <https://doi.org/10.1080/16066359.2019.1663832>
- Weaver, C. C., Martens, M. P., & Smith, A. E. (2012). Do protective behavioral strategies moderate the relationship between negative urgency and alcohol-related outcomes among intercollegiate athletes? *Journal of Studies on Alcohol and Drugs*, 73(3), 498–503. <https://doi.org/10.15288/jsad.2012.73.498>
- Werch, C. E. (1990). Behavioral self-control strategies for deliberately limiting drinking among college students. *Addictive Behaviors*, 15(2), 119–128. [https://doi.org/10.1016/0306-4603\(90\)90015-P](https://doi.org/10.1016/0306-4603(90)90015-P)
- Wong, M. M., Craun, E. A., Bravo, A. J., Pearson, M. R., & Protective Strategies Study Team. (2019). Insomnia symptoms, cannabis protective behavioral strategies, and hazardous cannabis use among U.S. college students. *Experimental and Clinical Psychopharmacology*, 27(4), 309–317. <https://doi.org/10.1037/pha0000273>
- Zeigler-Hill, V., Madson, M. B., & Ricedorf, A. (2012). Does self-esteem moderate the associations between protective behavioral strategies and negative outcomes associated with alcohol consumption? *Journal of Drug Education*, 42, 211–227. <https://doi.org/10.2190/DE.42.2.f>

Received October 30, 2020

Revision received April 26, 2021

Accepted April 29, 2021 ■

E-Mail Notification of Your Latest Issue Online!

Would you like to know when the next issue of your favorite APA journal will be available online? This service is now available to you. Sign up at <https://my.apa.org/portal/alerts/> and you will be notified by e-mail when issues of interest to you become available!