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To cite this article: Eric R. Pedersen, Jordan P. Davis, Justin F. Hummer, Graham DiGuseppi, Angeles Sedano, Anthony Rodriguez & John D. Clapp (2020) Development of a Measure to Assess Protective Behavioral Strategies for Pregaming among Young Adults, Substance Use & Misuse, 55:4, 534-545, DOI: [10.1080/10826084.2019.1686025](https://doi.org/10.1080/10826084.2019.1686025)

To link to this article: <https://doi.org/10.1080/10826084.2019.1686025>



Published online: 17 Dec 2019.



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ORIGINAL ARTICLE



## Development of a Measure to Assess Protective Behavioral Strategies for Pregaming among Young Adults

Eric R. Pedersen<sup>a</sup> , Jordan P. Davis<sup>b</sup>, Justin F. Hummer<sup>a</sup>, Graham DiGuseppi<sup>b</sup>, Angeles Sedano<sup>b</sup>, Anthony Rodriguez<sup>c</sup>, and John D. Clapp<sup>d</sup>

<sup>a</sup>RAND Corporation, Santa Monica, California, USA; <sup>b</sup>University of Southern California, Suzanne Dworak-Peck School of Social Work; USC Institute for Addiction Science, Los Angeles, California, USA; <sup>c</sup>RAND Corporation, Boston, Massachusetts, USA; <sup>d</sup>University of Southern California, Suzanne Dworak-Peck School of Social Work; Department of Preventive Medicine, Keck School of Medicine; USC Institute for Addiction Science, Los Angeles, California, USA

### ABSTRACT

**Background:** Although most young adults drink alcohol, there are specific drinking contexts that are associated with increased risk for alcohol-related consequences. One such drinking context is pregameing, which typically involves heavy drinking in brief periods of time and has consistently been linked to consequences within the pregameing event itself, on a night after pregameing, and in the long-term. Intervention efforts that specifically target this risky behavior are needed, but these efforts need to be informed by empirical work to better understand what behaviors young people engage in that can protect them from pregameing-related harms. **Purpose:** We designed this study to create a measure of protective behavioral strategies that young people use before, during, and after pregameing to inform future intervention work. **Methods:** We tested an item pool with 363 young adult college students who engaged in pregameing in the past year and conducted exploratory factor analysis to develop a 19-item Protective Behavioral Strategies for Pregameing (PBSP) scale, which featured four subscales of safety and familiarity, setting drink limits, pacing strategies, and minimizing intoxication. **Results:** Each subscale negatively and significantly correlated with measures of alcohol use and consequences, though subscales differed in their associations with specific pregameing outcomes and by sex. **Conclusion:** This initial exploratory examination of the PBSP scale's psychometric properties suggests that use of protective behavioral strategies used specifically during pregameing events may protect young people from heavy drinking and harms. More research with the PBSP scale is encouraged to determine its practical utility as a clinical and assessment tool with young people.

### KEYWORDS

Alcohol; young adults; binge drinking; scale development; protective strategies

Pregameing (also referred to as prepartying, preloading, and front loading) is a high-risk drinking event that is common among young adults and consistently involves or leads to heavy and problematic drinking (Foster & Ferguson, 2013; Zamboanga & Olthuis, 2016). Pregameing involves drinking alcohol during a brief period of time prior to going to an event or social gathering where more alcohol is typically consumed (Zamboanga & Olthuis, 2016). Most studies of pregameing have focused on college students and have shown past month prevalence rates ranging from 50% to 85% (Pedersen, 2016; Zamboanga & Olthuis, 2016). Students report pregameing across a number of different drinking contexts, such as before going to bars and parties, concerts, football games, dates; with friends or alone; while playing drinking games; while getting ready to go out; and even while driving to their destination for the night (Labhart, Graham, Wells, & Kuntsche, 2013; Pedersen & LaBrie, 2007; Pedersen, LaBrie, & Kilmer, 2009; Zamboanga et al., 2013). Importantly, the rate of drinking *early* in an event (i.e. pregameing before a night of drinking) is critical to the peak

intoxication drinkers obtain during that event (Giraldo et al., 2017).

During pregameing events, which are high-risk by their brief nature, young people consume about three to five drinks within just one to two hours, on average, with about one-third of pregameing events that last less than one hour involving the consumption of at least four or five drinks (Pedersen & LaBrie, 2007). As such, estimated blood alcohol levels (BALs) reached during pregameing itself average higher than levels for legal intoxication (i.e. 0.08), at which point judgment, motor coordination, and decision-making abilities are impaired (LaBrie & Pedersen, 2008). Young people are more likely to drink heavily on a night they pregame than on a night they do not and they are about twice as likely to experience alcohol-related consequences on a pregameing night than on a non-pregameing night (Fairlie, Maggs, & Lanza, 2015; LaBrie & Pedersen, 2008; Merrill, Vermont, Bachrach, & Read, 2013; Pedersen & LaBrie, 2007; Radomski, Blayney, Prince, & Read, 2016; Read, Merrill, & Bytschkow, 2010). Consequences linked to pregameing on a

particular night mirror those resulting from other high intensity drinking incidents, such as hospitalizations, regretted sex, driving after drinking, blacking out, throwing up, hangovers, and passing out (Ahmed, Hustad, LaSalle, & Borsari, 2014; Hummer, Napper, Ehret, & LaBrie, 2013; LaBrie & Pedersen, 2008; Merrill et al., 2013). Longitudinal research shows that pregame frequency predicts heavy drinking behavior and alcohol problems one year later (LaBrie, Earle, Hummer, & Boyle, 2016), underscoring this behavior's relationship with risky alcohol use trajectories.

Pregaming is one of many risky drinking practices that young adults might participate in. Other specific drinking events, such as 21st birthdays and spring break, are also associated with elevated risks for alcohol-related harm (e.g. Del Boca, Darkes, Greenbaum, & Goldman, 2004; Neighbors et al., 2011, 2012; Neighbors, Lee, Lewis, Fossos, & Walter, 2009). However, unlike other, more prescribed high-risk drinking events, pregameing is much more prevalent and is ubiquitous across college drinking contexts, consistently involving or leading to high intensity drinking within the brief pregameing event itself, but also leading to problematic drinking both on a night after pregameing and in the long-term. In these ways, findings from multiple studies strongly suggest pregameing to be among the riskiest high-intensity drinking practices among young people.

Research regarding gender differences in pregameing is mixed, with some studies finding no difference between men and women in pregameing frequency (e.g. DeJong, DeRocco, & Schneider, 2010; LaBrie & Pedersen, 2008; Merrill et al., 2013; Pedersen & LaBrie, 2007; Pedersen et al., 2009) and other research observing that men pregame more often than women (Bachrach, Merrill, Bytschkow, & Read, 2012) or women pregame more often than men (Zamboanga et al., 2013). Of note, an event-specific study (LaBrie & Pedersen, 2008) found that despite men consuming more drinks than women overall during a drinking day involving pregameing, both reached similar BALs. The inconsistency regarding the importance of gender in the frequency of pregameing, along with finding that pregameing may facilitate women matching the intoxication levels (i.e. BALs) of their male peers, warrants a consideration of gender differences in the current study.

Protective behavioral strategies are harm-reduction behaviors that one engages in prior to, during, or after drinking to buffer against potential unwanted harms resulting from alcohol use. Protective behavioral strategies include, for example, avoiding high-risk drinking activities like drinking games and chugging, monitoring how much one is drinking, alternating alcoholic and nonalcoholic drinks, and using designated drivers (Martens et al., 2005; Martens, Pedersen, LaBrie, Ferrier, & Cimini, 2007; Pearson, 2013; Prince, Carey, & Maisto, 2013). Multiple studies demonstrate that the use of protective behavioral strategies by young adults has been linked to fewer heavy drinking behaviors and less frequent alcohol-related consequences (Araas & Adams, 2008; Benton et al., 2004; Madden & Clapp, 2019; Martens et al., 2005, 2007; Pearson, Kite, & Henson, 2012; Sugarman & Carey, 2007). Recent studies also suggest that

helping young people increase their use of protective behavioral strategies through brief intervention can have short-term effects on drinking outcomes (Braitman & Henson, 2016; Kenney, Napper, LaBrie, & Martens, 2014; LaBrie, Napper, Grimaldi, Kenney, & Lac, 2015; Leeman et al., 2016; Magill et al., 2017; Martens, Smith, & Murphy, 2013).

Despite the promise of protective behavioral strategies on reducing heavy drinking and preventing alcohol-related consequences for young people, research on increased use of protective factors as a mechanism of change (or mediator of direct intervention effects) in brief intervention studies is equivocal, with small effect sizes and support for short-term efficacy only (Reid & Carey, 2015). Directly targeting and reducing specific drinking behaviors known to lead to problematic drinking (i.e. pregameing) may be a key component to reducing overall heavy drinking and consequences for young people (Pedersen, 2016). One of the first steps towards designing pregameing-specific interventions is to better understand what protective behavioral strategies are specific to pregameing and their relationship to alcohol-related outcomes, such that research and clinical efforts targeting pregameing could seek to help young people increase use of such strategies. Although there are measures to assess alcohol protective behavioral strategies more generally (Martens et al., 2005, 2007; Palmer, Corbin, & Cronce, 2010; Sugarman & Carey, 2007), there are no measures assessing pregameing-specific protective behavioral strategies.

## The present study

We designed the present study to develop a brief measure of protective behavioral strategies for pregameing using quantitative and qualitative methods with a sample of college students who engaged in pregameing. We explored the scale's initial psychometric properties, including multiple factor structure, and examined the relationships between the measure and drinking outcomes. We hypothesized that more frequent use of protective behavioral strategies for pregameing would be associated with less frequent drinking, lower quantity of drinking, and lower BALs during pregameing and overall on drinking days, as well as with lower peak drinks consumed during pregameing and fewer overall alcohol-related consequences. We explored whether specific factors of pregameing were more strongly associated with individual drinking outcomes and explored whether protective behavioral strategies differed between men and women.

## Methods

### Participants

A sample of 549 college students were recruited from one large private university on the west coast for a study to examine the drinking behavior of young people. The university's registrar generated a random sample of 5000 university email addresses for undergraduate students between the ages of 18 and 24. We emailed students a description of the study, with a link to a website with the consent form and a

brief 20–30 min online survey. The study was advertised to students as a study of “health behaviors and experiences you may have had while in college.” Participants were offered a \$25 Amazon gift card for completing the survey. The local Institutional Review Board approved all procedures.

Of the 5000 emails received, we randomly selected emails and sent out batches of approximately 250 to 1500 emails per day over the course of five days in March of 2019 until we reached an approved recruitment maximum. A total of 4250 students were sent emails, of which 549 completed the survey. Of those 549, 22 were dropped from the sample due to failing built-in verification checks, such as incorrectly answering test items asking participants to select a specific response or completing the survey in a questionable brief amount of time with seemingly random responding. Of the remaining 527, 363 participants (69%) reported pregameing at least once in the past year. These participants were asked to fill out the pregameing and general drinking items described below, as well as the measure of pregameing-specific protective behavioral strategies.

## Procedures

**Development of the Protective Behavioral Strategies for Pregameing scale.** The purpose of the Protective Behavioral Strategies for Pregameing (PBSP) scale was to assess protective strategies that young people use before, during, and after pregameing in order to minimize the harms associated with the risky behavior. Item creation began through a review of current protective behavioral strategies scales for general alcohol use; primarily the Protective Behavioral Strategies Scale (Martens et al., 2005, 2007; Treloar, Martens, & McCarthy, 2015), the Strategy Questionnaire (Sugarman & Carey, 2007), and the Protective Strategies Questionnaire (Palmer et al., 2010). Items relevant to pregameing-type drinking were extracted and reworded as appropriate. Additional items were generated through formal discussions with undergraduate and graduate students, as well as through a thorough review of the pregameing literature. Our research team reviewed and refined the wording of the items and collaboratively decided on which items to retain, combine, or drop. In total, we generated 29 items for inclusion that reflected themes of limiting use, pacing drinking, methods to limit intoxication, harm-reduction and safety strategies, using in familiar settings and with familiar people (e.g. friends), and alternating activities besides drinking heavily. These strategies were then included as a scale in the online survey and displayed to participants who endorsed any pregameing drinking behavior in the past year.

The instructions for the scale were modified from the Protective Behavioral Strategies Scale (Martens et al., 2005, 2007; Treloar et al., 2015) to read, “Please indicate the degree to which you engaged in the following behaviors on drinking occasions where you pregameed.” Pregameing was defined earlier in the survey as “When we ask you about pregameing (a.k.a., prepartying), we are talking about the consumption of alcohol prior to attending an event or activity (e.g. party, bar, concert, sporting event) at which more

alcohol may or may not be consumed.” Items were rated on the following scale: 1 = never, 2 = rarely, 3 = occasionally, 4 = sometimes, 5 = usually, and 6 = always. After completing the 29 PBSP items, participants were asked an open-ended question to assess specific individual behaviors that may have been overlooked during the iterative development phase: “What are some other things you do on drinking occasions where you pregame to help you avoid some of the not so good things about drinking?”

## Measures

Participants completed measures of age, race/ethnicity, gender, sex, and weight, as well as other measures of general and pregameing drinking behavior and alcohol-related consequences.

**General and pregameing drinking behavior.** Participants were first asked how often in the past year they drank alcohol, with responses ranging from 0 = never to 7 = daily or almost daily. Those who reported any drinking in the past year were then asked how often they pregameed in the past year, with responses ranging from 0 = never to 6 = daily or almost daily. Those who reported any past year general drinking and any past year pregameing completed an online version of the timeline followback (TLFB; Pedersen, Grow, Duncan, Neighbors, & Larimer, 2012; Rueger, Trella, Palmeri, & King, 2012) and indicated on each day of the past 30 days, the number of drinks they consumed over the course of the day, how long they spent drinking that day (in half hour increments), the number of drinks they consumed during pregameing, and how long they spent pregameing that day (in half hour increments). A picture with a standard drink definition preceded all alcohol questions. The TLFB was used to create past month outcomes of drinking days (i.e. the number of days with any drinking), average number of drinks per drinking day, pregameing drinking days (i.e. the number of days with any pregameing drinking), average number of drinks consumed during pregameing, and peak number of drinks consumed on the pregameing drinking occasion where the participant drank the most. We then used the Widmark Equation (Watson, Watson, & Batt, 1981) to calculate the estimated typical BAL reached during general drinking per day and during pregameing specifically.

**General and pregameing drinking consequences.** Participants completed the 24-item Brief Young Adult Alcohol Questionnaire (B-YAACQ; Kahler, Hustad, Barnett, Strong, & Borsari, 2008; Kahler, Strong, & Read, 2005). Participants indicated whether they experienced each of the consequences (e.g. While drinking I said or did embarrassing things, I passed out from drinking) during the past 30 days (yes/no;  $\alpha = 0.83$ ).

## Analytic plan

Prior to running exploratory factor analyses, data were assessed for sampling adequacy using the Kaiser-Meyer-Olkin

**Table 1.** Characteristics of the sample.

	Total <i>N</i> = 363 M(SD) or <i>n</i> %	Female <i>n</i> = 224 M(SD) or <i>n</i> %	Male <i>n</i> = 139 M(SD) or <i>n</i> %
<b>Demographics</b>			
Age	20.0 (1.37)	20.0 (1.37)	20.0 (1.39)
Sex (percent female) <sup>a</sup>	224 (61.7%)	—	—
White	159 (43.8%)	92 (41.1%)	67 (48.2%)
Hispanic/Latino(a)	58 (16.0%)	37 (16.5%)	21 (15.1%)
Black	13 (3.58%)	10 (4.46%)	3 (2.16%)
Asian	102 (28.1%)	66 (29.5%)	36 (25.9%)
American Indian/Alaskan Native	1 (0.28%)	1 (0.45%)	0 (0.00%)
Native Hawaiian/Pacific Islander	1 (0.28%)	0 (0.00%)	1 (0.72%)
Other race/ethnicity	3 (0.83%)	2 (0.89%)	1 (0.72%)
Multi-race/ethnicity	26 (7.16%)	16 (7.14%)	10 (7.19%)
<b>Overall drinking (past month)</b>			
Number of drinking days	4.98 (4.27)	4.44 (3.58)	5.83 (5.08)
Average drinks per occasion	3.64 (1.85)	3.27 (1.65)	4.23 (2.00)
Average BAL	0.08 (0.06)	0.08 (0.06)	0.08 (0.06)
Alcohol-related consequences	4.25 (3.84)	4.21 (3.78)	4.31 (3.96)
<b>Pregaming drinking (past month)</b>			
Number of pregame drinking days	1.82 (1.97)	1.82 (1.96)	1.81 (2.01)
Average drinks per pregame occasion	3.06 (2.48)	2.75 (1.70)	3.57 (3.34)
Average BAL during pregame	0.05 (0.05)	0.05 (0.05)	0.03 (0.03)
Peak pregame drinks	3.76 (3.35)	3.42 (3.21)	4.31 (3.64)
<b>Protective behavioral strategies for pregame</b>			
PBSP: Safety and familiarity	5.05 (0.80)	5.18 (0.80)	4.85 (0.86)
PBSP: Setting drink limits	3.51 (1.38)	3.69 (1.40)	3.20 (1.31)
PBSP: Pacing strategies	3.73 (0.98)	3.79 (0.99)	3.65 (0.97)
PBSP: Minimizing intoxication	3.58 (1.04)	3.66 (1.04)	3.45 (1.05)

Note: BAL: blood alcohol level; PBSP: protective behavioral strategies for pregame.

<sup>a</sup>There was one biological female that identified as transgender. For all analyses in this paper, male/female refers to biological sex.

(KMO) value and the Bartlett test of sphericity. The KMO statistic assesses how small the partial correlations are in relation to the zero-order correlations among items. KMO values greater than 0.8 are considered good and indicate that factor analyses are useful for the variables (Kaiser, 1974). The Bartlett test of sphericity assesses that the correlation matrix is an identity matrix (e.g. diagonal elements are 1 and off diagonal elements are 0).

Exploratory factor analysis (EFA) was then used to extract common factors for the PSBP measure. While both confirmatory and exploratory factor analysis approaches seek to account for as much variance as possible with the smallest set of components or latent factors as possible, EFA is particularly appropriate for scale development when there is little theoretical basis for setting a priori number of common factors (Hurley et al., 1997). We used a maximum likelihood estimator with a Promax rotation on the 29 items from the PBSP scale. The use of Promax rotation and the maximum likelihood estimator are appropriate for continuous scaled items. A Promax (e.g. oblique) rotation allows common factors to be correlated. A combination of criteria were used to assess the number of factors to be extracted: the Kaiser criterion, a visual examination of the scree plot (Cattell, 1966), the theoretical salience of the factor structure, interpretability, and simple structure. Items should load greater than 0.4 on relevant factors and less than 0.3 on all other factors (Costello & Osborne, 2005). Furthermore, the decision on number of factors to retain was reliant on balancing parsimony with underlying correlations so the utility of major factors that are extracted are differentiated from minor factors (Velicer, Eaton, & Fava, 2000). Once the best fitting model was selected, poorly

fitting items were removed and subscales (e.g. emergent factors) were calculated. We then calculated Pearson correlations between the PBSP scale and several measures of general drinking and pregame drinking behaviors which provided our new PBSP measure with construct validity. Next, we assessed variation in the PBSP subscales across self-reported participant sex using simple independent *t*-tests to explore if male or female college students were more or less likely to endorse specific protective strategies for pregame. Finally, two of the authors independently coded the open-ended responses into subjective categories. Another two authors reviewed these categories and, through discussion, combined categories when appropriate for parsimony and presentation.

## Results

### Participants

Participants were, on average, 20 years old and mostly female (61.7%). Nearly 44% of participants identified as White, with 28.1% Asian, 16.0% Hispanic, 3.6% Black, 7.2% multi-race/ethnicity, and 1.3% Other. Participants reported drinking on 4.98 (*SD* = 4.27) days and pregame on 1.82 (*SD* = 1.97) days in the past month. See Table 1 for more information on participant characteristics.

### Exploratory factor analysis

Prior to factor extraction we tested the factorability of the underlying covariance matrix using two indices: the KMO index and the Bartlett's test of sphericity. Both the KMO



index of sampling adequacy (0.87; Kaiser, 1974) and the Bartlett's test of sphericity ( $\chi^2 = 3664.7$  (406),  $p < 0.01$ ), which compares the correlation matrix with the identity matrix, were good (Bartlett, 1950).

### Factor structure and content

Looking at the Eigen values for our initial EFA, results pointed to an eight factor structure based on eigenvalues greater than one (Kaiser, 1960). However, after examining the scree plot (Cattell, 1966) results strongly supported a four factor solution, but possibly as many as five factors. We compared solutions for both four and five factors. In the five factor solution model fit was good (RMSEA = 0.054, SRMR = 0.040) but Factor 2 only contained two items with one item loading above 1.0, indicating possible misspecification of the five factor solution. Factor correlations were adequate, however, Factor 1 and Factor 4 had a correlation of 0.17 and Factor 4 and Factor 3 had a correlation of 0.21, indicating some factors within this solution may not be related. The two items on Factor 2 also had clear content overlap with another factor (e.g. cross-loading).

The four factor solution model fit was good (RMSEA = 0.059, SRMR = 0.045). Factor 1 contained five items (two below the 0.40 cutoff), Factor 2 contained 4 items (one below the 0.40 cutoff), Factor 3 contained 7 items (one below the 0.40 cutoff), and Factor 4 contained 6 items (none below the 0.40 cutoff, 1 item [item 28] cross-loaded with Factor 3). Given cross-loadings, low factor loadings, and unclear substantive meaning of some factors (Gorsuch, 1983), we re-estimated the model after removing any item that was not greater than or equal to 0.40 (i.e. removal of 11 items; see Table 2). Our final solution resulted in excellent model fit (RMSEA = 0.058, SRMR = 0.036). All factor loadings were adequate (range 0.39 to 0.89) and factor correlations ranged from 0.29 to 0.46 indicating an oblique structure with correlated factors was appropriate. Furthermore, none of the items in the final factor solution cross-loaded. This four-factor model with 19 items explained 55.9% of the variance in the model. Reliability for each of the subscales was adequate: Factor 1  $\alpha = 0.69$ ; Factor 2  $\alpha = 0.79$ ; Factor 3  $\alpha = 0.75$ ; Factor 4  $\alpha = 0.79$ .

Table 2 contains the factor loadings, means, standard deviations, and percentage of endorsement for the 19 items remaining in the final solution. The content of items in Factor 1 reflected items of "safety and familiarity," such as using a designated driver and pregaming with well-known friends, in familiar settings, and only in one location rather than attending multiple pregame events. Factor 2 reflected items of "setting drink limits" including not exceeding a pre-specified number of drinks during and after pregame and having a friend watch out for them. Factor 3 contained items around strategies for pacing drinking ("pacing strategies") such as drinking water or other nonalcoholic drinks, consuming drinks with lower concentrations of alcohol, spreading drinking out over time and drinking slowly, and eating before drinking to slow down the speed of absorption of alcohol from the stomach into the bloodstream. Lastly,

Factor 4 contained items related to "minimizing intoxication" levels reached during pregame itself, so as to limit the potential that one would leave a pregame event already intoxicated. Items were avoiding specific drinks and behaviors like drinking to get drunk during pregame, mixing different types of alcohol, consuming caffeinated alcoholic drinks that make mask the depressant effects of alcohol, drinking "fruity drinks" than may mask the taste of the pure alcohol, and drinking one or fewer drinks per hour.

### Construct validity

To examine how the PBSP scale was related to drinking outcomes, we evaluated the correlations between all four subscales of the PBSP scale and days of any alcohol use, days of pregame, average number of drinks consumed per occasion and during pregame specifically, average BAL for drinking in general, average BAL during pregame specifically, peak number of drinks consumed during pregame, and consequences of alcohol use (see Table 3). We found that all four subscales were significantly negatively correlated with number of past month drinking days (range  $r = -0.17$  to  $-0.27$ ) and number of alcohol-related consequences (range  $r = -0.14$  to  $-0.26$ ). Average drinks per occasion was negatively and significantly correlated with Factors 2, 3, and 4 (range  $r = -0.18$  to  $-0.28$ ) and average BAL was negatively correlated with Factors 3 and 4 ( $r = -0.14$ ;  $r = -0.22$ ). The factors differentially associated with pregame-specific behaviors. Pregame drinking days was significantly negatively correlated with Factor 4 ( $r = -0.15$ ) and average pregame drinks was significantly negatively correlated with Factor 1 ( $r = -0.19$ ). Peak drinks during pregame was significantly negatively correlated with Factors 1 and 3 ( $r = -0.13$ ;  $r = -0.15$ ). Average BAL reached during pregame was significantly positively associated with Factors 1 and 2 ( $r = 0.21$ ;  $r = 0.19$ ). Partial correlations where we controlled for general drinking days reduced the correlations to non-significance in some instances, including all the correlations with alcohol-related consequences (see Table 3).

We also sought to understand mean differences in PBSP subscales across sex for men and women. We found that women reported significantly higher scores on both Factor 1 ( $t = 3.91$  (360),  $p < .01$ , effect size Cohen's  $d = 0.42$ ) and Factor 2 ( $t = 3.33$  (360),  $p < .01$ ,  $d = 0.36$ ). Due to observed differences, we evaluated the correlations between all four subscales of the PBSP scale and the drinking outcomes by gender (Table 4).

### Open-ended responses

Table 5 includes the categories of the open-ended responses coded by the authors, as well as examples of actual responses from participants. Though participants were asked to provide us with "other things you do" on pregame occasions besides the items listed in the item pool of behaviors, most participants wrote out their personal pregame drinking practices, which in most occasions were already

**Table 2.** Final EFA factor loadings, means, and standard deviations.

Item	Factor 1: Safety and Familiarity	Factor 2: Setting Drink Limits	Factor 3: Pacing Strategies	Factor 4: Minimizing Intoxication	Mean	SD	N(%)
1. Use a designated driver (like Uber, Lyft, campus cruiser, sober friend) to get to my intended destination after pregaming	<b>0.387</b>	0.108	0.034	−0.188	5.42	1.12	352 (97.0%)
2. Determine not to exceed a set number of drinks during pregaming	−0.018	<b>0.873</b>	−0.035	0.153	3.83	1.65	313 (86.2%)
3. If I pregame beforehand, determine not to exceed a set number of drinks when drinking after pregaming	0.06	<b>0.824</b>	0.021	0.097	3.77	1.62	316 (87.1%)
4. Alternate alcoholic and nonalcoholic drinks during pregaming	−0.021	0.260	<b>0.596</b>	−0.149	3.59	1.66	313 (86.2%)
5. Have a friend let me know when I've had enough to drink during pregaming	−0.095	<b>0.407</b>	0.294	−0.038	2.91	1.65	270 (74.4%)
7. Drink alcoholic drinks that have a lower concentration of alcohol by volume, such as drinking beers instead of shots during pregaming	−0.042	−0.135	<b>0.533</b>	0.123	3.08	1.43	305 (84.0%)
8. Spread drinks out during pregaming rather than drink quickly in a short period of time	0.018	−0.056	<b>0.679</b>	0.009	3.58	1.38	333 (91.7%)
9. Drink water during pregaming	0.060	−0.008	<b>0.702</b>	−0.183	4.28	1.53	343 (94.5%)
11. Drink slowly, rather than gulp or chug during pregaming	0.030	−0.018	<b>0.500</b>	0.185	3.66	1.42	343 (94.5%)
15. Eat a meal or snacks during pregaming	0.035	−0.080	<b>0.434</b>	0.114	4.21	1.39	348 (95.9%)
16. Pregame with friends I know well rather than new people or casual acquaintances	<b>0.816</b>	0.034	−0.026	0.007	5.11	0.97	359 (98.9%)
17. Pregame in familiar/safe settings	<b>0.893</b>	−0.036	0.054	−0.017	5.15	0.94	360 (99.2%)
18. Avoid "getting drunk" during pregaming	0.069	−0.003	0.255	<b>0.478</b>	3.89	1.48	342 (94.2%)
19. Avoid mixing different types of alcohol during pregaming	0.007	0.001	0.005	<b>0.700</b>	3.76	1.48	340 (93.7%)
20. Avoid caffeinated alcoholic drinks (e.g., energy drinks mixed with alcohol) during pregaming	0.224	0.018	−0.067	<b>0.454</b>	4.53	1.48	348 (95.9%)
21. Avoid mixed drinks that may make it difficult to know how much alcohol is in the drink when pregaming	−0.023	0.150	−0.100	<b>0.769</b>	3.58	1.49	332 (91.5%)
22. Avoid flavored alcohols (e.g., lemon vodka, fireball whiskey, Jägermeister, coconut rum) when pregaming	−0.097	−0.007	−0.026	<b>0.652</b>	2.95	1.57	289 (79.6%)
25. Only participate in pregaming at one location or only attend one pregaming event	<b>0.442</b>	−0.011	0.028	0.182	4.50	1.33	350 (96.4%)
28. Stick to 1 drink or fewer per hour during pregaming	−0.093	0.032	0.322	<b>0.440</b>	2.78	1.42	289 (79.6%)
<i>Items dropped due to factor loadings &lt; 0.40 in initial EFA run</i>							
6. Avoid playing drinking games during pregaming	−0.028	0.284	0.167	0.156	2.96	1.68	271 (74.7%)
10. Avoid using marijuana on days I pregame	0.224	−0.007	0.079	0.174	4.43	1.82	322 (88.7%)
12. Stick with drinks I know rather than trying new drinks during pregaming	0.301	0.019	0.163	0.234	4.11	1.44	341 (93.9%)
13. Avoid trying to "keep up" or "out drink" others during pregaming	0.271	0.097	0.288	0.033	4.37	1.47	347 (95.6%)
14. Make my own drinks during pregaming rather than have someone else make them for me	0.332	0.074	0.147	0.059	4.37	1.40	346 (95.3%)
23. Use a shot glass to measure number of liquor shots mixed into a cocktail when pregaming	0.118	0.19	−0.051	0.177	3.58	1.64	309 (85.1%)
24. Keep track of the number of drinks you consume while pregaming (e.g., notes on a phone, tally marks on your hand)	0.013	0.324	−0.030	0.233	3.39	1.76	285 (78.5%)
26. Leave a drink unfinished at a pregame (e.g., not chug an unfinished drink if it's time to leave)	0.060	0.084	0.392	0.107	3.50	1.36	336 (92.6%)
27. Avoid using prescription drugs not for medical purposes (e.g., taking a Xanax not prescribed for you) on days you pregame	0.398	−0.114	0.059	0.104	5.53	1.21	347 (95.6%)
29. Avoid drinking while traveling en route to your destination after pregaming	0.328	−0.033	0.215	0.128	4.65	1.42	352 (97.0%)

Note: Factor pattern matrix for 19 items remaining in final four factor solution is displayed. Factor pattern matrix for the 10 dropped items is displayed from the initial EFA. Items were rated as 1 = never, 2 = rarely, 3 = occasionally, 4 = sometimes, 5 = often, 6 = always. Bold indicates item is included in respective factor. N/% indicates the N and percentage of participants that endorsed that item as 2 (rarely) or higher.

**Table 3.** Correlations between study variables and subscales of PBSP scale.

	1	2	3	4	5	6	7	8	9	10	11	12
1. PBSP: Safety and familiarity	–											
2. PBSP: Setting drink limits	<b>.280</b>	–										
3. PBSP: Pacing strategies	<b>.280</b>	<b>.462</b>	–									
4. PBSP: Minimizing intoxication	<b>.291</b>	<b>.408</b>	<b>.450</b>	–								
5. Drinking days	–.165	–.214	–.184	–.271	–							
6. Average drinks per occasion	–.020	–.175 <sup>a</sup>	–.244	–.277	<b>.264</b>	–						
7. Pregaming drinking days	.041	.016 <sup>b</sup>	–.096	–.155 <sup>a</sup>	<b>.435</b>	<b>.460</b>	–					
8. Average pregame drinks	–.190	–.114	–.126	–.001	.074	<b>.345</b>	.066	–				
9. Peak pregame drinks	–.132 <sup>a</sup>	–.085	–.147	–.009	<b>.197</b>	<b>.352</b>	<b>.244</b>	<b>.881</b>	–			
10. Average BAL	.083	.001	–.138 <sup>a</sup>	–.223	<b>.186</b>	<b>.795</b>	<b>.515</b>	<b>.327</b>	<b>.351</b>	–		
11. Average BAL during pregame	<b>.206</b>	<b>.192</b>	–.094	–.045	–.243	<b>.494</b>	<b>.317</b>	<b>.316</b>	<b>.303</b>	<b>.705</b>	–	
12. Alcohol-related consequences	–.145 <sup>a</sup>	–.165 <sup>a</sup>	–.220 <sup>a</sup>	–.263 <sup>a</sup>	<b>.432</b>	<b>.395</b>	<b>.343</b>	.064	.102	<b>.319</b>	–.015	–

Note: bold  $p < 0.05$ . BAL: blood alcohol level; PBSP: protective behavioral strategies for pregame.

<sup>a</sup>Correlation reduced in magnitude to non-significance in partial correlations controlling for general drinking days.

<sup>b</sup>Correlation increased in magnitude to significance in partial correlations controlling for general drinking days.

**Table 4.** Correlations between study variables and subscales of PBSP scale by gender.

	1	2	3	4	5	6	7	8	9	10	11	12
1. PBSP: Safety and familiarity	–	<b>.276</b>	<b>.308</b>	<b>.293</b>	.003	.067	.046	.100	.074	.066	<b>.172</b>	–.149
2. PBSP: Setting drink limits	<b>.226</b>	–	<b>.473</b>	<b>.366</b>	–.172	–.118	.024	–.008	–.006	–.026	.137	–.124
3. PBSP: Pacing strategies	<b>.224</b>	<b>.433</b>	–	<b>.436</b>	–.149	–.185	–.109	–.103	–.121	–.110	–.102	–.208
4. PBSP: Minimizing intoxication	<b>.262</b>	<b>.456</b>	<b>.463</b>	–	–.184	–.219	–.124	–.143	–.027	–.224	–.031	–.269
5. Drinking days	–.274	–.225	–.212	–.352	–	.135	<b>.451</b>	.100	<b>.202</b>	.133	–.224	<b>.329</b>
6. Average drinks per occasion	–.009	–.172	–.332	–.332	.031	–	<b>.373</b>	<b>.641</b>	<b>.439</b>	<b>.848</b>	<b>.653</b>	<b>.291</b>
7. Pregaming drinking days	.036	.001	–.076	–.201	<b>.433</b>	<b>.514</b>	–	.087	<b>.247</b>	<b>.463</b>	<b>.285</b>	<b>.270</b>
8. Average pregame drinks	–.359	–.174	–.157	.120	–.013	.078	.039	–	<b>.843</b>	<b>.635</b>	<b>.602</b>	.107
9. Peak pregame drinks	–.328	–.155	–.181	.022	.133	.179	<b>.230</b>	<b>.955</b>	–	<b>.454</b>	<b>.391</b>	.086
10. Average BAL	.049	–.018	–.211	–.257	<b>.305</b>	<b>.875</b>	<b>.496</b>	.143	<b>.248</b>	–	<b>.756</b>	<b>.230</b>
11. Average BAL during pregame	.153	<b>.221</b>	–.118	–.104	–.174	<b>.528</b>	<b>.454</b>	.177	<b>.265</b>	<b>.608</b>	–	–0.029
12. Alcohol-related consequences	–.148	–.240	–.239	–.255	<b>.546</b>	<b>.397</b>	<b>.286</b>	.029	.115	<b>.329</b>	–.009	–

Note: bold  $p < 0.05$ . BAL: blood alcohol level; PBSP: protective behavioral strategies for pregame. Correlations for men are below diagonal, correlations for women are above diagonal.

**Table 5.** Themes from open-ended responses.

Theme	Number of participants	Examples
<b>Attempts to delay absorption of alcohol into bloodstream</b> (eat, drink water, drink less concentrated drinks, avoid shots, dilute drinks)	132	"Try to drink more water," "Tend to eat foods high in carbs so that the alcohol does not have much of an effect," "Only drink low content alcohol like wine"
<b>Familiarity and safety</b> (pregame in familiar settings with familiar people, watch out for friends, pour own drinks, arrange sober transportation)	75	"Drink with my friends rather than strangers, so I know I can trust those around me," "My friends and I will watch each other and make sure no one is drinking too much beforehand,"
<b>Self-monitor</b> (count drinks, make a limit and stick to it)	40	"Tally on my hand how much I drink," "Usually try to limit it to 3-4 drinks at a pregame"
<b>Alternate activities</b> (not drink, distract oneself with other activities while out, commit to not drink once out, not go out at all)	35	"Try to watch TV or play video games or talk to people in order to not make binge drinking the main focus," "Start getting ready while the pregame is happening in my room so I don't end up drinking as much because I am preoccupied," "Don't drink at the pregame"
<b>Pay attention to how one is feeling</b> (stop drinking once feeling buzzed or drunk)	33	"I just stop drinking when I can feel I'm drunk," "I also make sure to have gum with me as a way to remind myself to stop drinking if I start to feel too drunk; by putting gum in my mouth, it's a physical reminder not to keep drinking once I'm drunk."
<b>Pacing and avoiding chugging</b> (lengthen timing between drinks/ space out drinks, avoid drinking games or play them with water)	32	"Slowly sip on drinks, rather than downing it," "I try not to drink too much and avoid playing games that involve a lot of drinking," "Don't try and keep up with friends,"
<b>Avoid social pressure</b> (make up an excuse so others do not pressure one to drink, carry a cup with nonalcoholic drinks so others do not offer another drink, be assertive and say no when offered a drink)	18	"Mostly just saying 'no' when I don't want to drink," "Just hold an empty red solo cup to avoid peer pressure," "Stick around people who don't pressure drinking"
<b>Myths/not protective behaviors</b> (chasing shots, substituting other drugs for drinking, drink cheap alcohol)	12	"I also tend to drink less alcohol in favor of smoking and getting crossfaded," "Use lemons with salt to ease the pain," "I predominantly pregame to avoid paying a high price for drinks (bars, etc.) or to avoid low-quality alcohol (parties, etc.)," "Drink a lot and then 'pull the trigger' which means throw up so that you can drink more"
<b>Avoid mixing drinks with other drugs</b> (e.g., prescription drugs, marijuana)	3	"Won't drink if I take my prescription drug too late in the day," "never do drugs"
<b>Do not use other strategies beyond those mentioned</b>	31	"Nothing other than what is listed above," "I almost never pregame and have no built habits"
<b>Did not respond</b>	25	–



covered by the items included in the measure. The most frequently discussed strategies, described by 36% of participants, related to attempts to slow down the absorption rate of alcohol, presumably to avoid intoxication or prevent hangovers, which was captured by items in Factors 3 and 4 of the PBSP scale. A number of participants (21%) described behaviors included in Factor 1, with behaviors related to having “control” over the pregaming setting, such as only pregaming with known friends, hosting pregames at their own residence, and pouring their own drinks. Within this familiarity and safety theme, 20 participants also discussed watching out for friends, which appeared to be a protective strategy for others (e.g. watching out for friends so they do not get too intoxicated during pregaming) rather than the participants themselves. About 10% of participants described each of the behaviors of self-monitoring (including counting drinks and setting a limit and sticking to it), engaging in other activities to avoid heavy drinking (e.g. not drinking either during or after pregaming, walking around and socializing or getting dressed instead of pregaming), pacing drinking and spacing out their drinks, and simply paying attention to how one feels (e.g. stopping once one starts to feel the effects). All of these were captured by the PBSP scale with the exception of the latter behavior. An additional theme of behavior that emerged that was not assessed by the PBSP was avoiding social pressure (about 5% of participants), such as pretending to have a drink so others would not ask to fill their cup or simply saying no to offered drinks when they had reached their limit. A minority of participants (3%) endorsed myths of limiting intoxication and replacement behaviors, such as using marijuana or cigarettes instead of drinking, chasing shots with lemons and salt, taking vitamins, or potentially dangerous behaviors like throwing up.

## Discussion

This study was designed to develop and conduct a preliminary psychometric assessment of a new measure of protective behavioral strategies specific to the high-risk drinking context of pregaming. Using a sample of 363 college students who engaged in past year pregaming, we developed a 19-item measure that captured four factors of pregaming behavior: safety and familiarity, setting drink limits, pacing strategies, and minimizing intoxication. The four-factor model accounted for approximately 56% of the variance, with each of the four factors displaying adequate internal consistency. All items were endorsed with a mean reflecting at least “occasionally,” with three items from the safety and familiarity factor endorsed most frequently (designated driver, pregame in familiar/safe settings, pregame with friends). The three least frequently endorsed items were from the minimizing intoxication factor (two items: avoid flavored alcohols, drink one drink or fewer per hour) and the setting limits factor (one item: have a friend monitor drinking). Significant moderate correlations were evident between each of the factors, with safety and familiarity items as a whole endorsed with the greatest frequency (mean

represented a response option of “usually”), followed by the other three factors, with means for each representing a response of “sometimes.” Female participants reported significantly greater frequency of protective behavioral strategies compared to male participants for the safety and familiarity factor and the setting drink limits factor. Interestingly, despite male and female participants reporting reaching comparable BALs on drinking days (mean of 0.08), female participants reported higher BALs reached during pregaming (0.05 compared to 0.03 for males) despite consuming approximately one fewer drink than males during pregaming. The inherent biological differences between males and females (Mumenthaler, Taylor, O’Hara, & Yesavage, 1999) may make the practice of using protective behavioral strategies especially beneficial for young adult females.

In most respects, PBSP subscales were significantly and negatively associated with drinking outcomes, such that more frequent use of protective behavioral strategies better protected participants from heavy drinking and resulting consequences. This was particularly evident for overall drinking days and number of alcohol-related consequences experienced in the past month, as all four factors significantly and negatively correlated with these outcomes. For the other drinking outcomes, significant associations were evident only for certain factors. Setting drink limits, pacing strategies, and attempts to minimize intoxication during pregaming were significantly associated with fewer drinks consumed overall, while pacing strategies and attempts to minimize intoxication during pregaming were significantly associated with lower BALs reached overall. Attempts to minimize intoxication during pregaming was significantly associated with a lower frequency of pregaming days, while safety and familiarity was significantly associated with a lower average amount consumed during pregaming and a lower peak amount consumed during pregaming in the past month. Pacing was also associated with a lower peak amount consumed during pregaming.

Interestingly, greater frequency of use of protective behavioral strategies within the safety and familiarity factor and the setting drink limits factor were associated with significantly *higher* BAL reached during pregaming. For the safety and familiarity factor, this makes conceptual sense, as items in this factor relate to attempts to avoid serious harm that may be independent of actual level of intoxication reached. For example, an individual may feel safe to reach higher BALs when pregaming with known friends in familiar settings and if they have arranged for safe transportation from the pregaming event. For the setting drink limits factor, the significant positive correlation with pregaming BAL may reflect participants choosing a limited number of drinks that actually makes them reach an intoxicated level (i.e. the limit they set for themselves is high). Likewise, they may also be unaware of the link between number of drinks and BAL, such as thinking that six drinks leads to a lower BAL than it actually does. Given that the correlations between alcohol-related consequences and the pacing strategies and minimizing intoxication factors are stronger than those for

safety and familiarity and setting drink limits factors, it may be more important during interventions to help heavy drinking students increase their use of items within these latter factors to reduce BAL levels reached during pregameing and prevent resulting harm.

Very few open-ended responses emerged that were not already captured by the PBSP scale items. Two exceptions of themes were those around avoiding social pressure, such as pretending to drink so no one would offer the participant another drink or drinking half a drink and pouring the rest out before getting another, and monitoring how one was feeling, such as stopping drinking once the participants started to feel impaired from the effects of alcohol; endorsed by 18 and 33 participants, respectively. An additional exception, within the familiarity and safety theme, was an item related to watching out for friends (especially female friends), which was conceptually different from pregameing with known friends or having friends watch out for the participant him/herself for safety reasons. A mention of watching out for friends (e.g. "My friends and I will watch each other and make sure no one is drinking too much beforehand," "I offer to be 'the responsible one' i.e. check on my friends and make sure they're okay, so I know I need to be more in control and sober than others," and "Keep an eye on others and make sure everyone uses a ride share service") was discussed by 20 participants. For some, it could be that the sense of responsibility of watching out for others helped them limit the amount that they themselves drank, but we were not able to glean this from the responses given. It may be indicated to include items from the areas of avoiding social pressure, monitoring how one is feeling, and watching out for friends in a follow-up validation study of the PBSP.

Harm-reduction approaches with young adults have been prominent in brief intervention attempts to reduce heavy alcohol use and prevent consequences (Logan & Marlatt, 2010; Marlatt, Larimer, & Witkiewitz, 2011; Neighbors, Larimer, Lostutter, & Woods, 2006). We know of two college intervention studies that reported through secondary analyses on pregameing behaviors as an outcome. In the first study, Borsari, Merrill, Yurasek, Miller, and Carey (2016) found no treatment effect on pregameing frequency in the past month following a brief motivational intervention targeting general alcohol use among mandated students. Participants for the analysis were selected based on a rather low threshold: the inclusion criterion was that pregameing must have been spontaneously discussed during the intervention. Yet these discussions were cursory, never exceeding two participant utterances. In the second study, Zamboanga et al. (2019) evaluated whether intercollegiate athletes who received *myPlaybook* (a student-athlete-specific web-based alcohol intervention) avoided pregameing as a protective behavioral strategy across a four-month follow-up period. Treatment condition was not associated with change in avoidance of pregameing. Evidence from these studies reveal that pregameing is a unique event-specific drinking pattern that may respond best to a more intensive event-specific intervention (Neighbors et al., 2007). Furthermore, and

germane to the current study, both studies reasoned that a targeted intervention approach would likely benefit greatly from the inclusion of specific protective behavioral strategies relevant in reducing risk for harm in pregameing contexts.

## Limitations

This is the first attempt at developing a pregameing-specific protective behavioral strategies measures and future work should improve upon the limitations to this study. First, the PBSP would benefit from further validation in samples that include both college and non-college young adults, as well as tests to examine race/ethnicity differences in more representative samples. Second, we developed the PBSP to examine behaviors specific to pregameing, as no measure yet has assessed pregameing-specific practices. However, the existing protective behavioral strategies scales that target global drinking may capture pregameing-specific protective behaviors without differentiating between global drinking and pregame drinking. In addition to follow-up research assessing the convergent validity of the PBSP with other measures of global alcohol protective behavioral strategies, more in-depth studies are needed that examine protective behavioral strategies used specifically in relation to pregameing (i.e. the PBSP) and strategies used more globally (i.e. strategies used on days where no pregameing occurs).

Pregameing, though a context in itself, could extend to a number of unique contexts (e.g. different locations, with different people). Drinking events are known to be complex and dynamic, often moving across multiple social environments (Clapp, Madden, Mooney, & Dahlquist, 2017; Clapp et al., 2018; Madden & Clapp, 2019). As such, the use of protective behavioral strategies may vary by specific pregameing context, which we did not assess in this study. Use of strategies at the event or daily-level using ecological momentary assessment would be important extensions of this initial work. Lastly, by design we did not include a timeframe for when these strategies were used and our inclusion criteria included participants that pregameed at least once in the past year. Follow-up studies of the scale could consider comparing frequent pregameers to less frequent pregameers (e.g. those pregameing every time they drink versus those that pregame infrequently) and compare versions with variations including a time period (e.g. use of strategies in the last 10 days versus use of strategies in the past three months).

## Conclusions

Many brief interventions with young people discuss the use of protective behavioral strategies (Reid & Carey, 2015), with some evidence for the efficacy of interventions that solely target the use global protective behavioral strategies (Braitman & Henson, 2016; Kenney et al., 2014; LaBrie et al., 2015; Leeman et al., 2016; Magill et al., 2017; Martens et al., 2013). Incorporating pregameing-specific protective behavioral strategies could be an important missing component of these interventions, particularly since pregameing has consistently been linked to heavy and problematic drinking

among young people (Pedersen, 2016; Zamboanga & Olthuis, 2016). The PBSP scale could be incorporated into existing interventions or be tested in pregame-specific interventions with young people, as well as be included in research studies to assess usage of the behaviors over time. The PBSP also has much potential in practical settings, such as through assessments during counseling sessions with young people, to learn what strategies an individual uses regularly and what strategies could be taught to help them reduce heavy drinking during pregame and prevent resulting consequences. Given the promise of this new measure, we encourage others to refine and test the PBSP scale with other samples to learn more about its utility across young adult groups and within both cross-sectional and longitudinal study designs.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

This work was funded by a grant from the National Institute on Alcohol Abuse and Alcoholism (R34AA025968 “Mobile Application Intervention Targeting the High Risk Drinking Practice of Prepartying”) awarded to Eric R. Pedersen. We would like to thank Rushil Zutshi at RAND for his assistance with data cleaning.

## ORCID

Eric R. Pedersen  <http://orcid.org/0000-0002-8017-6246>

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## Appendix A

### The Protective Behavioral Strategies for Pregaming (PBSP) scale

Please indicate the degree to which you engaged in the following behaviors on drinking occasions where you pregameed.

1 = never, 2 = rarely, 3 = occasionally, 4 = sometimes, 5 = usually, 6 = always

Item	Factor
1. Use a designated driver (like Uber, Lyft, campus cruiser, sober friend) to get to my intended destination after pregameing	1
2. Determine not to exceed a set number of drinks <i>during</i> pregameing	2
3. If I pregame beforehand, determine not to exceed a set number of drinks when drinking <i>after</i> pregameing	2
4. Alternate alcoholic and nonalcoholic drinks during pregameing	3
5. Have a friend let me know when I've had enough to drink during pregameing	2
6. Drink alcoholic drinks that have a lower concentration of alcohol by volume, such as drinking beers instead of shots during pregameing	3
7. Spread drinks out during pregameing rather than drink quickly in a short period of time	3
8. Drink water during pregameing	3
9. Drink slowly, rather than gulp or chug during pregameing	3
10. Eat a meal or snacks during pregameing	3
11. Pregame with friends I know well rather than new people or casual acquaintances	1
12. Pregame in familiar/safe settings	1
13. Avoid "getting drunk" during pregameing	4
14. Avoid mixing different types of alcohol during pregameing	4
15. Avoid caffeinated alcoholic drinks (e.g., energy drinks mixed with alcohol) during pregameing	4
16. Avoid mixed drinks that may make it difficult to know how much alcohol is in the drink when pregameing	4
17. Avoid flavored alcohols (e.g., lemon vodka, fireball whiskey, Jägermeister, coconut rum) when pregameing	4
18. Only participate in pregameing at one location or only attend one pregameing event	1
19. Stick to 1 drink or fewer per hour during pregameing	4

Scoring Instructions: Factor 1(Safety and familiarity): Mean of items 1, 11, 12, 18. Factor 2 (Setting drink limits): Mean of items 2, 3, 5. Factor 3 (Pacing strategies): Mean of items 4, 6, 7, 8, 9, 10. Factor 4 (Minimizing intoxication): Mean of items 13, 14, 15, 16, 17, 19.