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2015

Stand-Alone Personalized Normative Feedback for College Student Drinkers: A Meta-Analytic Review, 2004 to 2014

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STAND-ALONE PERSONALIZED NORMATIVE FEEDBACK FOR COLLEGE STUDENT DRINKERS: A META-ANALYTIC REVIEW, 2004 TO 2014

by

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B.A. Georgia State University, 2010

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Psychology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Spring Term
2015

ABSTRACT

Personalized normative feedback (PNF) has shown promise as a stand-alone intervention for reducing alcohol use among college students. PNF uses norms clarification to correct drinking norms misperceptions by highlighting discrepancies between personal alcohol use, perceived peer alcohol use, and actual peer alcohol use. Previous reviews of personalized feedback interventions have identified norms clarification as key a component, prompting researchers to study PNF as a single-component intervention for college drinking. As the number of publications focused on PNF effectiveness has increased in recent years, an empirical review of these studies is warranted to assess the potential impact of PNF as a stand-alone program. The purpose of the present study was to summarize available research and to perform a meta-analytic review of personalized normative feedback as a stand-alone intervention for college student drinking. Studies were included if they examined a stand-alone PNF drinking intervention, used a college student sample, reported alcohol use outcomes, and used a pre-post experimental design with follow-up at least 28 days post-intervention. Eight studies (13 interventions) completed between 2004 and 2014 were included. Effect size estimates (ESs) were calculated as the standardized mean difference in change scores between treatment and control groups. Compared to control participants, students who received PNF reported a greater reduction in drinking and harms from baseline to follow-up. Results were similar for both gender-neutral and gender-specific PNF. Overall, intervention effects for drinking were small but reliable. This study offers an empirical summary of stand-alone PNF for reducing college student drinking and provides a foundation for future research.

I dedicate this thesis to my best friend and future husband, Daniel Bayley. Your unwavering faith and support have helped me to have the courage and confidence to persevere.

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CHAPTER 1: INTRODUCTION

Alcohol is one of the leading causes of death for individuals 15 to 24 years of age worldwide (World Health Organization [WHO], 2013). College students in this age range are a particularly high-risk group in need of effective prevention and intervention programs. National survey findings indicate that 80% of U.S. college students consumed alcohol in the past thirty days (Hingson, Zha, & Weitzman, 2009). Compared to non-collegiate peers of the same age, college students engage in more high-risk drinking behaviors and experience more alcohol-related negative consequences, including alcohol-related sexual assault, injury, and death (Hingson et al., 2009). Alcohol use is also the most prevalent contributor to academic failure among college students, with nearly 25% of college students reporting alcohol-related academic consequences, including missed classes, incomplete assignments, and poor grades (Hingson et al., 2009; Wechsler et al., 2002; Wechsler & Nelson, 2008).

In addition to fatalities, physical harms, and academic consequences, the financial impact of drinking is enormous. According to the Center for Disease Control (CDC), the economic cost of alcohol misuse in the United States in 2006 was $223.5 billion and included losses in workplace productivity, healthcare, criminal justice expenses, and motor vehicle accidents. Nearly 76% of these alcohol-related costs were attributed to binge drinking, defined as consuming five or more drinks in one sitting for men and four or more drinks in one sitting for women (Bouchery, Harwood, Sacks, Simon, & Brewer, 2011). In the U.S., binge drinking is more common among college students than non-collegiate peers, with 40% of U.S. college students reporting at least one binge drinking episode in the past two weeks (Bouchery, et al., 2011; Johnston, O'Malley, Bachman, & Schulenburg, 2012; Slutske et al., 2004; Substance

Abuse and Mental Health Services Administration [SAMHSA], 2014). In a national survey of U.S. college students, 13% reported engaging in "extreme binge drinking," defined as consuming ten or more drinks in one sitting, during the past two weeks (Johnston et al., 2012). Shockingly, 15% of 21- to 24 year-olds reported consuming 20 or more drinks in one sitting (Johnston et al., 2012). College students were also more likely to endorse a pattern of heavy episodic drinking – binge drinking periodically – rather than frequent, heavy drinking. Each binge drinking episode constitutes high-risk drinking. At this high level of drinking, each additional drink consumed is associated with increased risk for harms. Given this risk, even a small reduction in quantity consumed could be the difference in a student experiencing a "hangover" or having alcohol poisoning. This is a key premise for prevention and early intervention programs for college student drinking. As risky drinking and widespread negative consequences among college students continues to be a major public health concern, there is increasing emphasis on the growing need for universal prevention and intervention programs aimed at reducing high-risk drinking at both the population-level and the individual-level (Hingson & White, 2014).

Social norms clarification is one approach that has been examined as both a universal prevention program and as an individual intervention (Walters, 2000). Social Norms Theory (SNT) provides the theoretical basis for social norms interventions. This theory posits that an individual's perception of how peers think and act influences the individual's behavior. There is substantial evidence implicating social norms as a contributory factor for high-risk drinking among college students. Research has shown that individual beliefs about peer alcohol use significantly predict personal alcohol use among college students (Baer, Stacy, & Larimer, 1991; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins, 2002). Further, college students tend to overestimate peer alcohol use and, subsequently, increase their own alcohol use based on this overestimation (Borsari & Carey, 2003; Lewis & Neighbors, 2004). According to SNT, normative influence will lead to behavior change *only* when "highlighted prominently in consciousness" (Cialdini & Goldstein, 2004). Drawing on this theory, social norms interventions aim to increase students' awareness of their own drinking patterns and to highlight any discrepancies between their own drinking patterns, their perceptions of peer drinking patterns, and actual peer drinking patterns. According to SNT, highlighting discrepancies in perceived and actual peer drinking and correcting normative misperceptions should lead to drinking reductions.

Most universal social norms approaches have been implemented through large-scale social marketing campaigns and have been found to have little to no effect on drinking norms, alcohol use, or alcohol-related harms (for a review see Foxcroft, Moreira, Almeida Santiamano, & Smith, 2015). It has been hypothesized that the impersonal nature of such campaigns may account for their poor effects. When provided in an individual format, interventions that include social norms clarification have shown moderate to large effects on drinking norms and small to moderate effects in reducing alcohol consumption and binge drinking episodes among high-risk college students (Collins, Carey, & Sliwinsky, 2002; Cunningham, Humphreys, & Koski-Jannes, 2000; Murphy et al., 2004; Neighbors, Larimer, & Lewis, 2004; Riper et al., 2009). Social norms clarification has typically been studied in combination with additional intervention components, but recent research has focused on social norms clarification as a stand-alone intervention without additional components, known as Personalized Normative Feedback (PNF).

PNF interventions use both graphs and text to provide individualized feedback based on self-report measures for drinking, most commonly: number of drinking days per week, average drinks per sitting, and average drinks per week. Typically, feedback includes bar graphs for each drinking outcome, with separate bars representing the student's (a) own drinking behavior, (b) reported perceptions of drinking behavior norms for specified reference group, and (c) actual drinking norms for specified reference group. Students are also provided a percentile rank comparing their drinking behaviors with that of other students in the specified reference group (e.g., "Your percentile rank is 72%; this means that you drink as much or more than 72% of other college students on your campus"). PNF reference groups may be general, known as gender-neutral (i.e., "college students on your campus") or may be matched on one or more demographic characteristics, such as gender-specific (i.e., "female college students on your campus"). Drinking norms are generally derived from large-scale surveys administered at individual universities where PNF is being implemented.

The efficacy of PNF has been evaluated in provider-guided and a variety of self-guided formats (e.g., mail, email, web-based) with promising results. PNF has been implemented in structured settings (i.e., research laboratory or clinical setting) as well as unstructured settings (i.e., available outside of laboratory or clinic). PNF was introduced originally as a single component included in more extensive face-to-face provider-guided interventions and, more recently, as a component in computer-delivered interventions (Dimeff et al., 1999; Riper et al., 2009). As research on computer-delivered interventions has continued to expand, PNF has been examined as a stand-alone computer-delivered intervention. First, computer-delivered PNF was administered as a self-guided intervention in a structured setting, with results suggesting small to moderate effects for drinking reductions (Lewis & Neighbors, 206; Neighbors, Lewis, Bergstrom, & Larimer, 2006). More recently, computer-delivered stand-alone PNF has been evaluated as a web-based intervention in non-structured settings, whereby students receive an email with a web link to access the intervention (Lewis et al., 2014; LaBrie et al., 2013).

Whether administered in a structured or non-structured setting, computer-delivered PNF is the predominant modality at this time. In a review of individual interventions for college student drinking, researchers reported small to moderate within-group effects on drinking for stand-alone PNF (Miller et al., 2012). These results were similar to those found in more extensive and time-intensive multicomponent feedback interventions. This effect is more pronounced among college students who report drinking for social reasons (Neighbors, 2005).

As the number of publications focused on computerized PNF effectiveness has increased in recent years, an empirical review of these studies is warranted to assess the potential impact of PNF as a stand-alone computer-based program. The purpose of the present study was to summarize available research and to perform a meta-analytic review of personalized normative feedback as a stand-alone preventive intervention for college student drinking.

CHAPTER 2: METHOD

Sample of Studies

I conducted a three-tier literature search to identify relevant studies. First, I searched electronic databases (PsycInfo, PubMed, MEDLINE, ProQuest Dissertation Abstracts, ERIC, DARE, CINAHL, and The Cochrane Library) using a Boolean search strategy with the following search terms: (alcohol OR drink* OR binge) AND (college* OR university) AND (intervention OR prevention OR treatment OR feedback) AND (norm* OR personal* OR individual). Second, I reviewed references of relevant articles and empirical reviews retrieved from database searches. Third, I conducted a forward literature search for publications that cited relevant articles and reviews. To ensure that all relevant studies were obtained, a trained bachelor-level research assistant completed the literature search independently as well. Finally, I contacted prominent researchers for unpublished findings relevant to this study. Studies meeting selection criteria and available by November 2014 were included.

Selection Criteria

Studies were included if they (a) examined a stand-alone PNF drinking intervention with descriptive norms; (b) used a college student sample; (c) included a control condition; (d) reported outcomes for drinking norms and actual drinking behavior; (e) used a pre-post experimental design with a minimum of 28-days between baseline and follow-up; and (f) provided adequate information for effect size (ES) calculation. Studies were excluded if they (a) reported additional intervention components (e.g., alcohol education, protective behavioral strategies, motivational interviewing); (b) used a non-college student sample; or (c) did not report actual drinking outcomes. I requested additional data necessary for inclusion from one primary author but did not receive a response; therefore, the study was excluded from the analysis. All studies were published in English and none were excluded for language. Eight studies (13 interventions) completed between 2004 and 2014 were included (see Figure C1).

Coding and Reliability

I developed a comprehensive coding manual to systematically extract study-level and effect-size level data from each study (see Appendix A). Three coders (first author and two trained bachelor-level research assistants) independently coded sample characteristics (e.g., sex, ethnicity), intervention details (e.g., feedback format, setting, normative referent), and methodology. Study design features were coded to assess study quality, including methods for condition assignment, attrition rates, and baseline differences. Intercoder reliability was high (Cohen's $k = .84$). Coding disagreements were resolved through discussion.

Study Outcomes

I calculated effect size estimates for alcohol consumption and alcohol-related problems. When more than one drinking outcome was reported I calculated a separate ES for each outcome. Due to the small sample of studies included in this meta-analysis and variability in drinking outcomes across studies, there was insufficient statistical power to warrant separate analyses of each drinking outcome. *Drinks per week* was the only drinking outcome reported consistently across all studies, therefore it was used to calculate the alcohol consumption ES estimate (Lipsey & Wilson, 2001). When multiple follow-ups were reported, the first follow-up was used in the analyses.

Effect Size Derivation

Between-group ESs were calculated as the standardized mean difference in change scores between treatment and control groups divided by the pooled standard deviation (Cohen's $d_{between}$; Morris & DeShon, 2002). This formula was selected because it accounts for pretest-posttest correlation (*r*) in independent-groups repeated measures designs (Smith, Glass, & Miller, 1980). When pre-post correlations were not reported, a correlation of 0.6 was used for within-group comparisons. This pre-post correlation estimate was calculated using an existing dataset of college student drinkers provided by a scientist who studies college student drinking.

Additionally, within-group ESs were calculated for each treatment and control group when sufficient data were reported. Within-group ES estimates were calculated as the raw mean difference between baseline and follow-up divided by the pooled within-groups SD (d_{within}). The within-group ES for each intervention condition was compared to its' respective control condition to examine the impact of maturation on the magnitude of intervention effects and to identify the source of between-group differences (Feingold, 2009).

When means and standard deviations were not reported, ESs were calculated from the available statistics (e.g., *t*-value). Positive ESs indicate a reduction in drinking and alcohol-related problems from baseline to follow-up for participants receiving PNF compared to control group participants. ESs were weighted using inverse variance weighting procedures. Inverse variance weighting allocates weights to ESs based on standard errors, with more precise ES estimates receiving greater weights (Hunter & Schmidt, 2004). An effect size of 0.2 can be interpreted as small, 0.5 as medium, and 0.8 as large (Cohen, 1977). I conducted separate analyses for gender-specific PNF and gender-neutral PNF when both interventions were compared to the same control group within a study. The assumption of independence precluded use of one analysis to compare multiple interventions to the same control condition (Rosenthal, 1995).

Statistical analyses

All analyses were conducted using Comprehensive Meta-Analysis ™ (Borenstein, Hedges, Higgins, & Rothstein, 2010). Weighted mean ES estimates (*d*) were calculated using random-effects procedures (Borenstein et al., 2010). The random effects model assumes between-study variance and treats each study as a sample from a population of studies. This model estimates the mean of the distribution of effects, while accounting for differences between studies (Borenstein et al., 2010).

I conducted moderator analyses for variables identified a priori (Hedges, 1994). I analyzed categorical variables (e.g., publication type) using analysis of variance (ANOVA) and analyzed continuous variables (e.g., length of time until follow up) using meta-regression. The *Q* statistic was calculated to measure the presence or absence of homogeneity. A significant *Q*-value indicates that homogeneity is not present and suggests that there may be heterogeneity. The I^2 statistic provides an estimate of heterogeneity ranging from 0 to 100%. Larger values of I^2 indicate a greater degree of heterogeneity, with 25% interpreted as low, 50% as moderate, and 75% as high (Higgins, Thompson, Deeks, & Altman, 2003). I calculated power using the random effects method suggested by Hedges and Pigott (2001).

CHAPTER 3: RESULTS

Descriptives

Descriptive characteristics of the eight studies are provided in Table B1. Publication years ranged from 2004 to 2014. Seven studies were conducted in the United States and one study was conducted in Canada. Four studies were conducted at large public universities, three at mid-size public universities, and one was conducted at two schools (a large public university and a mid-size private university). The analysis included a total of 2,050 participants (PNF n = 1,181; control n = 869). Six studies reported outcomes for gender-neutral PNF and seven reported outcomes for gender-specific PNF. Five studies used an assessment-only control condition and three studies used an attention-matched control condition.

Intervention Effects on Drinking

Between-group weighted mean ESs are reported separately for gender-neutral PNF (see Table B2) and gender-specific PNF (see Table B3). Forest plots also are provided separately for gender-neutral PNF (see Figure C2) and gender-specific PNF (see Figure C3). Compared to control participants, students who received PNF reported a greater reduction in drinking from baseline to follow-up. Results were similar for both gender-neutral PNF (d = 0.291, 95% CI [0.159, 0.423]) and gender-specific PNF (d = 0.284, 95% CI [0.117, 0.451]).

Within-group raw mean differences (D_{within}) are provided separately for gender-neutral PNF (see Table B4) and gender-specific PNF (see Table B5). Overall, compared to baseline, students who received gender-neutral PNF (k = 5) reported 3.027 (95% CI [2.171, 3.882], p < .001) fewer drinks per week at first follow-up. Results were similar for gender-specific PNF (k =

5), with students reporting 3.089 (95% CI [0.992, 5.186], $p = .004$) fewer drinks per week at first follow-up, compared to baseline.

Intervention Effects on Alcohol-related Harms

Between-group weighted mean ESs for alcohol-related harms are reported in Table 6. Compared to control participants, students who received PNF reported a greater reduction in alcohol-related harms from baseline to follow-up, though observed effects were minimal ($d = 0.157$, 95% CI [0.037, 0.278], $p = .010$). This effect represents a mean reduction of less than one alcohol-related harm from baseline to follow-up.

Moderator Analyses

For gender-neutral PNF ($k = 6$) the Q-value was non-significant ($Q = 4.695$, $p = .454$) and $I^2 = 0.000$, suggesting homogeneity. For gender-specific PNF ($k = 7$) the Q-value was non-significant ($Q = 10.863$, $p = .093$) and $I^2 = 44.768$, suggesting a low to moderate degree of heterogeneity. Studies were examined and one outlier was identified. Sensitivity analyses revealed that the outlier had little impact on the summary effect. Excluding the outlier would not change the interpretation of the findings, therefore, in order to conserve power it was not excluded from main effects analyses. Though findings were homogeneous, moderator analyses were conducted for variables identified a priori. Moderator analyses for both gender-neutral and gender-specific PNF were non-significant for all moderator variables examined (i.e., modality, normative referent, control type, follow-up time, publication type, and sample).

Publication Bias

I conducted fail-safe analyses to estimate the number of missing studies with null findings that would nullify the observed summary effect (Rosenthal, 1979). Results indicated that 36 studies would be necessary to nullify the findings for both gender-neutral and gender-specific PNF. I conducted trim-and-fill analyses to assess and adjust for publication bias (Duval & Tweedie, 2000). Results suggested two missing studies. Weighted mean ESs adjusted for publication bias were similar to unadjusted ESs for both gender-neutral PNF (observed d = 0.291, 95% CI [0.159, 0.423]; adjusted d = 0.243, 95% CI [0.083, 0.403]) and gender-specific PNF (observed d = 0.284, 95% CI [0.117, 0.451]; adjusted d = 0.206, 95% CI [0.024, 0.387]). These results indicate that including two missing studies would not change overall findings or implications of this meta-analysis.

CHAPTER 4: DISCUSSION

Results from this meta-analysis indicate that computer-delivered PNF is an effective stand-alone approach for reducing college student drinking, but has minimal impact on alcohol-related harms. Overall, effect sizes were small but significant for alcohol use and less than small for alcohol-related harms. Results were consistent regardless of intervention setting. These findings suggest that computer-delivered PNF is equally effective when completed in a structured setting and when completed in a non-structured setting. Foxcroft and colleagues (2015) reported similar findings in their recent systematic review of social norms approaches for college student drinking; however, they concluded that effects were not clinically significant. Though PNF may be limited in clinical significance as a primary intervention, the observed effects on drinking, though small, are clinically relevant when PNF is examined as a preventive approach.

Outcome research typically examines differences between treatment and control groups following a treatment, with between-group differences representing treatment effects. While this methodological approach is appropriate for treatment outcome studies, it is not ideal for prevention research. The "prevention paradox" asserts that the aim of prevention is to improve global outcomes by causing small changes among a large portion of a given population. As such, prevention programs would be expected to improve population-level outcomes, with relatively small improvements on an individual level (Collins, Parks, & Marlatt, 1985). Given the substantial interpretive differences for treatment versus prevention effects, it is imperative that researchers consider carefully the aims and anticipated outcomes of intervention studies in order to measure and report outcomes accurately. For instance, for a prevention study measuring drinking outcomes as drinks per week, we would not predict a large effect for drink reductions but would instead anticipate a slower increase in drinking at long-term follow-up for students receiving prevention compared to students in a control condition. Further, although *drinks per week* provides a common metric of overall drinking quantity, it is not best suited to measure drinking among college students, which typically consists of periodic binge drinking episodes, rather than regular, frequent drinking. Although *number of binge drinking episodes* is commonly reported, this measure provides categorical data with limited utility in allowing researchers to understand an intervention's impact on drinking. Rather than reporting categorical data, it would be more helpful if researchers would routinely report additional continuous measures of drinking, such as actual number of drinks consumed during each binge drinking episode. Appropriate outcome reporting has substantial implications for interpreting effects in intervention outcome studies. For instance, a reduction of four drinks per week will be interpreted much differently if the reduction occurs during a single binge drinking episode compared to a reduction of four drinks that occurs across four low-risk drinking occasions. It is imperative that researchers assess outcomes appropriately for the population of interest, rather than selecting a measure solely because it is the common metric.

There is a natural maturation process that seems to occur for most college student drinkers. Research has shown that first-year college students are a particularly high-risk group and that there is a natural "maturing out" process, whereby high-risk drinking tends to decrease over time (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001). Results of the present study suggest that PNF may expedite this process. When comparing PNF within-group effects to within-group effects of control participants, it appears that overall, drinking tends to decline between baseline and follow-up, with a more pronounced effect for students who received PNF.

Though the overall within-group effect for controls is not statistically significant, the pattern of maturation is evident (see Tables B4 & B5). Longitudinal research is needed to examine the degree to which PNF attenuates drinking among college students and to assess the degree to which PNF may accelerate the "maturing out" process. This maturation effect will not be apparent when outcomes are analyzed using only between-groups, post-test mean differences. To study the impact of PNF on drinking maturation, researchers should incorporate statistical approaches that examine changes between and within groups over time.

In addition to examining the potential positive effects of PNF, future research should consider the limitations and problems with PNF. Given the proliferation of web-based intervention approaches, researchers must consider whether students are actually viewing and processing the intervention content. According to a recent study by Lewis and Neighbors (2014), students reported engaging in other activities while completing web-based interventions. This finding highlights the need for researchers to develop interventions that garner engagement, particularly if they are to be delivered in non-structured settings. This is important because web-based interventions provide an efficient and cost-effective approach to delivering interventions to college students.

Researchers have also voiced concerns about a potential "boomerang effect" for low risk drinkers that may lead them to drink more after receiving feedback stating that they consume less alcohol than peers. In a recent study, Prince and colleagues (2014) assessed for a boomerang effect among low-risk drinkers by examining drinking outcomes in feedback-based intervention trials. Computer-delivered stand-alone PNF interventions were used in two of the trials, which included a total of 466 undergraduate students (Trial 1 n = 252; Trial 1 n = 214). Researchers found no evidence to support a boomerang effect for low risk drinkers (Prince et al., 2014).

Although this study provides preliminary support for PNF as a universal prevention program, as research on stand-alone PNF expands, continued efforts should be made to assess potential negative outcomes among non-drinkers.

Finally, a major problem remaining in the literature is the overly general and inconsistent terminology used to refer to various interventions with heterogeneous content. Common terms used to describe these interventions include personalized feedback, personalized normative feedback, normative feedback, individualized feedback, and multicomponent feedback, among others. Inconsistent use of these terms may lead to inaccurate interpretations of intervention effects when the same term is used to identify various combinations of intervention components. Future research in this area should consider adopting a consistent set of terms to identify specific interventions and components.

Limitations. There are several notable limitations of this study. First, only eight primary studies were included in this meta-analysis. With such a small sample of studies, generalizability of these findings is limited and results must be interpreted with caution. Second, given the relatively recent advent of stand-alone PNF, much of the research has been conducted by a small pool of researchers and thus, may be biased. Third, by design, meta-analyses are limited by the studies and data made available for inclusion. I made substantial efforts to conduct a thorough, exhaustive literature search and sought additional unpublished data through direct contact attempts with prominent researchers. Fourth, outcomes and moderators were limited to the data included in the primary studies; therefore, I was unable to examine the impact of other variables of interest (e.g., social reasons for drinking).

Overall, findings of this meta-analysis suggest that stand-alone PNF is promising as a universal prevention approach for college student drinking. These results are consistent with the literature (Foxcroft et al., 2015). Despite the limitations, this study offers an empirical summary of stand-alone PNF for college student drinking and provides a foundation for future prevention research.

APPENDIX A: CODING MANUAL

__ __ Coder ID

STUDY-LEVEL CODING FORM

Reference: ____

__ __ __ __ 1. Study ID number [STUDYID]

__ 2. Type of publication [PUBTYPE]

- 1 journal article
- 2 dissertation
- 3 other (specify): ____________________

__ __ __ __ 3. Publication year [PUBYEAR]

Sample Descriptors

__ __ . __ __ 4. Mean age [MEANAGE]

__ 5. Predominant race/ethnicity [RACE]

- 1 >60% White
- 2 >60% Black
- 3 >60% Hispanic
- 4 >60% Other
- 5 mixed, none more than 60%
- 6 mixed, cannot estimate proportion
- 9 insufficient information

__ 6. Predominant sex [SEX]

- 1 <5% female
- 2 5%-25% female
- 3 26%-49% female
- 4 50% female
- 5 51%-74% female
- 6 75%-95% female
- 7 >95% female
- 9 insufficient information

__ 7. Subject sample [SUBJECTS]

- 1 General college student sample
- 2 First-year (freshman) students
- 3 Freshman and sophomore students, combined
- 4 other (specify): ______________

1

__ __ Coder ID

__ 8. Participant recruitment method [RECRUIT]

1 Email from registrar list

2 Psychology classes

3 Other ______________

Research Design Descriptors

__ 9. Type of assignment to conditions [ASSIGN]

1 random after matching, stratification, blocking, etc.

2 random, simple

3 nonrandom

4 other (specify): _____________

5 insufficient information

__ 10. Overall confidence of judgment on how subjects were assigned [CRASSIGN]

1 very low (little basis)

2 low (guess)

3 moderate (weak inference)

4 high (strong inference)

5 very high (explicitly stated)

__ 11. Baseline differences between treatment and control groups [PREDIFFS]

1 negligible differences, judged unimportant

2 some differences, judged of uncertain importance

3 some differences, judged important

__ __ __ __ 12. Treatment group sample size at start of study (completed baseline) [ORIG_TXN]

__ __ __ __ 13. Control group sample size at start of study (completed baseline) [ORIG_CN]

__ __ __ __ 14. Total sample size at start of study (completed baseline) [TOTALN]

Intervention Descriptors

__ 15. Type of administration [ADMIN]

1 self-guided

2 provider-guided

2

__ __ Coder ID

__ 16. Intervention modality [MODALITY]

1 computer-based in a structured setting (lab/clinic), with paper feedback

2 computer-based in a structured setting (lab/clinic), without paper feedback

3 web-based, non-structured setting

4 paper-based, in a structured setting (lab/clinic)

5 verbal, in a structured setting (lab/clinic)

6 other (specify): ______________________

__ 17. Normative referent group [NORMREF]

1 Gender-neutral

2 Gender-specific

3 Other ________________

4 Unknown

__ 18. Type of control group [CGTYPE]

1 waitlist, assessment only

2 attention-matched (not related to alcohol use)

3 treatment as usual, minimal content (alcohol education)

4 treatment as usual, brief therapy with provider

5 other (specify) ______________________

__ __ Coder ID

EFFECT SIZE LEVEL CODING FORM

__ __ __ __ 1. Study ID number [STUDYID]

__ __ 2. Effect size type [ESTYPE]

1 drinks per week
2 drinks per sitting
3 peak drinks
4 frequency
6 drinking composite, quantity-frequency measure
7 harms
8 norms

Dependent Measures Descriptors

__ 3. Follow-up type [FU_TYPE]

1 posttest comparison (first follow-up post-intervention)
2 follow-up comparison (any additional follow-ups)
3 final follow-up comparison (use this if only one follow-up)

__ __ __ 4. Time since baseline, in weeks [FU_WKS]

__ 5. Category of outcome construct [OUTCOME]

1 drinking outcome, single measure (e.g., drinks per week, peak BAC, frequency)
2 drinking outcome, combined (e.g., ACI, quantity-frequency measure, composite)
3 harms measure (BYAACQ, RAPI, SIP)
4 norms measure

Effect Size Data

__ 6. Type of data effect size based on [ESDATA]

1 adjusted means and standard deviations
2 raw means and standard deviations
3 adjusted means and standard errors
4 means and standard errors
5 *t*-value or *F*-value
6 ratio measure
7 mean difference
8 other ______________________

__ __ __ __ 7. Page number where effect size data found [PAGENUM]

4

__ __ Coder ID

Sample Size

__ __ __ 8a. Treatment group sample size at baseline [TXN]

__ __ __ 8b. Control group sample size baseline [CGN]

Answer the following questions to help select the appropriate ES calculation for each outcome:

1) Are the means and standard deviations/standard errors provided for both the treatment and control group?

If NO: Proceed to next question.

If YES: Are M and SD/SE provided for both baseline *and* follow-up?

If YES: Complete both sections of A1 (for SD) or A2 (for SE) below.

If NO: Complete "Follow-up (Post-test)" section of A1 (for SD) or A2 (for SE) below.

2) Is the *t*-value of the outcome provided comparing the treatment and control group?

IF NO: Proceed to next question.

IF YES: Enter the t-value under section B below, then use the calculator found at:

http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-SMD2.php

to calculate Cohen's *d*. Enter *d* and variance under "Calculated effect size".

3) Is the mean difference (*d*) provided comparing the treatment and control group?

IF NO: Enter available data in appropriate section below.

IF YES: Complete section D below AND enter *d* value under "calculated effect size"

A1 *Means and Standard Deviations*

Baseline (Pre-test)

__ __ __ __ 9a. Treatment group mean at baseline [TXMEANPRE]

__ __ __ __ 9b. Control group mean at baseline [CGMEANPRE]

__ __ __ __ 9c. Treatment group standard deviation at baseline [TXSDPRE]

__ __ __ __ 9d. Control group standard deviation at baseline [CGSDPRE]

Follow-up (Post-test)

__ __ __ __ 9e. Treatment group mean at follow-up [TXMEANPOST]

__ __ __ __ 9f. Control group mean at follow-up [CGMEANPOST]

__ __ __ __ 9g. Treatment group standard deviation at follow-up [TXSDPOST]

__ __ __ __ 9h. Control group standard deviation at follow-up [CGSDPOST]

__ __ __ __ 9i. Pre-post correlation (if not reported enter 0.6) [PPCORR]

5

__ __ Coder ID

A2 ***Means and Standard Errors*** ****Calculate SDs using Excel spreadsheet*

Baseline (Pre-test)

__ __ __ __ 10a. Treatment group mean at baseline [TXMEANPRE]

__ __ __ __ 10b. Control group mean at baseline [CGMEANPRE]

__ __ __ __ 10c. Treatment group standard error at baseline [TXSEPRE]

Calculated SD ____________________ [TXPRE_CALCSD]

__ __ __ __ 10d. Control group standard error at baseline [CGSEPRE]

Calculated SD ____________________ [CGPRE_CALCSD]

Follow-up (Post-test)

__ __ __ __ 10e. Treatment group mean at follow-up [TXMEANPOST]

__ __ __ __ 10f. Control group mean at follow-up [CGMEANPOST]

__ __ __ __ 10g. Treatment group standard error at follow-up [TXSEPOST]

Calculated SD ____________________ [TXPOST_CALCSD]

__ __ __ __ 10h. Control group standard error at follow-up [CGSEPOST]

Calculated SD ____________________ [CGPOST_CALCSD]

__ __ __ __ 10i. Pre-post correlation (if not reported enter 0.6) [PPCORR]

B ***Significance Tests***

__ __ __ __ 11a. *t*-value [T_VALUE]

__ __ __ __ 11b. *F*-value (*df* for the numerator must = 1) [F_VALUE]

__ __ __ __ 11c. Chi-square value (*df* = 1) [CHISQUARE]

C ***Ratios***

__ __ __ __ 12a. Rate ratio [RR_VALUE]

__ __ __ __ 12b. Rate ratio confidence interval [RR_CI]

D ***Mean difference (d)***

__ __ __ __ 13a. Mean difference (*d*)

__ __ __ 13b. Treatment group sample size at baseline [TXN]

__ __ __ 13c. Control group sample size at baseline [CGN]

6

__ __ Coder ID

Calculated Effect Size

__ __ __ __ 14. Effect size (Cohen's *d*) [ES]

__ __ __ __ 15. Effect size variance [ESVAR] – if calculated

__ 16. Confidence rating in effect size computation [CR_ES]

1 highly estimated

2 moderate estimation

3 some estimation

4 slight estimation

5 no estimation

APPENDIX B: TABLES

Table 1
Study Descriptives

Study	Groups (N)	Modality	FU Wks	Included sample	M age (SD)	Sample	Attrition
Curtis (2005)	GS (34); A/O control (47)	W	6	81	20.5 (1.9)	Undergraduates at a large public university in Canada 60.0% female	14.6%
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)	GS (184); GN (187); attention control (184)	W	4	555	19.92 (1.3)	Undergraduates from registrar list at 2 west coast universities in US (large public ~30,000 enrolled; mid-size private ~6,000 enrolled) 75.7% Caucasian; 56.7% female	10.3%*
Lewis (2005) Females	GS (32); GN (39); A/O control (27)	C	4	98	20.01 (1.79)	Undergraduates in psychology course at midsized Midwest university in US 97.3% Caucasian; 54.6% female	11%*
Lewis (2005) Males	GS (33); GN (21); A/O control (30)			84			
Lewis, Neighbors, Oster-Aaland, Kirkeby, Larimer (2007)	GS (75); GN (82); A/O control (88)	C	20	245	18.53 (2.04)	Freshmen in orientation course at midsized Midwest university in US 99.6% Caucasian; 52.24% female	14.7%
Lewis, Patrick, Litt, Atkins, Kim, Blayney, Norris, George, Larimer (2014)	GS (119); attention control (121)	W	12	240	20.08 (1.48)	Undergraduates contacted via registrar list at large Northwest university in US 70.0% Caucasian; 57.6% female	9.6%*
Neighbors, Jensen, Tidwell, Walter, Fossos, Lewis (2011)	GS (141); attention control (140)	W	12	281	Not reported	Freshmen and sophomores at large Northwest university in US 52.5% Asian, 32.9% Caucasian; 60.8% female	4.2%*
Neighbors, Larimer, Lewis (2004)	GN (126); A/O control (126)	C	12	252	18.5 (1.24)	Psychology students – large Northwest university in US 79.5% Caucasian; 58.7% female	21%
Neighbors, Lewis, Bergstrom, Larimer (2006)	GN (108); A/O control (106)	C	8	214	19.67 (2.02)	Psychology students at midsized Midwest university in US 98.04% Caucasian; 55.6% female 59.80% freshmen, 25.00% sophomores, 9.31% juniors, 5.88% seniors	13.6%

Note. * denotes studies from which data from unrelated treatment groups were excluded. GN = gender-neutral norms; GS = gender-specific norms; A/O = assessment-only control group; W = web-based in non-structured setting; C = computer-based in structured setting with paper printout; FU Wks = number of weeks from baseline to follow-up.

Table 2
Gender-neutral PNF between-group weighted mean ESs for drinks per week.

Study	Subgroup	FU Wks	Sample size PNF	Sample size Control	d_+ (95% CI)
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)		4	187	184	0.187 (-0.017, 0.390)
Lewis (2005)	Females	4	39	27	**0.722 (0.216, 1.228)**
	Males	4	21	30	**0.649 (0.077, 1.220)**
Lewis, Neighbors, Oster-Aaland, Kirkeby, Larimer (2007)		20	82	88	**0.361 (0.058, 0.664)**
Neighbors, Larimer, Lewis (2004)		12	126	126	0.229 (-0.018, 0.477)
Neighbors, Lewis, Bergstrom, Larimer (2006)		8	108	106	0.234 (-0.035, 0.502)
Summary effect (k = 6)			563	561	**0.291 (0.159, 0.423)**

Note. Positive between-group effect sizes (d_+) indicate improved outcome for treatment groups compared to control. Bold font indicates statistically significant weighted mean ES. PNF = Personalized Normative Feedback; FU Wks = number of weeks from baseline to follow-up; k = number of interventions; CI = confidence interval.

Table 3
Gender-specific PNF between-group weighted mean ESs for drinks per week.

Study	Subgroup	FU Wks	Sample size PNF	Sample size Control	d_+ (95% CI)
Curtis (2005)		6	34	47	0.108 (-0.334, 0.549)
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)		4	184	184	0.050 (-0.154, 0.255)
Lewis (2005)	Females	4	32	27	**0.651 (0.125, 1.176)**
	Males	4	33	30	**0.751 (0.239, 1.262)**
Lewis, Neighbors, Oster-Aaland, Kirkeby, Larimer (2007)		20	75	88	**0.429 (0.117, 0.741)**
Lewis, Patrick, Litt, Atkins, Kim, Blayney, Norris, George, Larimer (2014)		12	119	121	**0.290 (0.035, 0.544)**
Neighbors, Jensen, Tidwell, Walter, Fossos, Lewis (2011)		12	141	140	0.181 (-0.053, 0.416)
Summary effect (k = 7)			618	637	**0.284 (0.117, 0.451)**

Note. Positive between-group effect sizes (d_+) indicate improved outcome for treatment groups compared to control. Bold font indicates statistically significant weighted mean ES. PNF = Personalized Normative Feedback; FU Wks = number of weeks from baseline to follow-up; *k* = number of interventions; CI = confidence interval.

Table 4
Gender-neutral PNF within-group effects for drinks per week.

Study	Subgroup	FU Wks	Sample size PNF	Sample size Control	GN PNF D_{within}	Control D_{within}
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)		4	187	184	**1.900 (0.746, 3.054)**	0.300 (-0.962, 1.562)
Lewis (2005)	Females	4	39	27	**3.650 (1.807, 5.493)**	-0.180 (-2.447, 2.087)
	Males	4	21	30	**4.440 (0.516, 8.364)**	-1.450 (-4.825, 1.925)
Neighbors, Larimer, Lewis (2004)		12	126	126	**3.410 (2.061, 4.759)**	**1.460 (0.003, 2.917)**
Neighbors, Lewis, Bergstrom, Larimer (2006)		8	108	106	**3.600 (1.784, 5.416)**	1.280 (-0.638, 3.198)
Summary effect (k = 5)			563	561	**3.027 (2.171, 3.882)**	0.642 (-0.135, 1.420)

Note. Positive D_{within} indicates a reduction in drinks per week from baseline to follow-up. Bold font indicates statistically significant weighted mean difference. D_{within} = raw mean difference; GN = gender-neutral; PNF = Personalized Normative Feedback; *k* = number of interventions; FU Wks = number of weeks from baseline to follow-up; CI = confidence interval.

Table 5
Gender-specific PNF within-group effects for drinks per week.

Study	Subgroup	FU Wks	Sample size PNF	Sample size Control	GS PNF D_{within}	Control D_{within}
Curtis (2005)		6	34	47	1.000 (-1.202, 3.202)	0.100 (-2.087, 2.287)
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)		4	184	184	0.800 (-0.403, 2.003)	0.300 (-0.962, 1.562)
Lewis (2005)	Females	4	32	27	**3.830 (1.412, 6.248)**	-0.180 (-2.447, 2.087)
	Males	4	33	30	**5.390 (2.400, 8.380)**	-1.450 (-4.825, 1.925)
Lewis, Patrick, Litt, Atkins, Kim, Blayney, Norris, George, Larimer (2014)		12	119	121	**5.010 (3.393, 6.627)**	**2.470 (0.929, 4.011)**
Summary effect (k = 5)					**3.089 (0.992, 5.186)**	0.557 (-0.663, 1.778)

Note. Positive D_{within} indicates a reduction in drinks per week from baseline to follow-up. Bold font indicates statistically significant weighted mean difference. k = number of interventions; GS = gender-specific; PNF = Personalized Normative Feedback; FU Wks = number of weeks from baseline to follow-up; CI = confidence interval.

Table 6
Between-group weighted mean effects for alcohol-related harms.

Study	**Harms Measure**	**d_+ (95% CI)**
Curtis (2005)	SIP	0.196 (-0.246, 0.639)
LaBrie, Lewis, Atkins, Neighbors, Zheng, Kenney, Napper, Walter, Kilmer, Hummer, Grossbard, Ghaidarov, Desai, Lee, and Larimer (2013)	RAPI	0.175 (-0.060, 0.409)
Lewis, Patrick, Litt, Atkins, Kim, Blayney, Norris, George, Larimer (2014)	BYAACQ	0.134 (-0.119, 0.387)
Neighbors, Larimer, Lewis (2004)	RAPI	0.127 (-0.120, 0.375)
Neighbors, Lewis, Bergstrom, Larimer (2006)	RAPI	0.183 (-0.088, 0.454)
Summary effect (*k* = 5)		**0.157 (0.037, 0.278)**

Note. Positive between-group effect sizes (d_+) indicate improved outcome for treatment groups compared to control. Bold font indicates statistically significant weighted mean ES. *k* = number of interventions; CI = confidence interval; SIP = Short Index of Problems; RAPI = Rutgers Alcohol Problems Index; BYAACQ = Brief Young Adult Alcohol Consequences Questionnaire.

APPENDIX C: FIGURES

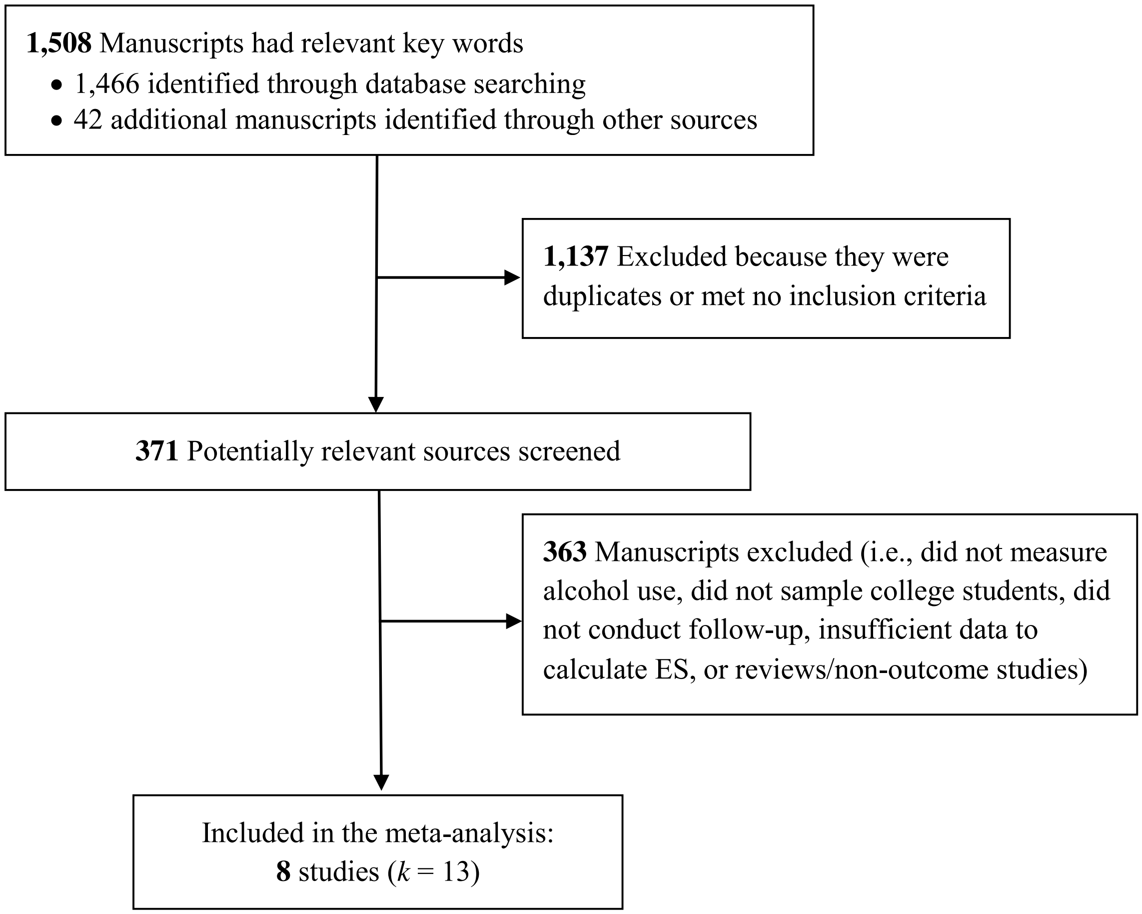

Figure 1: Study flow diagram.

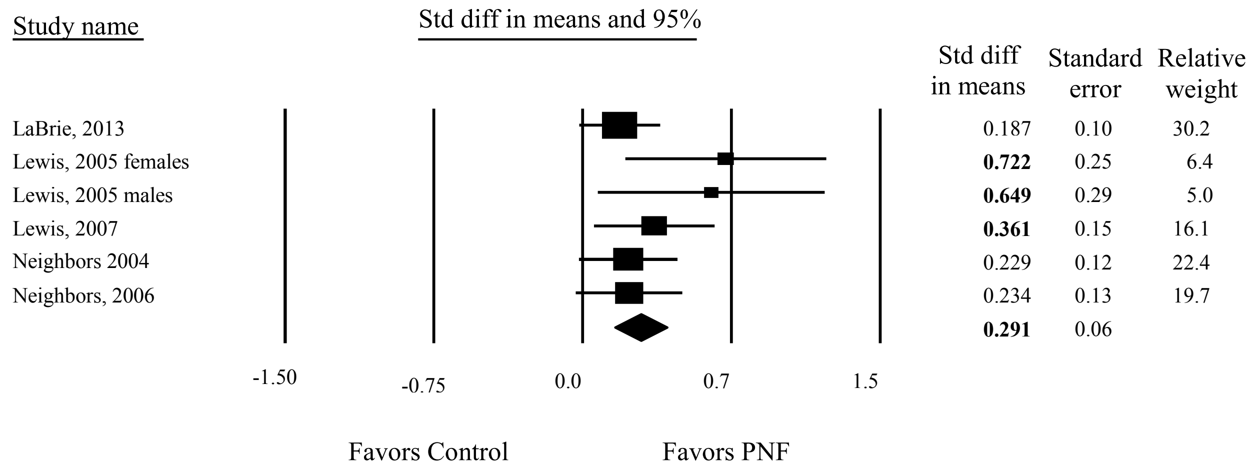

Figure 2: Forest plot of gender-neutral PNF between-group effects on drinks per week.

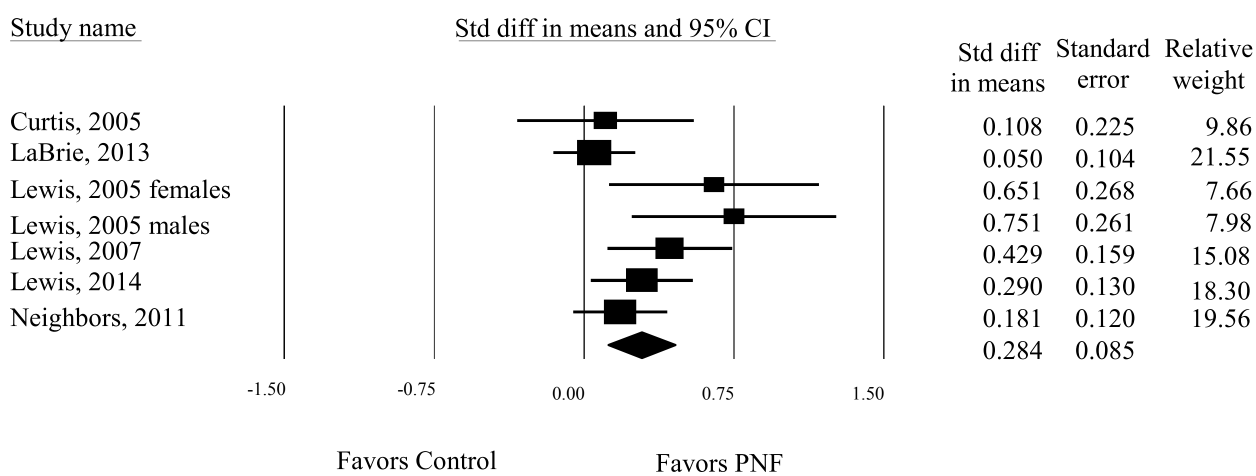

Figure 3: Forest plot of gender-specific PNF between-group effects on drinks per week.

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