Examining personalized feedback interventions for gambling disorders: A systematic review

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Background and aims: Personalized feedback interventions (PFI) have shown success as a low-cost, scalable intervention for reducing problematic and excessive consumption of alcohol. Recently, researchers have begun to apply PFI as an intervention method for problematic gambling behaviors. A systematic review of the literature on PFI as an intervention/prevention method for gambling behaviors was performed. *Methods:* Studies were included if they met the following criteria: the design included both a PFI group and a comparison group, and the interventions focused on gambling prevention and/or reduction. Six relevant studies were found meeting all criteria. *Results:* Results revealed that PFI treatment groups showed decreases in a variety of gambling behaviors as compared to control groups, and perceived norms on gambling behaviors significantly decreased after interventions as compared to control groups. *Conclusions:* Overall, the research suggests that while PFI applied to gambling is still in its infancy, problematic gamblers appear to benefit from programs incorporating PFIs. Further, PFI may also be used as a promising source of preventative measures for individuals displaying at-risk gambling behaviors. While, evidence is still limited, and additional research needs to be conducted with PFI for gambling problems, the preliminary positive results along with the structure of PFI as a scalable and relatively inexpensive intervention method provides promising support for future studies.

Keywords: personalized feedback interventions, personalized normative feedback, gambling, intervention, prevention

Problem gambling is a growing concern among adolescents and young adults, and has both short-term and long-term consequences for individuals, families and society. Never before has gambling been so socially accepted, widespread, easily accessible, with the proliferation of available gambling outlets including casinos, online gambling sites, poker rooms, and lotteries dramatically increasing. Approximately, 75% of U.S. college students have reported having gambled for money within the past year (Barnes, Welte, Hoffman, & Tidwell, 2010). This increased accessibility can escalate the risk of having a gambling problem and has led to increased public health concerns. Canadian and U.S. youth, ages 15–24 years old are estimated to be at heightened risk for gambling problems compared to the adult population (Korn & Shaffer, 1999; Shaffer & Hall, 2001; Volberg, Abbott, Ronnberg, & Munck, 2001). For example, Shaffer, Vander Bilt, and Hall (1999) estimated that 17% of youth were at-risk of a gambling problem, whereas in another study Shaffer and Hall (2001) estimated that 5% of adults were at-risk. Additionally, many individuals at-risk of developing gambling problems are from disadvantaged and marginalized backgrounds, including unemployed members of ethnic minority groups (Volberg et al., 2001). Early exposure to gambling has been shown to be a significant predictor and risk factor for later gambling and other risky behaviors. Specifically, results from Burge, Pietrzak, and Petry (2006) suggest that youth who gambled before the age of 15 were more likely to report gambling

problems and comorbid disorders including substance abuse, psychological disorders, and suicide ideation than later onset gamblers. Additionally, early-onset gamblers are more likely to use Internet-based gambling and are less likely to be married, compared to late-onset gamblers (Shin et al., 2014). It has been argued that as younger gamblers are more capable of using and accessing new media, they are also more likely to be exposed to remote gambling opportunities (Griffiths & Parke, 2010).

Young adults often report gambling due to boredom and the various types of online games and venues remain highly attractive (Derevensky & Gupta, 2011). There is a heightened need for the development of new and innovative prevention and harm minimization strategies in order to manage and reduce harmful patterns of gambling behavior before they become problematic (Derevensky & Gupta, 2011). Due to shared risk factors and consequences, commonalities exist between gambling and alcohol problems. Interventions, such as personalized feedback interventions (PFI) and personalized normative feedback (PNF) that have shown success with problem drinking may be considered

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a potentially beneficial intervention model for gambling problems as well (Neighbors et al., 2015). PFI has its basic origins in social learning theory (Bandura, 1971), and is predicated on using a social norms approach (Berkowitz, 2005). In essence, it is designed to decrease overestimated descriptive normative perceptions thus creating an internal discrepancy (between one's behavior and the normative behavior of the peer group) in order to decrease/reduce an undesirable behavior (Collins, Kirouac, Lewis, Witkiewitz, & Carey, 2014).

SOCIAL NORMS APPROACH

The assumption is that when individuals perceive their attitudes or behaviors to be different than the normative beliefs of their social group they experience cognitive dissonance and discomfort, and thus try to resolve the discrepancy by modifying their own beliefs and behaviors (Prentice & Miller, 1993). Norms are communicated and perceived by two general properties. They are defined by how people behave in public (their public statement), which then extends to the belief that these public statements accurately reflect the individual's actual norms. However, it is important to distinguish that despite these two properties sharing a label (i.e., norms), evidence has shown that there is a difference between their behaviors and those views they actually approve (Deutsch & Gerard, 1955). Secondly, norms are instilled with the impression of universality; that is, people will assume that all members of the group endorse similar norms. In turn, the power of the norms to affect the individual's personal attitudes and behavior is heavily dependent on their perceived universality (Cialdini, Kallgren, & Raymond, 1991; Prentice & Miller, 1993).

The social norms approach is an increasingly popular evidence-based approach to addressing health issues. Although defined by public health approaches as an attempt to *change* social norms, the terms "social norms" and "social norms approaches" refer to the *correction* of misrepresentations of social norms rather than an attempt to change social norms (Berkowitz, 2005). It is important to distinguish between these two definitions as they represent two different models of change. Social norms approach suggests that there are situations where individuals incorrectly perceive the attitudes and behavior of their peers and other community members as different from their own. When these misperceptions occur they take on two forms; either the individual overestimates the norms which results in problem or risk behaviors, or the individual underestimates the norms which results in healthy or protective factors (Berkowitz, 2005). The phenomenon where misperception occurs with a majority of individuals in a group has been referred to as "pluralistic ignorance" (Prentice & Miller, 1993). One of the effects of pluralistic ignorance is to cause a change in an individual's behavior to be better aligned with the misperceived norm. Pluralistic ignorance develops under circumstances where there is a general misperception of private views. Leading them off course, a group of individuals then tend to rely on other people's behavior to identify the social norms. They assume that although their own behavior may be driven by social pressures, other people's behavior is

driven by their true feelings (Prentice & Miller, 1993). As a result, rationalization of problem behaviors and the reduction of healthy behaviors occur. This pattern of rationalization and reduction has been well documented in a variety of unhealthy and risky behaviors including alcohol, smoking, and illegal drug use (Miller & McFarland, 1987). However, if participants understood that this was a misrepresentation, the situation would likely be self-correcting (Prentice & Miller, 1993).

A social norms approach assumes that interventions where misrepresentations are corrected by revealing actual, healthier norms of the relevant social group ultimately, result in beneficial effects for most individuals by either reducing participation in unhealthy activities or increasing protective factors.

APPLICATIONS OF A SOCIAL NORMS APPROACH

The social norms approach, initially proposed by Perkins and Berkowitz (1986), was first introduced in 1989 by Michael Haines (Haines & Spear, 1996) as a prevention strategy. By applying what is now referred to as "social norms marketing" (SNM), Haines and colleagues expanded on the approach by creating marketing techniques including, posters and media campaigns, representing actual healthy norms. The prevention campaigns, initiated at Northern Illinois University (NIU), produced significant results in increasing abstinence and moderate drinking, while decreasing heavy drinking among college students (Haines & Spear, 1996). This led to campaigns with similar results in other universities targeting both the entire college population, and subgroups including student-athletes, fraternities, and sororities (Berkowitz, 2005).

Simultaneously with the development of SNM campaigns, was the development of social norms interventions, where small group interactive workshops were incorporated. The "Small Group Norms Model" (SGNM) was created at Washington State University in the late 1980s by Far and Miller (2003). It provided normative feedback for alcohol consumption within an interactive talk show format to small student groups including athletic teams, fraternities/sororities, and first-year undergraduate students. Far and Miller (2003) concluded that the use of normative feedback was better suited within pre-existing groups where the group norms are particularly relevant to the individual.

Additionally, normative feedback interventions may also be applied to a single individual. Initially, Dimeff, Baerk, Kvilahan, and Marlatt (1999), along with Agostinelli, Brown, and Miller (1995) used motivational interviewing and stage theory as their structure for interventions. Programs within this framework, using standardized protocols and individual feedback, including the Alcohol Skills Training Program (ASTP) and the Brief Alcohol Screening and Intervention for College Students (BASICS), have reported effectiveness in reducing unhealthy excessive drinking behaviors among college students (Agostinelli et al., 1995; Dimeff et al., 1999). Recently, research has also shown that providing normative feedback by itself, without a multi-component intervention may be likewise effective (Bryant, Henslee, & Correia, 2013).

The success of a social norms approach is often reported in relation to college student alcohol use. The premise being that most college students overestimate the alcohol consumption of their peers (they have a pluralistic ignorance of alcohol use), resulting in a large proportion of moderate or light-drinkers consuming more alcohol than they would normally do. Additionally, heavy drinkers are even more likely to believe in this overestimation and use it to justify and rationalize their heavy drinking behaviors. This is considered "false consensus," where one incorrectly believes that others are alike when, in reality they are not (Ross, Greene, & House, 1976). These two concepts of social norms approach (pluralistic ignorance and false consensus) are self-perpetuating and jointly reinforcing. In essence, "the minority is vocal because it believes it is the majority", and "the majority is silent because it believes it is the minority" (Berkowitz, 2005, p. 194). The same may be applied to gambling behaviors, where students also overestimate the frequency and amount of gambling among their peers, which is then associated with increased "gambling frequency, spending, and gambling-related problems" (Celio & Lisman, 2014, p. 154).

Alcohol abuse often co-occurs with excessive gambling and there are also shared risk factors and consequences between both (Neighbors et al., 2015). Given the co-occurrence and similarities between gambling and excessive alcohol use it is plausible that similar treatment plans would yield similarly positive results (e.g., programs such as Gamblers Anonymous follow the same treatment plans as Alcoholics Anonymous). Personalized feedback interventions have shown success with alcohol abuse and other addictive behaviors (Bryant et al., 2013; Collins et al., 2014; Doumas, Esp, Turrisi, Hausheer, & Cuffee, 2014; LaBrie et al., 2013; Lewis et al., 2014), and as such could possibly be beneficial for problem gambling behaviors as well.

PERSONALIZED FEEDBACK INTERVENTIONS

Personalized feedback intervention (PFI) is a brief intervention used to alter behavior by providing the individual with a salient discrepancy between perceived and actual norms. Ultimately this approach allows for an accurate context within which an individual can self-evaluate their own behavior (Celio & Lisman, 2014). The assumption is that when norms are salient they motivate and direct behavior towards the norm (Cialdini et al., 1991). Originally, PFI was offered through a brief multicomponent, motivational, in-person intervention for alcohol addictions, (e.g., the Brief Alcohol Screening and Intervention for College Students (BASICS) model). However, it has gained traction and acceptance as a stand-alone intervention delivered through personal computers, via the Internet, or mail (Collins, et al., 2014; Larimer et al., 2011). PFI programs follow a multi-component design and although there are variations in content of feedback, typical components of a PFI include (1) a personalized normative feedback component, consisting of a summary of the individuals drinking patterns and their use as compared to norms (school norms, national norms, gender norms); (2) a discussion of the negative

consequences related to that behavior; (3) didactics; and (4) a review of moderation strategies (Bryant et al., 2013).

Given it potential beneficial effects, the objective of this study is to review interventions for problem gambling behaviors incorporating a personalized feedback intervention platform.

METHODS

Literature search, selection of studies and data extraction

Following the PRISMA protocol for systemic reviews the following criteria were set for literature search and selection. Relevant articles published in English in peer-reviewed journals from 2003 through May 2015 were identified through an electronic search of multiple databases including psycINFO, Medline, Scopus, and Web of Science. The following terms were used in various combinations; "personalized feedback interventions, gambling, trial, and effect." Limits included the year of publication, language, and availability of full text. The titles and abstracts were reviewed for potential relevance and further explored for inclusion. Additionally, a backward search from identified papers was also conducted. Articles were included if (1) one of the compared intervention methods included personalized feedback interventions, (2) the intervention focused on gambling prevention and/or reduction, and (3) the study included a comparison group (see Figure 1).

The data extraction from each publication was carried out by the first author (LM). When possible and effect sizes were not available they were estimated using F-test results and an effect size calculator (Wilson & Lipsey, 2001). Partial eta square effect sizes were converted to Cohen's *d* (Cohen, 1988). Further data extraction included author, publication year, sample size, study design, outcome measures, follow-up time and drop-out rate (see Table 1).

RESULTS

The literature search identified 15 publications for evaluation that were successful in meeting the original criteria search word. Of these 15 studies, six were excluded as they did not focus on gambling prevention or reduction and three were excluded for a lack of inclusion of a comparison group. After eliminating articles which did not meet the established criteria, six articles were identified and included in the review.

Participants

Most of the studies that met inclusion criteria targeted problem or at-risk gamblers, with one study targeting university students who self-reported having participated in at least one gambling activity during the past 30 days. Most studies included university students (67%), while the other two studies recruited at-risk participants from a general community sample, with a total reported age ranging from 18–46.6 years old. Mean reported age for the university sample was 21 years old, while mean age for the general

Table 1. Summary of included studies using PFIs on gambling

Reference (country)	Study design	Population (final *n*, age, gender, setting)	Follow-up period with drop-out rate	Outcome measures	Results
Celio and Lisman (2014) U.S.	2 conditions: PFI and attention control group	*n* = 136; m(age) = 19; 55% male; university students	1 week; 6% drop-out rate	BART; PAC; GQPN (6-item model)	Baseline perceptions were greater than actual norms; self-reported gambling was greater than actual norms (both were positively correlated with each other) After PFI: 1) Significant decrease on all three norm categories in PFI group 2) Control group showed greater increase in adjusted pumps per trial from T1–T2 3) Significant group by time interaction for risk coefficient and total money spent (control group showed greater increase in total money wagered and risk coefficient from T1–T2)
Cunningham, Hodgins, Toneatto, and Murphy (2012) Canada	RCT 3 conditions: PFI, partial feedback, and wait-list control	*n* = 209; m(age) = 46.6; 52.6% male; problem gamblers	3, 6 & 12 months; At 12 months 67% drop-out rate	Mean number of dollars lost/month; mean days gambled/month; PGSI (3$^+$ considered PG)	1) All groups decreased in money spent from T1–T2 2) Significant time by intervention effect for number of days gambled and PGSI score (partial feedback group had significant decreases in number of days gambled compared to full PFI and AOC) 3) All groups decreased in greatest amount of money spent 4) Group that received full PFI at 6 months demonstrated decreased perceptions of actual norms on money wagered on gambling at 12-month follow-up, while the partial feedback group did not
Cunningham, Hodgins, Toneatto, Rai, and Cordingley (2009) Canada	2 conditions: PFI group and control wait-list group	*n* = 49, m(age) of PFI group = 41.2; 48% male; problem gamblers	3 months; 20% drop-out rate	Baseline: CPGI (8$^+$ considered PG); GCQ follow-up: CPGI; two questions on gambling expenditure	1) Significant impact of intervention on money spent, with moderate effect size (with PFI spending less than control) 2) Decrease in maximum money spent and CPGI scores but not significant

(Continued)

Table 1. (Continued)

| Reference (country)	Study design	Population (final *n*, age, gender, setting)	Follow-up period with drop-out rate	Outcome measures	Results
Larimer, Neighbors, Lostutter, Whiteside, Cronce, Kaysen, and Walker (2011) U.S.	RCT 3 conditions: PFI, CBI, and AOC	*n* = 111; m(age) = 21; 65.3% male; at-risk/problem gamblers	6 months; 24% drop-out rate	Screening: SOGS; GQPN Baseline and follow-up: GQPN; NODS; 6-item subscale of BACS	1) PFI group showed significant decreases in frequency relative to AOC (CBI group did not) 2) Both PFI (*d* = 0.48) and CBI (*d* = .39) were associated with decreases in PG 3) PFI (*d* = .60) and CBI (*d* = .48) endorsed fewer DSM-IV criteria at follow-up relative to AOC 4) PFI group had greater decreases in perceived norms than AOC 5) CBI was associated with decreases in illusions of control compared to AOC 6) Changes in norms did account for decreases in gambling frequency as function of PFI participation (norms as mediator)
Neighbors, Rodriguez, Rinker, Gonzales, Agana, Tackett, and Foster (2015) U.S.	2 conditions: PFI and AOC	*n* = 252; m(age) = 23.11; 59.5% male; scored 2+ on SOGS	3 and 6 months; 10% drop-out rate	SOGS; GQPNS; GPI; MIWG-modified	1) Significant intervention effects in reducing perceived norms for quantities lost and won 2) Significant intervention effects in reducing actual quantity lost and gambling problems at 3 months 3) These results remained constant at 6 months 4) Intervention effects were moderated by self-identification with other student gamblers
Takushi, Neighbors, Larimer, Lostutter, Cronce, and Marlatt (2004) U.S.	2 conditions: PFI and AOC	*n* = 21; age = 18–21; 86% male; at-risk/problem gamblers	3 months; 25% drop-out rate	SOGS; GSI; GSRI	1) Gambling behaviors decreased in both groups but more in PFI group 2) Decreased frequency of gambling and drinking simultaneously in PFI group
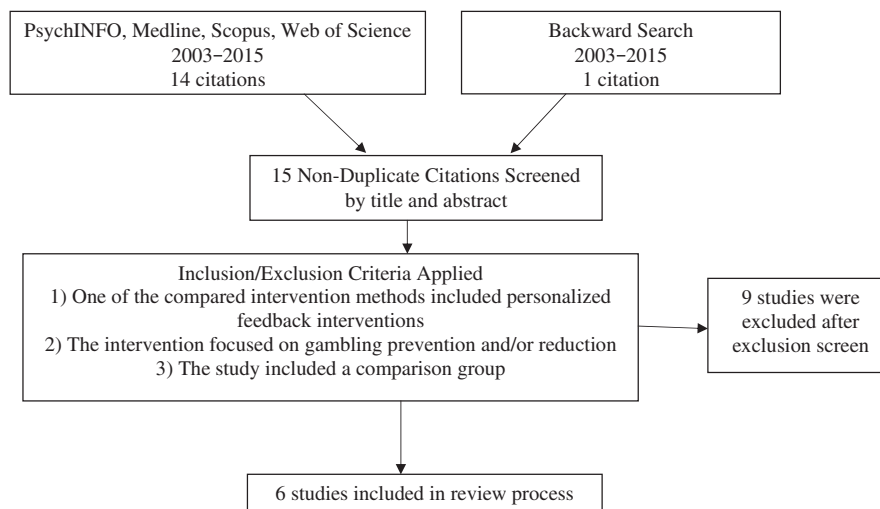
Figure 1. Study identification and analysis flow diagram

community sample was 43.9 years old. Sample sizes across studies varied with a range from 21–252 participants. Percentage of males within the samples ranged from 48–86% (mean 61%).

Interventions and duration of trials

Most of the studies (67%) incorporated two conditions (i.e., one PFI group and one assessment only control wait-list group (AOC)). Two studies incorporated randomized controlled trial methodology that used three conditions including comparisons between PFI, cognitive-behavioral interventions (CBI), partial feedback (no normative feedback), and assessment-only control groups (AOC). Finally, two studies adopted an in-person therapist PFI model while the remaining three studies sent the normative feedback information by mail or simply provided the feedback without in-person therapy sessions.

Most study designs followed a pre-post-test and follow-up model, with only two studies conducting assessments at multiple follow-up time points. Across the five studies, one study had a maximum follow-up period of 1 week, two had a maximum follow-up period of 3 months, two had a maximum follow-up period of 6 months, and only one had a maximum follow-up period of 12 months.

Reported drop-out rates of participants ranged from 6% to 31%, depending on the duration of trials and amount of time between follow-up periods. All studies reported combined drop-out rates (rather than the rate of drop-out per condition), stating no significant differences between interventions groups and control groups. Mean whole sample drop-out rate at 1-week follow-up was 6%, at 3-month follow-up was 19%, at 6-month follow-up was 20%, and at 12-month follow-up was 30%.

Outcomes

A wide variation of outcome measures were employed throughout the studies, with all the studies including some form of standardized assessment measure of problem gambling behaviors (e.g., Canadian Problem Gambling Index

(CPGI), Gambling Problem Index (GPI), the South Oaks Gambling Screen (SOGS), Problem Gambling Severity Index (PGSI)). In order to achieve a behavioral measure for gambling behaviors Celio and Lisman (2014) used the Balloon Analogue Risk Task (BART) and the Pick-a-Card (PAC) task. These tasks measure behavioral risk taking and allow for aspects of the study to go beyond self-report. Finally, Larimer et al. (2011) used the National Opinion Research Center DSM-IV Screen (NODS) to measure DSM-IV criteria for pathological gambling. In addition to these assessments of gambling behavior, Celio and Lisman (2014), Larimer et al. (2011), and Neighbors et al. (2015) employed instruments measuring perceived norms around gambling behaviors (e.g., Gambling Quantity and Perceived Norms Scale (GQPN)). Further, to measure social identity, Neighbors et al. (2015) incorporated a modified version of the Measure of Identification with Groups (MIWG). This measure identifies the level of affiliation between participants and other students at the university-level who gamble. Cunningham, Hodgins, Toneatto, Rai, and Cordingley (2009) and Larimer et al. (2011) included assessments measuring participant's beliefs and cognitions (e.g., Beliefs About Control (BACS) and the Gambling Cognitions Questionnaire (GCQ)), although the GCQ was only used at pre-test by Cunningham et al. (2009). Finally, Cunningham, Hodgins, Toneatto, and Murphy (2012) and Cunningham et al. (2009) included questions measuring monetary spending and days spent gambling.

Effects of personalized feedback interventions

Gambling. All study results revealed some decreases in gambling behavior as compared to other conditions (AOC, partial, or CBI), however, they did not always reach statistically significant decreases in gambling behavior. For example, Takushi et al. (2004) reported that both the PFI and control groups conveyed decreases in gambling behaviors (according to PGSI, SOGS, and the Gamblers Self-Report Inventory (GSRI)), however, the PFI group did show slightly better results. In this case, the data analyses were not provided in order to further analyze the strength of this

statement. In addition, Celio and Lisman (2014) reported that the control group showed increased levels of the risk coefficient from baseline to week one as compared to the PFI group (Cohen's $d = .29$). However, the PFI group results did not decrease over time but rather increased at a slower rate or remained stable compared to the AOC group. In this case, the lack of at-risk/problem gamblers in the sample would be a possible and important factor in explaining the absence of decreased gambling behavior within the PFI condition. After controlling for differences between control and PFI conditions, age and gender of participant, Cunningham et al. (2009) reported that the PFI group reported significant decreases in gambling expenditure (Cohen's $d = .84$), and a decreasing trend in problem gambling behaviors according to the CPGI (Cohen's $d = .46$). In congruence with these findings, Neighbors et al. (2015) reported a significant treatment effect for quantity lost (Cohen's $d = .37$) and gambling problems (Cohen's $d = .32$) at 3-month follow-up. Further results remained statistically significant for the amount of money lost at 6-month follow-up (Cohen's $d = .60$). When comparing PFI to a cognitive behavioral intervention, both conditions showed reductions in problem gambling relative to controls, however, effect sizes were slightly larger for the PFI group (Cohen's $d = .48$ vs. $.39$) (Larimer et al., 2011). Additionally, the PFI demonstrated a decrease in gambling frequency (Cohen's $d = .34$) and endorsed fewer DSM-IV criteria (Cohen's $d = .60$) relative to controls with moderate to strong effect sizes, while the CBI condition either did not decrease frequency of wagering or had a weaker effect size (Larimer et al., 2011). Finally, Cunningham et al. (2012) reported significant decreases in the number of days spent gambling (Cohen's $d = .45$) and problem gambling scores on the PGSI from baseline to 12-month follow-up, with partial feedback groups demonstrating significant decreases with respect to the number of days spent gambling in the past month compared to either the full PFI group or the assessment-only control group. They did not, however, find any significant differences between groups on the amount of money wagered and largest amount of money wagered in a single day, as all groups showed reductions on these measures from baseline to follow-up. Although the results are encouraging, the lack of significant and congruent results in these samples with normed gambling measures (i.e., Problem Gambling Index (PGI), Balloon Analogue Risk Task (BART)) would suggest that further studies need to be conducted in order to assess the efficacy of PFIs on gambling behaviors.

Perceived norms. Four of the six studies also examined perceptions of gambling norms among participants. Celio and Lisman (2014) discovered that baseline norms of the participants were higher than of the normal population (Cohen's $d = .97$). Additionally, participant's perceptions of norms were positively correlated with the frequency of gambling, that is, when participants had high gambling norm perceptions they also tended to gamble more frequently (Cohen's $d = .36$). Following the PFI, participant's norms significantly decreased on all categories (at post-test and follow-up). All other studies found similar results in that the personalized feedback intervention groups had significant decreases in perceived gambling norms as compared to

control groups (Cunningham et al., 2012; Larimer et al., 2011; Neighbors et al., 2015), and these results remained significant at 6-month follow-up (Neighbors et al., 2015). Further, when examining mediation effects, changes in norms accounted for declines in gambling frequency as a function of PFI participation (Larimer et al., 2011). The congruence in results among these studies would suggest that PFIs are relatively reliable methods for decreasing participants perceived gambling norms.

Beliefs and cognitions. As only one study used a secondary outcome measure assessing participants' cognitions and beliefs about gambling at post-test, results on cognitions and beliefs cannot be compared to other studies. However, the results from Larimer et al. (2011) indicated no overall group differences for illusions of control (Cohen's $d = .30$). Nevertheless relative to the AOC group, CBI was associated with reduced illusions of control (Cohen's $d = .43$). Yet, there were no indirect mediating effects of illusions of control between CBI and gambling problems or between CBI and DSM criteria (Larimer et al., 2011). The results, therefore, suggest that although CBI is associated with reduced illusions of control (a contributing factor to at-risk gambling behavior), this reduction was not a mediating factor to decreases in problem gambling behavior while decreases in perceived norms seemed to impact problem gambling behaviors (Larimer et al., 2011).

DISCUSSION

Personalized feedback interventions offer a plausible alternative treatment and prevention option for individuals with gambling problems. Yet, their effectiveness has not been systematically evaluated on a wide scale, and there are a limited number of published studies to date (it should be noted that a number of unpublished reports exist) that have compared PFIs for gambling problems with a control group. The studies reviewed in this paper consisted primarily of university student participants who were considered at-risk for gambling problems. As a result, caution should be exercised in generalizing from these findings as the samples may not be representative of the general population.

The brevity of intervention descriptions, the varied outcome measures, and follow-up periods across the studies also hinder generalizations surrounding efficacy of PFI for reducing gambling behaviors. However, based upon a limited sample of studies, overall, results suggest that PFI may be a reliable intervention for changing maladaptive perceived norms towards gambling (Celio & Lisman, 2014; Cunningham et al., 2012; Larimer et al., 2011; Neighbors et al., 2015), and has the possibility of either stabilizing social gambling behavior or decreasing at-risk problem gambling behaviors. In particular, PFIs are more efficacious than assessment alone and slightly more efficacious than CBIs. Further, mediation analyses support the proposed mechanism for PFI, in that changes in gambling losses after the intervention were mediated by changes in perceived norms for gambling losses (Neighbors et al., 2015).

Of the studies published in the past 12 years, three stand out. First, Larimer et al. (2011) undertook the only study to compare a PFI condition to both an AOC and CBI condition

on multiple outcome measures. The results not only allow comparisons between conditions, thereby creating a deeper understanding for the effectiveness of PFI versus other popular gambling intervention methods, but illustrate the mediating potential of both illusions of control (a cognitive measure) and perceived norms on gambling behavior. This allows for a better-informed decision when applied to practice.

Celio and Lisman's (2014) study incorporated behavioral measures as well as self-report measures to assess gambling behavior. Additionally, they recruited a sample of students who were not necessarily at-risk or problem gamblers, that is, participants who reported social/recreational gambling during the past 30 days. In this way, results can be interpreted for using PFI as a possible successful prevention method as opposed to solely an intervention method for at-risk or problem gamblers. Students in the PFI group slightly decreased on all gambling measures or remained stable, whereas the control group significantly increased on gambling measures. They suggest that without PFI, students were more likely to continually increase their gambling behavior, leading to possible at-risk or problem gambling behaviors.

Finally, Neighbors et al.'s (2015) study evaluated PFI on a large sample size of at-risk university students, looking at not only changes in gambling behaviors but changes in perceived norms (and its mediating effects) and moderating effects of social identity. Results were significant for the PFI group in four of the seven gambling outcome measures evaluated, and changes in perceived norms mediated changes in gambling behaviors. Further, consistent with social identity theory, receiving feedback about one's peers was more effective and led to increased changes at 3-month follow-up for those who identified strongly with their peers. Their results suggest that PFIs should focus on specific peer groups (i.e., student-athletes) in order to achieve the best results.

CONCLUSIONS

Implications for research

The limited amount of peer-reviewed articles using PFI for treatment of gambling problems suggests that more extensive research needs to be conducted in order to address the clinical appropriateness and usability of this intervention method. All participants in this review were adults. Future studies should also investigate the effectiveness of PFI on adolescent participants in reducing gambling behaviors. Individuals who gamble before the age of 15 are more likely to report comorbid disorders, and approximately 70–80% of adolescents report gambling before leaving high school. The high rate of gambling among this age group provides a strong basis for PFI prevention to be implemented early in adolescence (Burge et al., 2006; Gupta & Derevensky, 1998). Additionally, PFIs should be extended to include more Internet-based platforms. Given the potential benefits of PFIs on reducing gambling behavior, using Internet-based methods (including smartphones) may likely increase benefits through cost-effective delivery and wider

implementation possibilities. Specifically, Internet and mobile-based PFIs would be beneficial in recruiting individuals who may not otherwise seek traditional forms of treatment. In particular gambling research has shown that the majority of individuals with gambling disorders do not seek treatment, with only 1 in 10 lifetime diagnosed gamblers ever seeking treatment (Cunningham, 2005).

A significant challenge for the research on PFI will be standardizing intervention methods in order to be able to compare and evaluate the efficacy of programs more efficiently. Decisions on whether norms closer to the target population (e.g., fraternities) or norms based upon a group more distant and global (e.g., college students in general) need to be addressed in the standardization process. In general, when students are closer in characteristics and proximity, they tend to develop similar patterns of misperceptions over time (Bowen & Bourgeois, 2001). Therefore, selecting the most salient norms should be a priority in the standardization process. Being able to provide very individualistic and global norms and feedback, while also creating a standardized format poses a significant challenge for future researchers. Further, with the constant advances in sophisticated computers, personal data assistants (PDAs), smartphones and software capabilities may require developers to create Internet-based standardized programs and applications that can keep up with technological advances.

Implications for practice

While current research evidence is lacking and requires more studying, it does suggest that at-risk or problematic gamblers may benefit from PFI treatment interventions. Results demonstrate that PFI may also be used as a promising source of preventative measures for at-risk gambling behaviors. This type of intervention may be especially useful for individuals who view themselves as part of a particular group (e.g., fraternity), as it entails correcting personalized norms, that are often exaggerated. Confidence in this type of intervention is further enhanced by the success of previous extensive research looking at the efficacy of PFI for excessive alcohol consumption. Given the co-occurrence of excessive drinking and gambling behavior, through increased persistence when losing and wagering larger amounts of money (Kyngdon & Dickerson, 1999), having an intervention method that is effective for both gambling and alcohol problems may be highly beneficial. As these two addictions often overlap and have many similarities, similar intervention results may be realized.

Another implication to consider are the effects of personalized feedback interventions when the individual underestimates the norms. Typically, this underestimation would result in healthy or protective factors. However, if individuals are then provided with norms that are higher than their initial perceptions, social norms approach would suggest they might increase their behaviors, moving closer to the norm. Studying and understanding this possible effect, as well as the effect of PFI on at-risk individuals is not only necessary for research but should be a consideration when using PFI as a preventative measure. Evidence is still limited and additional controlled trials need to be

conducted, however, this review provides preliminary promising support for personalized feedback interventions.

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