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ORIGINAL RESEARCH

Stacked Deck: An Effective, School-Based Program for the Prevention of Problem Gambling

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Abstract School-based prevention programs are an important component of problem gambling prevention, but empirically effective programs are lacking. Stacked Deck is a set of 5–6 interactive lessons that teach about the history of gambling; the true odds and "house edge"; gambling fallacies; signs, risk factors, and causes of problem gambling; and skills for good decision making and problem solving. An overriding theme of the program is to approach life as a "smart gambler" by determining the odds and weighing the pros versus cons of your actions. A total of 949 grade 9–12 students in 10 schools throughout southern Alberta received the program and completed baseline and follow-up measures. These students were compared to 291 students in 4 control schools. Four months after receiving the program, students in the intervention group had significantly more negative attitudes toward gambling, improved knowledge about gambling and problem gambling, improved resistance to gambling fallacies, improved decision making and problem solving, decreased gambling frequency, and decreased rates of problem gambling. There was no change in involvement in high risk activities or money lost gambling. These results indicate that Stacked Deck is a promising curriculum for the prevention of problem gambling.

Keywords Gambling · Prevention · Problem · Youth · Adolescent · School

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The past 30 years has seen a dramatic increase in the worldwide availability of legalized gambling opportunities. With increased availability has come increased participation and increased rates of problem gambling. Problem gambling is defined as difficulties in limiting money and/or time spent on gambling that leads to significant adverse consequences for the gambler, others, or for the community (Neal et al. 2005). Severe forms of problem gambling are also known as "pathological gambling," or "compulsive gambling." Among adults, the prevalence of problem gambling in North America increased significantly from 1977 to 1993 (Shaffer et al. 1997). In 2001, it was estimated that 4.0% of North American adults met criteria for either problem or pathological gambling in the past year (Shaffer and Hall 2001). Worldwide prevalence studies since 2005 have found past year adult rates of 0.4–6.5%, depending on the country (Alberta Gaming Research Institute 2010).

Rates among youth are even higher. National prevalence studies in the United States, Canada, Australia, and Sweden have found problem gambling to peak in the age group 18–24 (Gerstein et al. 1999; Productivity Commission 1999; Statistics Canada 2003; Rönnberg et al. 1999). Similarly, a meta-analysis of North American prevalence studies found that lifetime rates of problem gambling were highest in college and university students (16.4%), followed by adolescents (11.8%; Shaffer and Hall 2001).[1] The elevated rates among youth are likely due to the fact that young adults typically have the highest rates of involvement in most risky behaviors (e.g., substance use, reckless driving, unsafe sex; e.g., Eaton et al. 2006), as well as the fact that this is one of the first generations to have been raised in an environment of extensive legalized and government-sanctioned gambling.

The biopsychosocial model posits that problem gambling develops through a complex interaction between many different endogenous attributes of the individual and exogenous stimuli in the environment (National Research Council 1999; Petry 2005; Williams et al. 2007, 2008). The relative influence of different risk factors in contributing to the development of problem gambling varies from person to person, as does the age of onset. Since a multitude of internal and external factors contribute to problem gambling, prevention requires coordinated, extensive, and enduring efforts between effective policy initiatives that constrain the availability and provision of gambling and effective educational initiatives that change internal knowledge, attitudes, beliefs, and skills so as to deter an individual from risky gambling behavior (Nation et al. 1993; Stockwell et al. 2005; Williams et al. 2007, 2008).

A wide array of educational and policy initiatives to prevent problem gambling are currently being developed, tested, and used (Williams et al. 2008). School-based programs are particularly important part of an overall prevention strategy because they provide an intervention to individuals who may not yet have engaged in the behavior as well as to an age group that is at particular risk for subsequent problem gambling. Furthermore, if successful, educational interventions have the potential to provide long-term deterrence to risky gambling behavior in a wide array of environments/contexts.

Current school-based problem gambling prevention programs exist on a continuum. At one end are the many videos, plays, interactive CDs or DVDs, websites, resource manuals, and one-session presentations developed and often delivered by governmental health, social service, education, and/or addiction agencies (see Ferentzy et al. 2006, and Williams et al. 2008, for a listing of some of these). At the other end are much more substantive multi-session programs delivered over a longer time frame. Examples of this latter type include Don't Bet On It in South Australia for ages 6–9, Gambling: Minimising Health Risks in Queensland for grade 5, Facing the Odds in Louisiana for grades 5–8, All Bets Are Off in Michigan for grades 7 and 8, Kids Don't Gamble…Wanna Bet in Minnesota and Illinois for grades 3–8, Youth Making Choices for high school students in Ontario, Count Me Out in Quebec for ages 8–17, and the Problem Gambling Prevention Program in Florida for middle and high school students. The content of school-based programs is diverse, but they usually contain one or more of the following elements: information about the addictive nature of gambling, signs of problem gambling, available treatment resources, guidelines or suggestions for problem-free gambling, true gambling odds, gambling fallacies, exercises to build self-esteem, and peer resistance training.

To date, only a few of these programs have been formally evaluated. The Addiction Foundation of Manitoba evaluated their 45–60 min gambling education and awareness presentation (It's Your Lucky Day) among 894 grade 7 and 8 students in Manitoba (Lemaire et al. 2004). One month after receiving the presentation, students in the intervention group showed improved knowledge of gambling and problem gambling as well as decreased gambling fallacies relative to students in the control group. The International Centre for Youth Gambling Problems and High-Risk Behaviors (ICYGPHRB) in Montreal, Quebec, undertook an evaluation of their interactive CDs for the prevention of problem gambling (Hooked City for grade 7–12 students and The Amazing Chateau for grades 4–6). Several months after being exposed to these interactive CDs, students had significantly improved knowledge about gambling, more awareness of the signs of problem gambling,

[1] A recent U.S. national study found lower rates of problem gambling in adolescents and young adults compared to all adults (Welte et al. 2008).

and fewer gambling fallacies. However, there was no significant change in gambling behavior, although there was a trend in this direction (IGYGPHRB 2004). A pre-post evaluation of 60-minute program developed by the Centre for Addiction and Mental Health in Ontario found the program to significantly improve students' understanding of random chance but did not result in any change in gambling behavior, coping strategies, or attitudes towards gambling (Turner et al. 2008).

Robert Ladouceur et al. at Laval University in Quebec have conducted several evaluations of their initiatives. Gaboury and Ladouceur (1993) evaluated a 3-session program (75 min per session) among 289 juniors and seniors from 5 Quebec high schools. The program included an overview of gambling, discussion of legal issues, how the gambling industry manipulates the chances of winning, gambling fallacies, development of problem gambling, and coping skills. Six months later, students in the intervention group had improved knowledge about gambling relative to the control group. However, the improvement in coping skills seen after training was not maintained at 6-month follow-up, nor was there any significant change in students' actual gambling behavior or attitudes toward gambling at either post-test or follow-up. Ferland et al. (2005) evaluated a somewhat different 3-session program (60 min per session) with 1,193 Quebec students in grades 8, 9, and 10. The program focused on the nature of gambling, gambling fallacies, social problem solving to resist peer pressure, and excessive gambling. Three months later, students in the intervention group demonstrated a significant improvement in knowledge about gambling, and a decrease in gambling misconceptions relative to the control group. However, there was no improvement in their social problem solving ability or change in their level of gambling participation.

The Laval University group has also conducted several evaluations of shorter interventions directed primarily to students in grades 5–8. These involve a 20-minute educational video (Ladouceur et al. 2004; Lavoie and Ladouceur 2004; Ladouceur et al. 2005), a 40- to 60-minute interactive presentation (Ladouceur et al. 2003; Ladouceur et al. 2004), and a combination of video and presentation (Ferland et al. 2002). Follow-up evaluations were typically conducted immediately or 1 week after, with results compared against a control group of students that did not receive the intervention. In all cases, significant improvements in general knowledge about gambling, knowledge about problem gambling, and/or decreases in gambling fallacies were obtained, with the results being dependent on the specific focus of the intervention.

To summarize, school-based programs are an important part of an overall problem gambling prevention strategy. Several programs exist; however, very few of these have been evaluated. The ones that have been evaluated have reliably obtained improvements in knowledge about gambling, knowledge about problem gambling, and a decrease in gambling fallacies. Most of these programs have not evaluated actual behavioral change. The few that have, however, have not found evidence of skill development or a significant change in gambling behavior. (Note: This review has not included the handful of university- and college-based programs that have also been evaluated. See Williams et al. 2008, for details of some of these programs and their effectiveness.)

In many ways, these results mirror results found in other areas of prevention. In general, educational efforts to improve peoples' awareness or knowledge of risky health practices is often successful (Centre for Addiction and Mental Health [CAMH] 1999; Duperrex et al. 2002; Grilli et al. 2002; Sowden et al. 2003). However, though knowledge and attitudinal changes have been fairly reliably obtained, the ability of educational initiatives to produce actual changes in behavior is much less common (CAMH 1999; Duperrex et al. 2002; Faggiano et al. 2005; Franklin et al. 1997; Grilli et al. 2002; Slater et al. 2005; Sowden et al. 2003; Stacy et al. 1994; cf. Mytton et al. 2006). Even with more substantive interventions, effects on the desired behavior have often been small (Etter and Bouvier 2006; Foxcroft et al. 1997; Merzel and D'Afflitti 2003; Sowden et al. 2003; Thomas and Perera 2006; Wandersman and Florin 2003), nonexistent (Gates et al. 2006; Secker-Walker et al. 2002), and occasionally in the opposite direction (Roberts and Kwan 2001).

Needless to say, it is important that effective school-based programs for the prevention of problem gambling be identified and put in place. Furthermore, in identifying effective programs it is important to focus on meaningful behavioral change as the primary measure of effectiveness. Improvements in

awareness, knowledge, or attitudes are of value as intermediate steps in the right direction but of very limited importance if not accompanied by behavioral change. Furthermore, developing these initiatives in the context of a theoretical model of behavioral change (e.g., Health Beliefs Model; Janz et al. 2002) will help improve the likelihood of a successful outcome. The purpose of the present study is to address this need for a behaviorally effective school-based problem gambling prevention program.

Methodology

Program Development

The nature and content of the Stacked Deck program was derived from existing programs, what is known about the causes of problem gambling, and a careful study of effective strategies for behavior change from primary prevention programs in other areas (Capuzzi and Gross 2000; Durlak 1997; Durlak and Wells 1997; Lipsey and Wilson 1993; Mullen et al. 1997; Weissberg and Gullotta 1997). As much as possible, there was also incorporation of what was known about effective educational strategies in schools (e.g., Borich 2006; Elliot et al. 1999; Hunt et al. 1999).

The program consisted of five basic lessons (Standard Program) with an optional sixth lesson (Booster Program):

Lesson 1: History and the "House Edge"

This focused on what gambling is, the history and types of gambling currently available, the odds of traditional gambling games, and the insurmountable long-term advantage of the house edge.

Lesson 2: Problem Gambling

This lesson discussed the addictive potential of gambling, the signs and symptoms of problem gambling, causes and risk factors for problem gambling, and where to get help for gambling problems.

Lesson 3: Gambling Fallacies

This lesson consisted of exercises designed to make students more cognizant of and less susceptible to errors in thinking that contribute to excessive gambling (i.e., selective memory for wins, the development of superstitious beliefs through conditioning, illusory belief of control, the influence of early big wins, misunderstandings of randomness, ignoring the law of averages, and the belief that money can solve all problems; Joukhador et al. 2003; Toneatto et al. 1997).

Lesson 4: Decision Making and Problem Solving

There is good evidence that problem gambling is typically part of a broader pattern of high-risk behaviors, characterized by core deficits in decision-making, judgment, and problem-solving skills (Dickson et al. 2002). To address this, the message of Lesson 4 was that everything you do is a gamble, and the important thing is to approach life as a "smart gambler." This is done by being a "problem solver" and routinely assessing whether (a) the odds are in your favor, (b) what you could win is of significant value, and (c) what you could lose is something you can afford to lose.

Lesson 5: Barriers to Good Decision Making and Problem Solving

This lesson focused on examining the reasons why people sometimes take "bad gambles" or make bad decisions (e.g., peer pressure, not having all the information, not being objective, not taking time to weigh the pros versus cons). The second part of this lesson addressed ways to overcome these barriers, particularly peer pressure. For adolescents, gambling activities are typically social in nature, such as playing cards for money or betting against friends on a sporting event (Gupta and Derevensky 1998; Hardoon and Derevensky 2001). Successful treatment of adolescent substance abuse usually requires addressing issues of peer pressure and peer group activities (Williams and Chang 2000). It is almost certain that the same issues are relevant for the prevention of problem gambling.

Lesson 6: Quiz Game

In some schools students were exposed to a sixth booster session given at least 1 month after receiving Lesson 5. In this lesson, the class is divided into two

groups who compete for the high score on the basis of their answers to 20 questions derived from Lessons 1–5. After each question, the correct answer is discussed in detail. The primary purpose of Lesson 6 is to consolidate the knowledge and skills learned in Lessons 1–5.

While the educational content of any primary prevention program is crucial to its success, it is equally important to structure the program in such a way that students can easily engage, absorb, and retain the content. Thus, a substantial amount of attention was devoted to the format of the program, such that it incorporated the following important features:

1. *An entertaining and engaging delivery*. The program relied strongly on visual elements. To that end, all lessons were presented via PowerPoint slides. Students were also shown a video on problem gambling. All lessons were also highly interactive, requiring the active participation of all students in group discussions, games, and small group exercises. Additionally, the researchers endeavored to select research assistants with dynamic and personable teaching styles to deliver the program.
2. *A strong emphasis on skill learning and application of knowledge*. Most problem gambling prevention programs have only been one session long, which may help explain the lack of behavioral changes. It is well known that prevention programs emphasizing skill development and corrective feedback over a longer period of time achieve better outcomes (e.g., Driskell et al. 1992; Tobler et al. 2000; Wilson et al. 2001). Hence, the Stacked Deck program is presented over five sessions with each session lasting up to 100 min. The program was also often distributed over a 2-week period rather than on consecutive days to take advantage of the superior skill retention that occurs with spaced over massed practice (Dempster 1989; Donovan and Radosevich 1999). Further to this end, the sixth booster session was always scheduled 1 month after Lesson 5.
3. *Targeting the social environment (i.e., peers) of the people receiving the program*. The impact of individual skill development is limited unless there are also environmental changes that decrease the opportunities, acceptability, and pressure to participate in gambling activities (Williams et al. 2007, 2008). This is especially true of the more socially oriented types of gambling engaged in by adolescents. These environmental changes were accomplished by ensuring the program was delivered to all students in the school who were in that particular grade or course, as these are the main peers of other students in that grade/course. (This was done for most but not all schools.) To further ensure widespread awareness, poster contests were conducted in several schools whereby students competed to create the best poster on problem gambling (with the poster entries displayed throughout the school). The greater effectiveness of these more pervasive approaches has been demonstrated both in primary prevention (Durlak and Wells 1997; Sowden et al. 2003; Spinks et al. 2009) and in the treatment of addictive behaviors (Miller et al. 2003; cf. Secker-Walker et al. 2002).

A pilot program consisting of many of these above elements was tested in 2001/2002 in two Calgary, Alberta, high schools (Davis 2003; Williams 2002). In 2003, the content and structure of the program was substantially revamped based on these results as well as feedback from teachers and students.

Study Design

The revised Stacked Deck program was implemented between January 2003 and June 2005 by five trained research assistants ("trainers"). A total of 1,253 grade 9–12 students in 10 schools in southern Alberta received the program (in the three urban centers of Calgary, Lethbridge, and Medicine Hat and the four rural communities of Coaldale, Vauxhall, Taber, and Cardston). In addition, 433 students in 4 different schools (in Calgary, Lethbridge, Coaldale, and Cardston) were in a control group that was administered the baseline and follow-up questionnaires but did not receive the program. Schools were randomly assigned to condition (intervention or control) under the constraint that three quarters of the schools would be in the intervention condition. After assignment, one school indicated they did not wish to be a control school and one school indicated they did not wish to

be an intervention school. After accommodating these requests, the investigators also changed the condition assignment of two other schools to ensure that control schools provided comparability to the intervention schools in terms of urban/rural split, school enrollment numbers, and student demographics. All control schools subsequently received the program and became intervention schools. In most schools, the lessons were administered in the Well Being unit of the Career and Life Management course that all Alberta high school students are required to take. However, in some schools it was administered in the Health class.

One to two weeks prior to implementation, students were notified they would be participating in a "problem gambling prevention program" and were provided with parental consent forms. These forms briefly described the lessons and asked parents to sign and return the form if they did not wish their son/daughter to participate in its evaluation (i.e., filling out the baseline and follow-up questionnaires). No permission was sought for participating in the program, as its content was consistent with the goals of the Career and Life Management or Health class in which it was taught. (The above protocol was approved by the University Ethics Committee.) Almost no parental forms were returned, resulting in a very high rate of eligible participation.

Assessment

At the beginning of the first lesson students were administered a baseline questionnaire to assess their "general gambling knowledge, attitudes, and behavior." They were told that completion of the questionnaire was optional, but if they completed both the baseline and follow-up questionnaires, they would receive $10 (cash in some schools, gift certificates at other schools depending on the preference of the school). It was further explained that their responses would be anonymous. We needed only their birth date, mother's first name, and the last 2 digits of their telephone number to match the baseline questionnaire with the follow-up questionnaire. Furthermore, students were assured that all information collected would be confidential with no one outside the research team having access to the data.

The baseline questionnaire collected demographic information and assessed the following areas (the lack of established scales in several of these areas required the development of several new scales that were field tested and refined during the 2001/2002 pilot):

1. Gambling Attitudes as measured by a 2-question scale (score range: −4 to +4, with positive scores reflecting positive attitudes) that measured people's general attitude toward gambling. The first question asked the person about his or her belief about the benefit versus harm that gambling has for society, with response options ranging from *benefits far outweigh the harm* to *harm far outweighs the benefits*. The second question asked the person to indicate whether he or she believes gambling is morally wrong or not. This scale had a good 1-month test–retest reliability ($r = .78$; Williams 2003). It also had good concurrent and predictive validity as evidenced by its significant correlation with current and future gambling behavior in the present study.
2. General knowledge of gambling and problem gambling as measured by the 10-question Gambling Knowledge scale (score range: 0–10). Questions in this scale asked items such as what the legal age for purchase of lottery tickets is, whether gambling can become as addictive as drugs and alcohol, what the risk factors for problem gambling are, what the most addictive form of gambling is, whether there is any system by which you can beat the casino, whether the number of bets you make influences your chances of winning, what the name of the Alberta government agency that provides free treatment for problem gambling is, and what the odds of winning the national lottery are. This scale had good concurrent and predictive validity as evidenced by its significant negative association with gambling fallacies and problem gambling (i.e., DSM-IV-Multiple Response-Juvenile [DSM-IV-MR-J] scores, see below) both at baseline and follow-up in the present study.
3. Awareness of and resistance to common gambling fallacies as measured by the 10 question Gambling Fallacies scale (score range: 0–10, with higher scores reflecting greater resistance to gambling fallacies). This scale was adapted from Moore and Ohtsuka (1999) and measured the

person's knowledge of superstitious conditioning, the independence of random events (e.g., is it better to play a slot machine that has not paid out in a while or just paid out), the illusion of control (e.g., is it better to choose your own lottery numbers or have them chosen for you), the belief that one is luckier than other people, and sensitivity to sample size in probabilistic judgments. It had adequate 1-month test–retest reliability ($r = .69$; Williams 2003). It also had good concurrent and predictive validity as evidenced by its significant correlation with problem gambling scores on the DSM-IV-MR-J at both baseline and follow-up.

4. Decision-Making and Problem-Solving Skill as assessed by an 8-question scale (score range: 0–10) asking about self and other peoples' rating of the person's decision making and problem solving in the past 3 months (e.g., how often do you do a thorough and objective analysis of the pros and cons of your decisions, how often do your major decisions and problem-solving solutions prove to be the right ones, how would your parents and friends would rate you as a problem solver, how good is your ability to resist peer pressure). The concurrent and predictive validity of this scale was evidenced by its significant negative correlation with High-Risk Activities (see below) as well as DSM-IV-MR-J scores at baseline and at follow-up.
5. Stated involvement in High-Risk Activities in the past 3 months. This was a 9-question scale (score range: 0–10) asking about substance use, illegal behavior (e.g., shoplifting), skipping school, driving while intoxicated, etc. The concurrent and predictive validity of this scale was evidenced by its significant positive correlation with both baseline and follow-up scores on the DSM-IV-MR-J as well as a significant negative correlation with baseline and follow-up scores on Decision-making and Problem-solving Skill.
6. Gambling Behavior in the past 3 months. Specifically, this was a self-report of (a) whether the person had gambled, (b) the types of gambling engaged in, (c) the frequency of gambling (number of days gambled in the past 90 days), and (d) the amount of money both won and lost gambling.
7. Problem Gambling in the past year. The first measure used was the DSM-IV-Multiple Response-Juvenile (Fisher 2000). This was a 9-question scale developed for adolescents and modeled after DSM-IV criteria for pathological gambling. A score of 4 or higher is indicative of problem gambling. This scale has previously demonstrated good internal consistency (Cronbach alpha = .75; Fisher 2000), but its reliability has been questioned by Pelletier et al. (2004), who found a roughly 25% decrease in problem gambling prevalence when verbally re-administering it to 265 out of 661 grade 7 and 8 students that had just obtained the highest scores after self-administration. However, it is unclear how much this decrease reflected true test–retest unreliability or just the demand characteristics of the reassessment procedure. The DSM-IV-MR-J has good construct validity in terms of its ability to reliably distinguish between social and pathological gamblers (Fisher 2000). In the present study, it also evidenced statistically significant associations with gambling frequency ($\eta = .87$), money lost gambling ($\eta = -.65$), and gambling fallacies ($\eta = .12$) at baseline. Unfortunately, because of a mistaken instruction in the baseline questionnaire, 25% of students did not complete the DSM-IV-MR-J. Fortunately, a second measure of Self-Reported Problem Gambling was also employed. This was a 2-part question that asked students, "Has your gambling caused you or anyone else any problems in the past 12 months? By this we mean things such as stress or anxiety, arguments with friends or family, worries about money, health problems, legal problems, or problems at school or work." A follow-up question then asked the person to indicate the type of problems, their frequency, and their seriousness. The person was deemed a problem gambler if they reported "serious" or "very serious" problems of any frequency. In addition to having good face validity, this measure had a significant association with problem gambling status at baseline as assessed by the DSM-IV-MR-J, although the magnitude of the correlation was not large (Cramer's $V = .31$, $p < .001$). This measure also had a significant association with baseline gambling frequency

($\eta = .60$), money lost gambling ($\eta = -.47$), and gambling fallacies ($\eta = .11$).

A follow-up questionnaire containing these same scales was administered 3–7 months after the program had ended (average of 4.1 months for all groups combined; 4.0 months for the intervention groups and 4.4 months for the control group). School breaks over the summer and other scheduling issues precluded a standard follow-up interval.

Results

Sample

The mean age of the students was 16.0 ($SD = 1.0$) ranging from 14 to 20 years of age. Eight percent were in grade 9, 33% in grade 10, 51% in grade 11, and 8% in grade 12. Fifty-three percent were male. Approximately 67% identified their ancestry as primarily European, 8% East Asian, 3% South Asian, 3% Aboriginal, 2% African, 3% Latin American, and 13% Other.

Table 1 indicates the number of students in each of the three groups and the follow-up rates for each (which averaged 73.5% for all three groups combined).

Analysis of Baseline Differences and Effects of Attrition

All variables were initially examined for accuracy of data entry, missing values, univariate outliers, and normality. When missing values comprised less than 5% of the total data set for that variable, values were imputed using SPSS Linear Trend at Point for continuous variables and mode for discrete variables. The variables of high-risk behavior, gambling frequency, and money lost gambling were found to be skewed and had outliers at both baseline and follow-up. Skewness and outliers were significantly reduced by winsorizing the top 1% of values for each of these variables.

Table 1 Sample sizes and follow-up rates for each group

Group	Baseline	Follow-up
Standard program	911	682 (74.9%)
Booster program	342	267 (78.1%)
Control group	433	291 (67.2%)
Total	1686	1240 (73.5%)

Chi-square tests for nominal variables and *t*-tests for continuous variables investigated whether the three groups differed at baseline ($p < .01$) on gender, age, grade, gambling attitudes, decision-making skill, gambling knowledge, gambling fallacies, percentage of gamblers, high-risk activity, gambling frequency, money lost gambling, and rates of problem gambling. Age and grade were found to be significantly lower in the Booster Group relative to the Standard and Control Groups. Hence, these two variables were entered as covariates in subsequent analyses.

This same procedure was used to determine whether there were any significant differences ($p < .01$) between students who completed the follow-up questionnaire and those who did not. It was found that students who did not complete follow-up questionnaires tended to be somewhat older and in a higher grade. There were no significant differences in gambling behavior, problem gambling, gambling fallacies, gambling attitudes, decision-making skill, or high-risk behavior.

Baseline Gambling Attitudes, Knowledge, and Behavior

Attitudes, Knowledge, and Gambling Fallacies

Most students were neutral or slightly negative in their attitudes towards gambling at baseline ($M = -.28$; $SD = 1.7$). Students possessed some knowledge about gambling and problem gambling at baseline with the average score on this scale being 4.8 out of a possible 10 ($SD = 1.5$). The average number of correct answers on the gambling fallacies scale was 4.9 out of 10 ($SD = 1.7$).

Gambling Behavior

Forty-one percent of students reported having participated in at least one activity where they wagered money in the past 3 months (i.e., gambled). Among the 697 gamblers, the most common activities were betting on games of skill against other people (e.g., pool, golf, darts, video games; 56%), betting on card games (52%), sports betting (40%), gambling on dice games (28%), buying lottery and instant win tickets (21%), buying sports lottery tickets (14%), playing

bingo (10%), playing video lottery terminals or slot machines (6%), and horse race betting (6%). In terms of frequency, 45% reported gambling once a month, 22% 2–3 times a month, 16% once a week, 12% 2–6 times a week, and 6% daily. Among gamblers, the median reported loss in the past 3 months was $10, with 90% reporting a loss of $75 or less. However, the overall median net win/loss was a reported win of $10. In fact, 79% of all gamblers reported having a net win over the past 3 months. Wood and Williams (2007) have documented that self-reported gambling expenditure tends to be very unreliable, and that reported losses tend to be more valid that reported net win/loss. Hence, net win/loss was not used in any of the subsequent analyses.

Problem Gambling

According to the DSM-IV-MR-J, 3.2% of students were problem gamblers at baseline. According to the Self-Reported Problem Gambling measure, 5.2% of students were problem gamblers at baseline. Among the Self-Reported Problem Gamblers, the most common gambling-related problems were money worries (77%), school or work problems (76%), stress or anxiety (75%), problems with friends or family (74%), health problems (47%), and legal problems (39%).

Effects of the Prevention Program

The effects of the prevention program were assessed by means of Analysis of Covariance (ANCOVA) for repeated measures. A separate Group (Control, Standard, or Booster) × Time (baseline or follow-up) analysis was performed on each of the following dependent variables: Gambling Attitudes, Gambling Knowledge, Gambling Fallacies, Decision Making, High-Risk Activity, Gambling Frequency, Money Spent Gambling, and Problem Gambling. Age and grade were entered as covariates. The main effect of interest was the Group × Time interaction. Changes in the percentage of gamblers and in the percentage of problem gamblers from baseline to follow-up were evaluated with McNemar tests. Results of these analyses are summarized in Table 2.[2]

[2] A hierarchical multilevel analysis could have been used in recognition of the nested structure of the data (i.e., students within schools). However, while the delivery of the intervention was based in the schools, this was simply a mechanism by which to draw the sample. The focus of the intervention was still primarily on the individual. Furthermore, an individual level analysis is justified considering the lack of any significant community or school effects on program outcomes (see Impact of Mediating Variables on Changes in Gambling Behavior section) and because of the homogeneity of the student population in southern Alberta.

Attitudes

A statistically significant Group × Time interaction was obtained, $F(2, 1235) = 15.4$, $p < .001$. Post-hoc *t*-tests determined this interaction effect to be due to significantly more negative attitudes toward gambling from baseline to follow-up in the Standard Group ($t = 11.0$, $p < .001$) and in the Booster Group ($t = 8.94$, $p < .001$) but not the Control Group ($t = 1.72$, $p = .087$). At follow-up, the attitudes in the Standard Group were also significantly more negative than the attitudes in the Control Group ($t = 4.54$, $p < .001$). Attitudes in the Booster Group were also significantly more negative than attitudes in the Standard Group ($t = 2.50$, $p = .013$).

Knowledge

There was a statistically significant Group × Time interaction, $F(2, 1235) = 35.1$, $p < .001$. Post-hoc *t*-tests determined this interaction to be due to significant gains in knowledge from baseline to follow-up in the Standard Group ($t = 13.6$, $p < .001$) and in the Booster Group ($t = 13.4, p < .001$) but not the Control Group ($t = 1.66, p = .098$). At follow-up, the level of knowledge in the Standard Group was significantly better than the Control Group ($t = 8.04$, $p < .001$). The level of knowledge in the Booster Group was also significantly better than the level of knowledge in the Standard Group ($t = 5.69, p < .001$).

Gambling Fallacies

There was a statistically significant Group × Time interaction, $F(2, 1235) = 34.4$, $p < .001$. Post-hoc *t*-tests determined this interaction effect to be due to a significant decrease in gambling fallacies from baseline to follow-up in the Standard Group ($t = 11.1, p < .001$)

Table 2 Changes in dependent variables from baseline to follow-up in the three groups

Dependent variable (Scale)	Groups	Baseline *M* (*SD*)	Follow-up *M* (*SD*)
Gambling attitudes (−4 to +4)	Control group	−.33 (1.8)	−.52 (1.7)
	Standard program	−.24 (1.7)	−1.06 (1.7)*,**
	Booster program	−.38 (1.7)	−1.37 (1.7)*,***
Gambling knowledge (0–10)	Control group	4.66 (1.4)	4.84 (1.6)
	Standard program	4.72 (1.6)	5.73 (1.6)*,**
	Booster program	4.94 (1.4)	6.39 (1.7)*,***
Resistance to gambling fallacies (0–10)	Control group	5.01 (1.7)	4.89 (1.8)
	Standard program	4.95 (1.8)	5.94 (2.1)*,**
	Booster program	4.86 (1.7)	6.19 (2.0)*,**
Decision making & problem solving (past 3 months; 0–8)	Control group	5.83 (1.6)	5.71 (1.8)
	Standard program	5.74 (1.8)	6.07 (1.7)*,**
	Booster program	5.77 (1.7)	6.06 (1.8)*,**
High-risk activities (past 3 months; 0–9)	Control group	1.68 (1.7)	1.64 (1.6)
	Standard program	1.59 (1.5)	1.63 (1.7)
	Booster program	1.79 (1.4)	1.83 (1.6)
Gamblers (past 3 months)	Control group	46.4%	43.0%
	Standard program	39.7%	27.1%*,**
	Booster program	41.9%	23.2%*,**
Gambling frequency (all participants; # days gambling in past 90)	Control group	15.87 (44.3)	16.78 (35.5)
	Standard program	13.88 (41.0)	6.91 (23.9)*,**
	Booster program	13.27 (39.4)	6.12 (21.1)*,**
Money lost gambling (all participants; past 3 months)	Control group	$5.88 (21.2)	$5.18 (19.9)
	Standard program	$5.66 (22.3)	$3.52 (18.9)
	Booster program	$7.77 (28.8)	$3.01 (17.7)
Problem gamblers DSM-IV-MR-J (past 12 months)	Control group	3.0% (6/197)	5.1% (10/197)
	Standard program	3.5% (16/462)	3.0% (14/462)
	Booster program	3.1% (6/193)	1.6% (3/193)**
Problem gamblers self-reported (past 12 months)	Control group	4.8% (14/291)	7.2% (21/291)
	Standard program	5.1% (35/682)	4.0% (27/682)**
	Booster program	5.2% (14/267)	2.6% (7/267)**

Note: In the majority of cases the actual *p*-value is considerably less than .05

* significant change ($p < .05$) from baseline

** significantly different ($p < .05$) from Control Group at follow-up

*** significantly different ($p < .05$) from Control Group and Standard Group at follow-up

and in the Booster Group ($t = 9.68$, $p < .001$) but not the Control Group ($t = .99$, $p = .326$). At follow-up, the average number of gambling fallacies in the Standard Group was significantly lower than the number in the Control Group ($t = 7.51$, $p < .001$). However, average level of gambling fallacies in the Booster Group at follow-up was not significantly lower than that observed in the Standard Group ($t = 1.65$, $p = .10$).

Decision Making and Problem Solving

There was a statistically significant Group × Time interaction, $F(2, 1235) = 6.29$, $p = .002$. Post-hoc *t*-tests determined this interaction effect to be due to significant improvement in decision making and problem solving from baseline to follow-up in the Standard Group ($t = 4.41$, $p < .001$) and in the Booster Group ($t = 2.94$, $p = .004$) but not the

Control Group ($t = 1.09$, $p = .275$). At follow-up, Decision-Making Skills in the Standard Group were significantly better than the Control Group ($t = 3.02$, $p = .003$). However, Decision Making and Problem Solving in the Booster Group at follow-up was not significantly different from that observed in the Standard Group ($t = .03$, $p = .98$).

High-Risk Activity

No significant Group × Time interaction was obtained, $F(2, 1235) = .03$, $p = .86$.

Percentage of Gamblers

A McNemar test found a significant decrease in the percentage of gamblers from baseline to follow-up in the Standard Group ($p < .001$) as well as the Booster Group ($p < .001$) but not in the Control Group ($p = .337$). At follow-up, a chi-square test determined that the percentage of gamblers in the Standard Group was significantly lower than the Control Group, $\chi^2(1df) = 23.5$, $p < .001$. However, the percentage of gamblers in the Booster Group at follow-up was not significantly lower than the Standard Group, $\chi^2(1, N = 949) = 1.52$, $p = .218$.

Gambling Frequency

There was a statistically significant Group × Time interaction, $F(2, 1235) = 4.07$, $p = .017$. Post-hoc *t*-tests determined this interaction effect to be due to a significant decrease in gambling frequency from baseline to follow-up in the Standard Group ($t = 4.42$, $p < .001$) and in the Booster Group ($t = 3.07$, $p = .002$) but not the Control Group ($t = .35$, $p = .728$). At follow-up, the gambling frequency of the Standard Group was significantly lower than the Control Group ($t = 5.1$, $p < .001$). However, gambling frequency in the Booster Group was not significantly lower than the Standard Group ($t = .47$, $p = .636$).

Money Lost Gambling

There was no significant Group × Time interaction, $F(2, 1235) = 1.74$, $p = .176$.

Percentage of Problem Gamblers

Using DSM-IV-MR-J criteria, a McNemar test did not find any significant change in the percentage of problem gamblers from baseline to follow-up in either the Control Group ($p = .388$), Standard Group ($p = .839$), or Booster Group ($p = .375$). The rate of problem gambling in the Standard Group was also not significantly lower than the Control Group at follow-up, $\chi^2(1df) = 1.65$, $p = .199$. However, there was a lower rate of problem gambling in the Booster Group relative to the Control Group at follow-up that was at significance, $\chi^2(1df) = 3.75$, $p = .053$. The rate of problem gambling in the Booster Group was not significantly lower than that seen in the Standard Group, $\chi^2(1df) = 1.17$, $p = .279$. Table 3 indicates the changes in problem gambling status from baseline to follow-up in the three groups. As can be seen, only a minority of students who were problem gamblers at baseline were still problem gamblers at follow-up:

Table 3 Changes in problem gambling (PG) and non-problem gambling (NPG) status from baseline to follow-up in the three groups

Group	DSM-IV-MR-J criteria			Self-reported problem gambling criteria		
	Baseline	Follow-up		Baseline	Follow-up	
		NPG	PG		NPG	PG
Control group	NPG = 191	183	8	NPG = 277	259	18
	PG = 6	4	2	PG = 14	11	3
Standard program	NPG = 446	435	11	NPG = 647	627	20
	PG = 16	13	3	PG = 35	28	7
Booster program	NPG = 187	186	1	NPG = 253	248	5
	PG = 6	4	2	PG = 14	12	2

33.3% (2/6) in the Control Group, 18.8% (3/16) in the Standard Group, and 33.3% (2/6) in the Booster Group. The rate of new cases in each group at follow-up (incidence) was as follows: 4.2% (8/191) Control Group, 2.5% (11/446) Standard Group, and 0.5% (1/187) Booster Group.

Using Self-Reported Problem Gambling criteria, a McNemar test did not detect any significant change in the percentage of problem gamblers from baseline to follow-up in either the Control Group ($p = .265$), Standard Group ($p = .312$), or Booster Group ($p = .143$). However, the rate of problem gambling in the Standard Group was significantly lower than the Control Group at follow-up, $\chi^2(1df) = 4.61$, $p = .032$, as was the rate of problem gambling in the Booster Group, $\chi^2(1df) = 6.17$, $p = .013$. The rate of problem gambling in the Booster Group at follow-up was not significantly lower than the rate in the Standard Group, $\chi^2(1df) = .99$, $p = .319$. Table 3 illustrates the changes in problem gambling status from baseline to follow-up in the three groups. Similar to what was found with the DSM-IV-MR-J criteria, only a minority of problem gamblers at baseline were still problem gamblers at follow-up: 21.4% (3/14) in the Control Group, 20.0% (7/35) in the Standard Group, and 14.3% (2/14) in the Booster Group. The rate of new cases in each group at follow-up (incidence) was as follows: 6.5% (18/277) Control Group, 3.1% (20/647) Standard Group, and 2.0% (5/253) Booster Group.

Impact of Mediating Variables on Changes in Gambling Behavior

Three multiple regression analyses were carried out to identify factors associated with program effectiveness within the Standard and Booster Groups combined. The dependent variables for these analyses were changed from baseline to follow-up in gambling status (i.e., gambler or non-gambler), overall frequency of gambling, and DSM-IV-MR-J scores. The independent variables were gender, age, grade, school, community, trainer, date of program administration, group (Standard or Booster), length of follow-up interval, baseline attitudes, baseline gambling knowledge, baseline gambling fallacies, baseline decision making and problem solving, and baseline involvement in high-risk activities. Entry of the independent variables was forward stepwise. All nominal variables were dummy coded.

Table 4 displays the unstandardized (B) and standardized (β) regression coefficients for the variables that contributed significantly to decreased gambling behavior in each of the three analyses. R was significantly different from zero in all three analyses: $F(2, 932) = 62.1$, $p < .001$ for gambling status; $F(2, 931) = 1032.9$, $p < .001$ for gambling frequency; and $F(5, 466) = 31.52$, $p < .001$ for DSM-IV-MR-J scores. The percentage of variance accounted for (adjusted R^2) was 6.6% for gambling status, 68.9% for gambling frequency, and 27.4% for DSM-IV-MR-J

Table 4 Stepwise multiple regressions of variables predicting decreases in gambling behavior in the intervention groups from baseline to follow-up

Independent variable	Regression coefficients (B)	Standardized regression coefficients (β)	Adjusted R^2	Step
Change in status from gambler to non-gambler				
Baseline frequency of gambling	.003	.235	.061	1
Baseline gambling attitudes	.026	.077	.066	2
Decreased gambling frequency				
Baseline frequency of gambling	.833	.839	.686	1
Baseline gambling attitudes	1.314	.057	.689	2
Decreased DSM-IV-MR-J scores				
Baseline DSM-IV-MR-J score	.992	.678	.186	1
Baseline frequency of gambling	.011	.252	.218	2
Date of program administration	.000001	.133	.244	3
Baseline involvement in high-risk activities	−.166	−.152	.264	4
Trainer A	−.767	−.117	.274	5

scores. There were two variables that were statistically associated with greater noninvolvement in gambling as well as greater decreases in gambling frequency at follow-up: a higher level of baseline gambling behavior and more positive baseline attitudes toward gambling. Baseline level of gambling frequency accounted for the large majority of variance explained in both analyses. There were five variables statistically associated with greater decreases in DSM-IV-MR-J scores: higher baseline DSM-IV-MR-J score, higher level of baseline gambling frequency, later date of program administration, lower rate of baseline involvement in high-risk activities, and not receiving the program from a certain trainer. Baseline DSM-IV-MR-J score accounted for most of the variance explained in this analysis.

Discussion

As expected, and consistent with previous research, the Stacked Deck program produced significant and sustained changes in gambling attitudes, knowledge, and fallacies. At follow-up, students in the intervention schools demonstrated significantly more negative attitudes toward gambling, greater knowledge of both gambling and problem gambling, and greater resistance to gambling fallacies. This is an important result, indicating that the content of the Stacked Deck program was appropriate and delivered in a fashion that allowed for retention of this material. It is also likely the case that changes in these attributes are preconditions for actual changes in gambling behavior.

In addition, the present program also produced significant improvements in applied decision making and problem solving, a decrease in the percentage of gamblers, decreased overall gambling frequency, and, most importantly, some evidence of decreased rates of problem gambling (i.e., significantly lower rates of problem gambling at follow-up compared to the control group).[3] To our knowledge, this is the first time that a school-based problem gambling prevention program has produced actual behavioral changes.

An argument can be made that decreased gambling participation may not be an appropriate goal of problem gambling prevention, when gambling is a normative activity in western society as well as a non-problematic activity for the large majority of people who engage in it (including high school students). However, as seen in the present study, gambling is not a normative activity among adolescents (only 41% of students gambled at baseline), and some types of gambling they report engaging in are illegal for their age group. Second, a decrease in gambling may well be appropriate outcome when considering that our primary goal was for students to decrease any behavior that can be construed as a bad gamble (i.e., when the odds are not in your favor and when the advantages of engaging in the behavior are less than the disadvantages). Finally, a decrease in the rate of problem gambling is definitely an appropriate measure of effectiveness, and it is hard to imagine this occurring without a concomitant decrease in overall gambling involvement.

The program was also found to be equally effective for all ages, genders, grades, schools, and communities. Furthermore, it also appears to be useful for students with high baseline levels of gambling frequency and/or symptoms of problem gambling. This is partly due to regression to the mean as well as these individuals having more "room for improvement." However, what this also speaks to is the instability of gambling and problem gambling in young people. As seen in Table 3, only a minority of problem gamblers at baseline were still problem gamblers at follow-up, including problem gamblers in the control group who received no intervention at all.

Other variables related to an enhanced outcome were more positive attitudes toward gambling at baseline, later date of program administration, higher baseline involvement in high-risk activities, and which trainer delivered the program. A more positive attitude is related to better outcome likely because the program had an impact on changing these attitudes, which presumably led to decreases in gambling behavior. Receiving the Stacked Deck program later in the study probably reflects the trainers' greater fluency in administering the program with greater practice. A lower rate of involvement in high-risk activities is related to better outcome perhaps because

[3] The failure to find unambiguous decreases in problem gambling from baseline to follow-up is likely due to low statistical power. The failure to find significant decreases in gambling monetary losses is partly due to the low average amounts being wagered plus the high variability in these amounts.

it reflects a less entrenched pattern of behavior more amenable to change. Finally, it comes as no surprise that there should be individual variability in the effectiveness of different trainers.

There are several important differences with previous programs that may explain why behavioral change was obtained in this study and not in others.

1. The focus on improving decision making and problem solving was somewhat different, as was the reported improvement in these skills. However, the failure of this improvement in decision making and problem solving to decrease other high-risk behaviors (e.g., substance use) makes it uncertain about their role in decreasing gambling behavior.
2. The orientation of the Stacked Deck program in advocating smart gambling/risk taking is different.
3. Targeting entire cohorts of students so as to include most of their peers was unique to the present study.
4. The average age of the students (16) is older than in other studies. Other problem gambling prevention programs have modeled themselves after tobacco and illicit drug use programs where the intervention is delivered to elementary school students who have not yet engaged in the behavior that is the target of prevention. This makes sense for prevention of tobacco and illicit drug use where total noninvolvement is the goal. However, noninvolvement in gambling is not a realistic (or appropriate) goal. Furthermore, some of the important concepts (e.g., odds, probabilities, independence of random events, law of large numbers) require a degree of mathematical and intellectual sophistication that may be beyond the grasp of many elementary school students. A stronger case can be made for intervening prior to the typical onset of problem gambling, which, admittedly, does appear to be present in high school students. However, as seen earlier, problem gambling does not appear to be a very stable or well-formed entity in this age group. Furthermore, the ability of the Stacked Deck program to change the behavior of heavily involved gamblers is evidence of its utility in this age group.[4]
5. Perhaps the most important difference from previous studies is the much heavier emphasis on the development and retention of skills, accomplished by making the program much longer (up to 600 min over 6 sessions), by spaced administration of lessons, and by its interactive and skill-oriented content. The superiority of the Booster Program over the Standard Program in some areas supports the notion that length and spacing is a contributing factor to the program's effectiveness. However, the comprehensiveness of the program is also likely important, as the authors have implemented other, even more substantive prevention initiatives in focused areas (i.e., mathematics of gambling) to university students that have failed to produce behavioral change (Williams and Connolly 2006). The authors appreciate the difficulty in incorporating multisession programs into already tight high school curriculums. However, it is important to recognize that the limited effectiveness of most current problem gambling educational and policy initiatives have to do with the fact that the ones that are implemented tend to be those that cause the least inconvenience, and consequently, have the least actual impact (Williams et al. 2007, 2008). We believe that problem gambling prevention needs to aspire to avoid the situation found in the substance abuse area, where the most commonly used (and entrenched) prevention and treatment interventions tend to be the less effective ones (e.g., Miller et al. 2003). Efficiencies may be obtained if the Stacked Deck program were administered in conjunction with prevention modules for tobacco, illicit drugs, and other substances because of potentially common content with respect to improving decision making, social problem solving, and coping skills.

[4] The ascertainment of problem gambling in adolescents is an under researched and controversial area (Derevensky et al. 2003). There is good evidence that certain instruments have produced elevated prevalence rates due to measurement error (i.e., South Oaks Gambling Scale and South Oaks Gambling Scale Revised for Adolescents; Ladouceur et al. 2000). The possibility also exists that the instability in problem gambling seen in the present study reflects a measurement problem. A team of researchers under the aegis of the Canadian Centre on Substance Abuse has been working on the development of a new, well validated instrument for the past several years.

Limitations

The present results indicate that the Stacked Deck program has promise as a problem gambling prevention initiative. However, there are several caveats to consider. First, students within the same school may be more similar to each other in some attributes relative to students from other schools. The extent to which this is true is the extent to which the observations are not totally independent and there could be some increase in the possibility of a Type I error. Second, the long-term impact of the program is uncertain beyond 4 months. A third limitation is that while we anticipate the program should achieve similar results in all high school students, there is a need to replicate these findings in different jurisdictions with different students. A final problem is that we are uncertain about whether there are specific "active ingredients" that contributed to the effects. There may be value in conducting further research to dismantle the program so as to determine whether there are vital components.

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