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# Gamblers' aces in the hole: The effect of erroneous cognitions on dysfunctional gambling


## Abstract

**Purpose -** As the popularity of gambling has grown, questions are being raised about its excessive use and factors related to addictive behaviours. This paper investigates whether gamblers' erroneous cognitive ~~errors~~ precesses affect gambling involvement and addiction.

**Design/methodology/approach -** A survey on 508 gamblers was conducted and a conceptual model using structural equation modelling was developed and tested.

**Findings -** Among the three sets of erroneous beliefs investigated, Luck and Superstition was a significant predictor of both gambling involvement and the severity of gambling problems (according to the ~~Canadian~~ Problem Gambling Severity Index; ~~C~~PGSI), while the Illusion of control showed a negative relationship with the ~~C~~PGSI. Moreover, gambling involvement positively affected the potential risk of disease and mediates the relationship between Luck, ~~and~~ Superstition and ~~C~~PGSI.

**Research limitations/implications -** Testing the model across different geographical contexts ~~would allow~~is recommended to investigate the hypothesized relationships in other cultural, social and regulatory environments. Moreover, ~~plans for~~ future research should ~~include the extension of~~extend ~~the~~ analysis to consider other variables that may moderate or mediate the causal relationships.

**Social implications** ~~–~~ The results of this study can be used to~~e implications of the study are noteworthy for~~ develop~~ing~~ social marketing campaigns aimed at avoiding the potential detrimental effects of gambling.

**Originality/value –** The paper proposes (a) a deeper exploration of the relationships among beliefs, gambling involvement and dysfunctional gambling and (b) an appropriate scale to capture the most important gamblers' beliefs which could be valid for every form of game and type of gambler.


**Keywords**: gambling; beliefs; problem gambling; behaviour; structural equation modelling

## Introduction

Over the last decade, the gambling industry has experienced ~~a~~ remarkable worldwide growth. This expansion has been the result of numerous national governments' interest in reducing illegal gambling, with the dual aim of ensuring greater consumer protection and increasing tax revenues. The price being paid is the development of problematic and pathological behaviours that affect 1% to 3% of the adult population (Diagnostic and Statistical Manual of Mental Disorders V; DSM-V). Problematic or pathological gambling is considered a progressive disorder characterised by an increasing commitment of time and money to gambling that can lead to harmful~~-~~ consequences to the gambler, those around them and the broader community (Dickerson et al., 1997; Neal et al.,

2005). The DSM-V has classified such a condition as an addictive disorder, with sufferers exhibiting many similarities to those who have substance addictions. Therefore, there is general concern about the social effects of dysfunctional gambling.

A variety of explanations have been advanced to understand pathological gambling. Among these, one relates to the beliefs and cognitive biases that lead people to continue gambling despite having incurred substantial losses. Gamblers frequently fall victim to several well-documented decision-making mistakes, heuristics and biases. In particular, pathological gamblers are prone to various patterns of deviation in judgment. As a consequence, understanding gamblers' cognitive errors is essential for preventing and correcting problematic behaviours.

Based on the above, this study aims to investigate the relationships among beliefs, gambling involvement (operationalised as a synthesis of the number of gambling activities, gaming frequency and weekly expenditure) and dysfunctional gambling.

The paper is organised as follows. After reviewing the literature on gambling-related cognitions, the next section explains the objectives underpinning the study. Then, the methodology is presented, including the procedures that were used to collect the sample and data and the measurements that were developed and employed. Subsequently, the results are described and discussed, followed by some reflections on further research directions.

**Literature review**

Gamblers' erroneous reasoning has been analysed using a cognitive-based approach, mainly drawing on the studies of Tversky, Kahneman and Slovic on heuristics and systematic biases that influence the decision-making process (e.g., Kahneman et al., 1982; Slovic et al., 2002; Tversky and Kahneman, 1974). The most common mistakes are the *Monte Carlo fallacy*, the *near miss*, the *illusion of control* and the *mental accounting fallacy*, in addition to the belief in *luck* and *superstition*.

The Monte Carlo fallacy - also called the gambler's fallacy - is the belief that the likelihood of a random event is influenced and/or predicted by other independent events. Gamblers are firmly convinced that a particular outcome of a random event is more likely to occur because it has not happened recently, and vice versa. Such expectations occur because of the representativeness heuristic (Tverky and Kanheman, 1974); specifically, people tend to judge the probability of an event by finding a comparable known event and assuming that the probabilities will be similar, without considering the actual odds.

Strictly related to the Monte Carlo fallacy is the near miss effect (Reid, 1986). It occurs if the result forecasted by the gambler is a loss that is close to the winning outcome. This is the case of two winning symbols on the payoff line of a slot machine and a third winning symbol immediately above or below the payoff line. The thought of having "touched" the win spurs people to continue playing because they believe that they have a good chance of winning.

Langer (1975) showed that human beings suffer from the illusion of controlling chance events. More precisely, people feel that they have some responsibility for arranging an outcome that is demonstrably defined by chance. Such a perceived influence is due to one's personal choice, expertise on the game rules and knowledge of the activities related to the gamble. The belief that one can control the uncontrollable clarifies why players a) place higher bets if they can throw the ball onto the roulette wheel themselves, as opposed to the croupier throwing the ball for them; b)

have to be able to interpret the "behaviour" of the slot machine to understand at what moment the machine is going to pay; and c) have to acquire technical skills to make successful sport bets.

Thaler (1999) defined mental accounting as "the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities". According to his theory, people divide their current and future assets into separate, non-transferable portions and assign different levels of utility to each asset group, which affects their consumption decisions and other behaviors. The mental accounting theory explains what Luceri and Vergura (2015) found in gamblers' behaviour, namely that they tend to bet all or part of the money won because they consider it separate from one's assets. Although the money has already been acquired, the fact that it comes from a win makes it a different type of asset, which is categorised in a different mental account. Being unexpected, it is perceived as a surplus and is accordingly subject to a higher grade of risk.

Luck is interpreted and understood in two different ways (Darke and Freedman, 1997b). Luck acts as an external force if it is accidental and occurs beyond one's control. Under this interpretation, people are not responsible for luck and can only hope to be fortunate. Conversely, luck appears to be an internal force if it is considered one of the stable attributes of an individual and, as such, controllable. In this case, the result is the strengthening of the illusion of control.

Superstition is the widespread belief that an act has the mysterious and irrational power to promote a positive or avert a negative event. Actually, the co-occurrence of the act and the expected event is rare and completely random, but it suffices as evidence of a cause-and-effect relationship. The behaviour is repeated, though it is not the real cause of the desired event, thus leading to superstition (Skinner, 1948). Superstition explains why some gamblers carry lucky charms or perform rituals to improve their chances of winning.

Gamblers' erroneous cognitions have been described as prominent factors that affect gambling involvement and pathological gambling. Research has shown that superstition, belief in luck and belief in personal skills are related to a higher frequency of gambling and an increased gambling expenditure (e.g., Darke and Freedman, 1997a; Joukhador et al., 2004; Moodie, 2008; Wood and Clapham, 2005; Zhou et al., 2012). In addition, problem gamblers are more likely to display erroneous cognitions than are recreational gamblers (Chiu and Storm, 2010; Jouchador et al., 2004; Lambos and Delfabbro, 2007; Moodie, 2008; Moore and Ohtsuka, 1999; Myrseth et al., 2010; Steenberg et al., 2002; Tao et al., 2011).

Based on the suggestions above, this paper investigates the relationships between gamblers' erroneous cognitions and their level of (a) gambling involvement and (b) gambling addiction. In addition, because the literature has speculated that gambling involvement has a positive effect on dysfunctional gambling (e.g., Griffiths and Barnes, 2008; Joukhador et al., 2004; Moodie, 2008; Platz and Millar, 2001; Wiebe et al., 2001), such a relationship is also explored. Finally, a mediating role of involvement in the relationship between gamblers' erroneous cognitions and gambling addiction is hypothesized. The proposed conceptual model is shown in Figure 1. The results are useful for practitioners in understanding and correcting gamblers' behaviour.

## Materials and method

*Procedure and participants*

An online structured interview was conducted with a ~~national (Italian)~~ sample of 508 regular and

occasional Italian gamblers who engaged in different forms of gambling. The sample was drawn from a panel representative of the Italian online population and attention was paid to obtain sufficient variety in geographic, age and gender distribution. Participation was restricted to people allowed to gamble by law (18 years of age or older). A cover letter containing information about the characteristics of the study and privacy protection was given to the participants.

*Measures*

The questionnaire included questions about general demographics (gender, age, marital status, education, and income) and gambling involvement (gaming frequency and weekly expenditure); the Gambling Beliefs Scale (GBS); and the ~~Canadian~~ Problem Gambling Severity Index (~~C~~PGSI).

*Gambling frequency*. Gambling frequency was measured for 14 gambling activities, each of which was measured on a 5-point scale ~~ranging from *never* to *more than once a week*~~ (1 = *never*; 2 = *few times a year*; 3 = *once or twice a month*; 4 = *once a week*; 5 = *more than once a week*). A total score was calculated by summing the responses for each game.

*~~Canadian~~ Problem Gambling Severity Index (PGSI)*. ~~The CPGI (Ferris and Wynne, 2001)~~ The PGSI (Ferris and Wynne, 2001) is a tool specifically created for detecting problem gambling in general population samples. It is part of a long questionnaire, the *Canadian Problem Gambling Index* (CPGI), aimed at probing gambling involvement, problem gambling behaviour and adverse consequences. Only the second section, the PGSI, produces a prevalence rate for problem gambling. This section contains nine questions that are each scored on a 4-point scale, ranging from *never* to *always*, in which the participants are asked to rate how frequently within the past 12 months they experienced certain symptoms that are commonly associated with dysfunctional gambling. A total score of 0 identifies no problem gambling; 1–2 indicates low problem gambling, 3–7 indicates moderate problem gambling, and 8–27 indicates severe problem gambling. The scale shows good internal reliability (Cronbach's alpha = 0.84) and test-retest reliability (r = 0.78).

*Gambling Beliefs Scale (GBS)*. The literature provides several scales to capture gamblers' beliefs, but they suffer from some limitations. ~~However, some scales have been validated with respect to one or a few types of gambling (e.g., Jefferson and Nicki, 2003; Jonsson et al., 2003; Joukhador et al., 2004; Lambos and Delfabbro, 2007; Monaghan, Blaszczynski, and Nower, 2009; Williams, 2002) or focus on one or a few beliefs instead of considering all of the cognitive errors that drive gambling behaviour (e.g., Carlson et al., 2009; Chiu and Storm, 2010; Darke and Freedman, 1997b; Joukhador et al., 2004; Lambos and Delfabbro, 2007; Wood and Clapman, 2005). Moreover, Other scales have been developed to measure generic beliefs, regardless of gambling (e.g., Carlson et al., 2009; Darke and Freedman, 1997b).~~ In particular, some authors developed scales to measure generic beliefs, regardless of gambling. Among these, Carlson et al. (2009) proposed a general measure of a propensity to be superstitious, while Darke and Freedman (1997b) modelled the Belief in Good Luck Scale to capture irrational or superstitious beliefs people hold about luck. The studies which propose specifically developed scales for gambling differ for the context of investigation. Some scholars restricted the analysis to one or a few types of games, mainly electronic gaming machines (e.g. Jefferson and Nicki, 2003; Joukhador et al., 2004; Lambos and Delfabbro, 2007; Monaghan, Blaszczynski, and Nower, 2009). Other scales focus on one or a few beliefs instead of considering all of the cognitive errors that drive gambling behaviour (e.g. Joukhador et al., 2004;

Lambos and Delfabbro, 2007; Moore, and Ohtsuka, 1999; Ohtsuka and Chan, 2010; Wood and Clapman, 2005). In order to fill thise gap inof the existing literature, it seemed necessary to develop a new measure of gambling beliefs that encompasses any form of game, place of consumption and type of gambler. Based on the results of a qualitative study with Italian gamblers (Luceri and Vergura, 2015) and literature review, a revised pool of items relating to gambling beliefs that encompasses any type of belief and any form of game was derived. Specifically, thirteen items were identified as adequate indicators of gamblers' beliefs. For each of the measurement items, the respondents were required to rate "how much do you agree with each of the following statements?" on a self-anchored 5-point scale (1 = *none*; 5 = *very much*). The instrument was pre-tested using the think-aloud method with five gamblers to assess the items' wording and clarity. This phase led to several superficial linguistic adjustments when the original formulation of an item generated confusion.

The scales were translated from the English language version to target language (Italian) by the author. Then, a professional translator fluent in both English and Italian verified the translation.

A pilot test was conducted with 50 (26 males and 24 females) adult gamblers (18 years of age or older) who engaged in different forms of gambling. Reliability was assessed as internal consistency using Cronbach's alpha coefficient (Cronbach, 1951) and item-total correlation. The internal consistency reliability was very high, as demonstrated by an alpha index (0.92) that was greater than the threshold value of 0.70 (Nunnally, 1978). All items had a high item-total correlation (greater than 0.49), indicating their ability to tap the construct, and the alpha value did not increase when each item was removed. The correlation coefficients between the items are shown in Appendix A.

## Results

*Profiles of the respondents*

The sample was almost evenly composed of males and females (M = 46%; F = 54%), and the average age was 41 years (S.D. = 12.867). Just over half of the respondents (53%) had completed high school, 28% had graduated from university, 2% had left school after the primary level, and 17% had left school after the secondary level. More than half of the respondents (61%) were married or cohabitating, 35% were single, 3% were separated, and 1% were widowed. Twenty percent of the sample had an annual net income under 10,000 Euros, 73% earned between 10,000 and 50,000 Euros annually, and only 7% earned more than 50,000 Euros a year.

Examining the number of gambling activities showed that, on average, the respondents engaged in seven forms of gambling, with a weekly expenditure of 23 Euros (S.D. = 41.254).

The reliability of ~~C~~PGSI was very high (Cronbach's alpha = 0.94), according to Nunnally (1978). Almost half of the sample (49%) reported no gambling-related problems, while 25% were classified as low risk gamblers, and 12% as moderate risk gamblers. The share of gamblers with a severe level of problem gambling was 14%. This result appears much higher than other national estimates (2%). However, previous studies (Barbaranelli, 2013; Colasante et al., 2012) have estimated the problem gambling prevalence rate with reference to the adult Italian population, thus also including non-gamblers. Moreover, other studies have found higher levels of problem gambling (ranging from 9% to 13%) among Chinese and Australian populations (Boldero and Bell, 2012; Loo et al., 2010; Ohtsuka and Chan, 2010).

*Exploratory and confirmatory factor analysis of GBS*

After verifying the internal consistency of the GBS scale (α = 0.92), a principal component analysis (PCA) was performed on the 13-items with orthogonal rotation (varimax). A cut-off of 0.40 was fixed to interpret an item as loading on a factor.

The KMO (= 0.944) and Bartlett ($X^2$ = 3682.622, $p < .001$) tests assessed the PCA adequacy of the Gambling Beliefs Scale (GBS). The optimal solution consisted of one dimension with eigenvalues greater than 1 (Kaiser, 1960), which explained 53% of the overall variance. However, the scree plot showed inflexions that would justify retaining three factors (Cattell, 1966), which explained approximately 67% of the overall variance. Examining the structure of the items showed that all 13 items loaded on at least one factor and that most items loaded on only one factor. Therefore, this factor structure was retained for the analysis. The first factor (luck and superstition) explains 34% of the overall variance and shows gamblers' confidence in luck and superstition. Moreover, mental accounting plays an important role, and the Monte Carlo fallacy seems to determine the moment when luck will favour the player. Factor two (the illusion of control) explains 17% of the overall variance. It reflects gamblers' confidence in their ability to affect the outcome of the game with their own capabilities and actions. The third factor (supernatural help) explains 16% of the overall variance and concerns the belief in a supernatural entity (e.g., God or Lady Luck) that occasionally chooses to be benevolent to a particular person.

To validate the three-factor model, a confirmatory factor analysis (CFA) with the maximum likelihood method was undertaken using LISREL 8.80. To scale the latent variables, the first factor loading for each of them was set to 1. The fit of the model was interpreted based on a range of fit indices, namely the Chi-square ($\chi^2$) value, the degree of freedom (df), the comparative fit index (CFI), the non-normed fit index (NNFI), the goodness-of-fit index (GFI), the root mean square error of approximation (RMSEA), and the standardised root mean square residual (SRMR). A good fit of the data was indicated by a chi-square/degrees of freedom value less than 4 (Field, 2000). Values in the 0.90 range and above have been deemed acceptable for CFI, NNFI and GFI (Hooper et al., 2008; Hu and Bentler, 1995), and values lower than 0.08 have been deemed acceptable for the RMSEA and the SRMR (Bollen, 1989; Browne and Cudeck, 1993).

As multivariate normal assumption was violated ($\chi^2$ = 1923.962, $p < 0.001$), robust estimates were calculated using the Satorra-Bentler method. Table 1 presents the factor loadings for the items and the CR (Construct Reliability) value of each factor as a measure of their internal consistency. All items loaded significantly on the hypothesised latent variables and the model fit indices indicated a good overall fit of the conceptual model to the data ($\chi^2$ = 143.992; df = 62; CFI = 0.992; NNFI = 0.989; RMSEA = 0.051; GFI = 0.944, SRMR = 0.034).

A second CFA was conducted to verify the goodness of the 1-factor solution suggested by EFA, according to Kaiser's criterion. The model showed a better fit to the empirical data, as revealed by an examination of the fit indices: $\chi^2$ = 251.662; df = 65; CFI = 0.981; NNFI = 0.977; RMSEA = 0.075, p = 0.000, SRMR = 0.045; GFI = 0.906. The $\Delta\chi^2$ value (368.728, p < 0.001) which supported the choice to retain the 3-factor solution.

**Table I**. Factor loadings for the GBS[a]

*Estimation of the proposed model*

Structural equation modelling with the Satorra-Bentler method was employed to investigate the hypothesized relationships among gambling beliefs, gambling involvement (operationalised as a synthesis of the number of gambling activities, gaming frequency, and weekly expenditure) and problem gambling.

The findings showed that the model fits the data ~~acceptably well~~ ($\chi^2$ = 208.693; df = 110; CFI = 0.993; NNFI = 0.992; RMSEA = 0.042; SRMR = 0.038; GFI = 0.94). The standardized regression coefficients are shown in Figure 1. Overall, the model explains a good amount of the variance for gambling involvement (37%) and ~~C~~PGSI (60%). However, some non-significant path coefficients from the belief~~s~~ variables emerged. Specifically, the effect of the illusion of control on gambling involvement and the effect of supernatural help on gambling involvement and ~~C~~PGSI were non-significant. Only luck and superstition strongly influenced gambling involvement (β = .757, $p$ < .01). More precisely, gamblers who believed in the role that luck and superstition play in influencing gambling results were more involved in gambling activities. In addition, such a belief implied an increased prevalence of problem gambling (β = .904, $p$ < .01). Mediation analysis showed that the indirect and total effect of luck and superstition on ~~C~~PGSI was significant ($p$ < 0.01). Therefore, involvement acts as a mediator between such a belief and the risk of developing problematic behaviours. Interestingly, the illusion of control appeared to have a negative direct influence on ~~C~~PGSI (β = -.228, $p$ < .05), while the mediation effect of gambling involvement was not significant ($p$ > 0.05). Thus, reliance on personal skills or simply having an active personal role in the game does not influence gambling involvement. On the contrary, it acts as a source of awareness of gambling related risks. Finally, consistent with prior research, people who were more involved in gambling showed a greater risk of developing dysfunctional behaviours (β = .186, $p$ < .01).

Figure 1. Structural model with standardized coefficients

**Conclusions and implications**

The primary objective of this study was to enrich the debate about the relationships among gamblers' erroneous cognitions, gambling involvement and dysfunctional gambling. ~~In this perspective, it~~ The current study may help in explaining and modelling problem gambling and the results can be used to inform public policy and social marketing initiatives in this area. Secondly, ~~it~~ the paper offers another relevant contribution to the literature, namely the development of a tool for assessing the most important gamblers' beliefs which could be valid for every form of game and type of gambler.

The study confirmed the significant role played by a belief in luck and superstition in developing and maintaining gambling behaviour. Of the three factors, only this one was positively influential in increasing gambling involvement and the prevalence of problem gambling, with gambling involvement acting as a mediator in the causal relationship. Conversely, the illusion of control was negatively related to ~~C~~PGSI. This result deserves further examination. First, people who feel that they have some responsibility in determining an outcome would be better able to control their

gambling engagement, thus reducing the risk of developing dysfunctional behaviours. Second, games that actually involve elements of skill, such as card games, would be less risky than those of pure chance. This evidence is consistent with the identification of the slot machine – the outcomes of which are determined exclusively by chance – as being most responsible for the development of problem gambling (Griffiths, 1999, Smith and Wynne, 2004; Turner, 2004). Finally, belief in supernatural help was not found to be related to gambling involvement or to the prevalence of problem gambling.

From a demarketing perspective, these findings have noteworthy implications for marketers, public policy makers and health professionals. The negative effect of the illusion of control on dysfunctional behaviours should encourage the development of communication strategies that emphasise the individual's potential to influence the gambling outcome through the knowledge of gambling rules, the use of personal skills or simply having an active role in the game dynamics. An additional benefit of this option is that it should not encounter resistance from marketers because it does not influence gambling involvement.

Moreover, social marketing campaigns wishing to discourage gambling should understate the role of luck and superstition in determining the outcome of the game. This is especially true if more gullible and superstitious thinking is rooted in a particular culture. Because this construct includes an item relating to the expectation of winning in the long run ("In the long run, I will win more money than I will lose gambling"), messages should also emphasise the low chances of success and the high long-term costs of gambling investments. In several countries, including Italy, the current social marketing campaigns are limited to information indicating that "gambling can cause addiction" and recommendations centre upon encouraging people to "gamble the right (amount)" (this sentence has to be written, according to Italian law, on all the communication campaigns and on gambling machines and tickets). More targeted and accurate campaigns are needed to educate people about the dangers of gambling. Contextually, it would be useful to conduct prevention programs, for example in schools, aimed at reducing such erroneous cognitions among young people. Similarly, such preventive and educational programs should be aimed at the less educated segments of the population. Ohtsuka and Chan (2010) found a high negative correlation between education level and superstitious belief., Tthat is, the person ~~who is~~with a lower education level will endorse~~d~~ more superstitious beliefs.

Belief in luck and superstition could also be used as a diagnostic tool. Because such cognitive distortion is crucial in developing gambling behaviour, assessing it seems to be useful in predicting gambling take up and persistence and detecting excessive and pathological gambling. Companies providing on line gambling and wishing to avoid the potential detrimental effects of gambling on people's well-being may periodically survey their gamblers in order to control their belief in luck and superstition. Individuals who exhibit strong belief in luck and superstition may be most exposed to the risk of developing problematic gambling behaviours. Therefore, they may use their online gaming platforms to provide targeted health messages to this particularly vulnerable group of gamblers.

Similarly, therapists, psychologists and gambling addiction counsellors should work on belief in luck and superstition during therapy to help their patients with gambling~~n~~ addictions.

~~Obviously, the suggestions outlined above should be interpreted conversely from a marketing perspective. Namely, luck and superstition are the elements to be leveraged to promote gambling.~~

**Limitations and future research**

A strength of this study is that the participants came from a community sample, as opposed to using convenient samples (i.e., participants from university courses). Accordingly, they were representative of typical gamblers. However, there are some ~~a number of~~ limitations associated with this study, which highlight opportunities to develop what has been presented above.

First, although the psychometric properties of the GBS appear promising, plans for future research include the administration of the scale to other samples of gamblers to confirm its reliability and validity are recommended. Further studies are also recommended to assess the sensitivity of the scale to changes over time through the test-retest reliability.

Second, testing the model across different geographical contexts would allow ~~to~~ investigation of~~e~~ the hypothesized relationships in other cultural, social and regulatory environments, thus making an excellent contribution, from both a theoretical and practical perspective.

Third, because not all cognitive dimensions apparently influence gambling behaviour, future research should extend the analysis to include other variables that may moderate or mediate the causal relationship. Similarly, it seems interesting to investigate whether the factors that influence gambling behaviour (namely, the illusion of control and belief in luck and superstition) act differently depending on the type of favourite game. This information may be used to better target social marketing efforts.

Finally, some limitations relate to the online instrument and the potential for social desirability bias. S~~The s~~elf-administered surveys may ~~tends to~~ produce ~~a~~ more valid results compared to the interview model as it prevents participants feeling uncomfortable in front of the interviewer, which may cause a~~or~~ natural pressure ~~in giving~~to give a "correct" response. However, ~~it may still exist~~ the potential for social desirability bias in self reporting behaviour may exist in both survey forms. Therefore, the inclusion of a social desirability scale in the questionnaire would have been appropriate. Moreover, the survey was administered online, thus requiring access to and some fluency with a computer. As a result, although the sample is sufficiently representative of the population in terms of gender, age and geographic distribution, it is highly educated.

**Appendix A**. Correlation matrix of observed variables

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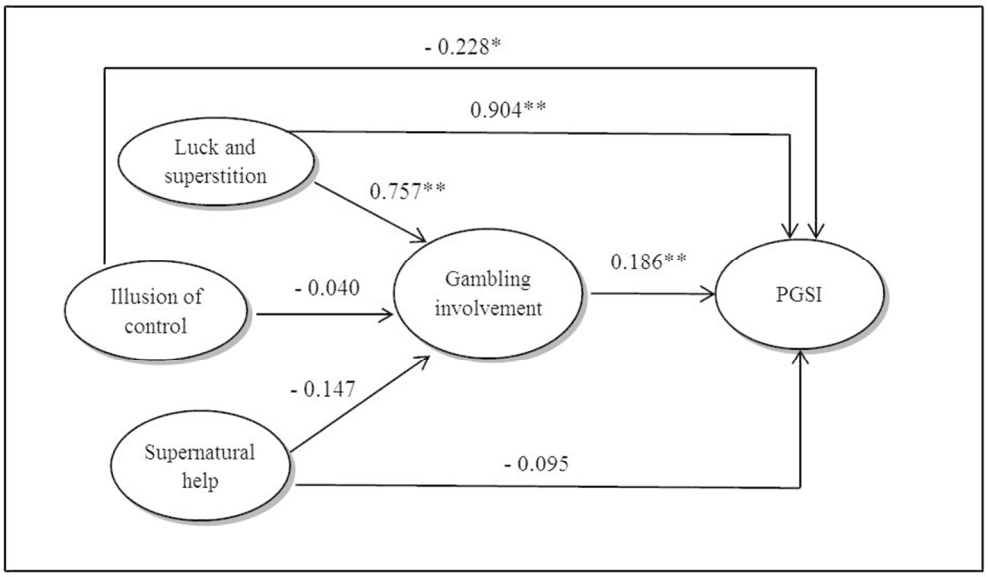
**Table I** CFA: factor loadings for the GBS[a]

| | Luck and superstition | Illusion of control | Supernatural help |
|---|---|---|---|
| I have a secret technique that I use when I gamble | 0.874 | | |
| If I am losing, I have to continue to play because I will not miss the chance to win | 0.800 | | |
| I perform propitiatory rituals to increase my chances of winning | 0.841 | | |
| I gamble because I think I am lucky | 0.758 | | |
| In the long run, I will win more money than I will lose gambling | 0.654 | | |
| I don't mind if I play the money I won and I lose it because it is a surplus compared to "my money" | 0.652 | | |
| I keep a lucky charm when I gamble | 0.756 | | |
| Knowledge of game rules increases the probability of winning | | 0.590 | |
| My choices or actions affect the game on which I am betting | | 0.868 | |
| There are clear signs that suggest whether I should continue or stop gambling | | 0.741 | |
| God's help is important to win | | | 0.693 |
| I lose because "Lady Luck" turns her back on me | | | 0.679 |
| I have "my" magic numbers | | | 0.707 |
| Construct Reliability | 0.91 | 0.78 | 0.74 |

$\chi^2$ = 143.992; df = 62; CFI = 0.992; NNFI = 0.989; RMSEA = 0.051; GFI = 0.944, SRMR = 0.034

[a] All path coefficients are significant at $p < .01$.

**Figure 1**. Structural model with standardized coefficients




$\chi^2 = 208.693$; df = 110; CFI = 0.993; NNFI = 0.992; RMSEA = 0.042; SRMR = 0.038; GFI = 0.94

** $p < 0.01$; * $p < 0.05$

Figure 1. Structural model with standardized coefficients
161x113mm (150 x 150 DPI)

**Appendix A.** Correlation matrix of observed variables

| | B_1 | B_2 | B_3 | B_4 | B_5 | B_6 | B_7 | B_8 | B_9 | B_10 | B_11 | B_12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B_1 I keep a lucky charm when I gamble | 1 | | | | | | | | | | | |
| B_2 Knowledge of game rules increases the probability of winning | .382** | 1 | | | | | | | | | | |
| B_3 If I am losing, I have to continue to play because I will not miss the chance to win | .728** | .481** | 1 | | | | | | | | | |
| B_4 I gamble because I think I am lucky | .673** | .397** | .739** | 1 | | | | | | | | |
| B_5 I have a secret technique that I use when I gamble | .566** | .608** | .624** | .650** | 1 | | | | | | | |
| B_6 There are clear signs that suggest whether I should continue or stop gambling | .374** | .422** | .434** | .550** | .692** | 1 | | | | | | |
| B_7 In the long run, I will win more money than I will lose gambling | .373** | .266 | .371** | .381** | .336* | .462** | 1 | | | | | |
| B_8 My choices or actions affect the game on which I am betting | .616** | .473** | .543** | .656** | .739**** | .708 | .371** | 1 | | | | |
| B_9 God's help is important to win | .277 | .402** | .350* | .499** | .479** | .426** | .291* | .419** | 1 | | | |
| B_10 I have “my” magic numbers | .450** | .395** | .411** | .541** | .673** | .516** | .243 | .475** | .487** | 1 | | |
| B_11 I lose because “Lady Luck" turns her back on me | .386** | .275 | .479** | .491** | .544** | .466** | .347* | .437** | .511** | .538** | 1 | |
| B_12 I perform propitiatory rituals to increase my chances of winning | .675** | .417** | .690** | .599** | .523** | .430** | .631** | .530** | .494** | .345* | .549** | 1 |
| B_13 I don’t mind if I play the money I won and I lose it because it is a surplus compared to “my money” | .476** | .382** | .508** | .623** | .409** | .343* | .495** | .303* | .388** | .393** | .400** | .637** |

*$p \leq 0.05$; **$p \leq 0.01$