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# Impulsivity partially mediates the relationship between depression and problem gambling

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## Abstract

This study extended Clarke's (2006) examination of impulsivity as a mediator in the relationship between depression and problem gambling. The sample comprised 78 men and 75 women from Western Sydney who reported playing gaming machines at least twice weekly over the past six months. Their mean age was 39.24 years ( $SD = 17.43$ ) with 30% from a non-English speaking background. According to the South Oaks Gambling Screen-Revised, 27% were identified as probable pathological gamblers. Participants were recruited in gaming venues and completed a questionnaire that included the depression scale from the DASS21 and the N5 impulsiveness scale from the NEO PI-R. Unlike Clarke's (2006) finding, impulsivity was found to be a partial mediator only and not a full mediator of the relationship between depression and problem gambling. These results are discussed with reference to Blaszczynski and Nower's (2002) pathways model of problem gambling and the treatment of problem gambling.

**Keywords:** depression, impulsivity, problem gambling

## Introduction

Blaszczynski and Nower (2002) proposed three pathways to problem gambling that reflected the heterogeneity of gamblers found in clinical and non-clinical samples. Two of these pathways identified emotional vulnerability (e.g., depression) as a motivator for participation in gambling and that, through a process of conditioning, habituation and chasing losses, this could lead to problem gambling. However, the third pathway also included impulsivity as a mediator of the relationship between emotional vulnerability and problem gambling.

Clarke (2006) tested this aspect of the Blaszczynski and Nower (2002) model and found that impulsiveness fully mediated the relationship between depression and problem gambling. That is, when impulsiveness was included in the model, the relationship between depression and problem gambling no longer achieved statistical significance ( $p > .05$ ). This result had both theoretical and therapeutic importance for the understanding of problem gambling. From a theoretical position, Clarke's finding provided some support for the model of problem gambling put forward by Blaszczynski and Nower (2002). In particular, Clarke's result supported Blaszczynski and Nower's third path to problem gambling that related to emotionally and biologically vulnerable gamblers and their predisposition toward addictive behaviours. This group was identified by Blaszczynski

and Nower to have the most entrenched problem gambling symptoms and to be particularly difficult to treat.

Clarke's (2006) findings also suggested that, in a therapy situation, addressing impulsiveness in this group of gamblers may be sufficient to weaken the depression-problem gambling link. Even if depression and problem gambling were only covariates, with no clear directional effect, impulsiveness was still able to account for the relationship between depression and problem gambling.

However, there were a number of problems with the Clarke (2006) study that limit generalising these conclusions to other populations. In Australia and many other countries, electronic gaming machines (EGMs) are the most common form of gambling associated with harmful consequences (Dickerson & Baron, 2000; Productivity Commission, 1999; Raylu & Oei, 2002; Walker, Shannon, Blaszczynski & Sharpe, 2003), and regular gaming machine players are a group considered most "at risk" to developing problem gambling (ACNielsen, 2007; O'Connor & Dickerson, 2003; Productivity Commission, 1999). Clarke's (2006) sample comprised 159 university students enrolled in an introductory psychology course at Massey University in New Zealand. The criterion for inclusion in the study was that they had gambled at least once, on any activity, during the past 12 months. The sample was predominantly young Caucasian women (80%) with moderate to high socioeconomic status. This is not a group noted for high levels of problem gambling. However, Clarke reported that 16% of this group met the classification of problem gambler according to the South Oaks Gambling Screen-Revised cut-off score of three or greater (Abbott & Volberg, 1996). The problem gambling rate among the general population in New Zealand was estimated at 1.3% using the six-month version of the SOGS-R (Abbott, Volberg & Ronnberg, 2004), and in the last National survey in Australia (Productivity Commission, 1999) it was estimated at 4.9% (lifetime SOGS score of three or more). Due to the lack of detail regarding the gambling characteristics of the sample (e.g., preferred form, level of involvement) it's difficult to reconcile the difference between Clarke's sample and the general population. It is also difficult to apply Clarke's findings with confidence to an Australian sample of regular EGM gamblers.

The results from Clarke's (2006) study may also be limited by the measures used for depression and impulsiveness. The measure for problem gambling appears appropriate as it was a slightly modified version of the SOGS-R (12 months). The modification was the collapsing of the last nine items into one question, giving the scale a total of 12 items instead of 20. The SOGS-R is a widely used measure in gambling research (Abbot & Volberg, 2006) and Clarke reported a high coefficient of internal consistency of 0.94 with his modified version. However, the measure used for depression had not been used before in gambling research and little information exists about its validity and reliability overall. This measure was taken from Bell, LeRoy and Stephenson (1982) who state that the psychometric properties were developed in a study of medical inpatients and outpatients in New York State in 1962 and 1963. While Clarke found good internal consistency with this scale for his sample (0.82) and justified its use over the Beck Depression Inventory because he had a community rather than a clinical sample, its use on an Australian sample of regular EGM players is questionable.

A more widely used measure of depression in Australia is the depression scale from the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995). This has been recommended by the authors of the scale for research purposes and has been shown as a valid and reliable measure of depression for an Australian sample. Another important research consideration is that the short version of the DASS (the DASS21) contains only seven items for measuring depression, reducing

the time required for completion. This scale has been used recently in a gambling study involving an Australian sample. Oei, Lin and Raylu (2008) reported a significant ( $p < .01$ ) correlation of 0.25 between the SOGS and the depression scale of the DASS.

Clarke (2006) also included the “narrow impulsivity” subscale of the Eysenck Impulsiveness Scale in his questionnaire. This scale has been used on Australian gamblers before and shown to differentiate between problem and non-problem gamblers (Blaszczynski, Steele & McConaghy, 1997). A medium effect size was reported, however a much smaller effect size in a subsequent study by Steel and Blaszczynski (1998) was found when correlating the Eysenck scale with the SOGS. Clarke (2006) also found a small effect size in the relationship between the Eysenck impulsiveness scale and the SOGS-R and while the internal consistency of the scale was good (0.73), it was the weakest of the three scales used in his study.

Whiteside and Lynam (2001) examined the concept of impulsiveness as a personality trait in response to the various measures and conceptualisations of impulsivity that exist. Using nine different impulsiveness measures (17 subscales in total, including the Eysenck impulsiveness scale) Whiteside and Lynam tested each in relation to the Five Factor Model of personality as measured by the NEO Personality Inventory–Revised (NEO PI-R) (Costa & McRae, 1992). They found that the four impulsiveness facets within the NEO PI-R (impulsiveness, self discipline, deliberation, and excitement seeking) were able to account for 66% of the variance in the 17 subscales of impulsivity. Whiteside and Lynam reported that the impulsiveness facet of the NEO PI-R was associated with items that reflected impulsive behaviour under conditions of negative affect. This included impulsive behaviours undertaken to alleviate negative emotions, despite the long-term harmful consequences of these actions. This facet of impulsivity seems to best describe impulsive behaviour in relation to problem gambling and depression.

Recently, Bagby et al. (2007) administered the NEO PI-R to a sample of 106 pathological gamblers and 177 non-pathological gamblers (according to DSM-IV criteria). The NEO PI-R was tested on this sample based on the finding of Whiteside and Lynam (2001). Bagby et al. found that three of the four impulsiveness facets – impulsiveness, self-discipline, and deliberation – distinguished pathological gamblers from non-pathological gamblers in his sample. The effect size for each difference was around the same as for the Blaszczynski et al. (1997) study (i.e., medium) with the impulsiveness facet of the NEO PI-R being slightly larger than the other two. Hence, it would appear that the impulsiveness facet of the NEO PI-R would be an appropriate measure of impulsiveness in a study of depression, impulsivity and problem gambling.

The aim of the current study is to test impulsivity as a mediator in the relationship between depression and problem gambling. The study is based on Clarke’s (2006) model, however it will utilise regular gaming machine players and different measures of depression and impulsivity.

## **Method**

### *Participants*

The sample consisted of 153 gaming machine players who were recruited from two gaming venues in Western Sydney, New South Wales (NSW), Australia. Participants were approached whilst playing EGMs and were first screened to ensure they had played the gaming machines on average at least once per week over the past six months. A gender balance was also aimed for later in the recruitment process and this resulted in a sample comprising 78 men and 75 women. The age distribution was normally distributed with no outliers. Ages ranged from 18 to 82, with

an average age of 39.24 (SD = 17.43) years. Thirty percent of the sample reported that they were from a non-English speaking background with the largest group reporting a Lebanese background (4% of the total sample). Most of the participants (69%) reported a yearly income that was less than the NSW average and 55% did not have any tertiary education qualifications. With regard to gambling activity, the sample reported playing EGMs an average of 2.29 days per week over the past six months, with each session of play averaging 2 hours and 15 minutes (SD = 109.27 minutes). Their median yearly expenditure on gaming machines was almost six times the NSW per capita (Australian Gaming Council, 2007) and 40% scored 3 or higher on the SOGS-R, with 27 % scoring 5 or higher (i.e., 13% would be classified as problem gamblers and 27% as probable pathological gamblers).

### *Measures*

*Revised South Oaks Gambling Screen (SOGS-R).* The SOGS-R used in the current study was the same as that used by Clarke (2006) except the full 20 items were given. The time frame was also shortened to 6 months instead of 12 months as Abbott and Volberg (2006) reported that the original SOGS-R utilised a 6-month time frame and that there was greater psychometric information related to the 6-month version. For the present study the coefficient of internal consistency was 0.83.

*Depression scale.* The depression scale from the Depression, Anxiety, Stress Scales (DASS21, Lovibond & Lovibond, 1995) was included in the questionnaire. This scale was chosen due to its brevity (seven items) and it has been shown to have high internal consistency and has been recommended for both research and clinical use (Lovibond & Lovibond, 1995). The scale has also been used with other Australian gamblers demonstrating high reliability (Oei et al., 2008). Each item is rated on a four-point scale from “Did not apply to me at all” to “Applied to me very much, or most of the time”. For the current sample the internal consistency was 0.92.

*Impulsiveness scale.* Impulsivity was measured with the items from the impulsiveness facet of the neuroticism domain in the Revised NEO Personality Inventory (NEO PI-R) (Costa & McCrae, 1992). This eight-item scale was used by Bagby et al. (2007) and was shown to differentiate between pathological and non-pathological gamblers. The internal consistency for the current sample was 0.65.

### *Procedure*

Clarke (2006) followed the procedure set out by Baron and Kenny (1986) for testing mediation. There are four conditions that must be met to demonstrate statistically the mediating effect of impulsiveness on the path from depression to problem gambling. First, depression must be associated with impulsiveness and second, depression must be associated with problem gambling. Impulsiveness must be related to problem gambling and finally when impulsiveness is controlled there must be a statistically significant reduction in the effect of depression on problem gambling. If the relationship between depression and problem gambling is reduced to a non-significant level, then full mediation is demonstrated. If the relationship is reduced, but still significant, then partial mediation has occurred. Path analysis could then be undertaken to determine the direct and indirect effects of the mediating variable (impulsiveness) on the relationship between depression and problem gambling.

The interaction effect of depression and impulsiveness was tested using the same method as Clarke (2006). Scores for depression and impulsiveness were centered and their interaction term entered respectively into a hierarchical regression analysis.

## Results

The continuous variables of age, problem gambling, impulsiveness, and depression were screened for outliers and normality. Problem gambling (SOGS-R) and depression (DASS) scores were significantly skewed and square root transformation was undertaken resulting in no outliers and normal distributions. Age and impulsiveness did not require transformation.

### *Characteristics of the Sample*

In comparison to normative values on the depression scale (Lovibond & Lovibond, 1992), 45% of the sample scored in the normal range, 35% in the mild/moderate range and 20% in the severe/extremely severe range. For impulsiveness, scores were classified by gender and compared with normative sample scores (Costa & McRae, 1992) resulting in 49% of the current sample scoring within the average range, 27% in the low/very low range and 24% in the high/very high range. There were no significant ( $p > .05$ ) gender differences within the three scales (SOGS-R, depression, impulsiveness).

### *Effects of Impulsiveness*

To test for any mediation effect, correlations must first be obtained between the three variables of interest (problem gambling, depression, impulsiveness). Clarke (2006) found almost no difference between zero-order correlations and partial correlations (controlling for age and sex). This allowed him to remove age and sex from any subsequent analysis. However, for the current sample, partial correlation coefficients were much lower than zero-order coefficients. Age was found to be significantly and negatively correlated with all three scales while no relationship was found for sex. Correlations were performed again, controlling only for age, revealing identical results to the first matrix and indicating that it was age and not sex reducing the zero-order correlation coefficients. Table 1 depicts the intercorrelations among the variables on their own and also controlling for age. As can be seen, all three coefficients remained significant, but reduced in value.

**Table 1** Means, standard deviations, zero-order and partial correlations ( $N = 153$ )

Variable	Depression	Impulsiveness	Problem Gambling
Depression		0.19*	0.37***
Impulsivity	0.26**		0.31***
Problem Gambling	0.43***	0.40***	
Mean	11.44	15.39	3.31
SD	10.51	4.28	3.82

Note: Pearson product-moment correlations appear below the diagonal; partial correlations controlling for age, above the diagonal. All tests are one-tailed.

Table 1 confirms the fulfillment of the first requirement of the mediation analysis by showing that depression was related to impulsivity. A weak, but significant, partial correlation of 0.19 between depression and impulsiveness was found and this justifies the subsequent regression analyses.

Table 2 displays the results of the regression analysis testing for impulsivity as a mediator of the depression-problem gambling relationship, controlling for age (Pedhazur, 1997). The results indicated that impulsivity was a partial mediator of the depression-problem gambling relationship. In the first two regression analyses, variations in depression scores significantly accounted for variations in impulsivity scores ( $\beta = 0.44$ ),  $t = 2.37$ ,  $p < .05$  and the relationship between depression and problem gambling was also significant ( $\beta = .22$ ),  $t = 4.93$ ,  $p < .001$ . In the final model, variations in impulsivity significantly accounted for variations in problem gambling ( $\beta = 0.06$ ),  $t = 3.32$ ,  $p < .01$  and the depression on problem gambling coefficient was significantly reduced from  $\beta = 0.22$  to  $\beta = 0.19$ ,  $F(1, 149) = 11.00$ ,  $p < .01$ . Depression still remained significant in the final model, indicating that impulsivity was partially mediating the depression-problem gambling relationship.

**Table 2** Hierarchical regression analysis for direct, indirect and interaction effects of depression on problem gambling symptoms via impulsivity ( $N = 153$ ).

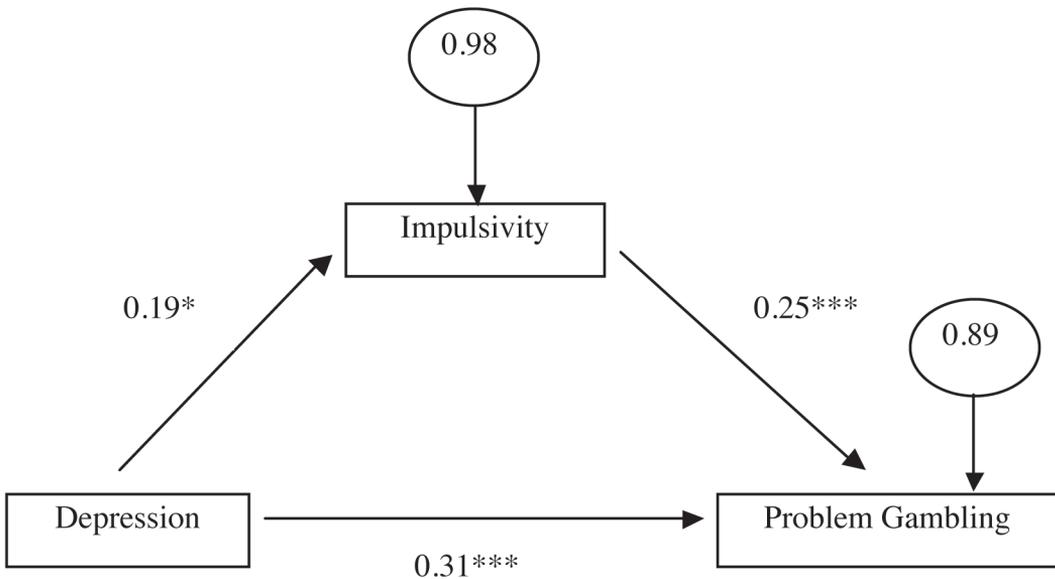
Variable	$\beta$	SE $\beta$	$\beta$	Partial $R^2$
(1) Regression of impulsivity on depression controlling for age ( $R^2 = 0.15$ )				
Constant	16.96	1.08		
Depression	0.44*	0.19	0.19	0.03
Age	-0.07***	0.02	-0.29	0.12
(2) Regression of problem gambling symptoms on depression controlling for age ( $R^2 = 0.26$ )				
Constant	2.13	0.20		
Depression	0.22***	0.05	0.36	0.19
Age	-0.02***	0.01	-0.27	0.07
(3) Regression of problem gambling symptoms on impulsivity and depression controlling for age ( $R^2 = 0.32$ )				
Constant	1.95	0.20		
Depression	0.19***	0.04	0.31	0.19
Impulsivity	0.06***	0.02	0.25	0.09
Age	-0.01**	0.01	-0.20	0.03
Indirect			0.05	
Spurious			0.07	
Depression x Impulsivity	0.13	0.01	0.10	0.01

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

The results of the interaction effect of depression and impulsivity on problem gambling, after the introduction of the main effects, were similar to those found by Clarke (2006). As shown in Table 2, the interaction effect explained very little additional variance ( $\Delta R^2 = 0.01$ ),  $F(1, 148) = 1.98$ ,  $p > .05$ .

Also shown in Table 2 are the results of the third regression. The total effect of depression on problem gambling was 0.36 and this included the direct effect (0.31) as well as the indirect effect obtained via the influence of impulsivity scores (0.05). Hence, impulsiveness was only a partial mediator and was only able to account for 14% of the total effect of depression on problem gambling. The spurious component of the relationship between impulsivity and problem gambling (.07) is an indication of the proportion of this relationship that is shared, due to the effect of depression on both impulsivity and problem gambling. For the third regression, an  $R^2$  of 0.32 yields a  $f^2$  of 0.47 indicating a large effect size was observed for the final model (Cohen, 1992).

Figure 1 represents the path analysis of the final model, based on calculations from Pedhazur (1997). This figure shows that the path from depression to impulsivity was still significant, after the inclusion of impulsivity.



**Figure 1** A path diagram with standardised regression coefficients and residuals (in circles) depicting the partial mediating effects of impulsivity on the depression and problem gambling relationship (controlling for age). \*  $p < 0.05$ ; \*\*\*  $p < 0.001$ .

## Discussion and Conclusion

The aim of the present study was to test the role of impulsiveness in the relationship between depression and problem gambling. Clarke (2006) found that impulsiveness fully mediated this relationship, however, impulsiveness was found to only partially mediate this relationship in the current study. That is, the strength of the relationship between depression and problem gambling was reduced, but still remained significant. Nonetheless, the results of both studies provided some support for the third pathway to problem gambling proposed by Blaszczynski and Nower (2002).

It must be noted that both the present study and Clarke's (2006) study had large sample sizes and high statistical power associated with this. The present study found that 14% of the effect of depression on problem gambling goes through, or is mediated by, impulsivity. Clarke reported this figure as 32% in his sample, which was enough to be deemed full mediation (statistically) but it still meant that depression largely (68%) had a direct effect on problem gambling. In the Blaszczynski and Nower (2002) model the only difference between pathway two and pathway three is the inclusion of "impulsivist traits" in the third pathway. It can be argued that the results of both the present study and Clarke (2006) show more support for direct connection between depression and problem gambling in pathway two than the inclusion of impulsivity in pathway three. This has implications for Clarke's suggestion that dealing with impulsivity in a therapy situation may be sufficient to weaken the depression-problem gambling link. The results of the current study suggest that dealing with the depression is a more likely way of reducing the depression–problem gambling link than indirectly via impulsiveness.

Whilst the current study found only weak support for the third pathway proposed by Blaszczynski and Nower (2002), there were some measurement issues that could explain this. The measure of depression appears sound with a good reliability coefficient and a moderate correlation with problem gambling (0.43). This correlation was stronger than the 0.24 reported by Clark (2006). However, depression did not correlate as highly with the eight-item impulsiveness facet (N5) of the NEO PI-R. Although the results of Whiteside and Lynam (2001) suggested that the N5 was a good measure of impulsiveness under conditions of negative affect, in the current study the correlation between depression and impulsivity was 0.26, whereas Clarke (2006) and Blaszczynski et al. (1997) found correlations in the order of 0.48 and 0.42 respectively, using the Eysenck scale. Furthermore, the internal consistency reliability of the impulsiveness measure in the current study was relatively low (0.65) compared to the measure used by Clarke (2006) and the other measures used for depression and problem gambling.

The N5 measure may have been a too restricted measure of impulsiveness which is increasingly being considered to be a complex and multifaceted construct (Rodriguez-Jimenez et al., 2006). Moeller, Barratt, Dougherty, Schmitz and Swann (2001) put forward a definition of impulsiveness as a "predisposition toward rapid, unplanned reactions to internal or external stimuli with diminished regard to the negative consequences of these reactions to the impulsive individual or other" (p. 1784) which reflects its multidimensionality probably beyond what an eight-item scale could properly assess.

The N5 measure of impulsivity did, however, correlate relatively highly with problem gambling. Bagby et al. (2007) found that the N5 could differentiate between problem and non-problem gamblers and for the current study, a moderate correlation of 0.40 was found. Both Clarke (2006) and Steele and Blaszczynski (1998) reported correlations of 0.26 between the Eysenck impulsiveness scale and the SOGS. Based on these findings, the inclusion of the other measures of impulsiveness, such as those from the NEO PI-R (i.e., self-discipline, deliberation) may have improved the reliability and validity of the impulsiveness measure in the current study. This may result in a stronger correlation with depression while retaining the moderate sized correlation with problem gambling.

There were also other differences between Clarke's (2006) study and the present study that strengthen the findings of the current study. The sample in the current study was generally more heterogeneous and the demographic characteristics better reflect the gambling population (Raylu & Oei, 2002). They were older and had greater variability in their ages and tended to be of

lower socioeconomic status as they were less likely to have tertiary education qualifications and generally had lower income levels than the population. This sample was also more involved in gambling as they were recruited based on playing gaming machines at least twice per week over the past six months. This tends to fit better with the Blaszczynski and Nower (2002) pathways as the process to problem gambling includes a history of conditioning, habituation, and chasing losses. Further evidence of the representatives of the current sample was revealed with age being negatively correlated with problem gambling, depression, and impulsivity. This generally matches the relationship with other studies of these constructs (e.g., ACNielsen, 2006; Eysenck & Eysenck, 1977; Mackinnon, Jorm & Hickey, 2004).

The current study extends the findings of Clarke (2006) and adds some cautious empirical support for the pathways model of problem gambling put forward by Blaszczynski and Nower (2002). Statistically, the current results suggest that impulsivity plays a mediating role in the link between depression and problem gambling. However, it is questionable whether Blaszczynski and Nower's (2002) model hypothesised impulsivity to be a mediator in the statistical sense. Clarke (2006) interpreted it as such and the term mediator was used by Blaszczynski et al. (1997) and Steel and Blaszczynski (1998), but it was never stated as such by Blaszczynski and Nower (2002). Furthermore, a pathways model is not the same as a path analysis diagram and Clarke (2006) may be interpreting this body of work in a strict statistical sense. This is somewhat understandable given that Blaszczynski and Nower (2002) do end their paper with "the model is open to empirical testing" (p. 497) but there are possible semantic issues across all of this research and future research needs to be cautious when using terms such as mediation, moderation, and interaction.

Nonetheless, future research should still examine the construct of impulsivity in a gambling context and include a broader measure of impulsivity than that used in the current study. A greater understanding of the relationship between depression, impulsivity, and problem gambling will enhance treatment regimes for this impulse-control disorder and diminish the negative consequences that excessive gambling can have for individuals, their families and the community.

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