

## Abstract

The serotonin transporter length polymorphic region (5-HTTLPR) is associated with numerous neuropsychiatric conditions. Serotonin is also involved in impulse control. To better understand the relationship between impulse control and 5-HTTLPR polymorphisms 277 pathological and at-risk gamblers and 172 controls were recruited from various sources. All participants were genotyped at 5-HTTLPR and asked to complete the DSM-IV questionnaire for pathological gambling, plus two self-report measures on impulsivity: the Barratt Impulsiveness scale (BIS-11) and Delayed Discounting Task (DDT). Both measures of impulsivity associated strongly with pathological gambling. However, 5-HTTLPR polymorphisms did not predict either impulsivity or pathological gambling.

## Introduction

•PG is an addiction and impulse control disorder with enormous negative economic and social repercussions [1] [2].

•Variation in serotonin signalling associates with poor impulse control, where people act without forethought or particular attention to consequence [3] [4].

•The serotonin transporter (5-HTT) mediates reuptake of serotonin at synapses, thus terminating its effects. 5HTT has a length polymorphic region (HTTLPR) in the promoter resulting in long (l) and short (s) alleles [5].

The long allele has been associated with increased gene transcription and greater serotonin reuptake capacity [5].

## Objective

•The current study intends to confirm the association between impulsivity and pathological gambling, and determine whether variation in 5-HTTLPR contributes to these behavioural characteristics.

## Methods

### Participants

•Participants were recruited primarily from the Ottawa area through various addiction centers, casinos, hospitals and community-based recruitment. 277 pathological and at-risk gamblers and 172 controls were recruited.

### Measures

•Barratt Impulsiveness Scale: A self-report test that evaluates total impulsivity and gives submeasures for attentional, motor and non-planning impulsivity.

•Delayed discounting task: A self-report test that gauges willingness to forfeit larger long-term reward in favor of an immediate smaller reward.

•DSM-IV for pathological gambling: A self-report test that is diagnostic for PG.

### Genotyping

•Participant saliva samples were collected for DNA extraction. Extractions were done by JS.

•The forward primer sequence was 5'-GGCGTTGCCGCTCTGAATGC-3' and the reverse primer sequence was 5'GAGGGACTGAGCTGGACAACCAC-3'.

•Genotyping was done was Megan McDougall.

• Additional participants were recruited after the genotyping resulting in varying sizes of N

### Ethics

• Research protocol was approved by Carleton University Research Ethics Board for Psychological Research.

## Results

•Total, non-planning and motor impulsivity are weakly associated with DDT scores. Attentional impulsivity was not significantly correlated.

Table 1. Pearson's correlation coefficients between BIS-11 measures of impulsivity and DDT scores (N= 449)

	Total	Non-planning	Motor	Attentional
DDT	-.24*	-.30*	-.19*	-.08

\*p<0.01

High BIS-11 scores and low DDT scores are indicative of impulsivity thus accounting for the observed negative correlations.

•Pathological gamblers are more impulsive than non-gamblers, across all measures of impulsivity

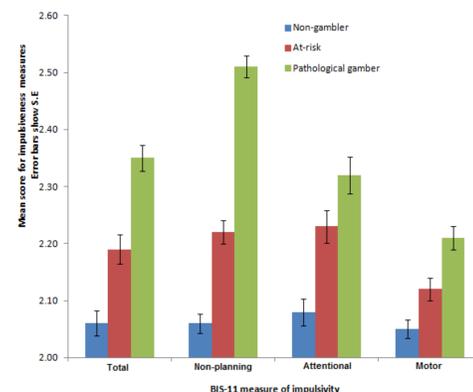


Figure 1. BIS-11 impulsivity measures as a function of gambling behavior

One-way ANOVA showed significant effects of all four measures of impulsivity on gambling behavior. Total impulsivity varied significantly with gambling behaviour,  $F(2,285) = 15.29, p < 0.001$  as did attentional impulsivity,  $F(2,285) = 5.25, p < 0.01$ . Non-planning impulsivity,  $F(2,285) = 23.62, p < 0.001$  and motor impulsivity,  $F(2,285) = 4.84, p < 0.01$ , also showed significant effects.

Tukey post-hoc comparisons of the three gambling groups indicated that pathological gamblers reported significantly higher impulsivity scores than non-gamblers for all measures.

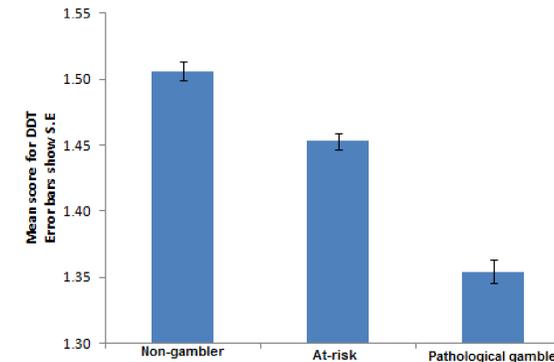


Figure 2. Mean DDT scores as a function of gambling behavior

One-way ANOVA showed a significant effect of DDT scores on gambling behavior,  $F(2,445) = 22.86, p < 0.001$ . Post hoc Tukey test revealed that pathological gamblers had significantly lower scores than at-risk and non-gamblers ( $p < 0.01$ ).

•5-HTTLPR genotype does not predict impulsivity or pathological gambling

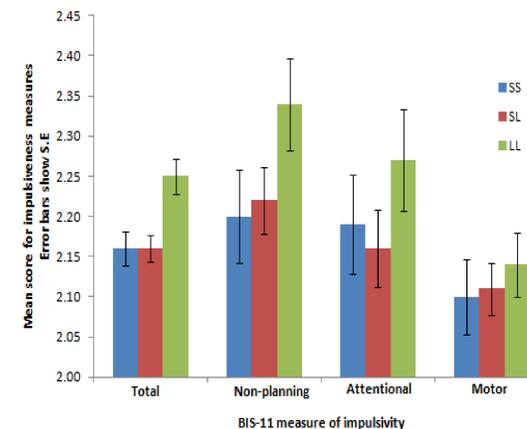


Figure 3. BIS-11 Relationship between BIS-11 impulsivity measures and 5-HTTLPR genotype

Total impulsivity did not vary significantly with genotype  $F(2,285) = (p = 0.254)$

Students t test comparing non-planning impulsiveness between SS and SL genotypes in combination with LL,  $p = 0.057$ .

Table 2. Distribution of gambling behavior across 5-HTTLPR genotype

	SS	SL	LL
Non-gambler	25.0% N=27	49.1% N=53	25.9% N=28
At-risk	25% N=23	44.6% N=41	30.4% N=28
Pathological gambling	23.9% N=21	45.5% N=40	30.7% N=27

There was no association between 5-HTTLPR genotype and pathological gambling ( $X^2$  test of independence (4,  $N=288$ ) = 0.783,  $p = 0.941$ ). However, it was found that pathological gambling is more common in men  $X^2(2, N=288) = 16.55, p < .001$ , thus verifying a finding well supported in the literature [6].

## Conclusion

- DDT and BIS-11, two measures of impulsivity, correlate weakly.
- Both measures of impulsivity robustly predict gambling behaviour.
- 5-HTTLPR polymorphisms did not affect performance on DDT and BIS-11.
- The distribution of pathological gambling behaviour was independent of genotype.
- These results support the conclusion that although impulsivity powerfully predicts gambling behaviour these effects are independent of 5-HTTLPR variation.

## References

- [1] Shaffer HJ, Korn DA (2002) Gambling and related mental disorders: A Public Health Analysis. *Annu Rev Public Health* 23:171-212.
- [2] Lesieur H (1998) Costs and treatment of pathological gambling. *Ann Am Acad Pol Soc Sci* 556:153-171.
- [3] Dalley J, Everitt B, Robbins T (2011) Impulsivity, compulsivity, and top-down cognitive control. *Neuron* 69:680-694.
- [4] Stoltenberg SF, Christ CC, Highland KB (2012) Serotonin system gene polymorphisms are associated with impulsivity in a context dependent manner. *Progress in Neuropsychopharmacology & Biological Psychiatry* 39:182-191.
- [5] Marini S, Bagnoli S, Bessi V, Tedde A, Bracco L, Sorbi S, Nacmias B (2011) Implication of serotonin-transporter (5-HTT) gene polymorphism in subjective memory complaints and mild cognitive impairment (MCI). *Arch Gerontol Geriatr* 52:e71-e74.
- [6] Janssen PKC, Bakker SC, Réthelyi J, Zwinderman AH, Touw DJ, Olivier B, Waldinger MD (2009) Serotonin Transporter Promoter Region (5-HTTLPR) Polymorphism is Associated with the Intravaginal Ejaculation Latency Time in Dutch Men with Lifelong Premature Ejaculation. *Journal of Sexual Medicine* 6:276-284.