

## An interdisciplinary dialogue on gambling: Perspectives on the role for neuroscience in gambling policy and treatment

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Yucel, M., Carter, A., Allen, A.R., Balleine, B., Clark, L., Dowling, N.A, Gainsbury, S.M., Goudriaan, A.E., Grant, J., Hayes, A., Hodgins, D., van Holst, R., Lattimore, R., LivingstoneC., Lorenzetti, V., Lubman, D., Murawski, C., Parkes, L., Petry, N., Room, R., Singh, B., Thomas, A., Townshend, P., Youssef, G., Hall, W. (2017). An interdisciplinary dialogue on gambling: Perspectives on the role for neuroscience in gambling policy and treatment. *The Lancet Psychiatry*.

[http://dx.doi.org/10.1016/S2215-0366\(16\)30369-8](http://dx.doi.org/10.1016/S2215-0366(16)30369-8)

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**Panel key conclusions were that:**

- (i) Neuroscience may aid the development of safer gambling products;
- (ii) Neuroscience shows how EGMs are particularly 'addictive' commodities that need careful regulation;
- (iii) Industry involvement in research needs urgent attention (e.g. funding guidelines);
- (iv) Inter-disciplinarity is critical to the design and interpretation of studies; and
- (v) Studies must include problem gamblers who do not fulfill diagnostic criteria but suffer significant harms.

## **Abstract**

The 2013 and 2014 workshops '*Problem gambling: An interdisciplinary dialogue between neuroscientists, clinicians and policy makers*' held in Melbourne, Australia brought together a consortium of multidisciplinary gambling researchers aiming to improve the clinical and policy impact of neuroscience research on gambling. The format allowed in-depth discussion of issues from a multidisciplinary perspective. The first meeting identified the most salient issues raised by neuroscience research on gambling and highlighted the specific challenges faced by workers within their disciplines. The second workshop examined further three pressing issues: (1) the neuroscience of gambling on Electronic Gaming Machines (EGMs), one of the most harmful forms of gambling; (2) the validity and utility of subtyping problem gamblers in clinical treatment and policy-related decision-making; and (3) pre-commitment policy interventions. This report is a summary of the main points of discussion, areas of consensus and disagreement, and recommended priorities from the consortium.

**Keywords:** gambling; neuroscience; treatment; prevention; policy; addiction.

## 1. Introduction

According to the latest re-conceptualization of the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5), *Addiction and Related Disorders* includes Gambling Disorder (referred to hereafter as “Problem Gambling”) within a *Non-Substance-Related Disorders* subcategory.<sup>1</sup> This change was based on growing evidence that behavioral addictions, such as problem gambling, are associated with similar responses in the brain seen in alcohol and other drug addictions.<sup>2</sup> Yet, compared with the large research initiatives in drug addiction (e.g. Dutch NEXT study in ecstasy; US ABCD study for substance addiction),<sup>3,4</sup> problem gambling remains a relatively nascent and underexplored topic, with research often failing to translate into clinical or policy interventions. To address this, a multidisciplinary international consortium of 25 gambling and addiction researchers from neuroscience, economics, public health and policy, and clinicians met at two workshops in 2013 and 2014 called *Problem gambling: An interdisciplinary dialogue between neuroscientists, clinicians and policy makers* (Melbourne, Australia). The aim of these meetings was to determine how research may better inform, and be informed by, clinical and policy concerns to improve the relevance and impact of gambling research.

## 2. Gambling Workshop 2013: Scoping the Field

The first workshop outlined the unique issues facing gambling scientists, clinicians and policy makers. According to the Australian Productivity Commission, gambling raises approximately \$19 billion in revenue per annum in Australia, 55% of which flows through electronic gaming machines (EGMs) located in clubs and hotels.<sup>5</sup> Despite significant gambling-related harms and associated costs, gambling yields a net benefit to the economy estimated to be between \$4-11 billion per year, although these benefits ignore the secondary costs such as those associated with suicide, divorce and loss of social capital.<sup>5</sup> The extremely low prevalence of problem gambling in the community (~0.6%)<sup>6</sup> also grossly misrepresents the scale of the problem among those who use EGMs. High intensity machines allow losses up to \$12,000 per hour and the prevalence of problem

gambling in those who use EGMs is as high as 15%.<sup>5</sup> While only 0.6% of the population are thought to be problem gamblers, this group accounts for an estimated 40% of monetary losses on EGMs.<sup>5</sup>

Clinical outcomes are adversely impacted by significant community and professional stigma and shame surrounding problem gambling. Treatment seeking for gambling is low (<10%), and is lower than substance use disorders and other mental health disorders. Like other drug addictions<sup>7</sup>, natural recovery appears common with a more transitory and episodic pattern of gambling, rather than an enduring and chronic pattern for most affected individuals.<sup>8</sup> The process of treatment-assisted recovery is similar to other addictions, with problem gamblers relying upon several approaches to overcome their condition.

Psychotherapies (i.e., cognitive behavioral therapy, brief interventions) are moderately effective in the treatment of problem gambling and there is some evidence of the effectiveness of pharmacological treatments (e.g. naltrexone, naloxone, nalmefene).<sup>9,10</sup> Further research is urgently required to uncover the mechanisms of various treatment modalities and to determine how services are best provided.

### ***2.1 Implications of neuroscience for treatment and policy***

Pathological gambling is associated with a number of cognitive impairments, including: diminished reward sensitivity (associated with reduced activity in the reward circuits), reduced ability to delay reward or learn from negative consequences, stronger physiological responses to near wins, and poor error monitoring. The neuropsychological impact of near wins in developing and maintaining gambling addiction was recognized as a key feature. Limitations with this research were highlighted, including the presence of conflicting findings that are often ignored – a major concern given the prevalence of false positives in neuroscience research.<sup>11,12</sup> Higher impulsivity in treatment seeking problem gamblers versus problem gamblers from the general community, may explain some of the variability in research findings,<sup>13</sup> and warrant further investigations (e.g. treatment-seeking

vs non-treatment seeking; relapsing vs. non-relapsing problem gamblers).<sup>14</sup> Views on the clinical and policy implications of this research were similarly cautious.

Treatment matching through biomarkers was regarded as premature with further evidence from clinical trials required.<sup>15,16</sup> The identification of gambling subtypes (i.e., mild, moderate, severe) was believed to be a promising area of investigation that may yield better outcomes in the future. Greater optimism was held for emerging treatments from neuroscience research, particularly those that exploited targeted cognitive therapies, such as neurostimulation or neurofeedback. Neuroscience may also provide novel tools for assessing the effectiveness of new clinical or policy interventions prior to implementation (e.g. Virtual Reality), or allow the evidence-based development of less harmful gambling products (e.g., EGMs).

The inclusion of problem gambling disorders as a behavioral addiction in the DSM-5 was controversial. The impact of ratifying gambling disorder as an addiction on most insurance policies remains unclear. For example, the Affordable Health Care and Mental Health Parity and Addiction Equity Acts ensure that all US citizens receive the same level of benefits for mental or substance use treatment care as they do for traditional medical services. It is unclear whether the reclassification of gambling within the category of Addiction and Related Disorders will ensure that people with gambling disorders are covered by the recent increased medical insurance coverage in the US.

Apart from policy, the characterization of gambling as an addiction also impacts research. As many of the workshop's participants pointed out during the discussion, neurobiological studies of problem gambling could focus on the addictive properties of the 'machine'. While there is some debate about the precise level of addictiveness of EGMs in the literature,<sup>17</sup> there was widespread consensus among participants at both meetings that EGMs represented the most harmful and dangerous form of gambling activity. Modification

of the characteristics of gambling products was viewed as being more effective in reducing gambling-related harm: for example, the highly addictive elements of the EGMs could be dampened in favor of less addictive, 'safer' EGMs (e.g., less frequent near-wins, visual reminders of the money and time spent on the machine, limits on total losses).

A major challenge for policy makers is that benefits and harms are not objective and require a consideration of moral qualities such as justice and respect for persons.

Gambling is a regressive form of resource redistribution that tends to extract the greatest resources and cause the greatest harm in socially disadvantaged areas where EGMs are most concentrated. Effective policy should support a sustainable gambling industry to maximise benefits, including personal enjoyment, while minimising harms.

Policy must also be practical and achievable, a process that requires the balancing of pragmatic concerns, including the role or influence of other vested interests, such as industry and government. While it is common not to accept industry contributions in alcohol and tobacco research, this is not the case in gambling research. However, gambling research is an area that receives limited government support, and is often funded through taxes on the proceeds of gambling. While industry funding can bias research, a consensus about the appropriateness of receiving industry contributions for the support of gambling research or treatment could not be reached at the workshops.

Greater transparency and guidance is needed on when and how it might be permissible to accept industry funding, such as the development of research funding guidelines that receive widespread support, as has occurred in other areas of addiction research. It was also suggested that more research is needed to determine the best strategies for policy implementation (as contrasted with policy development) because of the inherent difficulties

<sup>^</sup>The discussion about issues in industry funding of gambling research was continued, with conference participants involved, through publication of a paper by Charles Livingstone and Peter Adams, with commentaries and a response in the January 2016 issue of *Addiction* (vol. 111, pp. 5-17).

in identifying whose responsibility it is to implement policy. Moreover, potential conflicting interests pervade the policy implementation landscape. Addressing the advertising of gambling products and making the process for appealing gaming licenses more accessible and transparent were two areas where policy change could be made quickly and easily, given the necessary political will.

### **3. Gambling Workshop 2014: Key Challenges**

The 2014 meeting explored in greater detail three key issues at the intersection of neuroscience, clinical and policy identified in the 2013 meeting. The aim was to understand how to best implement change in these areas, whether they be at the scientific, clinical or policy level. The three key topics were:

1. The neuroscience of Electronic Gaming Machines (EGMs)
2. The validity and utility of subtyping gamblers in clinical treatment and policy making
3. Pre-commitment policy interventions

#### ***3.1 The Neuroscience of the Electronic Gaming Machine (EGM)***

EGMs were regarded by participants as the source of the greatest harm in gambling, a view supported by both clinical and epidemiological evidence.<sup>17-19</sup> EGMs are sophisticatedly designed, both in terms of the game and broader environmental settings that keep people using them.<sup>20</sup> Greater research examining the characteristics of modern EGMs, and how they exploit human cognition, is needed. Research suggests that there are various features of EGMs that elicit gambling-related cognitive distortions that perpetuate gambling. These features include traditional near-wins (or near-miss) outcomes<sup>21</sup> and the 'loss disguised as a win' on modern multi-line slot machines.<sup>22</sup> Studies employing psychophysiology (skin conductance, heart rate) and neuroimaging techniques indicate that these game events activate the sympathetic nervous system and recruit

reward-related neural circuitry,<sup>23,24</sup> and that these responses are amplified in participants with disordered gambling.<sup>25</sup>

Pathological decision-making can emerge from a dysregulated executive system, which can be difficult to alter, as in problem gambling. “Losses disguised as wins” are particularly pernicious in that they undermine the decision-making capacity of individuals who are already experiencing cognitive distortions and thereby impair their ability to make rational choices.<sup>22,26</sup> For instance, it has been shown that individuals often interpret near-wins as evidence that they are mastering the game, which in turn fosters an illusion of control.<sup>27</sup> There was a general consensus that “losses disguised as wins” was an area in which policy makers could easily and quickly make regulatory changes to prevent a practice that promotes gambling.

A potential advantage of research on the neuroscience of EGMs was increased focus on the machine or gambling activity, both as a target of much needed policy intervention and a priority for additional research. The neuroscience of decision-making and the sophisticated engineering of EGMs to exploit gamblers’ poor decision making may provide an important motivation for governments and policy makers to address the highly addictive nature of EGMs. Some delegates however raised concerns that neuroscience, particularly the brain disease model of gambling, may focus attention on the individual gambler and deflect attention from addressing gambling addiction vectors (e.g. EGMs).<sup>28</sup>

While we have a greater understanding of why EGMs are dangerous, questions remain: How do we address the harmfulness of these machines? Do we ask governments to legislate to remove the harmful elements out of the machine, and if so which ones? Do we simply require manufacturers to include prominent warning messages on the machines that state that they are harmful?

### ***3.2 The Validity and Utility of Subtyping Gamblers in Clinical Treatment and Policy Making***

An important question concerns the validity and utility of subtyping gamblers in clinical treatment and policy-making. The treatment of problem gambling is complicated by substantial heterogeneity, much of which is due to high rates of comorbidity with other psychiatric disorders. Several recent theoretical typologies of problem gambling, such as the pathways model<sup>29</sup> and the clinical typology proposed by Dannon and colleagues,<sup>30</sup> have attempted to account for this heterogeneity. For instance, the pathways model includes three sub-populations: (i) behaviourally conditioned problem gamblers; (ii) emotionally vulnerable problem gamblers; and (iii) antisocial, impulsivity problem gamblers. The existence of problem gambling sub-populations may help advance our understanding of the etiology and course of problem gambling, facilitate the study of genetic and neurobiological mechanisms, and allow for the evaluation of differential responsiveness to treatment. While there is strong convergent validity for the three subtypes outlined in the pathways model,<sup>31</sup> subtyping remains a promising theory and the focus of important scientific research. It was concluded that the available evidence does not currently support the routine use of subtyping in clinical practice.

The greatest challenge to gambling treatment is getting and keeping individuals in treatment. While more intensive interventions (e.g. professionally-delivered cognitive behavioral therapy) can be more effective than brief interventions (i.e. < 10 minutes), even brief or online interventions can substantially reduce the severity of problem gambling.<sup>32</sup> The research in this area suggests that there should be greater emphasis on low cost non-intensive interventions for problem gambling, with more intensive interventions reserved for those who do not respond to the briefer approaches.

### ***3.3 Pre-Commitment Policy Interventions***

There has been significant worldwide attention on pre-commitment interventions that enable gamblers to stick to their self-imposed limits.<sup>33</sup> A number of different pre-commitment models (e.g. full, partial, mandatory, voluntary or hybrid) and different features (e.g. spend limits, time limits) have been proposed. These models are typically based on behavioral economic theories such as dual-process models of cognition. Such models postulate that decision-making is a function of both experiential and affective processes (intuitive system) and/or analytical and deliberative processes (rational system). Impulsive behavior emerges when the intuitive system dominates decision-making, often triggered by arousal after exposure to situational cues (e.g., in gambling venues). In this framework, pre-commitment strategies enable problem gamblers to adhere to rational decisions made at times of low arousal and avoid being overwhelmed by increased cognitive and emotional arousal while gambling, which can lead them to focus on immediate reward at the expense of longer-term goals. Unfortunately, the research on pre-commitment is often undermined by poor study design, such as inadequate study duration or politically driven changes in trial implementation. Therefore, there is still substantial uncertainty about the efficacy of pre-commitment mechanisms strategies. Recent research in decision neuroscience casts doubt on the validity of dual-process models on which pre-commitment mechanisms are based, suggesting that current interventions may need to be reconsidered.<sup>34,35</sup> Attributing problem gambling solely to a breakdown of impulse control, as the dual-process model suggests, is misleading as it ignores other, more potent aspects of the disorder, including compulsivity and learning deficiencies.<sup>24-26,36</sup>

#### **4. The Promise and Pitfalls of Neuroscience Research on Gambling**

Neuroscience may provide new targeted treatments for problem gambling, methods for identifying those at greater risk of developing a problem gambling disorder or methods to match problem gamblers to more effective treatments. Caution is needed to ensure that the search for neurobiological targets to treat problem gambling does not divert attention from the social drivers of gambling or population based approaches to preventing

gambling-related harm. We should also avoid an exclusive focus on the individual problem gambler at the expense of gambling products as possible targets for intervention.

There was broad agreement that the most promising focus for neuroscience research was to further our understanding of how EGMs work to reinforce their use, and help to design machines and policies on EGMs that minimize the harms that they can cause.

Suggestions included: using neuroscience to develop less harmful or reinforcing machines, and providing rating scales to assess the harmfulness of different gambling products.

A major impediment to gambling research was access to industry products and data. Epidemiological data about the prevalence of gambling, amount of money lost over periods of time, and by whom is critical to developing effective policies for reducing this harm. Governments could require the gambling industry to collect and provide data on gambling income by licensed venues to government agencies that can be used in scientific research. Access to data on EGM characteristics (i.e., game type, reinforcement schedule), would enable researchers to determine how different EGM characteristics are related to gambling behavior and how changing certain aspects of EGMs will alter problematic gambling behaviors.

Neuroscience was seen as providing a stronger rationale for pre-commitment strategies,<sup>33</sup> by acknowledging the impact that increased cognitive and emotional arousal while gambling can have on over-riding more rational decisions about long-term goals. It can be used to argue that gambling, especially using EGMs, is not an ordinary commodity and that the use of these products should be carefully regulated like other addictive products (e.g., alcohol, tobacco). It may also be possible to develop neurocognitive tests to examine the effectiveness of community or clinical messages to reduce or prevent gambling harm.

At the same time, neurobiological explanations of mental illness have been shown to have significant, and often adverse impacts on the attitudes of clinicians and members of the general public towards people with an addiction.<sup>37,38</sup> It could increase stigma by suggesting that problem gamblers are unable to control their behaviour because it is hard wired into their brains. Research has shown that neurogenetic explanations of drug addiction increase the view that addicted individuals have less control over their behaviour and are more dangerous, resulting in greater stigma.<sup>39</sup> Future research will need to address the social impacts of neuroscience on public understanding of problem gambling.

## **5. Using Neuroscience to Influence Policy**

A crucial question is how we ensure that our research findings are heard and acted upon by policy makers. This means ensuring that research is applied and either directly or indirectly focused on policy-relevant topics (e.g., machine design, defining safer gambling, venue environment, person-environment interaction, temperament). To enact change, research must produce results that can be acted on in a timely fashion. This includes clearly linking findings to recommended outcomes. Researchers should also consider multiple methods of disseminating findings to increase the likelihood that they are seen and understood by policymakers.

Researchers and health care professionals need to clearly demonstrate the relevance of problem gambling to society. Gambling disorder is highly comorbid with other mental illnesses. However, gambling is often left out of addiction and mental health treatment and research. There is an urgent need to link with other areas (e.g. alcohol, mental health). At a minimum, we need to incorporate gambling research questions into large longitudinal studies.

Researchers need to broaden the consideration of harm to include low and moderate risk gamblers, as these are the populations on which we can have the most impact and include

individuals who may go on to become more severely disordered gamblers. Broadening awareness of the scale of the gambling problem is essential if we are to demonstrate to policy makers the importance of the issue and the extent of social harm that problem gambling causes. Problem gambling may be easier to ignore if the problem is mistakenly seen as a problem affecting less than 1% of the population that arises from the disordered brains of these gamblers.

It is also important to determine what constitutes sufficient evidence for enacting policy or clinical change. Researchers need to educate and inform policy makers about the various levels of scientific evidence and the characteristics of good quality research. Researchers are best placed to provide the most comprehensive overview of the current evidence that may balance the messages and viewpoints that they receive from other more vested interests (e.g., industry). But they must clearly articulate this evidence in short, easily digestible briefing documents. Neuroscientists and clinicians also need a better understanding of the policy-making process – the various processes and people that evidence needs to go through in order to have an impact and the forces that can shape or interfere with the evidence.

## **6. Conclusions and Future Directions**

Neuroscience insights can help patients make sense of their situation and to take steps to eliminate harmful gambling, while also providing a rationale for psychosocial interventions. There is however a lack of clear evidence of the impact that neurobiological messages have on problem gamblers' behavior and the ways in which they are viewed by the wider society. More research is needed to examine who neurobiologically-informed messages should be aimed at and how they should be delivered. While neuroscience has demonstrated that disordered gamblers have cognitive impairments, environmental and emotional cues drive gambling behaviour as well, emphasising the need to also address these drivers.

A recurring theme in the 2014 meeting was the need to have an explicit understanding of the overarching aim or philosophy in addressing gambling. The language used to describe this can be instructive. Stakeholders often employ the phrase “responsible gambling”, but many stakeholders had different conceptions of who was responsible and what ensuring responsible gambling entails. Responsibility may refer to corporate responsibility, such as the venue or industry, to provide safe gambling environments and products. In contrast, the industry stresses the role of the individual in gambling responsibly. Neuroscience can be used in the service of focusing attention on the minority of individuals at greater risk of developing problem gambling (as supported by industry) or to focus policy attention on the dangers of the products used in gambling. Neuroscience researchers need to ensure that the former does not predominate.

A consistent message from these meetings was the need for interdisciplinary collaborations to reduce the harms of gambling and to ensure that researchers ask appropriate and relevant questions. Inter-disciplinary collaborations broaden our understanding of the issues involved in addressing gambling and improve our interpretation and design of scientific studies. Inter-disciplinarity is also necessary in dealing with complex data sets that require a wide range of research skills. This is a message that researchers, clinicians and funding agencies need to heed as well.

### **Acknowledgements**

This research was supported by funding from Monash University and the Victorian Responsible Gambling Foundation. MY was supported by a National Health and Medical Research Council of Australia Fellowship (#APP1021973) and the David W. Turner Endowment Fund.

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