Addictive Behaviors 71 (2017) 96–103

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Delay discounting and impulsivity traits in young and older gambling disorder patients

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HIGHLIGHTS

- Delay discounting has been linked with gambling severity in previous research.
- We assessed the association between delay discounting, impulsivity and age in patients with gambling disorder.
- No significant differences in delay discounting were identified between younger and older gambling patients.
- Positive correlations between impulsivity traits and delay discounting were found in younger patients.
- Our findings uphold the existence of differing impulsivity mechanisms in younger and older gamblers.

ARTICLE INFO

Article history:
Received 7 December 2016
Received in revised form 23 February 2017
Accepted 4 March 2017
Available online 06 March 2017

Keywords:
Delay discounting
Gambling disorder
Impulsivity
Age
Urgency

ABSTRACT

Background: Impulsivity is understood to be a multidimensional construct involving aspects such as impulsive choice and impulsive traits. Delay discounting, the tendency to place greater value in immediate rewards over larger, long-term rewards, has been associated with maladaptive choices in gambling disorder (GD). Delay discounting is known to evolve with age; though no study to date has evaluated the interactions between impulsivity, GD severity and age in treatment-seeking patients.
Objectives: We aimed to examine whether associations between delay discounting and impulsivity traits differed between younger and older-aged GD patients. Secondly, we sought to untangle the mediating role of impulsivity in determining gambling behavior in these two age groups.
Methods: GD patients ($N = 335$) were evaluated using the UPPS-P Impulsive Behavior Scale and a delay discounting task. Structural Equation Modeling (SEM) was used to explore associations between impulsivity measures and gambling severity in young (18–30 years) and old (31–70) GD patients.
Results: No differences in delay discounting were found between young and old GD patients. Significant correlations between delay discounting and urgency levels (the tendency to act rashly under emotional states) were identified only in the young GD group. Path analyses also revealed both positive and negative urgency to be a mediator of GD severity levels in young GD patients.
Discussion and conclusions: Significant associations between impulsive choice and positive urgency are only present in young gamblers, suggesting that positive urgency influence choice behavior to a greater degree at younger ages. Implications for targeted interventions are discussed.

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http://dx.doi.org/10.1016/j.addbeh.2017.03.001
0306-4603/

1. Introduction

Gambling disorder (GD) is strongly linked with dysfunction across multiple cognitive domains, many of which can be considered in terms of impulsivity (Del Prete et al., 2017; Grant, Odlaug, & Chamberlain, 2016; Mackillop et al., 2014). However, due to the numerous ways by which it can be measured, impulsivity is increasingly understood to be a multidimensional construct (Evenden, 1999; Mackillop et al., 2016). Motor impulsivity is thought to reflect a dysregulation of outward behavior due to decreased inhibitory control. Contrastingly, impulsive choice is characterized as an individual's motivational and decision-making style (e.g. choosing immediate gratification over larger, delayed rewards) (Grant & Chamberlain, 2014). Lastly, impulsive personality traits are thought to be indicative of individual's ability to self-regulate dominant preferences (e.g., to act without deliberation, to give up on tasks) (Cyders & Smith, 2008b).

In recent years, given the heterogeneity of impulsivity models, attempts at developing more inclusive models have been made. For example, the UPPS-P framework identifies five separate impulsivity-related traits. These subscales are: (lack of) premeditation and perseverance, positive and negative urgency, and sensation seeking (Berg, Latzman, Bliwise, & Lilienfeld, 2015). Urgency (emotion-laden impulsivity) has specifically been found to distinguish between treatment-seeking pathological gamblers and controls, and to be linked to affective mechanisms related to problem gambling. This approach allows for a more comprehensive assessment of the associations between impulsive traits and GD (Canale, Vieno, Bowden-Jones, & Billieux, 2017; Canale, Vieno, Griffiths, Rubaltelli, & Santinello, 2015a) than general personality constructs.

Impulsive choice and urgency have been found to be strongly linked to gambling severity, though results on the existence of associations between motor impulsivity and GD severity levels are inconsistent (Brevers et al., 2012; Torres et al., 2013). This three-factor model of impulsivity has been tested in large samples and has been found to properly reflect meaningful and quantitatively discrete domains of impulsivity (Mackillop et al., 2016). Few studies to date, however, have conducted a within-subject comparison of these aspects of impulsivity in GD patients while taking factors such as age into account. Epidemiological research suggests a negative correlation between chronological age and impulsivity in non-clinical populations (Galvan, Hare, Voss, Glover, & Casey, 2007; Steinberg et al., 2008). As a majority of GD patients report first engaging in gambling behavior at a young age (Granero et al., 2013), empirical studies would be useful to gain a better understanding of whether this association between age and choice impulsivity is also present in the GD phenotype.

One of the most widely utilized indices of choice impulsivity is delay discounting (i.e. temporal discounting) (Amlung, Vedelago, Acker, Balodis, & Mackillop, 2017). Delay discounting refers to the subjective devaluation of rewards according to the temporal delay of their receipt, and is commonly measured by presenting subjects with questions in which a choice must be made between a smaller-immediate or a larger-delayed reward (e.g. 'Would you prefer € 31 now or € 85 in 7 days?') (Madden & Bickel, 2009). At each delay, indifference points are plotted and a delay discounting curve is modeled using a hyperbolic function. This function yields the derived parameter, *k*, which corresponds to an individual's discount rate. Larger *k* values indicate steeper discounting and thus, increased choice impulsivity (Kirby, Petry, & Bickel, 1999).

Multiple studies have found that GD patients present higher levels of delay discounting than control subjects (Albein-Urios, Martinez-González, Lozano, & Verdejo-Garcia, 2014; Amlung et al., 2017; Dixon, Marley, & Jacobs, 2003; Krmpotich et al., 2015; Petry, 2001), and that gamblers with steeper delay discounting show greater risk taking, poorer decision-making and higher levels of bet chasing (Kräplin et al., 2014b). Alterations in delay discounting are believed to be underpinned by a hypoactive reward system, which modify reward representations and consequently influence behavior (Madden & Bickel, 2009). Other research, however, has not found a direct association between impulsive choice and GD severity levels, though GD severity has been found to highly correlate with other impulsive traits, such as acting without proper planning (Brevers et al., 2012; Secades-Villa, Martínez-Loredo, Grande-Gosende, & Fernández-Hermida, 2016).

The neural areas associated with impulsivity continue to develop into the young adulthood (Giedd, 2004); therefore, the relationship between delay discounting and impulsive action, such as gambling behavior, could very well be distinct in younger versus older adults. Indeed, studies in young men at increased risk of engaging in HIV risk behaviors and in adolescents with bipolar disorders have identified increased monetary delay discounting to be linked to age-specific risky behavior and improvements in delay tolerance, respectively (Jones & Sullivan, 2016; Urošević, Youngstrom, Collins, Jensen, & Luciana, 2016). Another study specifically examining the mediating effects of decision-making in trait urgency and gambling problems in young adults found age-related differences, with young people tending to act rashly in response to extreme moods and having lower levels of deliberative decision-making (Canale, Vieno, Griffiths, Rubaltelli, & Santinello, 2015b). The sample in this study however only consisted of students aged 16–25 and did not explore how associations between delay discounting and gambling behavior evolved into older adulthood. Moreover, as opposed to the present study, the community-based nature of Canale et al. (2015b), does not allow for determining whether such associations hold true in a clinical setting in which GD severity levels are higher.

With excessive delay discounting identified as a process underlying a wide variety of clinical conditions, increased attention has been given to understanding how individuals' discount rates change with age. Developmental studies point to deliberative decision-making abilities maturing over time, and to emotionally-charged impulsivity (i.e. urgency) being heightened during adolescence compared to adulthood (Cyders & Smith, 2008a). Relatedly, urgency and lack of premeditation significantly correlate with each other in adolescents (Tomko, Prisciandaro, Falls, & Magid, 2016). Studies have found that relying upon decision-making processes largely based on emotion appraisal decreases adolescents ability to delay gratification, and is linked to participation delinquent behaviors including, substance use and risky sex (Wardell, Strang, & Hendershot, 2016; Wolff & Crockett, 2011).

More specifically, changes in discount rates can be interpreted from the perspective of the competing neurobehavioral decision systems theory, which describes a combination of developmental neurological and behavioral processes that account for delay discounting (Koffarnus, Jarmolowicz, Mueller, & Bickel, 2013). Younger gamblers could be less able to successfully inhibit impulsive choices that they would be unlikely to engage in if not for their vulnerability to their particular emotional state (i.e. positive and/or negative urgency). As such, disentangling the decision-making components of GD in the context of age could potentially allow for the development of targeted intervention strategies that focus on emotion regulation and impulsive control strategies (Jiménez-Murcia et al., 2013; Jiménez-Murcia et al., 2015; Kräplin et al., 2014b; Lobo et al., 2014). Recent research has highlighted the possible existence of a GD patient subgroup characterized by young age, early problem gambling onset and more dysfunctional personality traits (Granero et al., 2013); yet little is known on how choice impulsivity factors into the these age-divided subgroups.

The purpose of this research was two-fold. Our first aim was to examine whether the associations between delay discounting and impulsivity varied between younger and older treatment-seeking GD patients. Our second aim was to identify the mediating role of impulsivity factors between age and GD severity levels by means of path analysis. Being that empirically derived *k* values from delay-discounting tasks are context sensitive and are not constant across various settings (Dixon, Jacobs, & Sanders, 2006), we did not hypothesize that significant differences in choice impulsivity would exist between younger and older GD