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Research paper

Increased reward-oriented impulsivity in older bipolar patients: A preliminary study

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ABSTRACT

Objective: Impulsivity is a well-established trait of bipolar disorder (BD) that persists across mood phases. It is, however, still unknown whether, in BD, impulsivity remains stable or varies in intensity over the lifespan. This cross-sectional study compared impulsive behavior in older euthymic BD patients and healthy individuals using a range of self-rating and behavioral measures of impulsivity.

Methods: 28 BD patients (56.07 ± 4.08 years, 16 women) and 15 healthy controls (HC; 55.1 ± 3.95 years, 6 women) were administered the Barratt Impulsivity Scale (BIS) and selected tasks of the Cambridge Neuropsychological Test Automated Batter (CANTAB) reflecting impulsivity. Multivariate analysis of variance controlled for age compared impulsivity measures across BD and HC.

Results: BD patients displayed poor decision making, risk taking, and increased delay aversion. Other measures of impulsivity such as response inhibition, sustained cognitive control, and BIS scores were, overall, comparable between BD and HC.

Conclusions: These preliminary findings suggest that, in BD, aspects of impulsivity related to reward-based decision making persist into late adulthood. Large scale, longitudinal studies are needed to evaluate the relationship of age to impulsivity over time, and explore the link between impulsivity and illness progression in elderly individuals with BD.

1. Objective

Mental illness affects 20% of individuals aged 55 years or older, with the most prevalent conditions including bipolar disorder (BD), depression, and anxiety (CDC, 2008). In spite of the growing body of research highlighting the link between aging, mood disorders and cognitive impairment (Almeida et al., 2016; Fung et al., 2016), chronic health issues, (Chapman et al., 2005), and earlier mortality (Mezuk and Gallo, 2013) in adults with BD, mood disorders are still under-recognized and undertreated among older individuals.

Of particular relevance in BD research is the construct of impulsivity, which is an important predictor of poor clinical outcomes (Swann et al., 2009a) and risk-taking behaviors (Chamorro et al., 2012). A large body of research has shown that BD is characterized by reduced impulse control (Ernst et al., 2004; Johnson, 2005), reflected by poor reward-related decision making (Linke et al., 2012; Nusslock et al., 2012), inefficient money management skills (Cheema et al., 2015), and self-injurious behaviors (Simon et al., 2007). Current literature has, however, focused on young adults with BD and no study has explored whether, in older adults with BD, impulsivity is increased or comparable to that of elderly individuals with no lifetime history of mental illness.

Aging affects some facets of impulsivity more than others. A study using a laboratory-based behavioral measure of impulsivity (Matching-Familiar-Figures Test) indicated that elderly healthy adults (mean age:70.6 years) were more impulsive (in the form of reduced accuracy and faster response times) than young individuals (mean age: 21.9 years) (Coyne et al., 1978). Another large sample study (n = 2725) using a well-established self-rating measure of impulsivity (Behavioral Inhibition System and Behavioral Activation System; Carver and White, 1994) found that older individuals were less impulsive on self-rating behavioral inhibition and activation scales than the younger groups (Jorm et al., 1998). It has been suggested that, while dysfunctional impulsivity (e.g. tendency to make risky decisions) generally increases over time, functional impulsivity (e.g. tendency to make quick decisions with likely personal gain) is quite stable over the lifespan (Morales-

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Vives and Vigil-Colet, 2012). A study examining delay discounting showed that older adults discount monetary rewards at a slower rate than younger adults, which may reflect better self-control and an increased ability to appreciate delayed rewards (Jimura et al., 2011). Indeed, whereas children favor instant rewards, older adults focus on future, greater rewards (Drobetz et al., 2012). However, decreased life expectancy may counteract this trend, as individuals realize they have less time to benefit from delayed rewards. Indeed, a study on delay of gratification in older adults aged 60–94 years concluded that individuals aged over 80 years were overall more impulsive than those aged 60–69 years (Forstmeier et al., 2011). These results highlight the multidimensional nature of impulsivity (Meda et al., 2009) and the need for including a variety of measures, e.g. self-rated and behavioral measures, to study this concept.

With regard to impulsivity in BD, while clinical studies use self-rated measures of impulsivity (e.g. Barratt Impulsivity Scale), neuropsychological studies (Ethridge et al., 2014; Powers et al., 2013) view impulsivity as related to poor response inhibition and test it through tasks of the Go/No-Go type (Chamberlain and Sahakian, 2007), and measures of reward sensitivity, e.g. gambling and decision making tasks (Bauer et al., 2015; Christodoulou et al., 2006; Mason et al., 2014). It is noteworthy to mention that inhibitory control plays a critical role a number of important mental processes such as memory, attention, and affective processing (Bechara, 2005; Salgado et al., 2009). For instance, highly impulsive individuals typically struggle to inhibit prepotent responses to distracting stimuli, and make a high number of commission errors (Salgado et al., 2009). Further, the few studies on sustained attention and affective processing (Leibenluft et al., 2007; Walshaw et al., 2010) show that BD patients display impulsive, generally mood-congruent, responses to emotional stimuli, e.g. faster reaction times in response to positive *vs* negative stimuli in manic BD patients (Murphy et al., 1999; Roiser et al., 2009). It could be argued that self-rating impulsivity measures are more likely to capture trait-related aspects of impulsivity than laboratory-based tasks (Lai et al., 2011). However, there is evidence that impulsive responses to positive or negative stimuli acquired during affective episodes are independent from individuals' current mood state, and persist during the euthymic states (Linke et al., 2011). Further, a longitudinal study on cognitive changes in unipolar and bipolar patients showed that only individuals with past severe depression displayed cognitive deficits (Sarapas et al., 2012). This is in line with previous evidence that cognitive performance is not strongly affected by current mood state (Gruber et al., 2007). This may mean that, when examining behavioral measures of impulsivity, the distinction between "trait" and "state-related" impulsivity may be more blurred than previously believed. Focusing on the multidimensional construct of impulsivity may, therefore, be more informative than comparing state vs trait impulsivity.

Our previous work using laboratory-based tasks of impulsivity in adult BD patients with and without a lifetime history of substance use found a trend suggesting a relationship between a lifetime history of substance use and increased propensity to risk-taking on the Cambridge Gambling Task (Cambridge Neuropsychological Test Automated Battery - CANTAB; Bauer et al., 2015). In a separate sample of euthymic BD patients we found that the quality of decision making on the CGT was reduced in medicated adults with BD when compared to healthy controls (Wu et al., 2016). Reduced reward-related decision making may, therefore, persist in euthymic periods, regardless of the patients' medication status.

The literature linking impulsivity, aging and BD is unfortunately limited and somewhat contradictory. Two longitudinal studies showed a decline in performance on the Mini-Mental State Examination (Dhingra and Rabins, 1991), and the Dementia Rating Scale (Gildengers et al., 2009). Three studies did not find evidence of significant cognitive decline in old BD patients when compared to HC over a period of 2–5 years (Depp et al., 2008; Schouws et al., 2016, 2012). Notably, Depp et al. (2008) reported that, in the BD sample, there was significant intra-individual cognitive variability between time points. Further, this variability did not appear to be related to baseline measures or changes in the severity of affective symptoms (Depp et al., 2008). Another study showed that elderly BD displayed a more pronounced slowing in processing speed compared to healthy elderly individuals (Lewandowski et al., 2014). Taken together these finding indicate that intra-individual variability in cognitive performance is a core feature of aging. This may be due to age-related alterations in cognitive abilities required for decision making, e.g. some individuals may be slow in learning to associate high-value tokens and low gains. Since the majority of these studies used summary or total cognitive scores and did not report results for specific cognitive domains (e.g. attention, executive functions), the interpretation of current findings with regard to impulsivity is limited. Further, to date, "neuropsychological" aspects of impulsivity such as inhibitory control and decision making have not been examined in an older BD population.

In sum, impulsive tendencies may contribute to risky behaviors (e.g. suicide) and poor clinical outcomes in BD. Aging is characterized by cognitive changes and increased exposure to stressful physical and environmental changes. In BD, aging could, therefore, impair decision-making, and lead to an even higher risk for maladaptive behaviors. Given the potential link between aging, impulsivity, and mental health, additional work is needed to characterize the performance of elderly BD patients on various impulsivity facets. To address this issue we conducted a cross-sectional study to compare a range of behavioral and self-rating measures of impulsivity in individuals aged 50 years and above to that of elderly individuals with no lifetime history of mental illness. Our working hypothesis was that older BD patients would display increased self-rated and behavioral impulsivity compared to older healthy controls with no lifetime history of mental illness.

2. Methods

2.1. Sample and psychiatric assessment

The sample included 15 healthy controls (HC; M ± SD: 55.1 ± 3.95 years, 6 females) and 28 adult BD patients (M ± SD: 56.07 ± 4.08 years, 16 women) (see Table 1). Participants were recruited from inpatient and outpatient clinics of the University of North Carolina at Chapel Hill (UNC) (n = 21:10HC, 11BD) and the University of Texas Health Science Center at Houston (UT) (n = 22: 5HC, 17BD). HC were recruited via oral presentations and flyers. Specific inclusion criteria for HC were: no current or lifetime axis I psychiatric diagnosis, no lifetime history of substance use disorder, no previous history of neurologic disorders including head injury with loss of consciousness for any period of time, pregnancy, family history of hereditary neurologic disorder, psychiatric disorder in first-degree relatives, use of any prescribed psychiatric medication in their lifetimes. Participants were excluded if they had any current serious medical problems including cardiovascular and neurological disorders. Medication was not an exclusion criterion. The diagnosis of BD among patients were ascertained by the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders Axis I (SCID I) (First et al., 2012). The SCID was administered to all participants by an independent psychiatrist or trained research assistant. The clinical interview also included the Montgomery-Åsberg Depression Rating Scale (MADRS) (Montgomery and Asberg, 1979) and the Young Mania Rating Scale (YMRS) (Young et al., 1978). All participants were administered the Full Scale IQ (WASI) (Wechsler, 1999) which is a measure of premorbid intellectual quotient (IQ). The study protocol was approved by the local Institutional Review boards at both recruitment sites and informed consent was obtained from all the participants.