Impulsivity and risk-taking in co-occurring psychotic disorders and substance abuse

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ABSTRACT

Impulsivity is a risk-factor associated with substance use disorders. On paper-and-pencil measures, people with comorbid psychotic disorders and substance abuse have been shown to be more impulsive than their non-using counterparts. However, there has been little research on the behavioral components that, collectively, define the construct of impulsivity, which have been identified as: temporal discounting, risk taking, underestimating time, and failure to inhibit extraneous responding. This study compared people with psychotic disorders who did and did not use cocaine on behavioral measures of these components. One group (COC-now) had a positive urine drug screen (UDS) for cocaine (N = 20). A second group (COC-past) had a negative UDS, but a positive cocaine history (N = 20). Finally, the third group (control) had no history of cocaine use (N = 20). Those with a current or past history of cocaine use engaged in more risk-taking behaviors and seemed to be less affected by anticipated loss and more attuned to monetary gains. However, contrary to our hypothesis, patients in the COC-now group selected larger, delayed rewards over the smaller, immediate rewards. Performance on the immediate/delay task also suggested greater attentiveness to the magnitude of the monetary reward for patients with a positive UDS.

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1. Introduction

People with a diagnosis of schizophrenia spectrum disorders have higher rates of substance use than the general population or groups characterized by other psychiatric disorders, ranging from 33% to 50% (Blanchard et al., 2000). Of particular concern is abuse and dependence of psychostimulants. Several studies have found that the frequency of cocaine use among people with schizophrenia was 27% higher than use of other substances (Sevy et al., 1990; Shaner et al., 1995; Genata et al., 2001). Cocaine use among people with psychotic disorders leads to poorer treatment outcomes, more severe psychiatric symptoms (including positive symptoms), increased rates of treatment noncompliance, violence, HIV infection, homelessness and higher medical costs (Genata et al., 2001). Given the association of schizophrenia spectrum disorders with substance dependence in general, and psychostimulant use in particular, it is important to better understand the psychological mechanisms that predispose to drug use. One candidate mechanism is impulsivity.

Few studies have examined impulsivity in clinical populations (Kjome et al., 2010) and the neural correlates of impulsivity in people with schizophrenia are not well understood (Kaladjian et al., 2010). Even though impulsivity has been found to characterize people with

substance use disorders alone (Hollander and Rosen, 2000; Whiteside and Lynam, 2001), this construct is not well understood and often is used to refer to various and separable response tendencies (Dervaux et al., 2001). Therefore, this study adopted a multivariate approach to examine impulsivity in people with both psychotic disorders and substance dependence. Specifically, we assessed the following components: a) temporal discounting (whether a person chooses smaller, immediate rewards over larger, delayed rewards); b) risk taking (probability people who engage in risk-taking behaviors are concerned with the risk of injury versus the potential for rewards); c) underestimating time and; d) failure to inhibit extraneous responding (responding prematurely or having the inability to withhold a response). These measures were chosen based on published reports that substance abusers in the general population tend to: 1) discount the value of delayed rewards (Moeller et al., 2001; Petry, 2001; Holt et al., 2003; Murray et al., 2003) and tend to choose the smaller, more immediate alternatives compared to the larger, delayed reward-tendencies also found in animal studies of substance dependence (Madden et al., 1997; Vuchinich and Simpson, 1998; Kirby, et al., 1999; Crean et al., 2000; Odum et al., 2000; Moeller, et al., 2001; Petry, 2001; Holt, et al., 2003; Murray, et al., 2003); 2) engage in more risk-taking behaviors (Zuckerman et al., 1990; DiClimente, 1993; Lejuez et al., 2002); 3) underestimate the span of time (White et al., 1994; Zimbardo et al., 1997; 4) fail to inhibit extraneous responding (Fillmore and Rush, 2002). In summary, we examined whether people with psychotic disorders who currently use cocaine relative to patients who only have a history of cocaine or no use at all are more

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impulsive, operationally defined as discounting delayed rewards, choosing riskier alternatives, underestimating the span of time and/or failing to inhibit extraneous responding.

2. Methods

2.1. Participants

Sixty patients (33 men and 27 women) with either a diagnosis of either schizophrenia, schizoaffective or psychosis disorders between the ages of 18–60 ($M = 38.1$, $SD = 9.88$) participated. Table 1 summarizes the demographic and diagnostic information of participants. See Table 2 for psychosocial variables for the subjects. There were no significant differences between the three groups on these variables. Urine drug screens (UDS), collected upon admission to the hospital, screened for alcohol, opiates, heroin, cocaine, barbituates, amphetamines, cannabis, sedatives, hallucinogens and methadone. Based on their UDS and self-reported history of substance abuse, obtained through the Addiction Severity Index (McLellan et al., 1992), they were assigned to one of three groups. Group 1 (COC-now) had a positive UDS for cocaine and a self-reported history of cocaine abuse; Group 2 (COC-past) had a negative UDS for cocaine and other substances, but had a self-reported history of cocaine abuse; Group 3 (control) had a negative UDS and no history of substance abuse. Participants in all groups met diagnostic criteria for schizophrenia, schizoaffective disorder or psychotic disorder. All participants were taking antipsychotic medications. In the COC-now group patients were taking the following medications: Clozaril = 1; other atypical antipsychotics = 17; typical antipsychotics = 2. In the COC-past group: Clozaril = 1; other atypical antipsychotics = 15; typical antipsychotics = 4. In the control group: Clozaril = 5; other atypical antipsychotics = 11; typical antipsychotics = 4. All participants were clinically stabilized and none had active withdrawal symptoms. The exclusion criteria were: involuntary hospitalization, UDS for cocaine (COC-past and control); significant medical disorders sufficiently severe to require medical care while a patient on the unit; an IQ score less than 70 (measured by the Kaufman Brief Intelligence Test (Kaufman and Kaufman, 1990) or current suicidal ideation indicated during the administration of Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) (First et al., 1997).

2.2. Procedures

Patients were referred by the acute psychiatry unit. Two screening instruments were used to determine eligibility to participate: the SCID and the Kaufman Brief Intelligence Test. On the morning of the first day of testing, participants completed three paper and pencil measures: the Addiction Severity Index (ASI), the Barratt Impulsiveness Scale-11 (BIS-11) (Patton et al., 1995) and the Cocaine Selective Severity Assessment (CSSA) (Kampman, et al., 2001). The BIS-11 measured three components of impulsivity: ability to plan for the future (future planning), tendency to act without thinking (motor impulsivity) and tendency to make quick cognitive decisions.

Table 1
Demographic, intake urinalysis and drug use characteristics of the participants.

Variable		Experimental group		
		Positive use and history	Negative use and positive history	Negative use and negative history
n		20	20	20
Age	Mean	38.75	35.95	39.85
	SD	(10.65)	(8.57)	(10.42)
Gender				
	Male	10 (50%)	13 (65%)	10 (50%)
	Female	10 (50%)	7 (35%)	10 (50%)
Race/ethnic				
	Black	14 (70%)	13 (65%)	13 (65%)
	Caucasian	4 (20%)	5 (25%)	4 (20%)
	Hispanic	2 (10%)	2 (10%)	2 (10%)
	Asian	0	0	0
Intake urinalysis				
	Cocaine	20 (100%)	0	0
	Cannabis	3 (15%)	4 (20%)	1 (5%)
	Heroin	5 (25%)	2 (10%)	0
	Tranquilizer	2 (10%)	0	0
	Barbiturates	5 (25%)	0	0
	Methadone	1 (5%)	0	0
Diagnosis				
	Schizophrenia	14 (20%)	8 (40%)	12 (60%)
	Schizoaffective	2 (10%)	7 (35%)	3 (15%)
	Psychosis NOS	3 (15%)	4 (20%)	4 (20%)
	Substance Abuse	20 (100%)	0	0
	Substance Dep.	20 (100%0	0	0

Table 2
Psychosocial characteristics of participants in each experimental group.

Variable	Experimental group		
	Positive use and history	Negative use and positive history	Negative use and negative history
n	20	20	20
IQ			
Mean	82.95	80.70	78.95
SD	(1.54)	(8.10)	(7.20)
Job (3 yrs.)			
Employed	8 (40%)	9 (45%)	3 (15%)
Unemployed	12 (60%)	11 (55%)	17 (85%)
Longest job			
1–10 years	16 (80%)	20 (100%)	19 (95%)
10 or more	4 (20%)	n.a.	1 (5%)
Marital status			
Single	5 (25%)	6 (30%)	2 (10%)
Never married	15 (75%)	13 (65%)	15 (75%)
Married	n.a.	1 (5%)	3 (15%)
Living situation			
Family member	11 (55%)	8 (40%)	9 (45%)
Alone	7 (35%)	7 (35%)	2 (10%)
Controlled living	2 (10%)	5 (25%)	9 (45%)
Hospitalized			
0–10 times	13 (65%)	12 (60%)	10 (50%)
10 or more	7 (35%)	8 (40 %)	10 (50%)

Two computerized tasks were administered in the afternoon of the first day and included the Behavioral Measure of Risk Taking (BART) and the Single Key Impulsivity Paradigm (SKIP). On the second day of testing, participants completed three computer programs: the Two Choice Impulsivity Paradigm (TCIP), the Time Paradigm (TIME) and the GoStop Impulsivity Paradigm (GoStop). Each of these laboratory measures of impulsivity is described below.

2.3. Measures

.2.3.1. Behavioral measure of risk taking: the Balloon Analogue Risk Task (BART) (Lejuez et al., 2002)

On each trial, a small balloon and a balloon pump are displayed on the computer screen along with a counter showing the total amount of money earned. The participant can inflate the balloon and earn $0.05 cents by pressing the mouse button. Five cents is added to the total amount earned if the inflation does not cause the balloon to explode. If the participant inflates the balloon to the point of explosion by clicking the balloon pump too frequently, the participant loses all the money earned. At anytime, the participant can choose to collect all the money earned, and therefore reduce the risk of losing the accumulated earnings, by clicking the collect money button. After the participant's balloon either explodes or the money is transferred to the accumulated total, a new balloon appears. There are a total of 30 trials.

.2.3.2. Laboratory behavioral measures of impulsivity (Dougherty et al., 2002)

This battery includes four computerized behavioral tasks: GoStop impulsivity paradigm, single key impulsivity paradigm, time paradigm and two choice impulsivity paradigm.

a. GoStop Impulsivity Task — the GoStop task measures response inhibition. Participants are instructed to pay attention and remember numbers that appear on the computer monitor. On each trial, they are presented with a five digit black number against a white background. The set of numbers flashes once for two seconds on the screen. After the presentation of the first numbers another set of numbers appears. If the second set matches the first set (go signal), the participant has to click the left mouse button while the matching number is still visible (400 ms) to be rewarded. If the numbers do not match, the participant has to refrain from responding. However, on occasion, the second matching number turns red (stop signal). If this occurs, the participant has to withhold responding. Stop-signal color change happens after different intervals within 400 ms of a go signal. These stop signals adjust according to task performance: interval lengths decrease following failure to inhibit and increase following successful inhibition. Stop-signals intervals continue to adjust until the participant is able to inhibit at least 50% of trails. Once they meet the 50% criterion, the stop response time is calculated by subtracting the stop-signal delay from the go reaction time. Longer stop reaction time values reflect behavioral disinhibition (Reynolds et al., 2007).

b. Single Key Impulsivity Task — the SKIP task measures response inhibition. On this task, participants can press the button rapidly or slowly, but there are no temporal cues signaling when to press the button. The longer the delay between each response, the greater number of points earned. Response inhibition is the average inter-response time (IRT). IRT is the length of time between two consecutive responses.