The Relationship between Risk-Taking, Substance Abuse and Aggression in Schizophrenia

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Abstract

Substance abuse and aggression are significant problems in individuals with schizophrenia. Studies on populations other than schizophrenia have shown that people who engage in risk-taking behaviors are also more likely to abuse substances and engage in aggressive behaviors. In schizophrenia, however, it is unknown whether risk-taking traits underlie the abuse of substances and aggressive behavior, or if there are other underlying mechanisms that are driving the addictive and aggressive behaviors (e.g., psychosis. Identifying who are at risk for substance abuse and aggressive behavior can be beneficial for the individual and public. Our results showed that: 1) schizophrenia patients were more aggressive than healthy controls, but exhibited attenuated risk-taking as measured by the Balloon Analogue Risk Task; 2) only hostile aggression was related to risk-taking in the schizophrenia population; and, 3) patients with less psychopathology showed similar risk-taking performance to the controls. Our regression analysis demonstrated how risk-taking propensity is a decent predictor of aggressive behavior, in particular hostility. Most importantly, this study provides further evidence that schizophrenia patients exhibit a distinct pattern of risk-taking that may be modulated by their level of psychopathological symptoms, in particular their positive symptomatology.

Introduction

Substance abuse and aggression are significant problems in individuals with schizophrenia. These individuals are 2-4 times more likely to be aggressive than people in the general population (Walsh et al., 2002), a risk that increases 8-fold with co-morbid substance abuse (Swanson et al., 2006) with 40 to 50% of patients suffering from a substance use disorder (Arkerele & Levin, 2002). These behaviors may have major implications on social functioning, such as poor treatment prognosis and increased number of hospitalizations (Tandon et al., 2008). Thus, being able to identify those who are at risk for substance abuse and aggressive behavior may have substantial benefits to both the individual and to the public

Despite extensive research on the topic, it remains unclear who among people with schizophrenia are more likely to be both substance abusers and aggressive. Studies on populations other than schizophrenia have shown that people who engage in risk-taking behaviors – activities that can be considered dangerous – are also more likely to abuse substances and engage in aggressive behaviors (Luejez et al, 2004). In schizophrenia, however, it is unknown whether risk-taking traits underlie the abuse of substances and aggressive behavior, or if there are other underlying mechanisms that are driving the addictive and aggressive behaviors (e.g., psychosis). Improving our understanding of the relationship between risk-taking, substance abuse and aggression in people with schizophrenia may inform novel treatments that target the aggression and substance abuse related symptoms. This knowledge may help to create treatment that not only targets the pathology, but also conforms to the specific way the patients asses risk as

they engage in substance abuse and aggression. Improvement in the overall efficacy of treatment may have a significant impact on their social functioning.

Schizophrenia

Schizophrenia is a severe mental disorder that affects 1.1% of the population - approximately 3.2 million Americans and 24 million people worldwide (National Institute of Mental Health, 2009; World Health Organization, 2008). The disorder is characterized by a disintegration of cognitive and emotional processes that affect the individual's behavior. The diagnostic features of schizophrenia are conceptualized into three broad categories: positive, negative and cognitive symptoms (Diagnostic Statistical Manual-IV-Text Revised, 2000). The positive symptoms include distortions in thoughts of reality (delusions), distortions in perceptions of stimuli (hallucinations), disorganized speech and thought disorder. Negative symptoms include flat affect, problems in producing speech and thought (alogia), lack of pleasure in everyday life (anhedonia), and lack of motivation (avolition). Cognitive symptoms include poor executive functioning (impaired ability to understand information and use it to make decisions) and trouble focusing and paying attention. These deteriorating symptoms may in some cases contribute to poor quality of life, functional disability and poor social functioning.

Cognitive Deficits: Decision-Making and Reward Processing

Schizophrenia patients suffer deficits across many areas of cognitive functioning; 90% of patients suffer deficits in at least one area of cognition (Kern & Horan, 2010). Research has shown that patients suffer deficits especially in areas of decision-making and reward processing (Kester et al., 2006; Gold et al., 2008). Deficits in decision-

making refer to failure to make rational optimal choices (Franken & Muris, 2005), and reward processing involves the valuing of a positive choice over a neutral or aversive consequence (Gold et al., 2008). Patients with impaired reward-based decision-making often pursue actions that bring some kind of immediate reward, despite severe long-term consequences such as the loss of job, home and family. (Franken & Muris, 2005).

Both decision-making and reward processing are mediated through the orbital frontal cortex (OFC) (Rolls, 2000), which is located in the prefrontal lobe. In patients with schizophrenia, structural abnormalities in the OFC have been related to poor performance on decision-making tasks (Kester et al., 2006; Shurman, Horan & Neuchterlein, 2005). The ability to make an educated decision – by assessing the value of a reward over punishment – is a central feature in the evaluation of a risky situation. When assessed with the Iowa Gambling Task, a task intended to simulate real-life decision-making processes with the evaluation of reward and punishment, schizophrenia patients have consistently performed significantly worse than controls (Kester et al. 2006; Shurman, Horan & Neuchterlein, 2005). The pattern of performance shows how patients repeatedly chose disadvantageous choices and failed to adjust their behavior to avoid punishment in the future. This is consistent with Bechara et al.'s (1994) interpretation that patients with OFC abnormalities suffer from "myopia for the future," responding to the immediate reinforces properties of the reward while failing to adjust their behavior to the punishments strategies.

In a review paper, Gold et al. (2008) suggest that impairment in decision-making processes in schizophrenia patients influence their ability to fully represent the value of different choices and compromises reward processing (Gold et al. 2008). In studies that

examines whether a person will have a preference for smaller immediate rewards over larger delayed rewards, schizophrenia patients have been found to discount value of future rewards more steeply than healthy subjects and chose smaller immediate rewards over larger delayed rewards (Heerey et al. 2007). This may suggest that patients with schizophrenia who discount rewards fail to fully weigh risk of losses when faced with potential gains (Heerey et al., 2008).

Risk-Taking

Risk taking is directly related to decision-making and reward processing. Individuals who are high-risk takers are more likely to have impaired decision-making and reward-processing systems. Risk-taking involves some probability of danger and also provides an opportunity for rewards (Whiteside & Lynam, 2003). Risk-taking behaviors are those that simultaneously involve high potential for danger or punishment and opportunity to obtain reward (Lejuez et al., 2002). It is possible that some people who engage in risk-taking behaviors are less concerned about the risk of injury than the potential rewards associated with the behaviors, and prefer immediate rewards as they engage in discounting.

Several studies have shown a high correlation between risk taking propensity and substance abuse in both adolescents and adults (DiClemente,1993; Lejuez et al., 2005). Increased risk-taking – assessed by the balloon analogue risk task (BART), a computerized measure of risk-taking – is significantly related to behaviors such as alcohol and drug use, cigarette smoking, gambling, theft, aggression in both adolescents (Aklin, Luejez, Zvolensky, Kahler & Gwadz, 2005) and adult samples (Luejez, Simmons,

Aklin, Daughters & Dvir, 2004). Research has also shown that those more likely to engage in high-risk behavior tend to discount the value of delayed rewards at higher rate than other groups (Murray et al., 2003). For example, Petry and Casarrela (1999) found that substance abusers with gambling problems discounted delayed rewards more steeply than substance abusers without gambling problems and a healthy control population; suggesting discounting of rewards as an important behavioral dimension of risk-taking.

Risk-taking and Aggression

Another aspect that underlies risk-taking is impulsivity. Individuals who engage in risky behaviors are often defined as impulsive, which involve a lack of control over one's behavior with a tendency to act without thinking of the consequences. Impulsive individuals have difficulty in inhibiting responses and prefer immediate rewards to delayed rewards (Franken & Muris, 2005). Both, lack of control and steep discounting refer to different mechanism of impulsivity. Impulsivity has previously been considered to have a significant role in criminal, antisocial and aggressive acts (Eysenck & Gudjonson 1989; Krakowski, 2005). Research on psychopathic individuals (characterized by poor impulse control and aggressiveness) suggest that these individuals exhibit a significant tendency to engage in high-risk activities, such as violent behaviors, institutional misconduct, incarcerations and risky sexual activity (Buffington-Vollum, Edens, Johnson & Johnson, 2002). In a schizophrenia population, Kumari (2009) found that schizophrenia individuals with a high propensity for repetitive violence showed higher impulsivity levels, as measured by an impulsiveness scale, than schizophrenia patients without a history of violent behaviors and controls. The high rates of aggression and engaging in risky behaviors among a psychiatric population may contribute to a

negative social outcome in these individuals, such as incarceration, hospitalization, substance abuse and overall poor quality of life.

Overall, as discussed above, there is a strong body of literature that links risk-taking with aggression and substance abuse. There is empirical evidence on the prevalence of the relationship between these factors and negative outcomes in people with schizophrenia, a population at higher risk for aggressive behavior and substance abuse than the general population (Walsh et al,. 2002;Arkerele & Levin, 2002). Considering the negative psychological, legal and interpersonal consequences associated with high-risk behaviors (Luejez et al., 2004), it is important to further our understanding of the relationship between risk-taking traits and substance abuse and aggression in people with schizophrenia. However, to our knowledge, limited research has specifically examined this relationship in schizophrenia patients. As a matter of fact, we know very little about the underlying mechanism of risk-taking in schizophrenia. It remains unclear whether subgroups of "riskier" individuals are more likely to engage in substance abuse and aggression, or if other underlying mechanisms, such as psychosis, are driving these behaviors. The only literature that examines some form of risk-taking in schizophrenia patients focuses on impulsivity (Kumari et al. 2009; Hoptman et al. 2004). More importantly, these studies assessed impulsivity and risk-taking behaviors with self- report instruments. This has been shown to be problematic as individuals may not report actual risky behaviors out of fear of negative consequences (Luejez et al., 2002). There is a need for studies that explore this relationship using valid and more reliable behavioral measures that involve actual risk behavior.

The objective of the current study was to assess risk-taking propensity in schizophrenia patients and in healthy controls using a laboratory based measures that involve actual risky behaviors (the BART) and examine the association with substance abuse, aggression, and social functioning. Being able to identify those who are at risk for substance abuse and aggressive tendencies may have substantial benefits to individuals with schizophrenia. For the study we hypothesized:

(1) Increased risk-taking behavior (as measured by the BART) will be associated with substance abuse and poor social outcome in both experimental groups

(2) Risk-taking behavior will be associated with aggressive behavior

(3) Individuals with schizophrenia will show lower levels of risk taking behavior than controls.

Methods

1. Participants

Participants included 32 Schizophrenia patients and 10 healthy volunteers. Individuals diagnosed with schizophrenia disorder were recruited from outpatient mental health clinics from Bellevue Hospital Center. The diagnosis of schizophrenia was confirmed using the Structured Clinical Interview for DSM-IV (SCID) (Sptizer et al., 1992). The 10 healthy controls were recruited as part of a Schizophrenia study recruited via advertisements placed on www.craigslist.com (a community classifieds and forums Website) and fliers posted at New York University Medical Center and Bellevue Hospital Center.

The inclusion criteria required all participants to be between 18 and 55 years of age and to have English as their first language. The exclusion criteria for volunteers disqualified any participant with a family history of psychosis and or any lifetime Axis I diagnosis (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision, 2000). Volunteers were paid $10 per hour for their participation and were treated in accordance with the "Ethical Principles of Psychologist and Code of Conduct" (American Psychological Association, 1992). All participants provided written informed consent.

Overall, 42 participants completed all baseline assessments. Schizophrenia patients (20 male and 12 females) had average mean age of 43.09 (sd=9.2) and a mean of 12.81 years in education. 53% of patients were African American, 31% Caucasian, and

16% other race. Healthy Controls (7 male and 3 female) had an average mean age of 37 (sd=9.5) and a mean of 14.80 years of education; where 60% were African American, 20% Asian and 20% other race.

2.Measures

2.1 To assess Risk-taking

Balloon Analog Risk Task (BART; Luejez et al.,2002). To asses risk taking, we administered the BART, which has successfully used to describe currently risk behaviors in adults (Luejez et al., 2002, 2003). It is a computerized experimental measure of propensity towards risk taking behavior. At the start of the BART, participants followed instructions on the screen that clearly explained the procedure of the task. They are required to sequentially inflate a balloon that either will increase in size or explode. The game displayed four items: a small balloon accompanied by a balloon pump labeled "Press to Pump the balloon," a reset button labeled "Press to Collect $$$," a "Total Earned" display and a second display labeled "Last Balloon" that listed the money earned on the last balloon. A larger balloon is associated with increased risk for explosion, as well as increased reward. The participant earns $0.05 per "pump" and can "cash out", stop pumping the balloon, at any time and click the "Collect $$$" button and the earned money is transferred into a "bank". When balloons explode, all the money in the temporary bank is lost, and the next deflated balloon appears on the screen. A total of 30 balloons (i.e. trials) are completed. If the balloon explodes, s/he loses the earned money (not the money in the bank). It is important to note that participants were given no precise information about the probability of explosion. Modeling real-world situations in which

excessive risk often produces diminishing returns and increasing threats to one's health and safety, each successive pump on a particular balloon trial (a) increased the amount to be lost due to an explosion and (b) decreased the relative gain of any additional pump.

2.2 Assessment of Aggression

Life History of Aggression (LHA; Coccaro, Berman & Kavoussi, 1997). A semi-structured interview containing 11-items that assess a person's aggressive and antisocial behavior in the past. The scale is comprised of three subscales: physical aggression, antisocial behavior, and self-directed aggression. Higher scores indicates higher levels of historical aggression.

Aggression Questionnaire (AQ; Buss & Perry, 1992). An inventory of 29 self-reported items assessing aggressive tendencies. Its questions are in four domains: physical aggression, verbal aggression, anger, and hostility. Higher scores indicated higher levels of aggression.

2.3 Assessment of Substance use and poor social functioning

Diagnostic Interview of Genetic Studies (DIGS) was used to assess lifetime and current psychiatric diagnoses. It includes assessments for depression/dysthymia, mania/hypomania, alcohol/other drug abuse or dependence, suicidal behavior, violence, pathological gambling, antisocial personality disorder, and Global Assessment of Functioning.

Positive and Negative Syndrome Scale (PANSS) is a 30 item instrument organized into five scales: Negative, Positive, Dysphoric Mood, Activation, and Autistic

Preoccupation. It evaluates the presence/absence and severity of positive, negative and general psychopathology of schizophrenia.

World Health Quality of Life (WHOQOL) is a 26-item instrument that measures five conceptual domains of quality of life: material and physical well-being, relationships with other people, social, community and civic activities, personal development and fulfillment, and recreation. For the purpose of this study we only looked at the total score of the WHOQOL as a surrogate measure for overall level of social functioning.

3. Procedures

Participants were part of a larger study examining the relationship of schizophrenia symptoms and paternal age. Study procedures were approved by the New York University School of Medicine Institutional Review Board. All participants completed a standardized informed consent process with trained recruiters and were advised that a Federal Certificate of Confidentiality would protect their information. Participants completed the diagnostic interview first, and thereafter completed the remaining baseline assessments. The BART was administered last in the same clinical testing room as the other interviews.

Results

Descriptive Statistic

Clinical Measures:

Using *t*-test statistics, our analyses indicate that schizophrenia patients reported significantly higher levels of life history of aggression than controls (M=18.8, SD=11.1 and M=7.1, SD=5.8, respectively, $p < 0.05$), as measured with the LHA scale. Schizophrenia patients also reported higher levels of current aggressive features compared to controls on the self-report AQ, (M=67. 2, SD= 22.1 and M=25.1 SD= 12.3, respectively, $p = 0.001$). Patients' scores on the subscales of the two aggression measures were mostly significantly higher than controls, except for verbal aggression (see Table 2).

Balloon Analogue Risk Tasks performance:

The mean number of balloon inflations (average clicks across trials) on the BART was higher for controls (M=29. 7, SD=13. 1) than for patients (M=19.7, SD=10.9), $p = 0.03$. The controls popped significantly more balloons (M=10 SD= 4.6) than the patients (M=6.2, SD= 3.7), $p = 0.02$. Overall, controls (32.33 USD) had a significantly higher average of earning than patients (24.41 USD), $p < 0.05$.

Correlational data

There were no significant correlations in controls between the BART and the aggression measures. In patients, there was a significant positive correlation between self-reported hostility in the AQ with the average adjusted balloons inflations ($r=0.48$, $p=0.01$), the number of balloon pops ($r= 0.47$, $p= 0.01$), and earnings ($r= 0.42$, $p= 0.02$). When looking at the relationship between psychopathology, aggression and BART, our analysis focused only on schizophrenia patients. There was a significant positive correlation between the negative, activation, and autism symptoms subscales of the PANSS and the physical aggression on the AQ ($p<0.05$ for all). There was also a significant correlation between the PANSS activation subscale and AQ verbal aggression, anger, and total aggression ($p<0.01$ for all). The positive symptoms of psychopathology were also negatively correlated with both the averages adjusted balloon inflations ($r=-0.39$, $p=0.03$), the number of balloon pops ($r=-0.36$, $p= 0.04$), and earnings ($r= -0.38$, $p= 0.03$). There was no significant correlation of the LHA and risk taking as measured by the BART in controls or patients.

Substance Abuse, Psychopathology, Aggression, and Risk Taking

Sixty-six percent of the patients (21 of 32) met criteria for a history of substance abuse, whereas no controls reported any substance abuse. Patients with a history of substance abuse showed a higher rate of total aggression on the AQ ($t=-2.13$, $p=0.04$), as well as the AQ physical and anger subscales ($p<0.05$), compared to patients without a history of substance abuse. Additionally, patients with substance abuse histories reported

significantly higher life history of aggression; antisocial aggression, physical aggression, and total history of aggression ($p<0.05$). There was no significant difference in performance on the BART for the substance versus no substance abuse groups. Those with a history of substance abuse scored significantly higher on the total psychopathology scale ($t=-2.11$, $p=0.04$).

BART, Aggression, and Quality of Life in Patients

In follow up analyses we explored the relationship between BART variables and Quality of Life as a measure how risk taking and aggression may influence patients' daily life. BART average earnings and average inflations were negatively correlated with total quality of life ($p<0.05$), indicating that those who demonstrated more risk taking had poorer daily life functioning. Quality of life was also negatively correlated with total aggression and hostility on the AQ ($p<0.01$). Those patients with histories of substance abuse demonstrated a trend towards poorer quality of life ($t=1.97$, $p=0.06$); no difference was found between substance groups on BART variables and AQ hostility, although there was a significant difference for total AQ aggression ($t=-2.13$, $p=0.04$).

Regression Analyses

Due to our findings above, we conducted hierarchical linear multiple regression analyses to examine the predictability of BART average inflations, quality of life, substance abuse, positive psychopathological symptoms on AQ total aggression and hostility. In both analyses, demographics (sex, education, substance abuse) were first entered, then quality of life and positive symptoms in the second step, before entering

BART average inflations in the third step to see if risk taking predicted aggression over and above other variables (dependent variables were total aggression [analysis 1] and hostility [analysis 2]). The results indicated that quality of life and average inflations accounted for a significant amount of the total aggression (R^2=0.34, F (1, 21) = 5.62, p=0.01), without other variables significantly contributing. However, the quality of life variable predicted over and above the average inflations variable and accounted for close to 34% (of 34% total) of the total aggression variance. Similarly, our results indicated that quality of life and average inflations accounted for a significant amount of the hostility as well (R^2=0.46, F(1, 21) = 9.01, p=0.002), without other variables significantly contributing. The quality of life variable predicted over and above the average inflations variable and accounted for approximately 40% of the variance, and the average inflations variable added another 6% to the variance. Based on our results, risk taking as measured with the BART average inflations, in combination with current quality of life, is a decent predictor of aggression, in particular hostility.

Discussion

We investigated the relationship of risk-taking, aggression, and substance abuse in schizophrenia and healthy controls. To our knowledge, this study represents the first report of the BART administered in a schizophrenia population. The three major findings of our study are: 1) schizophrenia patients were more aggressive than healthy controls, but exhibited attenuated risk-taking as measured by the BART; 2) only hostile aggression was related to risk-taking in the schizophrenia population; and, 3) patients with less psychopathology showed similar risk-taking performance to the controls.

Consistent with the literature on aggression and substance abuse in schizophrenia (Walsh et al., 2002; Arkel & Levin, 2002), we found a high rate of patients with substance abuse and they were significantly more aggressive than controls. Although higher in aggression, patients exhibited attenuated risk taking as measured with the BART, a computer task that assesses risk-taking propensity. Controls showed higher risk-taking as they had higher inflations and monetary earnings than the patients. These findings can be at first glance surprising given the line of research that suggests an association between high risk taking and aggressive and addictive behavior in non-schizophrenia populations. (Luejez et al., 2002; Aklin et al., 2005). However, our results support our hypothesis that patients would show lower risk taking than controls and is supported by literature suggesting a distinct pattern of decision-making in people with schizophrenia (Shurman et al., 2005), as well as deficits in reward processing (Gold et al., 2008).

Our results showed that patients popped significantly less balloons than controls, but earned less money. This pattern of performance may suggest a different reward processing in the schizophrenia group than the healthy controls. The displacement of the value of the reward is apparent as they had a consistent focus on popping less balloons than on gaining more money. This is consistent Gold's (2008) literature review that decision-making in patients appear to be compromised by deficits in the ability to fully weight the value of a different choices.

Moreover, consistent with our hypothesis, there was evidence of a significant association between risk-taking and aggression in patients. Although we expected to be a stronger correlation across all measures of aggression, it was only significant in the self-reported hostility in the AQ ($r=0.47$, $p=0.01$). The higher the hostility, the higher the total earned money, average inflations, and number of balloon pops. Hostility, which consists of feelings of ill will and injustice, represents the cognitive component of behavior (Buss & Perry, 1992). Therefore, it is interesting that only the cognitive component of aggression and not the actual physical or preparation of aggression showed a link with behavioral risk-taking performance. Given that literature supports a different pattern of decision-making for schizophrenia patients (Kester et al., 2006); these results highlight the importance of looking into the decision-making aspect of taking the risk. Despite strong correlation between both aggression measures, there was no significant correlation of LHA and the risk taking as measured by the BART in controls or patients. This may be because the LHA measures lifetime aggressions, whereas the AQ focuses on self-reported current aggressive features.

When examining substance abuse in patients, the results showed no significant difference in performance on the BART for the substance abuse vs. no substance abuse groups. However, consistent with the literature on substance abuse and aggression in schizophrenia (Swason et al., 2006), the patients with a history of substance abuse showed a higher total aggression in comparison to the patients without a history of substance abuse.

One of the most interesting results in this study came as we examined the relationship of risk-taking performance and the severity of psychopathology (PANSS) in patients. The negative correlation between the positive symptoms of psychopathology and higher risk-taking yielded interesting interpretation for the pattern of performance in the schizophrenia population. The less positive symptoms the patient reported, the higher the monetary earnings and adjusted inflations. In other words, less positive psychopathology was associated with risk-taking behavior similar to the healthy controls. This finding supports the idea that the psychopathology is indeed interfering with the patient's ability to process risk-taking in a similar manner as the healthy population. The impairment in cognitive functions, compromised decision-making and reward process is attributed in other studies to the patient's poor performance on other computerized risk-taking task (Kester, et al., 2006). Our results provides further evidence that schizophrenia patients exhibit a distinct pattern of risk taking that may be modulated by their level of psychopathological symptoms, in particular their positive symptomatology.

In our follow up analyses that examined the influence of risk taking in a patient's daily life, our results were consistent with our predictions that those who demonstrated more risk taking had a poorer daily life functioning. These findings support the line of

literature that highlight how engaging in risk-taking behavior contribute to negative social outcomes such as incarceration and hospitalizations (Hunt et al., 2010). To further explore this in combination with substance abuse and aggression, we conducted a regression analysis, in which we demonstrated that current life quality and risk taking propensity is a decent predictor of aggressive behavior, in particular hostility. This may not be surprising as the hostility items consist of items that correspond to sensation-seeking content that trigger the behavior (Buss & Perry, 1992).

In summary, the lack of research exploring the relations among behavioral risk taking, aggression, substance abuse and life quality in schizophrenia make the results of the study particularly intriguing. In future research, it will be important to further specify how symptomatology influences performance of risk-taking. It would be helpful to collect a verbal report of the patient's experience and decision-making strategies while performing the BART. In addition, it will be important to complement with self-report measures designed to assess related conducts. Such programs of research will help to elucidate theoretical models and clinical correlates of schizophrenia, which may result in increased understanding of the way patients make decisions about risky situations and thus reducing the negative consequences of the behavior.

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Table 1. Demographic and Clinical Information

	Schizophrenia (n=32)	Control (n=10)	Statistic
Age in years	43.09 (9.2)	37.00 (9.5)	NS
Education in years	12.81 (2.4)	14.80 (2.3)	$t = 2.3$, $p = 0.03$
Sex (male/female)	20/12	7/3	NS
Race/ethnicity			χ^2 (5, n = 42) = 12.01, $p = 0.03$
Caucasian	12	0	
Black	17	8	
Asian/Pacific Islander	0	2	
Native American	1	0	
Other/more than one race	2	0	
Hispanic/non-Hispanic	5/27	3/7	NS
Diagnosis (schizophrenia/ schizoaffective disorder)	28/4	--	--
Substance Abuse (yes/no)	22/10	0/10	χ^2 (n = 42) = 14.43, $p < 0.01$
PANSS			
Total	58.73 (14.7)	--	--
Positive	10.80 (4.5)	--	--
Negative	16.33 (5.2)	--	--
Activation	8.73 (2.1)	--	--
Dysphoria	12.30 (5.5)	--	--
Autism	10.56 (3.3)	--	--

Standard deviations appear in parentheses

Table 2. Aggression and BART data.

	Schizophrenia (n=32)	Control (n=10)	Statistic
Life History of Aggression			
Total	18.8 (11.1)	7.1 (5.8)	t = -3.0, p = 0.05
Physical Aggression	11.93 (7.1)	4.66 (3.6)	t = -2.9, p = 0.05
Antisocial Aggression	5.5 (2.4)	2.44 (3.8)	t = -1.7, p = 0.66
Self-Directed Aggression	1.31 (1.3)	0 (0.0)	t = -2.8, p = 0.06
Buss Perry Aggression Questionnaire			
Total	67.2 (22.1)	52.0 (12.8)	t = -2.3, p = 0.03
Physical Aggression	20.4 (8.1)	14.4 (5.5)	t = -3.3, p = 0.02
Verbal Aggression	12.4 (5.5)	13.0 (6.4)	NS
Anger	14.1 (5.5)	11.7 (4.0)	NS
Hostility	20.4 (7.9)	12.8 (6.1)	t = -2.6, p = 0.02
BART			
Adjusted number of balloons inflations across trial	19.7 (10.9)	29.7 (13.1)	t = 2.2, p = 0.03
Balloons pops	10 (4.6)	6.3 (3.7)	t = 2.4, p = 0.02
Average Earning	24.4 (11.7)	32.09 (11.9)	t = 1.7, p = 0.08

Standard deviations appear in parentheses