Published in final edited form as:

J Nerv Ment Dis. 2013 January ; 201(1): 43–47. doi:10.1097/NMD.0b013e31827aaf9d.

Psychosocial predictors of impulsivity in alcohol-dependent patients

Andrzej Jakubczyk, M.D., Ph.D.¹, Anna Klimkiewicz, M.D.^{1,2}, Katarzyna Mika, M.A.¹, Marcin Bugaj, M.D.¹, Aleksandra Konopa, M.D.¹, Anna Podgórska, M.Sc.¹, Kirk J. Brower, M.D.², and Marcin Wojnar, M.D., Ph.D.^{1,2}

¹Department of Psychiatry, Medical University of Warsaw, Warsaw, Poland ²Department of Psychiatry, University of Michigan, Ann Arbor, MI, USA

Abstract

Impulsivity is an important risk factor of severe course of alcohol dependence. However, the significance of environmental determinants of impulsivity has been underestimated. The aim of the study was to identify psychosocial factors increasing the level of impulsivity in alcoholics. Levels of impulsivity were measured in 304 alcohol-dependent patients. *Stop-signal task* was used to assess behavioral impulsivity, and Barratt Impulsiveness Scale to measure global and cognitive impulsivity. Correlations between impulsivity and psychosocial variables were examined. A significant association between level of impulsivity and severity of psychopathological symptoms were observed. Patients who reported childhood sexual or physical abuse, lower social support, more severe course of alcohol dependence were more impulsive, especially in cognitive domain. When entered into a linear regression analysis model, severity of alcohol dependence, psychopathology and childhood physical abuse remained significant. These results suggest that psychosocial variables are important factors associated with high levels of impulsivity in alcohol-dependent patients.

Keywords

impulsivity; alcohol dependence; sexual abuse; physical abuse

INTRODUCTION

Impulsivity is considered as an important symptom of many psychiatric disorders and is included among the diagnostic criteria for several disorders in both DSM-IV and ICD-10 classifications (APA, 2000; WHO, 1992). Impulsivity is a significant risk factor of suicidal behavior (BacaGarcia et al., 2005; Mann et al., 1999). Lifetime risk of making a suicide attempt in alcohol-dependent patients is estimated to be about 7%; about 60% of these attempts are impulsive (Wojnar et al., 2008). Impulsivity is also among the causes of

Corresponding author: Marcin Wojnar, M.D., Ph.D., Department of Psychiatry, Medical University of Warsaw, Nowowiejska 27, 00-665 Warsaw, Poland. Tel.: +48 600822669; fax: +48228251315, mwojnar@med.umich.edu, marcin.wojnar@wum.edu.pl.

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DISCLOSURES

The authors declare no conflicts of interest.

aggressive behavior; it is considered to be a key feature of antisocial personality – impulsivity commonly diagnosed in alcohol-dependent as well as incarcerated individuals (Moeller et al., 2001).

According to Moeller et al. (2001), impulsivity may be defined as “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions”. This definition overlaps with at least two symptoms of alcohol dependence according to ICD-10 and DSM-IV criteria: *drinking more alcohol than previously planned* and *drinking despite knowledge of negative consequences* (APA, 2000; WHO, 1992). Results of several studies confirm that high levels of impulsivity may contribute to development of alcohol dependence (Dom et al., 2006; Finn et al., 2002; Lejuez et al., 2010) as well as poor outcomes following treatment of this disorder (Rubio et al., 2008). At least two types of impulsivity have been distinguished in current research: *behavioral* (impaired ability to stop an initiated response) and *cognitive* (impairment in weighing the consequences of someone’s behavior) (Arce and Santisteban, 2006). These two are suggested to be independent and different phenomena.

According to the results of previous studies, impulsivity is influenced by both genetic and external (environmental and psychosocial) factors. Recent data suggests that genetic factors account for 16–45% of the variance (Congdon and Canli, 2008; Pedersen et al., 1988; Seroczynski et al., 1999), indicating that levels of impulsivity depend mostly on external influences. Yet few studies have investigated psychosocial correlates of impulsivity and to the best of our knowledge, no such study to date has been performed in alcohol-dependent individuals. Moreover, analysis of literature shows that the performed studies applied mostly to cognitive, but not behavioral impulsivity.

Pedersen et al. (1988) studied twins raised together or apart and found a minimal influence of family environment, pointing to the importance of other factors. On the other hand, according to Olson et al. (2002), the type of caregiver–child interaction during infancy may be an important predictor of impulsivity. In this study, high levels of cognitive stimulation and low levels of mothers’ restrictiveness were associated with lower levels of behavioral and cognitive impulsivity in school-age children. In addition, results of a single study conducted in a group of adult women suggest that a history of physical or sexual abuse in childhood may contribute to high levels of global impulsivity (as measured by Barratt Impulsiveness Scale) in these individuals (Möhler et al., 2009).

In some studies the association between education and impulsivity has been described (Godoy et al., 2004; Harrison et al., 2002). Becker and Mulligan (1997) in their theoretical model emphasize the role of school in developing a child’s ability to plan and foresee the consequences of his or her behavior, which is the factor of cognitive impulsivity. According to this model, levels of impulsivity change during the lifetime: decreasing during childhood (as the maturation of the central nervous system proceeds) (Congdon and Canli, 2008); reaching the minimum in middle age and starting to rise while approaching the period of senility, when the value of immediate reward exceeds the importance of remote planning. This theoretical model has not been confirmed entirely in research studies. Although the level of impulsivity in adolescents has been described to be lower than in children (Scheres et al., 2006) and retired individuals have been reported to be more impulsive (Harrison et al., 2002), the increase of impulsivity in the old age has not been confirmed (Godoy et al., 2004; Harrison et al., 2002).

A few studies have investigated a relationship between gender and impulsivity. According to evolutionary theory of Bjorklund and Kipp (1996), female individuals are characterized by better behavioral control, which comes from a belief that leaving temporary needs may lead

to better long-term perspectives for the offspring. However a metaanalysis performed by Silvermann (2003) did not confirm significant differences between men and women in terms of cognitive impulsivity. The recent metaanalysis of Cross et al. (2011) found that men are more sensation seeking and more punishment sensitive than women (in self-report questionnaires). No differences between genders in delay-discounting task and executive function tests (Stop-signal task, Continuous Performance Test, Go/No-Go) were observed (Cross et al., 2011). In other studies the association between poor economic situation and higher cognitive impulsivity (Godoy et al., 2004; Harrison et al., 2002) has been observed. Interestingly, recent research points also to the significance of diet ingredients for the level of impulsivity. Low levels of cholesterol (Troisi, 2011) and tryptophan depleting diet (Crean et al., 2002) were associated with high levels of impulsivity.

Considering the importance of impulsivity in alcohol dependence and the lack of studies of psychosocial predictors of impulsivity in this group of patients, we aimed to investigate the associations between different psychosocial factors (social support, history of sexual and physical abuse, education, employment, and economic situation) and impulsivity in alcohol-dependent patients. In addition, we designed our study to compare these influences with other recognized factors (comorbid psychopathology, severity and duration of alcohol dependence) (de Wit, 2009; Moeller et al., 2001). Taking into account the results of studies suggesting that cognitive and behavioral impulsivity are probably separate and independent phenomena (Arce and Santisteban, 2006), we analyzed our data independently for global, cognitive and behavioral impulsivity.

METHODS

Subjects

The study was performed in a group of 304 adult patients entering abstinence-based, drug-free alcohol treatment programs in Warsaw, Poland. Most of the patients were recruited from residential treatment centers (270 patients); and 34 patients came from outpatient clinics. All patients signed informed consent after became acquainted with the protocol. Participation was completely voluntary and confidential. The study was approved by the Medical School Institutional Review Board at the University of Michigan and the Bioethics Committee at the Medical University of Warsaw. Eligible patients were 18 years of age and older, met DSM-IV criteria for a current diagnosis of alcohol dependence. Patients with a current diagnosis of psychosis or mania, based on clinical observation and the MINI International Neuropsychiatric Interview (Sheehan et al., 1998), with symptoms of acute withdrawal, being an imminent danger to self or others, or with cognitive impairment as indicated by a score < 25 on the Mini-Mental State Examination (Folstein et al., 1975) were excluded from the study.

Procedures

All participants were asked to complete a questionnaire to assess demographics and psychosocial conditions (age, education, employment, economic situation, experience of sexual and physical abuse before and after 18 years of age), severity of alcohol problems, comorbid psychopathology, social support, cognitive function and impulsivity. In addition, subjects performed the stop-signal task in the presence of a trained member of the research team.

Measures

- I. The level of impulsivity was measured by the Barratt Impulsiveness Scale and the stop-signal task.

1. The Barratt Impulsiveness Scale (BIS-11) (Patton et al., 1995) was used as a subjective measure of global impulsivity as well as its different dimensions. Six basic factors of impulsivity in BIS-11 are: motor impulsivity, attention factor, perseverance, cognitive instability, cognitive complexity and self-control. The three complex factors of impulsivity are combinations of basic factors: motor impulsivity (motor impulsivity as a basic factor and perseverance), non-planning impulsivity (self-control and cognitive complexity) and attentional impulsivity (attention factor and cognitive instability). In this study the total scores of BIS-11 and scores for the three complex factors of impulsivity were analyzed. Based on the definition of behavioral and cognitive impulsivity, attentional impulsivity and particularly non-planning impulsivity were considered as indicators of cognitive impulsivity whereas motor impulsivity was treated as an indicator of behavioral impulsivity.
 2. The stop-signal task was used as a manipulation-free method of evaluating the level of *behavioral impulsivity* (Logan et al., 1984). The stop-signal task tests the ability of stopping the reaction that has already been started. It is administered via a computer program; the results are presented in milliseconds as *stop reaction time* (StopRT) (Band et al., 2003), which is a useful indicator of executive functions: the higher its value, the higher level of *behavioral impulsivity*.
- II. The severity of alcohol dependence was evaluated using the Michigan Alcoholism Screening Test (MAST) (Selzer, 1971).
 - III. The level of social support was evaluated using the Medical Outcomes Study Social Support Survey (MOSSSS) (Sherbourne and Stewart, 1991).
 - IV. The level of psychopathology was assessed with the General Severity Index of the Brief Symptom Inventory (BSI), a self-administered, 53-item questionnaire (Derogatis and Melisaratos, 1983).

Statistical analysis

Statistical analysis was performed with Statistica software, version 9.0 (insert manufacturer, and location of manufacturer). All continuous data were checked for normal distribution by the Kolmogorov-Smirnov test. Data are presented as arithmetic means and standard deviations (mean $\pm$ SD) for parametric variables. For non-parametric variables, data are presented as median and quartiles (25; 75). The main aim of the analyses was to examine associations between the levels of total, behavioral and cognitive impulsivity and different psychosocial conditions (education, employment, economic situation, experience of sexual and physical abuse before and after 18 years of age) in alcohol-dependent patients. In addition, correlations between impulsivity and severity of alcohol dependence (MAST), severity of comorbid psychopathology (GSI) and social support (MOSSSS) were examined. All variables that turned out to be significant in the primary analyses as well as control demographic variables (age, gender) were put into linear regression analysis in order to compare the significance of the correlates of impulsivity in alcohol-dependent individuals.

RESULTS

The sample was comprised of 74% males with a mean age of 43.5 ± 9.7 years (range: 23 to 73 years). All patients were Caucasian. The median education level was 12 years (the last level of secondary school in Poland). At the time of the study, 38.9% of the patients were employed and more than a half (50.5%) declared difficult economic situation (defined as not

having enough money for everyday needs). The symptoms of alcohol dependence lasted for 19.2 years on average. In the group of female patients 20.2% revealed sexual abuse before 18 years of age, (8.1% of the whole study group) and 32.2% of women - sexual abuse after 18 years of age (11.6% of the study group); 29.4% of patients experienced physical abuse before 18 years of age, including 31.6 % of women.

The statistical analysis showed a significantly positive association between the level of global impulsivity as measured by the Barratt Impulsiveness Scale and severity of psychopathological symptoms in Brief Psychiatric Inventory ($r = 0.46$, $p < 0.0005$; see Table 1). In addition, a significant correlations for all three BIS-11 subscales were observed (see table 1), of which attention impulsivity was the most strongly correlated with GSI ($r = 0.54$, $p < 0.005$, see table 1). There was no significant correlation between objective measure of behavioral impulsivity (StopRT) and GSI ($r = 0.05$, $p = 0.396$). We also noted a significant positive correlation between the severity of alcohol dependence and the level of global impulsivity in BIS scale. Patients with higher scores in MAST ($r = 0.27$, $p < 0.0005$) and longer duration of alcohol dependence symptoms ($r = 0.13$, $p = 0.021$) turned out to be more impulsive, especially in nonplanning impulsivity subscale (see table 1). Notably, observed association between the level of impulsivity and social support reached highest values also in the subscale of nonplanning impulsivity ($r = -0.24$, $p < 0.0005$). Patients with stronger social support appeared to be less impulsive than individuals who declared low levels of social support. In this case, an association between MOSSSS score and behavioral impulsivity evaluated by an objective measure (stop-signal task) ($r = -0.13$, $p = 0.033$) was observed.

The statistical analysis revealed a significant association between the experience of physical and sexual abuse and the level of impulsivity in the group of alcohol-dependent patients. Individuals who reported sexual abuse were more impulsive in BIS total score ($p = 0.012$) and attention impulsivity subscale ($p = 0.001$). Subjects who experienced physical abuse before and after 18 years of age turned out to be significantly more impulsive in all subscales of BIS-11 (see table 2). There was no association between behavioral impulsivity as measured by stop-signal task and the experience of sexual and physical abuse in the group of alcohol dependent patients.

All significant variables associated with BIS score (GSI, MAST, duration of alcohol dependence, education, economic situation, experience of sexual and physical abuse) as well as control variables (age, gender) were put into linear regression analysis, which showed that severity of psychopathology (GIS) was the strongest predictor impulsivity ($\beta = 0.331$, $p < 0.000005$). Also, severity of alcohol dependence (MAST) ($\beta = 0.182$, $p = 0.005$) and experience of physical abuse before 18 years of age ($\beta = 0.133$, $p = 0.035$) remained significant after adjustment for other variables (see table 3).

DISCUSSION

Results of our study indicate that impulsivity in alcohol-dependent patients is associated with several demographic and psychosocial factors. Lack of education and social support, difficult economic situation, experience of sexual or physical abuse, have been shown to be potential correlates of impulsivity. Interestingly, most of the factors have been associated with indicators of cognitive (attention and non-planning impulsivity), but not behavioral impulsivity as measured by stop-signal task.

The results of numerous studies show that impulsivity is not only one among possible predictors of alcohol use disorders (Lykouras et al., 2004; Nigg et al., 2006; Rubio et al., 2008; Rubio et al., 2007), but may also be treated as a result of alcohol drinking in the

mechanism of frontal lobe dysfunction (Adams et al., 1993; de Wit, 2009; Nicolas et al., 1993) as well as disequilibrium between glutamate and GABA neurotransmission (Murphy et al., 2011; Villafuerte et al., 2011). The results of our study are consistent with the literature as longer duration of alcohol dependence and its severity were associated with higher levels of cognitive impulsivity. Notably, the severity of alcohol dependence turned out to be the second most important predictor of global impulsivity in multifactorial model of regression analysis for the prediction of BIS score. This result emphasizes significance of alcohol use in increasing the level of impulsivity in subjects with initially high levels of impulsivity.

The comparison of impulsivity between the groups of male and female patients did not reveal any significant association, which is consistent with the results of meta-analysis of Silverman (2003), and confirms his conclusions in the group of alcohol-dependent individuals.

A new finding of our study is a significant association between the experience of sexual and physical abuse in the childhood and impulsivity in alcohol-dependent patients. The results indicate that the experience of physical abuse prior to age 18 may contribute to high levels of cognitive impulsivity in the adulthood. To the best of our knowledge, this is the second study to investigate this issue in general and the first in a group of alcohol-dependent patients. Mohler et al. (2009) observed a similar relationship in the context of sexual abuse in a group of women without alcohol dependence. Notably, sexual as well as physical abuse were associated with suicidal behavior (King and Merchant, 2008; Ystgaard et al., 2004), which has also been associated with increased impulsivity (BacaGarcia et al., 2005; Mann et al., 1999). Thus a tendency to suicidal behavior may be potentially associated with impulsivity in individuals with a history of sexual or physical abuse (Braquehais et al., 2010).

Another important manifestation of impulsivity is a tendency towards rapid and aggressive behavior. The results of research studies indicate that approximately 30% of abused parents transmit the experience of violence to their own children (Oliver, 1993). This may be the effect of genetic heritability of impulsivity, but may also result from a serious life event itself. According to cognitive style “reflectivity-impulsivity” formulated by Kagan et al. (1964) high levels of impulsivity result from negative self-esteem and increase in situations associated with fear. Our results are consistent with this theory as the experience of physical or sexual abuse in childhood may provide the feeling of anxiety and negative self-esteem throughout the life. In addition, other conditions which turned out to be associated with cognitive impulsivity in our study (lack of social support, difficult economic situation, unemployment) may also be considered as factors that cause fear and lack of self-confidence. From all these conditions, after adjustment for other tested variables in multifactorial model only experience of physical abuse before 18 years of age remained significant. It is important to note that more than 30% of study sample admitted experience of physical abuse during childhood. This indicates that such trauma is not an infrequent event among alcohol-dependent individuals.

The results of regression analysis indicate that high level of psychopathology as measured by the General Severity Index (GSI as calculated from the BSI measure) is the strongest predictor of impulsivity in alcohol-dependent patients. This result illustrates an interesting observation that impulsivity is a common characteristic of many psychiatric disorders that are considered to be risk factors of alcohol dependence (attention deficit hyperactivity disorder (ADHD), antisocial and borderline personality, bipolar disorder) (Moeller et al., 2001). As mentioned in the introduction, impulsivity is believed to be a multidimensional construct and these different dimensions may be separately exposed in different disorders

(e.g., motor impulsivity in manic episode, attentional impulsivity in ADHD, non-planning impulsivity in depression, inability to delay reward in antisocial personality). Evaluating the general severity of psychopathology is associated with summing up the influences of all psychiatric conditions, possibly related to alcohol dependence.

It is interesting to note that most of the observed associations applied to cognitive (attention and lack of planning) but not behavioral dimensions of impulsivity. Another analysis in the same group of patients suggests that behavioral impulsivity (as measured by the stop-signal task) was associated mainly with genetic factors, whereas the Barratt Impulsiveness Scale was not. This provides a new, interesting perspective suggesting that behavioral impulsivity is associated with genetic background whereas cognitive impulsivity is associated mainly with demographic and psychosocial factors.

The limitation of the study is that the analyzed sample, which is limited to people entering residential alcohol treatment programs and therefore not fully representative of all alcohol-dependent individuals. In addition, most of the study sample (74%) consisted of men who might have decreased the significance of sexual abuse, the results were similar among the women in this study (data not shown). Finally, the data was obtained by self-administered questionnaires and not confirmed by an objective assessment.

In conclusion, our results suggest an association between cognitive impulsivity and several psychosocial variables in the group of alcohol-dependent patients. The severity of alcohol dependence and experience of physical abuse before 18 years of age are important factors contributing to high levels of impulsivity in this group of patients. Assessing the history of physical and sexual abuse as well as patient's general socio-economic situation may be useful in planning treatment of alcohol dependence and evaluating the risk of behavioral manifestations of impulsivity (suicide attempt, aggressive behavior) in clinical practice.

Acknowledgments

This study was supported by the Polish Ministry of Science and Higher Education grant NN405357239, the Fogarty International Center/NIDA International Substance Abuse Research Program grant D43-TW05818, the Fogarty International Center/NIAAA International Collaborative Alcohol & Injury Research Training Program grant D43-TW007569 and NIAAA grant R21 AA016104. We would like to thank all members of the research team in Poland (especially, Anna Wnorowska, MD; Katarzyna Kositorna, MS; Maciej Kopera, MD; Julia Pupek, MD; Piotr Serafin MD; Izabela Nowosad MD) as well as the medical staff and patients at "Kolska", "Pruszkow", "Petra" and "Solec" Addiction Treatment Centers in Warsaw for their support of this research.

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Table 1

Relationship between general severity of psychopathology (GSI), social support (MOSSSS), severity of alcohol dependence (MAST), duration of alcohol dependence, education and different varieties of impulsivity in alcohol-dependent patients (comparison of „r” and „p” values).

	Behavioral impulsivity (StopRT)	Global impulsivity (BIS-11)	Attention impulsivity (BIS-11)	Motor impulsivity (BIS-11)	Non-planning impulsivity (BIS-11)
GSI	0.05 p=0.396	0.46 p<0.0005	0.54 p<0.005	0.29 p<0.0005	0.33 p<0.0005
MOSSSS	-0.13 p=0.033	-0.21 p<0.0005	-0.16 p=0.004	-0.08 p=0.153	-0.24 p<0.0005
MAST	0.02 p=0.711	0.27 p<0.0005	0.19 p=0.001	0.23 p<0.0005	0.22 p<0.0005
Duration of alcohol dependence	0.07 p=0.214	0.13 p=0.021	0.10 p=0.079	0.11 p=0.070	0.12 p=0.048
Education (number of classes graduated)	0.07 p=0.291	-0.15 p=0.012	-0.14 p=0.024	-0.11 p=0.073	-0.13 p=0.038

GSI- General Severity Index in the Brief Symptom Inventory; BIS – Barratt Impulsiveness Scale; MOSSSS – Medical Outcomes Study Social Support Survey; MAST - Michigan Alcoholism Screening Test

Table 2

Sexual and physical abuse and different varieties of impulsivity in alcohol-dependent patients (comparison of „p” values).

	Global impulsivity (BIS-11)	Attention impulsivity (BIS-11)	Motor impulsivity (BIS-11)	Non-planning impulsivity (BIS-11)
Sexual abuse before 18 years of age	0.012	0.001	0.244	0.058
Sexual abuse after 18 years of age	0.393	0.455	0.549	0.444
Physical abuse before 18 years of age	<0.000005	0.0002	0.0003	0.0001
Physical abuse after 18 years of age	0.0007	0.005	0.0004	0.046

BIS – Barratt Impulsiveness Scale

p-values < 0.05 were bolded, Student t-test was applied

Table 3

Multifactorial model of linear regression analysis for the prediction of impulsivity (BIS total score).

Predictive factor	Beta	p
Severity of psychopathology (GSI)	0.331	<0.0000005
Severity of alcohol dependence (MAST)	0.182	0.005
Physical abuse before 18 years of age	0.133	0.035
Age	-0.144	0.067
Duration of alcohol dependence	0.130	0.108
Social support (MOSSSS)	0.077	0.207
Gender	0.069	0.294
Education (number of classes graduated)	-0.052	0.360
Economic situation	0.041	0.532
Employment	0.035	0.570
Physical abuse after 18 years of age	-0.034	0.603
Sexual abuse before 18 years of age	-0.028	0.628

BIS – Barratt Impulsiveness Scale, MOSSSS – Medical Outcomes Status Social Support Survey, MAST - Michigan Alcoholism Screening Test p-values < 0.05 are bolded

Non-parametric values were logarithmized before being put to the regression analysis

Model:

Dependent variable – BIS score

$R = 0.55$; $R^2 = 0.31$; corr $R^2 = 0.27$

$F = 8.56$; $df = 12.23$; $p < 0.0000005$