

Decision-making and personality characteristics of patients with major depressive disorder following a suicide attempt

Ph.D. Thesis – Summary

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1. Introduction

A suicide attempt occurs in a complex bio-psycho-social context. Psychological components are among the most relevant risk factors for suicidal behaviour, and can be influenced by the healthcare system. Therefore, a focus on these variables can be important in a psychiatric setting.

There is a broadening knowledge about the psychological alterations related to suicidal behaviour; although, most studies report the characteristics of individuals with a history of a suicide attempt, which mostly facilitates to draw conclusions about trait-like aspects. Indeed, observing definite state-dependent features of suicidal crisis is one of the greatest issues of this field. Better understanding of the alterations featuring suicidal behaviour would be essential; however, measuring the period preceding the suicide attempt is challenging. Capturing individuals' state of mind within a tight time frame following their suicide attempt seems to be a suitable solution.

Thus, the present study aimed to explore certain cognitive and personality factors among medication-free individuals with major depressive disorder within 72 hours following their suicide attempt. Since patients were enrolled in this research in quite a sensitive state, selection of well-founded variables was crucial. Decision-making as a cognitive function and impulsivity, temperament and character factors as personality components were chosen to be observed.

1.1. Decision-making

Decision-making refers to a process resulting in choices in uncertain situations when more options are available and it proved to have an important role in suicide. Specificity of this dysfunction in suicidal behaviour is considered to be largely due to structural and functional impairments in the orbitofrontal cortex (OFC) / ventromedial prefrontal cortex (VMPFC) as a part of the “suicidal brain”; since these areas play an important role in this function.

Several forms of decision-making can be differentiated, of which decision-making in ambiguous and risky situations was highlighted in the present study. This aspect is usually measured by a computerized card game, the Iowa Gambling Task (IGT). During this test, participants can choose cards from four decks, which are followed by different amount of immediate rewards and sometimes also by money losses. The goal of the game is to gain as

much money as possible. Subjects need to recognize that some decks are disadvantageous in the long-term, since their high rewards are associated with even higher losses; while the others are more beneficial with their lower rewards followed by moderate punishments. Thus, for a better performance, participants have to refuse higher immediate rewards.

Given that rejection of high rewards is essential for a better future outcome, one obvious explanation for poor performance on this task can be hypersensitivity to reward; and on the other hand, decreased sensitivity to punishment can also contribute to the preference for risky decks. Nonetheless, the original test does not allow the understanding of the complete background of disadvantageous decisions; thus, a modified version of the IGT was designed. The main differences between the original (“ABCD”) and the modified (“EFGH”) version are that in the latter one, the choosing of cards is followed by immediate punishments, and the addition of rewards is occasional. Decks with higher losses provide even higher rewards; therefore, these are advantageous in the long-term. Poor performance of both versions raises an alternative explanation besides those limited to the sensitivity to reward or punishment: it can be interpreted as the insensitivity for future consequences.

Even though the comprehensive interpretation of decision-making function requires both versions, the IGT EFGH performance of persons with suicidal behaviour is not known. Besides, performance of individuals with a recent suicide attempt has not been explored yet.

1.2. Temperament and character, impulsivity

From the psychobiological approach of personality, four temperament (harm avoidance, novelty seeking, reward-dependence, persistence) and three character factors (self-directedness, cooperativeness, transcendence) can be differentiated. Temperament determines learning dispositions to behave, react emotionally and attach to each other; while character refers to the self-regulatory aspects of personality. These factors can be measured by a paper-and-pencil test.

Regarding suicidal behaviour, higher harm avoidance is one of the most decisive factors behind suicide ideations and attempts among temperament factors. As for character components, lower self-directedness and lower cooperativeness could play a role in suicidal behaviour.

Impulsivity is a multifactorial, partly heritable construct referring to different forms of impaired self-regulation. It is usually measured by self-report or neuropsychological tests grasping its behavioural or personality aspects.

As a personality component, impulsivity can refer to a lack of deliberation and persistence, novelty seeking behaviour, rapid processing of information and the inability to delay gratification and to forethought before acting. Its different facets can be measured by different personality tests, such as motor, cognitive / attentional and non-planning impulsivity which can be measured by the Barratt Impulsiveness Scale.

Since impulsivity could indicate the lack of a well-balanced functioning, it could associate with affective disorders and suicidal behaviour among others. Certain aspects of impulsivity can be specific to manic states, depressive states or suicidal behaviour.

2. Aims and hypotheses

The present study aimed to explore distinct psychological characteristics of major depressed individuals with a recent suicide attempt. The purpose of the study was to contribute to the better understanding of the suicidal mind via the following layout:

- (1) Medication-free inpatients were enrolled within 72 hours following their suicide attempt, enabling to best model the suicidal crisis state preceding the attempt. Their characteristics were compared to healthy control individuals'
- (2) Decision-making in ambiguous and risky situations as a cognitive component was measured. Two versions of the decision-making task were used, since the study aimed to be the first to report a comprehensive profile of this function among individuals with a suicide attempt
- (3) Impulsivity, temperament and character components were observed in order to the better understanding of possible personality correlates of a recent suicide attempt during a major depressive episode

- (4) Cognitive and personality characteristics best describing the mind of depressed individuals with a recent suicide attempt among the observed variables were explored

Based on the overview of the literature of this field, the following hypotheses were proposed:

- (H1) Since a person who attempt suicide may experience difficulties in focusing on future plans, it was hypothesized that participants following a suicide attempt do not anticipate the long-term consequences of their decisions. Therefore, poor decision-making on both IGT versions (i.e. preference for choices with better immediate outcomes, but disadvantageous long-term results) was hypothesized
- (H2) Relating to previous studies, higher harm avoidance and lower self-directedness were hypothesized to be specific to major depressive individuals' state following a suicide attempt. Besides, higher impulsivity of patients was hypothesized
- (H3) This study included variables with presumably important role in suicidal behaviour. Thus, predictive value of some factors was hypothesized in case of major depressed individuals with a recent suicide attempt. Namely, specific role of decision-making, impulsivity and temperament and character factors was assumed

3. Methods

3.1. Participants

This study was carried out at the Department of Psychiatry, Faculty of Medicine, University of Szeged. Fifty-nine individuals with a suicide attempt and a diagnosis of major depressive disorder and forty-six healthy control volunteers with no personal history of psychiatric diagnosis and suicidal behaviour were included. Participants between 18 and 65 years were recruited.

Members of the patient group were hospitalized at the clinic and were recruited and assessed within 72 hours after their suicide attempt. Suicide attempt was defined as a non-fatal self-directed potentially injurious behaviour with an intent to die. Individuals with a suicide attempt received all necessary life-saving interventions. They were free from psychiatric medication at the time of the assessment. Tests were conducted as soon as their condition allowed it, and psychiatric treatment was started following data collection if it was necessary. Patients with neurological illnesses, bipolar disorders, substance-related disorders, schizophrenia spectrum disorders, obsessive-compulsive disorders or major neurocognitive disorders were excluded.

Convenience sampling method was used during the enrolment of healthy control individuals. Their assessment took place in the outpatient exam rooms of the clinic. Patients and controls were matched for gender and age.

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Human Investigation Review Board, University of Szeged (ethical approval number: 2443). Written informed consent was obtained from each participant.

3.2. Measures

Diagnoses were made with the Mini-International Neuropsychiatric Interview. Severity of depressive symptoms was measured with a clinician-administered semi-structured interview, the Hamilton Depression Rating Scale (HAM-D) in the patient group. Impulsivity was measured by a paper-and-pencil test, the Barratt Impulsiveness Scale (BIS). Temperament and character factors were assessed with the Temperament and Character Inventory.

Decision-making ability was assessed with two versions of the Iowa Gambling Task (IGT ABCD, IGT EFGH). During this computerized test, participants choose cards 100 times from four decks with different properties. Following the choices, different values of gained / lost virtual money appears. The ABCD version contains two decks with small immediate rewards, but with tolerable occasional losses and two others with high immediate gains paired with significant irregular losses. Decks with high immediate punishments and even higher rewards, and decks with small losses, but insignificant occasional gains are present in the EFGH version. For a better overall outcome, acceptance of lower immediate rewards pays off with the ABCD version (it is sensitive to reward), and toleration of high immediate losses does so with

the EFGH version (it is sensitive to punishment). All participants received standard instructions and were told that the goal of the game is to win as much money as possible. They were informed that the decks are different from each other, the game is not unfair and does not work randomly; therefore, there are better and worse choices. Test performance can be evaluated based on overall net scores and sub-scores for every set of 20 choices (1–20, 21–40, 41–60, 61–80 and 81–100).

3.3. Statistical analysis

SPSS 24 was used for data analysis.

One-way multivariate analysis of variance (MANOVA) with Bonferroni post-hoc analysis was conducted to reveal statistical differences on personality and cognitive variables between the two groups. Effect sizes were indicated by partial eta-squared.

Comprehensive analysis of the two groups' performance on the IGT was made by Repeated Measures ANOVA with Bonferroni post-hoc test. The Greenhouse-Geisser correction was applied due to results of Mauchly's Test of Sphericity.

Binary logistic regression with a stepwise method of forward likelihood ratio was conducted to explore that among the observed variables, which are the strongest indicators of a suicide attempt during a major depressive episode and whether they can be included into a model with sufficient prediction value. Overall decision-making performance, impulsivity and temperament and character factors were set as covariates. Fitness of the model was monitored with the Hosmer-Lemeshow test.

Level of significance was set at $p < 0.05$.

4. Results

This thesis summary reports the most relevant statistical analyses of the study.

There was a significant difference between the two groups on the combined effect of decision-making, impulsivity, temperament and character factors (Pillai's trace = 0.530; $F(10,88) = 0.530$, $p < 0.001$, $\eta^2 = 0.53$).

As regards decision-making performance, the Repeated Measures ANOVA revealed significant interaction effect between factors BLOCKS and GROUPS on the IGT ABCD ($F(3.357, 345.812) = 4.171$, $p = 0.005$, $\eta^2 = 0.04$). A trend towards significant differences was

shown on the IGT EFGH ($F(3.078, 317.017) = 2.370, p = 0.069, \eta^2 = 0.02$). These results were due to between-group differences among certain blocks of the IGT (see *Figure 1.*), and distinct learning patterns (i.e. within-group block-to-block differences) during the test.

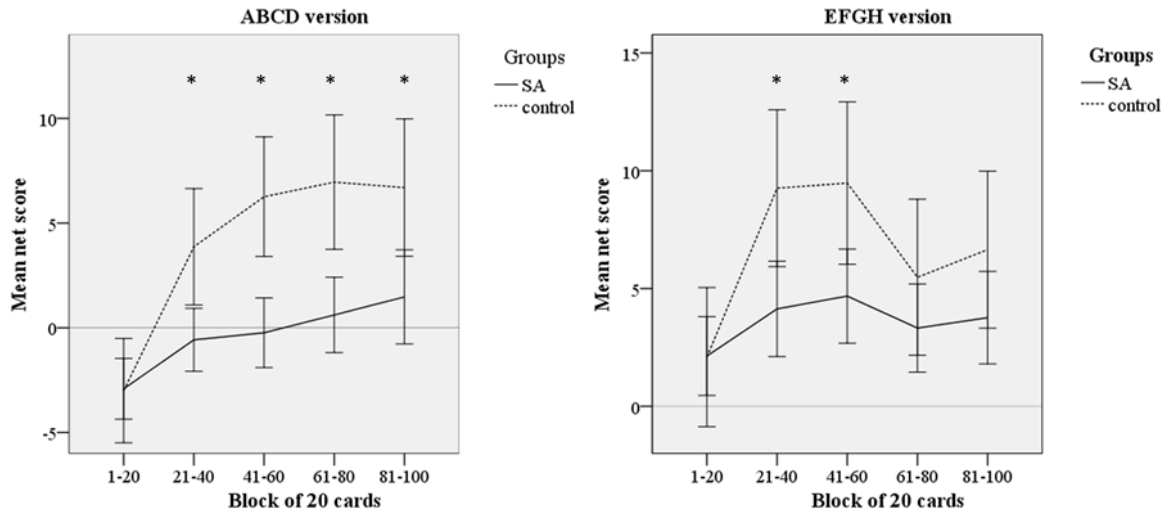


Figure 1.

Changes in decision-making performance of 59 patients with a suicide attempt (SA) and 46 healthy control subjects (control) during the five blocks of two versions of the Iowa Gambling Task. Mean net scores (disadvantageous minus advantageous choices) and standard error means are shown. The * symbol indicate statistical differences ($p < 0.05$).

As regards personality components, significant between-group differences were found regarding impulsivity ($F(1) = 19.51, p < 0.001, \eta^2 = 0.17$), harm avoidance ($F(1) = 51.12, p < 0.001, \eta^2 = 0.35$), self-directedness ($F(1) = 49.29, p < 0.001, \eta^2 = 0.34$), cooperativeness ($F(1) = 7.01, p = 0.009, \eta^2 = 0.07$) and transcendence ($F(1) = 10.59, p = 0.002, \eta^2 = 0.10$). Between-subject personality differences are presented in *Table 1*.

Table 1.

Personality differences between individuals with a diagnosis of major depressive disorder and a recent suicide attempt (SA) and healthy controls (HC)

	SA (N=59)	HC (N=45)	Post-hoc test			
	Mean (SD)	Mean (SD)	<i>F</i>	<i>df</i>	<i>P</i>	ηp^2
BIS/Total	71.54 (12.71)	61.31 (9.78)	19.51	1	<0.001	0.17
TCI/NS	18.52 (6.00)	20.2 (5.71)	2.02	1	0.159	0.02
TCI/HA	21.91 (7.00)	12.49 (5.90)	51.12	1	<0.001	0.35
TCI/RD	15.41 (3.08)	16.29 (3.00)	2.06	1	0.154	0.02
TCI/P	4.74 (2.51)	4.71 (1.83)	0.04	1	0.948	<0.01
TCI/S-D	23.63 (6.14)	31.13 (4.04)	49.29	1	<0.001	0.34
TCI/C	28.06 (6.60)	31.13 (4.04)	7.01	1	0.009	0.07
TCI/T	15.35 (6.97)	11.22 (5.35)	10.59	1	0.002	0.10

Abbreviations: BIS (Barratt Impulsiveness Scale), TCI (Temperament and Character Inventory), NS (novelty seeking), HA (harm avoidance), RD (reward dependence), P (persistence), S-D (self-directedness), C (cooperativeness), T (transcendence)

Stepwise forward binary logistic regression model included IGT ABCD net score, harm avoidance and self-directedness in the equation from the observed components presented in *Table 1*. These variables added significantly to the prediction: IGT ABCD net score ($\chi^2 = 7.459$; df: 1; $p = 0.006$), harm avoidance ($\chi^2 = 7.502$; df: 1; $p = 0.006$), and self-directedness ($\chi^2 = 6.763$; 0.169; df: 1; $p = 0.009$). No indication of multicollinearity was found among these variables (VIF below 2.247 for every variable in the model). The baseline model ($\chi^2 = 0.816$; df: 1; $p = 0.366$) had an accuracy of 54.5% overall percentage. The Hosmer–Lemeshow test (χ^2 : 9.262; df: 8; $p = 0.321$) indicates that this model adequately fitted the data. The model was significant (χ^2 : 58.108; df: 5; $p < 0.001$), explains 59.4% of the variance (Nagelkerke R^2) and correctly classified 79.8% of cases.

5. Discussion

This study observed significant decision-making, impulsivity, temperament (i.e. harm avoidance) and character (i.e. self-directedness, cooperativeness, transcendence) differences between medication-free major depressed individuals with a recent suicide attempt and healthy control participants. Besides, it performed a comprehensive analysis of decision-making functioning. Lastly, it presented a model indicating that among these variables, poor decision-making on the IGT ABCD, high harm avoidance and low self-directedness were the most powerful characteristics of the patient group. These three factors had a significant predictive value and classify 79.8% of participants correctly.

Therefore, the main hypotheses were confirmed by the results, while some minor assumptions were not verified.

- (H1) The first hypothesis concerning decision-making performance on both IGT versions was supported by the results: significant between-group differences (i.e. poor performance of the patient group) were present during the ABCD version, and a trend towards significant alterations during the EFGH version could also be reported
- (H2) Findings verified the assumed between-group personality differences: the patient group could be characterized by higher harm avoidance, lower self-directedness and higher impulsivity. However, some further between-group differences were also revealed. Lower cooperativeness and higher transcendence could be observed among major depressed individuals with a recent suicide attempt
- (H3) Predictive value of decision-making performance, impulsivity and certain temperament and character factors were assumed. The study verified the role of decision-making during the IGT ABCD, harm avoidance and self-directedness. Thus, impulsivity and IGT EFGH were not included in the model

As regards decision-making, significant between-group differences during IGT ABCD and a trend towards significant alterations during IGT EFGH was revealed. Effect of IGT ABCD was dominant, since it was included in the model presented.

Detailed analysis of the IGT revealed that besides the performance in the IGT ABCD and EFGH (i.e. between-group differences), the two group also differed in terms of block-to-block learning (i.e. within-group differences). Analysis of within-group performance of major depressive individuals with a recent suicide attempt showed an almost completely constant performance at different stages of the IGT ABCD and EFGH: significant improvement could only be seen between block 1 and block 5 on the IGT ABCD. In contrast, results of the control individuals increased significantly after the first block of both versions. It is an important difference, since at the beginning of the game, participants should get familiar with the rules; therefore, decision-making performance in risky situations can be observed in the second part of the task. Significant improvement following the first block may indicate that control subjects identified advantageous decks quickly and they preferred them; while in the case of patients, learning tendencies could not be detected.

It is important to notice, that a significant drop in control participants' performance could be seen following block 3 of the IGT EFGH. Their poorer performance in the last two blocks can be explained by the quick identification of the advantageous strategy, causing the running out of cards from the beneficial decks and therefore masked the significance of differences regarding this version. Counterbalancing the order of the IGT versions was not implemented in this study: learning effect following the IGT ABCD could not be controlled. General rules of the IGT were already known at the beginning of the IGT EFGH; thereby, sooner identification of advantageous decks could be present, which can explain the running out of advantageous cards in case of the control subjects.

Anyhow, patients' decision-making can be regarded as disadvantageous on both versions of the IGT. Considering IGT ABCD, these findings fit well within the scientific literature. However, to the best of our knowledge, suicide attempters' performance on the IGT EFGH was not assessed before; thus, this is the first study providing information about the comprehensive IGT profile of this group.

Without the use of the IGT EFGH, results of recently suicidal individuals could be explained by increased reward-sensitivity or decreased punishment-sensitivity. Results of the

EFGH showed opposite tendencies; therefore, it questioned the applicability of reward- and punishment-based models in this group. Accordingly, the additional information of the IGT EFGH allows to explain more precisely how the reported decision-making pattern may relate to the status of major depressive individuals following a suicide attempt.

Patients preferred decks with the best immediate outcomes, causing poor performance on both IGT versions, which can be explained by myopia for future consequences. However, it should be clarified whether individuals with a recent suicide attempt do not care for the future for psychological reasons, or if they cannot plan for it because of other contributing neuropsychological dysfunctions. Prediction of the near future is based on learning models of action and requires several cognitive skills (e.g. working memory, cognitive inhibition), which are proved to be affected among individuals with suicidal behaviour. Thus, decision-making profile of patients could be explained partly by cognitive difficulties.

In case of personality components, higher harm avoidance, lower self-directedness, lower cooperativeness, higher transcendence and higher impulsivity were observed among depressed individuals with a recent suicide attempt in comparison to control subjects. However, the prediction model included only harm avoidance and self-directedness from these components, indicating that their role could be more pronounced.

Concerning temperament and character factors, a fearful, pessimistic temperament style (higher harm avoidance) and characteristics of aimlessness, blaming (lower self-directedness), hostility, self-centeredness (lower cooperativeness), suspiciousness behaviour (higher transcendence with the constellation of lower cooperativeness and self-directedness) can be highlighted among depressed individuals with a recent suicide attempt. However, the model included harm avoidance and self-directedness among these factors.

In terms of suicidal behaviour, impulsivity was assumed to play an important role and was indeed proved to be a characteristic of major depressed individuals with a recent suicide attempt. However, contrary to the hypothesis, impulsivity was not entered in the model presented. Less robust power of this factor can be explained by methodological issues – behavioural indicators of impulsivity may represent more relevant predictive power.

In summary, this study focused on some possibly relevant cognitive and personality factors and observed their impact on major depressive individuals' status following a recent suicide attempt. Overall, the results suggest that I) the inability to make decisions according to

the assessment of possible future consequences (poor decision-making performance), II) a pessimistic and shy temperament (higher harm avoidance), and III) loss of willpower and goal-orientation (lower self-directedness) were the strongest characteristics of the patients.

These findings present the status of major depressed patients within 72 hours following their suicide attempt. However, with the lack of an affective control group (with no history of a suicide attempt) or a within-subject design, conclusions about state- or trait-dependency of this findings cannot be drawn directly. Based on indirect data, it is a possible explanation that the study could grasp state-like deficits: a decision-making profile which probably associates with suicidal crisis state, and further alterations which have trait-like aspects as well, but become pronounced in relation to suicidal behaviour.

To summarize the importance of this study, it observed cognitive and personality characteristics of major depressed individuals in quite a sensitive state: within 72 hours following their suicide attempt. It was the first to report comprehensive decision-making profile measured by the IGT of persons with a suicide attempt. It is important to highlight that participants were free from psychiatric medication at time of the assessment, which strengthen the results of this study.

This study has limitations, of which the lack of a depressed control groups with a past suicide attempt and without a history of a suicide attempt is the most relevant, because it narrows the possibility of a suicidal state-specific interpretation. A within-group design could also give data about state-dependent changes; however, the applied decision-making task is not repeatable. Information about type of suicide attempts (violent or non-violent), history of previous attempts, ongoing suicide intent / ideation and comorbid personality disorders was not collected; although, these variables could mediate the findings. Besides, participants were not matched for education. Finally, a limitation specific to the assessment of decision-making was also arisen: administration of the two versions of the IGT was not counterbalanced, which causes some methodological concerns.

Further studies should explore other psychological dimensions possibly specific to suicidal crisis. In addition, recruitment of depressive persons with past history of a suicide attempt and with no history of a suicide attempt as control participants or a within-subject study design may also add to the existing research.

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