LANGUAGE IN MILD DEPRESSION: HOW IT IS SPOKEN, WHAT IT IS ABOUT, AND WHY IT IS IMPORTANT TO LISTEN

Daria Smirnova[1,2], Dmitry Romanov[1], Elena Sloeva[3], Natalia Kuvshinova[3], Paul Cumming[4,5] & Gennadii Nosachev[1]

[1]*Department of Psychiatry, Narcology, Psychotherapy and Clinical Psychology,*
Samara State Medical University, Samara, Russia
[2]*Centre for Clinical Research in Neuropsychiatry, Division of Psychiatry, Faculty of Health and Medical Sciences,*
University of Western Australia, Perth, Australia
[3]*Department of Pedagogy, Psychology and Psycholinguistics, Samara State Medical University, Samara, Russia*
[4]*Institute of Nuclear Medicine, Inselpital, Bern University, Bern, Switzerland*
[5]*School of Psychology and Counselling and IHBI, Queensland University of Technology, Brisbane, Australia*

SUMMARY

Background: Our previous research demonstrated that mild depression (MD) is characterized by patterns of atypical language use such as inverted word order, greater repetition, increased use of reflexive/personal (e.g. myself) or negative/ indefinite (e.g. nobody) pronouns, verbs in past tense, and other lexico-grammatical, stylistic and syntactic indicators (how the patient speaks). We now investigate the role of semantic features (what the patient speaks about) in diagnosing (why it is important to listen) affective states.

Subjects and methods: 201 written narratives from 124 patients with MD and 77 healthy controls (HC), including 35 cases of normal sadness (NS), were studied using principle component lexis analysis. Statistical data evaluation was performed with SPSS-25 (p<0.05, significant) and included the Cohen's kappa for inter-rater reliability, nonparametric methods to measure between-group differences (Mann-Whitney U-test, Pearson Chi-square test, Kruskal-Wallis, one-way ANOVA), and discriminant analysis for modeling of semantic variables related to affective diagnostic types.

Results: Component lexis analysis revealed an exaggerated usage of semantic categories describing existential and family values in the texts of MD patients compared to HC. However, there were fewer cognitive and altruistic categories presented in patients' self-reports. The most substantial between-group difference was the lesser semantics of self-realization in MD patients, as well as their significantly lower ranking of social status' priorities. Communicative and hedonic values in MD speech displaced and predominated in ranking over the values of social status, versus the opposite relationship in HC speech. The discriminant model revealed a set of semantic indicators significantly distinguishing the MD, HC and NS groups (96.3%; Wilks' λ=0.001, p<0.001, r=0.996).

Conclusions: Linguistic structure and content of patients' verbalizations may serve as diagnostic markers of MD. Evaluation of psychosocial themes within the content of narratives should enable a better understanding of MD pathogenesis and emphasize the importance of monitoring social difficulties during treatment.

Key words: *affective disorders - mild depression - component analysis - language - semantic categories*

Abbreviations: *HC - entire group of healthy controls; MD - mild depression; NH - normal healthy participants with euthymic state; NS - normal sadness*

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INTRODUCTION

Mild depression (MD) has been registered in 15% of the population (Shim et al. 2011) and demonstrates a continuous, gradual growth of disease incidence over recent decades (Wittayanukorn et al. 2014). MD often represents a maladaptive response of the individual leading to excessive reactions to environmental stressors (Kessler 1997), which causes personal and professional difficulties (Paykel et al. 2005), and brings an elevated risk of unemployment (Birnhaum et al. 2010) and social isolation. Indeed, the onset of MD is often precipitated by negative life events (Bagot et al. 2014, Paykel 2003), and social defeat stresses (Liu et al. 2017), leading to the adjustment disorder after chronic exposure (Hammen 2005). The continued exposure to stress

factors can initiate a recurrent course of depression (Liu & Alloy 2010, Monroe & Harkness 2005), bringing anhedonia, reduced quality of life (Yang et al. 2015) and increased suicidality risk (Holmstrand et al. 2008).

The pathogenesis of MD entails distortions in affective (e.g. sad mood) and cognitive (e.g. negative thought content) components presented only through patients' language, while in severe forms of depression also compounded by observable signs of motor component (e.g. slow bodily movements). However, there is a lack of objective tests to recognise MD, and its diagnosis can include subjective elements. Previous research shows that language can serve as a specific diagnostic marker of clinical depression (Anreasen & Pfohl 1976, Bernard et al. 2016, Bucci & Freedman 1981, Smirnova 2013, Trifu et al. 2017). In particular, MD patients demon-

strate atypical patterns of language use, which differ from those in a euthymic state or normal sadness (NS) as a non-pathological reaction to adverse life circumstances (see for literature overview and study details, Smirnova et al. 2013, 2018). Pennebaker et al. (2003, p. 548) postulated that "the styles in which people use words" as well as "the content of what they say" and "language per se" represent valid depictions of a patient`s affective symptoms. Our recent study showed that written narratives of MD patients differed in a number of respects from those of euthymic controls or individuals suffering from NS. The MD narratives were longer, of rather descriptive style, and marked by various features such as repetitions, increased use of personal pronouns, and verbs in continuous/imperfective and past tenses, consistently characterized by switching to the self-focusing style and to retrospective ruminations, expressed in the past tense (Smirnova et al. 2018).

The cognitive theory of depression describes dysfunctional thought patterns focusing on three areas of experience: the self, personal future, and the world (Beck 1995). In the event-congruency hypothesis, a match of the nature of stress factors and individual personal vulnerability substantially heightens the risk to develop depression (Beck 1987). Furthermore, intrapersonal conflicts contributing to the onset of stress-related depressions are exacerbated by the changing value systems and degraded social support of post-industrial societies (Targ 1976) in the era of "socially prescribed perfectionism" (Hewitt & Flett 1991). For example, contemporary social media popularize overly critical self-evaluation (Frost et al. 1990), and unrealistic or unattainable aspirations for self and others, all of which set the stage for decreased emotional well-being and depression (Hewitt & Flett 1990, 1991, Yang et al. 2015). Street et al. (2001) highlighted four psychosocial determinants of depression: (i) cognitive style resulting in a lack of positive intrapersonal and interpersonal communication, (ii) behaviors and the impact of environmental stressors, (iii) the individual's pursuit of unrealistic goals and a perceived lack of control, and (iv) self-focus and self-reinforcement. The connection of these factors with language was introduced by Barnard`s observation (2009) that MD patients express ruminative and avoidant thought patterns and perceive word meanings selectively, focusing on the meanings of certain things, while neglecting other meanings. Luria (1975) defined the spoken or written word as "a special form of reflection of reality", such that language establishes a secondary linguistic reality, e.g. whereby adding subjective meanings that bring deevaluation of self-realization, enables a person create a new, depressive reality. Language can thus establish the pathological basis for the formation of novel maladaptive meanings.

The key semantic component of depressive thought has the meaning of «internal threat» (Glukhareva 2000, Mikirtumov 2004), which undermines the integrity of self-image and brings guilt-feelings and ruminations, where meanings of life can be lost (Hedayati & Khazaei 2014, Stillman et al. 2009). Following up Luria, Rudnev (2002) states that depression entails a revised linguistic representation of reality, where meaning is either decreased, absorbed by one universal negative meaning, or transitive in the sense that loss of value of one thing generalizes to all things, the so-called «objectlessness of melancholy».

In this study, we proceed from our earlier report on lexico-grammatical, stylistic, and syntactic indicators of language in depression (how patient speaks) (Smirnova et al. 2018), to a study of an analysis of the semantic characteristics of the content of patients' language in relation to attenuated life meanings and values (what patient speaks about). As such, we test the hypothesis that these differences in language content also serve as a diagnostic marker (why it is important to listen to patient's language), significantly distinguishing the affective states of MD, NS and euthymia.

SUBJECTS AND METHODS

201 participants were examined at the University's Department of Psychiatry after giving written informed consent to participate in a study approved by the University Ethics committee). This group is identical to the study populations from our recent publication (Smirnova et al. 2018). The entire group included 124 patients with diagnosis of MD, who were of mean (SD) age 42 (12) years. In this MD group, 94 (76%) were females, 57 (46%) single or divorced, and 66 (53%) had a college or university degree. Their ICD-10 categories were: F32.0 (n=27; 22%), F41.2 (n=26; 21%), F43.20 (n=29; 23%), F43.21 (n=23; 19%), F43.22 (n=19; 15%). We also recruited 77 age-matched healthy controls (HC) of mean (SD) age 40 (12) years, of whom 61 (79%) were female. Of the 77 HCs, 42 participants were designated as normal healthy (NH) and 35 qualified as being in a state of normal sadness (NS), based on reporting current life problems and low mood. The ICD-10 categories of the NS group were: Z56 - Problems related to employment and unemployment (n=7; 20%), Z59 - housing and economic circumstances (n=14; 40%), Z60 - social environment (n=4; 11%), Z63 - primary support group, including family circumstances (n=10; 29%). The total Hamilton Depression Rating Scale-21 score for the MD group (Mean (SD)) was 14.3 (2.2), which differed significantly from that of the HC (3.03 (0.89)), NS (3.77 (0.65)) and NH (2.40 (0.50)) groups (ANOVA $F_{(2, 198)}=4,110.05$, $p<0.001$, $\eta^2=0.976$), with significant paired between-groups differences after post hoc Bonferroni correction ($p<0.05$; $\alpha=0.05$), $p<0.001$.

There were 201 narratives (written self-reports on the topic «The current state of life and future expectations») investigated by the research team, consisting of a psychiatrist (DS), linguist (ES) and clinical psychologist (NK).

Table 1. Semantic categories and themes presented in the written narratives of individuals with mild depression, normal sadness and healthy participants

Semantic categories and themes	Descriptive statistics - n (%)				Between-group comparison			
		Control group			MD vs HC *		MD vs NH vs NS *	
			Subgroups		Pearson Chi-square Test		Kruskal-Wallis One-way ANOVA	
	MD (n=124)	HC (n=77)	NH (n=42)	NS (n=35)	χ^2	Effect size w	H (corrected for ties) df=2, n=201	Effect size Cohen's f
Existential category	124 (100%)	65 (84%)	38 (49%)	27 (77%)	20.55	0.319	26.47	0.390
To be free	12 (10%)	10 (13%)	8 (19%)	2 (6%)	5.52	0.165	10.38	0.234
To live	124 (100%)	64 (83%)	38 (42%)	26 (74%)	22.38	0.334	30.50	0.424
To love	73 (59%)	29 (38%)	18 (42%)	11 (31%)	3.64#	0.134	4.80#	0.157
Family category	124 (100%)	59 (76%)	32 (76%)	27 (77%)	8.10	0.200	8.07	0.205
To pass on the best to one's children	121 (98%)	54 (70%)	27 (64%)	27 (77%)	8.74	0.208	10.71	0.237
To live for the sake of one's family	104 (84%)	58 (75%)	31 (74%)	27 (77%)	2.58#	0.113	2.66#	0.116
To help relatives	120 (97%)	52 (68%)	29 (69%)	23 (66%)	9.10	0.212	9.18	0.219
Self-realization category	34 (27%)	42 (55%)	26 (62%)	16 (46%)	55.60	0.525	57.94	0.639
To perfect oneself	12 (10%)	33 (43%)	21 (50%)	12 (34%)	46.70	0.482	49.53	0.574
To realize oneself	14 (11%)	38 (49%)	23 (55%)	15 (43%)	64.44	0.566	65.77	0.700
To realise opportunities	9 (7%)	33 (43%)	21 (50%)	12 (34%)	52.83	0.512	55.76	0.622
Social status category	20 (16%)	36 (47%)	22 (52%)	14 (40%)	42.64	0.460	44.11	0.532
To be successful	2 (2%)	16 (21%)	11 (26%)	5 (14%)	21.40	0.326	24.60	0.375
To make a career	11 (9%)	28 (36%)	19 (45%)	9 (26%)	36.19	0.424	41.28	0.510
To achieve high social status	11 (9%)	26 (34%)	17 (40%)	9 (26%)	34.89	0.416	37.98	0.484
Communicative category	20 (16%)	30 (39%)	17 (40%)	13 (37%)	13.25	0.256	13.30	0.267
To be together with a significant other	7 (6%)	24 (31%)	15 (36%)	9 (26%)	23.72	0.343	25.06	0.359
To feel needed by others	10 (8%)	8 (10%)	2 (5%)	6 (17%)	0.32#	0.040	3.89#	0.140
To enjoy friendship	11 (9%)	11 (14%)	11 (26%)	2 (6%)	2.90#	0.120	10.46	0.235
Hedonic category	28 (23%)	23 (30%)	15 (36%)	8 (23%)	1.33#	0.081	2.99#	0.123
To derive pleasure	4 (3%)	19 (25%)	13 (31%)	6 (17%)	21.57	0.328	25.04	0.358
To be happy	5 (4%)	17 (22%)	11 (26%)	6 (17%)	15.87	0.280	17.39	0.309
To have sensations	26 (21%)	18 (23%)	13 (31%)	5 (14%)	0.16#	0.028	3.25#	0.129
Cognitive category	8 (6%)	19 (25%)	12 (29%)	11 (31%)	15.28	0.275	17.79	0.312
To know oneself	8 (6%)	10 (13%)	2 (5%)	8 (23%)	13.62	0.260	25.58	0.363
To know God	2 (2%)	1 (1%)	1 (1%)	0 (0%)	0.12#	0.024	1.21#	0.078
To understand life	4 (3%)	16 (21%)	6 (14%)	9 (26%)	12.38	0.248	13.92	0.274
Altruistic category	4 (3%)	18 (23%)	12 (29%)	6 (17%)	19.79	0.314	22.24	0.353
To help others	2 (2%)	13 (17%)	7 (17%)	6 (27%)	16.04	0.282	15.97	0.295
To do good to others	1 (1%)	7 (9%)	4 (10%)	3 (9%)	8.53	0.206	8.53	0.211
To improve the world around one	2 (2%)	9 (12%)	9 (21%)	0 (0%)	9.32	0.215	26.14	0.387

* $p<0.05$ significant; # n.s. non significant $p>0.05$; HC: The entire healthy control group; NH: Normal healthy participants with euthymic state; NS: Normal sadness; MD: Patients with mild depression

Detailed analysis of lexico-grammatical, lexico-semantic and syntactic features of the texts are presented in our recent paper (Smirnova et al. 2018). We now focused on semantic features of the text, which were evaluated using component lexis analysis (Mikirtumov 2004). This hierarchal analysis consisted of three stages: 1) determining for each utterance the keywords, known as lexical-grammatical items, i.e. the smallest semantic units, 2) combining the keywords into semantic ranks (known as lexical-semantic groups), which are based on the common semantic meaning, and finally 3) codifying the semantic ranks into semantic themes, and then into semantic categories, known as semantic extra-items or arch-items. We used the classification of fundamental semantic themes and categories to standardize themes and categories obtained at the final stage of component analysis (Kotlyakov 2013; Table 1). Each language sample was scored by the profile of semantic themes and categories presented in the text. For example, we analyzed the MD utterance "I was useless and did not help anybody, neither my daughter, nor my grandchildren" according to a consensus-based opinion of the three team members, following the defined stages of the component lexis analysis: 1. Keywords "useless", "help", "daughter", "grandchildren". 2. Semantic ranks "help/aid" and "relatives". 3. Semantic theme "To help relatives" and Semantic category "Family". Each of the three researchers rated all the texts using component analysis and by codifying semantic arch-items. While one rater (DS) was unavoidably informed about the clinical state of the participants, the other two raters were blind regarding the group assignment. The simple majority (two out of three raters) resolved any conflicts regarding semantic categories.

All statistical analyses were performed with the IBM SPSS Statistics 25 (IBM Corp. 2017). An inter-rater reliability (the Cohen's Kappa, k) was assessed to determine consistency between the three raters in coding the semantic features. Differences between groups were evaluated using the nonparametric Mann-Whitney U-test, Pearson Chi-square test, and Kruskal-Wallis, one-way ANOVA, depending on the variable type and number of groups compared. Values of $p<0.05$ were deemed to be statistically significant. Mathematical modeling of discriminant analysis (λ–Wilks; method Standard) was applied to establish the level of significance in relation to between-group differences and included semantic categories and themes as independent variables.

RESULTS

The average inter-rater reliability on semantic categorization between the two blind raters was high: k=0.834, p<0.001, 95% CI (0.802-0.857). Component lexis analysis showed that texts of patients with MD significantly differed from written reports of HC and NS participants in the majority of examined semantic categories and themes (Table 1).

Semantic categories describing existential and family values were exaggerated in the narratives of MD patients compared to HC, while cognitive and altruistic categories were mentioned significantly less often in MD patients' texts, in line with the rest of categories. However, selected themes such as "to love" from the existential category, "to live for the sake of the family" from the family category and "to know God" from the cognitive category, did not show statistically significant differences between MD, HC and NS groups. The most substantial between-group difference, according to the size-effects, was the lesser representation of self-realization in MD patients, as well as their significantly lower ranking of social status' priorities. Communicative and hedonic values in the MD group were displaced and prioritized in ranking over the values of social status, which was the opposite finding to that in the HC group (Table 1, 2).

The discriminant analysis revealed that our mathematical model significantly characterized the study sample such that the set of semantic categories and themes distinguishes affective states of MD, NS and euthymia in NH with a probability of 96.3% (Figure 1). The spread of canonical discriminant functions demonstrated significant differences between MD, NS and NH (96.3%; test of functions 1 through 2: Wilks' $\lambda(180)=0.001$, p<0.001, canonical correlation r=0.996).

Table 2. Ranking of Semantic categories presented in the texts of patients with mild depression and healthy participants

Study groups	HC		MD	
Semantic Category	№ Ranking	n (%)	№ Ranking	n (%)
Existential	1	65 (84%)	1 >	124 (100%)
Family	2	59 (76%)	2 >	124 (100%)
Self-realization	3	42 (55%)	3 <	34 (27%)
Social status	4	36 (47%)	5	20 (16%)
Communicative	5	30 (39%)	6	20 (16%)
Hedonic	6	23 (30%)	4	28 (23%)
Cognitive	7	19 (25%)	7 <	8 (6 %)
Altruistic	8	18 (23%)	8 <	4 (3 %)
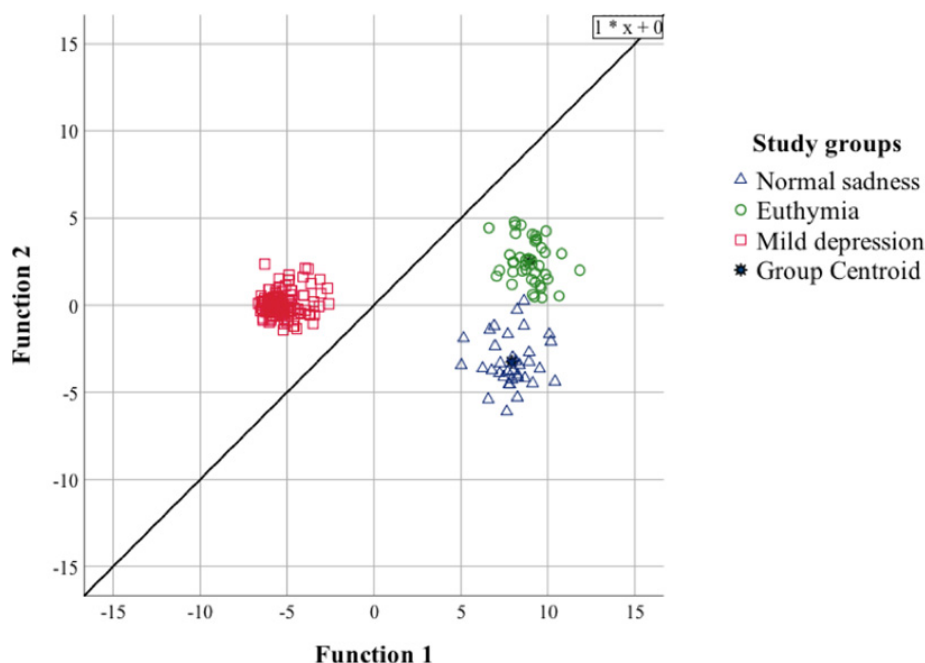
Figure 1. Canonical discriminant functions. Discriminant model of the diagnostic types of mild depression, normal sadness and euthymia, based on component lexis analysis of narratives

DISCUSSION

The topic for written reports of our study participants «The current state of life and future expectations» was chosen to investigate those psychosocial themes and life priorities that tend to be emphasized by MD patients in the contextual framework of experiencing their depressed mood. Consistent with our previous analysis of language style (Smirnova et al. 2018), we found that narratives of MD patients different significantly from those in NS and euthymia according to the spectrum of semantic categories and themes presented in the written content, i.e. semantic features correlated with an affective component. This finding supports the proposition that language can serve as a diagnostic marker of clinical depression (Anreasen & Pfohl 1976, Bernard et al. 2016, Bucci & Freedman 1981, Smirnova 2013, Trifu et al. 2017), and gives important new information about the linguistic basis of the distortion in the spectrum of semantic categories in MD; some were over-prioritized, and others were significantly reduced (Barnard 2009, Pennebaker et al. 2003, Rudnev 2002). Thus, the new finding of significantly attenuated semantic representation of categories of self-realization and social status, along with a lower ranking of social status in the MD group, is consistent with other findings that depression is associated with professional disabilities (Paykel et al. 2005) and unemployment (Birnhaum et al. 2010). These social deficits arise from impaired intrapersonal and interpersonal communication (Street et al. 2001), where lower life meanings lead to selective neglect of previously held priorities more in accord with euthymia (Barnard et al. 2009, Rudnev 2002, Hedayati & Khazaei 2014, Stillman et al. 2009). These changes

exacerbate the increased social distance by switching to a more self-focusing style (Pennebaker et al. 2003), accompanied by a tendency for unhealthy criticism of self, other people, and external events (Beck 1995, Monroe & Harkness 2005, Stillman et al. 2009). In MD, this self-focusing style with reduced societal values enables avoidance of traumatic circumstances, which further compromise integration into society, often due to a sense of failure to have achieved the unrealistic standards typical of modern societies (Hewitt, Flett 1990, 1991). However, narratives of the MD patients had an elevated occurrence of family category, and the communicative category supplanted social status values in ranking, while remaining significantly lower in comparison to HC. This re-prioritization might be attributed to a search for support from the primary social group as a compensatory strategy in response to the decreased sense of social well-being due to experiencing social pressure and psychosocial stressors, perceived or real (Beck 1987, Hedayati & Khazaei 2014, Kessler 1997, Stillman et al. 2009, Yang et al. 2015).

The fewer instances of hedonic category in the MD group has an obvious association with symptoms of anhedonia (Yang et al. 2015). The concomitantly lower content related to altruistic and cognitive categories reflects the problems to prioritize the high level of values in the hierarchy of needs (e.g. morality, faith) following the difficulties with the basic needs of safety (e.g. resources, employment) (Hedayati & Khazaei 2014), which also seems at odds with the self-focusing strategies typically observed in depression (Pennebaker et al. 2003). That certain semantic themes such as "to love" from the existential category, "to live for the sake of the family" from the family category and "to know

God" from the cognitive category did not significantly differ between MD, NS and HC groups points to them as life priorities that are resilient to or independent of depressive mood. Thus, the most prominent differences between MD, NS and HC lie in the area of decreased social values within self-realization and social status («to realize oneself», «to realize opportunities», «to make a career»), also include low cognitive and altrustic intentions and, conversely, exagerrated existential («to live») and family («to pass on the best to one´s children», «to help relatives») semantics.

CONCLUSIONS

Features of language structure and of content may represent objective diagnostic markers of MD. Precise evaluation of psychosocial themes specified in the content of patients' verbalizations or writings might also impart a better understanding of the pathogenesis of MD, which often starts as a maladaptive reaction to social stressors, then exacerbated by further social difficulties arising due to the depression itself. In the absence of reliable biomarkers or test for MD, linguistic analysis (listening to what the patient says) may afford accurate monitoring of the dynamics of affective state during treatment.

Limitations of the study

We studied written narratives, which may not relate simply to natural speech flow in MD. Our classification systems for semantic categorization is based on earlier investigations of Russian language speakers and, being inseparable from life values and priorities, might be specific to the Russian mentality. Therefore, the cross-cultural validity of this analysis must be confirmed by further investigation. Future research would benefit from application of expanded semantic approach, through implementation of a questionnaire specifically designed for diagnosis of MD. Such a questionnaire based on analysis of semantic categories and psychosocial topics, while also probing relationships between salient stress factors and individual vulnerabilities of life values and priorities, might reveal optimal targets for psychotherapeutic interventions.

Contribution of individual authors:

Daria Smirnova, Elena Sloeva & Gennadii Nosachev designed the project.
Daria Smirnovaa & Gennadii Nosachev collected the data.
Daria Smirnova, Elena Sloeva, Natalia Kuvshinova & Gennadii Nosachev analyzed the data with advice from *Dmitry Romanov & Paul Cumming*.
Daria Smirnova & Paul Cumming wrote the first draft of the manuscript, and revised upon input from the other co-authors.

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Correspondence:

Assist. Prof. Daria Smirnova; MD, PhD
Department of Psychiatry, Narcology,
Psychotherapy and Clinical Psychology, Samara State Medical University
119-29, Krasnoarmeyskaya Street, 443030 Samara, Russia
E-mail: daria.smirnova.md.phd@gmail.com