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THE DEVELOPMENT OF TEMPERAMENT EVALUATION OF MEMPHIS, PISA, PARIS, AND SAN DIEGO - AUTO-QUESTIONNAIRE FOR ADOLESCENTS (A-TEMPS-A) IN A SERBIAN SAMPLE

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SUMMARY

Background: *Previous studies suggest that temperament features of adolescents may be good predictors of the development of future psychopathology in this population. The aim of the study was to adapt the content and validate the psychometric properties of the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego - Auto-questionnaire in a sample of Serbian adolescents.*

Subjects and methods: *The sample included 2113 adolescents, 56% girls and 44% boys, average age 16.73±0.47, attending 48 Serbian secondary schools. The base for the development of this scale included Serbian standardised versions as well as the TEMPS-I, Interview version.*

Results: *The final scale is comprised of 36 items, with six factors (depressive, cyclothymic, hyperthymic, irritable, and anxious-cognitive/somatic) explaining 39.9% of the total variance, the internal consistency coefficient α=0.77, and the average test–retest coefficient (rho=0.84). The correlations among the temperaments ranged from weak to moderate, with the highest positive correlations between the depressive, cyclothymic and anxious scales. The highest values were detected on hyperthymic and the lowest on depressive temperament. Significantly higher scores of depressive, cyclothymic and anxious temperaments were detected in girls, whereas boys had higher scores on the hyperthymic scale.*

Conclusions: *The scale has shown good psychometric properties, which encourages its further use in adolescent population. The results show certain specific features of this population, such as higher scores on all temperament types than the ones in student and adult population and a tendency of socially desirable answers.*

Key words: *adolescent population - psychometric properties - temperament - TEMPS-A*

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INTRODUCTION

The period of adolescence is an intermediate stage between childhood and adulthood, when individuals intensively develop both physically and on a socio-emotional plane, which makes this population a unique group with specific cognitive, emotional and social characteristics. Yet, adolescents are insufficiently presented in national health statistics, and represent a population that health care providers are not routinely trained to serve (WHO 2015).

The terms personality and temperament are frequently used interchangeably or even synonymously in the literature. Nevertheless, such levelling-up of the two concepts is unjustified because personality is the super ordinate concept, representing a relatively stable organisation of an individual and encompassing temperament (emotional responses), intelligence, moral and volitional elements (Ristić-Ignjatović 2011). Temperament refers to innate aspects of personality, which by definition constitute a firm and biologically determined base of emotional responses that is displayed from a relatively early age and remains fairly stable throughout one's life, indirectly defining both the cognitive aspect of personality and the activity level of an individual (Akiskal & Akiskal 2005).

Investigating temperament types in adolescents is a particularly important field of research because temperament has a prominent role in psychosocial personality development. Many studies have indicated a relationship between extreme markedness of different temperamental traits and emotional/behavioural problems in adolescents through increased vulnerability to certain psychopathological disorders or other people's responses to these specific temperament expressions (Masi et al. 2003).

Studies have suggested that certain affective temperament types are considerably important for occurrence, course and development of symptoms of some affective disorders, such as depression, bipolar disorder and anxiety (Tanabe et al. 2016, Maremmani et al. 2011, Tavormina 2010, Rihmer et al. 2010, Schuch 2009, Signoretta et al. 2005, Kochman et al. 2005, Masi et al. 2003), but that they also have a strong connection with suicidal behaviour (Baldessarini et al. 2016, Skala et al. 2012, Pompili et al. 2008). Moreover, if temperament is a risk factor for mood disorders, it may be activated or amplified by the complex psychosocial and biological changes associated with puberty and the transition to adolescence (Nolen-Hoeksema 2002).

In the light of such findings, determining types of temperament in adolescents could provide us with opportunity to detect potential risks for the development of a mental illness at early stages, and consequently to intervene promptly.

Temperament Evaluation of Memphis, Pisa, Paris, and San Diego - Auto-questionnaire - TEMPS-A, has been validated throughout the world and proven to be a valuable tool, not only for describing emotional reactivity and affective traits which are the fundamental predisposition underlying mood and affective disorders (Akiskal & Akiskal 2005), but also certain forms of positive reactions in general population (Kesebir et al. 2013), as well as creativity and professional preferences (Rovai et al. 2013, Vellante et al. 2011). The scale assesses five temperament types: cyclothymic temperament, which relates to mood swings and emotional shifts, depressive, which relates to prevailing feelings of sadness, lethargy, apathy and pessimism, hyperthymic which includes increased activity and energy, positive mood, self-confidence and enthusiasm, while irritable temperament includes aggressive and impulsive reactions, fretfulness and bad-temperedness. In our previous studies (Ristić-Ignjatović et al. 2014, Hinić et al. 2013), anxious factor was divided into anxious-cognitive, which refers to cognitive manifestations of apprehension and uneasiness, and anxious-somatic, with somatic manifestations in headaches, stomachache and cardiovascular problems.

Although widely used, only a few studies to date have administred this scale on adolescents. Consequently, there is an evident need for an instrument measuring temperament types, adapted to adolescent population, which certainly differs from other populations, not only in its developmental characteristics, but also their lexicon, frame of reference and similar factors influencing comprehension of the scale content and items.

Aim of the study

The aim of this study was to validate the psychometric properties and factor structure of the TEMPS-A in a large sample of adolescents.

SUBJECT AND METHODS

In Serbia, primary education is compulsory and it lasts eight years. Secondary education includes grammar schools or vocational secondary schools (eg medical, technical, etc), which last four years and are attended by adolescents aged 15–18.

Based on the data from the Ministry of Education and Science of the Republic of Serbia (MPNTR 2015), at the time of research 462 secondary schools operated in the country territory. Firstly, we determined the geographic distribution of the schools in the sample based on the number of schools in the five official regions of Serbia (SORS 2015). Secondly, we determined their distribution according to the school type (grammar, vocational secondary schools). Having formed the quotas of the strata, we randomly selected 48 schools from the list of schools (i.e. 10% of all schools in total). In the schools themselves, we also randomly chose the concrete classes to take part in the research.

The participation in the study was voluntary, anonymous, and the informed consent was provided in written form. The approval was obtained by the Ethical Committee, University of Pristina, with temporary residence in Kosovska Mitrovica.

Due to the specific nature of adolescent population, trained administrators (trained psychologists as well as student teachers) were present during the questionnaire-taking time, with an aim to help the subjects with potential uncertainties regarding the content of the items.

Participants

The final sample included 2113 adolescents, out of 2239 initially surveyed, 56% females and 44% males, with the mean age of M=16.73; SD=0.47. Detailed data concerning sociodemographic characteristics of the sample are shown in Table 1.

Table 1. Demographic characteristics of the sample

Region	%	School Type	%	Average overall marks	%	Economic status	%
Belgrade	14.3	grammar	38.4	excellent	38.1	low	5.9
Vojvodina	20.6	technical	24.1	very good	37.2	lower middle	10.6
Central & West Serbia	23.3	economics	17.1	good	22.6	middle	39.5
South & East Serbia	32.3	medical	14.4	satisfactory	2.0	upper middle	27.2
Kosovo & Metohia	9.4	other	6.0			high	16.9

The number of girls is significantly higher in grammar schools (χ^2=39.02; p<0.001), medical schools (χ^2=70.85; p<0.001) and schools of economics (χ^2=29.88; p<0.001), while boys outnumbered girls in technical schools (χ^2=114.14; p<0.001); hence this variable will be controlled in certain analyses.

Measures

All the participants filled in a brief sociodemographic questionnaire (age, sex, region, school type, average overall school marks, economic status), and the Adolescent Temperament Evaluation of Memphis, Pisa, Paris, and San Diego - Auto-questionnaire (A-TEMPS-A).

The following scales served as a basis for the development of this version of the scale: Serbian standardised version of TEMPS-A for adult population (Ristić-Ignjatović et al. 2014), TEMPS-A version for university student population (Hinić et al. 2013), and the TEMPS-I, Interview version (Placidi et al. 1998a), which was employed in an Italian study for a sample mainly consisting of adolescents and administered in an interview format. The TEMPS-I was translated into the Serbian language by a certified translator. One more study was analysed, with the sample including adolescents (Guerreiro et al. 2013), wherein the TEMPS-A scale was also used. The accuracy of the final A-TEMPS-A translation was verified by one of the original authors of the scale (Akiskal H.S.). The internal consistency of the scale in Serbian university student population was α=0.77 (Hinić et al. 2013), in adult α=0.83 (Ristić et al. 2014), with the average test–retest coefficient (rho=0.82) in both studies.

By means of analysing the existing items of the abovementioned scales, the overlapping items were deleted, as well as those inappropriate for adolescent population as regards their content. The final version of the scale, with 81 items, classified under five original temperament types: depressive (eg I often feel sad and unhappy), cyclothymic (eg My mood often changes for no reason), hyperthymic (eg I'm always on the move), irritable, (eg People say I burst for no reason), and anxious (eg I worry about usual daily things others consider minor). The subjects responded to yes/no statements, depending on whether they were applicable to them or not.

Statistical Analyses

The scores of each temperament subscale were represented by mean values, the total sums divided by the number of appropriate items. The normal distribution of the variables was verified with the Kolmogorov-Smirnov test, retest reliability with Spearman's coefficient and the reliability of the subscales was measured by Cronbach's alpha coefficient. Since the scores were not normally distributed, differences in scores were computed by the Mann–Whitney and Kruskal-Wallis tests, while the Spearman's coefficient was used for correlations. Confirmatory factor analysis (Maximum likelihood method) was also employed, in Amos 18. For the purposes of data analysis, SPSS for Windows 18 was used.

RESULTS

Factorial structure of the A-TEMPS-A

Besides items with weak initial extraction loadings (<0.20), items that were problematic for the participants during the testing time (the ones they refused to answer or failed to understand the meaning of their content due to age and language barriers) were also excluded from the scale (eg I am driven by unpleasant restlessness that I don't understand). The scale included only items with >0.40 factor loadings, while those with negative loadings were excluded. The scale has shown good preliminary results that justified further factor analysis (Bartlett's test of sphericity χ^2(630)=13647.42; p<0.01; KMO=0.89).

Subsequently, confirmatory factor analysis (Maximum likelihood method) was employed, with a forced four-, five- and six-factor solutions, appearing as the most common models in the literature for this scale (cf Elias et al. 2017, Ristić et al. 2014, Hinić et al. 2013). The four-factor model explained 33% of the variance, anxious-cognitive items were placed under depressive, and anxious-somatic under cyclothymic factor. The five-factor model explained 36% of the variance, anxious-somatic items again fell under cyclothymic, while the cognitive factor was extracted as a single factor. Finally, the six-factor model explained 39.9% of the variance, in which items from the anxious scale were also clearly divided into the somatic and cognitive subscales (Table 2). This model showed best model fit indices (χ^2/df=3.526; p<0.01; GFI=0.948; AGFI=0.940; CFI=0.889; RMSEA=0.035; PCLOSE=1.000).

Cyclothymic factor was singled out as a dominant temperament type and explained 16.6% of the variance. Depressive temperament explained 7.6% of the variance, hyperthymic 5.0%, and irritable temperament 4.2%. Finally, in this study the anxious type was divided into anxious-cognitive (3.5% of the variance), and anxious-somatic (3.2% of the variance).

Similarly to previous studies, two superfactors were extracted, explaining 60% of the total variance. The first, contained depressive, cyclothymic, irritable and both types of anxious temperaments and explained 42.6% of the variance, whereas the second with hyperthymic temperament explained 17.5% of the variance. The correlations between temperaments ranged from weak to moderate, with the highest positive correlations between the depressive, cyclothymic, and anxious scales (Table 3).

Table 2. Adolescent TEMPS-A factor loadings

	Cyclo-thymic	Depres-sive	Hyper-thymic	Irrit able	Anxious-Cognitive	Anxious-Somatic
1. I get sudden changes in mood and energy	0.591					
2. My mood often changes for no reason	0.660					
3. I am constantly being switched between lively and listless	0.631					
4. Sometimes I go to bed feeling great, and wake up in the morning feeling down	0.504					
5. My need for sleep varies a lot from just a few hours to over 9 hours	0.439					
6. I can be sad and happy at the same time	0.456					
7. I sometimes have problems to fall asleep for no reason	0.443					
8. I often feel sad and unhappy		0.619				
9. People tell me that I am unable to see the brighter side of things		0.495				
10. I suffered much in life		0.542				
11. I think that things often come out for the worst		0.414				
12. I have always felt like a failure		0.560				
13. I was told to be pessimistic about things, and forget about previous happy times		0.452				
14. I am by nature dissatisfied person		0.465				
15. Usually I am cheerful and in a good mood			0.583			
16. I enjoy beautiful things that my life is made of			0.435			
17. I love telling jokes, and participate in games			0.510			
18. I am the type of person who believes that everything will eventually turn out well			0.475			
19. I have great confidence in myself			0.594			
20. I often get great ideas			0.533			
21. I'm always on the move			0.606			
22. I love to hang out with a lot of people			0.478			
23. When I disagree with someone, I can fall into the boiling argument				0.604		
24. I often feel like being on the edge				0.433		
25. I often get so furious I'd demolish everything				0.587		
26. When I get angry, I could get in the fight				0.664		
27. People say I burst for no reason				0.543		
28. When I get angry, I sauce to people				0.534		
29. I can be so furious that I could hurt someone				0.650		
30. I always worry about one thing or another (school, friends, home)					0.694	
31. I worry about usual daily things others consider minor					0.696	
32. Many people told me I'm not able to relax					0.697	
33. When I'm under stress, my hands often shake						0.633
34. When I'm nervous, I often feel nausea and have upset stomach						0.612
35. I easily get headaches when I'm under stress						0.405
36. When I'm under stress, I get uneasy feeling in my chest or heart pounding						0.513

Table 3. Correlation coefficients between the Adolescent TEMPS subscales

	Cyclothymic	Hyperthymic	Irritable	Anx.Cog.	Anx.Som.
Depressive	0.399**	-0.379**	0.307**	0.448**	0.394**
Cyclothymic		-0.147**	0.381**	0.326**	0.430**
Hyperthymic	-0.147**		-0.025	-0.202**	-0.178**
Irritable	0.381**	-0.025		0.219**	0.279**
Anx.Cognitive	0.326**	-0.202**	0.219**		0.370**

**p<0.01

Table 4. Basic results of the Adolescent TEMPS-A scale

Temperaments	Mean (StD)	Female M (StD)	Male M (StD)	Kolmogorov -Smirnov	Skewness/ Kurtosis	α	rho
Depressive	0.23 (0.24)	0.26 (0.25)	0.20 (0.22)	0.221**	1.048/0.409	0.69	0.78
Cyclothymic	0.52 (0.28)	0.58 (0.28)	0.44 (0.27)	0.119**	0.017/-0.994	0.66	0.81
Hyperthymic	0.74 (0.24)	0.72 (0.24)	0.77 (0.22)	0.195**	-0.812/-0.107	0.68	0.91
Irritable	0.49 (0.30)	0.50 (0.30)	0.48 (0.29)	0.117**	0.074/-1.006	0.71	0.87
Anxious-Cognitive	0.42 (0.39)	0.47 (0.40)	0.34 (0.37)	0.232**	0.309/-1.401	0.70	0.81
Anxious-Somatic	0.36 (0.31)	0.44 (0.32)	0.27 (0.28)	0.196**	0.456/-0.855	0.69	0.82

**p<0.01

Table 5. Differences and correlations between demographic variables and TEMPS scale

	Depressive	Cyclothymic	Hyperthymic	Irritable	Anx. Cog.	Anx. Som.
Sex	U=-6.106**	U=-11.917**	U=5.744**	U=-1.112	U=-7.793**	U=-13.484**
Av. mark	rho=0.081*	rho=0.166**	rho=0.109**	rho=0.164**	rho=-0.042	rho=0.061*
Econ.status	rho=-0.186**	rho=-0.102**	rho=0.083**	rho=-0.009	rho=-0.124**	rho=-0.092**
Region	H=9.55*	H=8.70	H=40.22**	H=8.45	H=1.83	H=3.07

**p<0.01; *p<0.05

The final A-TEMPS-A scale showed good overall reliability, with internal consistency coefficient α=0.77, average retest coefficient rho=0.78 and Spearman-Brown coefficient of validity of 0.71.

All the tested scores for both sex groups, except for hyperthymic temperament, deviated from normal distribution and showed a negatively skewed distribution (Table 4). The hyperthymic scores were skewed towards higher values.

Temperaments and demographic characteristics

The female participants had significantly higher scores on depressive, cyclothymic and both types of anxious temperaments, while male participants reported higher scores on hyperthymic (Table 5). We have not performed a correlation with age because all the subjects were 16 or 17 years old. The correlation with school achievement (average overall mark) was detected in some types of temperament (Table 5). However, the correlation was quite low, as it was with economic status. According to regions, no significant differences were detected, except for depressive temperament, where the scores in Kosovo and Metohia were the lowest, and in Vojvodina the highest. The same was true for hyperthymic temperament, where these differences were in reverse order (Vojvodina reported the lowest, Kosovo and Metohia the highest values). According to school types, differences follow the distribution of students according to sex; hence, these results will not be presented herein.

The mean values (Table 4) showed the highest values on hyperthymic temperament and the lowest on depressive, which tallies with the results of similar studies in non-clinical samples (cf Ristić et al. 2014). When these values are compared with the results in general population obtained upon the standardisation of the Serbian version of the scale (Ristić et al. 2014), significantly higher scores may be noticed in adolescents on all temperament types, from anxious-cognitive ($t(2)=4.43$; $p<0.001$; $d=0.10$) and somatic ($t(2)=12.41$; $p<0.001$; $d=0.26$), where the difference is the smallest, to cyclothymic ($t(2)=30.52$; $p<0.001$; $d=0.68$) and irritable ($t(2)=32.58$; $p<0.001$; $d=0.70$), with the highest differences. The adolescents also showed higher values of average scores in comparison to the scores obtained in university student research in Serbia. These values are statistically higher on all temperament types, from irritable ($t(2)=29.49$; $p<0.001$; $d=0.63$) and cyclothymic ($t(2)=25.66$; $p<0.001$; $d=0.57$), to hyperthymic ($t(2)=19.96$; $p<0.001$; $d=0.43$) and depressive ($t(2)=15.97$; $p<0.001$; $d=0.33$), except for anxious ($t=3.68$), which in the said research was not divided into two subfactors.

DISCUSSION

The main finding of the present study is that affective temperaments can be reliably identified in adolescent population with this version of the scale. The final version of the scale had 36 items, clustered around depressive (7), cyclothymic (7), hyperthymic (8), irritable (7), anxious-cognitive (3), anxious-somatic (4). Since the number of items on subscales is not the same, we propose that the average value for each subscale should be computed, so that the gathered values could be comparable.

As with many other previous studies conducted in younger and adult samples (Woodruff et al. 2011, Figueira et al. 2010, Rózsa et al. 2008, Blöink et al. 2005), the results of the current study have shown expected strong (positive) correlations between depressive, cyclothymic and both types of anxious temperament, and cyclothymic and both types of anxious temperament. Apart from that, a positive correlation between irritable and cyclothymic temperament was confirmed in these studies, and a negative between hyperthymic and all other temperament types. Such a link between temperament types has clinical implications too. Therefore, some authors maintain that hyperthymic temperament could be a protective factor against suicide among affective patients (Vázquez et al. 2010). Likewise, in a study where a number of subjects included adolescents (Guerreiro et al. 2013), hyperthymic temperament was the only dimension of temperament which did not have significant association with self-harm.

The mean values (Table 4) showed the highest values on hyperthymic temperament. In the two previous studies which included adolescent samples (Placidi et al. 1998a, Placidi et al. 1998b), the highest score was also detected on hyperthymic temperament. The distribution of other scores corresponds with our results to a certain extent. A temperament type following hyperthymic in high scores was cyclothymic, which tallies with the results reported in the literature, underlining that cyclothymia appears in early adolescence (Akiskal 1995).

The participants reported the lowest scores on depressive temperament, which may be interpreted to mean that depressive temperament is not fully developed in that period of life, and that it can be conditioned by specific cultural features of the environment surrounding the participants. The most significant factor with regard to depression in younger children is related to sadness, lack of enjoyment, feelings of being unloved, while in adolescents the symptoms are grouped under a general depressive-anxiety factor, which also includes worries, irritability and some somatic symptoms (Poli et al. 2001). High emotionality, being a temperament feature, is closely connected with the risk of depression and anxiety in adolescents (Masi et al. 2003), which may be the reason for joint covariance of these traits and overlapping of factors in the original five-factor model of the TEMPS-A scale.

Gender differences have also been found in the present study. Namely, girls had significantly higher scores on depressive, cyclothymic and both types of anxious temperament, while boys had higher scores on hyperthymic temperament. Such results correspond with earlier research in adolescents (Placidi et al. 1998a), and previous research on student population, both in Serbia (Hinić et al. 2013) and worldwide (Vázquez et al. 2012, Woodruff et al. 2011). These results may be interpreted in view of the following statement: cyclothymic temperament is more frequent in females and hyperthymia might be more of a male attribute, especially in juvenile years (Akiskal & Akiskal 2005). In a similar vein, the results tend to support the hypothesis on the evolutionary function of anxious-depressive traits in women (Akiskal & Akiskal 2005) as well as findings supporting the idea that the prevalence of depressive disorders in females does not start to be evident before adolescence (Poli et al. 2001). Bearing in mind the fact that recent studies indicate that certain brain structures of boys and girls are differently developed under the influence of sex hormones, the maturation process may partly have an impact on the mentioned gender differences (Herting et al. 2015).

In studies that used the Cloninger's model (Zohar et al. 2018; Cloninger et al. 1994), it is reported that girls have lower scores in novelty seeking and higher in harm avoidance. Earlier findings show that the harm avoidance dimension is negatively associated with hyperthymic temperament scores, and positively with both depressive and anxious temperament scores (Ristic-Ignjatovic et al. 2014, Rozsa et al. 2008). Therefore, those findings correspond to our results that girls had higher scores on depressive and anxiety temperament, and lower on hyperimetic than boys.

It is interesting to note that all the scores reported in the current study are significantly higher than those reported in university students (Hinić et al. 2013), and general population (Ristić et al. 2014). Similar results were reported in some other studies (Guerreiro et al. 2013, Placidia et al. 1998b). One of the possible explanations would be that the temperament traits determine a young person's responses to the environment to the greatest extent (Zentner & Shiner 2012), whereas in later stages of life these responses are conditioned by character traits, which are formed in the course of personality maturation under the influence of society and social norms. The mere temperament traits are considered to be the outcome of the maturation of biologically determined neurological structures (Shiner & Caspi 2003), which are under the impact of environmental experiences (Kochman et al. 2005) and social interactions. This is in accordance with previous studies which show that an increase in stability occurs with age (Vázquez et al. 2012, Sanson et al. 1991); thus, there is clear stability of temperaments throughout adulthood (Kawamura et al. 2010), and instability in childhood, particularly in adolescence (Placidi et al. 1998b).

The adolescents in the present study have shown the greatest difference in scores on irritable and cyclothymic temperaments in comparison to general and university student population, which also speaks in

favour of potential influence of social norms and social interactions during life, where newly formed personality traits have a control function over emotional responses. It was also difficult for the subjects to respond honestly to some of the items since these may be found too intimate in this developmental stage (eg all the items relating to sexual behaviour, love etc) or impose a high social pressure on them (if they are organised, hard-working etc; all the items relating to alcohol consumption or consumption of other substances; if they tease other people; and even the item referring to the fact whether they swear a lot was problematic). The existing research, especially studies conducted in university students, has shown similar problems with culturally "coloured" items (Hinić et al. 2013, Dolenc et al. 2013).

Major strengths of this study include a large sample size, representative of different regions in Serbia, as well as different socioeconomic status. However, due to the specific design of the study, the subjects were not chosen according to the health criterion, which represents a limitation of the present study.

CONCLUSIONS

The final version of the A-TEMPS-A scale has shown good psychometric properties in this understudied population. Furthermore, the results on all the subscales show increased values in comparison to adult population, which may be the reason why it would be advisable to monitor the stability of temperament in some prospective study.

Although external validation with some personality scales, eg TCI-R scale (Dzamonja-Ignjatovic et al. 2010), has already been performed in adult population in Serbia, an excellent accompaniment to this scale would be some personality inventory, adapted to younger populations.

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Contribution of individual authors:

Jović Jelena - data collection, design of the study, manuscript writing, literature searches and analyses, interpretation of data;

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Kareen Akiskal & Icro Maremmani - design of the study, literature searches and analyses;

Dina Popović - literature searches and analyses, interpretation of data, manuscript writing;

Dragana Ristić-Ignjatović - data collection, design of the study, manuscript writing.

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