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Impulsiveness and cyclothymic traits of affective temperament as predictors of risky gambling behavior

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Summary

Aim. To investigate bipolar traits and impulsiveness in pathological gamblers, compared to non-pathological gamblers and non-gambling general population. To investigate interaction between traits of affective temperament, impulsiveness and the severity of pathological gambling.

Methods. 139 participants (63 women, 76 men; mean age: 30.32; *SD* = 10.69) were included in the study. *The Barratt Impulsiveness Scale* was used to evaluate impulsiveness and *the Temperament Evaluation of Memphis, Pisa and San Diego Autoquestionnaire* was used to evaluate affective temperamental traits. The participants were also screened for bipolar affective disorder spectrum using *the Mood Disorder Questionnaire* and *the Hypomania Checklist-32*. *The Canadian Problem Gambling Index* (CPGI) was used to evaluate the severity of pathological gambling in the assessed population. Polish versions of the questionnaires were filled out anonymously via the internet.

Results. Pathological gamblers ($N = 36$) scored higher on 'Motor impulsiveness', 'Cyclothymic' and 'Irritability' subscales versus non-pathological gamblers ($N = 61$) and non-gamblers ($N = 42$). Cyclothymic and motor impulsiveness significantly predicted CPGI scores. Motor impulsiveness was found to moderate the influence of cyclothymic affective temperamental traits on pathological gambling.

Conclusions. Our data support prior reports of higher impulsivity traits and traits from the bipolar spectrum among pathological gamblers. The results indicate that the influence of affective temperamental traits on pathological gambling severity is moderated by impulsiveness.

Key words: pathological gambling, bipolar disorder

Introduction

Gambling is a widely spread activity across Poland. According to the CBOS (*Centrum Badania Opinii Społecznej* – Centre for Public Opinion Research) report, every third Pole (34.2%) over 15 years of age has played a game for money in a last year [1]. Pathological gambling is a disorder based on recurrent gambling behavior that gradually dominate the person's life to the detriment of social, occupational, material, and family commitments [2]. Today pathological gambling is classified as a behavioral addiction, however, in DSM-III it was described as a impulse control disorder [3]. In Poland, about 16% of people tend to show symptoms, indicating a heightened risk of pathological gambling. It is estimated that 2.2% of Polish people gambled pathologically in 2014, and the rising tendency can be observed – in 2012 the number reached 1% [1]. Pathological gambling is related to a number of comorbidities, among them the most frequent are substance addiction (58% of pathological gamblers), affective disorders (38%) and anxiety disorders (38%) [4]. The comparison of the most reliable screening tests for pathological gambling considered following factors: specificity, sensitivity, positive and negative predictive values, and showed that *the Canadian Problem Gambling Index* (CPGI) is the most suitable tool for testing in Polish population [5].

Impulsiveness is commonly understood as a tendency to fast, unplanned reactions on stimuli without taking into consideration the negative consequences, which is related to risk taking, disinhibition and reduced cognitive control [6]. Excessive impulsiveness occurs in a various of psychiatric disorders (it is mostly observed in mania in the case of patients with bipolar disorder). However, there is research indicating residually increased impulsiveness also in euthymia [7–13]. Increased impulsiveness is also a common problem associated with behavioral addictions and drug dependencies [14]. As a theoretical construct, impulsiveness can be seen as composed of multiple domains, traditionally including attentional, motor and non-planning impulsiveness [15]. One of the most commonly used questionnaires for testing impulsiveness – *the Barratt Impulsiveness Scale* (BIS-11) – is based on this multidimensional conceptualization. It contains 30 items (examples of impulsive behavior or actions) and the participant is asked to judge the frequency of the occurrence of such behavior on a four-level scale. The aforementioned three domains of impulsiveness are complex factors, each being a combination of basic factors [15].

Researchers, using self-report questionnaires and neuroimaging techniques, conclude that pathological gambling is associated with lowered cognitive control, increased impulsiveness and non-adaptive decision-making strategies [16, 17]. Furthermore, the relationship between the self-reported levels of impulsiveness and the level of execution of tests requiring potentially risky decisions was found, supporting the legitimacy of using self-report methods in research on impulsiveness [18, 19].

The previous studies indicate that the mood-dependent impulsiveness plays a significant role in pathological gambling and hint at the diversified relationship between the domains of impulsiveness and the affective states, as indicated by the correlations

between motor impulsiveness and mania symptoms among patients with bipolar affective disorder [20, 21]. The theoretical concept of affective temperamental traits was proposed by Akiskal, whose inspirations included Kraepelin and Kretschmer. Akiskal created the tool for measuring affective temperamental traits, self-report questionnaire called *Temperament Evaluation of Memphis, Pisa and San Diego Autoquestionnaire* (TEMPS-A). Affective temperament is currently defined as a biologically determined, hereditary core of personality, characterized by its stability and relative permanence across lifespan, which determines the basic levels of reactivity, impulsiveness, mood and energy, as well as the risk of psychopathologies. The construct assumes the existence of five affective temperamental traits, which can be observed in every person with varying intensity: (1) depressive affective temperamental trait is associated with low level of energy; (2) hyperthymic trait characterizes optimistic, eager and active people; (3) cyclothymic trait is linked to mood lability and the tendency of quick fluctuations in energy levels; (4) irritable trait, which is partially overlapping with cyclothymic one, is more associated with lack of empathy and high levels of energy; and (5) anxious trait is increased among people with tendencies to worry. The proportions of specific affective temperamental traits are variable in the case of high risk of or incidence of affective disorders (measured in euthymia) or other psychiatric disorders [22]. Tendencies to bipolar behavior, i.e., based on lability of mood and frequent energy fluctuations, are also examined by screening questionnaires for bipolar disorder spectrum. In addition to the screening function, the questionnaires prove themselves to be valuable in quantifying information on bipolar tendencies [23, 24].

Considering the high index of comorbidity of pathological gambling and bipolar affective disorder [4], increased impulsiveness in both patients with bipolar disorder in euthymic state [7–10, 12, 13] and pathological gamblers [16, 17], pathological gambling and bipolar affective disorder can be interconnected. Considering the biological determinants of affective temperamental traits, which can provide an insight into the nature of relationship between gambling and affective disorders with its subclinical variations, a measurement of affective temperamental traits was included in the study. The epidemiological and psychological research presents gender as an important risk factor of the development of pathological gambling behavior – men are five times more likely to develop pathological gambling behavior [25] and dominate in the populations of pathological and non-pathological gamblers [26]. The aim of the study is to describe the possible relation between impulsiveness, bipolarity traits and the severity of pathological gambling. It was assumed that (1) with the increase in severity of pathological gambling, the level of impulsiveness would increase as well; (2) people who non-pathologically engage in gambling would be characterized by more severe bipolarity traits than people who do not gamble, and (3) participants pathologically engaging in gambling would be characterized by the most severe bipolarity traits of all three groups. (4) Men were assumed to be more likely to exhibit pathological gambling behavior, according to the epidemiological research. Taking into consideration the previously described interconnections between bipolarity and

impulsiveness [8], (5) the potential interaction between the traits, modifying gambling behaviour, was also assumed.

Methodology

The study group (N = 139; 63 women, 76 men) filled in a web-based set of questionnaires, hosted on Google Forms application. Information about the study with the link to the study was posted on online discussion forums dedicated to gambling. Participants not engaging in gambling were recruited via social media and online forums dedicated to various topics (e.g., fishing, decorations, wedding organization) or intended for specific age groups (e.g., students, young adults) or local area residents. The aim of the study included in the description available to the participants was described as the measurement of temperamental traits and gambling behavior. The names of the questionnaires were available to the participants. 4 participants who reported that they have been or are currently treated psychiatrically were excluded from the study, and 2 people were excluded based on clearly biased or impossible answers (i.e., giving only positive or negative answers, or incorrectly filled data about demographic characteristics). All questionnaires are standardized and normalized within Polish population, as well as possess satisfactory psychometric indexes of reliability and accuracy.

Mean age of participants was 30.32 (SD = 10.69), there were no significant differences between men and women in this respect. For the purpose of between-groups comparisons, participants were divided into three groups based on the CPGI score, measuring the severity of gambling: (1) participants who did not engage in gambling (NG) and obtained 0 points in the CPGI (N = 42); (2) participants engaging in non-pathological gambling (NPG), with CPGI score between 1 and 7 points (N = 61); and (3) participants engaging in pathological gambling (PG) and scoring higher than 8 points in the CPGI (N = 36). The division of groups was based on the diagnostic cut-off point of CPGI scores adopted in Poland [4]. Education and other demographics are presented in Table1. Participants engaging in pathological gambling were significantly older than non-gambling participants (on average by 6.16 years; p = 0.028) and than participants engaging in non-pathological gambling (on average by 5.59 years; p = 0.032). The groups differed in terms of gender distribution ($\chi^2(2) = 30.933$; $p > 0.001$). Significantly more women were in the non-gambling group and significantly more men engaged in any gambling, either pathological and non-pathological. This finding is consistent with the available epidemiological literature on the prevalence of gambling behavior among women and men [26]. The groups did not differ in terms of education.

Table 1. **Gender, education and mean age of participants who did not engage in gambling (NG), participants engaging in non-pathological gambling (NPG), and participants engaging in pathological gambling (PG) with a comparison of intergroup differences in gender and education (chi-square) and age (ANOVA)**

Variable	Groups			Comparison of the significance of intergroup differences
	NG [N = 42]	NPG [N = 61]	PG [N = 36]	
Gender	Men 8 (19%) Women 34 (81%)	Men 42 (68.9%) Women 19 (31.1%)	Men 26 (72.2%) Women 10 (27.8%)	$\chi^2(2) = 30.933$; $p > 0.001$
Education	Primary 0 (0%) Basic vocational 1 (2.4%) Secondary 10 (23.%) Incomplete higher 16 (38.1%) Higher 15 (35.7%)	Primary 1 (1.6%) Basic vocational 4 (6.6%) Secondary 19 (31.1%) Incomplete higher 18 (29.5%) Higher 19 (31.1%)	Primary 3 (8.3%) Basic vocational 3 (8.3%) Secondary12 (33.3%) Incomplete higher 7 (19.4%) Higher 11 (30.6%)	$\chi^2(8) = 9.764$; $p = 0.282$
Age M (±SD)	28.48 (±10.8)	29.05 (±10.17)	34.64 (±10.54)	$F(2, 156) = 4.175$ $p = 0.017$

Polish versions of research tools were used to create an online Google Forms survey form. The permission of the University Bioethics Committee was obtained for the use of questionnaires in the online form. All used questionnaires are available in open access mode and can be found using the Google search engine. The CPGI was implemented to screen the participants for pathological gambling [5]. The TEMPS-A was used to measure affective temperamental traits [23, 27]. *The Mood Disorder Questionnaire* (MDQ) [28] and *the Hypomania Checklist-32* [29] were used to screen the participants for bipolar disorder spectrum and hypomania symptoms. Based on Polish validation studies, the cut-off point for the MDQ was set at 7 or more positive answers to questions about hypo(mania) symptoms – both the qualitative results and the screening tests results for the MDQ have been taken into consideration during statistical analysis [28]. The cut-off point for the HCL-32 was set at 14 and more points, based on Polish pilot and exploration research [29]. The BIS-11 was implemented to test the severity of impulsiveness. To measure the three characteristics of impulsiveness: 'Motor impulsiveness', 'Non-planning impulsiveness', and 'Attentional impulsiveness', raw results obtained by the participants in BIS-11 individual subscales were used in statistical analysis [14].

Statistical analysis

All statistical analyzes were performed using IBM SPSS Statistics version 24. The Shapiro-Wilk test was used to check the assumption about the normal distribution of the results. In order to determine intergroup differences, a parametric analysis of variance *F* (ANOVA) was used. In order to indicate which average results obtained by the participants differ from each other, a suitably selected *post-hoc* Tukey test was used. The chi-square test was used to compare the demographic characteristics of the participants and analyze the prevalence of positive screening results.

In order to determine the correlation between particular variables, Pearson's *r* correlation coefficient was calculated for each group individually and for all participants. To check the relationship of explanatory variables (subscales of the TEMPS-A, subscales of and total score of the BIS-11, and raw results of the MDQ and HCL-32) with the explained variable (CPGI), a multiple regression analysis was performed with stepwise variable input method, controlling for the influence of age and gender. It was decided to use this procedure due to the recognition of pathological gambling as a continuous variable, which could be expressed in varying degrees in the participants (it would be an oversimplification to treat pathological gambling as a dichotomous variable, especially taking into consideration used methods of recruitment and the implementation of screening tools). An interaction analysis has been carried out, for which independent variables have been centered according to the guidelines for the occurrence of the possibly problematic high co-linearity of the predictors and the moderator [30].

Results

As presented in Table 2, participants engaging in pathological gambling showed a higher rate of motor impulsiveness as compared to non-gambling participants ($p < 0.001$) and participants engaging in non-pathological gambling ($p = 0.001$). In the TEMPS-A questionnaire, participants engaging in pathological gambling also obtained significantly higher scores in the 'Cyclothymic' subscale ($p < 0.001$) compared to the non-gambling group, and in the 'Irritability' subscale: compared to non-gambling ($p = 0.008$) and non-pathological gambling group ($p = 0.017$).

Table 2. **Significance of differences in impulsiveness, measured by the Barratt Impulsiveness Scale and its subscales (BIS-11), bipolarity traits, measured by the Mood Disorder Questionnaire (MDQ) and the Hypomania Checklist-32 (HCL), and affective temperamental traits, measured by the Temperament Evaluation of Memphis, Pisa and San Diego Autoquestionnaire (TEMPS-A) between participants who did not engage in gambling (NG), participants engaging in non-pathological gambling (NPG), and participants engaging in pathological gambling (PG)**

Variables	Mean score in NG [N = 42]	Mean score in NPG [N = 61]	Mean score in PG [N = 36]	df	F	p for NG vs. NPG	p for NG vs. PG	p for NPG vs. PG
Impulsiveness (total BIS-11)	69.74 (±5.40)	66.36 (±9.08)	70.33 (±9.32)	2, 136	3.434*	p = 0.104	p = 0.945	p = 0.59

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Attentional impulsiveness	18.55 (±2.49)	17.89 (±3.30)	17.19 (±3.45)	2, 136	1.825	p = 0.541	p = 0.14	p = 0.545
Motor impulsiveness	21.69 (±2.97)	22.33 (±3.59)	25.03 (±4.21)	2, 136	9.444***	p = 0.651	p < 0.001	p = 0.001
Non-planning impulsiveness	29.50 (±3.66)	26.15 (±4.64)	28.11 (±4.65)	2, 136	7.572***	p = 0.001	p = 0.344	p = 0.086
Depressive trait	0.40 (±0.15)	0.39 (±0.47)	0.47 (±0.17)	2, 136	2.639	p = 0.979	p = 0.158	p = 0.077
Irritable trait	0.28 (±0.19)	0.30 (±0.2)	0.42 (±0.23)	2, 136	6.425**	p = 0.849	p = 0.008	p = 0.017
Anxious trait	0.32 (±0.16)	0.29 (±0.23)	0.45 (±0.24)	2, 136	5.413**	p = 0.669	p = 0.034	p = 0.002
Cyclothymic trait	0.33 (±0.21)	0.42 (±0.22)	0.60 (±0.23)	2, 136	15.078***	p = 0.13	p < 0.001	p < 0.001
Hyperthymic trait	0.43 (±0.17)	0.52 (±0.20)	0.44 (±0.22)	2, 136	3.544**	p = 0.047	p = 0.962	p = 0.116
Raw MDQ score	4.79 (±3.44)	5.23 (±3.4)	8.25 (±3.34)	2, 136	12.05***	p = 0.792	p < 0.001	p < 0.001
Raw HCL score	8.62 (±5.2)	9.44 (±6.13)	12.33 (±7.06)	2, 136	3.926*	p = 0.781	p = 0.023	p = 0.067

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

In addition to intergroup comparisons of the obtained scores, the screening results of *the Mood Disorder Questionnaire* (MDQ) were also analyzed in order to compare the group results of the screening diagnosis of bipolar disorder spectrum. The chi-square test was also performed (Table 3). Significantly more positive MDQ results were observed in the group of participants engaging in pathological gambling.

Table 3. **Comparison of the frequency of positive screening (MDQ result) for bipolar disorders in participants who did not engage in gambling (NG), participants engaging in non-pathological gambling (NPG), and participants engaging in pathological gambling (PG)**

	NG [N = 42]	NPG [N = 61]	PG [N = 36]	Chi-square test result
7 and more points in the symptomatic part of the MDQ	9.5% (4 persons)	6.5% (4 persons)	36.1% (13 persons)	$\chi^2(2) = 10.759$; $p < 0.001$

Values of Pearson's *r* correlation coefficient are presented in Table 4 for participants who did not engage in gambling, in Table 5 for participants engaging in non-pathological gambling and in Table 6 for participants engaging in pathological gambling. The sum of points obtained in the CPGI correlated significantly with other variables only in the group of participants engaging in pathological gambling.

Table 4. **Pearson's r correlation coefficient values in the group of participants who did not engage in gambling (N = 42)**

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Impulsiveness (total BIS-11)	-0.092										

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3. Attentional impulsiveness	-0.204	0.696 ***									
4. Motor impulsiveness	-0.197	0.421 **	0.096								
5. Non-planning impulsiveness	0.162	0.661 **	0.269	-0.255							
6. Raw MDQ score	0.266	0.199	0.282	-0.09	0.175						
7. Raw HCL score	-0.043	0.207	0.077	-0.049	0.294	0.586 ***					
8. Cyclothymic trait	-0.135	0.288	0.377 *	0.087	0.098	0.589 ***	0.54 ***				
9. Depressive trait	0.209	0.114	0.26	-0.037	0.022	0.463 **	0.164	0.513 ***			
10. Irritable trait	0.129	0.388 **	0.382 *	0.246	0.113	0.429 **	0.16	0.5***	0.396 **		
11. Anxious trait	-0.064	0.257	0.343 *	0.117	0.051	0.229	0.249	0.536 ***	0.528 ***	0.522 ***	
12. Hyperthymic trait	0.003	0.220	0.232	-0.145	0.285	0.249	0.085	-0.161	-0.423 **	0.076	-0.321 **

Table 5. **Pearson's r correlation coefficient values in the group of participants engaging in non-pathological gambling (N = 61)**

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. CPGI	-0.078											

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3. Impulsiveness (total BIS-11)	-0.289 *	-0.035										
4. Attentional impulsiveness	-0.127	-0.031	0.769 ***									
5. Motor impulsiveness	-0.251	-0.005	0.729 ***	0.376 **								
6. Non-planning impulsiveness	-0.281 *	-0.042	0.846 ***	0.502 ***	0.386 **							
7. Raw MDQ score	-0.072	0.162	0.354 **	0.395 **	0.027 *	0.203						
8. Raw HCL score	-0.216	0.237	0.416 ***	0.254 *	0.399 ***	0.324 ***	0.527 ***					
9. Cyclothymic trait	-0.069	0.077	0.46 ***	0.312 *	0.401 ***	0.362 **	0.515 ***	0.403 ***				
10. Depressive trait	-0.021	-0.069	0.083	0.03	-0.064	0.191	0.097	0.111	0.558 ***			
11. Irritable trait	-0.144	0.129	0.295 *	0.306 *	0.176	0.224	0.538 ***	0.185	0.658 ***	0.371 **		
12. Anxious trait	0.238	-0.151	0.205	0.203	0.086	0.19	0.302 *	0.087	0.648 ***	0.63 ***	0.421 ***	
13. Hyperthymic trait	-0.085	0.165	0.218	0.215	0.317 *	0.028	0.137	0.237	-0.072	-0.443 ***	0.055	-0.343 **

Table 6. **Pearson's r correlation coefficient values in the group of participants engaging in pathological gambling (N = 36)**

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												

table continued on the next page

2. CPGI	-0.274											
3. Impulsiveness (total BIS-11)	-0.456 **	0.392 *										
4. Attentional impulsiveness	-0.461 **	0.472**	0.75 ***									
5. Motor impulsiveness	-0.314	0.524 ***	0.842 ***	0.671 ***								
6. Non-planning impulsiveness	-0.288	-0.04	0.685 ***	0.154	0.284							
7. Raw MDQ score	-0.197	0.488 **	0.24	0.266	0.375 *	-0.057						
8. Raw HCL score	-0.216	0.128	0.202	0.087	0.29	0.077	0.431 **					
9. Cyclothymic trait	-0.248	0.384 *	0.488 **	0.468 **	0.46 **	0.134	0.631 ***	0.356 *				
10. Depressive trait	0.145	0.08	0.169	0.148	0.056	0.179	-0.046	0.002	0.365 *			
11. Irritable trait	0.017	0.361 *	0.44 **	0.508 **	0.504 **	0.047	0.396 *	0.208	0.584 ***	0.227		
12. Anxious trait	-0.023	0.238	0.424 **	0.465 **	0.349 *	0.188	0.201	0.039	0.473 **	0.29	0.597 ***	
13. 13. Hyperthymic trait	-0.091	0.169	0.152	0.218	0.307	-0.134	0.44 **	0.083	-0.049	-0.544 ***	0.141	0.009

Cyclothymic trait ($\beta = 9.921$; $t = 4.548$; $p < 0.001$), Motor impulsiveness ($\beta = 0.620$; $t = 4.413$; $p < 0.001$), gender ($\beta = -4.653$; $t = -4.892$; $p < 0.001$), and age ($\beta = 0.144$; $t = 3.199$; $p = 0.002$) were significant predictors and explained 40.3% of the variance

of the results of the explaining variable ($R2 = 0.403$), with a standard estimation error of 5.573. The regression assumptions were met by the presented model. The model was well suited to the analyzed data (F (4, 134) = 24.2284; $p < 0.001$).

In order to verify the hypothesis about the interaction between 'Cyclothymic trait' and 'Motor impulsiveness', further hierarchical analysis of regression with the predictors significant in the primary regression model was carried out. The obtained total model was significant ($R2 = 0.383$; F (7, 131) = 13.225; $p < 0.001$). Continuous variable 'Motor impulsiveness' was transformed into a interval variable according to the median of results [31], forming two compartments: low impulsiveness and high impulsiveness (starting from the result equal to 22 points).

In the first step, three variables were included: 'Motor impulsiveness', 'Gender' and 'Cyclothymic trait'. These predictors explained the significant magnitude of the variance of the obtained results ($R2 = 0.362$; F (3, 135) = 27.11; $p < 0.001$). Next, it was further examined whether the individual pairs of predictors interacted with each other – the interactions between 'Motor impulsiveness' and 'Cyclothymic trait', as well as between 'Gender' and 'Cyclothymic trait' were found to be significant and are described in detail in Table 7. This points to the ambiguous nature of 'Cyclothymic trait's' effects on the severity of pathological gambling. The new model, taking into account the interactions between individual predictors, also explained a significant number of variance results with a better fit ($R2 = 0.387$; F (6, 132) = 15.50; $p < 0.001$).

Table 7. **The description of the significant interactions of individual pairs of predictors: 'Cyclothymic' subscale of the TEMPS-A (Temperament Evaluation of Memphis, Pisa and San Diego Autoquestionnaire), 'Motor impulsiveness' subscale of the BIS-11 (Barratt Impulsiveness Scale 11) and gender of the participants**

Pair of predictors	b	t	p
Cyclothymic trait (TEMPS-A) * Motor impulsiveness (BIS-11)	0.149	2.051	0.042
Cyclothymic trait (TEMPS-A) * Gender	-0.158	-2.125	0.035

Graphs presenting the calculated interaction effects (Figures 1 and 2) show the high level of 'Motor impulsiveness' and male gender enhancing the effect of 'Cyclothymic trait' on the severity of pathological gambling. The influence of 'Cyclothymic trait' on the severity of pathological gambling significantly increases with the increase in 'Motor impulsiveness'. Men also presented a stronger enhancing effect of 'Cyclothymic trait' on the severity of pathological gambling. The obtained interactions may indicate the connections between 'Motor impulsiveness' and 'Cyclothymic trait', as well as male gender and 'Cyclothymic trait'. However, there was found no interaction that would indicate a simultaneous moderation of the influence of 'Cyclothymic trait' on pathological gambling by both gender and the level of 'Motor impulsiveness'. In an additional regression analysis, age did not prove to be a significant moderator.

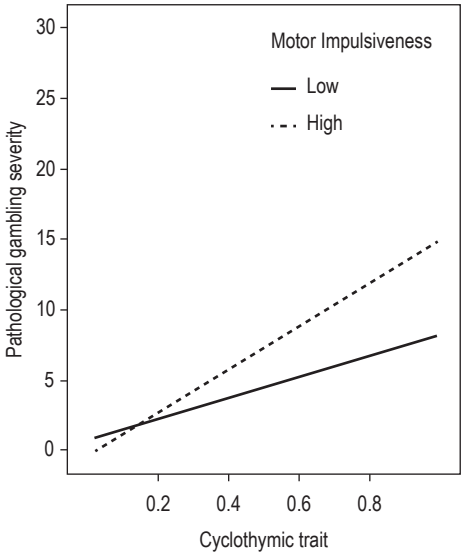

Figure 1. **Relationship between the severity of pathological gambling (measured by the CPGI) and cyclothymic trait ('Cyclothymic' subscale of the TEMPS-A) at various levels of motor impulsiveness ('Motor impulsiveness' subscale of the BIS-11) – an interaction effect**

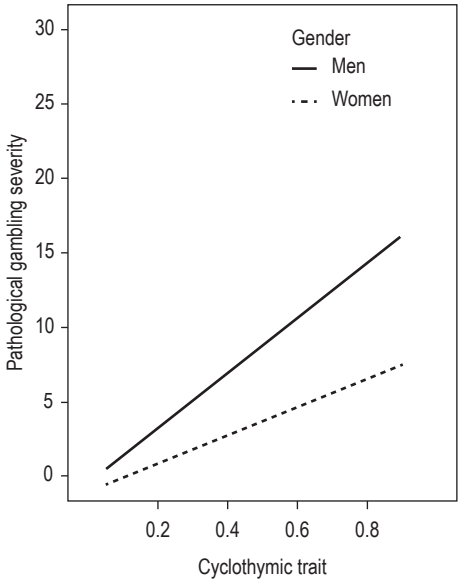

Figure 2. **Relationship between the severity of pathological gambling (measured by the CPGI) and cyclothymic trait ('Cyclothymic' subscale of the TEMPS-A) in men and women – an interaction effect**

Discussion

According to authors' knowledge, this the first scientific paper describing relationships between affective temperamental traits and the severity of pathological gambling behavior. The results of regression analysis indicate a significant association between cyclothymic affective temperamental traits and the level of risky or pathological gambling tendencies. This relationship is supported by moderately strong correlations between CPGI score, TEMPS-A Cyclothymic subscale results, and MDQ and HCL-32 scores observed in participants engaging in pathological gambling. Furthermore, every third participant engaging in pathological gambling was positively screened for bipolar disorder spectrum. Among participants engaging in pathological gambling there are more men, while there are more women among the participants not engaging in gambling. These unequal proportions may have caused the inclusion of male gender as a risk factor for pathological gambling in the statistical analysis.

The obtained screening results partially overlap with the previous epidemiological research on the comorbidity of pathological gambling and other psychiatric disorders. Meta-analysis of population-based research focused on pathological gambling comorbidity found the comorbidity reaching 10% with bipolar disorder or mania episodes

and over 23% with depression [4]. According to world-wide epidemiological studies, pathological gambling is more prevalent among men [32]. Such gender disproportion of pathological gambling is a probable cause of the majority of male participants in the pathological gambling group in the presented study, contrary to non-gambling group with majority of female participants.

Motor impulsiveness is described as acting on momentary impulse, which may be influenced by perseverance, described in the literature as a tendency to prioritize stabilized way of living [14]. Increased motor impulsiveness in participants engaging in pathological gambling may be associated with the decreased ability to inhibit reactions in Go/No-go paradigm [33] and using less adaptive strategies prioritizing short-term gains [34]. From a clinical perspective, there is a possible connection between intensified impulsiveness in people engaging in pathological gambling and lower treatment effects [35]. The described interaction effect of motor impulsiveness and cyclothymic trait is consistent with the previous research on the influence of motor impulsiveness on the severity of manic symptoms in patients with bipolar disorder [21], including risky behavior, sensation seeking and behavioral disinhibiton. Increased motor impulsiveness in bipolar patients with coexisting impulse control problems [36] indicates that motor impulsiveness may be related to both bipolar disorder spectrum and behavioral addictions. The presented results are consistent with the previously described research on bipolar disorder spectrum and pathological gambling, and indicate the possibility of including affective temperamental traits and bipolarity spectrum in pathological gambling research [7, 8, 16, 20, 21]. The results also incline towards considering cyclothymic trait as a potential factor in the thorough clinical diagnostics of pathological gambling.

Our research has several limitations. Internet-based surveys are associated with an increased risk of false and negligent responses, while at the same time reducing the probable influence of the need for social approval in the presented responses – this is particularly important in the case of pathological gambling and other socially unacceptable behaviors [37]. The exclusion of extreme responses, seen as attempts of joking or an intentional manipulation of the result, contributed to increasing the reliability of the obtained data. The names of the used questionnaires and the partial objective of the study was disclosed to the participants, which could have influenced the increased bias in the response. Another limitation is the inclusion of only self-reported data to determine the impulsiveness of participants. The study lacked the use of behavioral impulsiveness measurement, such as the Go/No Go test or *the Stroop Color and Word Test*. In addition, the inclusion of confirmatory clinical diagnosis of pathological gambling of the participants with the help of trained psychiatry specialists would allow for more reliable statistical analysis.

Conclusions

14. Motor impulsiveness and cyclothymic trait were found to be significant predictors of the severity of pathological gambling. Motor impulsiveness also enhances the influence of cyclothymic trait on pathological gambling.
15. Male sex is associated with an increased risk of pathological gambling.
16. The results indicate the importance of impulsiveness and cyclothymic trait in the picture of pathological gambling. These parameters should be taken into account in the full clinical diagnosis of this disorder.

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