

# Psychometric properties of the Polish version of the tool for measuring impulsivity in adolescents – BIS-brief

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## ABSTRACT

### Objective

The article presents the results of the process of adaptation and research that were used to determine the psychometric properties of the Polish version of the BIS-Brief scale. The tool is designed for adolescents and measures impulsivity understood as a tendency for sudden and unplanned action (Barratt, 1959).

### Method

In order to determine the factor structure of the tool, its accuracy and distribution of impulsivity in the population of adolescents, the research was conducted in the group of individuals aged 12 to 20 years (N = 6710). The impulsivity was measured using the short Polish version of the BIS-Brief scale, which was the subject of an adaptation. The accuracy was determined using the IVE Impulsivity Questionnaire and a questionnaire on adolescent risk behaviours.

### Results

Exploratory factor analysis revealed two factors explaining more than 54% of the total variance in the scores of the tool. Apart from the total score, the BIS-Brief scale measures two scales: self-control and impulsivity in action. The distribution of the examined trait in the group of adolescents is right-skewed, dominated by persons with low or average intensity of the examined trait. Impulsivity measured by the BIS-Brief scale correlates with the results of the IVE questionnaire and the characteristics of risk behaviour in adolescents.

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## Conclusions

The short Polish version of the BIS-Brief scale has satisfactory psychometric properties. It can be used to measure general impulsivity and its two components: self-control and impulsivity in action. The shortened form of the tool and the adequacy of the content of the test items to the period of adolescence make the scale applicable in diagnostics for educational and preventive measures for students and in scientific research.

**Keywords:** impulsivity, BIS scale, adolescence, risk behaviours

## INTRODUCTION

As Poprawa (2019) notes, impulsivity is an ambiguous concept that is not easy to define. It appears in various sources both as a trait of normally functioning individuals and as a part of mental disorders (Jakubczyk, Wojnar, 2009). The aforementioned authors review definitions of impulsivity including behavioural and cognitive approaches (Jakubczyk, Wojnar, 2009). In these multiple views, Moeller and co-authors (2001), distinguish several factors that are present in almost every definition of impulsivity. These include:

- low sensitivity to possible negative consequences of own behaviour,
- abrupt, unplanned reactions, starting before the analysis of the external stimulus is completed, and
- failure to consider the long-term consequences of actions (Moeller et al., 2001).

Also noteworthy is the approach of Lynam et al. (2006) who distinguish five dimensions of impulsivity, namely: positive and negative urgency, lack of premeditation (caution), lack of perseverance and sensation seeking. Based on this approach, the UPPS-P Impulsive Behaviour Scale was created, the development and validation of which for the Polish conditions was undertaken by Poprawa (2019).

In recent years, due to the development of non-invasive neuroimaging methods, studies on the biological basis of impulsivity have been developed. These point to a significant role of dopamine and noradrenaline neurotransmitter pathways. However, it is important to distinguish different types of impulsivity, e.g. motor impulsivity and decision-making impulsivity. Distinct neurological mechanisms form the bases of these different types of impulsivity, which is important for further research into this trait. On a practical level, this affects the need for a separate interpretation of the biological underpinnings of different disorders of which impulsivity is an important correlate (Pattij, Vanderschuren, 2020; Robbins, Dalley, 2017).

This work is based on Ernest Barratt's theory of impulsivity (1959; Patton, Stanford, Barratt, 1995). According to him, impulsivity is a complex trait (Barratt, 1959) that manifests itself through a tendency to act suddenly without planning (Patton, Stanford, Barratt, 1995; Hamilton et al., 2015). It is the tendency to make quick decisions and to fail to consider the consequences of one's actions. Sudden and unplanned reactions may be a response to both external and internal

stimuli. An impulsive person usually does not consider the possible negative consequences of their behaviour (Steinberg et al., 2013).

Impulsivity is similarly defined by Eysenck and Eysenck (2011). In their view, it is a characteristic of people who enjoy new challenges and new experiences. These individuals are willing to take risks and even actively seek them. Eysenck and Eysenck (2011) treat impulsivity as a pathological dimension of risk behaviour, in which the consequences of one's actions are not taken into account. This distinguishes impulsivity from risk proneness (Jaworowska, 2011).

In the research on impulsivity, two or three components are described, depending on the method and statistical analysis tools used (Hamilton et al., 2015). Barratt (1959, 1987), the author of the concept on which the tool described in this article is based, points to three of them:

- 1) impulsivity observed in a motor dimension,
- 2) impulsivity in a cognitive dimension related to making decisions too quickly, and
- 3) impulsivity in a dimension concerning planning skills.

This translates into the aforementioned urgency of action, rashness and lack of reflection on its consequences, as well as concentration on the present moment without planning for the future. The motor dimension is associated with two complementary characteristics, which include difficulty in stopping and abandoning an activity as well as a rapid onset of action. The cognitive and planning dimensions are in turn, related to the pursuit of quick and easy gratification as opposed to the pursuit of long-term goals (Hamilton et al., 2015).

In people with high impulsivity, disturbed behaviour is often observed, which reveals the so-called dysfunctional and negative image of this trait (Claes, Vertommen, Braspenning, 2000). On the other hand, in some situations, impulsivity is desirable. This concerns tasks that require quick decision-making or an efficient reaction to signals from the environment (Jakubczyk, Wojnar, 2009). In other situations, it is mostly important to carefully plan and reflect on the consequences (Claes et al., 2000). A typical property of impulsive reactions is their rapidity and low cognitive load. Reflective behaviour (Strack, Deutsch, 2004), on the other hand, is associated with a slower and more demanding analytical processing. During this process action plans are compared with existing priorities, motives and the memory of previous analogous situations. This leads to either taking up the activity or giving it up (Grzesiak, Beszle, Szechiński, 2008), which is important for the course of motivational processes.

### **Impulsivity versus risk behaviours and difficulties in functioning**

Impulsivity understood in a negative way covers various areas of functioning. In the cognitive dimension, high impulsivity is accompanied by impaired attention, impaired working memory, and the diminished ability to retrieve experiences and consequences of previous activities from the memory. This, in turn, explains the tendency to prefer easily accessible rewards over those requiring greater self-control and more effort (Khurana et al., 2012). High impulsivity also impairs learning

and task performance. Increasing impulsivity leads to an increasing number of errors made, which in turn lowers the quality of learning (Barratt, 1959).

Another dimension is the behavioural dimension. Poprawa (2019) in his research using the SUPPS-P scale (a Polish adaptation of the UPPS-P scale) observes significant correlations with impulsivity as measured by other tools, risk-taking, emotional dysregulation, neuroticism, self-control ability and frequency of internalising and externalising problems and disorders.

High impulsivity is more frequently observed in adolescents with diagnosed ADHD and eating disorders than in a control group of neurotypical individuals (Hartmann, Rief, Hilbert, 2011). Another area where impulsivity is of importance is engaging in risk behaviours during adolescence and adulthood. Adolescents who react on the spur of the moment are more likely to report using psychoactive substances: alcohol, marijuana, or smoking cigarettes (Martínez-Loredo et al., 2015). A positive association between impulsivity and aggressive behaviour has been observed (Barratt, Stanford, Kent, Felthous, 1997). It impairs performance in reasoning and decision-making (Barratt et al., 1997). It is also a concomitant factor in gaming and gambling addictions in young people and adults (Izdebski et al., 2015; Turek et al., 2019).

These data highlight the relationship between impulsivity and engaging in risk behaviours that are dangerous to life and health. Risk behaviours range from the use of psychoactive substances and gambling to reckless driving and other behaviours against the law and/or norms as well as those resulting in other negative consequences. In a clinical group of people with behavioural or psychoactive substance addictions, the correlations with impulsivity are analogous. They are more frequently observed in males than in females (Patton, Stanford, & Barratt, 1995; Poprawa, 2019; Studenski, 2004). Among adolescents, a number of environmental factors increase the risk of impulsivity having a negative impact on behaviour. In particular, the quality of peer relationships, group influence and the amount of support received from parents are significant (Barker, Trentacosta, & Salekin, 2011). A supportive environment, parental control, and positive peer influence attenuate the negative consequences of high impulsivity. Pro-social activities undertaken by adolescents, parental models of pro-health behaviours and caregivers' knowledge of effective ways of support are important protective factors against risk behaviours (Ostaszewski, Poleszak, 2019).

### **Tools for measuring impulsivity in Barratt's approach**

A popular tool for measuring impulsivity is the scale developed by Barratt (1959). The Barratt Impulsivity Scale (BIS) in its full version consists of 30 test items. In the Polish literature, the scale has been described and is available in a study by Grzesiak and colleagues (2008). This tool, in addition to determining the general level of impulsivity, enables the determination of the subdimensions of impulsivity: motor, cognitive, and planning dimension.

A short version of the scale (BIS-Brief), consisting of 8 items, was originally developed by the team of Steinberg, Sharp, Stanford, Tharp (2013). The test items

were selected based on the results of a confirmatory factor analysis performed on adult survey data. The authors described the tool as unidimensional. They assessed its diagnostic value in relation to the full version. They checked for possible differences in measurement between the two versions of the scale. The analyses included several research groups: adults suffering from borderline disorder, people who use violence and adolescent psychiatric patients. Both the full and the short version had the same precision of measurement in each group. The similarity of the tools also concerned the correlation of total scores with the symptoms of the aforementioned disorders and behaviours. The work on the short version of the BIS scale allowed us to conclude that this version correctly – and analogously to the full version – differentiates individuals who manifest selected difficulties and disorders. The data obtained by the authors justify the use of the short version in diagnostic practice, screening and research projects. Eight test items allow the measurement of general impulsivity without describing the specific dimensions (Steinberg et al., 2013). The short version also overcomes the limitations of the full version of the scale in terms of studying adolescents. These limitations relate to the content of the test items, some of which are inadequate, in terms of meaning, for the life stage prior to adulthood (Fields et al., 2015; Mathias et al., 2018).

The value of the selected eight items and their effectiveness in diagnosing impulsivity was confirmed in a study by Morean et al. (2014). Moreover, the authors demonstrated a two-factor structure of the tool, which was confirmed in further research. One dimension is low self-control, understood as the difficulty in concentrating actions and attention on the goal pursued. The second dimension is impulsivity in action, which refers to a tendency to react abruptly in response to different stimuli (Charles, Floyd, & Barry, 2019; Morean et al., 2014). These dimensions have a different relationship with variables describing risk behaviours: age of initiation psychoactive substance use as well as its frequency (Charles et al., 2019). The age of the subjects correlates with the intensity of the impulsivity subscale, which is higher in subjects at the threshold of adulthood (Mathias et al., 2018).

The information on other tools for testing impulsivity collected in this article served to prepare the process of validation and analysis of the properties of the Polish version of the BIS-Brief tool designed for adolescents aged 12–20. The main purpose of the present study is to adapt and determine the psychometric properties of the scale. The study poses the following research hypotheses:

1. The factor structure of the tool corresponds to the model with two dimensions examining self-control and impulsivity in action.
2. The distribution of impulsivity in the group of Polish adolescents has the features of a normal distribution and the most numerous group are people with moderate intensity of the trait.
3. There is a relationship between impulsivity as measured by the BIS-Brief scale and the results of another tool examining this trait. This relationship confirms the theoretical relevance of the scale.
4. The BIS-Brief results correlate with the frequency of risk behaviours reported by adolescents as well as selected characteristics of their functioning (use of psychoactive substances, age of initiation, use of violence, poor school performance).

## METHOD

### Subjects and course of study

The research was conducted within the framework of a project of the You Have a Chance Foundation (Fundacja Masz Szansę) called “System of Preventive Actions in Poland – status and recommendations for increasing effectiveness and efficiency of planning and conducting preventive actions on micro and macro scale” („System Oddziaływań Profilaktycznych w Polsce – stan i rekomendacje dla zwiększenia skuteczności i efektywności planowania i realizowania działań profilaktycznych w mikro i makro skali”). The project covered a representative sample of school youth from all over Poland. Participation in the research was voluntary, free of charge and anonymous. Entire classes were surveyed during school lessons, and the number of class groups was selected proportionally to the size of pupil populations in particular voivodeships. The data of 6710 students aged 12 to 20 years ( $M = 15.51$ ,  $SD = 1.729$ ; 12–13-year-olds accounted for 14.7%, 14–15-year-olds for 34.2%, 16–17-year-olds for 37.7% and 18–20-year-olds for 13.5%) were used in the analyses. Boys constituted 49.7% and girls 50.3% of the respondents. The vast majority of the students lived with their parents (95.5%) during their school education, while the rest lived in a boarding school, school dormitory or some other place. Approximately half of the students ( $N = 3520$ ) attended lower secondary schools during the study, and 3190 persons attended secondary schools (among which 57.2% were students of secondary schools, 32.6% of technical secondary schools and 10.2% of trade schools).

### Methods applied

#### Measurement of impulsivity

The BIS-Brief, a short version of the Barratt scale, was developed by Steinberg et al. (2013). It consisted of items numbered 1, 2, 5, 8, 9, 12, 14 and 19 from the 30 items of the original scale. The test items listed constituted, according to the authors of the scale, one dimension examining overall impulsivity. The reliability of the Cronbach's alpha was reported at 0.78 (Steinberg et al., 2013). The right to modify the original English-language version of the tool, as well as permission to develop the Polish-language version and use it in the study, was obtained from one of the authors, M. S. Stanford. Two independent translators prepared the Polish version – the first translator, and then the English version again – the second translator. The back-and-forth translation proved to be convergent and showed no differences. In addition, the content of the items was assessed for compatibility with the definition of impulsivity by experts in psychology and pedagogy (cf. Gudmundsson, 2009). As a result, minor linguistic changes were made that did not change the meaning of the statements.

The accuracy of the BIS-Brief scale was tested by comparing its results with the IVE Impulsivity Questionnaire by Eysenck and Eysenck. The questionnaire examines risk propensity, impulsivity and empathy (Jaworowska, 2011).

### Risk behaviours and the characterisation of adolescent behaviour

The characterisation of students according to the type and frequency of risky and abusive behaviour was based on data from the questionnaire developed – as part of the abovementioned project – by the team consisting of the following: Robert Porzak, Krzysztof Ostaszewski, Jacek Pyżalski, Jakub Kołodziejczyk, Wiesław Poleszak, Grzegorz Kata. The analyses made use of questions about the age of first contact with psychoactive substances, frequency of use of these substances, the average of last semester's school grades, and the tendency to bully others. During the survey, students chose one of the response categories describing the frequency of the behaviour (categories: *never, once in a lifetime, several times in a lifetime, several times in the last year, several times in the last month, several times in the last week, daily*) or entered a numerical value related to age and school performance. The use of violence, on the other hand, was indicated by the declaration concerning the frequency of bullying, which was defined in the questionnaire as *an action consisting in doing very unpleasant things to another person for a longer period of time (hitting, name-calling, backbiting, excluding from the group)*. The survey has no validated psychometric properties.

### Data analysis

In order to determine the structure of the tool in the Polish version, an exploratory factor analysis with the method of main components and non-orthogonal rotation was applied, assuming a relation between the extracted factors. The number of dimensions was selected according to the scree plot and the Kaiser criterion. Additionally, confirmatory factor analysis was applied to confirm the adopted solution. The robust least squares method (Cheng-Hsien, 2016) was applied and the quality of match was checked by analysing the values of the CFI, TLI and RMSEA factors. The following value evaluation criteria were used:  $RMSEA < 0.08$  and  $CFI > 0.95$  and  $TLI > 0.97$  indicating an adequate factor solution (Schermelleh-Engel, Moosbrugger, 2003). Standard measures of dispersion and latent class analysis (LCA) were used to describe the distribution of impulsivity. This method has been applied in determining the number of groups of individuals with different characteristics in the measured trait e.g. in Pluess et al. (2018) or Tillmann, Matany, Duttweiler (2018). The purpose of LCA is to identify a latent variable that, in effect, groups respondents in accordance with the similarity of the measured characteristics. In this article, these characteristics are the answers given to the questions in the BIS questionnaire. The LCA method is thus compared to cluster analysis, which also leads to grouping of individuals. The difference between the techniques amounts to the method of separation. In the case of LCA, the clustering is based on the matching coefficients derived from the probability of individuals belonging to a particular class. A solution that maximises the similarity between participants in a given class and the differences between classes is chosen. In selecting the most optimal solution – which is the number of groups (classes) – the values of the matching coefficients are checked. The measures used in this article are: BIC (Bayesian information criterion),

ABIC (sample-size adjusted Bayesian information criterion) and CAIC (consistent Akaike information criterion). The solution chosen is the one in which most of the given measures reach the lowest values or the one in which a sudden drop in values is observed. In the latter case, the interpretation is analogous to reading a scree plot in the case of factor analysis (Achterhof, Huntjens, Meewisse, Henk, 2019; Morovati, 2014; Nylund-Gibson, Choi, 2018). The effect of using LCA was to obtain the information about the number of groups of adolescents with different intensity and characteristics of impulsivity. In addition to the method of grouping, the advantage of latent class analysis is the information about the percentage share of each group in the study population. The last two research questions (the third and the fourth) were analysed using correlation coefficients selected according to the assumptions related to the linearity of relationships and the shape of the distribution of variables. Theoretical validity was checked only on the group of adolescents aged over 16 years ( $N = 2326$ ), which resulted from the properties of the IVE Impulsivity Questionnaire as an alternative measurement method. LCA coefficients and confirmatory factor analysis were calculated using the R environment with the *poLCA* and *lavaan* package (Linzer, Lewis, 2011) and other statistics using the SPSS package.

## RESULTS

The analysis of results started by determining the factor structure of the tool. An exploratory factor analysis was conducted using the principal components method with Oblimin diagonal rotation. At first, the value of the KMO coefficient of sample adequacy was checked. For the overall sample it amounted to 0.738 and in relation to individual items it exceeded the value of 0.6, which proves the adequacy of data for the applied calculation procedure. This was also confirmed by the Bartlett's test of sphericity ( $\chi^2(28) = 11984$ ;  $p < 0.001$ ) and the determinant value of 0.167.

Using the Kaiser criterion, a model was selected based on two factors that together explain over 54% of the joint variance (Table 1).

**Table 1**

**Sums of squares of factors extracted from BIS-Brief test items ( $N = 6710$ )**

Component	Extraction Sums of squared loadings			Rotation Sums of squared loadings
	Total	% variance	% accumulated	Total
1	2.787	34.835	34.835	2.398
2	1.586	19.601	54.437	2.304



The factor loadings for individual questions in the questionnaire are presented in Table 2. The content of the test items associated with the first component makes it possible to conclude that it represents impulsivity in action and cognitive functioning. The second component is associated with questions related to self-control – consideration, planning, concentration of attention and composure. This solution is confirmed by the results of the confirmatory factor analysis, in which the following values of match coefficients were obtained for the model based on two factors: RMSEA = 0.062, CFI = 0.961 and TLI = 0.942. For comparison, in the univariate model, the aforementioned coefficients were: RMSEA = 0.141, CFI = 0.786 and TLI = 0.701. The data obtained therefore warrant a statement about the two-factor structure of the short version of the BIS scale. The Cronbach's alpha reliability coefficient for the total score reached a satisfactory value of 0.729 (95%, CI 0.719-0.739) and the McDonald's omega coefficient 0.697. The values of the coefficients for the self-control subscale are 0.696 for Cronbach's alpha and 0.701 for McDonald's omega, and in the case of the impulsivity in action subscale the values are 0.727 and 0.735, respectively.

Table 2

**Factor loadings of the test items of the Polish version of the BIS-Brief questionnaire (N = 6710)**

Number and content of the question	Component	
	1	2
8. I act on the spur of the moment.	0.829	
7. I say things without thinking.	0.827	
2. I act without thinking.	0.791	
3. I find it difficult to focus.	0.484	
6. I am thoughtful.		0.778
5. I find it easy to concentrate.		0.768
4. I have self-control.		0.733
1. I plan my tasks carefully.		0.596

The next area of analysis is the distribution of the measured trait in the population of students surveyed. The subscale scores obtained in the factor analysis were calculated. They constitute the sum of answers to questions belonging to the scales. Greater intensity of impulsivity in action or self-control shows higher values. The total score is a measure of overall impulsivity and was calculated after reversing the scores of items 1, 4, 5 and 6. Overall impulsivity and that expressed in the subscales has a distribution that deviates from the normal distribution. Overall impulsivity (M = 18.03; SD = 3.96; SKE = 0.17) has a slightly

right-skewed distribution, dominated by scores indicating average or low intensity of the trait (Table 3).

A similarly right-skewed distribution holds for the trait expressed by the impulsivity in action subscale ( $M = 8.48$ ;  $SD = 2.43$ ;  $SKE = 0.51$ ). The standardised skewness for self-control (1.83) did not reach the threshold for significance level  $\alpha = 0.05$ . However, this trait has a distribution only close to normal ( $M = 10.45$ ;  $SD = 2.51$ ;  $SKE = -0.06$ ) due to the significant dispersion of scores around the mean ( $K = -0.274$ ). For the total score and impulsivity in action, the kurtosis value is not significantly different from zero.

**Table 3**

**Descriptive statistics for total score and subscale scores (N = 6710)**

Scale of the tool	Descriptive statistics			
	M	SD	SKE	K
Total score	18,03	3,963	0,167	-0,050
Subscale: impulsivity in action	8,48	2,434	0,510	0,091
Subscale: self-control	10,45	2,503	-0,055	-0,274

*M* – mean; *SD* – standard deviation; *SKE* – skewness, *K* – kurtosis

As a next step, a latent class analysis (LCA) was performed. Its results support the solution based on three groups of subjects. The information criteria and the G2 statistic given in Table 4 reach the largest decreases in value from a model with one to three classes, and then the dynamics of change are reduced. The entropy value, the highest at this point, also supports the solution with three classes (cf. Nylund-Gibson & Choi, 2018).

**Table 4**

**Results of latent class analyses performed on the test items of the questionnaire (N = 6710)**

Number of classes	G <sup>2</sup>	BIC	aBIC	cAIC	Entropy
1	-65292,50	130796,47	130720,21	130820,47	–
2	-62286,49	125004,74	124849,03	125053,74	0,697
3	-60885,69	122423,43	122188,27	122497,43	0,710
4	-60035,26	120942,84	120628,24	121041,84	0,720
5	-59508,62	120109,85	119715,81	120233,85	0,716
6	-59022,41	119357,71	118884,23	119506,71	0,665

G<sup>2</sup> (log-likelihood), BIC (Bayesian information criterion), ABIC (sample-size adjusted Bayesian information criterion), CAIC (consistent Akaike information criterion)

The division into three groups of adolescents with different intensity of impulsivity is consistent with the shape of the distribution of this trait described above. Analysis of the results of latent class analysis conducted in the separated groups reveals the following regularities: 24.4% of the adolescents provide answers to the questions in the questionnaire which indicate high intensity of impulsivity and its dimensions (mean for the total score in this group  $M = 22.56$ ;  $SD = 2.88$ ); 45.9% of the students belong to the group of moderate impulsivity ( $M = 18.32$ ;  $SD = 1.94$ ); 29.6% of the examined population are those with low scores ( $M = 13.78$ ;  $SD = 2.51$ ). This percentage of subjects with different impulsivity shows the right-skewness of the distribution found.

The tool's accuracy was examined by checking for correlations with the IVE impulsivity test and the relationships with selected aspects of adolescent behaviour (criterion accuracy). The total score of the short version of the BIS is consistent with all scales measured by the IVE test (Table 5). The relationship with the highest intensity ( $r = 0.54$ ;  $p < 0.001$ ) concerns the IVE impulsivity scale and thus the tendency to act without properly considering the consequences of one's behaviour. A similar correlation result applies to the pair impulsivity in behaviour (BIS) and impulsivity measured by the IVE test ( $r = 0.52$ ;  $p < 0.001$ ). The aforementioned subscale also correlates low with propensity for risk (IVE), that is, engaging in risk behaviour and sensation seeking. An inverse correlation was observed for self-control and impulsivity (IVE) ( $r = -0.392$ ;  $p < 0.001$ ). In conclusion, the correlation values collected in Table 5 show a satisfactory convergence between the results of the two tools.

**Table 5**

**Relationship between the results of the short version of the BIS and the results of the IVE questionnaire of the adolescents studied (N = 2326)**

Impulsivity measures		Impulsivity (IVE)	Risk proneness (IVE)	Empathy (IVE)
Overall result (BIS)	r	0,544***	0,053	0,063
Impulsivity in action (BIS)	r	0,516***	0,110***	0,078***
Self-control (BIS)	r	-0,392***	0,023	-0,028

r – Pearson's r coefficient, relevance level: \*\*\*  $p < 0,001$ ; \*\*  $p < 0,01$ ; \* $p < 0,05$

According to the theoretical assumptions, impulsivity should also be related to problematic and risky behaviours observed in adolescents. Studying such correlations will enable to determine the criterion accuracy and at the same time the usefulness of the tool in practice and psycho-preventive work with young people. The analyses below cover the following behaviours: frequency of psychoactive substance use (cigarettes/e-cigarettes, alcohol, drugs and medication), age of initiation to psychoactive substances, use of violence in the form of bullying others and academic performance defined here as the average of grades from the last semester (it is likely that high impulsivity accompanies a low average of grades).

Table 6

**Relationship between the results of the short version of the BIS and the use of psychoactive substances by the young people surveyed (N = 6710)**

Psychoactive substance use		Total score (BIS)	Impulsivity in action (BIS)	Self-control (BIS)
Smoking cigarettes/e-cigarettes	r	0,147***	0,140***	-0,107***
Drinking beer	r	0,120***	0,140***	-0,073***
Drinking wine	r	0,091***	0,110***	-0,052***
Drinking vodka and other spirits	r	0,107***	0,121***	-0,065***
Getting drunk	r	0,131***	0,129***	-0,089***
Using drugs in order to intoxicate oneself	r	0,087***	0,050***	-0,082***
Using designer drugs	r	0,082***	0,042***	-0,069***
Smoking marijuana/hashish	r	0,106***	0,098***	-0,071***
Using other drugs	r	0,089***	0,058***	-0,072***

r – Pearson's r coefficient, relevance level: \*\*\* p < 0,001; \*\* p < 0,01; \*p < 0,05

At the beginning of the description of the results of the correlation of impulsivity with pupils' behaviour, it should be noted that the obtained values of the correlation coefficients, although statistically significant, mostly reach very low values. The statistical significance here results, among other things, from the large size of the studied sample (N = 6710). This area of research, therefore, requires follow-up and more analyses extended by, for example, a different set of tools than the survey solutions adopted in the project.

Impulsivity is weakly correlated with the declaration of having used most of the psychoactive substances listed in the questionnaire (Table 6). This applies both to the total score and to impulsivity in behaviour and self-control, where the correlations are inversely proportional. Impulsivity correlates most strongly with the reaching for cigarettes, beer, vodka as well as smoking marijuana and hashish. Significant correlations also extend to the relationship between impulsivity and age of initiation of psychoactive substance use (Table 7, p. 147).

Self-control may be a protective factor against early substance use. Its relationship with the age of initiation is significant and positive – the higher the self-control, the later the initiation. This is not the case for designer drugs and addictive drugs. In the case of drugs, no relationship was found between the age of initiation and general impulsivity or impulsivity in action ( $p > 0.05$ ). However, these dimensions are significant for the age of initiation for tobacco and strong alcohols ( $r > 0.1$  and  $p < 0.01$  for the total score).

**Table 7**

**Association of the results of the short version of the BIS with the declared age of initiation of psychoactive substance use by adolescents (N = 6170)**

Age of initiation of psychoactive substance use		Total score (BIS)	Impulsivity in action (BIS)	Self-control (BIS)
Smoking cigarettes/e-cigarettes	r	-0,113***	-0,071***	0,114***
Drinking beer	r	-0,091***	-0,083***	0,069***
Drinking wine	r	-0,061***	-0,043*	0,058***
Drinking vodka and other spirits	r	-0,144***	-0,093***	0,145***
Getting drunk	r	-0,110***	-0,068**	0,112***
Using drugs in order to intoxicate oneself	r	-0,044	0,098	0,168*
Using designer drugs	r	0,093	0,220	0,123
Smoking marijuana/hashish	r	-0,078	-0,051	0,075
Using other drugs	r	-0,004	0,115	0,129

r – Pearson's r coefficient, relevance level: \*\*\* p < 0,001; \*\* p < 0,01; \*p < 0,05

Theoretical assumptions suggest that there is a relationship between impulsivity and academic performance and the use of violence against peers (Table 8). In the conducted study, a student's response to a question about bullying others (physical and verbal violence, backbiting, excluding from the group) was an indicator of violence. This behaviour correlates with impulsivity ( $r = 0.18$  p < 0.001 for the total score and  $r = 0.15$  p < 0.001 for impulsivity in behaviour). A similar relationship holds for school subject grades and conduct grades, where impulsivity is a risk factor – the greater the impulsivity, the lower the academic performance – and self-control promotes student achievement.

**Table 8**

**Relationship of short BIS scores to declaration of using violence and students' grades (N = 6710)**

Using violence and students' grades		Total score (BIS)	Impulsivity in action (BIS)	Self-control (BIS)
Bullying others	r	0,175***	0,149***	-0,142***
Average of grades from the last semester	r	-0,183***	-0,080***	0,216***
Conduct grade from the last semester	r	-0,173***	-0,083***	0,190***

r – Pearson's r coefficient, relevance level: \*\*\* p < 0,001; \*\* p < 0,01; \*p < 0,05

The above data, although confirming the existence of relations between impulsivity and problem behaviour and academic performance, should be regarded with caution. The low values of the correlation coefficients are an argument for the need for additional research to verify the tool's criterial accuracy. The results obtained in the form of correlations of impulsivity with the results of another tool measuring the same trait, only enable the claim of satisfactory accuracy of the convergent scale.

## DISCUSSION

The obtained results prove satisfactory properties of the Polish version of the short BIS scale. This is supported by the values of reliability coefficients, confirmatory analysis and confirmation of convergent accuracy. In relation to the criterion accuracy, it would be valuable to conduct further studies with modifications in the form of alternative tools measuring specific risk behaviours of adolescents. The analyses carried out confirmed the two-factor structure of the questionnaire with the scales: impulsivity in behaviour and self-control as dimensions supplementing the total score. The latter is a general measure of the intensity of impulsivity in adolescents.

The two-factor structure is consistent with the work of other authors, e.g. Morean et al. (2014). Also, the reliability measure of Cronbach's alpha of 0.73 is analogous to the studies of Steinberg et al. (2013) and Morean et al. (2014). In the population of adolescent students, impulsivity is a trait with a right skewed distribution. Most students manifest low or moderate intensity of the diagnosed trait. High impulsivity affects 24.4% of the study population. This is a relatively high percentage, and because of that, the shortened BIS questionnaire can be used in the diagnosis and support of adolescents. The analyses did not compare impulsivity between gender and age groups, as these traits in other studies based on Barratt's concept were not found to be significant in relation to adolescents. Differences by age are observed between adolescents and adults, however, they were not examined in the project presented here (Mathias et al., 2018).

The relevance and usefulness of the scale in psychological practice is supported by data on the relationship of the BIS-Brief scores with an alternative method of measuring impulsivity (the IVE questionnaire) and preliminary data describing correlations with problem behaviour and academic performance. Impulsivity has been shown to correlate with psychoactive substances use and the age at which adolescents first use them. This relationship is also confirmed by other studies (Kata, 2019; Martínez-Loredo et al., 2015). The correlation values are low, indicating that impulsivity is only one correlate of problem behaviour. It is also a trait accompanied by a tendency to violence and low academic performance. The same relationships are found by Barratt (1959, 1987), author of the original full version of the questionnaire. Self-control can be considered a protective factor, which as one of the extracted dimensions of the tool is related to higher educational achievement and later age of initiation.

The tool described in the article, i.e. a short Polish version of the BIS-Brief questionnaire has good psychometric properties. It can be used in scientific research as a measure of general impulsivity and in psychological practice as part of the diagnosis of risk factors for disorders and problem behaviours of adolescents. The shortened form, the relevance of the content of the questions to the life stage of adolescence – in contrast to the questions in the full version (Mathias et al., 2018) – is an additional argument for using the scale in diagnosis and support work with young people. Further research on the tool should verify the criterion validity and correlates of the measured trait with problem behaviours and characteristics of student functioning. Extending the study group to include adults and checking the relationship between impulsivity and age and gender would also provide a valuable extension to the study.

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