ORIGINAL ARTICLE

Psychometric evaluation of the Czech Beck Depression Inventory-II in a sample of depressed patients and healthy controls

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Abstract

OBJECTIVE: The goal of this study was to explore reliability and validity of the Czech revised Beck Depression Inventory (BDI-II) and to identify the best cut-off for a correct identification of a potentially depressed individual.
METHOD: Two groups of adult participants entered the study. The first group consisted of 177 patients with depression (F32x or F33x according to the ICD-10). Furthermore, there were 767 healthy controls. Each participant filled in BDI-II. A part of the patients also completed the Beck Anxiety Inventory (BAI), the Dissociative Experiences Scale (DES), and the subjective Clinical Global Impression scale (CGI). A part of the controls filled in the Adult Dispositional Hope Scale (ADHS) and the Satisfaction with Life Scale (SWLS).
RESULTS: The average patients' BDI-II score was 30.8±10.3, the mean controls' score was 7.2±6.8. The internal consistency of the inventory was excellent (the ordinal alpha coefficient was 0.90 for the patients and 0.93 for the controls). The stability in time, measured two weeks apart, was also good (intra-class correlation coefficient r=0.83 for the patients and 0.77 for the controls). The exploratory factor analysis of the patients showed a three-factor solution, while the analysis of the controls' data identified two factors. As expected, BDI-II significantly positively correlated with BAI, DES, and CGI and was negatively connected to ADHS and SWLS. The cut-off score with the best sensitivity and specificity was 17.
CONCLUSION: The Czech BDI-II shows adequate psychometric characteristics.

INTRODUCTION

Despite an ongoing effort towards an early identification and treatment of individuals with depression, fifty to seventy percent of them remain undetected and untreated (González *et al.* 2010). The delay of the treatment or its absence may subsequently worsen the patients' prognosis (Denihan *et al.* 2000). A quick and correct diagnostics is an important clinical goal to strive.

The diagnostic process routinely consists of a clinical interview with a patient. Apart from that, self-report scales and inventories are often used to help to reach a correct diagnosis or to measure a treatment change. For these purposes, the revised Beck Depression Inventory (BDI-II) is one of the most commonly used methods.

Beck Depression Inventories were developed during several decades. Beck and his colleagues wanted to create a self-report measure which would increase the probability of a successful identification of a depressed person (Beck *et al.* 1961). The authors realized a number of structured interviews with depressed patients, asking them about their mental state. The most common symptoms of depression then served as a basis for the formulation of the original Beck Depression Inventory (BDI). The inventory consisted of 21 symptoms with each having several levels of intensity (e.g., the intensity of perceived sadness was based on four levels which varied from "I do not feel sad" to "I am so sad and unhappy that I cannot stand it."). The items roughly consisted of three clusters of the depressive symptoms – emotional (e.g., irritability), cognitive (e.g., pessimism), and physical (e.g., fatigue) (Beck *et al.* 1961).

A decade later, Beck with colleagues slightly changed the formulation of the inventory, and subsequently published it as BDI-IA. Furthermore, the assessed time duration of the symptoms increased from one day to one week (Beck *et al.* 1996).

The last step of the development was the introduction of the Revised Beck Depression Inventory (BDI-II) (Beck *et al.* 1996). The items were in congruence with the diagnostic criteria for major depressive episode in DSM-IV (Beck *et al.* 1996). Several items from BDI-IA were omitted (weight loss, somatic preoccupation, distorted body image, and inability to work), others were included (agitation, concentration difficulties, feelings of worthlessness, and energy loss) to improve the diagnostic potential of the method. Also, the evaluated time duration of the symptoms increased from one to two weeks (Beck *et al.* 1996).

The BDI-II has been seen as similar, however not interchangeable, with other psychopathology scales (Wang & Gorenstein 2013). For example, the overall BDI-II score moderately positively correlates with the severity of one's mental disorder (Zaider *et al.* 2003) and the intensity of anxiety (Beck *et al.* 1996). Other authors connected the depressive symptoms, assessed by the BDI-II, with dissociation (Bob *et al.* 2002). Also, the BDI-II score negatively correlates with hope (Hedayati & Khazaei 2014) and life satisfaction (Arrindell *et al.* 1991). Curiously, there is even a significant connection between mothers´ BDI-II scores and hemoglobin levels of children with inflammatory bowel diseases (Jelenova *et al.* 2015).

Research objective

A primary goal of the study was to assess the reliability, validity, and internal structure of the BDI-II in a sample of patients with a depressive disorder and among healthy controls. A secondary goal was to find a cut-off score with the highest sensitivity and specificity towards a correct identification of a depressed person.

METHOD

Sample

Two different samples participated in the study. The first one consisted of adults who have never been diagnosed or treated for a mental disorder. The inclusion criteria were the age of 18 or older and the absence of a mental disorder both now and in the past. The data from this group were obtained by the snowball method, and the collection took part between March 2016 and January 2017.

The second group was formed by adult patients with a florid unipolar depression. All individuals were treated between January 2012 and January 2017 in the outpatient or inpatient part of the Department of Psychiatry, University Hospital Olomouc. The participation was offered to patients with a diagnosis of F32 or F33 according to the ICD-10 (WHO 1992). The exclusion criteria were the diagnoses of an organic mental disorder or a current substance use disorder, psychotic symptoms, and intellectual disability.

The healthy controls consisted of 767 individuals. There were more women (n=571; i.e. 74.4%) than men (n=196; 25.6%) in the sample. The average age was 27.0±10.6 years. The most common level of education was secondary (n=540; 70.4%), followed by tertiary (n=202; 26.3%). Other levels of education were scarce – twenty individuals had vocational training (2.6%) and three others had a primary education (0.4%). A majority of the group were students (n=512; 66.8%) and employed and self-employed individuals (n=232; 30.2%). There were also seven unemployed persons (0.9%), ten individuals with a disability rent (1.3%), and six participants with an old age pension (0.8%). Most of the controls were single (n=613; 79.9%). 136 individuals were married (17.7%), 15 other were divorced (2.0%), and two individuals were widowers (0.3%).

The clinical group comprised 177 patients with unipolar depression. The majority of the sample were women (n=116; 65.5%; men: n=61; 34.5%). The mean age was 45.6±12.2 years. Most of the participants had the highest level of education secondary (n=78; 44.1%), fewer patients had vocational training (n=46; 26.0%),

tertiary (n=36; 20.3%) or primary (n=13; 7.3%) level of education. The patients were usually employed or self-employed (n=102; 57.6%). Others were unemployed (n=29; 16.4%), were taking a disability rent (n=24; 13.6%) or an old age pension (n=14; 7.9%). There were also seven students (4.0%). As for the marital status, eighty-eight patients were married (49.7%). Also, a considerable part of the participants was divorced (n=44; 24.9%) or single (n=37; 20.9). Eight patients were widowers (4.5%).

The primary diagnosis of the patients and the most common comorbidities are stated in the Table 1. The majority of the sample consisted of the individuals with mild and moderate depression. There were few severely depressed patients. 47 individuals had a comorbid mental disorder (26.6%), out of which the most common were anxiety disorders, other neurotic disorders, and personality disorders. There were nine patients with comorbid generalized anxiety disorder and fewer participants with panic disorder or agoraphobia (both n=3), specific phobia (n=2), and social phobia (n=1). The most prevalent comorbid personality disorder was the borderline type (n=9), followed by avoidant (n=3) and histrionic, narcissistic, and dependent personality disorder (in all these cases n=1).

Both groups differed from each other in several demographic factors. The patient group had a slightly more balanced proportion of men and women than the control group (χ^2=5.761; df=1; p<0.05). The clinical group was older than the controls (Mann-Whitney test: U=16653.5; p<0.001). Furthermore, the control group included more individuals with higher education (χ^2=172.890; df=3; p<0.001), and the patients were less often students and more often unemployed or had a disability rent (.χ^2=319.477; df=4; p<0.001). Also, the patients were divorced more often and less commonly single than the controls (χ^2=279.852; df=3; p<0.001).

A part of the participants, who were available for more time, completed several other methods apart from the BDI-II (more about the methods is lower in the text). 105 patients (59.3%), who were admitted to a hospitalization in a psychotherapeutic ward of the Department of Psychiatry, also filled with the Beck Anxiety Inventory (BAI), Clinical Global Impression (CGI), and Dissociative Experiences Scale (DES). The mean BAI score was 23.8±12.8 points, indicating moderately severe anxiety (Julian 2011). The average CGI score was 4.4±1.4, which again speaks for moderate severity of the mental disorder (Guy 1976). Lastly, the mean DES score (16.7±15.7 points) indicated that the patients suffered from slightly elevated symptoms of dissociation (Frischholz *et al.* 1990).

Four hundred controls (52.2%) also completed the Adult Dispositional Hope Scale (ADHS) and the Satisfaction with Life Scale (SWLS). Their mean level of hope was medium (46.5±7.3 points) (Ociskova *et al.* 2017), and the life satisfaction was also normal (23.9±5.7 points) (Diener *et al.* 1985).

Methods

Both groups of the participants completed a demographic questionnaire. Clinical data were obtained from the patients' documentation with their written approval. All individuals filled in the BDI-II.

Beck Depression Inventory-II (BDI-II; Beck *et al.* 1996) – The inventory consists of 21 items – symptoms of depression in which an individual chooses one of usually four levels of intensity experienced during the last two weeks. This way, a participant may score zero the three points in each item, possibly reaching the maximum score of 63 points (Beck *et al.* 1996). The score 16 is expected to show the highest sensitivity and specificity towards an identification of a depressed individual (Spreen & Strauss 1991). The internal consistency of the inventory is good to excellent (α=0.83–0.96) (Wang & Gorenstein 2013). The same quality shows the temporal stability of the method (r=0.73–0.96) (Wang & Gorenstein 2013). The internal structure of the inventory is ambiguous. Some authors identified two dominant factors forming the inventory; others described three major components which may be understood as varia-

Tab. 1. Primary diagnoses on a sample of the patients with a depression and comorbidities.

Primary diagnosis / Comorbidity	Number of the patients	Number of comorbidities			Selected comorbidities		
		0	1	2+	Anxiety disorder	Other neurotic disorder	Personality disorder
F32.0	79	61	14	4	9	6	5
F32.1	39	31	7	1	1	2	6
F32.2	6	3	0	3	1	0	1
F33.0	28	19	7	2	2	6	3
F33.1	22	14	7	1	4	4	1
F33.2	3	2	1	0	1	0	0
Total number	177	130	36	11	18	18	16

tions on somatic, emotional, and cognitive symptoms of depression (Wang & Gorenstein 2013). The Czech version of the BDI-II translated Preiss and Vacir (1999). Ptacek *et al.* (2016) recently evaluated the reliability of the measure (α=0.92–0.93) and its inner structure in a sample of healthy adult employees.

As mentioned, 105 patients also filled in several other measures:

Clinical Global Impression (CGI; Guy 1976) – The scale evaluates an overall mental state of a patient. There are two versions – subjective, completed by a patient, and objective, filled in by a mental health professional. The subjective version of the CGI (subjCGI) consists of seven points with additional description (1=normal, not at all ill; 7=extremely ill). A participant chooses one of the points according to his of her assessment of own mental state (Guy 1976).

Beck Anxiety Inventory (BAI; Beck *et al.* 1988) – The inventory comprises 21 items – symptoms of anxiety with several levels of intensity. A patient states how much he or she perceived the symptoms during the last week. The item score ranges from zero to three. Thus, the largest overall score is 63 points (Beck *et al.* 1988). Ten points are considered as a border between a normal and a significant clinical level of anxiety (Julian 2011). The inventory has high internal consistency and temporal stability (Beck *et al.* 1988). The Czech translation created Prasko with Mozny and validization performed Kamaradova *et al.* (2015). The Cronbach's alpha of the Czech translation varies from 0.82 to 0.95, and the temporal stability is also satisfactory (Kamaradova *et al.* 2015).

Dissociative Experiences Scale (DES; Bernstein & Putnam 1986) – DES consists of 28 dissociative experiences from the range of amnesia, absorption, fantasy, depersonalization, and derealization. An individual marks a point on a 10cm scale according to how often he or she perceives the dissociative symptoms (0 indicating 0% of the time, 100 meaning all the time) (Bernstein & Putnam 1986). The norm is relatively broad; even the score 23.8 indicates normal levels of dissociation (Frischholz *et al.* 1990). The Cronbach's alpha of the scale is excellent (0.96), and the same goes for its temporal stability (r=0.82–0.93) (Frischholz *et al.* 1990). The Czech DES introduced Ptacek *et al.* (2006) who also evaluated its psychometric properties and considered them satisfactory.

Last but not least, four hunder controls also completed two positive psychology scales which helped to evaluate the BDI-II validity from a different angle than offered the mentioned psychopathology scales filled by the patients.

Adult Dispositional Hope Scale (ADHS; Snyder 2000) – ADHS is based on the author's theory of hope.

According to Snyder (2000), hope emerged when an individual has a goal to reach, can find ways to do it (so-called pathways thinking), and disposes of sufficient motivation to get on the path (agency). The scale has twelve items out of which four measure pathways thinking, four assess agency, and the rest are distractors and remain unevaluated. The items consist of statements with eight-point Likert scales based on a level of agreement with each of them. The minimal score is 8; the maximum is 64 (Snyder 2000). Reliability and validity of the measure are good (Snyder *et al.* 1991). The Czech version translated and standardized Ociskova *et al.* (2017). Its Cronbach's alpha was 0.82 (Ociskova *et al.* 2017).

Satisfaction with Life Scale (SWLS; Diener *et al.* 1985) – This short scale has five items which measure an overall satisfaction with one's life. An individual chooses one of seven points of the Likert scale based on his or her agreement with each item's statement. The resultant score varies from 5 to 35 points where 20–24 points show an average life satisfaction (Diener *et al.* 1986). Internal consistency of the scale is good (α=0.82) (Vera-Villarroel *et al.* 2012). The Czech version of the scale created Krivohlavy (2002).

Statistics

All analyses were done by using statistical software SPSS 17.0, G*Power, and R. Descriptive statistics included the calculations of means and standard deviations, frequencies in demographic factors, and normality distribution with a Shapiro-Wilk test. Differences between BDI-II scores in relation to the sex and age and groups of probands paired with respect to their sex and age were analyzed by a Mann-Whitney test. Differences between the scores in other demographic and clinical factors were explored with a chi-square test or a Kruskal-Wallis test. The effect sizes of the significant differences were interpreted in accordance to Cohen (1988). Spearman's correlational coefficients were applied to indicate the strength of the BDI-II scores and age or other measures.

Internal consistency of the inventory was assessed by the calculation of the ordinal alpha which is an equivalent of the Cronbach's alpha for ordinal data. Retest took place two weeks after the first measurement. The connection between these two data sets assessed an intraclass correlation. Exploratory factor analysis consisted of the principal axis factoring method with a promax rotation. The choice of the method and rotation was based on a non-normal distribution of the BDI-II scores and knowledge of naturally significant relationship among expected factors. The cut-off scores were identified by a ROC curve and Youden's index analysis.

Ethics

The research took place with respect to the Helsinki Declaration (WMA 2013) and ethical principles of the

American Psychological Association (2010). A local ethical committee approved the study, and all participants signed an informal content.

RESULTS

Descriptive analysis

The Table 2 shows mean BDI-II scores of the clinical and control group and their subgroups. The patients scored significantly higher in the BDI-II than the controls (Mann-Whitney test: U=4264; sig. 0.001). The difference was large (Cohen's d=2.7). Apart from that, one other difference was statistically significant. The controls, who were unemployed or were taking the disability rent, scored noticeably higher in the BDI-II than those controls who were students, employed or self-employed, or had the old age pension. This difference was also large (Cohen's f=1.1). However, there were only seven unemployed controls, six individuals with the old age pension, and ten controls with the disability rent.

As we have shown, the mean BDI-II scores differed considerably between the patients and the controls. However, the controls were significantly younger than the patients and differed in the women to men ratio (the comparisons were described in the Sample). This fact could have skewed the statistical analysis. Thus, we performed one additional analysis to lower the possible influence of the basic demographic differences. We paired the participants from both groups (the patients and the controls) according to their sex and age and then compared their BDI-II scores. This way, we managed to pair 126 patients with 126 controls. In the clinical group, there were 84 women and 42 men with the mean age 43.3±13.4 years. The control group included 85 women and 41 men with the average mean 43.4±13.4 years. Both groups did not statistically differ in the sex ratio (χ^2=0.018; df=1; ns), nor in their mean age (Mann-Whitney test: U=7910.5; ns). The average BDI-II score of the paired patients was 30.4±10.4 points; the paired controls reached 8.1±7.9 points. Again, the difference

Tab. 2. Mean BDI-II scores of the patient and control group, their subgroups, and differences between them.

Category / Scores and statistics		BDI-II	
		Patients	**Controls**
The whole sample		30.8±10.3	7.2±6.8
Gender	Men	29.2±10.4	7.0±7.4
	Women	31.7±9.8	7.3±6.6
	Between group comparison	Mann–Whitney U test: U=2859.5; ns	Mann–Whitney U test: U=52328; ns
Age	Correlation	r^s=0.08; ns	r^s=−0.03; ns
Education	Primary level	29.2±10.2	18.3±11.0
	Vocational school	32.3±10.7	10.7±9.7
	Secondary level	31.9±10.7	7.2±6.7
	University level	28.7±8.5	6.7±6.2
	Between group comparison	Kruskal–Wallis test: χ^2=3.567; df=3; ns	Kruskal–Wallis test: χ^2=7.482; df=3; ns
Job status	Students	25.0±16.4	7.1±6.4
	Employed and self-employed	30.1±8.5	7.0±7.1
	Unemployed	31.6±11.1	15.4±11.8
	Taking an old age pension	27.5±12.7	8.7±3.5
	Taking a disability rent	35.9±10.6	13.9±10.3
	Between group comparison	Kruskal–Wallis test: χ^2=7.900; df=4; ns	**Kruskal–Wallis test: χ^2=12.125; df=4; ***
Marital status	Single	30.0±10.9	7.2±6.8
	Married	29.7±9.3	7.6±6.8
	Divorced	33.1±11.6	7.6±8.1
	Widowed	34.3±7.6	9.5±7.8
	Between group comparison	Kruskal–Wallis test: χ^2=3.961; df=3; ns	Kruskal–Wallis test: χ^2=1,565; df=3; ns

s=Spearman's correlation coefficient; *=p<0.05; ns=non-significant

Tab. 3. Reliability of the Czech BDI-II.

Inventory / Statistics	Patients				Controls			
	N	α	N	ICC	N	α	N	ICC
BDI-II	177	0.90	90	0.83***	767	0.93	147	0.77***

α=the ordinal alpha; ICC=intra-class correlation coefficient; *** *p*<0.001

between the groups was highly statistically significant (Mann-Whitney test: U=825.0; sig. 0.001).

In the next step, we were interested if there was a meaningful difference between the scores of the patients with a mild, moderate, or severe depression, diagnosed by a psychiatrist. The mean BDI-II score of the mildly depressed individuals (n=107) was 29.8±10.4 points. The moderately depressed patients (n=61) had a mean score of 32.4±9.8 points, and the persons with a severe depression (n=9) scored 34.7±10.1 points. The subgroups did not significantly differ from each other (Kruskal-Wallis test: χ^2=3.304; df=2; ns).

Similarly, we did not find a significant difference between the BDI-II scores of the individuals with a first episode of the depression (n=124) and a recurrent depressive disorder (n=53). The average BDI-II score in the F32x group was 30.5±10.2; the mean BDI-II scores in the F33x group was 31.5±10.5 (Mann-Whitney test: U=2877.5; ns).

Reliability

Firstly, we assessed the internal consistency of the inventory. The ordinal alpha, an indicator of the consistency, was excellent in both groups (α=0.90 for the clinical group and α=0.93 for the controls; the Table 3). None of the items decreased the alpha's value. Ninety patients and 147 controls completed the BDI-II twice, two weeks apart. The temporal stability of the BDI-II was also excellent (the Table 3).

Exploratory factor analysis

The inner structure of the inventory was identified by the exploratory factor analysis, specifically by the principal axis factoring with the promax rotation. Based on the patients' data, we identified three factors with an eigenvalue higher than 1 which explained 39.3% of

the scores variance (the Table 4). Table 5 shows factor loadings of the items. The first factor consisted of cognitive-emotional symptoms of the depression. Somatic depressive symptoms created the second factor and the third included fundamental emotional symptoms of the depression. Four depressive symptoms (Change in sleep patterns, Change in appetite, Concentration difficulties, and Loss of interest in sex) did not sufficiently load on either factor because the patients did not often score higher in these items.

The controls' data led to an identification of two factors with an eigenvalue greater than 1. These two factors explained 40.2% of the scores variance (the Table 4). The first factor included emotional symptoms of the depression, the second one then consisted of cognitive

Tab. 5. Factor loadings of the BDI-II items.

	Patients				Controls	
Items	Factor 1	Factor 2	Factor 3	Items	Factor 1	Factor 2
P1	−0.130	0.136	**0.689**	P1	**0.588**	0.202
P2	0.172	0.092	**0.515**	P2	**0.416**	0.129
P3	**0.507**	0.053	0.172	P3	0.258	**0.358**
P4	0.038	**0.620**	0.156	P4	**0.562**	−0.179
P5	**0.710**	−0.224	0.216	P5	0.158	0.678
P6	**0.606**	−0.191	−0.047	P6	0.157	0.048
P7	**0.668**	0.123	−0.020	P7	**0.600**	0.179
P8	**0.675**	0.221	−0.112	P8	0.017	**0.456**
P9	0.285	−0.112	**0.399**	P9	**0.676**	0.209
P10	0.286	−0.019	**0.309**	P10	**0.303**	−0.100
P11	−0.015	0.021	**0.426**	P11	−0.010	−0.005
P12	0.140	**0.661**	0.025	P12	**0.536**	−0.189
P13	**0.512**	0.111	−0.162	P13	−0.109	0.064
P14	**0.494**	0.124	−0.015	P14	**0.508**	0.107
P15	−0.125	**0.812**	0.122	P15	−0.052	0.236
P16	0.128	0.146	0.057	P16	0.013	**0.667**
P17	−0.145	0.075	**0.568**	P17	0.106	−0.186
P18	−0.131	−0.085	0.233	P18	0.180	0.208
P19	0.061	0.123	−0.165	P19	0.020	0.109
P20	0.030	**0.476**	−0.141	P20	−0.077	0.191
P21	0.153	0.156	0.024	P21	0.058	−0.151

Tab. 4. Eigenvalues of the factors and percentages of explained variance.

Factor / Statistics	Patients		Controls	
	Eigenvalue	Percentage of explained variance	Eigenvalue	Percentage of explained variance
F1	5.828	27.8	6.327	32.5
F2	1.440	6.9	1.078	7.7
F3	1.000	4.8		

symptoms. Other symptoms, mainly the physical ones, were experienced by the controls very rarely, and thus did not sufficiently load on either factor nor did they form their own factor.

Validity

To explore the validity of the BDI-II, we correlated the inventory with instruments that measure similar or opposite constructs. The correlational coefficients of these relationships are stated in the Table 6.

The BDI-II moderately positively correlated with the current anxiety symptoms (BAI) and dissociation (DES) and strongly positively with the subjective evaluation of the severity of one's mental disorder (subjCGI). Among the controls, the BDI-II score moderately negatively correlated with hope (ADHS) with its part agency and with life satisfaction (SWLS). The correlation between the BDI-II and pathways thinking was mildly negative (the Table 6).

Cut-off scores

In the last step, we used the BDI-II scores from both groups to identify a cut-off score which best differentiates between a possibly depressed and a non-depressed person. We used the ROC curve for this purpose. The area under the curve (AUC) was 0.97 (the standard error: 0.007, sig. 0.001). The optimal score was identified with the use of the Youden's index. The highest sensitivity and specificity showed a score 17 which had sensitivity 96.0% and specificity 91.0%. When using the 17 score as a cut-off score, we can reach the highest possibility of a correct identification of a depressed individual while at the same time avoiding the mistake of the labeling a healthy individual as a depressed.

Also, we identified a score which could serve as a border after which we can assume, that a person does not feel very well, and we should check his or her mental state. For this purpose, a score 13 was chosen. Firstly, the score 13 was the borderline score reached by several depressed individuals who were nearly remitted but still remained significantly clinically depressed. Secondly, the score 13 had an excellent sensitivity (98.3%) and good specificity (83.7%). Let us stress that the score 13 or higher speaks for general feelings of unwellness, not automatically for the (sub)depression.

DISCUSSION

The goals of the research were to explore basic psychometric properties of the Czech Beck Depression Inventory-II and to identify a cut-off score to differentiate between a possibly depressed and a non-depressed population. The translation used was that of Preiss and Vacir (1999). Two groups of probands entered the study – 177 individuals with a florid unipolar depression (F32x or F33x according to the ICD-10; 1992) and 767 controls who stated that they had not been diagnosed or treated for a mental disorder. In both samples, there

Tab. 6. Correlations between BDI-II and selected scales.

Patients		Controls	
Scales	BDI-II	Scales	BDI-II
BAI	0.41 s ***	ADHS	−0.30s ***
subjCGI	0.52 s ***	- Pathway Thinking	−0.22s ***
DES	0.34s ***	- Agency	−0.32s ***
		SWLS	−0.43s ***

BAI=the Beck Anxiety Inventory; subjCGI=the subjective version of the Clinical Global Impression scale; DES=the Dissociative Experiences Scale; ADHS=the Adult Dispositional Hope Scale; SWLS=Satisfaction With Life Scale; s=Spearman's correlation coefficient; *** *p*<0.001

were more women than men, and the control group was significantly younger than the patients. Also, the controls included a considerable number of students. Among the patients, the majority suffered from a mild or moderate depression. The structure of the samples presents several shortcomings of the study.

The average BDI-II score of the patients was 30.8±10.3 points (30.4±10.4 points in the subgroup paired with the controls) which are a score usual in depressed samples (reaching 28.6–38.6 points; Wang & Gorenstein 2013). The mean score of the controls was 7.2±6.8 points (8.1±7.9 in the paired subgroup of the controls) which also remains in the range common in non-clinical samples (5.1–18.5 points; Wang & Gorenstein 2013). Ptacek *et al.* (2016) identified the mean BDI-II score of approximately ten points in Czech adult employees.

We did not find a significant difference between the intensity of the depressive symptoms in the men and women. The meta-analysis of Wang and Gorenstein (2013) found that the influence of the sex on the BDI-II scores is ambiguous. Roelofs *et al.* (2013) concluded that if there is a significant difference between the sexes, it is small. Ptacek *et al.* (2016) described higher BDI-II scores among women. However, they did not perform a t-test or a Mann-Whitney test to explore the significance of the perceived difference. Similarly, we did not identify a significant connection between the age and the BDI-II score. Other authors also claimed that the relationship between those two factors is probably non-existant (Wang & Gorenstein 2013).

Apart from the findings of others (Roelofs *et al.* 2013; Arnau *et al.* 2001), we did not find higher levels of depressive symptoms among controls with lower education. This is probably due to low numbers of participants in the subgroups of the controls with primary school or vocational training. This explanation is backed by the BDI-II scores in these particular control subgroups which showed a trend towards the higher BDI-II scores among the persons with lower education. Furthermore, the unemployed controls or those

with the disability rent experienced more pronounced depressive symptoms when compared to the rest of the controls (students, employees, self-employed participants, or those with the old age pension). This finding was somewhat expected and in accordance to the meta-analysis of Wang and Gorenstein (2013). However, we have to mention low numbers of participants among the controls who were unemployed or took the old-age pension or the disability rent. Finally, the marital status also did not show any significant relationship with the BDI-II score.

As for the clinical factors, the BDI-II scores did not depend on the severity of the major depression (mild, moderate, or severe). This finding is rather surprising, although Dolle *et al.* (2012) explored the BDI-II among adolescents with mental health issues and concluded that it is not clear if the BDI-II may dispose of effective cut-off scores for the differentiation between the severity levels of depression. On the other side, Wang and Gorenstein (2013) think that the BDI-II has this differentiative ability. Thus, this topic should be placed under a scrutiny. Also, we did not find a difference between the BDI-II scores of the patients with a first depressive episode versus the patients with recurrent depression. Beck *et al.* (1996) identified higher BDI-II scores among the individuals with recurrent depression. The difference was small but still statistically significant. It is thus probable that the difference in the BDI-II between these two groups of the depressed patients is either small or negligible.

In the next part of the study, we studied the psychometric properties of the BDI-II. The internal consistency of the inventory was excellent in both samples (α=0.90 and 0.93) and remained in the values published by other authors (α=0.73–0.96; Wang & Gorenstein 2013; Ptacek *et al.* 1996). The values of the intraclass correlational coefficient, measuring the temporal stability of the BDI-II, were 0.83 and 0.77 which again is in the range of other findings (r=0.73–0.96; Wang & Gorenstein 2013).

The inner structure of the BDI-II was evaluated by the exploratory factor analysis. We preferred this type of analysis instead of the confirmatory one because of a variable structure of the measure which highly depends on translation and a population in which it is used (Wang & Gorenstein 2013). The analysis the patients' data resulted in three major factors which included cognitive, somatic, and emotional symptoms of depression. This result is by other studies, though the alignment of the items to the factors varies across the studies (Wang & Gorenstein 2013; Ptacek *et al.* 2016). Interestingly, the patients did not commonly perceive certain somatic symptoms – changes in sleep and appetite, concentration difficulties, and the loss of libido. It may be that the result was caused by a structure of the sample where a considerable number of the patients were individuals with a mild depression who do not experience strong somatic symptoms (WHO 1992). A similar picture of

the BDI-II was identified in the controls' data where somatic symptoms failed to load on any factor or create its own. Thus, the data from both groups clustered into slightly different factors. Because this is a common finding in the studies of the BDI-II (Wang & Gorenstein 2013), we do not recommend using any subscores of the BDI-II and suggest using only the overall inventory's score.

Subsequently, the basic validity of the measure was assessed. According to the expectations (Beck *et al.* 1996; Zaider *et al.* 2003; Arrindell *et al.* 1991; Hedayati & Khazaei 2014; Lipsanen *et al.* 2004), depressive measured by the BDI-II positively correlated with anxiety (BAI), dissociation (DES), and the subjective severity of the mental disorder (subjCGI), and negatively correlated with hope (ADHS) and life satisfaction (SWLS). The shortcoming of this part of the study was the inability to administrate the similar measures to all participants. Only probands, who were willing and able to complete these methods, did so. Despite this methodological flaw, we confirmed the existence of the relationship between the BDI-II and other measures in a direction and strength found by others.

In the last step of the analysis, we identified two cut-off scores – one for a possible identification of a depressed individual and one for an identification of a person who experiences higher distress, and these issues preferably should not be left without a closer exploration. In the analysis of the ROC curve, the area under the curve (AUC) was 0.97 which is an excellent result (Akobeng 2007). The score 17 showed the highest sensitivity and specificity towards a correct identification of depressed and non-depressed individuals. As for the cut-off scores published by other authors, Wang and Gorenstein (2013) stated a range of scores between 9 and 25 points, varying upon a population in which the method is used. The highest AUC in the meta-analysis had a score 16 which reached a score of 0.96 (Arnau *et al.* 2001) which is similar to our finding. Furthermore, we identified a score 13 which showed excellent sensitivity and specificity for the differentiation between a depressed and a non-depressed population. While this score cannot serve as an indicator of depression, it should present a signal to explore the individual's mental state.

The future research should explore the utility of the BDI-II among the samples which were underpopulated in this study. It is mainly certain subgroups of the general population (elderly individuals, people with lower education, unemployed individuals, and divorced or widowed persons) and patients with physical illnesses or mental disorders other than depression.

To sum it up, the Czech BDI-II shows an excellent internal consistency in the samples of the depressed patients and healthy controls. Similarly good is its temporal stability, inner structure, and validity. The method shows a variable internal structure. The interpretation of the inventory should be based on an

overall score. A score of 17 was the most useful for the identification of a depressed and a non-depressed individual. The BDI-II is a screening method. Higher scores of the measure do not automatically speak for a depressive disorder.

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