



## High Beck Depression Inventory 21 scores in adolescents without depression are associated with negative self-image and immature defense style



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### ABSTRACT

Beck Depression Inventory (BDI) is widely used in assessing adolescents' psychological wellbeing, but occasionally the result diverges from diagnostics. Our aim was to identify factors associated with discrepancies between BDI scores and diagnostic assessment in adolescent psychiatric patients and general population.

The study comprised 206 inpatients (13–17 years old) and 203 age and gender matched non-referred adolescents. Study subjects filled self-reports on depression symptoms (BDI-21), alcohol use (AUDIT), defense styles (DSQ-40) and self-image (OSIQ-R), and on background information and adverse life events. Diagnostics was based on K-SADS-PL interview, and/or clinical interview and clinical records when available.

We compared subjects who scored in BDI-21 either 0–15 points or 16–63 points firstly among subjects without current unipolar depression ( $n = 284$ ), secondly among those with unipolar depression ( $n = 105$ ). High BDI-21 scores in subjects without depression diagnosis ( $n = 48$ ) were associated with female sex, adverse life events, parents' psychiatric problems, higher comorbidity, higher AUDIT scores, worse self-image and more immature defense styles. Low BDI-21 scores among subjects with depression diagnosis ( $n = 23$ ) were associated with male sex, more positive self-image and less immature defense style.

In conclusion, high BDI-21 scores in the absence of depression may reflect a broad range of challenges in an adolescent's psychological development.

### 1. Introduction

Major depressive disorder (MDD) is one of the most common psychiatric disorders in adolescence with a cumulative prevalence of up to 20% (Avenevoli et al., 2015). It often leads to a decrease in cognitive and social functioning and increases the risk for suicidality. Furthermore, depressive symptoms that do not reach the diagnostic threshold of MDD (prevalence 5–29%) also cause significant impairment (Carrellas et al., 2017). Several screening and diagnostic tools for depression have therefore been developed (Brooks and Kutcher, 2001; Stockings et al., 2015). In clinical practice, self-reported depressive symptoms and clinical diagnostics occasionally diverge raising the question what could explain this discrepancy. To our knowledge, this

issue has not been studied in adolescents.

Research data on the risk factors for depression point to factors worth considering also in subthreshold depression. The three most important risk factors for depression in adolescents are female sex, a family history of depression and exposure to psychosocial stress (Thapar et al., 2012). The intergenerational transmission of depressive symptoms arises from a mix of hereditary and environmental factors (Mason et al., 2017; Weissman et al., 2006). Various psychosocial stress factors can induce depression in adolescents (St Clair et al., 2015; Rice et al., 2017), and susceptibility appears to be higher in females than males (St Clair et al., 2015). Depressive symptoms in adolescents are also associated with psychological factors, in particular negative self-image (Fine et al., 1993; Erkolahiti et al., 2003) and immature styles

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(Chan, 1997; Muris et al., 2003; Ruuttu et al., 2006).

For identifying depressive symptoms, one of the most widely used structured self-reports is Beck Depression Inventory (BDI) – 21 (Beck et al., 1961). This 21-item depression scale has been validated for adolescents (Stockings et al., 2015). BDI-21 does not, however, directly screen the DSM depression criteria and stresses cognitive symptoms. For diagnostics in adolescents the gold standard is the semi-structured clinical interview called The Schedule for Affective Disorders and Schizophrenia for School-Age Children–Present and Lifetime version (K-SADS-PL) (Kaufman et al., 1997; Ambrosini, 2000). Studies that compare the results of BDI and clinical diagnostics usually aim at defining the psychometrics of BDI (Kumar et al., 2002; Osman et al., 2008; Dolle et al., 2012). Our aim, in contrast, is to investigate what psychological and background factors explain why the self-report and the diagnostic appraisal may diverge. We compare the BDI-21 scores and psychiatric diagnostics among both psychiatric inpatients and control subjects from general population. Our premise is to consider the clinicians' assessments as the gold standard for psychiatric diagnostics, while acknowledging that the diagnostics in adolescent psychiatry entails uncertainties (Lauth et al., 2010; Youngstrom et al., 2011). Drawing on research on the risk factors for depression, our hypothesis is that divergence between the absence of unipolar depression diagnosis and high BDI-21 scores is associated with immature defense styles and negative self-image.

## 2. Methods

### 2.1. Participants

#### 2.1.1. Patients

The participants and clinical procedures have been described previously (Rytila-Manninen et al., 2014). The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal, naturalistic study on clinical characteristics, psychometrics and the impact of treatment in adolescents (13–17 years old) who were hospitalized in adolescent psychiatry for the first time in their life between September 2006 and August 2010 ( $n = 395$ ). All participants and their legal guardians received verbal and written information about the study and gave thereafter their written informed consent. The Ethics Committee of the Helsinki University Hospital approved the study protocol, and the institutional authority at the Hyvinkää Hospital Area granted permission to conduct the study. Study participation required sufficient knowledge of the Finnish language and adequate cognitive capacity, as well as a hospital treatment period of at least two weeks. Of 395 adolescent patients, 315 were eligible. In 62 (16.4%) cases, the adolescent or his/her parents/guardians did consent to participation. In 23 cases (6%), patients or their parents/guardians discontinued treatment, and 24 cases (6%) provided incomplete data. The final sample consisted of 206 adolescents: 60 (29.1%) boys and 146 (70.9%) girls. Study non-participation was not related to age ( $p = 0.31$ ), socio-economic status (SES,  $p = 0.38$ ), living situation ( $p = 0.58$ ), or having a primary diagnosis of substance use ( $p = 0.59$ ), mood ( $p = 0.92$ ), anxiety ( $p = 0.39$ ), eating ( $p = 0.34$ ), or conduct disorders ( $p = 0.09$ ). It was, however, associated with male gender ( $p = 0.02$ ) and psychotic disorders ( $p = 0.02$ ) (Rytila-Manninen et al., 2014).

#### 2.1.2. Community sample

The comparison group was recruited from the same geographical area as the patient group. It consisted of a random sample of sex- and age-matched students from seven schools (two high/secondary schools, one vocational school and four middle/comprehensive schools). Of the 474 invited students, 43.0% ( $n = 203$ ) completed the interview and the questionnaires, 42.5% ( $n = 202$ ) refused to participate, and 14.5% ( $n = 68$ ) did not complete the questionnaires despite providing consent. The final comparison group consisted of 203 adolescents. There were no significant differences between completers and non-completers in

regards to socioeconomic status ( $p = 0.61$ ) or living situation ( $p = 0.49$ ). For adolescents who completed the K-SADS-PL-interview, a treatment referral was endorsed when appropriate.

### 2.2. Diagnostics and psychometrics

#### 2.2.1. Psychiatric diagnostics

Medical doctors who specialized in adolescent psychiatry evaluated the psychiatric diagnostics according to DSM-IV and based on clinical records, which were available for patients, and K-SADS-PL which was conducted by experienced psychiatric nurses trained in K-SADS-PL. The K-SADS-PL is a semi-structured diagnostic interview that has good to excellent test-retest reliability and high concurrent validity and inter-rater agreement for the original and translated versions (Kaufman et al., 1997; Ambrosini, 2000). The Finnish translation has been used in studies of adolescent inpatient and outpatient settings (Tuisku et al., 2006; Mustanoja et al., 2011). If a patient did not cooperate sufficiently for conducting K-SADS-PL reliably, psychiatric diagnostics was based on clinical interview, observation in the hospital and clinical records. Diagnostic meetings were held during data collection, and any discrepancies were settled by consensus between three experienced adolescent psychiatrists (H.H, N.L, K.K).

#### 2.2.2. Socio-demographic factors and adverse life events

Study subjects were interviewed on socio-demographic factors as well as adverse life events and stressors with a structured questionnaire composed for this study and as part of the K-SADS-interview as described in a previous publication (Rytila-Manninen et al., 2014). Their answers to questions on adverse life events and stressors were categorized as yes or no. In the K-SADS-PL interview, school bullying was screened in the school adaptation and social relationship section. In the post-traumatic stress disorder screening section of K-SADS-PL, domestic violence, exposure to physical and/or sexual abuse was inquired. In the structured background data questionnaire SES was assessed by asking "What is your father's occupation?", or if an adolescent lived with his/her mother (and stepfather), we recorded mother's occupation. SES was classified as high when the guardian (primarily the father) was a self-employed worker or upper-level employee, middle when the guardian was a lower-level employee or manual worker, and low if the guardian was retired, a student or unemployed. Subjects were also asked about parental divorce and whether he/she knew if his/her mother or father suffered from psychiatric or substance use problems requiring professional help. One question from the Life Events Checklist was used to record parents' criminality (Has your parent ever been arrested, suspected or judged for a legal offense?). In the patient group, clinical records additionally provided information on the family background as supplied by legal guardian(s)/parent(s).

#### 2.2.3. Self-reports on psychiatric symptoms and psychological factors

Study participants, both patients and control subjects, filled in structured self-reports on psychiatric symptoms and psychological factors.

BDI-21 is a 21-item self-report scale of depressive symptoms that has been validated for adolescents (Stockings et al., 2015).

Alcohol Use Disorders Identification Test (AUDIT) is a self-report scale screening for alcohol misuse, and in the extended version used in this study, also enquires about other substance use. It has been shown to be applicable to adolescents (Knight et al., 2003).

Defense Style Questionnaire (DSQ) – 40 a reliable and valid self-report instrument for adolescents. In adolescents, it appears to discriminate better four defense styles (mature, neurotic, image-distorting, and immature) rather than three, which is alternatively used in adult populations (Ruuttu et al., 2006).

Offer Self-Image Questionnaire (OSIQ) is a self-report inventory containing descriptive statements with six-point Likert-type scale. The OSIQ has been widely used to assess the self-image of adolescents, and

it has been validated among Finnish adolescents (Laukkanen et al., 2009). In the current study, we used the revised version OSIQ-R. It consists of 129 items, which make up 12 component scales: 1) emotional tone (ET) measures the affective harmony and stability, 2) impulse control (IC) measures the strength of the ego in handling pressure without resorting to inappropriate action, 3) mental health (MH) measures the presence or absence of psychopathological thoughts, 4) social functioning (SF) 5) family functioning (FF), 6) Self-Confidence (SC, former mastery of the External World), 7) Self-reliance (SR, former Superior Adjustment), measures how well the adolescent copes with her/himself and the world around, 8) Ethical Values (EV, former morals), 9) body image (BI), 10) Vocational attitude (VA) measures how well the adolescent is faring in accomplishing the tasks of learning and planning his/her future, 11) Sexuality (SX), 12) Idealism. In the current study, we focused on the scales that are most relevant in relation to depressive symptoms and thus omitted sexuality, vocational attitude and idealism. Furthermore, the sexuality scale reportedly has a U-curve nature and poor reliability. Also the idealism scale has poorer reliability than other scales in OSIQ and moreover, it reflects more cognition than emotions (Offer et al., 1992). We used the raw scores because the OSIQ-R has not been normalized in European populations. In raw scores, the higher the score, the worse the self-image.

### 2.3. Data analysis

The key question was how the self-reports of study subjects differed from clinical diagnostic appraisal. Thus, we examined what factors differentiated those who scored low on BDI-21 from those who scored high among subjects without a diagnosis of current unipolar depression, and among subjects with a diagnosis of current unipolar depression. We performed the analyses in the whole population as well as separately in the patient population and the control population.

We ran Receiver Operating Characteristic (ROC) analyses for BDI-21 with current depression diagnosis.

We chose the cutoff point for BDI based on the ROC analyses (ref. 3.1 Distributions, ROC analyses and correlations) and previous publications. In depression studies on adolescents, a sum score of 16 has been most widely used as a BDI-21 cut-off point for identifying MDD (Stockings et al., 2015). Based on the chosen cutoff point, we created a dichotomous variable of BDI-21 scores.

We compared with Pearson's chi square ( $\chi^2$ ) test in subjects not meeting the DSM-IV criteria for current unipolar depression the frequencies of background characteristics (sex, SES, parent's psychiatric care and substance use), adverse life events (parents' divorce, parent's death, exposure to physical abuse at home, exposure to physical abuse outside of home, witnessing intimate partner violence, sexual abuse victimization, being bullied at school), DMS-IV diagnostic groups between subjects grouped according to the BDI-21 cutoff point (16 points). Since not all variables were normally distributed, we used Mann Whitney *U*-test to compare in afore mentioned groups the distribution of age, scales of self-image (measured with OSIQ-R) and scales of defense styles (measured with DSQ-40 questionnaire) and AUDIT sum.

Secondly, we ran the afore described analyses for subjects who met the DSM-IV criteria for current unipolar depression and compared likewise subjects grouped according to the BDI-21 cutoff point.

We checked the correlations between BDI-21 scores and OSIQ-R areas and DSQ-40 defense styles with Spearman correlation.

We performed among subjects without depression binomial logistic regression analysis with the dichotomous BDI-21 variable (under 16 points or 16 points and over) as dependent variable and as independent variables study group (patient or control), sex, the number of psychiatric diagnoses, parent's psychiatric problems, defense style scores (DSQ-40) as well as the OSIQ-R component scores.

**Table 1**

Characteristics of the study population: comparison between patients and control subjects.

	PATIENTS 206 n (%)	CONTROLS 203 n (%)	p ( $\chi^2$ )
male	60 (29)	55 (27)	0.6
age median (min-max)	15 (13–17)	15 (13–17)	0.1 (MW■)
SES*: high	19 (9)	30 (15)	0.000
SES*: middle	78 (38)	109 (54)	
SES*: low	109 (53)	64 (31)	
previous psychiatric care	190 (92)	16 (8)	0.000
any current psychiatric DSM-IV diagnosis	206 (100)	44 (22)	0.000
> 1 current psychiatric DSM-IV diagnosis	141 (68)	8 (4)	0.000
subjects with any current DSM-IV unipolar depression diagnose	117 (57)	3 (1)	0.000
Major depressive disorder	102 (49)	1 (0.5)	
Depressive disorder NOS	14 (7)	1 (0.5)	
Dysthymic Disorder	2 (1)	1 (0.5)	
BDI – 21†	22 (0–55;186)	1 (0–31;203)	0.000
median (min-max; n)			(MW■)
AUDIT ‡	0 (0–31;192)	1 (0–28;201)	0.6 (MW■)
median (min-max; n)			

\* socio-economic status, † BDI Beck depression inventory.

‡ AUDIT Alcohol Use Disorders Identification Test, ■MW Mann-Whitney *U*-test for independent samples.

## 3. Results

### 3.1. Distributions, ROC analyses and correlations

Current unipolar depression DSM-IV diagnoses in the entire study population were distributed as follows: 1) the most common diagnosis was major depressive disorder (MDD, 296.20–296.35) as first diagnosis in 92, second diagnosis in 9 and third diagnosis in 2 subjects, 2) Depressive disorder NOS (311) as first diagnosis in 8, second diagnosis in 6 subjects and third diagnosis in 1 subject, 3) Dysthymic Disorder (300.4) as first diagnosis in 1 and as second diagnosis in 1 subject (Table 1). Overview and comparison of the distribution of background factors, diagnostics and psychometrics in the patient and control populations are depicted in Table 1. Patients had more psychiatric morbidity and their socio-economic status was lower compared with control subjects (Table 1). They scored higher in BDI-21, but not in AUDIT (Table 1) compared with control subjects.

The distributions of BDI-21 in the patient (Fig. 1A) and control (Fig. 1B) populations differed starkly. ROC curve for BDI-21 in this study population showed rather good accuracy for current depression diagnosis: The area under curve was 0.87 (95% confidence interval 0.84–0.91). For the optimal cutoff point, the point closest to (0,1) point was at BDI-21 point 15.5, whereas the Youden index suggested the optimal cutoff point to be 9.5. Assessing these results together with previous studies (Stockings et al., 2015), we chose the cutoff point of 16.

BDI-21 scores were positively correlated with all scales (1–9) of OSIQ-R used in this study, i.e. more severe depression symptoms in BDI-21 correlated with worse self-image (Table S1 in Supplement). BDI-21 scores were positively correlated with immature defense style measured with DSQ-40, and negatively correlated with mature defense style (Table S1 in online supplement).

### 3.2. Subjects without unipolar depression: comparisons based on BDI-21 dichotomous variable

Forty eight subjects scored high in BDI-21 (sum score 16 or above) even when they did not meet the DSM-IV criteria for current unipolar depression; 36 in the patient group and 12 in the control group. For the

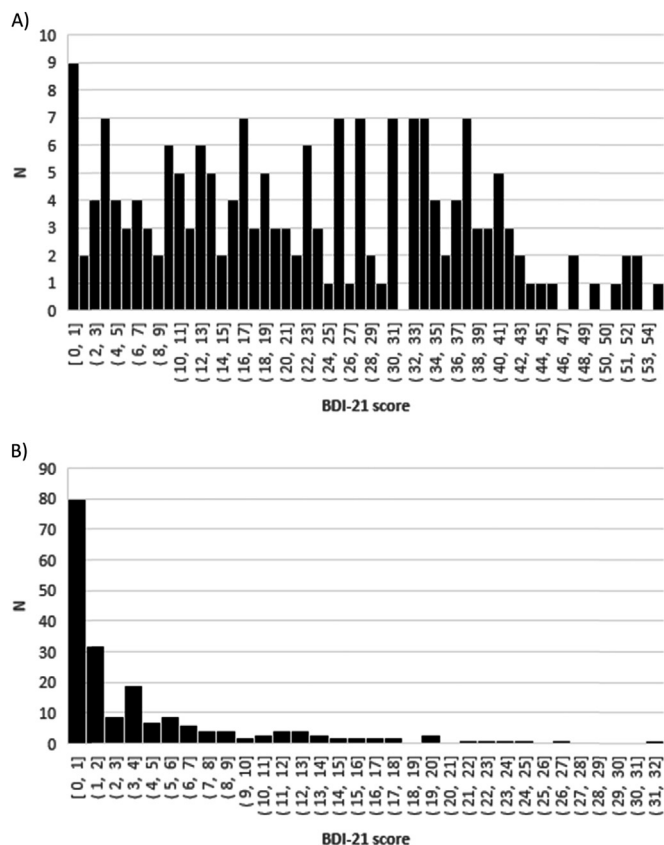


Fig. 1. Distribution of Beck Depression Inventory (BDI) – 21 scores among A) patients and B) control subjects. N.B. The axes are in different scales in A and B.

analyses on background variables, diagnoses, OSIQ-R and DSQ, shown are only results (Tables 2–5) with statistical significance ( $p < 0.05$ ) in at least one of the groups (whole population, patients only, control subjects only).

3.2.1. Sex, age, adverse life events and parental psychosocial problems

Subjects who scored high in BDI-21 even when they did not have current unipolar depression were more often female and in late adolescence (Table 2). They reported more often adverse life events and their parents having more often psychiatric care and/or treatment due to substance use problems than those scoring low in BDI-21 (Table 2). These differences were seen mainly in the control population where the

Table 2

Background variables and adverse life events of study subjects without DSM-IV unipolar depression diagnosis: comparison of subjects with BDI-21 0–15 points or 16–63 points in the whole population (controls and patients), among patients and among control subjects.

	ALL			PATIENTS			CONTROLS		
	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )
n (%)	236 (83)	48 (17)		48 (57)	36 (43)		188 (94)	12 (6)	
male	80 (34)	8 (17)	<b>0.019</b>	27 (56)	6 (17)	<b>0.000</b>	53 (28)	2 (17)	0.4
age mean (median; range; Mann-Whitney test)	15 (13–17)	15 (13–17)	<b>0.03</b>	15 (13–17)	15 (13–17)	0.05	15 (13–17;188)	15 (14–17;12)	0.40
previous psychiatric care	51 (22)	40 (83)	<b>0.000</b>	42 (88)	35 (97)	0.1	9 (5)	5 (42)	<b>0.000</b>
taken into custody	16 (9)	8 (17)	<b>0.025</b>	14 (29)	8 (22)	0.5	2 (1)	0 (0)	0.7
parents' divorce	98 (4)	29 (60)	<b>0.016</b>	31 (65)	25 (69)	0.6	67 (36)	4 (33)	0.9
parents' psychiatric problems	29 (12)	25 (52)	<b>0.000</b>	13 (27)	21 (58)	<b>0.004</b>	16 (9)	4 (33)	<b>0.005</b>
parent's substance use problems	23 (10)	18(38)	<b>0.000</b>	17 (35)	16 (47)	0.4	6 (3)	2 (17)	<b>0.02</b>
domestic violence	29 (12)	20 (42)	<b>0.000</b>	18 (38)	17 (47)	0.4	11 (6)	3 (25)	<b>0.01</b>
physical abuse	12(5)	13 (27)	<b>0.000</b>	7 (15)	11 (31)	0.055	5 (3)	2 (17)	<b>0.01</b>
sexual abuse	7 (3)	12 (25)	<b>0.000</b>	6 (13)	12 (33)	<b>0.01</b>	1 (1)	0 (0)	0.8
victim to school bullying	31 (13)	15 (31)	<b>0.001</b>	20 (42)	15 (42)	0.9	11 (6)	0 (0)	0.4
other trauma	35 (15)	18 (38)	<b>0.000</b>	23 (48)	15 (42)	0.6	12 (6)	3 (25)	<b>0.02</b>

Statistical significance  $p < 0.05$  is marked in bold.

overall prevalence of adverse life events and social problems was low, in contrast to the patient population (Table 2).

3.2.2. Psychiatric diagnoses

Only 2 of subjects scoring high in BDI-21 without current depression had no psychiatric diagnosis (Table 3) and these subjects belonged to the control population. Bipolar and other mood disorders, anxiety disorders, eating disorders and substance use disorder were more prevalent in these subjects than in those scoring low in BDI and no depression (Table 3). The differences were not as significant when the populations of patients and control subjects were examined separately (Table 3).

3.2.3. Self-image and psychological defense mechanisms

The self-image (measured with 9 scales of OSIQ-R) of subjects scoring high in BDI-21 but no depression was worse compared with subjects scoring low in BDI-21 and no depression (Table 4). In the control population, the difference was seen in all nine scales of OSIQ-R, whereas within the patient population the differences in the scales of morals and self-confidence were not statistically significant (Table 4).

Psychological defense mechanisms were measured with DSQ-40. BDI-21 scores 16 and higher in subjects without depression diagnosis were associated with less manifestation of mature defenses and more of immature defenses compared with subjects scoring low in BDI-21 and no depression (Table 4). Moreover, in the patient population, neurotic defenses were more common in subjects scoring high in BDI-21 and no depression (Table 4). In the control population, image distorting defenses were associated with high BDI-21 scores without depression compared with low BDI-21 scores and no depression.

3.2.4. AUDIT

In all subjects without depression diagnosis, higher AUDIT scores were associated with BDI-21 scores 16 or over compared with lower BDI-21 scores (Table 4).

3.2.5. Regression analysis

Binomial logistic regression analysis among subjects without depression was statistically significant,  $\chi^2(13) = 136, p < 0.0000$  ( $n = 248$ , missing 41). The Variance Inflation Factor (VIF) of the variables varied between 1.3 and 6.5. The model explained 73% (Nagelkerke R<sup>2</sup>) of the variance in BDI-21 dichotomous group and correctly classified 94% of cases. It showed, however, no single factor (patient/control,gender, the number of psychiatric diagnoses, parent's psychiatric problems, DSQ-40 scores, OSIQ-R component scores) to greatly contribute to the BDI-21 score group (0–15 points or 16 and

**Table 3**

DSM-IV diagnostic groups of study subjects **without** unipolar depression diagnosis: comparison of subjects with BDI-21 0–15 points or 16–63 points in the whole population (controls and patients), among patients and among control subjects.

	ALL			PATIENTS			CONTROLS		
	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )	BDI 0–15p	BDI 16–63 p	p (X <sup>2</sup> )
n (%)	236 (83)	48 (17)		48 (57)	36 (43)		188 (94)	12 (6)	
no psychiatric diagnosis	158 (67)	2 (4)	<b>0.000</b>	0	0		158 (84)	2 (17)	<b>0.000</b>
1 psychiatric diagnosis	45 (19)	16 (33)		18 (38)	9 (25)	0.3	27 (14)	7 (58)	
2 psychiatric diagnoses	23 (10)	24 (50)		20 (42)	21 (58)		3 (2)	3 (25)	
3 psychiatric diagnoses	10 (10)	6 (13)		10 (21)	6 (17)		0	0	
bipolar/other mood do <sup>a</sup>	4 (2)	10 (21)	<b>0.000</b>	4 (8)	10 (28)	<b>0.02</b>	0	0	1
conduct do	16 (7)	9 (19)	<b>0.008</b>	14 (29)	8 (22)	0.5	2 (1)	1 (8)	<b>0.045</b>
anxiety do	21 (9)	18 (38)	<b>0.000</b>	12 (25)	14 (39)	0.2	9 (5)	4 (33)	<b>0.000</b>
substance abuse	16 (7)	9 (19)	<b>0.04</b>	6 (13)	5 (14)	0.7	10 (5)	4 (33)	<b>0.000</b>
eating do	8 (3)	5 (10)	<b>0.03</b>	4 (8)	5 (14)	0.4	4 (2)	0	0.6
psychosis	13 (6)	5 (10)	0.2	12 (25)	5 (14)	0.2	1 (0.5)	0	0.8
OCD	1 (0.4)	3 (6)	<b>0.02</b>	1 (2)	3 (8)	0.2	0	0	1
ADHD/ADD	14 (6)	2 (4)	0.6	10 (21)	2 (6)	<b>0.05</b>	4 (2)	0	0.6
autism	7 (3)	2 (4)	0.7	7 (15)	2 (7)	0.2	0	0	1
other dg	7 (3)	8 (17)	<b>0.000</b>	7 (15)	8 (22)	0.3	0	0	1

Statistical significance  $p < 0.05$  is marked in **bold**.

<sup>a</sup> diagnoses: 1 subject with bipolar I, most recent episode depressed; 2 subjects with bipolar I, mixed; 1 with bipolar I, manic; 1 with bipolar II; 5 with bipolar NOS; 4 with mood disorder NOS.

**Table 4**

Scores in Offer self-image questionnaire revised (OSIQ-R) scales, defense style questionnaire (DSQ) – 40 and alcohol use disorders identification test (AUDIT) of study subjects **without** depression diagnosis: comparison of subjects with BDI-21 0–15 points or 16–63 points in the whole population (controls and patients), among patients and among control subjects.

	ALL			PATIENTS			CONTROLS		
	BDI 0–15p	BDI 16–63 p	p (MW <sup>*</sup> )	BDI 0–15p	BDI 16–63 p	p (MW <sup>*</sup> )	BDI 0–15p	BDI 16–63 p	p (MW <sup>*</sup> )
mean (median; range)									
OSIQ impulse control	23 (14–39;226)	34 (21–49;45)	<b>0.000</b>	24 (16–39;39)	34 (21–49;33)	<b>0.000</b>	20 (14–38;187)	36 (23–39;12)	<b>0.000</b>
OSIQ emotional tone	20 (10–46;225)	42 (20–57;45)	<b>0.000</b>	26 (10–42;38)	47 (27–59;33)	<b>0.000</b>	20 (10–46;187)	38 (25–51;12)	<b>0.000</b>
OSIQ mental health	37 (23–53;224)	47 (27–59;44)	<b>0.000</b>	37 (23–53;38)	47 (27–59;32)	<b>0.000</b>	37 (26–51;186)	46 (37–51;12)	<b>0.000</b>
OSIQ social functioning	20 (9–36;227)	31 (11–40;43)	<b>0.000</b>	24 (10–34;40)	32 (11–40;31)	<b>0.000</b>	19 (9–36;187)	28 (16–40;12)	<b>0.02</b>
OSIQ family functioning	40 (20–90;219)	60 (29–88;43)	<b>0.000</b>	41 (22–90;34)	60 (29–88;31)	<b>0.005</b>	39 (20–88;185)	61 (37–88;12)	<b>0.000</b>
OSIQ self confidence	23 (11–38;228)	34 (19–48;45)	<b>0.000</b>	26 (14–38;41)	34 (19–48;33)	<b>0.000</b>	23 (11–38;187)	34 (27–39;12)	<b>0.000</b>
OSIQ self reliance	39 (24–63;221)	44 (34–61;45)	<b>0.000</b>	42 (27–63;37)	44 (34–61;33)	0.08	39 (24–62;184)	46 (36–57;12)	<b>0.007</b>
OSIQ ethical values	23 (11–43;224)	27 (15–45;43)	<b>0.002</b>	23 (11–35;38)	26 (15–45;31)	0.16	23 (11–43;186)	30 (20–41;12)	<b>0.001</b>
OSIQ body image	20 (8–38;226)	32 (17–40;45)	<b>0.000</b>	23 (9–34;39)	33 (18–40;33)	<b>0.000</b>	19 (8–38;187)	30 (17–35;12)	<b>0.000</b>
DSQ mature	58 (10–88;228)	46 (18–71;46)	<b>0.000</b>	55 (17–82;44)	46 (18–71;34)	<b>0.004</b>	58 (10–88;184)	47 (20–54;12)	<b>0.000</b>
DSQ neurotic	35 (8–64;230)	39 (16–60;47)	<b>0.006</b>	34 (12;44)	42 (16–60;35)	<b>0.01</b>	35 (8–62;186)	35 (30–46;12)	0.6
DSQ image-distorting	34 (10–83;225)	41 (22–70;45)	<b>0.001</b>	34 (12–64;43)	41 (22–55;33)	0.1	34 (10–63;182)	40 (31–70;12)	<b>0.03</b>
DSQ immature	41 (12–84;227)	64 (37–90;46)	<b>0.000</b>	46 (12–79;43)	65 (39–90;34)	<b>0.000</b>	41 (12–84;184)	65 (37–81;12)	<b>0.000</b>
AUDIT sum	0 (0–25;234)	4 (0–31;46)	<b>0.001</b>	0 (0–25;48)	2 (0–31;34)	<b>0.01</b>	1 (0–20;186)	7 (0–28;12)	<b>0.000</b>

\* MW Mann-Whitney *U*-test for independent samples. Statistical significance  $p < 0.05$  is marked in **bold**.

over). The only statistically significant odds ratio was for OSIQ-R emotional tone scale (odds ratio 95% confidence interval 1.1–1.4,  $p = 0.003$ ).

### 3.2.6. Conclusion

In conclusion, high BDI-21 scores in subjects without depression diagnosis were associated with female sex, late adolescence, more adverse life events and parents' psychosocial problems (comparatively in the control population in particular), more psychiatric diagnoses, worse self-image, more immature and less mature defense styles compared with subjects with BDI-21 scores under 16 and no depression diagnosis.

### 3.3. Subjects with unipolar depression: comparisons based on BDI-21 dichotomous variable

Among subjects with current DSM-IV unipolar depression diagnosis ( $n = 105$ ), there were only 3 control subjects, and therefore we did not run the analyses separately with the control group. Of those with a diagnosis of depression, 23 subjects scored low in BDI-21 (sum score under 16) and 82 scored high in BDI-21.

#### 3.3.1. Sex, age, adverse life events and parental psychosocial problems

Background characteristics and most life stressors did not differ between those who scored low (under 16 points,  $n = 23$ ) and those who scored high in BDI-21 ( $n = 82$ ). The only significant differences were that subjects with depression but low BDI-21 scores were more often ( $p < 0.006$ ,  $\chi^2$  test) male (9/23, 39%) than those who scored higher in BDI-21 (males 11/82, 13%), and they had not been victim to sexual abuse ( $n = 0$  vs. 23/82, 28%,  $\chi^2$  test  $p < 0.005$ ).

#### 3.3.2. Psychiatric diagnoses

Psychiatric diagnoses or their number did not differ significantly between groups (Table S2 in Supplementary material).

#### 3.3.3. Self-image and psychological defense mechanisms

Subjects with unipolar depression but scoring low in BDI-21 had better self-image as measured with OSIQ-R compared with subjects with depression and scoring low in BDI-21 (Table 5).

In defense styles (measured with DSQ-40), no significant difference was observed in mature defenses, but neurotic, immature and image distorting defenses were less prevalent in subjects scoring low in BDI-21

**Table 5**

Scores in Offer self-image questionnaire revised (OSIQ-R) scales, defense style questionnaire (DSQ) – 40 and alcohol use disorders identification test (AUDIT) of study subjects with unipolar depression diagnosis: comparison of subjects with BDI-21 0–15 points or 16–63 points in the whole population (controls and patients). Results for patients and control subjects are not shown separately because among control subjects, only 3 had current DSM-IV unipolar depression.

	ALL with unipolar depression		
	BDI 0–15p	BDI 16–63 p	p (MW*)
mean (st dev; n)			
age	15.0 (1.1;23)	15.2 (1.2;82)	0.4
OSIQ impulse control	25 (4;22)	33 (6;76)	<b>0.000</b>
OSIQ emotional tone	28 (7;20)	43 (8;75)	<b>0.000</b>
OSIQ mental health	39 (6;22)	48 (7;73)	<b>0.000</b>
OSIQ social functioning	24 (6;22)	30 (8;76)	<b>0.000</b>
OSIQ family functioning	45 (11;18)	62 (16;74)	<b>0.000</b>
OSIQ self confidence	27 (5;22)	36 (7;76)	<b>0.000</b>
OSIQ self reliance	43 (7;22)	48 (8;72)	<b>0.004</b>
OSIQ ethical values	26 (7;19)	27 (7;74)	0.4
OSIQ body image	22 (6;22)	32 (6;75)	<b>0.000</b>
DSQ mature	47 (14;21)	42 (13;76)	0.1
DSQ neurotic	31 (11;20)	40 (15;78)	<b>0.01</b>
DSQ image-distorting	30 (11;19)	38 (11;75)	<b>0.01</b>
DSQ immature	43 (16;20)	59 (15;76)	<b>0.000</b>
AUDIT sum	1.7 (4;20)	5.0 (7;81)	<b>0.02</b>

and having depression compared with those scoring high in BDI-21 and having depression (Table 5).

### 3.3.4. AUDIT

Subjects with depression but BDI-21 under 16 scored lower in AUDIT than subjects with depression and high BDI-21 scores (Table 5).

## 4. Discussion

We investigated what psychological and background factors are associated with discrepancy between BDI-21 scores and unipolar depression diagnosis in an adolescent inpatient population and an age- and gender-matched sample from general population. The discrepancy between not fulfilling diagnostic criteria for unipolar depression but scoring high on BDI-21 was associated with female sex, negative self-image and immature defense style as well as parents having psychiatric problems in the patient population where all subjects had psychiatric problems, often accompanied by social problems and adverse life events. Of adverse life events, being victim of sexual abuse was associated with high BDI-21 sum score in the absence of clinical depression in the patient population. In the general population, where neither psychiatric nor social problems were as common, high BDI-21 sum score without depression diagnosis was in addition associated with psychiatric morbidity, parental psychiatric problems and substance use as well as physical abuse at home and outside of home. Discrepancy between fulfilling diagnostic criteria for current depression but scoring low on BDI-21 was associated with better self-image, and neurotic, immature and image distorting defenses were less prevalent compared with subjects with depression and scoring high in BDI-21.

### 4.1. BDI specificity and Comorbidity

Our results exemplify the fact that the specificity of BDI-21 for depression may be adequate for community samples, but not necessarily for patient samples where comorbidity is high (Brooks 2004). In our control population, 6% (12 subjects) scored 16 or higher on BDI-21 in the absence of clinical depression, whereas in the patient population, the corresponding figure was 43%. The high comorbidity in our patient population (68%) is consistent with observations in adolescent clinical populations (Angold et al., 1999; Karlsson et al., 2006) and also in adolescents with subthreshold MDD (Carrellas et al., 2017).

Discrepancy between BDI scores and diagnostics may also reflect diagnostic uncertainties: discerning between depression and anxiety disorders is difficult even when applying K-SADS-PL, the gold standard for diagnostics in adolescents (Lauth et al., 2010), and different diagnostic strategies may lead to different outcomes (Youngstrom et al., 2003). On the other hand, high BDI sum scores may reflect dissatisfaction, anxiety and dysphoria rather than specific depressive symptoms (Brooks and Kutcher, 2001). In our study population, anxiety disorders do not, however, conclusively explain the discrepancy between high BDI-21 scores and absence of depression diagnosis. Among control subjects who manifested this discrepancy, substance use disorder was as prevalent as anxiety disorders (4/12 or 33%). Substance use disorder often coincides with depression in adolescents (Kaminer et al., 2007), and has been associated with depressive symptoms measured with BDI-21 in adults (Moore et al., 2016). In our patient population among those with no depression diagnosis, anxiety disorder was not significantly more prevalent in those scoring high in BDI than in those scoring low. The observation that high BDI-21 scores even in the absence of depression were associated with female sex is in line with studies on adolescents that have reported that girls score on average as much as 10 points higher than boys in BDI-21 (Kumar et al., 2002) and that have reported subthreshold MDD to be more prevalent in girls than in boys (Carrellas et al., 2017).

### 4.2. Familial psychiatric morbidity, adverse life events and sex

We observed that parental psychiatric problems were significantly associated with the discrepancy of high BDI-21 scores and no clinical depression in both patient and control population. Parent's depression is an important risk factor for depression and other mental health problems in adolescence (Weissman et al., 2006; Rice et al., 2017). High BDI-21 scores in the absence of clinical depression may reflect clinical antecedent to MDD. Following this interpretation, our result does not, however, conform to a recent prospective study on offspring of depressed parents where clinical antecedent symptoms (irritability, fear/anxiety) were risk factors for MDD but they did not mediate the familial risk (Rice et al., 2017). Our study, like many previous studies, endorses the importance of preventive strategies aimed at parents with psychiatric problems and their children.

In regard to adverse life events, our most notable finding is that in patients without depression sexual abuse was more frequently reported among subjects who scored high in BDI-21 compared to those who scored low. The finding is in line with previous studies such as a recent longitudinal study on subjects from 4 years of age until 16 years that showed that sexual abuse in childhood was associated with higher prevalence of psychiatric symptoms as reported in Child Behavior Checklist by caregivers compared with other forms of maltreatment (Lewis et al., 2016). In the control population, adverse life events and problems in the family were reported only infrequently. Thus, the rather small number of cases prevents us from drawing any further conclusions regarding the general population.

Among subjects with depression, low BDI-21 scores were observed predominantly in males. The result suggests that psychiatric assessment of boys, in particular, should include depression diagnostics regardless of the BDI-21 score.

### 4.3. Self-image

Our findings that self-reported depressive symptoms are associated with negative self-image in most OSIQ scales is in line with previous studies on adolescents. OSIQ scales, especially Emotional Tone and Mastery of the External World (Self-Confidence) scales, have been reported to predict depression in adolescents (Fine et al., 1993). Significant correlation between self-reported depressive symptoms (high CDI scores) and negative self-image in all scales of OSIQ has been reported in a non-clinical adolescent population, where moreover, the

correlation was stronger for females than males (Erkolahti et al., 2003). Regarding the association between clinical diagnosis and self-image our results, however, differ from some earlier findings. In a clinical population with varied diagnoses, the worst self-image as measured with OSIQ was observed in patients with MDD (Koenig, 1988), whereas dysphoria i.e. milder depressive symptoms than MDD, was not associated with any problems in self-image (Koenig, 1988). Furthermore, patients with recurrent depression had less problems in self-image than those suffering from first episode of MDD, although no significant difference in the severity of current episode was observed (Koenig, 1988). Koenig thus argued that OSIQ would seem to measure different psychological factors than depressive symptoms. In our study, however, subjects who did not have clinical depression but scored high in BDI-21 scored worse in OSIQ-R (had more problems with self-image) than those without depression and with low BDI-21 scores. Longitudinal studies are needed to better determine in what extent the association between negative self-image as measured with OSIQ and depressive symptoms represents a true association between clinical symptoms and psychological factors rather than the manifestation of depressive mood and thoughts in various self-reports.

#### 4.4. Defense styles

Our study showed that adolescents who scored high on BDI-21 in absence of clinical depression relied more on immature defense styles and less on mature defense styles (as measured with DSQ-40) than those who scored low in BDI-21. This result on both non-clinical and clinical populations conforms with previous studies that have reported psychiatric symptoms to be associated with immature defense styles in non-clinical populations (Chan, 1997; Muris et al., 2003; Ruuttu et al., 2006) as well as clinical populations (Ruuttu et al., 2006). A meta-analysis on studies on clinical adult populations concluded that patients with MDD reported significantly lower scores in mature defense style and higher scores in neurotic and immature styles than control subjects (Calati et al., 2010). Muris et al. observed the association of depressive symptoms and immature defense styles among girls only, whereas in boys neurotic defense style was associated with depressive symptoms (Muris et al., 2003). Immature defense styles have been reported to also predict psychiatric symptoms in a longitudinal study on a non-clinical adolescent population (Tuulio-Henriksson et al., 1997). Also our observation that low BDI-21 scores in adolescents without depression were associated with mature defense styles is in agreement with previous reports on the association between mature defense styles and low prevalence of psychiatric symptoms (Muris et al., 2003; Ruuttu et al., 2006). In a five-year follow-up mature defense style was negatively associated with psychiatric problems, but only among female subjects (Tuulio-Henriksson et al., 1997). Muris et al. observed in their non-clinical study population that neurotic defense style was associated with various anxiety symptoms, among girls in particular (Muris et al., 2003).

#### 4.5. Strengths of the study

The essential strength of our study is that we had a relatively large study population and both patients and age- and sex-matched control subjects. The study represents a naturalistic setting in inpatient care with high comorbidity and many confounding factors, which can be considered both strength and a weakness. Careful diagnostics was conducted in all subjects. The self-assessment questionnaires that we used have been validated for adolescents. Participation rate was relatively high, but unfortunately varied in different self-reports.

#### 4.6. Limitations of the study

Our study population consists of two extremes: adolescents whose psychiatric problems require hospitalization and community-based

sample of students recruited from their schools. The results may not be applicable to other kinds of populations such as adolescents seeking help in primary health care services. Interpretation of our results is limited by the fact that personality disorders (or traits of any) were not considered, which is due to the fact that assessing personality disorders in adolescents has been controversial. The psychological characteristics (defense styles, self-image) are based on structured self-reports only. In-depth psychological testing would, however, be resource intensive in such a large study population. Adverse life events in our study were recalled retrospectively and in the case of control subjects, only adolescents themselves were enquired. Information on parental mental health and substance use was also obtained from study subjects only in the control group. In the patient group, information was supplemented by patients' clinical records. Another methodological limitation is that we did not assess the inter-rater reliability of K-SADS-PL interviews. On the other hand, all diagnoses were confirmed in diagnostic consensus meeting with experienced adolescent psychiatrists.

#### 4.7. Conclusions

Our study showed that adolescents who report many depression symptoms in BDI-21 but do not fulfill diagnostic criteria for current depression share many characteristics that in previous studies have been associated with depression and depressive symptoms. Even if she/he does not fulfill the criteria for depression, high scores in self-report BDI-21 merit a broader assessment of an adolescent's psychological and social wellbeing and need for support. Addressing adolescent's self-image and defense styles may be warranted, and on the other hand parents' psychiatric problems may be one key intervention.

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#### Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.psychres.2018.02.040>.

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