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Screening for depression in patients in treatment for alcohol use disorder using the Beck Depression Inventory-II and the Hopkins Symptom Checklist-10

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ABSTRACT

Alcohol use disorder (AUD) and major depressive disorder (MDD) are prevalent disorders that often co-occur. The aim of the study was to investigate how the Beck Depression Inventory (BDI-II) and Hopkins Symptom Checklist (HSCL-10) perform as screening instruments for MDD in AUD patients in treatment. The study included 127 mainly AUD inpatients currently in treatment at rehabilitation clinics in Norway. Demographic and clinical variables were examined using questionnaires and clinical interviews. The factor structures of the BDI-II and HCSL-10 were examined, as well as internal consistency and receiver operating characteristic (ROC) curve analyses. The Mini International Neuropsychiatric Interview (M.I.N.I.) was used as standard for diagnosing MDD. In total, 14% of the participants were diagnosed with MDD. BDI-II factor analysis retrieved three factors; cognition, somatic complaints and affect, and factor analysis for the HSCL-10 retrieved two factors; depression and anxiety. The optimal cut-off for the BDI-II was 24.5 with sensitivity of 80% and specificity of 78%. For HSCL-10 the optimal cut-off was 2.35, giving sensitivity of 80% and specificity of 69%. Both the BDI-II and HSCL-10 may be clinically useful screening instruments for MDD in AUD patients. There was a tendency that the affect factor of the BDI-II and the depression factor of the HSCL-10 were slightly more suitable for identifying MDD than the other factors. Optimal cut-offs for both the BDI-II and the HSCL-10 in this patient group were higher than cut-offs commonly used in the general population.

Introduction

Alcohol use disorder (AUD) and major depressive disorder (MDD) are two of the most common mental health disorders, accounting for a substantial part of the global burden of disease with considerable economic costs (Belmaker and Agam, 2008; Rehm et al., 2009; Rehm and Shield, 2019; WHO, 2018). Point prevalence of AUD in 2016 was around 1400 per 100.000, while the prevalence for depressive disorders in the same year was around 3600 per 100.000 (Rehm and Shield, 2019). AUD and MDD often co-occur, and lifetime MDD comorbidity rates are found to be as high as 25% among men and 50% among women with AUD (Conner et al., 2009). There is a bidirectional relationship between AUD and depression (Boden and Fergusson, 2011; DeVido and Weiss, 2012b; Hassan, 2018), where AUD can lead to MDD, MDD can lead to AUD, or underlying factors may increase the risk of developing both disorders. Screening for MDD among AUD patients in treatment is important, as depression is associated with worse outcomes of AUD treatment such as drop-out and increased risk of relapse (Conner et al., 2009; DeVido and Weiss, 2012b; Hesse, 2006).

There may be several barriers towards correct and effective diagnosis of depression in AUD patients. AUD is a complex and multifaceted disorder, and it can complicate or mimic other psychiatric disorders (Shivani et al., 2002). Alcohol intoxication and withdrawal symptoms can affect mood, high alcohol consumption can lead to a wide range of psychosocial stressors, and somatic symptoms such as sleep and psychomotor disturbances characterize both MDD and AUD withdrawal

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(Brown et al., 1995). Screening and diagnosing depression require that individuals report subjective symptoms not measurable by the observer, and self-report might be influenced by bias towards underreporting or over-reporting symptoms (Hunt et al., 2003; Rochlen et al., 2010).

Psychiatrists and psychologists are a scarce resource in the health system, and there is a need for screening instruments that are easily administered and scored and that are time efficient. The Beck Depression Inventory II (BDI-II) and The Hopkins Symptom Checklist 10 (HSCL-10) are instruments widely used in both clinical and research settings, and it is of importance to investigate their psychometric properties in different patient groups. The aim of the present study was to investigate how the BDI-II and the HSCL-10 perform as screening instruments for MDD in a group of inpatients with mainly AUD using the Mini International Neuropsychiatric Interview (M.I.N.I.) as standard for diagnosing MDD. In addition, we aimed to study if the complete instruments or factors within are useful when screening for MDD and to point to reasonable cut-offs for possible MDD among patients with AUD.

Materials and methods

Study participants

The study included 127 mainly AUD patients in treatment at three different rehabilitation clinics in Norway. Data were collected from January 2018 until August 2019. Among the 366 patients admitted to treatment in the clinics during the inclusion period, 238 (65%) were considered eligible for participation in the study based on a SUD or AUD diagnosis, their somatic and mental condition and ability to perform an interview and fill out questionnaires. The patients who could not speak a Scandinavian language were excluded from the study. Among the patients who were approached, 110 patients (46%) declined participation and 128 (54%) signed the written consent. Of these, 94 were men (73%; mean age 50.5, SD 11.4) and 34 were women (27%; mean age 48.6, SD 9.8). There was no statistically significant difference between included (128) and excluded (110) individuals regarding sex or age. The included patients had been in treatment for a median (95% CI) of 8 (5–14) days and reported abstinence from alcohol during the last 18 (13–30) days. Eighty-nine (70%) of the participants had a diagnosis of AUD, 25 (19%) had both AUD and SUD and 14 (11%) had a SUD diagnosis. One of the 128 patients did not complete the M.I.N.I. interview. For some participants there was missing information on some of the demographic and clinical variables. In total 93 participants completed the BDI-II. Four additional participants had five or fewer missing items. Means for total score and factor scores were imputed for these, giving a total number of 97 (76%) included BDI-II. The HSCL-10 was completed by 95 participants. Two participants had two or fewer missing items, and these participants' means for total score and factor scores were imputed, leaving the final number of HSCL-10 responses at 97 (76%).

The study was approved by the Norwegian Regional Ethics Committee (ID no: REC South East 2017/1314), and the research complied with the Helsinki Declaration. Written informed consent was obtained from the participants after providing information about the study.

Measures

M.I.N.I

M.I.N.I. is a brief diagnostic structured interview for 17 different mental health disorders compatible with DSM-IV and ICD-10 criteria (Lecrubier et al., 1997). The major depressive disorder (MDD) module of M.I.N.I. consists of 11 questions concerning previous and current depressive symptoms corresponding to the DSM-IV. The Norwegian translated version of the M.I.N.I., which is validated for Norwegian populations (Mordal et al., 2010), was used to categorize participants as currently having or not having MDD in the study.

BDI-II

The Beck Depression Inventory-II (BDI-II) is a commonly used self-report measure to assess depressive symptoms and symptom severity, originally developed by Beck in 1960 (Beck et al., 1961). The BDI-II consists of 21 items rated on a 4-point Likert scale, asking the respondents about how they have been feeling during the last two weeks including today. Total score ranges from 0 to 63, and higher score indicates higher symptom severity. Severity cut-offs that distinguish minimal (0–13), mild (14–19), moderate (20–29) and severe (29–63) depression have been established (Beck et al., 1996). A review by McPherson and Martin (2010) concluded that the factor structure of the BDI-II is consistent with either two or three factor models depending on the population. Across studies cognitive, somatic, and affective factors are common, with some studies combining these (Johnson et al., 2006; Manian et al., 2013; Skule et al., 2014; Tobias et al., 2017).

HSCL-10

The Hopkins Symptom Checklist (HSCL) is a measure of psychological distress (Derogatis et al., 1974). The HSCL-10 items version is a shorter version of the HSCL-90, performing almost as well as the longer versions (Strand et al., 2003). The HSCL-10 asks the respondent about symptoms related to anxiety and depression over the past week on a scale of 1 (not at all) to 4 (extremely). The mean score is calculated producing a range of scores from 1 to 4 where higher score corresponds to more psychological distress. An average score $\geq$1.85 has commonly been considered a cut-off to identify cases (Strand et al., 2003). The Norwegian version the HSCL-10 has previously been used successfully in an AUD population (Martinez et al., 2015). HSCL-10 consists of the two factors depression and anxiety (Schmalbach et al., 2019; Syed et al., 2008).

Traumatic experiences

Exposure to trauma was measured by a structured self-report form with five questions that have previously been used in a study of psychiatric inpatients (Toft et al., 2018). The three first questions ask about traumatic events in childhood (sexual assault, physical abuse, and other traumatic event) and the last two questions deal with experiences in adulthood (sexual assault or physical abuse and other traumatic event). For each item the response alternatives were No (0), Yes, once (1) or Yes, several times (2). The maximum severity scores were 6 for childhood trauma, 4 for adulthood trauma and 10 for total trauma.

AUDIT

The Alcohol Use Disorders Identification test (AUDIT) is a commonly used instrument for screening for alcohol related problems (Allen et al., 1997; Saunders et al., 1993). The AUDIT consists of 10 questions that represent three domains: alcohol consumption, dependence and alcohol-related consequences (Babor and Robaina, 2016). Responses are based on frequency of occurrence during the preceding 12 months and sum up to a total score between 0 and 40 where higher score indicates more problematic alcohol use. The AUDIT has shown good psychometric properties and effectiveness across different studies (Babor and Robaina, 2016; Reinert and Allen, 2002).

Statistical analysis

Statistical analyses were performed using SPSS version 26.0. All statistical tests were two-tailed with a significance level of $p = 0.05$. The participants with more than 25% missing BDI-II and HSCL-10 items (31 in total) were excluded from statistical analysis, and these were largely the same for the two instruments.

Principal component analysis (PCA) with orthogonal rotation (Varimax) was done to investigate factor structure and the weighting of the different items of BDI-II and HSCL-10. Oblique rotation (Direct Oblimin) was conducted for the 21 BDI-II items to see whether we could increase

the meaning of the factor structure produced by the orthogonal rotation. While some researchers, among these Gorsuch (1997), would argue that principal axis factoring would give more robust and replicable factors, PCA was chosen as it is commonly used in similar studies, the technique is easier and produce largely the same results (McPherson and Martin, 2010). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis. KMO = 0.856 for BDI-II and KMO = 0.887 for HSCL-10. All KMO values for individual items were > 0.754 for the BDI-II and > 0.857 for the HSCL-10, which is considered between middling and meritorious according to Kaiser and Rice (1974). Bartlett's test of sphericity ($p < 0.001$), indicated that correlations between items in both instruments were sufficiently large for conducting PCA. The factors used in the analyses were based on visual examinations of the scree plots, eigenvalues above the Kaiser's criterion of 1 and theoretical considerations. In the analysis of the factor pattern coefficients, only coefficients of 0.40 or greater were considered noteworthy. Internal consistency was examined with Cronbach's alpha. Receiver operating characteristic (ROC) curve analyses were conducted to find the optimal cut-off in both instruments using the M.I.N.I. as reference standard. The optimal cut-off score was defined as the point where an increase in sensitivity is associated with a significant drop in specificity and was determined through examination of the curves and tables.

Results

Descriptive analysis

All background and clinical variables were investigated in relation to presence or absence of MDD according to the M.I.N.I. (Table 1). In total 18 (14%) of the participants were categorized as having MDD, and 8 (44%) of these were female. There were no significant differences in socio demographic or clinical variables between those with or without MDD. There was a tendency towards higher occurrence of trauma during childhood among those with MDD. For those who experienced trauma during adulthood there was significant difference ($p = 0.044$) between those with and without MDD. In accordance with this a significantly larger ($p < 0.001$) portion of the patients with MDD (50%) had current PTSD compared to those without MDD (13%).

Factor analysis

Table 2 presents the orthogonal factor analysis of the BDI-II where four of the components had eigenvalues over the Kaiser's criterion of 1 (8.643; 1.654; 1.237; 1.152). These components explained 60.4% of the total variance. All four factors with eigenvalues greater than 1 (7.180; 3.912; 3.404; 4.173) were retained after the oblique rotation. On the basis of the theoretical similarity of items, factor two and three were merged. The BDI-II (Cronbach's alpha = 0.919) factor structure best suited a three factor-solution were the factors were labelled *cognition* (Cronbach's alpha = 0.899), *somatic complaints* (Cronbach's alpha = 0.770) and *affect* (Cronbach's alpha = 0.775).

Table 3 shows the factor analysis of the HSCL-10 (Cronbach's alpha = 0.914) and two components had eigenvalues greater than 1 (5.777 and 1.034). These two factors explained 68% of the total variance. Investigating the component matrix and the items included in each factor, we found one factor concerning depressive symptoms labelled *depression* (Cronbach's alpha = 0.908), and another concerning anxiety labelled *anxiety* (Cronbach's alpha = 0.812).

Discriminative analysis

The ROC curve (Fig. 1) showed predictive accuracy of the BDI-II (area under the curve (AUC) 0.831, $p = 0.001$), the cognition factor (AUC 0.761, $p = 0.007$), the somatic complaints factor (AUC 0.791, $p = 0.003$) and the affect factor (AUC 0.837, $p = 0.001$). The optimal cut-off determined for the BDI-II total score was 24.5 (mean = 1.17), which gives sensitivity of 80% and specificity of 78%. For the cognition factor, the optimal cut-off was 11.5 (mean = 1.28), with sensitivity and specificity of respectively 70% and 78%. For the somatic complaints factor the cut-off would either be 6.5 (mean = 0.81), giving sensitivity of 90% and specificity of 58.8% or 11 (mean = 1.38), giving sensitivity of 60% and specificity of 89%. For the affect factor, the optimal cut-off was 5.5 (mean = 1.38), with sensitivity of 80% and specificity of 84.5%.

The ROC curve (Fig. 2) showed predictive accuracy of the HSCL-10 (AUC 0.842, $p < 0.001$), as well as for the depression factor (AUC 0.814, $p = 0.001$) and the anxiety factor (AUC 0.833, $p = 0.001$). The optimal cut-off score determined for the HSCL-10 was 2.35, which gives sensitivity of 80% and specificity of 69%. For the depression factor the optimal cut-off was 2.5, giving sensitivity and specificity of 80% and 71%, and for the anxiety factor the optimal cut-off was 2.1, with sensitivity of 80% and specificity of 67%.

There was a significant difference in BDI-II score between participants with MDD (30.30 (SD 12.08)) and without MDD (16.36 (SD 10.34)) (Table 4). A significant difference between participants with

Table 1
Demographic and clinical data for the investigated patients in treatment for AUD. Comparing patients with current depressive episode as diagnosed using the MINI International Neuropsychiatric Interview to non-depressed patients. Significance level was set to $p < 0.05$ (indicated in bold).

			Non-MDD 109 (86%)	MDD 18 (14%)	p-value
Background variables					
Gender	Female	N (%)	26 (24%)	8 (44%)	0.068 [a]
Age	Years	Mean (SD)	50.1 (10.80)	50.3 (11.67)	0.924 [b]
Marital status	Married, partner or cohabiting	N (%)	20 (18%)	3 (17%)	0.593 [a]
Children	Yes	N (%)	55 (50%)	7 (39%)	0.218 [a]
Education	More than college	N (%)	26 (24%)	3 (17%)	0.994 [a]
Current employment status	Working	N (%)	42 (39%)	4 (22%)	0.666 [a]
Source of income	Paid work	N (%)	18 (17%)	0 (0%)	0.113 [a]
Previous stresses					
Parent with alco. prob.	Yes	N (%)	53 (49%)	8 (44%)	0.586 [a]
Parent with psychiatric prob.	Yes	N (%)	37 (34%)	5 (28%)	0.793 [a]
Trauma childhood	One or more trauma	Mean (SD)	2.1 (1.80)	3.0 (2.17)	0.178 [b]
Trauma adulthood	One or more trauma	Mean (SD)	1.2 (1.17)	2.1 (1.26)	**0.044** [b]
PTSD, current	Yes	N (%)	14 (13%)	9 (50%)	**<0.001** [a]
Clinical variables					
Age at first drink?	Years	Mean (SD)	15.1 (3.38)	15.2 (1.95)	0.986 [b]
Substance use	Dependence/ abuse	N (%)	31 (28%)	8 (44%)	0.173 [a]
Age at first drug?	Years	Mean (SD)	26.5 (13.50)	20.1 (4.56)	0.234 [b]
AUDIT score (10)		Mean (SD)	26.2 (9.39)	24.2 (11.38)	0.533 [b]

[a] Chi square, two-tailed.
[b] Independent *t*-test, two tailed.

Table 2
Standardized coefficients of factor loadings for a 3-factor model of the BDI-II.

	Factor		
Item	Cognition	Somatic complaints	Affect
1. Sadness			-0.573
2. Pessimism	.388		-0.521
3. Feeling of failure	.577		
4. Loss of joy			-0.497
5. Feeling of guilt	.786		
6. Feeling of beeing of punished		.482	-0.355
7. Dislike of oneself	.807		
8. Slefcriticism	.691		
9. Suicidal thoughts	.454		
10. Cry			-0.752
11. Restlessness		.757	
12. Loss of interest	.589		
13. Indecision	.583		
14. Worthlessness	.789		
15. Loss of energy	.791		
16. Change of sleep pattern		.731	
17. Irritability		.464	.377
18. Change of appetite			.697
19. Difficulty concentrating	.496		.555
20. Fatigue		.624	
21. Loss of sexual interest		.634	

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table 3
Standardized coefficients of factor loadings for a 2-factor model of the HSCL-10.

	Factor	
Item	Depression	Anxiety
1. Suddenly scared for no reason		0,853
2. Fealing fearful		0,810
3. Faintness, dizziness, or weakness	0,439	0,524
4. Feeling tense or keyed up		0,812
5. Blaming yourself	0,733	
6. Sleep difficulties		0,475
7. Feeling of worthlessness	0,869	
8. Feeling blue	0,689	0,527
9. Feeling everything is an effort	0,711	0,487
10. Feeling hopeless about the future	0,869	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

MDD compared to those without MDD across all three identified factors was also found. A significant difference on HSCL-10 score was found between participants with MDD (2.92 (SD 0.67)) compared to those without MDD (1.98 (SD 0.64)). Similarly, scores on the factors depression and anxiety was significantly different between participants with compared to without MDD.

To address the problem of abstinence duration and the influence on our estimates we performed a sensitivity analysis. We divided the material in two at median number of abstinence days (18 days) and performed the ROC analysis in each material. We found that the high cut-off is valid for both groups, with even a higher cut-off in the long abstinence group.

Discussion

In this study of mainly AUD patients, one in six had a major depressive disorder (MDD) according to a structured interview. Both BDI-II and HSCL-10 demonstrated good abilities in discriminating between depressed and non-depressed patients in a sample of AUD patients and may thus be considered clinically useful screening instruments. Factor analysis of BDI-II resulted in three factors, and the HSCL-10 in two factors. The factors did not differ statistically significant in their ability to discriminate between depressed and non-depressed participants, but there was a tendency that the affect factor of the BDI-II and the depression factor of the HSCL-10 were slightly more suitable for identifying MDD. The optimal cut-offs for both the BDI-II and the HSCL-10 in this patient group were higher than cut-offs commonly used for these instruments in the general population.

The factor analyses of the 21 items in the BDI-II gave a three-factor solution; a cognitive, a somatic and an affective domain best represented the underlying dimensions of BDI-II. These factors explained around two thirds of the total variance, was the structure that was best fit to the data and made most sense theoretically. The three domains showed high internal consistency, indicating reliability of the derived factors. The *cognitive* domain was characterized of items such as self-criticism, indecision, and worthlessness, and accounted for most of the common variance. The *somatic complaint* factor comprised items such as restlessness, change of appetite and fatigue. The third factor, *affect,* consisted of items such as sadness and crying. The affect factor had the fewest items and accounted for the least common variance in the study but contained items considered pivotal for depression. With some differences in the use of different labels, BDI-II seems to have a comparable three-factor structure solution across samples, including a cognitive, an affective, and a somatic factor in SUD or AUD patient groups (Buckley et al., 2001; Dum et al., 2008; Johnson et al., 2006; Luty and O'Gara, 2006; Seignourel et al., 2008; Win et al., 2019), and highlights the multidimensionality of depression in these patient groups. The separate affect factor has also been identified in several factor analyses of the BDI-II across different samples, although the cognitive and affective component often is regarded as one factor (McPherson and Martin, 2010; Wang and Gorenstein, 2013).

As expected, the factor analysis of the HSCL-10 gave a two-factor solution, a *depression* domain, and an *anxiety* domain. The high internal consistency indicated that these are meaningful constructs. Each factor included five items. Depression included items like feeling worthless, sadness and hopelessness while the anxiety included items like experiencing anxiety, dizziness and difficulty sleeping. This is in line with earlier research on HSCL-10 (Schmalbach et al., 2019; Syed et al., 2008).

Even if only marginally, the affect factor of BDI-II was the best and the somatic complaints factor was the least suited to differentiate between depressed vs. non-depressed patients in our study. For HSCL, both the total instrument and the two factors had high predictive validity with the depression factor being a somewhat better differentiator when using the optimal cut-off. Our study thus indicates that screening for depression in this patient group could be done by administering the less time consuming and smaller 4-item affect factor from BDI-II or the 5-item depression factor from the HSCL-10. This is not in line with a study by Seignourel et al. (2008) who found that the total BDI-II instrument performed better regarding diagnostic efficiency than the identified factors.

The ROC curves indicated that the optimal combination of sensitivity and specificity occurred when a BDI-II score of 24 or 25 was used as cut-off when assessing AUD patients. This gave a sensitivity of 80% and a specificity of 78%, corresponding to what has been found in similar patient groups (Seignourel et al., 2008). For HSCL-10 we also found a higher cut-off of 2.35, with sensitivity of 80% and specificity of 69%, indicating that the conventional cut-off score of 1.85 is too low for AUD patients. This is in agreement with other research investigating the use of HSCL-10 in SUD patients (Hoxmark et al., 2010).

Using population norms for cut-off in clinical populations could lead to over-estimation of symptoms and potential over-diagnosis due to higher general symptom load in populations with high prevalence of a phenomenon one could also use lower cut-off without the risk of over-diagnosing (Buckley et al., 2001). One example is studies of PTSD which found that the cut-off level of screening instruments must be set according to the symptom load in the population; higher with higher symptom load and lower with lower symptom load (Rash et al., 2008). We found only a few papers addressing cut-off levels for depression

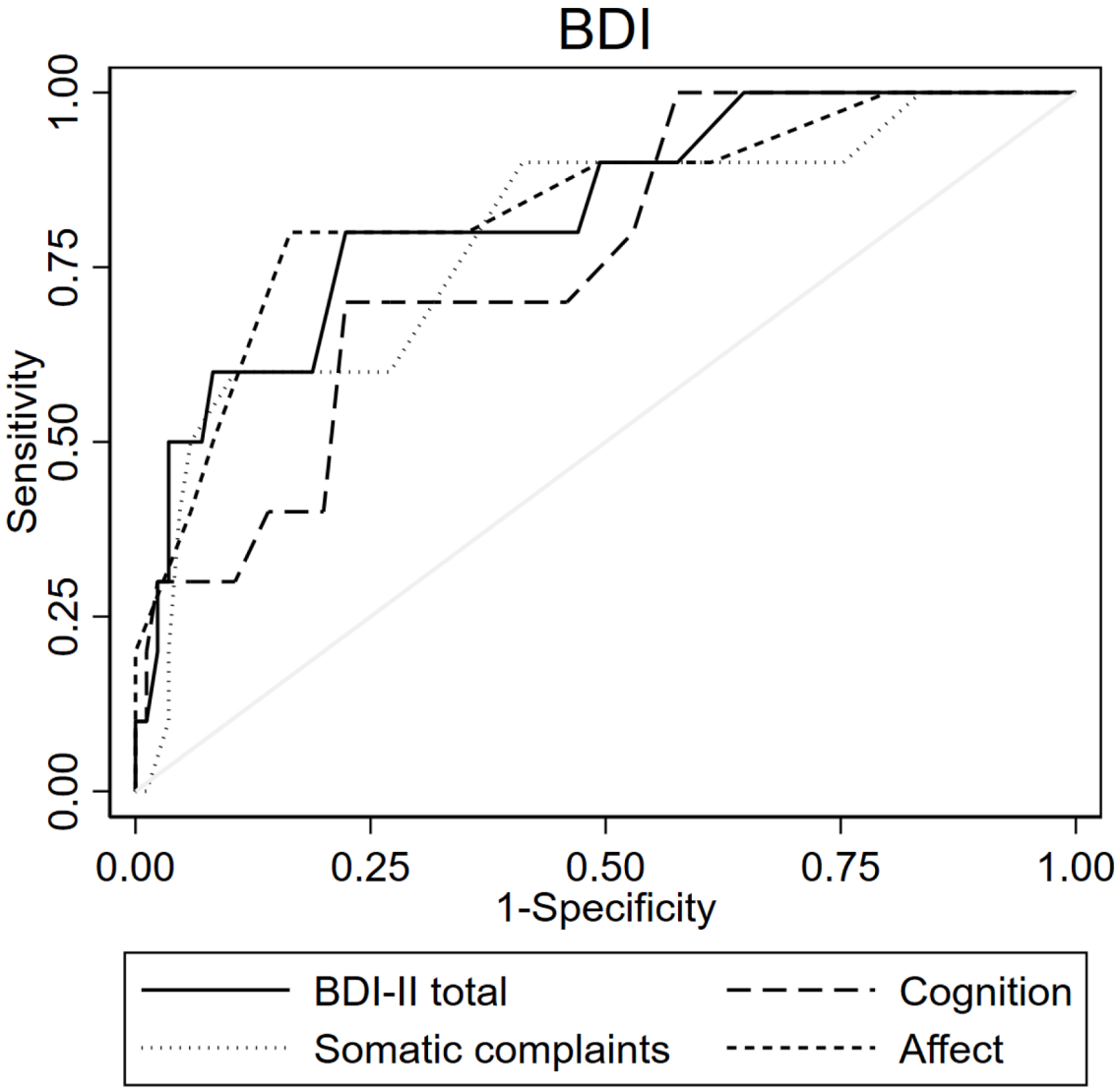

Fig. 1. Receiver operating characteristic (ROC) curves comparing the sensitivity and specificity of the BDI-II (total), the cognition factor, the somatic complaints factor and the affect factor using the M.I.N.I. MDD-module as a criterion standard. $N = 97$.

screening in different substance user groups. One paper using the Patient Health Questionnaire (PHQ-9) and PHQ-2 as depression case finding tools in an outpatient drug treatment sample in the United Kingdom found a cut-point of 12 for PHQ-9 (Delgadillo et al., 2011), but did not compare these results from a study on AUD patients with cut-offs in other groups. The same was true for a paper using Hospital Anxiety Depression Scale (HADS), not comparing the results with other populations (Værøy, 2011). In a study of adults with congenital heart disease a BDI-II score >11 was considered optimal, with highest sensitivity and specificity (96% and 92%) when differentiating between patients without MDD and patients with moderate to severe MDD (Westhoff-Bleck et al., 2020).

One Myanmar paper on youth substance users suggested a cut-off score of 10 on BDI-II (Win et al., 2019) but a low cut-off of 10 will give low positive predictive value in some populations (Barral et al., 2016) and several authors suggest a higher than usual cut-off when screening for MDD in AUD and SUD patients (Johnson et al., 2006). A US study of treatment seeking drug users found good predictive validity with cut-offs between 14 and 25 (Seignourel et al., 2008). The higher cut-off in AUD patients could be due to overlapping MDD and withdrawal symptoms such as insomnia and psychomotor agitation (Barral et al., 2016; McHugh and Weiss, 2019; Weiss et al., 2006). A diagnosis of depression during withdrawal should only be made tentatively and usually 2–4 weeks should pass before a formal diagnosis is set (DeVido and Weiss, 2012a), but it is appropriate to diagnose earlier to deliberate treatment upstart (Weiss et al., 2006).

The optimal cut-off is a tradeoff between sensitivity and specificity. One could argue that sensitivity should be preferred when screening for depression especially in an institution, given the consequences of unrecognized depression among AUD patients. The sensitivity and specificity when using a BDI-II cut-off score of 24 or 25 was 80% and 78% in the present study, which can be considered acceptable. Some studies using BDI-II across different samples (non-clinical, medical and psychiatric) find levels of sensitivity and specificity in the good and acceptable range (Chilcot et al., 2008; Gabarrón Hortal et al., 2002; Seignourel et al., 2008; Wang and Gorenstein, 2013), and other studies find low sensitivity and specificity (Subica et al., 2014; Wang and Gorenstein, 2013). When using the optimal cut-off 2.35 of the HSCL-10, sensitivity was 80% and specificity was 69%. Higher levels of both sensitivity and specificity has been found in previous studies using the HSCL-10 in non-clinical samples (Müller et al., 2010; Strand et al., 2003). In sum, our study indicates that the BDI-II and the HSCL-10 has acceptable ability to distinguish between AUD patients with vs. without MDD, when optimal cut-offs are used.

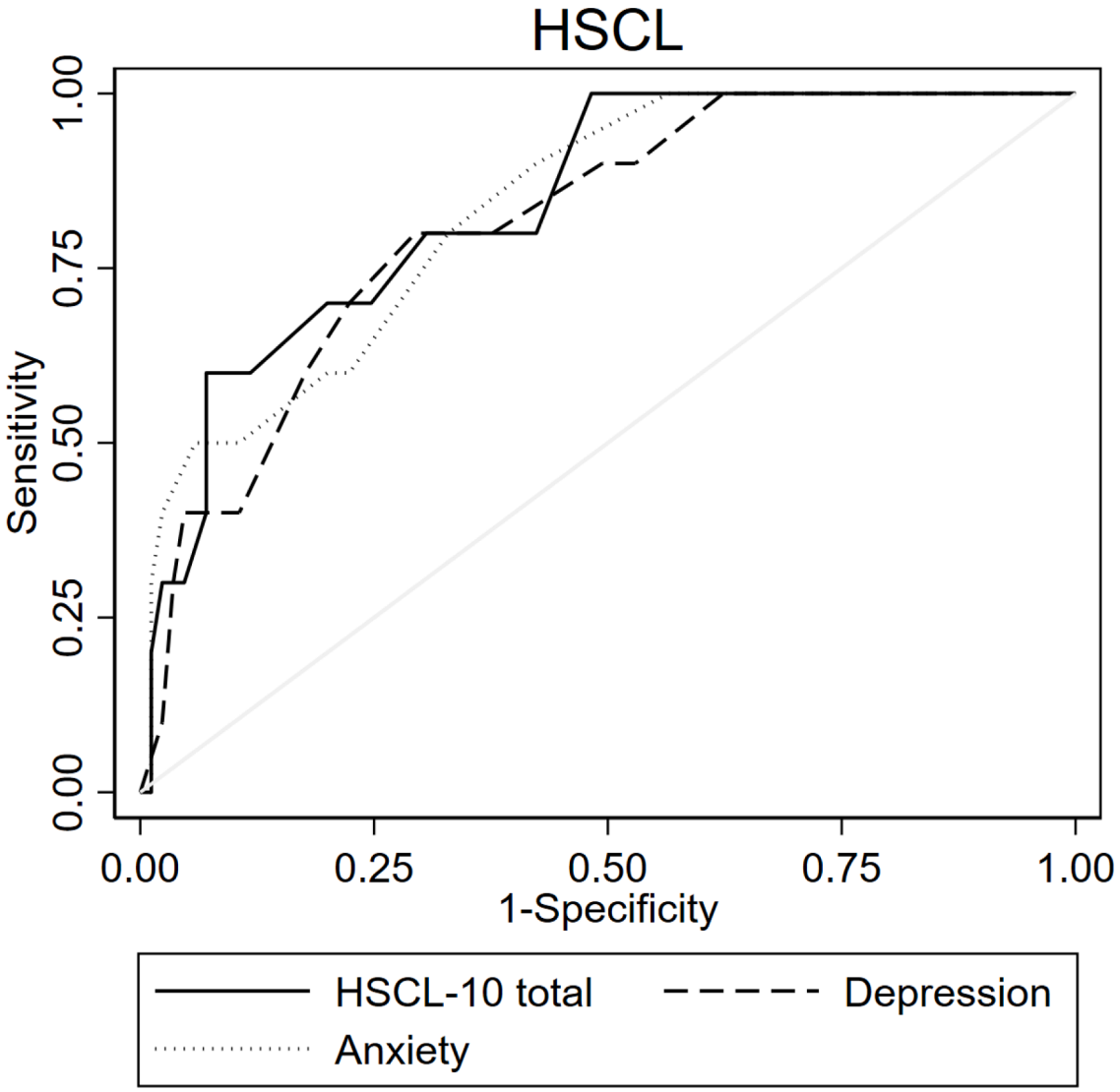

Fig. 2. ROC curves comparing the sensitivity and specificity of the HSCL-10 (total), the depression factor and the anxiety factor using the M.I.N.I. MDD-module as a criterion standard. $N = 97$.

Table 4
Comparison of BDI-II and BDI-II factor scores, and HSCL-10 and HSCL factor scores between participants with MDD and participants without MDD. Significance level was set to $p < 0.05$ (indicated in bold).

	Number of items		Non-MDD ($N = 86$)	MDD($N = 10$)	p-value
BDI-II	21	Sum (SD)	16.36 (10.34)	31.30 (12.08)	**0.00005** [a]
Cognition factor	9	Sum (SD)	7.63 (5.63)	13.80 (6.86)	**0.00140** [a]
Somatic complaints factor	8	Sum (SD)	6.13 (3.84)	11.00 (4.67)	**0.00033** [a]
Affect factor	4	Sum (SD)	2.76 (2.36)	6.50 (2.88)	**0.00001** [a]
HCSL-10	10	Mean (SD)	1.98 (0.64)	2.92 (0.67)	**0.00003** [a]
Depression factor	5	Mean (SD)	2.09 (0.77)	3.06 (0.74)	**0.00031** [a]
Anxiety	5	Mean (SD)	1.86 (0.62)	2.78 (0.71)	**0.00004** [a]

[a] Independent *t*-test, two tailed.

Limitations and strengths

The M.I.N.I. is not formally considered a diagnostic instrument and should always be combined with other pieces of information. However, the M.I.N.I was used in this study for categorizing participants into MDD or non-MDD groups and is one of the most common reference standards used against screening tools. It has high concordance with other diagnostic interviews such as the Structured Clinical Interview for DSM-III-R-Patient version (SCID) (Gill et al., 2017; Sheehan et al., 1998) and the Composite International Diagnostic Interview (CIDI) (Lecrubier et al., 1997), and can therefore aid in determining what cut-off scores are the most diagnostically accurate to diagnose depression. Another concern applies to the fact that the study is based on self-report questionnaires. An assumption behind this format is that the individual has enough expertise and self-knowledge to report both subtle and apparent dimensions of themselves and how they are feeling correctly. However, participants may report incorrectly, and this may lead to an over-estimation or underestimation of symptoms (Hunt et al., 2003).

Several BDI-II and HSCL-10 questionnaires had more than 25% missing responses. These were not included in the analyses, potentially leading to a bias towards a higher level functioning. In addition, there were relatively few participants in the present study in total. This made

it difficult to investigate how the different instruments and the identified factors work between groups based on background variables and clinical variables. The participants in the study were a selected group of patients where most had an AUD diagnosis who were currently in treatment and might not be representative for AUD patients in general.

The present study is not able to make interferences about whether the MDD was a primary depression or an alcohol-induced depression. The participants had been abstinent for a mean of 18 days when participating, we can therefore expect the recent detoxification to have only a small amount of influence on scores. This is in line with findings in a study by Skule et al. (2014), indicating that depressive symptoms in AUD patients are not merely transient and therefore should be routinely screened and targeted in treatment. For future studies, it would be interesting to administer the BDI-II and HSCL-10 after several weeks of treatment to investigate whether both total and factor scores change as treatment progresses and time from detoxification increases, especially concerning the somatic and affect items of the BDI-II.

The median number of abstinence days was 18 for this sample. To diagnose depression four weeks of abstinence is recommended. To test for the effect of abstinence days we performed a sensitivity analysis as mentioned in the results section showing no difference between those above and under the median number of abstinence days.

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Declaration of Competing Interest

Authors Lien, Bolstad, Lien and Bramness declare none.

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References

Allen, J.P., Litten, R.Z., Fertig, J.B., Babor, T., 1997. A review of research on the Alcohol Use Disorders Identification Test (AUDIT). Alcohol Clin. Exp. Res. 21 (4), 613–619.
Babor, T., Robaina, K., 2016. The Alcohol Use Disorders Identification Test (AUDIT): A review of graded severity algorithms and national adaptations. Int. J. Alcohol and Drug Res. 5 (2), 17–24.
Barral, C., Rodríguez-Cintas, L., Martínez-Luna, N., Bachiller, D., Pérez-Pazos, J., Alvarós, J., Casas, M., Roncero, C., 2016. Reliability of the Beck Depression Inventory in opiate-dependent patients. J. Substance Use 21 (2), 128–132.
Beck, A.T., Steer, R.A., Brown, G.K., 1996. Manual For the Beck Depression Inventory-II. Psychological Corp, San Antonio, TX.
Beck, A.T., Ward, C.H., Mendelson, M., Mock, J., Erbaugh, J., 1961. An inventory for measuring depression. Arch. Gen. Psychiatry 4, 561–571.
Belmaker, R.H., Agam, G., 2008. Major depressive disorder. N. Engl. J. Med. 358 (1), 55–68.
Boden, J.M., Fergusson, D.M., 2011. Alcohol and depression. Addiction 106 (5), 906–914.
Brown, S.A., Inaba, R.K., Gillin, J.C., Schuckit, M.A., Stewart, M.A., Irwin, M.R., 1995. Alcoholism and affective disorder: clinical course of depressive symptoms. Am. J. Psychiatry 152 (1), 45–52.
Buckley, T.C., Parker, J.D., Heggie, J., 2001. A psychometric evaluation of the BDI-II in treatment-seeking substance abusers. J. Subst. Abuse Treat. 20 (3), 197–204.
Chilcot, J., Wellsted, D., Farrington, K., 2008. Screening for depression while patients dialyse: an evaluation. Nephrol. Dial. Transplant. 23 (8), 2653–2659.
Conner, K.R., Pinquart, M., Gamble, S.A., 2009. Meta-analysis of depression and substance use among individuals with alcohol use disorders. J. Subst. Abuse Treat. 37 (2), 127–137.
Delgadillo, J., Payne, S., Gilbody, S., Godfrey, C., Gore, S., Jessop, D., Dale, V., 2011. How reliable is depression screening in alcohol and drug users? A validation of brief and ultra-brief questionnaires. J. Affect. Disord. 134 (1–3), 266–271.
Derogatis, L.R., Lipman, R.S., Rickels, K., Uhlenhuth, E.H., Covi, L., 1974. The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. Behav. Sci. 19 (1), 1–15.
DeVido, J.J., Weiss, R.D., 2012a. Treatment of the depressed alcoholic patient. Curr. Psychiatry Rep. 14 (6), 610–618.
DeVido, J.J., Weiss, R.D., 2012b. Treatment of the depressed alcoholic patient. Curr. Psychiatry Rep. 14 (6), 610–618.
Dum, M., Pickren, J., Sobell, L.C., Sobell, M.B., 2008. Comparing the BDI-II and the PHQ-9 with outpatient substance abusers. Addict. Behav. 33 (2), 381–387.
Gabarrón Hortal, E., Vidal Royo, J.M., Haro Abad, J.M., Boix Soriano, I., Jover Blanca, A., Arenas Prat, M., 2002. Prevalence and detection of depressive disorders in primary care. Aten Primaria 29 (6), 329–337.
Gill, S.J., Lukmanji, S., Fiest, K.M., Patten, S.B., Wiebe, S., Jette, N., 2017. Depression screening tools in persons with epilepsy: A systematic review of validated tools. Epilepsia 58 (5), 695–705.
Gorsuch, R.L., 1997. Exploratory factor analysis: its role in item analysis. J. Pers. Assess. 68 (3), 532–560.
Hassan, A.N., 2018. Patients with alcohol use disorder co-occurring with depression and anxiety symptoms: diagnostic and treatment initiation recommendations. J. Clin. Psychiatry 79 (1).
Hesse, M., 2006. The Beck Depression Inventory in patients undergoing opiate agonist maintenance treatment. Br. J. Clin. Psychol. 45 (Pt 3), 417–425.
Hoxmark, E., Nivison, M., Wynn, R., 2010. Predictors of mental distress among substance abusers receiving inpatient treatment. Subst. Abuse Treat. Prev. Policy 5, 15.
Hunt, M., Auriemma, J., Cashaw, A.C., 2003. Self-report bias and underreporting of depression on the BDI-II. J. Pers. Assess. 80 (1), 26–30.
Johnson, M.E., Neal, D.B., Brems, C., Fisher, D.G., 2006. Depression as measured by the Beck Depression Inventory-II among injecting drug users. Assessment 13 (2), 168–177.
Kaiser, H.F., Rice, J., 1974. Little Jiffy, Mark IV. Educ. Psychol. Meas. 34, 111–117.
Lecrubier, Y., Sheehan, D.V., Weiller, E., Amorim, P., Bonora, I., Sheehan, K.H., Janavs, J., Dunbar, G.C., 1997. The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. Eur. Psychiatry 12, 224–231.
Luty, J., O'Gara, C., 2006. Validation of the 13-Item Beck Depression Inventory in alcohol-dependent people. Int. J. Psychiatry Clin. Pract. 10 (1), 45–51.
Manian, N., Schmidt, E., Bornstein, M.H., Martinez, P., 2013. Factor structure and clinical utility of BDI-II factor scores in postpartum women. J. Affect. Disord. 149 (1–3), 259–268.
Martinez, P., Neupane, S.P., Perlestenbakken, B., Toutoungi, C., Bramness, J.G., 2015. The association between alcohol use and depressive symptoms across socioeconomic status among 40- and 45-year-old Norwegian adults. BMC Public Health 15, 1146.
McHugh, R.K., Weiss, R.D., 2019. Alcohol Use Disorder and Depressive Disorders. Alcohol Res. Curr. Rev. 40 (1) arcr.v40.41.01.
McPherson, A., Martin, C.R., 2010. A narrative review of the Beck Depression Inventory (BDI) and implications for its use in an alcohol-dependent population. J. Psychiatr. Ment. Health Nurs. 17 (1), 19–30.
Mordal, J., Gundersen, O., Bramness, J.G., 2010. Norwegian version of the Mini-International Neuropsychiatric Interview: feasibility, acceptability and test-retest reliability in an acute psychiatric ward. Eur. Psychiatry 25 (3), 172–177.
Müller, J.M., Postert, C., Beyer, T., Furniss, T., Achtergarde, S., 2010. Comparison of eleven short versions of the Symptom Checklist 90-Revised (SCL-90-R) for use in the assessment of general psychopathology. J. Psychopathol. Behav. Assess. 32, 246–254.
Rash, C.J., Coffey, S.F., Baschnagel, J.S., Drobes, D.J., Saladin, M.E., 2008. Psychometric properties of the IES-R in traumatized substance dependent individuals with and without PTSD. Addict. Behav. 33 (8), 1039–1047.
Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., Patra, J., 2009. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 373 (9682), 2223–2233.
Rehm, J., Shield, K.D., 2019. Global burden of disease and the impact of mental and addictive disorders. Curr. Psychiatry Rep. 21 (2), 10.
Reinert, D.F., Allen, J.P., 2002. The Alcohol Use Disorders Identification Test (AUDIT): a review of recent research. Alcohol Clin. Exp. Res. 26 (2), 272–279.
Rochlen, A.B., Paterniti, D.A., Epstein, R.M., Duberstein, P., Willeford, L., Kravitz, R.L., 2010. Barriers in diagnosing and treating men with depression: a focus group report. Am. J. Mens. Health 4 (2), 167–175.
Saunders, J.B., Aasland, O.G., Babor, T.F., de la Fuente, J.R., Grant, M., 1993. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption–II. Addiction 88 (6), 791–804.
Schmalbach, B., Zenger, M., Tibubos, A.N., Kliem, S., Petrowski, K., Brahler, E., 2019. Psychometric Properties of Two Brief Versions of the Hopkins Symptom Checklist: HSCL-5 and HSCL-10. Assessment, 1073191119860910.
Seignourel, P.J., Green, C., Schmitz, J.M., 2008. Factor structure and diagnostic efficiency of the BDI-II in treatment-seeking substance users. Drug Alcohol. Depend. 93 (3), 271–278.
Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., Dunbar, G.C., 1998. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. J. Clin. Psychiatry 59 (Suppl 20), 34–57, 22-33;quiz.
Shivani, R., Goldsmith, R.J., Anthenelli, R.M., 2002. Alcoholism and psychiatric disorders: Diagnostic challenges. Alcohol Res. Health 26 (2), 90.
Skule, C., Ulleberg, P., Dallavara Lending, H., Berge, T., Egeland, J., Brennen, T., Landro, N.I., 2014. Depressive symptoms in people with and without alcohol abuse: factor structure and measurement invariance of the Beck Depression Inventory (BDI-II) across groups. PLoS One 9 (2), e88321.
Strand, B.H., Dalgard, O.S., Tambs, K., Rognerud, M., 2003. Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). Nord. J. Psychiatry 57 (2), 113–118.

Subica, A.M., Fowler, J.C., Elhai, J.D., Frueh, B.C., Sharp, C., Kelly, E.L., Allen, J.G., 2014. Factor structure and diagnostic validity of the Beck Depression Inventory-II with adult clinical inpatients: comparison to a gold-standard diagnostic interview. Psychol. Assess. 26 (4), 1106–1115.

Syed, H.R., Zachrisson, H.D., Dalgard, O.S., Dalen, I., Ahlberg, N., 2008. Concordance between Hopkins Symptom Checklist (HSCL-10) and Pakistan Anxiety and Depression Questionnaire (PADQ), in a rural self-motivated population in Pakistan. BMC Psychiatry 8, 59.

Tobias, K.G., Lehrfeld, J., Rosenfeld, B., Pessin, H., Breitbart, W., 2017. Confirmatory factor analysis of the Beck Depression Inventory-II in patients with advanced cancer: A theory-driven approach. Palliat. Support Care 15 (6), 704–709.

Toft, H., Neupane, S.P., Bramness, J.G., Tilden, T., Wampold, B.E., Lien, L., 2018. The effect of trauma and alcohol on the relationship between level of cytokines and depression among patients entering psychiatric treatment. BMC Psychiatry 18 (1), 95.

Værøy, H., 2011. Depression, anxiety, and history of substance abuse among Norwegian inmates in preventive detention: Reasons to worry? BMC Psychiatry 11 (1), 40.

Wang, Y.P., Gorenstein, C., 2013. Psychometric properties of the Beck Depression Inventory-II: a comprehensive review. Braz. J. Psychiatry 35 (4), 416–431.

Weiss, R.D., Ziedonis, D.M., Albanese, M.J., 2006. Integrated Treatment for Mood and Substance Use Disorders.

Westhoff-Bleck, M., Winter, L., Aguirre Davila, L., Herrmann-Lingen, C., Treptau, J., Bauersachs, J., Bleich, S., Kahl, K.G., 2020. Diagnostic evaluation of the hospital depression scale (HADS) and the Beck depression inventory II (BDI-II) in adults with congenital heart disease using a structured clinical interview: Impact of depression severity. Eur. J. Prev. Cardiol. 27 (4), 381–390.

WHO, 2018. Global Status Report On Alcohol and Health. World Health Organization, Geneva, Switzerland p. volumes.

Win, K.L., Kawakami, N., Htet Doe, G., 2019. Factor structure and diagnostic efficiency of the Myanmar version BDI-II among substance users. Ann. Gen. Psychiatry 18, 12.