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The performance of the Health of the Nation Outcome Scales as measures of clinical severity

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Abstract

The aim of this study was to examine the performance of the Health of the Nation Outcome Scales (HoNOS) against other measures of functioning and mental health in a full three-year cohort of admissions to a psychiatric hospital. A sample of N=1,719 patients (35.3% females, aged 17-78 years) was assessed using observer-rated measures and self-reports of psychopathology at admission. Self-reports were available from 51.7% of the sample (34.4% females, aged 17-76 years). Functioning and psychopathology were compared across five ICD-10 diagnostic groups: substance use disorders (SUD; F1), schizophrenia and psychotic disorders (F2), affective disorders (F3), anxiety/somatoform disorders (F4) and personality disorders (F6). Associations between the measures were examined, stratifying by diagnostic subgroup. The HoNOS were strongly linked to other measures primarily in psychotic disorders (except for the behavioral subscale), while those with SUD showed rather poor links. Those with anxiety/somatoform disorders showed null or only small associations. This study raises questions about the overall validity of the HoNOS. It seems to entail different levels of validity when applied to different diagnostic groups. In clinical practice the HoNOS should not be used as a stand-alone instrument to assess outcome but rather as part of a more comprehensive battery including diagnosis-specific measures.

Keywords:

Health of the Nation Outcome Scales, validity, mental health, functioning, ICD-10

1. Introduction

In mental health services there is increasing interest for evidence demonstrating the effectiveness of an intervention. In turn, several standardized tools have been developed for the assessment of treatment outcomes (Hampson et al., 2011; Slade, 2002; Slade et al., 1999). The Health of the Nation Outcome Scales (HoNOS) (Wing et al., 1998) were developed by the Research Unit of the Royal College of Psychiatrists in the 1990s, in order to provide a brief, accurate, and relevant measure of overall mental health and social functioning. Since then, the HoNOS has been successfully implemented as an outcome measure in the United Kingdom, Australia, and New Zealand and has been widely used in surveys in numerous European countries (Pirkis et al., 2005). A German version (HoNOS-D) was developed (Andreas et al., 2007) and subsequently validated (Andreas et al., 2010a; Andreas et al., 2010b; Egger et al., 2015; Theodoridou et al., 2011).

Previous research raised serious doubts on the original subscale structure (Preston, 2000; Trauer, 1999). Alternative solutions, however, were not only found to be clearly superior to the original subscales (Bech et al., 2003; Newnham et al., 2009; Speak et al., 2015), but also revealed that the 12 items of the HoNOS are not supposed to be independent (Speak and Muncer, 2015; Williams et al., 2014). Nevertheless the original structure is still in use in research and clinical practice (Speak et al., 2015).

Although the psychometric properties of the HoNOS have been examined in large clinical samples (Speak and Muncer, 2015; Speak et al., 2015), only few studies have investigated their congruence to other psychometric scales across a broader spectrum of common mental disorders (Pirkis et al., 2005). Moreover, the HoNOS was originally developed and validated in clinical samples with large numbers of predominantly severe or chronic disorders (Wing et al., 1996); which challenges its utility for outcome monitoring of specific psychiatric

interventions, such as psychotherapy (Audin, 2001; Bebbington et al., 1999; Egger et al., 2015).

The aim of the current study was to examine the performance of the HoNOS to reflect clinical severity in a large sample of continuous admissions to a psychiatric hospital. Therefore, we examined a full 36-month sample of psychiatric inpatients across a broad diagnostic spectrum using a range of clinician- and patient-rated assessment scales. The performance of the HoNOS was examined by comparing the HoNOS scores against other well-validated measures for assessing psychopathology and functional impairment. By contrasting specific diagnostic groups we hoped to find evidence for the clinical specificity of the HoNOS.

2. Method

2.1. Sample and procedure

The Department of Psychiatry, Psychotherapy and Psychosomatics as part of the Psychiatric University Hospital of Zurich specializes in treating "heavy users" (Roick et al., 2002a; Roick et al., 2002b), i.e. patients with frequent or long-term hospitalizations for whom outpatient treatment alone is often insufficient to prevent relapse (Stulz et al., 2012).

We used data of a full three-year cohort of consecutive inpatients treated at our unit (N=1,913). Ten percent (10.14%; N=194) were initially dropped due to completely missing psychometric data. Dropouts did not differ from the remaining sample regarding sex, age, education, civil status and primary diagnosis at admission. The final study sample comprised N=1,719 patients (35.3% females) aged between 17 and 78 years (Mean=43.8; SD=11.8) from whom N=888 (51.7%) provided data on self-reported psychopathology. Self-reports of

the patients' psychopathology were gathered within the first three days following admission to the hospital. The majority of the sample was single (52.4%) or divorced (27.1%), had completed an apprenticeship or technical college (54.3%), and had an average of 2.2 (SD=4.1) hospital stays in our institution. More detailed information is provided in Table 1.

2.2. Raters and Training

Raters were clinicians, either psychiatrists, psychiatry residents or clinical psychologists. All raters were trained in specific workshops on the use and objectives of the measures used in the study. The workshops followed a standardized schedule, using case vignettes and videos of patients as examples. Refresher training sessions were provided on a regular basis, at least twice a year, with trainers being available for consultation at any time. On all measures, information was rated retrospectively for the seven days prior to admission. All relevant information was derived from either the admission interview or directly by behavioral observation, while additional information was provided by the nursing staff, social workers and significant others.

2.3. Diagnostic Groups

On the basis of the primary diagnosis defined according to the International Classification of Diseases, 10th edition (ICD-10) (World Health Organization, 1992), the sample was divided into 5 diagnostic groups: substance use disorders (SUD) (ICD 10: F1), schizophrenia and other psychotic disorders (ICD 10: F2), affective disorders (ICD 10: F3), anxiety and somatoform disorders (ICD 10: F4), and personality disorders (PD) (ICD 10: F6).

The data were collected as part of the routine clinical care procedure and therefore no specific written informed consent was obtained.

2.4. Measures

2.4.1. HoNOS

The HoNOS is an observer-rated scale and consists of 12 items with a five-point Likert scale response format from 0 (No problems) to 4 (Severe/very severe problems), scores above 2 are considered to be clinically significant. Although all scales were designed to be independent measures, they were combined into the following four dimensions of "behavior" (aggressiveness; non-accidental self-injury; problem drinking or drug-taking), "impairment" (cognitive problems; physical illness or disability problems), "symptoms" (hallucinations and delusions; depressed mood; other mental and behavioral problems) and "social problems" (problems with relationships; problems with activities related to daily living; problems with living conditions; problems with occupation and activities). Each subject could therefore be evaluated on subscale scores as well as on the total score. The HoNOS showed good internal consistencies apart from the subscale of behavioral problems (see Cronbach Alpha coefficients in Table 2).

2.4.2. Brief Symptom Inventory (BSI)

The BSI (Derogatis and Melisaratos, 1983) is a 53-item self-report questionnaire assessing symptoms of psychological distress. As it is a short version of the 90-item Symptom-Checklist (SCL-90; (Derogatis et al., 1976)), it can be used as a brief initial screening instrument as well as for outcome evaluation. Each item is rated on a five-point Likert-scale from 0 (not at all) to 4 (extremely). General psychopathology is then assessed by means of a global score (GSI-Global severity index) when at least 40 out of the 53 items are checked. The total score ranges from 0 to 212.

2.4.3. Global Assessment of Functioning (GAF)

The GAF is a 100-point single-item observer-rated scale. It rates overall functioning on a continuum from mental health to mental illness (Jean Endicott et al., 1976). The scale ranges from 1 (representing the most impaired individual) to 100 (representing the healthiest individual), 0 denoting insufficient information to make a clinical judgment. The GAF should be used to reflect overall functioning rated over the past seven days. The GAF has been widely used to describe subject samples, to monitor change over time, to assess treatment effects, to describe the natural history of various conditions and to validate other measures. It is frequently used in psychiatric services as a general outcome measure. The main strengths of this scale are its ease of use with minimal training requirements, its reliability and sensitivity to change over time.

2.4.4. Clinical Global Impression (CGI)

The CGI scale is a widely used observer-rated tool for measuring clinical severity in psychiatry, and was originally introduced in psychopharmacological trials (Guy, 1976). The CGI was intended to provide a brief, universal stand-alone assessment of illness severity and ranges from 1 representing the "healthy subject" to 7 the "extremely ill subject". Ratings of the CGI refer to the past week. The CGI correlates well with other standard measures across several psychiatric diagnoses (Leucht and Engel, 2006; Leucht et al., 2005; Spielmans and McFall, 2006).

2.4.5. Mini-ICF

The International Classification of Functioning (ICF) (World Health Organization, 2001) was introduced by the WHO in order to supplement the primarily symptom-related International Classification of Diseases (ICD-10) (World Health Organization, 1992). The ICF describes and classifies disorders according to the level of functioning and capacity – two entities,

which are linked to restrictions in social participation. However, the application of the ICF to clinical practice is rather restricted since its structure is highly complex and its daily application uneconomical. An abbreviated version, namely the Mini-ICF (Linden and Baron, 2005), was developed, which can be used as a short observer-rated scale for assessing function. The Mini-ICF contains, analog to the original version of the ICF, thirteen domains of functioning: (1) adherence to regulations and routines, (2) planning and structuring of tasks, (3) flexibility, (4) competency/efficacy, (5) endurance, (6) assertiveness, (7) contact with others, (8) public exposure, (9) intimacy, (10) non-work activities, (11) self-maintenance, (12) mobility and (13) competence to judge and decide. Each item is rated on a five-point Likert-scale from 0 (no disability) to 4 (total disability). Anchor definitions for each item are provided in the manual. The Mini-ICF was found to demonstrate good psychometric properties in its initial studies (Balestrieri et al., 2013; Baron and Linden, 2009; Linden and Baron, 2005; Molodynski et al., 2012).

2.5. Statistical analyses

Sample characteristics and their distributions across diagnostic subgroups are provided in Table 1. Descriptive statistics are provided in Table 2 for all study measures (Means, standard deviations, Cronbach's Alpha) for both the total sample and separately by diagnostic subgroup. Group comparisons were conducted using Chi-square tests for categorical variables or by a one-way ANOVA omnibus F-test for continuous measures. In Table 2, multiple comparisons were made using Bonferroni post-hoc tests to determine which means differ between groups.

Bivariate associations between the HoNOS scales and other study measures were established using Product-Moment correlations (Table 3). In order to test whether the strength of the association of each of the HoNOS scales (total and subscales) and other measures depends on the diagnostic category (i.e. primary diagnosis at admission) a series of two-way analyses of variance (ANOVA) models were conducted (Table 4). We used a two-step approach, i.e. as a first step the categorical group variable and the predictor variable (GAF, CGI, Mini-ICF, or BSI) were entered into the model, followed by adding a group-by-predictor interaction term to the model in a second step. This allows to examine the main effects of each predictor and the group factor (diagnostic group) on the HoNOS as well as whether there is an interaction between the predictor and the group. In order to avoid possible problems with multicolinearity the continuous predictor variables were centered prior to modeling (Aiken et al., 1991; Judd and McClelland, 1989) When the omnibus F test for an interaction term was significant, a post hoc regression model was conducted to explore the simple slopes and their significance for each group level (Table 5). Then, we tested reference contrasts to determine whether these slopes differ among groups by indicating each group level as the reference one by one in order to compare it against the other levels. All ANOVA models were adjusted for socio-demographic variables and the number of previous hospitalizations.

All analyses were conducted using Stata/SE 12 (StataCorp, 2011).

3. Results

Table 1 shows socio-demographic characteristics for the total sample as well as separately by diagnostic subgroup. One-thousand and seventy-nine subjects (62.8%) had a primary diagnosis of SUD, 274 (15.9%) a diagnosis of schizophrenia or psychotic disorder, 160

(9.3%) an affective disorder, 66 (3.8%) an anxiety or somatoform disorder, and 140 (8.1%) a PD. Groups differed significantly regarding sex, age, marital status, education, and the mean frequency of past hospital stays in our institution. For further details please refer to Table 1.

- Insert Table 1 about here -

Table 2 displays means and standard deviations (M and SD) as well as information on reliability (Cronbach´s Alpha) for all study measures for both the total sample as well as stratified by diagnostic subgroup. All study measures differed significantly across groups. SUD were linked to lower HoNOS total, symptom and social scores, higher HoNOS behavioral scores, lower BSI, CGI and Mini-ICF scores, as well as higher GAF scores. Psychotic disorders were associated with higher HoNOS total, impairment, symptom and social scores, with lower BSI and GAF scores as well as with higher CGI and Mini-ICF scores. Affective disorders were primarily associated with lower HoNOS behavioral and symptom scores. Anxiety or somatoform disorders and PD were associated with higher self-reported psychopathology (BSI) while being more or less at the population mean level regarding all other study measures. The HoNOS total and subscales, except for the behavioral subscale, showed satisfactory internal consistencies (see Table 2).

- Insert Table 2 about here -

Female sex was associated with higher impairment and symptom subscale scores as well as with higher BSI, CGI and Mini-ICF scores, but with lower HoNOS behavioral subscale and GAF scores (results not tabulated). The HoNOS total score, the behavioral, social and symptom subscale scores as well as the BSI and Mini-ICF scores were negatively associated with age, while the HoNOS impairment subscale score was positively associated with age (not tabulated). All study measures were significantly associated with education, all HoNOS scales (total and subscales) and the Mini-ICF were linked to marital status, and all measures, except for the HoNOS symptom scale and the BSI, which were linked to a higher number of previous hospital stays (not tabulated).

Self-reported psychopathology (BSI) was available from only 51.7% of the study sample. To estimate the impact of missing data, cases with and without self-reported data were compared regarding sociodemographic and clinical variables. Accordingly, numbers of complete self-report data varied significantly across diagnoses (Chi-Square=20.12; df=4; $p<0.001$): the respective figures of available data for SUD, psychotic disorders, affective disorders, anxiety or somatoform disorders, and PD were 50.7%, 43.4%, 59.4%, 59.1%, and 62.9%. Complete self-report data was further related to younger age ($F_{1;1,717}=19.63$; $p<0.001$), higher education (Chi-Square=31.75; df=3; $p<0.001$; 55.7%, 56.7%, 44.4%, and 33.6% for university degree, apprenticeship/technical college, compulsory school, and not having completed compulsory school), and to single marital status (Chi-Square=17.42; df=3; $p=0.001$; 56.2%, 46.5%, 47.4%, and 37.5% for single, married, separated/divorced, and widowed). Those with full data had significantly lower HoNOS total ($F_{1;1,646}=14.78$; $p<0.001$), impairment ($F_{1;1,636}=47.92$; $p<0.001$) and social scores ($F_{1;1,491}=5.52$; $p=0.019$) as well as lower CGI ($F_{1;1,716}=27.70$; $p<0.001$) and Mini-ICF scores ($F_{1;1,691}=13.47$; $p<0.001$). Diagnosis-stratified analyses revealed these differences to be largest for either psychotic (HoNOS-total: $F_{1;242}=8.54$; $p=0.004$; HoNOS-social: $F_{1;180}=9.18$; $p=0.003$; Mini-ICF: $F_{1;269}=13.40$; $p<0.001$)

or affective disorders (HoNOS-impairment: $F_{1;150}$=16.95; p<0.001; CGI: $F_{1;158}$=7.37; p=0.007).

Table 3 displays the associations among all study measures. The HoNOS total score is highly correlated with all the subscales while the associations among the latter were rather low. Other observer-rated measures (GAF, CGI and Mini-ICF) were correlated with the HoNOS scales at low to medium level. The BSI was very weakly correlated to all other study measures and completely unrelated to the behavioral and impairment subscales of the HoNOS.

- Insert Table 3 about here –

Multivariate ANOVA models confirmed the association of all HoNOS scales with other measures (except for the HoNOS social – BSI link) as well as with the primary diagnosis at admission (see Table 4). The addition of an interaction term in a second step indicated that group membership significantly moderated the association between GAF and HoNOS-total (Model 1a), and HoNOS-symptom scales (Model 4a), between the Mini-ICF and all the HoNOS scales (Models 1c, 3c, 4c and 5c) except for the HoNOS-behavioral subscale, and between CGI and the HoNOS-behavioral (Model 2b) and HoNOS-symptom scales (Model 4b).

- Insert Table 4 about here –

A significant interaction term means that the regression lines for these associations differ significantly across groups. Table 5 displays the simple effects, i.e. the strength of the associations (slopes) between the HoNOS scale and another measure at the group level, as well as the simple contrasts, i.e. the test of differences between groups in the slopes of the significant overall interactions. Accordingly, the HoNOS total and symptom subscale scores were negatively linked to the GAF but not for anxiety or somatoform disorders. However, the associations differed not significantly between these groups except in those with SUD the symptom subscale was significantly lower linked to the GAF than in other groups. The Mini-ICF was positively associated with the HoNOS total score and the social subscale for all groups and with the impairment and symptom subscales in all groups excepting for anxiety or somatoform disorders. These associations were significantly stronger in individuals with psychotic disorders compared to all other groups for the total scale as well as for the impairment scale and stronger than SUD for the social subscale. The CGI was positively related to the behavioral subscale in those with SUD, affective disorders and PD and to the symptom subscale in all groups except for the anxiety or somatoform diagnosis group. For the behavioral subscale these associations were higher for those with SUD and PD compared to the other groups and higher in the symptom subscale for those with psychotic and affective disorders.

- Insert Table 5 about here –

4. Discussion

This is the first study to examine the validity of the German version of the HoNOS in a very large clinical sample by directly contrasting different diagnostic subgroups. Indeed, we compared the associations of the HoNOS with other observer-rated scales of functioning and self-reports of mental health across the major categories of psychiatric disorders.

Our sample primarily comprised patients with severe clinical profiles. Indeed, most patients were referred to our institution after failure of treatment in community or outpatient settings, mostly with a sub-acute symptom load and functional impairment. Therefore, it was not surprising that we found more severe scores on our study measures, including the HoNOS, than those reported in other studies (Andreas et al., 2007; Andreas et al., 2010a; Bech et al., 2006; Berk et al., 2008; Goldney et al., 1998; Hatfield et al., 2000; Kisely et al., 2010; Trauer et al., 1999). In particular, the German validation studies of the HoNOS primarily focused on psychosomatic rehabilitation patients, while under-representing schizophrenia and bipolar patients (Andreas et al., 2007; Andreas et al., 2010a), who usually have a more severe course of disease and a higher degree of functional impairment.

4.1. Associations with other measures

In line with previous findings, associations of the HoNOS with other observer-rated instruments of functioning were superior to those with self-reports of mental health (Adams et al., 2000; Pirkis et al., 2005). In fact, the HoNOS has been described as a measure of functioning rather than as a tool for the assessment of symptoms (Bebbington et al., 1999; Egger et al., 2015; Lovaglio and Monzani, 2011). Additionally, since our service targets primarily on a specific population with rather sub-acute psychopathological symptoms as well as functional disturbances, low associations between the HoNOS scales (apart from the conceptually closely related symptoms subscale) and psychopathology were expected (Brooks, 2000; Oiesvold et al., 2011; Parabiaghi et al., 2005). Specific behavioral aspects

were not targeted in the current study; and therefore we observed overall low associations with the HoNOS behavioral problems subscale.

4.2. Group comparisons

Those patients with a psychotic disorder showed the poorest outcomes on almost all measures. Basically, schizophrenia and other psychotic disorders have a high clinical severity, along with overall impairment and disabilities (Whiteford et al., 2013). However, our data also suggest that patients with psychotic disorders were largely unaffected by behavioral impairment. A possible explanation might be that those patients were mostly referred to our clinic after initial treatment in an acute psychiatric facility. Symptoms leading to hospitalization (Dazzi et al., 2015; Jäger et al., 2014) are primarily encompassed by the HoNOS behavioral subscale (Wing et al., 1998). Those symptoms in particular tend to improve more quickly and therefore promote an earlier discharge, while cognitive symptoms and other impairment remain relatively stable over time (Jäger et al., 2014; Kelly et al., 1998; Müller et al., 2013). Interestingly, this group showed (together with SUD) the lowest scores on self-reported psychopathology, which was rather surprising, since almost all observer ratings indicated higher clinical severity. However, individuals with schizophrenia often have impaired illness insight, which might prevent them from reporting their symptoms accurately (McGorry and McConville, 2000). Alternatively, this could also be an artifact of the higher number of missing self-report data among patients with more severe clinical presentations. In fact, dropout analyses revealed that those with a primary diagnosis of psychotic disorders had partially poorer outcomes on other measures when self-reported data were not available.

In contrast, those with a primary diagnosis of SUD had better outcomes on almost all measures, suggesting that this group has comparably higher overall functioning and lower psychopathology. However, higher behavioral dysfunction was observed among these

individuals, which, however, was not surprising since one out of the three items of the behavioral subscale of the HoNOS specifically focuses on substance consumption (Pirkis et al., 2005; Wing et al., 1994).

Other diagnostic groups (i.e. affective, anxiety/somatoform and PD) were rated with all measures at intermediate levels between these two extreme groups, i.e. they scored higher than patients with SUD but lower than those with psychotic disorders. At a first glance it might be surprising that those heterogeneous diagnostic categories differ so little from each other in their observer ratings. However, the fact that there is only one item (item 8: "other mental and behavioral problems") for a broad range of psychopathological symptoms (phobia, anxiety, obsessive-compulsive, mental tension, dissociative, somatoform, eating, sleep, sexual) (Wing et al., 1999) blurred the lines between certain psychiatric disorders, a point that has already been criticized in earlier studies on the HoNOS (Audin, 2001; Lovaglio and Monzani, 2011; Trauer et al., 1999; Wing et al., 1999). Other observer-rated measures (CGI, GAF and Mini-ICF), in contrast, focus primarily on functioning independently of symptoms (Guy, 1976; Jean Endicott et al., 1976; Linden and Baron, 2005); therefore the results indicate that even divergent psychopathological symptoms and diagnoses might be linked to similar levels of impairment. This becomes particularly evident as affective disorders, anxiety or somtoform disorders, and PD differ considerably in their self-reported psychopathology from SUD and psychotic disorders.

Overall, although the HoNOS scales were associated with other observer-rated scales of functioning these associations varied considerably between diagnostic groups. Interaction analyses revealed that the variability in the HoNOS scales are not often explained by independent effects of either the diagnostic category or the measure of functioning (CGI, GAF, Mini-ICF), but rather by an interaction of both. No matter if total or subscales of the

HoNOS are considered, their relationships to other measures of functioning were more or less equal: while these associations in anxiety or somatoform disorders were either null or only small, significant associations were observed among other diagnostic groups. In detail, those with psychotic disorders mostly showed the strongest links, at least stronger than in those with SUD, which, in turn, showed rather weak associations. Those with affective disorders and PD more or less did not differ in their associations from each other, which might be due to the inability of the HoNOS to assess specific impairment for those disorders. On the other hand, as an exception, those with PD and SUD stood out in their associations with the HoNOS behavioral subscale. The items that were assessed by this subscale represent the principal symptoms that lead to admission and or treatment for either SUD or PD.

4.3. Strengths of the study

A major strength of our study was without doubt the use of a large representative clinical sample with a full examination of all admissions to one single psychiatric hospital during a three-year period. A further advantage was the standardized implementation of comprehensive and unselected assessments for all patients, which allowed for comparisons between diagnostic groups. To our knowledge, few studies have used the HoNOS as a permanent clinical tool, instead, most studies used it in "research settings" with no subsequent clinical integration (Kisely et al., 2010; Stein, 1999). A further important strength of the study is the simultaneous use of both self-report as well as observer-rated measures.

4.4. Limitations

Despite the strengths mentioned above, the current study also has some limitations, which must be acknowledged. First, the collection of measures we used to validate the HoNOS was more general rather than diagnosis-specific, which, however, allowed to compare associations

with the HoNOS across different diagnostic categories. Therefore, future investigations of the HoNOS's performance in a more disease specific context should include more specific measures. Second, there was a high rate of missing data on self-reported psychopathology, particularly for those with schizophrenia, suggesting that bias cannot be excluded. Third, the majority of our sample was composed of patients with a chronic course of illness with probably a higher number of previous hospitalizations. However, since the health care system is open and allows personal choice of treatment, we unfortunately are not aware of the actual number and duration of previous hospitalizations. Therefore, in the current study, frequency of stays was restricted to admissions to our hospital only. Indeed, some patients may have had longer or more intensive treatment periods than others. Fourth, a major part of our study sample was comprised of patients with SUD while other diagnostic groups were rather small. However, this was based on a time-limited therapeutic intervention specifically for SUD, which leads to a higher patient turnover than in other diagnostic groups. Finally, a bias might arise from the patterns and amount of comorbid psychiatric disorders and/or other medical conditions, which were not taken into account in the current analysis.

4.5. Final comments

Contrary to initial expectations, the HoNOS and its subscales were not equally valid across different diagnostic groups (Wing et al., 1998). Within the constraints of our study, which have been mentioned, we can conclude that the HoNOS performed rather poorly in more severe and debilitating disorders. This weakness, however, has already been acknowledged in other studies (Andreas et al., 2011; Audin, 2001). Consequently, it might be problematic to apply the HoNOS as a stand-alone measure (Preston, 2000); (Goldney et al., 1998), especially if it has implications for quality control and financial decisions in mental health care (Speak et

al., 2015). Instead, it has been recommended to use the HoNOS as part of a comprehensive battery of instruments including diagnosis-specific measures (Hampson et al., 2011).

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Table 1.

Socio-demographic characteristics of the study sample and by diagnostic group

		Total sample N=1,719 (100.0%)	Substance use disorders N=1,079 (62.8%)	Psychotic disorders N=274 (15.9%)	Affective disorders N=160 (9.3%)	Anxiety and somatoform disorders N=66 (3.8%)	Personality disorders N=140 (8.1%)	Test (Chi-square or one-way ANOVA)
		N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	p-value
Female sex		606 (35.3)	306 (28.4)	110 (40.2)	81 (50.6)	31 (47.00)	78 (55.7)	<0.001
Age in years (M±SD)		43.8±11.8	46.6±11.0	38.8±12.0	44.1±10.7	38.4±9.8	34.8±10.6	<0.001
Marital status	Single	900 (52.4)	524 (48.6)	199 (72.6)	55 (34.4)	31 (47.0)	91 (65.0)	<0.001
	Married	312(18.2)	199 (18.5)	28 (10.2)	51 (31.9)	15 (22.7)	19 (13.6)	
	Separated/divorced	466 (27.1)	324 (30.1)	45 (16.4)	52 (32.5)	15 (22.7)	30 (21.4)	
	Widowed	40 (2.3)	31 (2.9)	2 (0.7)	2 (1.3)	5 (7.6)	0 (0.0)	
Education	not completed compulsory school	119 (6.9)	59 (5.5)	40 (14.6)	4 (2.5)	7 (10.6)	9 (6.4)	<0.001
	Compulsory school	270 (15.7)	125 (11.6)	59 (21.5)	35 (21.9)	13 (19.7)	38 (27.1)	

	Apprenticeship/technical college	933 (54.3)	640 (59.3)	97 (35.4)	82 (51.3)	36 (54.6)	78 (55.7)	
	Secondary school/ college/university	271 (15.8)	192 (17.8)	35 (12.8)	28 (17.5)	7 (10.6)	9 (6.4)	
	N/A	126 (7.3)	63 (5.8)	43 (15.7)	11 (6.9)	3 (4.6)	6 (4.3)	
Previous hospitalization to our institution	Frequency of hospital stays (M±SD)	2.2±4.1	2.3±2.4	2.9±7.1	1.0±1.8	1.1±1.7	1.9±3.7	<0.001

Note: M=mean; SD=standard deviation

Table 2.

Reliability and descriptive statistics of study measures for the total sample and stratified by diagnostic groups

	Cronbachs Alpha	Total	Substance use disorders (ICD-10 F1)	Psychotic disorders (ICD-10 F2)	Affective disorders (ICD-10 F3)	Anxiety and somatoform disorders (ICD-10 F4)	Personality disorders (ICD-10 F6)	P-value	Group comparisons
		M±SD	M±SD	M±SD	M±SD	M±SD	M±SD		
HoNOS-total	0.76	15.9 ±7.0	14.4±6.6	20.8±7.8	17.4±6.0	16.1±4.6	16.8 ±6.1	<0.001	F1<F2,F3,F6 F2>F3,F4,F6
HoNOS-behavioral	0.16	2.8±2.0	3.1±1.9	2.3±2.2	1.8±1.7	2.0±1.7	2.9±2.1	<0.001	F1>F2,F3,F4 F3,F4<F6
HoNOS-impairment	0.53	2.6±1.8	2.5±1.8	3.3±2.0	2.6±1.7	1.9±1.8	1.8±1.5	<0.001	F1,F2,F3>F6 F2>F1,F3,F4
HoNOS-symptom	0.50	4.7±2.4	3.6±1.9	7.2±2.5	6.4±2.1	5.7±1.5	5.3±1.9	<0.001	F1<F2,F3,F4,F6 F2>F3,F4,F6 F3>F6
HoNOS-social	0.76	6.1±3.7	5.2±3.5	9.0±3.9	7.1±3.0	6.5±2.8	7.3±2.9	<0.001	F1<F2,F3,F4,F6 F2>F3,F4,F6
BSI-GSI	0.97	52.4±37.5	43.5±32.0	50.6±36.5	71.5±45.5	72.3±40.7	81.1±35.4	<0.001	F1,F2<F3,F4,F6
GAF	-	39.2±11.2	41.1±11.4	33.8±9.7	36.7±9.9	39.8±11.3	37.9±8.6	<0.001	F1>F2,F3,F6 F2<F4,F6
CGI	-	5.2±0.9	5.1±0.9	5.8±0.9	5.3±0.8	5.3±0.9	5.4±0.8	<0.001	F1<F2,F3,F6 F2>F3,F4,F6
Mini-ICF	0.94	18.9±10.7	16.1±10.6	25.7±9.6	22.1±9.2	20.9±8.4	23.0±7.9	<0.001	F1<F2,F3,F4,F6 F2>F3,F4

Note: ICD-10=International Classification of Diseases, 10th Edition; HoNOS= Health of the Nations Outcome Scales; BSI-GSI=Brief Symptom Inventory-Global Severity Index; GAF=Global Assessment of Functioning; CGI=Clinical Global Impression; Mini-ICF=Mini International Classification of Functioning; M=mean; SD=standard deviation

Table 3.

Bivariate associations among HoNOS (total and subscales) and measures of psychopathology or functioning

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. HoNOS-total	-								
2. HoNOS-behavioral	0.54***	-							
3. HoNOS-impairment	0.62***	0.22***	-						
4. HoNOS-symptom	0.72***	0.13***	0.33***	-					
5. HoNOS-social	0.87***	0.30***	0.40***	0.55***	-				
6. BSI-GSI	0.18***	0.04	0.04	0.28***	0.13***	-			
7. GAF	-0.38***	-0.19***	-0.27***	-0.33***	-0.31***	-0.20***	-		
8. CGI	0.50***	0.24***	0.40***	0.44***	0.38***	0.13***	-0.44***	-	
9. Mini-ICF-APP	0.54***	0.20***	0.34***	0.44***	0.51***	0.13***	-0.21***	0.36***	-

Note: *** p<0.001; HoNOS= Health of the Nations Outcome Scales; BSI-GSI=Brief Symptom Inventory-Global Severity Index; GAF=Global Assessment of Functioning; CGI=Clinical Global Impression; Mini-ICF=Mini International Classification of Functioning.

Table 4.

Two-way ANOVA models with interactions for the effect of functioning or mental health and diagnostic group on the HoNOS

Outcome		Steps		F	df	p-value	R-square
HoNOS-total	Model 1a	1	Diagnostic group	20.97	4;1521	<0.001	0.231
			GAF	168.52	1;1521	<0.001	
		2	Diagnostic group*GAF	2.74	4;1517	**0.027**	0.236
	Model 1b	1	Diagnostic group	16.13	4;1521	<0.001	0.308
			CGI	358.34	1;1521	<0.001	
		2	Diagnostic group*CGI	1.33	4;1517	0.256	0.311
	Model 1c	1	Diagnostic group	11.38	4;1507	<0.001	0.338
			Mini-ICF	433.38	1;1507	<0.001	
		2	Diagnostic group*Mini-ICF	8.00	4;1503	**<0.001**	0.352
	Model 1d	1	Diagnostic group	11.75	4;804	<0.001	0.152
			BSI	17.73	1;804	<0.001	
		2	Diagnostic group*BSI	1.84	4;800	0.120	0.160
HoNOS-behavioral	Model 2a	1	Diagnostic group	34.18	4;1540	<0.001	0.157
			GAF	85.12	1;1540	<0.001	
		2	Diagnostic group*GAF	0.76	4;1536	0.550	0.159
	Model 2b	1	Diagnostic group	42.28	4;1540	<0.001	0.200
			CGI	164.89	1;1540	<0.001	
		2	Diagnostic group*CGI	7.78	4;1536	**<0.001**	0.213
	Model 2c	1	Diagnostic group	41.66	4;1524	<0.001	0.180
			Mini-ICF	132.39	1;1524	<0.001	
		2	Diagnostic group*Mini-ICF	0.47	4;1520	0.760	0.181
	Model 2d	1	Diagnostic group	15.01	4;815	<0.001	0.129
			BSI	5.53	1;815	0.019	
		2	Diagnostic group*BSI	0.77	4;811	0.546	0.132
HoNOS-impairment	Model 3a	1	Diagnostic group	10.85	4;1509	<0.001	0.183
			GAF	84.04	1;1509	<0.001	
		2	Diagnostic group*GAF	0.54	4;1505	0.706	0.184
	Model 3b	1	Diagnostic group	9.51	4;1509	<0.001	0.240
			CGI	204.30	1;1509	<0.001	
		2	Diagnostic group*CGI	2.20	4;1505	0.067	0.245
	Model 3c	1	Diagnostic group	11.11	4;1495	<0.001	0.237
			Mini-ICF	194.02	1;1495	<0.001	
		2	Diagnostic group*Mini-ICF	4.32	4;1491	**0.002**	0.246
	Model 3d	1	Diagnostic group	10.16	4;797	<0.001	0.165
			BSI	10.68	1;797	0.001	
		2	Diagnostic group*BSI	0.58	4;793	0.679	0.168

HoNOS-sympto m	Model 4a	1	Diagnostic group	130.49	4;1545	<0.001	0.374
			GAF	94.90	1;1545	<0.001	
		2	Diagnostic group*GAF	8.38	4;1541	**<0.001**	0.388
	Model 4b	1	Diagnostic group	121.54	4;1545	<0.001	0.420
			CGI	225.44	1;1545	<0.001	
		2	Diagnostic group*CGI	9.45	4;1541	**<0.001**	0.434
	Model 4c	1	Diagnostic group	109.06	4;1529	<0.001	0.398
			Mini-ICF	157.44	1;1529	<0.001	
		2	Diagnostic group*Mini-ICF	12.15	4;1525	**<0.001**	0.416
	Model 4d	1	Diagnostic group	68.61	4;818	<0.001	0.337
			BSI	36.12	1;818	<0.001	
		2	Diagnostic group*BSI	0.60	4;814	0.662	0.339
HoNOS-social	Model 5a	1	Diagnostic group	26.82	4;1381	<0.001	0.218
			GAF	85.65	1;1381	<0.001	
		2	Diagnostic group*GAF	1.08	4;1377	0.363	0.220
	Model 5b	1	Diagnostic group	24.93	4;1381	<0.001	0.249
			CGI	146.07	1;1381	<0.001	
		2	Diagnostic group*CGI	0.76	4;1377	0.550	0.250
	Model 5c	1	Diagnostic group	14.36	4;1369	<0.001	0.327
			Mini-ICF	318.30	1;1369	<0.001	
		2	Diagnostic group*Mini-ICF	3.28	4;1365	**0.011**	0.334
	Model 5d	1	Diagnostic group	11.78	4;737	<0.001	0.150
			BSI	2.07	1;737	0.151	
		2	Diagnostic group*BSI	2.33	4;733	0.055	0.161

Note: All models were adjusted for sex, age, education, marital status and frequency of previous hospitalizations; Health of the Nations Outcome Scales; BSI-GSI=Brief Symptom Inventory-Global Severity Index; GAF=Global Assessment of Functioning; CGI=Clinical Global Impression; Mini-ICF=Mini International Classification of Functioning; df=degrees of freedom; df may vary as a function of missing data

Table 5.

Simple effects (unstandardized coefficients) and simple contrasts of significant interactions

Outcome			Unstandardized coefficients ± SE [a]	p-value	Significant contrasts
HoNOS-total	Model 1a	F1 x GAF	-1.98±0.20	<0.001	F2 vs F4* F3 vs F4* F4 vs F6*
		F2 x GAF	-2.75±0.48	<0.001	
		F3 x GAF	-3.14±0.58	<0.001	
		F4 x GAF	-0.70±0.78	0.368	
		F6 x GAF	-3.27±0.73	<0.001	
	Model 1c	F1 x Mini-ICF	2.87±0.19	<0.001	F1 vs F2*** F2 vs F3* F2 vs F4* F2 vs F6*
		F2 x Mini-ICF	5.44±0.43	<0.001	
		F3 x Mini-ICF	3.99±0.59	<0.001	
		F4 x Mini-ICF	2.78±0.97	0.004	
		F6 x Mini-ICF	3.37±0.69	<0.001	
HoNOS-behavioral	Model 2b	F1 x CGI	0.74±0.06	<0.001	F1 vs F2*** F1 vs F3* F2 vs F6*** F3 vs F6** F4 vs F6*
		F2 x CGI	0.09±0.13	0.489	
		F3 x CGI	0.37±0.17	0.025	
		F4 x CGI	0.34±0.27	0.207	
		F6 x CGI	1.07±0.18	<0.001	
HoNOS-impairment	Model 2c	F1 x Mini-ICF	0.55±0.05	<0.001	F1 vs F2*** F2 vs F3** F2 vs F4* F2 vs F6*
		F2 x Mini-ICF	1.05±0.12	<0.001	
		F3 x Mini-ICF	0.44±0.16	0.006	
		F4 x Mini-ICF	0.47±0.27	0.077	
		F6 x Mini-ICF	0.52±0.19	0.006	
HoNOS-symptom	Model 4a	F1 x GAF	-0.36±0.06	<0.001	F1 vs F2*** F1 vs F3** F1 vs F6** F2 vs F4*** F3 vs F4** F4 vs F6**
		F2 x GAF	-1.05±0.15	<0.001	
		F3 x GAF	-0.90±0.18	<0.001	
		F4 x GAF	-0.03±0.24	0.915	
		F6 x GAF	-1.01±0.23	<0.001	
	Model 4b	F1 x CGI	0.60±0.06	<0.001	F1 vs F2*** F1 vs F3** F2 vs F4*** F3 vs F4**
		F2 x CGI	1.38±0.13	<0.001	
		F3 x CGI	1.18±0.17	<0.001	
		F4 x CGI	0.33±0.28	0.240	
		F6 x CGI	0.96±0.19	<0.001	
	Model 4c	F1 x Mini-	0.45±0.06	<0.001	F1 vs F2***

		ICF			F1 vs F3*** F2 vs F4* F2 vs F6**
		F2 x Mini-ICF	1.40±0.14	<0.001	
		F3 x Mini-ICF	1.18±0.19	<0.001	
		F4 x Mini-ICF	0.61±0.31	0.050	
		F6 x Mini-ICF	0.70±0.22	0.002	
HoNOS-social	Model 5c	F1 x Mini-ICF	1.40±0.10	<0.001	F1 vs F2***
		F2 x Mini-ICF	2.35±0.25	<0.001	
		F3 x Mini-ICF	1.65±0.33	<0.001	
		F4 x Mini-ICF	1.58±0.56	0.005	
		F6 x Mini-ICF	1.80±0.39	<0.001	

Note: All models were adjusted for sex, age, education, marital status and frequency of previous hospitalizations; *** p<0.001; ** p<0.01; * p<0.05; SE=Standard error; HoNOS=Health of the Nations Outcome Scales; GAF=Global Assessment of Functioning; CGI=Clinical Global Impression; Mini-ICF=Mini International Classification of Functioning; F1=Substance use disorders; F2=Schizophrenia and psychotic disorders; F3=Affective disorders; F4=Anxiety/somatoform disorders; F6=Personality disorders