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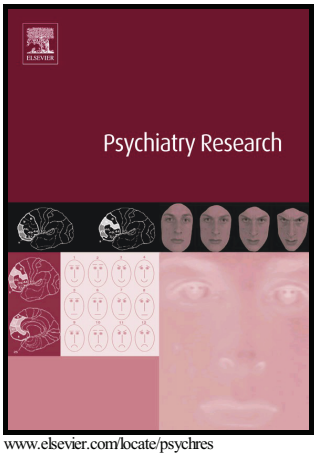

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Confirmatory factor analysis of a two scale model of the Health of the Nation Outcome Scales (HoNOS) across diagnostic categories.

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Abstract

The study examines the fit of a two factor model of the Health of the Nation Outcome scales for a large sample of patients referred to mental health services in England. The fit of the model for different diagnostic groups delineated by the English mental health cluster system is investigated. Overall the fit of the model is excellent at the supercluster level of psychotic disorders, organic disorders and good for non-psychotic disorders. It is, however, not as good at the cluster level.

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1. Introduction.

The Health of the Nation Outcome Scales (HoNOS) (Wing et al., 1998) have become a widely used outcome measure for mental health in Europe and Australasia. In recent years, the original four factor structure has been brought into question and other structures have been shown to be better (Speak et al., 2015; Speak and Muncer, 2016). It has been suggested that the validity of HoNOS differs between diagnostic groups (e.g. Muller et al., 2016) and this has also affected the various models of HoNOS.

Speak and Muncer (2016) conducted a confirmatory factor analysis on a large sample of 80,161 ratings taken at the point of referral to mental health services in England. They examined the fit of models on the total sample and also at samples differentiated by mental health cluster. The mental health clusters were developed in partnership between the Department of Health, the Royal College of Psychiatrists Centre for Advanced Learning and

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Conferences and the Care Pathways and Packages Project (CPPP) as a means of allocating clients to Care Clusters which in turn supports care planning and enables Mental Health Payment by Results (Department of Health, 2013). Clusters are also formed into three cluster superclasses with clusters 1-8 forming the non-psychosis clusters, 10-17 psychosis clusters, and 18-21 organic clusters; see Table 1 for further identification of individual clusters. It should be noted that so far there has been very little research on their reliability or validity but that they require the use of HoNOS.

Speak and Muncer (2016) also compared different factor structures at the level of cluster superclasses. They found that the fit statistics for the psychotic patient clusters were better than other patient groups, and the Speak et al, (2015) four factor model had consistently better fit than other models for 21 of the 24 patient groups. However, the fit statistics for cluster 14 (psychotic crisis) and 15 (severe psychotic depression) patient groups were poor. The fit statistics of the four factor model were mostly just acceptable or mediocre, with Root Mean Square Error of Approximation statistics that were between 0.07 and 0.1. In conclusion, they admitted that ”although superior to other factorial structures, the statistical fit was less than optimal for some clinical populations.(p.87)”

More recently Muncer and Speak (2016) used an item response theory approach with Mokken analysis on the same data to investigate other possible models of HoNOS. They proposed a Depression scale with items 2,7,8 and 9 and a Cognitive and Social Problems scale with items 4,9,10,11 and 12 as the best model.

In the current paper the two scale structure of HoNOS will be investigated on a different sample and more importantly it will be investigated at the cluster level to determine whether it offers any advantages over the four factor model. It is important to remember that the Mental Health Clusters were developed in partnership between the Department of Health, the Royal College of Psychiatrists Centre for Advanced Learning and Conferences and the Care Pathways and Packages Project (CPPP) as a means of allocating clients to Care

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Clusters which in turn supports care planning. It is, therefore, very important to check the structure of HoNOS across these groupings.

2. Method

2.1. Sample.

The sample were routinely collected 34,716 HoNOS ratings from adults at six NHS mental health service sites and have been described in more detail elsewhere (Speak, et al., 2015).

2.2. Confirmatory factor analysis

Confirmatory factor analysis was carried out using the Lavaan package in R (Rosseel, 2012). Diagonally weighted least squares estimation with correction to means and variances, was used as it is considered to be the best estimator for categorical data. Fit statistics were calculated for each super cluster and each cluster. We have presented the Comparative Fit Index (CFI), the Tucker Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA) as these have been given in previous HoNOS studies. Speak and Muncer (2016) used the criteria of > 0.95 as suggesting excellent fit for the TLI and CFI and less than 0.05 for the RMSEA. For good fit they suggested a CFI and TLI >0.90 and an RMSEA <0.08.

3. Results

The fit statistiscs for each cluster and supercluster are shown in Table 1. The fit for the three superclass clusters is good to excellent with the worst fit being for Superclass A. Furthermore, the upper limit of the confidence interval of the RMSEA is <.08 in all superclusters and all but four of the clusters. The ordinal alpha of the depression scale for superclass A, B and C were 0.62, 0.66 and 0.7, and for the Social Problems scale they were 0.7, 0.75 and 0.76 respectively. We also tested the model on all participants combined to find out if the model was invariant across groups. The overall fit of the model was

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acceptable (CFI = 0.98, RMSEA = 0.05); however, when the factor loadings were constrained to be equal across groups the fit was significantly worse (CFI = 0.93, RMSEA = 0.06, $\Delta X2(14) = 963.2$, $p < .001$)

4. Discussion

Although overall the two factor model is an improvement from some psychometric standpoints, it should be noted that it is a poorer fit to superclass A overall and not an excellent fit to cluster 1 (common mental health problems). It is notable that it shares some of the problems with fit of the four factor model. Both models were a poor fit to clusters 14 and 15 (psychotic crisis and severe psychotic depression) and the two factor model is also a poor fit to cluster 17 (psychosis and affective disorder-difficult to engage).

There have now been several studies exploring the structure of HoNOS which have used large samples and appropriate statistical measures. While there have been differences in results and some changes into the proposed factor structure, there are some similarities. It would be impossible to argue, for example, that HoNOS consists of twelve independent scales that measure separable dimensions. It is also clear that not all items are measuring the same dimension so there is little support for the use of an aggregated measure of HoNOS. It is notable that the Cronbach's alpha of some of the proposed subscales are relatively unimpressive at less than .7.

Recent research (Luo et al, 2016) has also questioned the test retest reliability of HoNOS by finding a correlation of 0.023 between total HoNOS scores at discharge and at community intake taken within 14 days. Luo et al, (2016) also looked at the correlations for the Speak et al (2015) four factor model, and although the correlations were higher, they still ranged between.09 to .31. It seems fair to assume that even if the test-retest reliabilities of our two factor version are better than these, they will still be some way from acceptability. It should be noted, however, that it has been argued that concepts such as predictive validity may be more important than internal validity in relation to the use of HoNOS (Golay, et al., 2016).

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In conclusion, there is evidence that the two factor solution to the structure of HoNOS is better than other proposals. However, there is little support for HoNOS as a reliable, robust measure that can be applied widely to the measurement of mental health outcome. In our view, it would be better to recognize these limitations and try to develop a better instrument or as Muller et al. (2016), suggest to use HoNOS only as part of a comprehensive battery of instruments.

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Table 1: Fit statistics for the nine item two factor model of the Health of the Nation Outcome Scales.

Cluster		CFI	Tucker Lewis	RMSEA	Upper RMSEA
Superclass A	Non psychotic disorders	0.98	0.95	0.06	0.063
Superclass B	Psychotic disorders	0.99	0.98	0.05	0.052
Superclass C	Organic disorders	0.99	0.99	0.04	0.041
1 Common mental health (low severity)		0.92	0.86	0.07	0.077
2 Common mental health (low severity/greater need)		0.97	0.94	0.07	0.075
3 Non psychotic (moderate)		0.96	0.93	0.06	0.066
4 Non psychotic (severe)		0.95	0.90	0.07	0.074
5 Non psychotic (very severe)		0.97	0.95	0.06	0.076
6 Non psychotic disorder of overvalued ideas		1	1	0	0.031
7 Enduring non psychotic (high disability)		0.98	0.97	0.05	0.065
8 Non psychotic chaotic and challenging disorders		0.98	0.97	0.05	0.062
10 First episode psychosis		0.98	0.97	0.06	0.068
11 Ongoing/Recurrent psychosis (low symptoms)		0.99	0.98	0.04	0.044
12 Ongoing/Recurrent psychosis (high disability)		0.98	0.97	0.04	0.051
13 Ongoing/Recurrent psychosis (high symptom & disability		0.98	0.97	0.05	0.060

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14 Psychotic crisis	0.96	0.93	0.07	0.086
15 Severe psychotic depression	0.92	0.85	0.08	0.106
16 Psychosis & affective disorder (high substance misuse/engagement)	0.99	0.97	0.05	0.068
17 Psychosis and affective disorder (difficult to engage)	0.93	0.87	0.11	0.116
18 Cognitive impairment (low need)	0.96	0.93	0.04	0.051
19 Cognitive impairment/dementia (moderate need)	0.98	0.96	0.04	0.046
20 Cognitive impairment/dementia (high need)	0.98	0.96	0.05	0.060
21 Cognitive impairment/dementia (high physical/engagement)	0.97	0.94	0.06	0.083

Highlights

1. A two factor model of HoNOS is tested on a large sample of mental health referrals
2. Although it is a better model overall than previous models it still has problems
3. It is not a very good fit to less serious mental health problems and also poor with some psychotic classifications

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