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An investigation into the psychometric properties of the CORE-OM in patients with eating disorders

Abstract

Aim: The current study aimed to explore the psychometric properties of the CORE-OM (Clinical Outcomes in Routine Evaluation – Outcome Measure) when used in an eating disorder sample. **Method**: The CORE-OM was administered at assessment to 360 consecutive referrals to an eating disorders service. Principal component analysis was conducted to look at the psychometric structure of the CORE-OM, and psychometric properties were investigated using analyses of reliability and validity. **Results**: Analyses of the psychometric structure suggested a three-component solution reflecting negatively worded, positively worded and risk items. The CORE-OM showed good acceptability, acceptable internal and test-retest reliabilities, as well as good convergent and known groups validity. **Conclusions**: The results of the current study support the CORE-OM as a reliable and valid measure for assessing psychological distress in eating disorders.

Keywords:

Outcome Measure; CORE-OM; Eating Disorders; Validation

The Clinical Outcomes in Routine Evaluation Outcome Measure (CORE-OM; Barkham et al., 2001; Evans et al., 2002) is a self-report questionnaire designed to measure general psychological distress, including an assessment of risk, in those presenting for psychological therapy. It can be used to assess differences between individuals in terms of their level of distress, and can also be used as a measure of individual change over time, and hence clinical effectiveness. The CORE-OM consists of 34 items covering the following four dimensions: subjective well-being; problems; functioning; and risk. Psychometric validation studies have reported good reliability ratings, with internal consistency for the subscales ranging from 0.75-0.94 (Evans et al., 2002; Barkham et al., 2005a). Acceptability of the measure has also been reported as good, with high completion rates; 80-90% of individuals complete the measure, with around 98% of questionnaires providing sufficient data for analysis (e.g., Barkham et al., 2005a). In terms of the structure of the measure, a four-subscale scoring matrix was originally proposed (Barkham et al., 2001; see also Uji, Sakamoto, Adachi, & Kitamura, 2012), and a three-component model has also been suggested (Evans et al., 2002). In a large study (N = 2,140) testing a number of hypothesised models, a two-component solution, assessing risk and psychological distress, was identified as having a good fit with the data (Lyne, Barrett, Evans, & Barkham, 2006).

To date, the CORE-OM has been used as an effective measure in a wide range of settings, including primary and secondary NHS services, as well as within occupational health, school, and university settings (e.g., Barkham et al., 2005a; Barkham et al., 2006; Killips, Cooper, Freire, & McGinnis, 2012; see also http://www.coreims.co.uk/Downloads_References.html for a list of studies). Research also suggests that the CORE-OM is acceptable to clients engaged in psychological therapy

(Barkham et al., 2005b; Cahill et al., 2006), and thus it has become a widely used outcome measure in mental health settings across the UK (Bedford et al., 2010). It has 'copyleft' status, meaning that it is free to use for not-for-profit purposes, and therefore has benefit in assessment and outcome measurement in a nationalised health service (e.g., Bewick, Trusler, Mullin, Grant, & Mothersole, 2006). It is a brief measure that can provide standardised responses across a range of treatments and conditions, designed to replace the wide number of different outcome measures that are often used. The provision for the assessment of risk gives clinical indicators for clinicians to explore further.

The assessment of functional impairment and global distress in eating disorders (EDs) is growing in importance as a key assessment and outcome measure (Jenkins, Hoste, Meyer, & Blissett, 2011). However, whilst a range of measures have been developed to assess ED pathology (e.g., EDE-Q, Fairburn & Beglin, 1994), and functional impairment secondary to ED symptoms (e.g., CIA; Bohn & Fairburn, 2008), there exist few measures assessing general psychological distress that have been validated for use in eating disorders. It is possible that the CORE-OM might represent a useful measure of psychological distress in this patient group that not only complements existing symptom-specific measures, but also provides a useful measure of clinical effectiveness.

The CORE-OM has been previously used in treatment studies of EDs (e.g., Traviss, Heywood-Everett, & Hill, 2011) and an association between eating disorder severity and impairment (as reported on the CORE-OM) has been found for individuals with EDs (e.g., Barkham et al., 2005a; Wright, Bewick, Barkham, House, & Hill, 2009). Other studies (e.g., Hoffart, Lysebo, Sommerfeldt, & Rø, 2010; Traviss et al., 2011;

Simpson & Slowey, 2011) have used the CORE-OM, or a subset of items derived from the measure, to assess outcome. However, despite recent use of the CORE-OM as a marker of impairment in some recent studies of eating disorders, it is not yet known whether this is a reliable and valid measure for use within the eating disorders field. In light of the unique nature of the impairment caused by the central characteristics of the disorder (Bohn et al., 2008) it is possible that patients with ED might demonstrate markedly higher or lower internal consistency and a different pattern of results from exploratory component analysis compared with other samples (e.g., Evans et al., 2002; Lyne et al., 2006) and this possibility will be explored by investigating whether the CORE-OM demonstrates similar psychometric properties in an ED sample compared to other clinical samples. The paper also aims to look at the acceptability of the CORE-OM, as well as provide estimates of internal reliability, test re-test reliability, convergent validity and known groups validity. Furthermore, variations associated with gender and ED diagnosis will also be investigated.

Method

Participants and Procedure

Participants were 360 referrals to a specialist adult community ED service over a three-year period. As part of routine clinical care, patients attending an initial assessment appointment at the ED service are asked to complete a number of self-report questionnaires, including those used in the present study. In addition, the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993) is administered by clinicians trained in its use. The protocol was reviewed by the local NHS Trust Research and

Development Team and was deemed to constitute an audit of the measures routinely used in clinical practice.

Measures

Sociodemographic Information

Information related to age, gender, and ethnicity was obtained from a demographic questionnaire routinely given to patients as part of their assessment.

The Clinical Outcomes in Routine Evaluation Outcome Measure (CORE-OM; Barkham et al., 2001)

The CORE-OM is a self-report measure of overall functioning, comprised of 34 items relating to symptoms experienced over the last week rated on a 5-point frequency scale ranging from 0 ('not at all') to 4 ('most or all of the time'), with higher scores indicating more problems. The CORE-OM also has subscales (domains) of *subjective well-being* (4 items), *problems* (12 items), and *functioning* (12 items), as well as a further domain assessing *risk* (6 items). Total and domain scores are calculated by summing scores of all those items that were completed, and dividing by the number of items completed. A *total minus risk* score can also be generated by summing the means of the domain scores (excluding *risk*), also labelled 'psychological distress' (Lyne et al., 2006). Following the suggestions of Evans et al. (2002), domain scores were pro-rated where only one item was missing. If more than three items of the total (i.e., of 34 items) had been omitted by a participant on the measure, scores were not pro-rated, designated as 'incomplete,' and excluded from subsequent analysis. Using this method, acceptability of the measure is generally high. Reported reliability ratings are generally good (see

above), with a number of validation studies supporting use of the CORE-OM in its original language, and also translated versions (e.g., Elfström et al., in press).

The Eating Disorder Examination (EDE; Fairburn & Cooper, 1993)

The EDE is an investigator-led interview widely used in the assessment of eating disorder psychopathology. The EDE generates the following four subscales: Dietary Restraint; Weight Concern; Shape Concern; and Eating Concern. Subscale ratings consist of frequency scores (0-6) and severity scores (0-6). The EDE also gathers information relating to the frequency of key eating disorder behaviours (e.g., binge eating, self-induced vomiting, laxative misuse, and driven exercise) and can be used to generate operationally defined DSM-IV eating disorder diagnoses. This interview has been refined over the years in order to improve its reliability and validity, with psychometric properties assessed in a number of studies. Alpha coefficients for subscale scores have been reported as ranging from .97 and .99 (Wilson & Smith, 1989). The EDE also has good discriminant (Wilson & Smith, 1989) and concurrent validity (Rosen, Vara, Wendt, & Leitenberg, 1990). It is widely regarded as the diagnostic 'gold standard' in eating disorders research and is suitable for use in community and clinical populations. The most up-to-date version of this instrument, EDE 16.0, is used by the service. As part of the EDE, weight was measured to the nearest 0.1kg using digital scales that were calibrated every 6 months and height was measured to the nearest centimeter using a stadiometer. These measurements were used to calculate Body Mass Index (BMI; weight (kgs) / height $(m)^2$). Cronbach's α for the Global EDE score was 0.85.

The Clinical Impairment Assessment (CIA; Bohn & Fairburn, 2008)

The CIA is a 16-item self-report measure of functional impairment occurring secondarily to eating disorder symptoms. Higher scores denote greater functional impairment, with items rated on how much they have interfered with functioning over the last 28 days on a scale of 0 ("Not at all") to 3 ("A lot"). Subscale scores can be computed, and an overall total score can be calculated (used in the current study) by summing the scores on all items (i.e., maximum total = 48). Preliminary studies support the psychometric properties of the CIA for assessing impairment resulting from ED symptoms (e.g., Bohn et al., 2008). Cronbach's α for the CIA Total score was 0.91.

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-item self report measure that can generate subscales giving an index of depression (HADS-D) and anxiety (HADS-A) symptoms over the past week. Responses are provided on a 4-point (0-3) scale, providing a possible total score of 21 for each subscale. It is widely used with good internal reliability (Crawford, Henry, Crombie, & Taylor, 2001) as well as good test-retest reliability (Spinhoven et al., 1997), and its use has been supported in a number of different samples (e.g., Bjelland, Dahl, Haug, & Neckelmann, 2002; Mykletun, Stordal, & Dahl, 2001; Snaith, 2003).

Data screening and Statistical Analysis

Prior to analysis, responses on all questionnaires were tabulated, and then descriptive statistics used to identify extreme values which may indicate data entry errors. Principal component analysis was carried out to investigate the psychometric structure of the CORE-OM, retaining items that loaded above .4 as this is often considered

suitable (Sheffield & Lemétayer, in press; Stevens, 2002). Subscale and total scores for the CORE-OM were non-normally distributed (Shapiro-Wilk *p*s < .05), and therefore nonparametric tests were used where possible (Evans et al., 2002). Cronbach's α was employed as an estimate of internal consistency reliability. Test-retest reliabilities were computed on a subset of participants who started treatment following assessment who had been waiting between 1-12 weeks (*n* = 33). Where possible, estimates of confidence intervals (CIs) for mean differences are provided to reflect a more meaningful interpretation of group comparisons. Given that the data were largely non-normally distributed, parametric CIs are reported although it should be cautioned that this violates the assumption of normality; however, it is unlikely that this will have caused the CIs to be very misleading. Analyses were conducted using SPSS version 19.0.

Results

Sample characteristics

Mean age was 27.6 years (SD = 9.4, range = 17 – 67, median = 25.0, 95% CIs 26.5 – 28.6) and 338 (93.9%) were female. Mean body mass index (BMI) was 21.8kg/m^2 (SD = 6.6, range = 12.0 – 61.9, median = 20.0, 95% CIs = 21.1 – 22.6). Two hundred and ninety one individuals described themselves as 'White British' (92.7%), four (1.3%) as 'White Irish', seven (2.2%) as 'White – Other', three (1.0%) as 'Asian/British', two (0.6%) as 'Black/British', one (0.3%) as 'Mixed heritage – White and Asian', and two (0.6%) as 'Mixed heritage – Other', and one individual (0.3%) indicated 'Any Other' Ethnic group. Forty-nine (13.6%) did not provide data on their ethnicity. 332 (92.2%) individuals were diagnosed with a clinical eating disorder; 28 (7.8%) did not have an

ED of clinical severity. Of those with an ED, 63 (19.0%) received a diagnosis of anorexia nervosa (AN), 120 (36.1%) were diagnosed with bulimia nervosa (BN), and 149 (44.9%) as eating disorder not otherwise specified (EDNOS), using DSM-IV criteria (APA, 2000). Mean BMI for those in the AN group was 16.8, for those in the BN group 24.3, and for those in the EDNOS group 22.1.

Gender differences in scores

Results of Mann-Witney *U* tests showed no statistically significant difference by gender of any of the scales of the CORE-OM (*p*s > .05). Group means and 95% confidence intervals (CIs) are reported in Table 1.

Insert Table 1

Diagnostic differences in scores

Results of Kruskal-Wallis tests showed no significant difference between CORE scores by ED diagnosis (*p*s > .417).

Acceptability

The most frequently missed items on the CORE-OM were Item 33 ('I have felt humiliated or shamed by other people') and 21 ('I have been able to do most things I needed to'), with a total of 6 omissions each (1.7%). There was also a clustering of missing data towards the end of the measure, suggesting that some people tend to fill in only page 1 (the measure is 2-sided). The overall item omission rate in this sample was 0.77% (95% CI = 0.73 – 0.82%) and completion rates were fairly high, with 97.5% of respondents providing sufficient data (after pro-rating) to allow scoring.

Determining the optimal psychometric structure

Kaiser-Meyer-Olkin Measure of Sampling Adequacy was high (.94) and Bartlett's test of sphericity was significant ($p < .001$). Principal component analysis (PCA) was conducted using pairwise deletion for missing data and oblique (Promax) rotation as items were hypothesised to correlate. These analyses were carried out on individuals who fulfilled the criteria for pro-rating (see above). Following inspection of the scree plot, it was decided that a 3-component solution was the most appropriate, which explained 45% of the variance (see Figure 1).

Insert Figure 1

Item loadings for the final 3-component solution are presented in Table 2.

Insert Table 2

Internal Structure

Cronbach's αs for the CORE-OM subscale scores demonstrated acceptable internal reliability (see Table 3). Regarding inter-item correlations, which also offer a measure of internal structure, Clark and Watson (1995) suggest that the average correlations should be 0.15-0.50. The only inter-item correlations falling outside of this range were for Items 6 ('I have been physically violent to others'; average inter-item correlation = 0.05) and 22 ('I have threatened or intimidated another person'; average correlation = 0.09).

Insert Table 3

Test-retest Reliability

Using a subset of patients who had been waiting between 1-12 weeks (n = 33), Spearman's r indicated that scores on the CORE-OM were stable across time; well-being = .67; problems = .87; functioning = .77; risk = .84; total minus risk = .85; total = .88 (all ps < .01).

Convergent Validity

Significant associations were found between the CORE-OM and measures of symptom severity. CORE-OM subscales were significantly correlated with the EDE Global score (see Table 4). Convergent validity was demonstrated with strong correlations between the CORE-OM and measures of depression, anxiety, and functional impairment (see Table 4), measures which are conceptually similar to the CORE-OM, suggestive of convergent validity.

Insert Table 4

Known Groups Validity

Mann Whitney U tests were used to assess whether the CORE-OM subscale scores could discriminate between those who had a clinical ED (n = 332), and those who did not (n = 28). Results (see Table 5) indicated that all subscale scores were significantly higher in the ED group compared with the non-ED group (ps < .05).

Insert Table 5

Discussion

This study aimed to explore the psychometric structure and properties of the CORE-OM when used in an ED sample. The present study found that a three-component structure emerged from PCA. Whilst similar findings are reported by Evans et al. (2002), who reported psychometric properties in a sample of outpatients referred for psychological therapy and a further non-clinical sample, it is worth considering that broad measures of psychological distress, such as the CORE-OM, are seldom designed to produce replicable component matrices. The only item in the current study that did not uniformly load onto one dimension was item 33, which was split between Components 1 (negatively worded) and 3 (risk). The internal structure of the subscales of the CORE-OM was generally good, with good internal consistency and acceptable inter-item correlations. However, the items that fell outside of the suggested range for inter-item correlations (see Clark & Watson, 1995) concerned items regarding violence to other people, which may be a reflection of the low prevalence of these behaviours in ED samples; these results are therefore more likely to be an artefact of the relative infrequency of these traits. The results of the present study may suggest some item redundancy (see also Bedford et al., 2010). Given that a number of variations on the battery of CORE measures exist (e.g., see Barkham et al., 2006; see also Barkham et al., 2010, which includes a discussion of the CORE-10 and CORE-5), future studies might consider whether alternative versions of the CORE-OM are as useful as the 34-item version described here.

The results indicate that the CORE-OM demonstrates good psychometric properties when used in an ED sample, with psychometric data similar to existing studies on other clinical samples (e.g., Evans et al., 2002). Although the proportion of

men in the current study was small, data from these individuals was included to provide a sample that was representative of individuals seen in a typical ED service; these results should therefore be treated cautiously in terms of their applicability to males with EDs. In line with previous findings (Barkham et al., 2005a), the results suggest that the CORE-OM is psychometrically robust and useful in a specialist ED setting. It discriminates between those with an ED and those without, and demonstrates good internal consistency. It correlates well with a measure of ED symptoms, an ED-specific measure of functional impairment and measures of general psychiatric symptoms (see also Barkham et al., 2001). Missing item analysis also supported its use, with very few individuals in the current study providing insufficient responses. Comparison of scores with data from a student counselling service (Connell, Barkham, & Mellor-Clark, 2007), who might be considered a less severely impaired sample, suggested that those with EDs scored higher on the CORE-OM subscales.

Test-retest reliability of the measure appeared good and comparable to previous studies (e.g., Evans et al., 2002), although the current study only used a subset of data. Further work might seek to replicate this in a larger sample taken at one point in time. As the data used in the current study was taken primarily from the initial assessment, the results are not necessarily generalisable to other points in treatment (e.g., follow-up), although existing studies suggest that the CORE-OM is stable and sensitive to change over time (Evans et al., 2002). Further studies might look at the responsiveness of the CORE-OM to change in eating disorder symptoms over time (e.g., following treatment). The findings of the present study broadly support the use of the CORE-OM with ED patients. As such, this measure might form a useful addition to existing measures that are either symptom-specific or concerned with symptom-related functional impairment.

More specifically, the CORE-OM might constitute a useful measure of psychological distress that can be used to explore differences between ED sub-groups, as well evaluate clinical change over time, although future studies may look at change during treatment to confirm this. It is possible that the CORE-OM might also be usefully used to compare outcomes across service settings. The preliminary findings reported here suggest that the CORE-OM can reflect differences between groups (e.g., on diagnosis), although this area warrants further investigation.

The findings of the current study provide preliminary evidence for the acceptability, reliability, and validity of the CORE-OM, suggesting that it may be constitute a useful instrument for assessing general distress and risk in eating disorders. Future research might usefully seek to replicate and extend the current findings, particularly in relation to further assessment of test re-test reliability and the measure's ability to detect clinical change over time.

Competing interests: none

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Table 1. Gender comparison in the sample on the CORE-OM subscales

CORE-OM subscale	Women (*n* = 329-332)	Men (*n* = 22)	Mean difference	95% CIs	*P*
Well-being	2.66	2.52	0.14	-0.29, 0.57	0.508
Problems	2.42	2.44	-.017	-0.47, 0.44	0.937
Functioning	2.09	2.11	-.021	-0.40, 0.36	0.907
Risk	0.68	0.92	-0.23	-0.65, 0.18	0.254
Total	1.99	2.10	-0.11	-.040, 0.38	0.554
Total minus risk	2.30	2.31	0.01	-0.39, 0.39	0.996

Table 2. Pattern matrix for the current sample

Item	Description	Domain	Component		
			1	2	3
1	I have felt terribly alone and isolated	F	**.530**	.258	.016
2	I have felt tense, anxious, or nervous	P	**.719**	-.076	-.160
3	I have felt I have someone to turn to for support when needed	F	-.393	**.779**	.165
4	I have felt OK about myself	W	.233	**.554**	-.046
5	I have felt totally lacking in energy and enthusiasm	P	**.546**	.126	-.215
6	I have been physically violent to others	R	-.257	-.156	**.727**
7	I have felt able to cope when things go wrong	F	.306	**.406**	-.033
8	I have been troubled by aches, pains or other physical problems	P	**.685**	-.246	-.107
9	I have thought of hurting myself	R	.152	.239	**.527**
10	Talking to people has felt too much for me	F	**.496**	.123	.099
11	Tension and anxiety have prevented me doing important things	P	**.658**	.010	.067
12	I have been happy with the things I have done	F	.033	**.794**	-.203
13	I have been disturbed by unwanted thoughts and feelings	P	**.680**	-.109	.074
14	I have felt like crying	W	**.646**	.067	-.044
15	I have felt panic or terror	P	**.754**	-.279	-.049
16	I made plans to end my life	R	.095	.152	**.503**

17	I have felt overwhelmed by my problems	W	**.747**	.042	-.011
18	I have had difficulty getting to sleep or staying asleep	P	**.639**	-.060	-.052
19	I have felt warmth or affection for someone	F	-.371	**.743**	.094
20	My problems have been impossible to put to one side	P	**.838**	-.069	-.144
21	I have been able to do most things I needed to	F	.125	**.486**	-.023
22	I have threatened or intimidated another person	R	-.169	-.171	**.709**
23	I have felt despairing or hopeless	P	**.664**	.154	.098
24	I have thought it would be better if I were dead	R	.213	.231	**.506**
25	I have felt criticised by other people	F	**.384**	.122	.181
26	I have thought I have no friends	F	.119	**.333**	.273
27	I have felt unhappy	P	**.576**	.316	-.022
28	Unwanted images or memories have been distressing me	P	**.623**	-.150	.171
29	I have been irritable when with other people	F	**.525**	-.002	.152
30	I have thought I am to blame for my problems and difficulties	P	**.534**	.123	-.039
31	I have felt optimistic about my future	W	.058	**.779**	-.218
32	I have achieved the things I wanted to	F	-.001	**.774**	-.178
33	I have felt humiliated or shamed by other people	F	**.374**	-.010	**.343**
34	I have hurt myself physically or taken dangerous risks with my health	R	.244	-.071	**.548**

Table 3. Internal consistency of the CORE-OM subscales (*n* = 353-357)

Subscale	Mean (SD)	Cronbach's α
Well-being	2.65 (0.89)	.75
Problems	2.41 (0.86)	.87
Functioning	2.09 (0.78)	.85
Risk	0.70 (0.77)	.77
Total	2.03 (0.78)	.94
Total minus Risk	2.31 (0.76)	.93

Table 4. Spearman's correlations (*r*) with measures in the current sample

		Measure			
CORE Subscale	*n*	EDE Global	CIA Total	HADS-D	HADS-A
Well-being	343	.47	.63	.57	.49
Problems	344	.51	.69	.62	.63
Functioning	342	.47	.62	.66	.52
Total	341	.53	.68	.67	.59
Total minus risk	342	.53	.69	.67	.60
Risk	344	.39	.49	.53	.43

Note: All significant at $p < .01$

Table 5. Diagnostic comparison (diagnosis of an ED vs. no diagnosis) on the CORE-OM subscales

CORE-OM subscale	ED (*n* = 324-326)	Non-ED (*n* = 28)	Mean Difference	95% CIs	*P*
Well-being	2.70	2.15	-0.55	-0.97, -0.12	.010
Problems	2.47	1.88	-0.58	-0.98, -0.19	.003
Functioning	2.12	1.74	-0.38	-0.72, -0.05	.016
Risk	0.73	0.26	-0.47	-0.71, -0.24	<.001
Total	2.05	1.10	-0.96	-1.54, -0.38	.003
Total minus risk	2.35	1.87	-0.49	-0.84, -0.14	.004

Figure 1. Scree plot for the sample