Factor Structure and Response Bias of the Obsessive-Compulsive Inventory-Revised (OCI-R) in a Female Undergraduate Sample from New Zealand

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As self-report measures of clinical constructs are increasingly administered to student populations, it is important that the psychometric properties of such measures are investigated. Additionally, the response bias intrinsic in self-report responses requires further understanding. The factor structure and response bias of the Obsessive-Compulsive Inventory-Revised (OCI-R) is investigated in a subclinical sample of 282 female students from New Zealand. The present study adds to previous research by using not only standard confirmatory factor analysis but also hierarchical confirmatory factor analysis, in parallel with an investigation of response bias. The six-factor model provided the most appropriate fit to the data, with a single latent factor driving the six differential factors. Further support is provided for strong internal reliability of the OCI-R. Overall, subscales of the OCI-R were robustly unrelated to the response bias of impression management.

As research on Obsessive-Compulsive Disorder (OCD) continues to diversify, subclinical (particularly student) samples are being drawn on more frequently to inform our knowledge of this pathology. It has been found that subclinical OCD exhibits very similar, albeit lessened, symptoms to that of clinical OCD (Gibbs, 1996). Self-report measures provide a fast and convenient data collection method, and are therefore particularly useful in subclinical research. It is however important that the psychometric properties of employed measures are understood in this population, so that we can be confident of the validity of findings from this more readily accessible group. The aim of this study was to evaluate the psychometric properties and structure of a common measure of OCD.

Obsessive-Compulsive Disorder is diagnostically characterised by the presence of obsessions such as pathological fear of harm associated with germs and contamination or violation of rules of symmetry, and of compulsive behaviours and mental acts that may include excessive washing or touching, checking and ordering (e.g., APA, 2000), and affects up to 3% of the population (Weissman, Bland, Canino, Greenwald, Hwu, & Lee, 1994). At the same time, OCD-like characteristics are also relatively common among the general population, meaning that individuals may display some (but not all) potentially debilitating symptoms characteristic of OCD without meeting the full criteria for a diagnosis of clinical OCD (see Gibbs, 1996, for a detailed review of research on OCD in nonclinical populations). Gibbs (1996) noted that a significant minority of the general population might be considered to display subclinical OCD, and that people who do so tend also to show elevated levels of anxiety and depression relative to normal controls (but lower than clinical OCD controls), as well as using qualitatively similar strategies for dealing with obsessive-compulsive symptoms. At the same time, an important difference in the symptom profile was the relative rarity of co-occurring obsessive *and* compulsive symptoms in comparison with samples with a diagnosis of clinical OCD (Gibbs, 1996). It has been argued that being able to identify such examples of subclinical OCD would allow early identification of those who might go on to develop full-blown OCD, and at the very least to treat symptoms even in those who do not (e.g., Morris, Morris, Blashfield, Rankupalli, Bradley, & Goodman, 1996/97; Zucker, Craske, Blackmore, & Nitz, 2006).

The Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002) is an 18-item self-report measure designed to assess six subtypes of OCD; Checking, Washing, Hoarding, Obsessing, Cleaning, and Neutralising. The OCI-R was developed from the original 42-item Obsessive-Compulsive Inventory (OCI; Foa, Kozak, Salkovskis, Coles, & Amir, 1998) by way of exploratory factor analysis (Foa et al., 2002). The OCI-R improves on the OCI by eliminating the seemingly redundant 'frequency scale', and discarding 24 items. Not only does this make the questionnaire significantly shorter, but cross loadings on multiple factors are eliminated, and an equal number of items in each subscale (three) simplifies scoring.

Foa et al. (2002) found good to excellent internal reliability ($\alpha > 0.70$)

among a non-anxious control group (NAC) of 74 undergraduate psychology students for both the total OCI-R score and all subscales but Neutralising (α = 0.34). In a more comprehensive study of subclinical OCI-R psychometrics, the same group (Hajcak, Huppert, Simons, & Foa, 2004) also found good to excellent internal reliability, again for all subscales except for Neutralising (α = 0.61) in a majority Caucasian college sample of 395 students. Test-retest reliability and convergent/divergent validity were found to be good to excellent. Hajcak et al. also reported evidence for the six-factor model of the OCI-R using confirmatory factor analysis. The OCI-R has been further validated in both clinical and subclinical populations (Abramowitz & Deacon, 2006; Huppert et al., 2007), as have French, Spanish and Icelandic versions of the instrument (Fullana, Tortella-Feliu, Caseras, Andion, Torrubia, & Mataix-Cols, 2005; Smari, Olason, Eythorsdottir, & Frolunde, 2007; Zermatten, Van der Linden, Jermann, & Ceschi, 2006). Validation of the psychometric properties of the OCI-R in a New Zealand population is a timely addition to this otherwise North American and European evidence base.

With the use of self-report scales, the possibility of participant response biases is an important consideration (Paulhus, 1991). Without a clinical interviewer to mediate between participant response and item rating, participants have more possibility to modify their responses in a socially desirable manner; for example by minimising or inflating aspects of their personality. Therefore a secondary aim of this study was to investigate whether the OCI-R is influenced by socially desirable responding.

Factorial analysis of various measures of social desirability administered simultaneously (e.g., Jackson & Messick, 1962; Paulhus, 1984) have suggested that these measures may in fact tap two separate components; self-deceptive enhancement (SDE: the honest, but overly optimistic endorsement of oneself) and impression management (IM: deliberately responding in a self-enhancing manner). This distinction has important implications for assessment and control of social desirability because (a) SDE has been shown to be consistently related to measures of wellbeing and self-esteem, and therefore should not be controlled (Paulhus, 1984), and (b) deliberate self-enhancement (IM) can serve to inflate self-report scores, and is therefore a primary concern for researchers. The Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1984) measures these aspects of response bias separately. As no study has investigated the effects of socially desirable responding on the OCI-R, the BIDR will be employed in the current study to assess IM as a potential issue for this increasingly popular measure.

Therefore the present study aims to further validate the psychometric properties of the OCI-R in a New Zealand undergraduate population, and secondarily to investigate the relationship between response bias and the OCI-R.

Method

Participants

Participants were 282 female undergraduate psychology students from Victoria University of Wellington, between the ages of 17 and 23 (M=18.71, SD=1.34). The majority of the sample were New Zealand European/Pakeha (74.5%), with Asian (12.5%) and Maori/Pacific Islands (5.7%) groups also represented. Fifty-nine participants (20.9%) scored higher than one standard deviation from the non-anxious control mean score as given by Foa et al. (2002), therefore placing them above Foa et al.'s NAC norm.

Measures

Obsessive-Compulsive Inventory-Revised (Foa et al., 2002) - The OCI-R is an 18-item unipolar self-report scale, where responses are measured on a Likert scale from 0 (*Not at all*) to 4 (*Extremely*). The OCI-R has exhibited good to excellent internal reliability among non-anxious control participants for all subscales but Neutralising (total scale α = 0.88; Hajcak et al., 2004). Hajcak et al. provide strong support for good test-retest reliability (r = .70), and convergent and divergent validity of the OCI-R in a college sample. Item examples include "*I check things more often than necessary*" and "*I feel I have to repeat certain numbers*".

Balanced Inventory of Desirable Responding (Paulhus, 1984) - The BIDR is a 40-item self-report measure where items are rated from 0 (*not true*) to 6 (*very true*). Half of the items are reverse-scored. The BIDR can be used as a total scale, or split into two subtypes of socially desirable responding: IM and SDE. Paulhus (1988) reported good internal consistency for both the summed BIDR measure (α = .83), and the IM subscale (α = .75 - .86). Additionally, the BIDR shows excellent criterion validity with two other measures: The Marlowe-Crowne scale (0.71) and the multidimensional Social Desirability Inventory (0.80). Item examples include "*I never cover up my mistakes*" and "*when I hear people talking privately, I avoid listening*".

Demographic variables (age, gender, and ethnicity) were measured via self-report.

Procedure

Participants completed the OCI-R as part of a larger study, and gained credit toward their course for participation. Due to the purpose of the larger study, only females were eligible for participation. Students self-selected into groups of no more than 15, by selecting the study from a list of graduate projects. Brief details about the study were provided to aid their decision; however no reference to OCD was made at the recruitment stage. Rather, the study was described as investigating "daily habits". Participants completed the questionnaires in a small research room following being read the information sheet. Participants were subsequently debriefed.

Data was entered into SPSS and LISREL computer packages for analysis. Cases with missing values were deleted from the data set. Cases with an OCI-R scale total higher than 2.5 standard deviations from the Foa et al. (2002) mean (n = 6) were determined to be outliers, and were also deleted.

Results

In order to examine whether full scale and subscale scores of the current sample were consistent with previous research, effect sizes (Cohen's d) were calculated to compare descriptive statistics with the original NAC scale

Table 1.

Means and Standard Deviations for the OCI-R compared to the NAC population from Foa et al. (2002), and student sample from Hajcak et al. (2004).

	Group							
	Current sample (n = 282)			Foa et al. (2002) (n = 74)		Hajcak et al. (2004) (n = 395)	
Subscale	*M*	*SD*	α	*M*	*SD*	*M*	*SD*
Checking	3.02	2.28	0.69	2.91	2.56	2.95	2.64
Hoarding	5.25	2.68	0.68	4.41[a]	2.67	4.44[a]	2.72
Neutralising	2.18	2.36	0.69	1.82	2.20	1.78[a]	2.20
Obsessing	3.72	2.84	0.83	2.86[a]	2.72	2.92[a]	2.82
Ordering	4.00	2.85	0.81	4.40	3.03	4.48[a]	3.16
Washing	2.02	2.14	0.71	2.41	2.50	2.41[a]	2.55
Total Score	20.20	10.67	0.88	18.82	11.10	18.91	11.38

Note: No effect size comparisons (Cohen's *d*) were larger than small (0.30).
Note: Scores annotated [a] differ significantly to the current sample ($p < 0.05$)

statistics (Foa et al., 2002) and a follow-up study of subclinical participants (Hajcak et al., 2004). No comparison was larger than a small effect size (0.30), and comparisons between the current sample scores and Foa and Hajcak samples were not significantly different ($t(354) = 0.98, p = 0.33$ns; $t(675) = 1.49$, $p = 0.49$) See Table 1 for descriptive statistics.

Internal Reliability

Cronbach's Alphas were calculated for the full scale and each subscale, to assess internal reliability of the OCI-R (see Table 1). Excellent internal reliability was confirmed for the full scale ($\alpha = 0.88$), and for the Obsessing, Ordering, and Washing subscales. Checking, Hoarding, and Neutralising subscales fell just short of the 0.70 threshold for an acceptable alpha (Cronbach, 1979).

Impression Management

Impression management (IM) was correlated with total scale score and subscale scores of the OCI-R, with no significant correlations observed (range $r = 0.00$-0.11). This indicates that the OCI-R is free from this form of response bias.

Factor Structure

Data was subject to a confirmatory factor analysis (CFA) using the statistical package LISREL. In contrast to traditional methods of exploratory factor analysis (e.g., Principal Components Analysis) that typically lead to data-driven factor solutions, CFA allows the researcher to evaluate the extent to which data conform to a priori specified models. Essentially, CFA allows comparison of the goodness of fit of data to any of several models, and this is most appropriate when there are established exploratory analyses that can be drawn upon for specifying competing models. In this case, we sought to compare a single-factor solution in which all items might reflect the single underlying OCD construct, with a six-factor model proposed by Foa et al. (2002), and a model in which the six first order factors proposed by Foa et al. are in turn related to a superordinate second order OCD factor. There are a variety of statistics available for assessment of model fit, including a model chi-square (a non-significant value indicating that the data do not differ significantly from the hypothesised model). As the chi-square is notoriously sensitive with larger samples, it has been argued that one should also consider the ratio of the chi-square to the degrees of freedom where a value exceeding 2 indicates an unsatisfactory model (Byrne, 1989). Hu and Bentler (1999) argued that when considering the overall adequacy of a model, it is important to take into account both the standardized Root Mean Square Residual (sRMR; a residual-based fit index) and one or more indices of comparative fit, such as the Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Comparative Fit Index (CFI) or Non-Normed Fit Index (NNFI). GFI, CFI and NNFI indices above .95, and RMSEA and sRMR values below .06 and .08, respectively, are indicative of good-fitting models (Hu & Bentler, 1999; see also Kline, 2005; Tabachnick & Fidell, 2001).

Application of these rules-of-thumb to our results suggested that a six-factor model provided an excellent model fit to the data (see Table 2 for goodness-of-fit statistics). The model chi-square was non-significant ($\chi^2(120) = 136.52$, $p = 0.14$), indicating the data do not differ significantly from the predicted structure. While the GFI (.86) did not exceed the criterion recommended, the CFI and NNFI did (both .98). Similarly, the RMSEA (.04) and sRMR (.07) were within acceptable limits (less than .06 and .08 respectively). In comparison, the data proved significantly different from a single-factor model ($\chi^2(135) = 294.52$, $p < 0.001$ (see Table 2), and all fit indices were unsatisfactory (all <.90) and the RMSEA and sRMR (both .11) exceeded recommendations for a satisfactorily fitting model. LISREL also provides an indication of how ill-fitting models may be improved, and in this case indicated that there was no better fit for the data than the six-factor model.

Finally, hierarchical CFA was conducted to investigate whether the six factors were being driven by a single 'umbrella' variable. Though the model produced a significant chi-square ($\chi^2(129) = 161.35$, $p < 0.05$ (see Table 2) the ratio of chi-square to degrees

Table 2.
Model of fit statistics for CFA and hierarchical CFA of OCI-R

	Six-factor	One-factor	Hierarchical (latent factor)
χ^2 (d.f.)	136.52 (120)	294.52 (135)	161.35 (129)
χ^2/d.f.	1.14	2.18	1.25
χ^2 p-value	0.14	<0.001	< 0.05
CFI	0.98	0.89	0.98
GFI	0.86	0.74	0.85
NNFI	0.98	0.87	0.97
RMR	0.07	0.11	0.08
RMSEA	0.04	0.11	0.04

of freedom (1.25) was still less than recommended by Byrne (1989) for satisfactory model-fit, and with the exception of the GFI all other indicators met the criteria described above. This indicates that a single latent variable maybe driving the six factors - that the six independent factors of the OCI-R are all part of a larger construct (OCD). At the same time, the six-factor model remains the best overall fit of the data. Table 3 shows LISREL factor loadings for each of the 18 items onto the six factors. With the exceptions of Items 1 (.46: "I have saved up so many things that they get in the way") and 5 (.49: "I find it difficult to touch an object when I know it has been touched by strangers or certain people"), all loadings were greater than .60. At the same time, the loadings for items 1 and 5 are significant for a sample of this size (>.35; Hair, Anderson, Tatham & Black, 1998).

Discussion

Consistent with previous factor-analytic studies (e.g., Foa et al., 2002) the current findings further highlight the six factor model as the best fit for the OCI-R, using a female cohort from New Zealand. This means that the six subscales or variants of OCD investigated by the OCI-R (namely Checking, Hoarding, Neutralising, Obsessing, Ordering and Washing) are statistically supported as distinct families of characteristics, clustering together as first-order factors in the analysis. In addition, hierarchical CFA was used to determine the number of higher-order factors needed to explain correlations among the first-order factors, and indicated that a single higher-order factor provided satisfactory fit for the data. This is consistent with the clinical classification of OCD, i.e. that the six measured constructs are subtypes of one clinical condition, and further supports the use of the OCI-R for use as an assessment tool for OCD screening.

No correlation was found between OCI-R scores and IM, indicating that this self-report measure is free from significant social desirability effects. Not only does this indicate that participants didn't consider the OCI-R items to appear prejudicial in style or content, but also that researchers using the instrument can be confident that participant scores are relatively free of at least the 'error' associated with social desirability response bias.

Solid internal reliability of all six factors was confirmed. While alpha levels for three of the subscales fall just under the generally accepted level set by Cronbach (1979), it must be noted that for a subscale of only three items, these figures are more than acceptable. Contrary to Foa et al. (2002) and Hajcak et al. (2004), Neutralising was found to display acceptable internal reliability. This difference may be due to cultural differences between New Zealand and American students.

It is interesting to note that the current New Zealand sample yielded a higher mean score on the OCI-R than both the Foa et al. (2002) and Hajcak et al. (2004) American samples, however this difference produced only a small effect size and did not reach significance. It should be noted that only females were used in this sample and there is evidence that women tend to experience OCD symptoms more than men (e.g., Karno, Golding, Sorenson & Burnam, 1988; Weissman et al., 1994), potentially inflating the difference between samples. Regardless, there is a strong argument for future research to assess the factor structure of male and/or mixed gender samples.

While total OCI-R scored did not differ, a number of differences between subscale scores were noted between samples. For example it is interesting to note that the New Zealand sample scored significantly lower on both Ordering and Washing subscales of the OCI-R compared to the American Hajcak et al. (2004) sample. Again, this may be due to cultural differences; the "laid-back" kiwi attitude may explain why these behaviours were less endorsed by New Zealand students than their American counterparts. However higher rates of Hoarding, Neutralising and Obsessing were found in the New Zealand sample. Other than our previous work with this sample (Roberts, 2006) no articles investigating obsessive-compulsive symptomology in a New Zealand cohort could be found with which to interpret these higher rates of subclinical behaviours. Further investigation of these subtypes and indeed subclinical obsessive-compulsive behaviours in general, is merited in the New Zealand population. Again, this may reflect the female-only sample used in this study, and may indicate a sex-related pattern of OCD symptoms. In this study, we focus on a female sample for very pragmatic reasons – the data collection of which this was a part focussed specifically on women, and male undergraduate psychology students are relatively rare and it is therefore difficult to obtain a male subsample of equivalent size. Unfortunately this does not allow us to make a sex-based test of equivalence of the models proposed. A further limitation of the study is the relatively youthful sample. Specifically, Karno et al. (1988) report that the median age of OCD-onset is around 23, yet 23 is the oldest of our sample. As a result, the absolute scores on the OCI-R scale and subscales reported here are of limited comparability with the general New Zealand female population.

Consistent with Foa et al. (2002) and Hajcak et al. (2004), the present study found Hoarding to be the most endorsed OCD subtype. High rates of hoarding in college samples is not a new finding:

Table 3.
LISREL factor loadings of OCI-R items

Item	FACTOR 1: HOARDING	Loading
13.	I avoid throwing things away because I am afraid I might need them later.	.78
7.	I collect things I don't need.	.68
1.	I have saved up so many things that they get in the way.	.46
	FACTOR 2: CHECKING	
14.	I repeatedly check gas and water taps and light switches after turning them off.	.67
8.	I repeatedly check doors, windows, drawers, etc.	.65
2.	I check things more often than necessary.	.62
	FACTOR 3: ORDERING	
15.	I need things to be arranged in a particular order.	.81
3.	I get upset if objects are not arranged properly.	.79
9.	I get upset if others change the way I have arranged things.	.68
	FACTOR 4: NEUTRALIZING	
10.	I feel I have to repeat certain numbers.	.75
4.	I feel compelled to count while I am doing things.	.62
16.	I feel that there are good and bad numbers.	.60
	FACTOR 5: WASHING	
11.	I sometimes have to wash or clean myself simply because I feel contaminated.	.78
17.	I wash my hands more often and longer than necessary.	.70
5.	I find it difficult to touch an object when I know it has been touched by strangers or certain people.	.49
	FACTOR 6: OBSESSING	
12.	I am upset by unpleasant thoughts that come into my mind against my will.	.86
18.	I frequently get nasty thoughts and have difficulty in getting rid of them.	.84
6.	I find it difficult to control my own thoughts.	.65

Coles, Frost, Heimburg and Steketee (2003) investigated hoarding behaviours in 563 college students, and found four distinct domains of hoarding; Difficulty Discarding, Acquisition Problems, Clutter, and Interference/Distress. Coles et al. linked hoarding to anxiety, which is often high in the student population. In particular, "test-anxiety" is found to significantly increase general anxiety levels in student populations (Preiss, Gayle, & Allen, 2006). This link between hoarding and anxiety symptoms may explain the consistently high levels of hoarding in university samples.

As this study has essentially supported the division of the OCI-R into the same factors as those previously obtained with mixed-sex samples, we would expect that the same structure should apply to male samples. As well as endorsing investigations to this effect, we would also suggest the utility of longitudinal studies to assess stability of the OCI-R over time, as well as its use in predicting future OCD diagnosis. For example, though Morris, Morris, Forbes, Bradley, and Goodman (2000) reported that 81% of a small sample of university students continued to display subclinical OCD at follow up (4 to 13 months after initial assessment), they do not (or cannot) report whether any of their sample 'graduate' from subclinical to clinical OCD. Similarly, Fullana, Tortella-Feliu, Caseras, Taberner, Torrubia, and Mataix-Cols (2007) reported non-significant changes in all subscales but Obsessing over a two-year period using an undergraduate student sample ($n = 132$), and again, the same limitations applied.

In conclusion, the OCI-R is a reliable measure, with its 6-factor structure consistently replicated across different cultures. These replications now include a New Zealand female undergraduate sample, indicating that the OCI-R is psychometrically sound research and clinical tool not only in North American and Europe but also within the New Zealand context. Subscales of the OCI-R were unrelated to the response bias of impression management, suggesting that this measure is unlikely to encourage inflated reports from its respondents.

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