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Replication of the Factor Structure of the Hopkins Symptom Checklist with New Zealand and United States Respondents.*

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The development of many new psychotropic drugs over the last 20 years has resulted in the need for psychological tests to assess their effectiveness. One such measure has been the Hopkins Symptom Checklist (HSCL-58). Because the factor structure of this measure was still in doubt, the procedure FACTOREP was used on data from two groups of New Zealand subjects and one group of American subjects, to examine factor by factor replication. Results showed that the five-factor structure claimed by the developers of the HSCL-58 could not be found, but there was solid evidence in support of the replicability of a three-factor structure within a previous identified group of 45 of the same items. Thus the shorter HSCL-45 is to be preferred. The outcome also gave further support to the use of rotations of restricted numbers of factors in such analyses.

The advent of many new psychopharmacological drugs over the last 20 years has seen the development of new psychological measures to assess the therapeutic effectiveness of anxiolytic and antidepressive medication. One of these is the Hopkins Symptom Checklist (HSCL-58), (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). The format of the measure has been changed since its development, suggestive of some basic underlying discontent with the original 58 items. In addition, various interpretations have been made of the original subscales. In their recent review, Cyr, McKenna-Foley, and Peacock (1985), concluded that the symptom dimensions have received only weak support and that the scale scores were based on unreliable factors.

Recently in New Zealand, the HSCL-58 has been found to be of value in the assessment of subjective, psychosomatic, and behavioural responses to stress. In particular, it has been used with personnel recovering victims after an aircrash in the Antarctic (Taylor & Frazer, 1982), in studies of Antarctic expeditioners (McCormick, 1983), functional gut disorder sufferers (Welch, 1983), and students (Walkey & McCormick, 1985a). But the test still needed to have its replicable factor structure identified.

In the past, many solutions have been described to determine the most appropriate number of factors that should be drawn from any given correlation matrix. The solution most commonly adopted has been to extract factors with eigenvalues greater than one, but this method has rarely produced consistent, replicable results (Cliff, 1988). An alternative, proposed by Walkey (1983), is to rotate relatively small numbers of factors, because unlike the rotation of larger numbers, this technique frequently produces replicable and interpretable factor structures. The choice for the number of factors to be sought can be derived either from an assessment of the developer's intended subscale structure, or from some other theoretically derived source. For example, using the author's expectations for the General Health Questionnaire (Goldberg, 1972), Siegert, McCormick, Taylor, and Walkey (1987), undertook a varimax rotation of the first four factors, and found clear evidence of a replicable four-factor solution. Similarly, Green and Walkey (1988) used a varimax rotation of the first three factors of the Maslach Burnout Inventory (Maslach & Jackson, 1981), and identified the elusive three-factor structure.

But it is difficult to use this alternative method of factor analysis if the test developers

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have not clearly stated their target factor structure, or if the structure they claim cannot be identified. Walkey and McCormick (1985b) overcame this problem with their factor replication procedure FACTOREP. This procedure requires the rotation of different numbers of factors until a structure is found which is replicated, factor by factor, across a number of independent subject groups. It uses the *s* index, a statistic resembling the Chi square and used by Cattell, Balcar, Horn, and Nesselroade (1969) to generate matrices of inter-factor similarity. It also permits the production of matrices with progressively stricter criteria for the inclusion of prominent items in each factor cluster, by providing flexibility in the setting of hyperplane cut-off levels. Finally, it enables the researcher systematically to examine factor loadings above these prescribed cut-off points.

In applying FACTOREP to the HSCL-58, a test for which Derogatis et al. (1974) claimed a stable five-factor structure, Walkey and McCormick (1985a) carried out both five and three-factor analyses with data from two independent groups of University students and from a further group of hospital outpatients. From their results they identified 45 items with three underlying symptom dimensions, which they labeled *General Feelings of Distress* (GFD), *Somatic Distress* (SD) and *Performance Difficulty* (PD). But the outcome warranted further exploration of the psychometric basis of the HSCL to see if a general factor might also be present.

Accordingly, correlation matrices for factor analysis were obtained from three New Zealand and American groups. In the first stage, the 45 item version was examined for the presence of a general factor which would provide the basis of an overall score for the HSCL-45. In the second stage, the FACTOREP procedure was used to determine the replicability of factors in four previously identified structures within the HSCL-58, including those from the 45 items identified by Walkey and McCormick (1985a).

Method

Subjects

The item-to-item correlation matrices were obtained from three independent populations who voluntarily completed the HSCL-58 questionnaire. These included a sample of 404 American anxious neurotic patients (Mattsson, Williams, Rickels, Lipman, & Uhlenhuth, 1969), a sample of 224 female nurses involved in a stress and coping research project, and a sample of 490 students from New Zealand who were enrolled in an introductory psychology course.

Procedure

Subjects were instructed to indicate the amount of distress they had experienced on the 58 symptoms listed during the previous seven days on a scale from *1* (not at all), to *4* (extremely).

Data analysis

Principal components analyses and varimax rotations were performed for each of the three groups using the Statistical Analysis Systems package (SAS Institute Inc., 1979). Subsequently, the *s* index values were calculated using the FACTOREP procedure (Walkey & McCormick, 1985b), to compare solutions from the three groups for each number of factors with loadings of .30, .40, and .50 as specified hyperplane cut-off levels.

Then analyses were conducted not only on the full 58 items, but also on three more selective groups of items that previous researchers had considered important contributors to the structure. These structures were those described by Derogatis et al. (1974), (58 items); Williams, Lipman, Rickels, Covi, Uhlenhuth, and Mattsson (1968), (45 items); Derogatis, Lipman, Covi, Rickels, and Uhlenhuth (1970), (29 items); and Walkey and McCormick (1985a), (45 items).

In the light of foregoing investigations of rotated factor structures, the unrotated factor loadings of each of the three subject groups were inspected for the presence of any general factor underlying the 45 items identified by Walkey and McCormick (1985a). Normally the presence of a general factor is indicated by a high mean of factor loadings on the first unrotated factor, accompanied by a low dispersion (standard deviation). These may then be compared with the means and standard deviations of loadings from subsequent unrotated factors, which will be found to have a mean factor loading approaching zero, and a higher level of dispersion of loadings as measured by their standard deviations (Walkey & McCormick, 1985c).

Corrected split-half reliability coefficients and Alpha coefficients were calculated for each of the three subscales and for the 45 items as a group.

Results

The Search for Previously Reported Factor Structures.

Only one of the factor structures reported in previous research was found replicated

Table 1: *S Index Values for Two, Three and Four Factor Solutions across Three Subject Groups at the .50 Cut-off Point.*

Group	Factors	Two-Factor Rotations		Three-Factor Rotations			Four-Factor Rotations			
		1	2	1	2	3	1	2	3	4
					Student's Data					
	1	.67	.00	.80	.00	.00	.80	.00	.00	.09
U.S.A.	2	.00	.82	.00	.59	.00	.00	.50	.00	.00
Data	3			.00	.00	.86	.00	.00	.86	.00
	4						.00	.00	.46	.00
					Student's Data					
	1	.84	.00	.77	.00	.00	.69	.00	.00	.24
Nurses	2	.00	.74	.00	.78	.00	.24	.60	.00	.00
Data	3			.00	.00	1.0	.00	.00	.92	.00
	4						.00	.33	.00	.00
					U.S.A. Data					
	1	.62	.06	.84	.00	.00	.78	.00	.00.	00
Nurses	2	.00	.78	.00	.86	.00	.19	.67	.00	.13
Data	3			.00	.00	.86	.00	.00	.77	.00
	4						.00	.00	.00	.09

Note: Factors have been re-ordered to increase clarity.

systematically across independent groups in the present study. Lack of space prevents the presentation of the results of the numerous comparisons, but complete details can be obtained from the senior author. The main finding was that the item grouping suggested by Walkey and McCormick (1985a), gave the clearest evidence of a replicable factor structure.

Identification of a Replicable Factor Structure.

The results of comparing the two, three, and four-factor solutions from the HSCL-45 across the responses of the present groups at the .50 hyperplane cut-off point are presented in Table 1.

The table shows that for two-factor solutions, the first and second factors are both replicated to a moderate level in each group. However, inspection of the patterns of factor loadings for each of the three groups shows evidence of under-factoring, in that the smaller Performance Difficulty subscale amalgamates with one or other of the two larger subscales in each case, to form uninterpretable clusters of items.

The results are even more equivocal with respect to the four-factor solutions. At the .50 cut-off level the diagonal *s* index values for the first three factors are relatively stable, though they range from only .50 up to .92. The diagonal values for the comparisons of the fourth factors shows that they are *not* replicated across the three groups. The off-diagonal values, which should approach zero, do so in many cases, but in some cases they are quite considerable, ranging as high as .46. Overall the four-factor solutions show signs of a replicable three-factor structure, but with the fourth factor emerging from different clusters of items for each group of subjects. In each case, the data from the FACTOREP analysis give very clear evidence of a replicable three-factor solution, with substantial values in the diagonal, and with values at other points tending towards zero. Moreover, the rotated three-factor patterns for each of the groups showed a clear separation of the three subscales. Factor 1 was clearly identified as *General Feelings of Distress,* Factor 2 as *Somatic Distress* and Factor 3 as *Performance Difficulty.*

A clarification of the relationships between the 45 items is seen in Figure 1. There their rotated loadings for the three factors are plotted

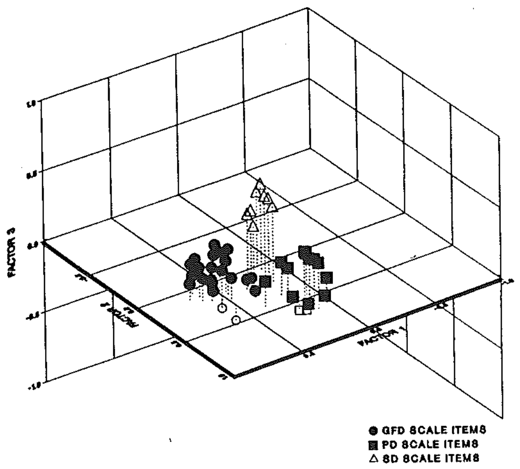
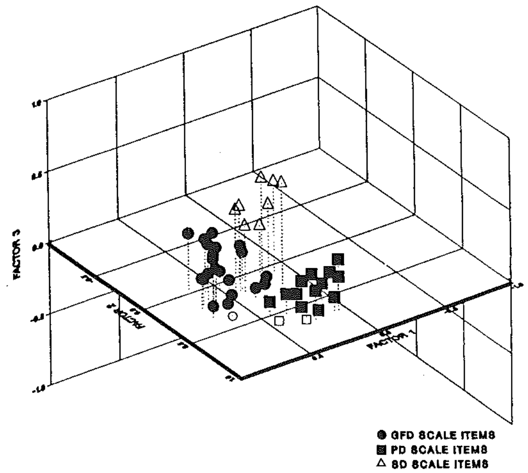


Figure Caption 1. Varimax Rotated Factor Loadings of the 45 Item HSCL for the Student Group (upper), and the American Group (lower).



in three-dimensional space to show their almost perfect clustering for both the student and American group.

The General Factor.

Inspection of the unrotated factor loadings on the 45 items for each of the three subject groups show strong indications of a general factor. The group of American subjects showed it most clearly with a mean loading of .56 (*SD* = .11) on the first unrotated factor and a mean of .03 (*SD* = .27) on the second. The Nurses' group showed a mean loading of .49 (*SD* = .16) on the first unrotated factor and a mean loading of .09 (*SD* = .30) on the second, while the Student group had a mean mean loading on the first unrotated factor of .48 (*SD* = .09) and a mean loading of .02 (*SD* = .26) on the second. All three of the groups therefore showed the typical general factor pattern of a high mean and low standard deviation on the first unrotated factor, and a low mean and high standard deviation on subsequent unrotated factors. This general factor could be described as providing a measure of symptom distress entitled either *Symptom Distress* or *Total Distress Score* after Parloff, Kelman, and Frank (1954).

Reliability of the Three Subscales.

The results of the reliability data for the HSCL-45 scale and subscales for the two New Zealand repondent groups for whom it could be calculated are presented in Table 2. The reliabilities are quite substantial with corrected split-half reliability for the three subscales ranging from .77 to .95, and their Alpha coefficients ranging from .75 to .94. The corresponding corrected split-half reliabilities for the 45 item scale were .84 and .95, while the Alpha coefficient values were .92 and .94.

Table 2: *Reliability Data for the HSCL-45 Subscales*

Group: Students

Subscale	Split-Half (*N*=490)	Coefficient Alpha (*N*=490)
Performance Difficulty	.77	.75
Somatic Distress	.84	.83
General Feelings of Distress	.91	.90
Total Distress Scale	.94	.92

Group: Nurses

Subscale	Split-Half (*N*=224)	Coefficient Alpha (*N*=224)
Performance Difficulty	.79	.79
Somatic Distress	.84	.82
General Feelings of Distress	.95	.94
Total Distress Scale	.95	.94

Discussion

Like Cyr et al. (1985), the present research gave little support for the previously declared HSCL five subscale structure. However, it found a three-factor structure that is considerably more robust than its predecessors, and embodies a general measure of distress. It supports the adoption of a shorter, three subscale, 45 item version of the HSCL-58 that has advantages for both researchers and clinicians. The first of the advantages is that it requires less time to administer. Second, it retains both a highly robust and stable factor structure, and third it has a strong general factor which indicates that it can be used as an overall symptom distress measure.

The present study was factor-analytic. It attempted neither to make a clinical validation nor to establish the appropriate cut-off point for particular psychiatric diagnoses. Other researchers might now care to pursue these matters. As it stands, the three factor HSCL-45 can be recommended as a highly suitable instrument for comparing the mean levels of psychological discomfort between groups.

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