Validation of the Norwegian version of the work-related sense of coherence scale

Karoline Grødal[1,2], Siw Tone Innstrand[1,2], Georg F. Bauer[3], Gørill Haugan[1,2], Toril Rannestad[1,2] and Beate André[1,2]

[1]Department of Public Health and Nursing, Faculty of Medicine and Health Science, NTNU – Norwegian University of Science and Technology, Trondheim, Norway

[2]NTNU Center for Health Promotion Research, Trondheim, Norway

[3]Division Public and Organizational Health, Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Switzerland

Author note: Correspondence concerning this article should be addressed to Karoline Grødal, NTNU, Faculty of Medicine and Health Sciences, Department of Public Health and Nursing, P.O Box 8905, 7491 Trondheim, Norway. E-mail: karoline.grodal@ntnu.no. Tel. +47 992 274 89.

Published version DOI: 10.1177/1403494817725466

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Abstract

Aim: The aim of this study was to investigate the psychometric properties of the Norwegian version of the work-related sense of coherence (work-SOC) scale, which measures the perceived comprehensibility, manageability, and meaningfulness of an individual´s current work situation. *Methods:* Factorial validity, convergent and discriminant validity of the factors, as well as scale reliability were tested with confirmatory factor analyses among two samples of employees in higher education institutions (N = 6951) and nursing homes (N = 558). Factorial invariance across occupational groups was also investigated. *Results:* A modified three-factor structure was shown to be valid and reliable in both samples and invariant across occupational groups. However, problems were detected regarding the discriminant validity between the factors comprehensibility and manageability. ***Conclusion:*** **The Norwegian version of the work-SOC scale seems to have good properties. Further development is needed to better distinguish between the comprehensibility and manageability dimensions.**

Keywords: Work-related sense of coherence, sense of coherence, psychometrics, factorial validity, scale reliability, measurement invariance, nursing homes, higher education

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Sense of coherence (SOC) refers to a global orientation to view one´s internal and external environments as comprehensible, manageable, and meaningful. It was coined by Antonovsky [1, 2] as the core concept of a salutogenic model to explain the origins of health. A positive relation between SOC and perceived health has been confirmed by a number of studies [3], and the concept has been applied in several settings. Context-specific conceptualizations of SOC have been proposed for universities [4], families [5], and more recently for work [6]. The assumption is that a work environment perceived as comprehensible, manageable, and meaningful is health promoting [6] and that measuring work-related SOC (work-SOC) will thereby be relevant for planning and evaluating health-related interventions at work [7]. The workplace is acknowledged by the World Health Organization [8] as a priority setting for health promotion in the current century and many organizations are becoming increasingly aware of the advantages of having a healthy and motivated workforce.

Similar to the global SOC, work-SOC is defined as “the perceived comprehensibility, manageability and meaningfulness of an individual´s current work situation” [7]. The three dimensions are cognitive, instrumental and motivational components of the concept, respectively. Comprehensibility is “the extent to which a work situation is perceived as structured, consistent, and clear”, manageability is “the extent to which an employee perceives that adequate resources are available to cope with demands in the workplace”, and meaningfulness is “the extent to which a situation at work is seen as worthy of commitment and involvement” [7]. Individual characteristics and previous experiences interact with the current work environment to influence the perception of the dimensions, and work-SOC is therefore assumed to vary according to the individual´s experiences throughout the work life [6, 7].

Bauer, Vogt, Inauen and Jenny [9] developed a 9-item semantic differential scale to measure work-SOC. Initially, three bipolar adjective pairs were suggested to measure each dimension. The validity of a three-dimensional construct was confirmed among Swiss workers with various occupations [9]. However, the final model had an uneven distribution of items, in which one item (manageable – unmanageable) loaded on comprehensibility rather than manageability. This factor structure was concluded to be invariant across time, gender, age groups, education levels, and whether or not the employees had leadership positions [7]. The same model was found valid among South African motor retail workers [10]. The model includes only two items for the manageability factor, and this can be problematic if using the measure in e.g., structural equation modeling [11]. However, Bauer and colleagues [9] recommended applying a composite work-SOC scale in statistical analysis because the subscales did not differ in their relationships with different health outcomes.

The convergent validity of the work-SOC scale has been supported by positive correlations with job resources [7, 9], affective organizational commitment [9], work enthusiasm [9], work engagement [9, 10], and mental health [12]. Negative correlations have been found with job demands [7, 9] and variables such as sleep problems, psychosomatic complaints and exhaustion [9]. Vogt and colleagues [7] found that work-SOC partially mediated the relationships between job resources and work engagement as well as job demands and exhaustion. In addition, Zweber [12] found that comprehensibility was a partial mediator for the relationship between the degree to which employees perceived that management and coworkers actively supported their well-being (organizational health climate) and mental health.

Thus, the work-SOC scale is a rather new measure and initial studies have shown that the measure is promising for research on what creates healthy workplaces and work environments. However, no studies on work-SOC from the Nordic countries have yet been

published. Future cross-national studies require the validity and reliability of translated and adapted versions of the instrument to be evaluated in their new target populations [13]. Therefore, the aim of this study is to investigate the psychometric properties of the Norwegian version of the work-SOC scale. More specifically, we investigated the factorial validity, convergent and discriminant validity among the factors, scale reliability, and factorial invariance across occupational groups.

Method

Participants and procedure

Cross-sectional survey data from two samples of employees in higher education and nursing homes were used in this study. These represent major parts of the public sector in Norway and cover different occupations such as academics, administrative personnel and health personnel. Both projects were approved by the Data Protection Official for Research, Norwegian Social Science Data Services.

Sample 1 initially consisted of 7859 employees from 15 higher education institutions in Norway. The respondents received e-mails with information and links to the online survey KIWEST (Knowledge-Intensive Work Environment Survey Target) as part of the ARK (Arbeidsmiljø- og klimaundersøkelser [Work Environment and Climate Surveys]) Intervention Program [14] between 2014 and 2015. Participation was voluntary and consent was given during the survey. The response rate was 67%. Respondents who answered the English language questionnaire (n = 908) were excluded from the final sample (N = 6951). The slight majority were female (53.5%). Age groups were distributed as follows: under 30 years (6.8%), 30-39 years (20.5%), 40-49 years (29.3%), 50-59 years (26.6%), and 60 years or older (16.8%). Academic employees including doctoral research fellows, accounted for 57% of the sample, whereas 43% were technical/administrative personnel including unit

leaders. Temporary workers accounted for 19.8% of the sample, and 80.2% had permanent contracts. The majority were employed in full-time positions (85.8%).

Sample 2 consisted of employees from 43 nursing homes in two Norwegian municipalities (N = 558). The data were collected between November 2015 and January 2016. Information about the research project and invitations to participate in an online survey were distributed to the employees by e-mail via contact persons in each nursing home. Participation was voluntary and consent was given by completing the survey. Based on a number of 2835 sent invitations, the response rate was estimated to be 20%. This is a minimum estimate because some contact persons reported that their mailing lists were not up to date, and some employees were likely employed in two or more nursing homes and received multiple invitations. The majority of the sample were female (89.7%) and the ages ranged from 17 to 72 years (M = 42.1, SD = 13.1), which is consistent with population statistics on the health and social services in Norway [15]. The most common professions were nurses (40.2%) and assistant nurses (38%), while the balance were other health- and social-related personnel (e.g., therapists, activity staff, physicians; 19.4%), and staff and support functions (2.4%). The employees reported means of 29.4 contracted work hours per week (SD = 9.6), tenure of 7.7 years at their current workplace (SD = 7.2), and 17.5% had leadership responsibilities.

Measure

Work-SOC was assessed by the scale developed by Bauer and colleagues [9]. The scale was translated into Norwegian during the development of KIWEST [14] and then back-translated to ensure equivalence. A bilingual (German and Norwegian) researcher was consulted in this process. The three underlying dimensions of comprehensibility, manageability, and meaningfulness were measured with nine bipolar adjective pairs scored on a seven-point scale. The overall question was “How do you personally find your current job and work situation in general?” The wording of the items can be seen in Table I along with

means and standard deviations for both samples. Cronbach´s alpha values ranging from .72 to .89 for the dimension scales and .83 to .93 for total work-SOC have been reported in earlier studies [7, 9, 10].

[Insert Table I about here]

Statistical analysis

Statistical analyses were performed using Stata version 14.2. Missing values were deleted listwise in all analyses. Factorial validity was investigated by CFAs on five models. In Model 1 (M1), all nine items loaded on one overall work-SOC factor, which is in line with the recommendation of using a composite work-SOC scale [9]. Model 2 (M2) was a two-factor model obtained from exploratory factor analyses in this study (results not shown) and the Swiss validation study [9] with the six comprehensibility and manageability items loading on the same factor and three items loading on meaningfulness. Model 3 (M3) and Model 4 (M4) were three-factor models hypothesized by theory, differing with item 1 loading on either comprehensibility or manageability, respectively. M3 was shown to be valid in Swiss and South African studies [9, 10], while M4 represents the structure of the initially developed measure (see note in Table I) [9]. Model 4a (M4a) was modified based on M4 as described in the results. The asymptotic distribution free estimation method was applied to circumvent issues with significant multivariate non-normally distributed data

Evaluations of goodness-of-fit were based on the following indices: 1) χ^2 test, 2) SRMR (standardized root mean squared residual) < 0.08, 3) RMSEA (root mean squared error of approximation) < 0.08, 4) CFI (comparative fit index) > 0.90, and 5) TLI (Tucker-Lewis index) > 0.90 [16]. The χ^2 is sensitive to sample size, and larger samples increases the probability of model rejection. Therefore, the best model was selected based on overall evaluations of model fit, parameter estimates, modification indices (MI) and standardized

covariance residuals (SR). MIs above 3.84 suggests that model fit (χ^2) can be significantly improved by adding an extra parameter to the model, while SRs above 2.58 indicates significant discrepancies between the observed and the estimated model [16]. Because the models were not nested, χ^2 difference tests or other significance tests were not used to compare models. It was also not possible to calculate Akaike´s information criterion in the context of the selected estimation method.

Convergent and discriminant validity were assessed by squared correlations (SC) between factors and average variances extracted (AVE). AVE ≥ SC indicates no problem with discriminant validity, whereas AVE ≥ 0.5 indicates no problem with convergent validity [17]. Scale reliabilities were evaluated by measuring the subscales´ internal consistencies. Composite reliabilities (CR) were evaluated by Raykov´s [18] formula. Values above 0.7 indicate reliable factor measurement [17]. Cronbach´s alpha (α) coefficients were also calculated to enable comparisons with other studies.

Factorial invariance was investigated across three groups of academics (n = 3963) and technical/administrative personnel (n = 2988) from sample 1 and health/social related personnel (n = 539) from sample 2. This was done by performing: 1) separate CFAs to ensure acceptable goodness-of-fit in each group, 2) multi-group CFA assuming equal forms (i.e. equal factor structures, no constraints on the model), 3) multi-group CFA assuming equal factor loadings, and 4) comparisons of goodness-of-fit of the two multi-group CFA models [19]. Non-significant differences in goodness-of-fit between the models indicated factorial invariance. This was evaluated by χ^2 difference tests and criteria of ΔRMSEA ≥ .015, ΔCFI ≥ −.010 and ΔSRMR ≥ .010 [20].

Results

The goodness-of-fit statistics from the CFAs investigating factorial validity are summarized in Table II. Similar results were found in both Sample 1 and Sample 2. M1 had poor fit to the data according to all indices in both samples. M2 and M3 had acceptable fit according to RMSEA and SRMR within cut-off values in Sample 1, and RMSEA and CFI in Sample 2, but this was not supported by the other indices. M4 fitted the data better than M2 and M3, but the values were lower than cut-offs for TLI in both samples and CFI in Sample 1. Inspection of MIs and SRs for M4 revealed multiple points of strain for Sample 1. The two largest MIs indicated cross-loadings of item 7 on meaningfulness (MI = 263.12) and comprehensibility (MI = 216.39). Omitting item 7 yielded a better fitting solution, but caused problems with convergent validity and scale reliability. The third largest MI indicated that item 1 cross-loaded on meaningfulness (MI = 170.27). In Sample 2, M4 seemed fairly good, but an evident point of strain was found with cross-loadings of item 1 on both meaningfulness (MI = 19.58) and comprehensibility (MI = 9.09). Item 1 was therefore omitted in a modified model, M4a. This yielded a substantial improvement of model fit in both samples. In Sample 1, the TLI was below, but approached an acceptable value, while RMSEA, TLI and CFI all indicated fairly good fit. In Sample 2, M4a fitted the data very well indicated by RMSEA, SRMR, CFI and TLI values clearly within the acceptable limits. Figure I shows the standardized factor loadings and factor correlations of M4a.

[Insert Table II about here]

[Insert Figure I about here]

Figure I. Standardized estimates of factor loadings and factor correlations of M4a for Sample 1/Sample 2. All estimates were statistically significant ($p < .001$).

M4a provided good results with relatively few weaknesses for Sample 2. However, significant SRs were detected between items 4 and 9 (SR = −3.115) and items 5 and 9 (SR =

−2.735). The two largest MIs indicated that the model fit could be improved by correlating the error terms of items 3 and 7 (MI = 14.309) and items 2 and 5 (MI = 6.582). More notable points of strain were detected for Sample 1. The misfit was particularly related to items 4 and 7 that comprised the manageability factor. Cross-loadings with similarly high MIs were apparent for items 4 and 7 on comprehensibility (MI = 133.63) and meaningfulness (MI = 133.63). The three largest SRs were between items 4 and 5 (SR = 37.85), items 2 and 7 (SR = −19.38), and items 4 and 6 (SR = −14.08). However, these MIs and SRs were not addressed by additional modifications to the model, and further analyses were based on M4a.

Table III shows that convergent validity was confirmed in both samples with all AVE values above 0.60. Problems with discriminant validity were indicated by SCs between manageability and comprehensibility of .826 in sample 1 and .945 in sample 2. These were clearly larger than the AVEs. The reliability of the subscales was satisfactory in both samples with CRs from .766 to .912 (Table III).

[Insert Table III about here]

The results of the factorial invariance tests are presented in Table IV. The single group solutions of M4a had acceptable fit to the data. The unconstrained multi-group model fitted the data well, and the model assuming equal factor loadings did not differ significantly from the unconstrained model. The values of RMSEA and SRMR were actually better in the constrained model. This indicated that the structure of M4a was equal across academics, technical/administrative personnel and health/social personnel.

[Insert Table IV about here]

Discussion

The aim of this study was to investigate the psychometric properties of the Norwegian version of the work-SOC scale by testing the factorial validity, convergent and discriminant

validity among the factors, scale reliability, and factorial invariance across occupational groups. In line with theory and previous studies [9, 10], the results favored a three-factor solution over a one- or two-factor solution. However, it seems that the metrics are slightly different in the Norwegian version. Item 1 cross-loaded on all factors and seemed unreliable. Removing item 1 resulted in a model that fitted the data of both samples well (M4a). The model was invariant across occupational groups and all subscales were reliable according to measures of internal consistency.

Item 1 (manageable) was also an issue in the validation of the German version where it moved from the manageability factor—in which it was theoretically developed to belong—to the comprehensibility factor [9]. It could be that this item relates strongly to the individual´s workload and thus job demands. Perceiving one´s job situation as unmanageable because of excessive workload may impede both comprehensibility and meaningfulness. In comparison, items 4 and 7 ("easy to influence" and "controllable") may relate more to job resources such as autonomy or decision latitude. Further research is needed to investigate these assumptions and, if they are true, whether the omission of item 1 leads to less predictive power of the work-SOC scale regarding negative health outcomes such as exhaustion.

The discriminant validity between the manageability and comprehensibility factors was poor in this study. This issue is also known from validation studies of global SOC measures. Some studies have shown that these dimensions correlate strongly [21] or cluster together in factor analysis [22]. A model with two factors would contradict the theory of a three-dimensional concept and has, earlier and in this study, been found to fit the data worse than a three-factor model [9]. On the other hand, high correlations can be expected based on Antonovsky´s [2] theoretical assumption that manageability is highly dependent on comprehensibility. Of note, all items designed to measure these two dimensions are reverse worded, whereas all items constituting the meaningfulness dimension are not. Method effects

may thus have influenced the results. Further studies can investigate if this is the case by reversing items differently when collecting the data, e.g., by putting all items in the same direction or by alternating between item reversals within each of the subscales.

The high correlation between manageability and comprehensibility indicates that using these subscales separately is not reasonable. In addition, Antonovsky [2] suggested that the dimensions are closely intertwined and should not be separated from each other. Using a composite work-SOC scale may thus be recommended, assuming that the multidimensionality of the concept does not influence the meaning of the total score. This was also recommended by Bauer and colleagues [9] for the German language work-SOC scale. However, researchers should be aware that applying a one-factor model in structural equation modeling seems problematic because the results of poor fit. Item parceling with the dimensions functioning as indicators of a latent work-SOC variable might be a solution to this [23], but was not tested in this study. This will also solve the potential issues caused by having only two indicators for the manageability factor in a structural equation model.

A major strength of this study was the application of two large samples representing two different sectors with different occupations. However, some limitations must be noted. First, the low response rate of the nursing home sample may have affected the internal validity of the study and caused biased results. Those with high work-SOC are presumably more likely to participate than those with low work-SOC, but it is uncertain whether this affects the factor structure. The response rate was a minimum estimate and the percentage is thus probably higher in reality, but is likely still low. At least, according to age and gender distributions, the sample was representative for the population. Second, generalizability to other occupations and types of organizations is unknown. However, finding a similar pattern of results in the two samples and concluding with factorial invariance across the three

different occupational groups strengthens the assumption of external validity of the study results and that the factor structure is universal and reliable across settings in Norway.

Overall, the Norwegian version of the work-SOC scale seems to have good properties and we argue that it can be useful for both research and practical purposes within the field of occupational health. However, further research is needed to address the dimensionality issues and identify solutions to better discriminate between the manageability and comprehensibility dimensions. We also recommend future longitudinal studies to investigate the stability and predictive validity of work-SOC.

Acknowledgements

The present study was funded by The Research Council of Norway ([insert grant number here]). The authors would also like to thank ARK Research Platform for access to the data material on higher education employees, and two anonymous reviewers for their helpful comments on the paper.

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Table I

Wording, means and standard deviations for work-SOC items

			Sample 1			Sample 2		
Item	Wording	Norwegian translation	*n*	*M*	*SD*	*n*	*M*	*SD*
1	Manageable – Unmanageable [r]	Håndterlig – Uhåndterlig [r]	6924	5.46	1.46	533	5.32	1.61
2	Meaningless – Meaningful	Meningsløs – Meningsfull	6907	5.72	1.37	529	5.80	1.60
3	Structured – Unstructured [r]	Strukturert – Ustrukturert [r]	6913	4.64	1.50	527	4.67	1.63
4	Easy to influence – Impossible to influence [r]	Lett å påvirke – Umulig å påvirke [r]	6912	4.59	1.45	526	4.44	1.54
5	Insignificant – Significant	Betydningsløs – Betydningsfull	6911	5.63	1.31	529	5.71	1.60
6	Clear – Unclear [r]	Oversiktlig – Uoversiktlig [r]	6917	4.68	1.52	528	4.74	1.65
7	Controllable – Uncontrollable [r]	Kontrollerbar – Ukontrollerbar [r]	6896	4.65	1.44	522	4.70	1.49
8	Unrewarding – Rewarding	Ikke givende – Givende	6911	5.59	1.40	531	5.75	1.56
9	Predictable – Unpredictable [r]	Forutsigelig - Uforutsigelig [r]	6898	4.55	1.47	524	4.47	1.60

Note. [r] = reversed (high scores indicates high work-SOC).

Items developed to measure comprehensibility (3, 6, 9), manageability (1, 4, 7) and meaningfulness (2, 5, 8) [9].

Table II

Goodness-of-fit statistics for the study models

	n	χ^2 (df)	RMSEA	SRMR	CFI	TLI
Sample 1						
M1	6761	1526.821(27)***	0.091	0.133	0.672	0.562
M2	6761	761.925(26)***	0.065	0.054	0.839	0.777
M3	6761	685.976(24)***	0.064	0.053	0.855	0.783
M4	6761	644.758(24)***	0.062	0.047	0.864	0.796
M4a	6770	356.529(17)***	0.054	0.038	0.925	0.876
Sample 2						
M1	496	116.976(27)***	0.082	0.160	0.806	0.742
M2	496	69.064(26)***	0.058	0.084	0.907	0.872
M3	496	67.257(24)***	0.060	0.083	0.907	0.860
M4	496	63.026(24)***	0.057	0.078	0.916	0.874
M4a	499	33.836(17)**	0.045	0.048	0.963	0.939

Note. Item 1 omitted in M4a. RMSEA: root mean squared error of approximation; SRMR: standard root mean squared residual; CFI: comparative fit index; TLI: Tucker-Lewis index.

**$p < .01$. ***$p < .001$

Table III

Convergent and discriminant validity between factors and subscale reliabilities

	Sample 1 (*n* = 6770)			Sample 2 (*n* = 499)		
Factor	1	2	3	1	2	3
1 Comprehensibility	-			-		
2 Manageability	.826	-		.945	-	
3 Meaningfulness	.248	.276	-	.257	.247	-
AVE	.600	.626	.693	.622	.671	.775
CR	.818	.766	.871	.832	.801	.912
α	.799	.709	.870	.796	.764	.902

Note. Squared correlations between factors (M4a)

AVE = average variance extracted. CR = composite reliability. α = Cronbach´s alpha.

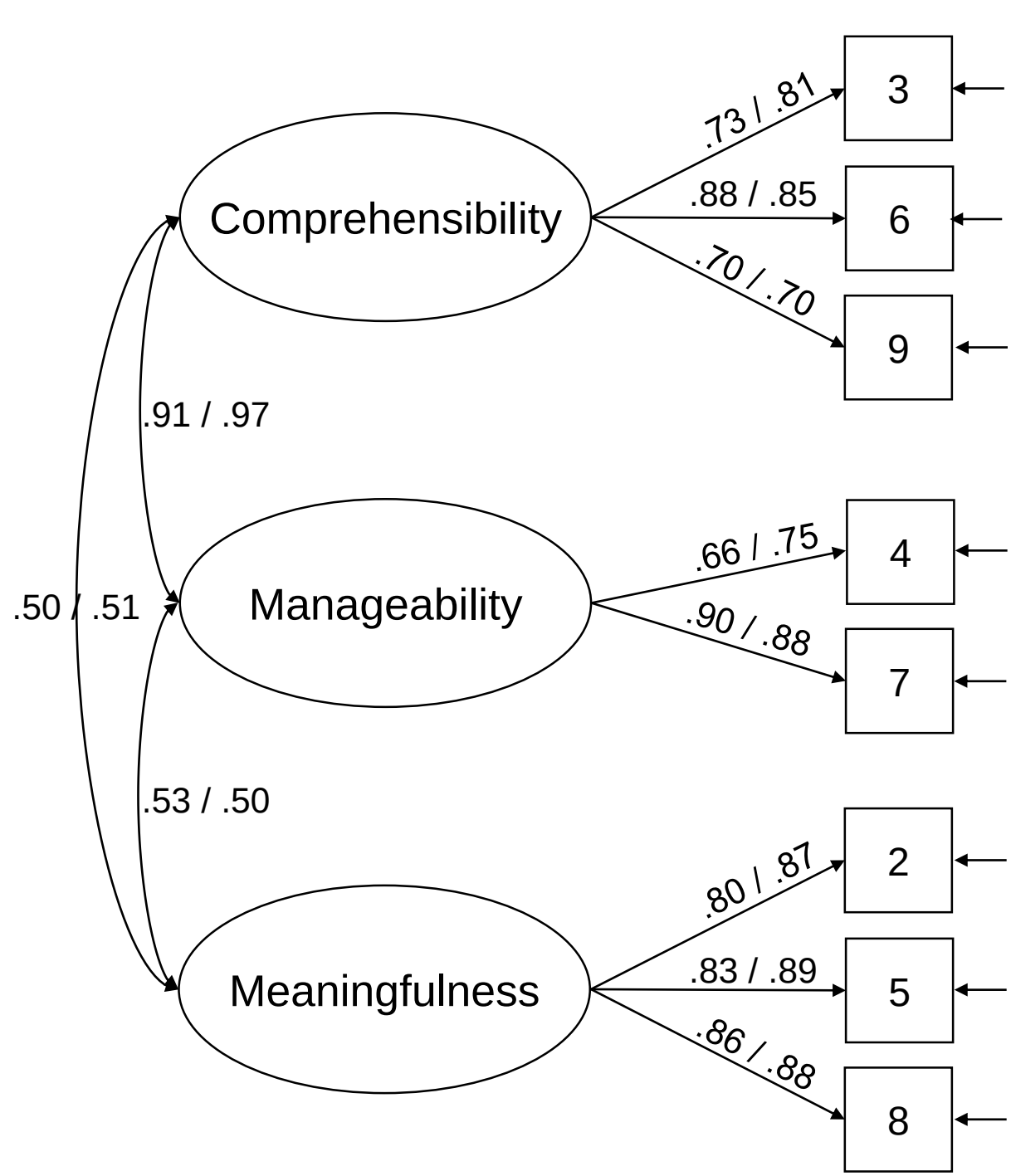
Table IV

Tests of factorial invariance of M4a across occupational groups (*N* = 7254)

	χ^2 (df)	RMSEA	SRMR	CFI	ΔRMSEA	ΔSRMR	ΔCFI	$\Delta\chi^2$ (df)
Single group solutions								
Academics (*n* = 3874)	194.904(17)***	0.052	0.032	0.933				
Technical/administrative personnel (*n* = 2896)	197.562(17)***	0.061	0.050	0.904				
Health/social personnel (*n* = 484)	35.330(17)**	0.047	0.048	0.959				
Measurement invariance								
Equal forms (unconstrained)	427.795(51)***	0.055	0.044	0.924				
Equal factor loadings	447.976(61)***	0.051	0.043	0.922	−0.004	−0.001	−0.002	20.181(10)*

Note. RMSEA: root mean squared error of approximation; SRMR: standard root mean squared residual; CFI: comparative fit index; TLI: Tucker-Lewis index.

*p < .05. **p < .01. ***p < .001.


Comprehensibility
Manageability
Meaningfulness
.73 / .81
.88 / .85
.70 / .70
.66 / .75
.90 / .88
.80 / .87
.83 / .89
.86 / .88
3
6
9
4
7
2
5
8
.91 / .97
.50 / .51
.53 / .50