BMC Psychology

Validity and reliability of the Polish adaptation of the work-related sense of coherence scale

Arkadiusz M. Jasiński[1,2*], Romuald Derbis[1], Magdalena Wrzesińska[2], Martin Tušl[3] and Georg F. Bauer[3]

Abstract

Background Work-related sense of coherence (Work-SoC) is defined as the perceived comprehensibility, manageability and meaningfulness of an individual's work situation. The purpose of this study was to investigate the factor structure, invariance, reliability, and validity of the Polish version of the Work-SoC Scale.

Method The research was carried out between September and November 2023 in a diverse sample of employees. Factor structure, internal consistency, and measurement equivalence analysis were performed on sample $N1 = 622$. Criterion validity was checked on sample $N2 = 255$. Temporal stability was checked on sample $N3 = 60$ using the test-retest method.

Results A three-factor solution was the best fit for the data, and invariant across sex, age, occupational group, and education. The Work-SoC was strongest in white-collar workers. Strength of Work-SoC was positively related to seniority ($r = 0.23$, $p < 0.001$). The reliability of the Work-SoC Scale was high ($\alpha = 0.84$, $\omega = 0.84$). Work-SoC was positively correlated with general SoC ($r = 0.36$, $p < 0.001$) and job satisfaction ($r = 0.50$, $p < 0.001$), and negatively correlated with job burnout ($r = -0.32$, $p < 0.001$). The temporal stability of the measurement for the overall scale was high ($r = 0.80$, $p < 0.001$).

Conclusion The Polish adaptation of the Work-SoC Scale has an identical structure and is as reliable as the original version. The high criterion validity, measurement stability, and the invariant structure of the scale by sex, age, occupational group, and education suggest that the Work-SoC Scale is a valuable tool for future research on employee health.

Keywords Work-related sense of coherence, Salutogenesis, Occupational health, Polish employees, Validation, Measurement invariance

*Correspondence:
Arkadiusz M. Jasiński
arkadiusz.jasinski@uni.opole.pl
[1]Institute of Psychology, University of Opole, plac Staszica 1,
Opole 45-052, Poland
[2]Medical University of Lodz, ul. Narutowicza 60, Łódź 90-136, Poland
[3]Division of Public and Organizational Health, Center of Salutogenesis,
Epidemiology, Biostatistics and Prevention Institute, University of Zurich,
Hirschengraben 84, Zurich 8001, Switzerland

Background

According to one of the basic assumptions of salutogenesis, the personal resource of a strong sense of coherence (SoC) helps an individual effectively cope with stressors and accompanying tension [1]. The SoC is defined as a global orientation that expresses the degree to which an individual has a sustained, dynamic, sense of confidence that (1) incoming stimuli from the internal and external environment are structured, predictable, and explainable (comprehensibility); (2) resources are available to enable the subject to cope with the demands and stresses caused by the stimuli (manageability); and (3) coping with the demands and stresses is a challenge worth the effort and commitment (meaningfulness) [2]. SoC has been thoroughly studied in the general population [3, 4], and in employees [5] regarding diverse health outcomes. In Poland, previous studies in the general population also document that SoC is positively correlated with health and psychological well-being [6]. Between 2020 and 2024, there have been 13 articles published investigating the association between SoC and health in the Polish general population [7]. However, research on the importance of SoC for Polish employees has received less attention with only three papers published in journals indexed in the Scopus database during the same period. In all those publications, SoC was measured with a Polish adaptation [8] of the SoC-29 questionnaire [2]. The most frequently studied group in the context of SoC was nurses, showing that a strong SoC in this occupational group is positively correlated with mental health and coping with stress at work [9] and negatively correlated with work-related burnout [10]. In other occupational groups, studies found negative correlations of SoC with PTSD symptoms in firefighters [11], fatigue, negative mood, and depressive symptoms in Olympic athletes [12]; and positive correlations of SoC with job satisfaction and work engagement in managers [13].

Beyond the general SoC, several studies examined how a context-specific type of SoC, namely work-related sense of coherence (Work-SoC), is associated with employee health [14]. Work-SoC is defined as the perceived comprehensibility, manageability, and meaningfulness of a person's current work situation [15]. Comprehensibility at work is a cognitive dimension and describes the degree to which a work situation is perceived as structured, consistent, and clear. Manageability at work is a behavioral dimension; it describes the degree to which an employee evaluates resources as sufficient to cope with the demands of the job. Meaningfulness is an emotional dimension and describes the degree to which work is perceived as worth the commitment and involvement. As the general SoC is assumed to be more stable, and as Work-SoC is also influenced by the more dynamic working conditions, it is considered more useful in planning, conducting, and evaluating workplace well-being interventions than the general SoC [14]. However, there are currently no studies on this concept in Poland nor a valid Polish version of the Work-SoC scale. The present paper aims to fill this gap.

Comprehensibility, manageability, and meaningfulness at work

Bauer and Jenny [16] introduced Work-SoC as a construct which is influenced by the interaction between the general SoC as an individual characteristic and job demands-resources as key characteristics of one's working environment. The Work-SoC scale was developed to measure the perceived comprehensibility, manageability, and meaningfulness of one's work situation [15, 17]. The scale consists of nine bipolar pairs of adjectives, such as "clear–unclear," which the subject uses to respond to the general question: "How do you personally find your current job and work situation in general?" According to the authors' original intentions, each Work-SoC subscale should consist of three pairs of adjectives. Validation studies [15, 17] suggest that a modified three-factor model is most accurate: comprehensibility (items 1, 3, 6, 9), manageability (items 4, 7), and meaningfulness (items 2, 5, 8). The Work-SoC Scale has been validated in the Norwegian [18], and in the South African [19] populations and further studies [15, 20] showed high internal consistency of the scale ($\alpha = 0.83–0.88$) supporting high reliability of this measure. Previous studies have shown that Work-SoC is an accurate predictor of employee health [21, 22].

Study aims and hypotheses

The main purpose of our study is to develop and evaluate the Polish adaptation of the Work-SoC scale in a diverse sample of employees. We are particularly interested in testing whether the structure of the scale is similar to the original three-factor scale found by Bauer et al. [17]. Furthermore, we want to test the measurement invariance of the Work-SoC Scale across sex, age, occupational group, and education level. In the final phase of the study, we will test intergroup differences in Work-SoC and the criterion validity by examining the relationships between Work-SoC, general SoC, job satisfaction, and job burnout. Based on the above literature review, we hypothesize:

H1 The Work-SoC scale has a three-factor structure with latent factors of comprehensibility, manageability, and meaningfulness.

Previous studies have confirmed the invariance of the Work-SoC Scale by sex, age, occupational group, and education level [15]. We examine the external validity of the scale using measurement invariance analysis and we state our next hypothesis:

H2 The Work-SoC Scale is invariant across sex, age, occupational group, and education level.

An area of research on Work-SoC that needs to be further examined is intergroup differences of the strength of Work-SoC by sex, age, occupational group, and education level. Previous research suggests that Work-SoC may be slightly stronger in females [17]. Other research indicates that general SoC may be stronger in males, but that sex difference only reaches significance in people older than 70 [23]. Given the results of the cited studies, we hypothesize:

H3a There are no differences in the strength of Work-SoC based on sex.

Previous research suggests a weak positive correlation between age and Work-SoC [15]. It is likely that older and, thus, more experienced employees perceive their work as more comprehensible, manageable, and meaningful. SoC is the result of a long-term learning process [2], and older workers have had longer to learn. Understanding SoC as a lifelong learning process is supported by evidence of positive correlations between SoC and age [24]. The lowest SoC was observed in the group of people under the age of 30 [23]. Thus:

H3b Older workers have stronger Work-SoC compared to younger workers.

Previous research suggests there is no correlation between Work-SoC and education level, but there is evidence of stronger Work-SoC in workers in managerial roles [17]. Beyond occupational position, also general work characteristics might play a role. White collar workers and managers have better working conditions [25], better balance of job demands and resources. Given the interactional nature of Work-SoC being influenced by both generalized SoC and working conditions, we expect that white collar workers and managers have stronger Work-SoC. Hence, the following further hypotheses:

H3c There are no differences in the strength of Work-SoC based on education.

H3d Work-SoC differs across occupational groups in that white-collar workers or workers in managerial positions have a stronger Work-SoC than blue-collar workers or workers not in managerial positions.

According to theoretical assumptions [16], the Work-SoC as a context-specific form of the general SoC is still strongly influenced by the general SoC. To test the convergent validity, we examined the relationship between Work-SoC and SoC. We hypothesized:

H4 General SoC is positively correlated with Work-SoC.

Conceptually, Work-SoC influences both the relationship between demands at work and negative health (pathogenic path of health development) and between work resources and positive health (salutogenic path; [14]). Previous research has supported these claims, documenting a positive association of Work-SoC with job resources and positive health and a negative association with job demands and negative health [15, 17, 26].

For the purposes of this study, we operationalized positive health outcomes at work as job satisfaction [26]. A studied manifestation of negative health resulting from excessive demands is occupational burnout, a state of physical, cognitive, and emotional exhaustion related to work [27]. Following on from the above, we tested the criterion validity of the Work-SoC Scale by testing the associations of Work-SoC with job satisfaction and job burnout and we hypothesized:

H5a Job satisfaction is positively correlated with Work-SoC.

H5b Job burnout is negatively correlated with Work-SoC.

Method
Study design and sampling
The study was cross-sectional and based on self-reported data. The study was self-reported and cross-sectional in nature. All participants were over 18 years of age. All participants gave written consent to participate in this anonymous, voluntary study. We conducted the research on three independent simple random samples of Polish workers (N1 = 622, N2 = 255, N3 = 60). The sample N1 was used to check the factor structure, internal consistency, and measurement invariance of the Polish scale. The sample N2 was used for criterion validity analysis. Representatives of sample N3 completed the Work-SoC questionnaire at two time points separated by an interval of five weeks. The study design was reviewed and approved by the University of Opole Research Quality Assessment Committee (KOJBN No. 24/2023). The data were collected between September and November 2023 with the help of a professional agency and by the authors of this study.

Participants

The first sample included N1=622 employees from three occupational groups: blue-collar and production workers (*N*=204); middle-level workers employed as clerks, office staff, and health care workers, (*N*=210); and senior or independent professionals with a high degree of specialization, such as teachers, scientists, doctors, managers in offices and companies (*N*=208). Females accounted for 49.7% of the study group, mean age of the subjects was 39.98 years (*SD*=10.98), mean length of service was 16.57 years (*SD*=10.80). The highest level of education was vocational education for 8.5% (*N*=53), secondary education for 35.9% (*N*=223), and higher education for 55.6% (*N*=346) of participants.

The second sample included N2=255 employees representing the three occupational groups outlined in N1. Female participants accounted for 54.9%, the mean age of respondents was 37.73 years (*SD*=11.97), and the mean length of service was 14.73 years (*SD*=11.65). The highest level of education was vocational education for 11.4% (*N*=29), secondary education for 34.5% (*N*=88), and higher education for 54.1% (*N*=138) of the sample.

The third sample included N3=60 employees representing the three occupational groups outlined in N1. Females accounted for 61.7% of the respondents. The mean age was 31.36 years (*SD*=9.13), and the mean length of service was 8.11 (SD=8.41). The highest level of education was vocational education for 10% (*N*=6), secondary education for 16.7% (*N*=10), and higher education for 73.3% (*N*=44) of participants.

Measures

Work-SoC was measured with a scale originally developed in German by Bauer et al. [17]. The scale measures overall Work-SoC and the three dimensions described above. The inclusion of item content in the form of 9 pairs of adjectives is intended to increase measurement accuracy, which was lower with the long and sometimes inconsistent items of the SoC-29 questionnaire [2]. The final base version had three pairs of adjectives per dimension. Answers are given on a 7-point scale. Scores are calculated by summing the responses of each scale item and dividing the resulting score by the number of statements of the overall scale or subscales. The range of possible scores on the overall scale and each of the subscales is from 1 to 7. The higher the score, the stronger the Work-SoC. Items 1, 3, 4, 6, 7, 9 are reverse-scored. For our study, the scale was translated into Polish in several steps: (1) first translation by two psychologists; (2) comparison of the two versions of the translation and their synthesis; (3) back-translation by two professional translators; (4)

consultation of the Polish version with the author of the original version and final adaptation.

General SoC was measured with the SoC-13 questionnaire. This is a shortened version of the SoC-29 tool [2] adapted to Polish [8]. The scale measures the general sense of coherence and its components. It consists of 13 questions about various aspects of the respondent's life, such as "How often do you experience feelings that you don't know if you can control?" Answers are given on a 7-point scale (1=very often, 7=very rarely or never). The range of possible overall scale value is from 1 to 7. The higher the score, the stronger the SoC. The reliability of the scale in our study was α=0.78, ω=0.78.

Job satisfaction and burnout were measured with the Copenhagen Psychosocial Questionnaire [28] in a Polish adaptation [29]. The Job Satisfaction Scale measures an employee's overall level of satisfaction with the resources available at work, career prospects, and physical working conditions, such as "How satisfied are you with your job as a whole, taking into account all aspects of it?" The burnout scale includes questions about perceived physical, emotional, and mental exhaustion from work, such as "How often have you felt emotionally exhausted?" The range of possible scores on both scales is from 0 to 100. The higher the score, the higher the level of job satisfaction or burnout. The reliability of the Job Satisfaction Scale was α=0.79, ω=0.80, and for job burnout it was α=0.85, ω=0.85.

Statistical analyses

First, we checked the factor structure of the scale using confirmatory factor analyses (CFA). The indicators of the model fit to the data and the criterion for choosing the right model were the χ2/df test, IFI (incremental fit index), TLI (Tucker-Lewis index), CFI (comparative fit index), RMSEA (root mean square error of approximation), SRMR (standardized root mean square residual), and the χ2 significance of difference test. After determining the factor structure, we performed Pearson's correlation analysis for all scale items, factors, and the overall scale. The next step was to check the measurement invariance of the scale (configural, metric, scalar) by sex, age, occupational group, and education of the subjects. For this purpose, we conducted multi-group confirmatory factor analyses (MGCFA). We used the χ2/df, CFI, RMSEA, SRMR, and the Δχ2/df, ΔCFI, ΔRMSEA, Δ SRMR significance of change indices to evaluate the models tested at this stage. Confirmation of measurement invariance can be judged by the following parameters: Δχ2/df is not statistically significant, or ΔCFI ≤ -0.010, ΔRMSEA≤0.015, Δ SRMR≤0.030 [30].

The next step was a series of analyses of intergroup differences using the Student's ' *t-test* and one-way analysis of variance. We used Pearson's correlation analysis to assess criterion validity. We assessed the internal consistency of the scale using Cronbach's α and McDonald's ω indices. We assessed the temporal stability of the measurement using Pearson's correlation analysis. We performed statistical analyses in IBM SPSS with the Amos and Process macro package [31].

Results

The results of the factor analysis are shown in Table 1. The modified three-factor model (M4) proved to be the best fit for the data (H1 supported). Item 1 was included in comprehensibility because it loaded more strongly on this factor (0.404) than on the manageability factor (0.079). The factor structure is presented in Fig. 1. Correlation coefficients between items, factors, and the Work-SoC total score are provided in Table 2. The results of the measurement invariance analysis (Table 3) suggest that the modified three-factor structure of the scale is equivalent across sex, age, occupational group, and educational level (H2 supported). The analysis of intergroup differences showed no significant differences in the strength of Work-SoC and of its components between male and female employees (H3a supported), or between groups with different levels of education (H3c supported). The results of the one-way analysis of variance indicate that there are significant differences between occupational groups in terms of Work-SoC and its components by occupational group membership. Post-hoc comparisons using Sheffe's test showed that white-collar workers had a stronger Work-SoC, manageability, and meaningfulness, compared to mid-level and blue-collar workers (H3d supported). The differences detected are significant at the $p < 0.01$ level for Work-SoC and meaningfulness and at the $p < 0.05$ level for manageability. The results of the one-way analysis of variance indicate that there are significant differences between workers of different ages in the strength of Work-SoC and all its dimensions. Post-hoc comparisons using the Sheffe's test showed that workers aged ≥ 55 had a stronger Work-SoC than workers aged 18−34 ($p_{difference} < 0.001$) and 35−44 ($p_{difference} = 0.005$), and also higher levels of comprehensibility than workers aged 18−34 ($p_{difference} = 0.005$) and 35−44 ($p_{difference} = 0.033$), and higher levels of meaningfulness than workers aged 18−34 ($p_{difference} = 0.001$) and 35−44 ($p_{difference} = 0.021$). Workers aged 45−54 had a stronger Work-SoC compared to workers aged 18−34 ($p_{difference} = 0.003$) and 35−44 ($p_{difference} = 0.032$), with higher levels of manageability than the 35−44 group ($p_{difference} = 0.027$), and higher levels of meaningfulness than workers aged 18−34 ($p_{difference}$

Table 1 Fit statistics for the study models. N=622

Model	χ²(df)	χ²/df	IFI	TLI	CFI	RMSEA	SRMR	Δχ²(df)	Model comparision
M1: One-factor model (items 1–9).	379.376(27)***	14.051	0.946	0.793	0.845	0.145	0.0761		
M2a: Two-factor model (Comprehensibility+Meaningfulness, and Manageability).	363.291(26)***	13.973	0.852	0.794	0.852	0.145	0.0770	16.085(1)***	M1 vs. M2a
M2b: Two-factor model (Comprehensibility, and Manageability+Meaningfulness).	316.285(26)***	12.165	0.873	0.823	0.872	0.134	0.0781	63.091(1)***	M1 vs. M2b
M2c: Two-factor model (Comprehensibility+Manageability, and Meaningfulness).	121.661(26)***	4.679	0.958	0.942	0.958	0.077	0.0463	194.624(1)***	M1 vs. M2c
M3: Three-factor model (Comprehensibility=3, 6, 9; Manageability=1, 4, 7; Meaningfulness=2, 5, 8).	121.472(24)***	5.061	0.957	0.936	0.957	0.081	0.0464	0.189(2)***	M2c vs. M3
M4. Modified three-factor model (Co=1, 3, 6, 9; Ma=4, 7; Me=2, 5, 8).	96.371(24)***	4.015	0.968	0.952	0.968	0.070	0.0407	25.29(2)***	M2c vs. M4

Note. Co=comprehensibility, Ma=manageability, Me=meaningfulness. ***p<0.001
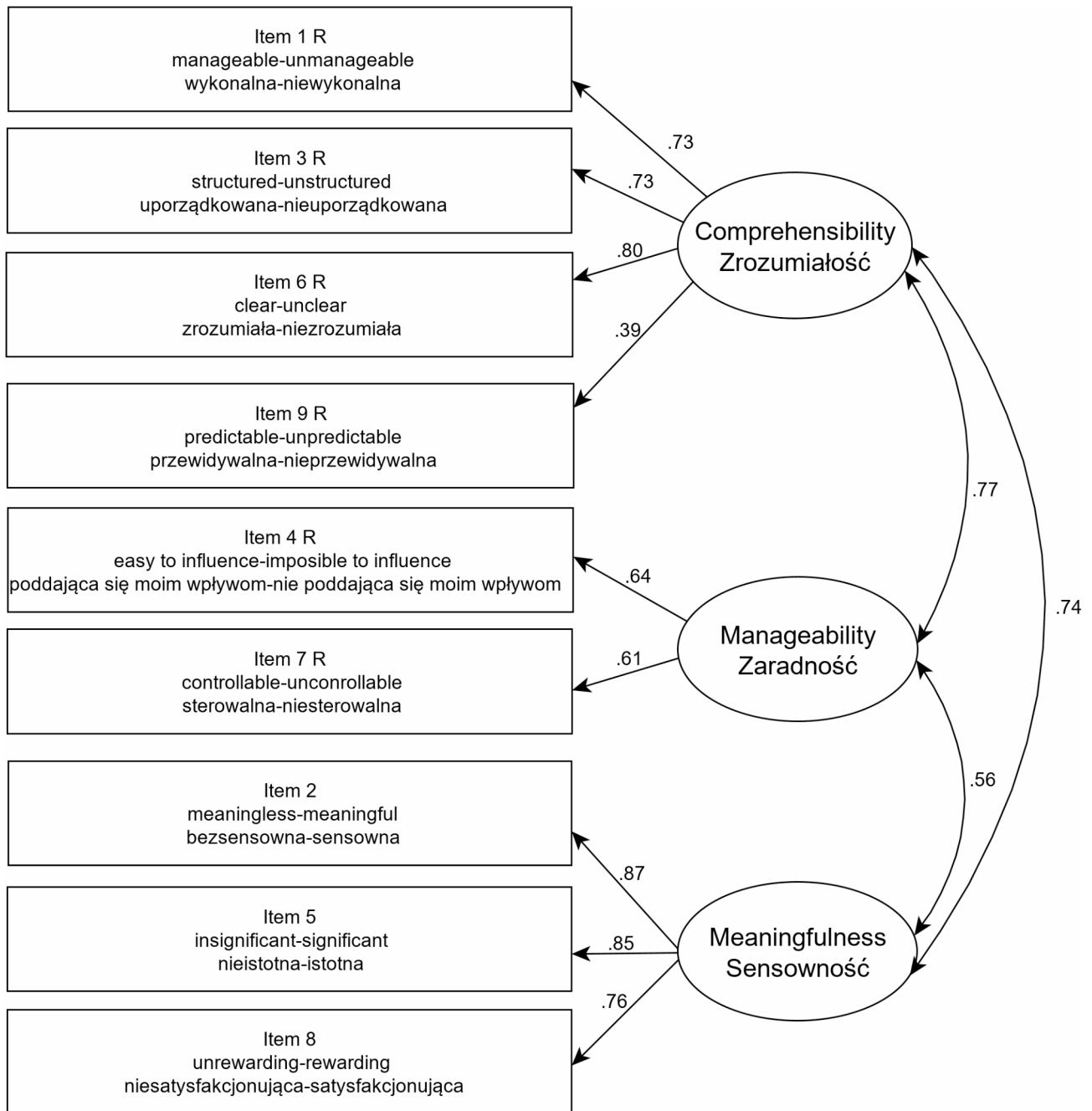
Fig. 1 Standardized estimates of factor loadings and factor correlations of Work-SoC subscales. All estimates were statistically significant ($p < 0.001$). $N = 622$. The wording of items are in English and Polish. R = reverse scoring

= 0.003). The results of the one-way analysis of variance showed no significant differences between occupational groups in terms of age $F(2, 619) = 0.938$, $p = 0.392$. Accordingly, hypothesis H3b is supported. Detailed results of intergroup comparisons are in Table 4.

CFA results on the N2 sample showed that the proposed model is a good fit for the data: $\chi^2(df) = 58.835(24)$, $p < 0.001$, CMIN = 2.451,

IFI = 952, TLI = 0.927, CFI = 0.951, RMSEA = 0.076, SRMR = 0.0700. The MGCFA results indicate that the factor structure of the Work-SoC Scale in samples N1 and N2 was unchanged: $\chi^2(df) = 155.206(48)$, $p < 0.001$, CMIN = 3.233, IFI = 0.964 TLI = 0.954, CFI = 0.964, RMSEA = 0.051, SRMR = 0.0407. The results of the criterion validity analysis (Table 5) indicate that generalized SoC and job satisfaction are positively correlated with Work-SoC, allowing us to accept hypotheses H4

Jasiński *et al. BMC Psychology*   (2024) 12:659

Page 7 of 11

Table 2 Descriptives statistics. $N=622$

Variable	M	SD	Sk	K	Age	Seniority	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Co	Ma	Me
Age	39.98	10.98	0.44	−0.49														
Seniority	16.57	10.80	0.68	−0.33	0.89													
Item 1	5.72	1.35	−1.05	0.77	0.08*	0.10*												
Item 2	5.50	1.38	−0.87	0.42	0.22	0.21	0.48											
Item 3	5.17	1.58	−0.65	−0.42	0.15	0.15	0.51	0.48										
Item 4	4.50	1.56	−0.29	−0.39	0.11	0.14	0.32	0.29	0.39									
Item 5	5.51	1.30	−0.83	0.57	0.22	0.22	0.47	0.75	0.46	0.33								
Item 6	5.67	1.35	−0.92	0.12	0.16	0.18	0.60	0.49	0.56	0.39	0.54							
Item 7	4.83	1.54	−0.39	−0.30	0.11	0.15	0.33	0.27	0.33	0.39	0.29	0.39						
Item 8	5.00	1.59	−0.67	−0.10	0.11**	0.11**	0.44	0.67	0.49	0.36	0.63	0.44	0.22					
Item 9	4.56	1.65	−0.26	−0.70	0.11**	0.13**	0.30	0.14	0.34	0.17	0.13	0.32	0.25	0.10				
Co	5.27	1.19	−0.43	−0.16	0.16	0.19	0.76	0.51	0.80	0.41	0.51	0.79	0.43	0.47	0.67			
Ma	4.66	1.12	−0.11	−0.10	0.13**	0.19	0.39	0.34	0.43	0.83	0.37	0.47	0.83	0.35	0.25	0.50		
Me	5.33	1.26	−0.63	0.19	0.20	0.20	0.52	0.90	0.54	0.37	0.88	0.55	0.29	0.88	0.14	0.56	0.40	
W-SoC	5.16	0.99	−0.12	−0.64	0.21	0.23	0.72	0.74	0.75	0.60	0.74	0.77	0.58	0.71	0.47	0.88	0.71	0.82

Note. Co=comprehensibility; Ma=manageability; Me=meaningfulness; W-SoC=work-related sense of coherence. * $p<0.05$, ** $p<0.01$, all other correlations are significant at $p<0.001$

and H5a. Occupational burnout correlates negatively with Work-SoC, so H5b was also accepted.

Analysis of the temporal stability of the measure in sample N3 suggests high stability for the overall scale and the subscales: Work-SoC T1 → Work-SoC T2 ($r=0.80$), comprehensibility T1 → comprehensibility T2 ($r=0.77$), manageability T1 → manageability T2 ($r=0.62$), meaningfulness T1 → meaningfulness T2 ($r=0.72$), and all correlations were significant at the $p<0.001$ level.

Discussion

The main purpose of this study was to validate the Polish version of the Work-SoC scale. All stated hypotheses were supported. The H1 hypothesis, where we assumed that a modified three-factor structure of the Work-SoC Scale would best fit the data, was fully supported. This is consistent with previous results [15, 19]. The best-fitting alternative to the three-factor solution was a two-factor model, in which comprehensibility and manageability were included as a single factor. The value of the correlation coefficient between comprehensibility and manageability in our study is identical to that in the original version of the scale ($r=0.77$, $p<0.001$; [17]) and lower than that in the Norwegian adaptation ($r=0.91$, $p<0.001$; [18]). Thus, the Polish version of the Work-SoC has an identical structure to the original version validated on large and diverse samples of workers from Switzerland, Austria, and Germany [17, 20]. Conceptually, the authors of the Work-SoC Scale expected item 1 (manageable–unmanageable) to be a component of the manageability subscale, but empirical arguments from the studies cited above and ours suggest that item 1 fits better the comprehensibility subscale. In light of our results and the underlying items, we can say that in the surveyed employees, comprehensibility is composed of feeling that their work is manageable, structured, and clear and that their course is predictable. The pattern of connections between items and latent variables was similar to that observed in the original version of the scale. As in Bauer et al. [17], we observed the lowest factor loading for item 9 (predictable–unpredictable). The strength and direction of correlations between items, dimensions, and the overall Work-SoC scale indicate that the dimensions maintain their distinctiveness and are internally consistent. The internal consistency of the overall scale is high ($α=0.84$, $ω=0.84$), with Cronbach's $α$ ranging from 0.52 to 0.86 for the subscales.

For H2 hypothesis, we assumed that the modified three-factor structure of Work-SoC Scale is invariant across sex, age, occupational group, and education level. The analysis of variance fully supported this

Table 3 Tests of measurement invariance across sex, age, occupational groups, and education. $N=622$

Grouping variable/ tested invariance	χ^2 (df)	χ^2/df	CFI	RMSEA	90% CI RMSEA	SRMR	$\Delta\chi^2$(df)	ΔCFI	ΔRMSEA	ΔSRMR
Sex										
Configural	135.094(48)***	2.814	0.962	0.054	[0.043-0.065]	0.0534				
Metric	140.489(54)***	2.602	0.963	0.051	[0.041-0.061]	0.0544	5.395(6)ns	0.001	−0.003	0.001
Scalar	145.978(63)***	2.317	0.964	0.046	[0.036-0.056]	0.0545	5.489(9)ns	0.001	−0.005	0.0001
Age										
Configural	181.371(96)***	1.889	0.962	0.038	[0.029-0.046]	0.0483				
Metric	195.645(114)***	1.716	0.964	0.034	[0.026-0.042]	0.0511	14.274(18)ns	0.002	−0.004	0.002
Scalar	268.983(141)***	1.908	0.943	0.038	[0.031-0.045]	0.0514	73.338(27)***	−0.021	0.004	0.0003
Occupational group										
Configural	182.883(72)***	2.540	0.952	0.050	[0.041-0.059]	0.0631				
Metric	193.889(84)***	2.308	0.952	0.046	[0.038-0.054]	0.0604	11.006(12)ns	0	−0.004	−0.002
Scalar	247.173(102)***	2.423	0.937	0.048	[0.040-0.056]	0.0599	53.284(18)***	−0.015	−0.002	−0.0005
Education										
Configural	162.614(72)***	2.259	0.961	0.045	[0.036-0.054]	0.0609				
Metric	186.315(84)***	2.218	0.956	0.044	[0.036-0.053]	0.0660	23.701(12)*	−0.005	−0.001	0.005
Scalar	207.344(102)***	2.033	0.955	0.041	[0.033-0.049]	0.0656	21.029(18)ns	−0.001	−0.003	−0.0004

*** $p<0.001$, ** $p<0.01$, * $p<0.01$

hypothesis. This result again is consistent with previous findings for the original German-language version [15]. Our results extend previous findings, as the current study compared the scale structure in more subgroups than Vogt et al. [15]: four age groups instead of three; three education groups instead of a higher-lower education division; three employment sectors instead of a managerial-nonmanagerial position division.

The H3a-b hypotheses, in which we investigated the intergroup differences between male and female employees, and age groups in strength of Work-SoC were supported. As expected, we did not find any differences in Work-SoC based on sex. This supports earlier findings that only in the age group over 70 years men have a significantly stronger general SoC than women [23]. We noticed that Work-SoC is positively related to age and years of work experience (r_{age} = 0.21, $r_{experience}$ = 0.23, $p<0.001$). This result is partially consistent with previous findings.Vogt et al. [15] showed a significant positive correlation between age and Work-SoC; however, in Bauer et al. [17], such a correlation was not observed. Our research clarifies the picture of these correlations. We compared several age groups of workers, and the results suggest that workers over the age of 45 have significantly stronger overall Work-SoC and also in all its components than workers below that age. Additional comparisons ruled out the possibility that these differences could be explained by a larger proportion of white-collar workers among older workers. In our view, the stronger Work-SoC in older groups may be both due to a healthy worker effect (i.e., people with a strong Work-SoC being more likely to stay employed) and due to greater experience in the occupation. Age and tenure in our study were

correlated at $r=0.89$, $p<0.001$. The H3c hypothesis, which states that strength of Work-SoC is not correlated with education level was supported. Individuals with different levels of education do not differ in Work-SoC strength, confirming previous findings and suggesting that job type plays a more important role than education level in predicting Work-SoC levels [17].

We confirmed our hypothesis H3d that white-collar workers or workers holding managerial positions have a stronger Work-SoC than blue-collar workers or workers not holding a managerial position. The largest and most significant differences were in meaningfulness. According to the salutogenic model, life experiences characterized by participation in shaping outcomes is a key driver for experiencing meaningfulness. The professions of teachers, doctors, lawyers, and senior government officials all have a particularly high potential for shaping outcomes. The comparable levels of comprehensibility across different professional groups may be because comprehensibility is a prerequisite for the effective delivery of any job.

Finally, we also confirmed our hypotheses H4 and H5a and H5b. As in previous studies, the SoC and its dimensions correlate positively with the Work-SoC and its dimensions [20]. The strength of the correlation ($r=0.36$, $p<0.001$) confirms our conjecture that the Work-SoC scale and the SoC-13 scale measure similar but not identical psychological variables. Job satisfaction is positively correlated to Work-SoC and its dimensions. This result aligns with previous studies [17]. The strongest correlation occurred between job satisfaction and meaningfulness, which confirms one of the basic assumptions of salutogenetic theory in the

Table 4 Intergroup comparisons. One-way ANOVA and Sheffe test results. *N*=622

Variable	Work-SoC					Work-Comprehensibility					Work-Manageability					Work-Meaningfulness				
	M	SD	df	F	η²	M	SD	df	F	η²	M	SD	df	F	η²	M	SD	df	F	η²
Occupational group			2, 619	7.02**	0.022			2, 619	1.61ns				2, 619	5.89**	0.018			2, 619	11.44***	0.035
Blue-collar workers	5.08	1.38				5.25	1.19				4.51	1.39				5.08	1.38			
Middle-level workers	5.07	0.97				5.19	1.09				4.55	1.27				5.27	1.21			
White-collar workers	5.37	0.95				5.38	1.08				4.91	1.19				5.65	1.13			
Age			3, 618	9.37***	0.043			3, 618	5.66**	0.026			3, 618	5.15**	0.024			3, 618	8.52***	0.039
18–34	4.98	0.97				5.12	1.13				4.54	1.29				5.10	1.34			
35–44	5.05	1.03				5.19	1.19				4.48	1.34				5.25	1.29			
45–54	5.39	0.95				5.44	1.03				4.93	1.17				5.61	1.16			
≥ 55	5.54	0.88				5.65	0.99				4.96	1.33				5.78	0.92			

*** p < 0.001, ** p < 0.01. ns=not significant

context of work, namely about the key role of meaningfulness [2].

The H5b hypothesis, in which we predicted a negative relationship between Work-SoC and job burnout, was supported. Work-SoC's correlation with burnout is weaker than with job satisfaction. The strength of the correlation between Work-SoC and job satisfaction is higher than that between general SoC and job satisfaction. These results confirm the higher predictive validity of Work-SoC in explaining work-specific variables [14]. On the other hand, the negative correlation between job burnout and Work-SoC is weaker than between burnout and general SoC. This suggests a more important role of the general SoC in preventing negative health outcomes. Job burnout is dependent on stressors and resources outside of work, which general SoC helps to deal with. On the other hand, job satisfaction is less dependent on these external factors. The time-stability analysis of the measure suggests high stability for the overall scale (r=0.80, p<0.001) and satisfactory stability for the subscales. This is higher than previous results (r=0.53, p<0.01), but the interval in our study was shorter (5 weeks) than in the previous study (1 year) [15]. This discrepancy supports the assumption that Work-SoC is stable in the short term but can change over the long term, making it a measure sensitive to changes in working conditions [17].

Strengths and limitations

Our study was the first to examine the psychometric properties of the Work-SoC scale beyond Germanic languages. Furthermore, our study is the first to compare Work-SoC in blue and white collar workers. We confirmed the theoretically postulated structure of the scale in a large and broad sample of Polish workers. Our findings support the use of the Work-SoC scale, as a reliable, valid measure with an invariant structure across sex, age, occupational group, and educational level.

The first limitation of our study is its cross-sectional nature. We added a longitudinal component, establishing the temporal stability of the test-retest measurement. The second limitation is the self-report nature of the research. We suggest cautious generalization of the results presented here, especially regarding intergroup comparisons. Another limitation stems from the fact that the health outcomes of working conditions have been reduced to job satisfaction and burnout. Sampling is also a limitation. The three groups of workers surveyed may not reflect the full picture of the various occupations and specialties present in the labor market.

Jasiński *et al. BMC Psychology*   (2024) 12:659

Page 10 of 11

Table 5 Correlations coefficients between Work-SoC subscales, generalized sense of coherence, job burnout and job satisfaction. $N=255$

Variable	M	SD	Sk	K	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Work-SoC	5.01	1	−0.88	1.05									
2. Work-Comprehensibility	4.9	1.23	−0.65	0.28	0.83***								
3. Work-Manageability	4.45	1.31	−0.37	−0.02	0.71***	0.47***							
4. Work-Meaningfulness	5.53	1.38	−1.17	0.85	0.73***	0.32***	0.35***						
5. SoC	4.10	0.78	−0.09	0.72	0.36***	0.26***	0.19**	0.35***					
6. Comprehensibility	3.58	0.88	0.25	0.02	0.21***	0.17**	0.07	0.21***	0.86***				
7. Manageability	3.91	0.97	0.07	−0.10	0.30***	0.26***	0.16**	0.23***	0.82***	0.63***			
8. Meaningfulness	4.93	1.04	−0.81	0.78	0.38***	0.21**	0.25***	0.41***	0.76***	0.46***	0.41***		
9. Job burnout	54.60	19.24	−0.004	−0.31	−0.32***	−0.27***	−0.13*	−0.30***	−0.51***	−0.43***	−0.45***	−0.38***	
10. Job satisfaction	60.61	17.87	−0.60	1.04	0.50***	0.32***	0.32***	0.51***	0.19**	0.06	0.21**	0.22***	−0.27***

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Conclusions

In summary, our results have shown that work-related sense of coherence is a useful construct for explaining positive and negative health outcomes at work. According to theoretical foundations, Work-SoC also has shown to be a positive correlate of general SoC. The findings support the high validity and reliability of the Work-SoC Scale. The concept and measurement of Work-SoC will inform further Polish salutogenic research in the field of occupational health psychology.

Data availability
Some or all data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was conducted according to the guidelines of the Declaration of Helsinki. The study design was reviewed and approved by the University of Opole Research Quality Assessment Committee (KOJBN No. 24/2023). All participants were over 18 years of age. Informed consent was obtained from all participants prior to the completion of the survey. All participants gave written consent to participate in this anonymous, voluntary study.

Consent for publication
Not aplicable.

Competing interests
The authors declare no competing interests.

References
1. Antonovsky A. Health, stress and coping. Jossey-Bass; 1979.
2. Antonovsky A. Unraveling the mystery of health: how people manage stress and stay well. Jossey-Bass; 1987.
3. Quansah F, Agormedah EK, Hagan JE, Frimpong JB, Ankomah F, Srem-Sai M, et al. Subjective social status and well-being of adolescents and young adults in Ghanaian schools: conditional process analysis. BMC Psychol. 2023;11:122.
4. Mittelmark MB, Bauer GF. Salutogenesis as a theory, as an orientation and as the sense of coherence. In: Mittelmark MB, Bauer GF, Vaandrager L, Pelikan JM, Sagy S, Eriksson M, et al. editors. The handbook of Salutogenesis. Cham: Springer International Publishing; 2022. pp. 11–7.
5. Tušl M, de Bloom J, Bauer GF. Sense of coherence, off-job crafting, and mental well-being: a path of positive health development. Health Promot Int. 2022;37:daac159.

6. Dymecka J, Gerymski R, Machnik-Czerwik A, Derbis R, Bidzan M. Fear of COVID-19 and life satisfaction: the role of the Health-related hardiness and sense of coherence. Front Psychiatry. 2021;12:1935.

7. Krok D. Sense of coherence and psychological well-being among coronary heart disease patients: a moderated mediation model of affect and meaning in life. Curr Psychol. 2022;41:4828–36.

8. Koniarek J, Dudek B, Makowska Z. Kwestionariusz Orientacji Życiowej. Adaptacja the sense of Coherence Questionnaire (SOC) A. Antonovsky'ego. Przegląd Psychol. 1993;36:491–502.

9. Betke K, Basińska MA, Andruszkiewicz A. Nurses' sense of coherence and stress management strategies against the types of health status. Nurs Open. 2021;8:3403–10.

10. Basińska M, Andruszkiewicz A, Grabowska M. Nurses' sense of coherence and their work related patterns of behaviour. Int J Occup Med Environ Health. 2011;24.

11. Dudek B, Koniarek J. Relationship between sense of coherence and post-traumatic stress disorder symptoms among firefighters. Int J Occup Med Environ Health. 2000;13:299–305.

12. Szczypińska M, Samełko A, Guszkowska M. What predicts the Mood of athletes involved in preparations for Tokyo 2020/2021 Olympic games during the covid – 19 pandemic? The role of sense of coherence, hope for success and coping strategies. J Sports Sci Med. 2021;20:421–30.

13. Derbis R, Jasiński AM. Work satisfaction, psychological resiliency and sense of coherence as correlates of work engagement. Cogent Psychol. 2018;5:1451610.

14. Jenny GJ, Bauer GF, Vinje HF, Brauchli R, Vogt K, Torp S. Applying salutogenesis in the Workplace. In: Mittelmark MB, Bauer GF, Vaandrager L, Pelikan JM, Sagy S, Eriksson M, et al. editors. The handbook of Salutogenesis. Cham: Springer International Publishing; 2022. pp. 321–36.

15. Vogt K, Jenny GJ, Bauer GF. Comprehensibility, manageability and meaningfulness at work: construct validity of a scale measuring work-related sense of coherence. SA J Ind Psychol. 2013;39:8.

16. Bauer G, Jenny GJ, Development. Implementation and Dissemination of Occupational Health Management (OHM). Putting salutogenesis into practice. Occup Health Psychol. 2007;2:219–50.

17. Bauer G, Vogt K, Inauen A, Jenny GJ. Work-SoC–Entwicklung und Validierung Einer Skala Zur Erfassung Des Arbeitsbezogenen Kohärenzgefühls. Z Für Gesundheitspsychologie. 2015;23:20–30.

18. Grødal K, Innstrand ST, Bauer GF, Haugan G, Rannestad T, André B. Validation of the Norwegian version of the work-related sense of coherence scale. Scand J Public Health. 2018;46:711–7.

19. van der Westhuizen S, Ramasodi E. Work-related sense of coherence scale: reliability and validity of scores in a South African sample. J Psychol Afr. 2016;26:216–20.

20. Broetje S, Bauer GF, Jenny GJ. The relationship between resourceful working conditions, work-related and general sense of coherence. Health Promot Int. 2020;35:1168–79.

21. Grødal K, Innstrand ST, Haugan G, André B. Work-related sense of Coherence and Longitudinal relationships with Work Engagement and Job satisfaction. Scand J Work Organ Psychol. 2019;4:5.

22. van der Westhuizen SC. Incremental validity of work-related sense of coherence in predicting work wellness. SA J Ind Psychol. 2018;44:7.

23. Lindmark U, Stenström U, Gerdin EW, Hugoson A. The distribution of 'sense of coherence' among Swedish adults: a quantitative cross-sectional population study. Scand J Public Health. 2010;38:1–8.

24. Meier Magistretti C et al. The Sense of Coherence in the Life Course. In: Mittelmark MB, Bauer GF, Vaandrager L, Pelikan JM, Sagy S, Eriksson M, editors. The Handbook of Salutogenesis. 2nd edition. Cham (CH): Springer; 2022.

25. Schreuder KJ, Roelen CaM, Koopmans PC, Groothoff JW. Job demands and health complaints in white and blue collar workers. Work Read Mass. 2008;31:425–32.

26. Brauchli R, Jenny GJ, Füllemann D, Bauer GF. Towards a job demands-resources Health Model: empirical testing with generalizable indicators of job demands, Job resources, and Comprehensive Health outcomes. BioMed Res Int. 2015;2015:959621.

27. Maslach C, Leiter MP. Understanding burnout: New models. Handb Stress Health Guide Res Pract. 2017;:36–56.

28. Pejtersen JH, Kristensen TS, Borg V, Bjorner JB. The second version of the Copenhagen Psychosocial Questionnaire. Scand J Public Health. 2010;38 3suppl:8–24.

29. Baka Ł. Kopenhaski Kwestionariusz Psychospołeczny (COPSOQ II): podręcznik do polskiej wersji narzędzia. CIOP - PIB; 2019.

30. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. Struct Equ Model Multidiscip J. 2007;14:464–504.

31. Hayes AF. Introduction to Mediation, Moderation, and conditional process analysis. Second. Guilford; 2017.

Publisher's note