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Validation of the work stress screener (WOSS-13) and resilience at work scale (ReWoS-24)

Jennifer Sweetman [a,*], Christina M van der Feltz-Cornelis [a,b], Iman Elfeddali [c,d], Edwin de Beurs [e]

[a] *Department of Health Sciences, University of York, UK*
[b] *Hull York Medical School, University of York, York, UK*
[c] *GGz Breburg, Tilburg, Netherlands*
[d] *Tranzo Department, Tilburg University, Tilburg, Netherlands*
[e] *Leiden University, Netherlands*

A B S T R A C T

Objective: Work stress is a global issue with countries such as the UK requiring organisations to protect employees. Work stress can be beneficial (challenging) or harmful (overwhelming), and characteristics such as resilience are thought to mitigate some of the negative effects. This paper describes the validation of two new scales. The WOSS-13 was designed to measure both benign and harmful experiences of work stress, while the ReWoS-24 captures information about individual and team resilience.
Methods: For both scales the assessment of individual items, domains captured by scale items, reliability and validity were completed using data from a survey of 1980 individuals from the University of York, England. A sub-sample of respondents ($N = 609$) provided additional data for retest purposes. Analyses were performed using these two samples.
Results: Responses to scale items were found to be normally distributed. Confirmatory factor analysis indicated the WOSS-13 was comprised of three subscales: positive work-related affect/stress, general positive affect and harmful stress. The ReWoS-24 is presented as four sub-scales: general well-being, well-being at work, satisfaction with job performance and team resilience. All subscales demonstrated good internal consistency (Cronbach's alpha ≥ 0.80). Both scales complement existing measures of stress and mental health.
Conclusion: The findings suggest that the WOSS-13 is a valid and reliable measure which enables the assessment of both benign and harmful forms of work stress. The ReWoS-24 is a valid and reliable measure of individual and team resilience. These scales could be used in workplaces to assess for and mitigate against, harmful work stress.

1. Introduction

Work-related stress is common and affects individuals, companies and society as a whole. In the UK alone, 828,000 workers reported suffering from work-related stress, depression or anxiety in 2019/20; over 17.9 million days are lost at work a year [1]. The Stevenson report stated that 300,000 employees drop out of work with mental health issues annually and 15% suffer from mental disorders [2]. UK employers now have a legal duty to protect employees from stress at work [3]. Work stress contributes to allostatic load which has been associated with poor health outcomes including diabetes, cardiovascular disease, musculoskeletal disorders, mood and anxiety disorders, post-traumatic stress disorder and psychotic disorders [4].

In the work context, stress is confusing as it is used loosely in common language, ill-defined, and not well operationalised in research. Conceptually, a distinction is needed between using "stress" to denote a stressor identifying environmental conditions such as having too much work to do, and stress as a subjective internal state resulting from exposure to stressors or stressful circumstances (being overwhelmed or having insufficient support). Here, "work stress" denotes a stressor and "stress" denotes the subjective internal state.

Commonly, work stress has negative connotations, associated with physical and psychological problems and may lead to illness [5,6]. There is, however, also a positive/ benign form of work stress related to being

positively challenged, leading to anticipated success and reward. Positive challenge related work stress is positively related to job satisfaction and negatively related to searching for another job; hindrance-related self-reported work stress is negatively related to job satisfaction and positively related to job search and turnover [7].

It is crucial to detect harmful work-related stress levels swiftly to prevent mental disorders or physical illness with sick-leave or even mortality as a consequence for individuals [8], and loss of competent employees and related human capital for employers. This, combined with legal obligations, has led to an abundance of companies offering support to employers in dealing with employee work stress. It is also important to detect benign work stress to foster positive challenges in the workplace. Ambiguity around work stress is reflected in:

1. Poor measurement practices using measures with unknown validity and reliability in organisational and research settings; questionnaires are often study specific and not validated [9,10]
2. Insufficient representation of positive stress in existing measures assessing work-related stress such as the Work Stress Questionnaire [11] which does not distinguish between benign stress and harmful stress.

Personality traits, such as resilience, may enhance access to resources or hinder development of burnout or mental disorders. Resilience has been defined as resistance to illness, the ability to adapt and thrive, and to bounce back or recover from stress [12]. This is thought to moderate the effect of work stress [13,14]. Specific qualities of resilience are emotional intelligence, the ability to be reflective, display empathy and social competence. Resilience has been associated with coping skills [15] and personality factors such as vitality, autonomy and independence [16–20]. Although resilience questionnaires exist(Resilience Assessment scale [21], Brief Resilience Scale [12]), none explore resilience in the context of work-related stress. In employment settings resilience may not only be relevant for the individual employee, but also in the work team. Hall and Lamont(2013) defined resilience of a community as the capacity of groups of people in an organisation, social class, race, community or nation, to safeguard their wellbeing or to improve their wellbeing when it is under threat [22]. Applied to team resilience, this would be the capacity of members of the team to safeguard their wellbeing or to improve their wellbeing when it is under threat from change, external demands, hostility from colleagues or clients, different opinions about how to perform tasks, work vision or team culture [23].

The balance between job related strain and the resources available to an employee to cope with strain has been described in the Job Demands-Resources model [24]. In this model, the interplay between Job Demands and resources contributes to furthering or hindering the development of work-related physical [25] and mental health issues, such as burnout [26]. Organisational factors such as job insecurity, too many tasks, unclear work roles, lack of peer support, bullying at work, and leadership style can play a role [27]. Resources can include personality characteristics such as the self-regulatory capacity to deal with lack of resources [28], a proactive personality that can mediate leadership style [29] or grit which has been found to protect against burnout [30]. Social factors can be resources that play a role as well in dealing with job demands, such as how the family deals with high job demand out of office hours [31], having a supportive partner, or being a single parent with children with a chronic medical condition [32]. Given the societal urgency and the results emanating from research in the Job Demands-Resources model, there is a need for a validated test to assess whether work-related stress levels are experienced that differentiate between stress which harms the work performance and stress which challenges the individual and may promote work performance. As the subjective experience, whether a challenge is experienced as harmful or benign can vary greatly between individuals based upon the subjective appraisal of reward; valid tests should assess this from a subjective, individual appraisal perspective. Such a measure would have clear benefits for employees, their employers and consequently society. In addition, the development of a measure which identifies how resilient members of a workforce are in the context of work stress is considered likely to enhance an employers' ability to support members of their team, to prevent work stress leading to negative consequences both for individual employees and work teams. Two scales were developed for this purpose, the Work Stress Screener (WOSS) and the Resilience at Work Scale (ReWoS).

The focus of this paper is to describe the validation of the WOSS and ReWoS, including refinement of these scales and the processes undertaken to review their validity and reliability when used in a general population sample.

2. Methods

The WOSS and ReWoS were developed based on a Delphi study exploring factors relevant to harmful stress, benign stress and work resilience [33]. Over three study rounds, the Delphi study was conducted among a random sample of 20–87 employees of a specialised mental health care institute, and among 9–35 research experts in work stress as well as occupational clinicians identified via the network of the research team. Items identified in the Delphi study, were rephrased as questions in a self-report questionnaire. These were piloted with ten people (five academics [including one mental health clinical academic, two mental health academics, one economist and one health services researcher] and five people from the general population) who completed the questions and discussed the content and whether this was covered appropriately according to them to test the content validity of the developed questionnaires.

Both measures presented items organised into two subscales: for the WOSS, Form A included items relating to benign work stress ("Feeling positively challenged at work") and Form B related to harmful work stress ("Feeling anxiety"). For the ReWoS, Form A related to characteristics of individual resilience ("Balancing work and life tasks well") and Form B targeted team resilience ("Experiencing a good team spirit"). Also, as this concerns the workplace, a question was added to each subscale asking if the problems, issues or situations had been hindering or helpful in this environment. Both scales focus on the previous two weeks. Tables 1 and 2 present all items.

2.1. Samples

Following the pilot, the WOSS and ReWoS were administered as part of a larger survey considering work stress during covid-19 [34] to obtain data for scale refinement and evaluation. A convenience sample of 1980 individuals (1055 staff; 925 working students) from the University of York responded to the survey(Sample A). On this sample, exploratory factor analysis(EFA) was performed. A second sample involved data collected at a second time point to perform confirmatory analysis(CFA) and test-retest reliability analysis(Sample B, $N = 609$). The time between sample data collection was intended to be >15 days to avoid memory effects, and <30 days, as in most studies [35]. To attain that, retest questionnaires were sent out after 12 days.

2.2. Measures

All items from the WOSS and ReWoS were included in the item evaluation; however, the summary questions were composed with different response options and not included in the factor, reliability or validity analyses.

A selection of relevant additional measures was included in the survey; data from these measures was used to assess convergent and discriminant validity. The Perceived Stress Questionnaire(PSQ) focuses on the cognitive perceptions of stress [36]. The Perceived Stress Reactivity Scale(PSRS) assesses individual responses to stressful situations

Table 1
Properties of the frequency distribution of item responses for WOSS.

		N	Mode	Median	Mean	Std. deviation	Skewness	Kurtosis
Form A								
Item 1	Feeling positively challenged at work	1935	1	1	1.42	0.92	0.27	−0.75
Item 2	Feeling motivated to do your work	1938	1	1	1.57	0.91	0.16	−0.60
Item 3	Concentrating well on your tasks	1939	1	1	1.48	0.87	0.19	−0.65
Item 4	Feeling hopeful	1938	1	1	1.44	0.86	0.20	−0.61
Item 5	Feeling optimistic	1935	1	1	1.40	0.87	0.27	−0.59
Item 6	Being productive	1937	1	1	1.56	0.87	0.14	−0.72
Item 7	Feeling cheerful	1934	1	1	1.46	0.86	0.22	−0.60
Item 8	Feeling committed to your work	1938	1	2	1.70	0.95	−0.08	−0.99
Item 9	If you marked any of these situations or feelings, how did these feelings or situations help you to do your work or get along with your colleagues?	1877	2	2	1.84	1.10	0.02	−0.81
Form B								
Item 1	Experiencing low job satisfaction	1919	1	1	1.05	0.93	0.63	−0.43
Item 2	Feeling anxiety	1922	1	1	1.45	1.02	0.20	−1.09
Item 3	Experiencing negative work situations	1908	1	1	0.85	0.86	0.79	−0.04
Item 4	Feeling hopeless	1916	0	1	0.85	0.94	0.82	−0.36
Item 5	Avoiding tasks that you should perform	1925	1	1	1.20	0.97	0.46	−0.73
Item 6	Having less patience than before	1922	1	1	1.17	0.95	0.45	−0.71
Item 7	Depending on others to do your work	1919	0	0	0.27	0.59	2.46[a]	6.32 [a]
Item 8	If you marked any of these problems, how difficult did this make it for you to do your work or get along with your colleagues?	1867	1	1	1.86	1.45	0.44	−1.25

N=Number of participants; [a] Item skewed and kurtotic.

[37]. The depression module of the Patient Health Questionnaire(PHQ-9) [38], General Anxiety Disorder scale(GAD-7) [39], somatic symptoms module of the Patient Health Questionnaire(PHQ-15) [40] and the number of chronic medical conditions reported.

2.3. Item evaluation

The distribution of responses to each item was evaluated to understand response tendencies including calculating the mode, median and mean values, and assessing skewness and kurtosis for each item.

Table 2
Properties of the frequency distribution of item responses for ReWoS.

		N	Mode	Median	Mean	Std. deviation	Skewness	Kurtosis
Form A								
Item 1	Being healthy	1743	3	2	2.04	0.91	−0.46	−0.87
Item 2	Feeling well in general	1743	2	2	2.00	0.87	−0.38	−0.81
Item 3	Feeling well rested	1746	1	1	1.45	0.95	0.04	−0.92
Item 4	Balancing work and life tasks well	1742	1	1	1.47	0.95	0.13	−0.92
Item 5	Being able to ask for help	1733	1	1	1.50	1.00	0.12	−1.07
Item 6	Feeling assertive	1732	1	1	1.37	0.93	0.23	−0.79
Item 7	Feeling self-confident	1739	1	1	1.46	0.92	0.15	−0.81
Item 8	Being flexible at work	1736	3	2	2.03	0.89	−0.46	−0.80
Item 9	Feeling in control	1737	1	1	1.45	0.95	0.16	−0.89
Item 10	Allowing yourself to make mistakes	1731	1	1	1.34	0.93	0.27	−0.76
Item 11	Feeling optimistic under workstress	1735	1	1	1.33	0.92	0.29	−0.71
Item 12	Trusting your ability to overcome barriers at work	1733	1	2	1.66	0.89	0.02	−0.86
Item 13	Feeling safe under workstress	1726	2	2	1.88	0.95	−0.32	−0.96
Item 14	Focusing on solutions or problems at work	1730	2	2	1.83	0.82	−0.06	−0.84
Item 15	Putting things in perspective	1737	2	2	1.82	0.86	−0.07	−0.91
Item 16	Persevering	1739	3	2	2.16	0.81	−0.51	−0.74
Item 17	Having a sense of responsibility in your work	1737	3	3	2.29	0.86	−0.93	−0.15
Item 18	Having patience to deal with work situations	1733	2	2	1.89	0.83	−0.18	−0.80
Item 19	Coping well with challenges at work	1736	2	2	1.81	0.86	−0.12	−0.83
Item 20	Being able to set limits	1734	1	2	1.67	0.93	−0.07	−0.92
Item 21	Experiencing work pleasure	1737	1	1	1.40	0.89	0.27	−0.67
Item 22	Working in a disciplined manner	1736	1	2	1.66	0.94	−0.03	−0.95
Item 23	If you marked any of these situations or feelings, how did these feelings or situations help you to do your work?	1682	4	2	2.35	1.45	−0.06	−1.50
Form B								
Item 1	Experiencing a good team spirit	1714	1	1	1.49	1.00	0.09	−1.06
Item 2	Feeling positively challenged	1725	1	1	1.42	0.90	0.25	−0.70
Item 3	Sharing humour with work colleagues	1720	1	2	1.60	1.01	−0.00	−1.13
Item 4	Receiving sufficient work guidance	1719	1	1	1.50	0.94	0.12	−0.88
Item 5	Having sufficient time to do your work	1726	3	2	1.77	1.05	−0.29	−1.15
Item 6	Feeling appreciated for your work	1719	1	1	1.46	0.99	0.11	−1.01
Item 7	Having a clear set of duties	1724	2	2	1.80	1.00	−0.29	−1.04
Item 8	If you marked any of these situations or feelings, how did these feelings or situations help you to do your work or get along with your colleagues?	1693	4	2	2.31	1.40	−0.02	−1.39

N=Number of participants.

2.4. Factor structure analysis

The WOSS and ReWoS were developed as separate scales to measure two pre-specified domains: stress and resilience.

The factor structure of the WOSS(15 items) and the ReWoS(29 items) were investigated in sample A with EFA(Ordinary Least Squares) using MinRes to find the minimum residual solution and oblimin rotation. Analyses were done with fa of the R psych package [41]. Complete case data from the entire dataset were analysed; staff and working student data were analysed separately to explore if the factor structure differed between groups. Likewise, we analysed data from males and females separately. Items with low loading on the main associated factor and strong cross-loading were removed from further analysis. Factor loadings <0.30 are not reported.

Next, the factor structures of the WOSS and the ReWoS were investigated using CFA with the R-package lavaan [42] on complete cases from sample B. Significant reduction in χ^2, Comparative Fit Index(CFI) ≥ 0.95 and Root mean square error of approximation(RMSEA) <0.06 to 0.08 were used to assess the fit of various models [43,44].

2.5. Scale reliability

Internal consistency was assessed using Cronbach's alpha scores for each scale. Test re-test reliability was assessed by calculating Intraclass Correlation coefficients(ICC) between scores of sample A and B.

2.6. Validity

Convergent and divergent validity of the WOSS was investigated using scores from the PSQ. Correlations were anticipated due to the focus on the perception of stress, with the WOSS focused on stress within the workplace. Strong correlations(>0.70) were anticipated between form B of the WOSS(harmful work stress) and the PSQ.

The PSRS was used to assess construct validity of the ReWoS as both measures consider responses to stressful situations. Additionally, scales measuring depression(PHQ-9 [38]), anxiety(GAD-7 [39]) and somatic symptoms(PHQ-15 [40]) were included in the survey and considered likely to correlate with both the WOSS and ReWoS, since stress is associated with anxiety [45], depression [46] and somatic symptoms [5,25,47–49]. Moderate correlations(approximately 0.60) were expected between the PHQ-15 and WOSS subscales. Weak correlations (<0.40) were anticipated between WOSS and ReWoS scales. We included the number of chronic medical conditions as a measure of divergent validity; no association was anticipated for WOSS or ReWoS scores. Moderate correlations were expected between PHQ-9 and GAD-7/PHQ-15 as correlations of 0.74 and 0.75 have previously been reported between these measures [50,51]. Low correlations were expected between GAD-7 and PHQ-15 as the associated between these measures has previously been reported as 0.54 [52].

Item evaluation, scale reliability and validity analyses were conducted using IMB SPSS version 26 [53]. Materials and analysis code for this study are not available.

3. Results

3.1. Sample

Sample A included 1980 individuals(1055 staff; 925 working students), 73% were female and the average age was 36.0(SD 13.8).

Sample B included 609 individuals. 62% were staff, 75% female and the average age was 38.6(SD 13.9). The mean interval between Samples A and B was 16.8 days(range 12–28).

3.2. Item evaluation

Each item on both scales was investigated to observe the distribution of responses collected during the initial survey. As shown in Tables 1 and 2, both scales were organised into two forms(A and B) using a 4-point Likert-style scale with a summary question at the end of each using a 5-point Likert-style scale.

As shown in Table 1, responses to all WOSS items, except for item 7 from Form B, were found to be normally distributed(skewness and kurtosis between −1.00 and 1.00). For item 7 from Form B a large proportion of the respondents used the lowest response category. The final item of Form A and Form B are summary questions which assess the impact of the responses to other items within that subscale. These summary items were not included in the analyses described in other sections and are not, therefore, included in the scoring for this scale.

Table 2 shows responses to all ReWoS items were found to be normally distributed. The final ReWoS items in Forms A and B are summary questions which are not included in further analyses.

3.3. Exploratory factor analysis (EFA)

The sampling adequacy of WOSS data was acceptable(KMO = 0.93) and according to Bartllett's test of sphericity correlations between items were large enough for EFA [χ^2 (190) = 15,896.47; $p < .001$]. EFA of WOSS data($N = 1869$) found six factors with eigenvalue >1.00; the scree plot suggested four factors and a parallel analysis also suggested four factors. Table A.1 and Fig. A.1(supplementary file) show the results of the 4-factor solution. The 4-factor solution corresponds with the distinction in benign(Form A) and harmful(Form B) stress, with a further distinction of Form A items in factor 1(items A1, A2, A3, A6, and A8) representing positive work-related affect and factor 2(items A4, A5, and A7 representing general positive affect). Factors 3 and 4 contain items from Form B. One item of Form B(5, avoiding tasks) has its highest negative loading on factor 1(Form A) and was not included in further analyses. Item B7(depending on others to do work) did not load on any factor and was therefore also removed.

Sampling adequacy of ReWoS data was acceptable(KMO = 0.96) and according to Bartllett's test of sphericity correlations between items were large enough for EFA (χ^2 (406) = 26,109.46; $p < .001$. EFA of ReWoS data($N = 1568$) found 11 factors with eigenvalues >1.00; the scree plot suggested a single factor and the parallel analysis suggested 7 factors. However, this 7-factor solution yielded 3 factors with only 2 or 3 items. We decided on a 4-factor solution, which resulted in an interpretable solution, explaining 62% of the variance, with a selection of Form A items splitting in three factors and Form B items 1–4, 6, and 7 composing the fourth factor. The factors were substantially correlated($r > 0.48$). Table A.2 and Fig. A.2(supplementary file) show the results of the 4-factor solution. Four items from Form A(4, Balancing work and life tasks; 5, ask for help; 14, solutions/problems at work; 18, patience with work situations) and one item from Form B(5, sufficient time to do work) loaded substantially onto two factors, did not load strongly onto a primary factor and were therefore not included in further analyses.

Factor analyses of the WOSS and ReWoS, performed separately for staff, working students, men, and women yielded the same factor structure with similar loadings.

3.4. Confirmatory factor analysis (CFA)

The factor structures of the WOSS was investigated with CFA using complete case data from Sample B($N = 548$). Various models were evaluated: a single factor, 2-factor, 4-factor, and bi-factor models. CFA results, as shown in Table A.3(supplementary file) indicated a model of all items from Forms A and B in a single factor was not a good representation of the data. Form A was explored as a single factor which A was not a good fit to the data either. The EFA on data from sample A had suggested two factors for Form A. When items from Form A were explored as a two-factor model the fit was sufficient. Finally, a bi-factor model with one general factor and two underlying factors for Form A was found to be the best representation of the data. Here, χ^2/df ≤ 3 was

met, a generally recommended cut-off for the ratio of χ^2 and df. For Form B, a two-factor model and a model with all items in a single factor both had poor fit. The results regarding fit of the models for the WOSS is shown in the upper half of Table A.3.

The factor structure of a selection of ReWoS items was investigated with CFA using complete case data from Sample B($N = 537$). Results are shown in the lower half of Table A.3. Forms A and B are best considered as distinct, but correlated. Of all tested models for Form A the bi-factor model(3 related factors under a general factor) had the best fit. There was insufficient fit of the single factor model of Form B.

The next step was to establish the internal consistency reliability of the subscales for each measure. Reliability analysis of the factors of the WOSS revealed that the internal consistency of the scales was sufficient (see scale reliability), except for the fourth factor(WoSS B items 2 and 6) which did not meet recommended standards; as a result, the WoSS B items 1 to 4, and 6 are considered to represent a single scale.

Taken together, findings from EFA and CFA indicate that the WOSS is best represented as two parts(Form A and B). Form A relates to benign stress; a CFA of only Form A items suggests that these items can be further organised into two subscales considering positive work-related affect/stress(items 1, 2, 3, 6, and 8) and general positive affect(items 4, 5, and 7). Form B relates to harmful stress at work(items 1, 2, 3, 4, and 6).

Findings regarding the ReWoS indicate that this scale is best represented as two parts(Form A and B). Form A can best be considered to comprise three interrelated subscales for positive feelings(A1, A2, and A3), positive resilience (A6 to A13, A15, A19-A21) and positive work attitude(A16, A17, and A22). We decided to score Form B as a single scale(B1-B4, B6, and B7). The final validated WOSS and ReWoS scales are available in the supplementary file.

3.5. Scale reliability

Cronbach's alpha was estimated to indicate the consistency of individual item responses associated with questionnaire scales and subscales [54]. Values of 0.80 or higher were considered evidence of internal consistency of the subscales identified using factor analyses [55]. Table 3 shows the reliability estimates (in parentheses) for the WOSS and ReWoS subscales; all Cronbach's alpha estimates exceeded 0.80 confirming the internal consistency of these subscales.

Re-test reliability was assessed using intra-class coefficients [56]. Two-way mixed effects models were used. Average scale scores allowing for up to 1 missing value were used at each time-point. All respondents described in Sample B were included in this analysis($N = 609$). Table 3 shows good reliability(ICC.58–0.72) for scales across time [57].

3.6. Validity

Correlations among WOSS and ReWoS subscales shown in Table 4 indicate substantial correlations. This is confirmed by the good fit of bifactor models. Convergent and divergent validity were assessed using Pearson's correlations; values above 0.60 were considered to indicate convergent validity and those lower than 0.40 represent divergence [58]. As expected, Table 4 shows that WOSS subscales are strongly correlated with perceived stress as indicated by PSQ scores. WOSS subscales A1 and A2 reflect benign work stress (positive affect/stress and general positive affect) which correlated negatively with stress according to the PSQ. Harmful stress(WOSS Form B) showed a strong, positive correlation with the PSQ. The same pattern was found with anxiety(GAD-7), depression(PHQ-9) and, to a lesser extent, somatic symptoms(PHQ-15). Authors anticipated medium or strong correlations

Table 3
Test re-test reliability estimates for WOSS and ReWoS subscales ($n = 609$).

	N	ICC	Mean at Time 1 (sd)	Mean at Time 2 (sd)	F value (df)
WOSS					
Scale A1	602	0.69	1.67 (0.73)	1.66 (0.71)	5.35 [a] (601)
Scale A2	596	0.58	1.53 (0.79)	1.53 (0.77)	3.73 [a] (595)
Scale B	591	0.65	1.01 (0.70)	0.92 (0.68)	4.80 [a] (590)
ReWoS					
Scale A1	556	0.66	1.94 (0.77)	1.89 (0.76)	4.82 [a] (555)
Scale A2	547	0.72	1.72 (0.68)	1.71 (0.65)	6.01 [a] (546)
Scale A3	557	0.61	2.16 (0.68)	2.14 (0.67)	4.13 [a] (556)
Scale B	547	0.68	1.69 (0.75)	1.67 (0.73)	5.29 [a] (546)

N = Number of Participants; ICC = Intraclass correlation coefficient; sd = standard deviation.
df = degrees of freedom; WOSS = Work Stress Scale; ReWoS = Resilience at Work Scale; [a] $P < .001$.

Table 4
Pearson's correlations to show convergent and divergent validity of WOSS and ReWoS scales.

	WOSS			ReWoS				PSQ	PSRS	GAD	PHQ	PHQ
	A1	A2	B	A1	A2	A3	B	Total	Total	7	9	15
WOSSA1	(0.88)											
WOSSA2	0.63**	(0.90)										
WOSSB	−0.56**	−0.60**	(0.82)									
ReWoSA1	0.47**	0.54**	−0.49**	(0.81)								
ReWoSA2	0.68**	0.71**	−0.67**	0.60**	(0.91)							
ReWoSA3	0.68**	0.48**	−0.42**	0.41**	0.63**	(0.80)						
ReWoSB	0.60**	0.51**	−0.52**	0.36**	0.63**	0.52**	(0.81)					
PSQ	−0.51**	−0.63**	0.72**	−0.62**	−0.72**	−0.39**	−0.46**	(0.95)				
PSRS Total	−0.39**	−0.43**	0.49**	−0.36**	−0.57**	−0.33**	−0.32**	0.58**	(0.88)			
GAD7	−0.41**	−0.52**	0.65**	−0.49**	−0.55**	−0.32**	−0.32**	0.73**	0.59**	(0.91)		
PHQ9	−0.53**	−0.57**	0.66**	−0.58**	−0.59**	−0.44**	−0.40**	0.73**	0.53**	0.79**	(0.89)	
PHQ15	−0.31**	−0.34**	0.44**	−0.48**	−0.39**	−0.21**	−0.23**	0.54**	0.43**	0.57**	0.64**	(0.79)
CMC Total	0.03	−0.01	0.09**	−0.16**	−0.06*	0.03	−0.00	0.13**	0.15**	0.17**	0.15**	0.30**

Cronbach's alpha estimates for scales and subscales are shown in parentheses. WOSS=Work Stress Scale; ReWoS = Resilience at Work Scale; PSQ = Perceived Stress Questionnaire; PSRS = Perceived Stress Reactivity Scale; GAD7 = General Anxiety Disorder scale; PHQ9 = Patient Health Questionnaire module for depression; PHQ15 = Patient Health Questionnaire module for somatic symptoms; CMC=Number of Chronic Medical Conditions.

between the ReWoS and PSRS; this was not supported by the data. Subscale A2(well-being at work) showed the strongest correlation with total PSRS scores; however, other subscales were not found to be related. ReWoS scores for general well-being and well-being at work were found to be negatively related to stress(PSQ), depression(PHQ-9) and anxiety (GAD-7). As anticipated, both WOSS and ReWoS scales were found to be distinct from the number of chronic medical conditions.

4. Discussion

The findings suggest the WOSS-13 and ReWoS-24 to be reliable and valid tools for measuring the level and nature of work stress and resilience experienced by individuals and teams. These brief measures (WOSS: 13 items, ReWoS: 24 items) have been shown to measure both benign and harmful forms of work stress(WOSS-13), in addition to individual and team resilience(ReWoS-24). Internal consistency and test-retest reliability of subscales was good. Factor analysis confirmed that WOSS items captured both the benign and harmful experiences of work stress; ReWoS items reflected both individual and team resilience. Convergent and divergent validity analyses showed the expected correlations between for WOSS and ReWoS subscales.

The reliability and validity analyses reported here are based on the findings from the EFA and CFA; only items related to the domains of interest were retained in the final scales. Some items were removed because they were not significantly associated with any identified factor, or, were associated with more than one of the identified factors in the analysis without strong association to a specific factor. These items may be generally applicable to work stress and resilience at work; however, they were superfluous in this context.

We found a strong correlation between PHQ-9 and GAD-7 scores (0.79), and medium correlations between PHQ-9 and PHQ-15 scores (0.64) and between GAD-7 and PHQ-15 scores(0.57). These findings support the relationship between somatic, anxiety and depressive symptoms known as the "SAD" triad [59,60]. Correlations between the ReWoS and PSRS were expected but not found in this analysis. Resilience is not measured specifically in the PSRS; however, since associations between perceived stress reactivity and personality characteristics have been demonstrated [37], it was considered likely that there would be an association between these measures. It is possible that some PSRS subscales may have correlated more strongly with the ReWoS than others; this was not explored.

Data were from a large general population sample ($n = 1980$) that was predominantly female(73%) and white(88%) [39]. The sample size is considered a strength; the sample included 1055 staff members with different levels of educational background likely to reflect the general population and 925 working students. The gender imbalance of the sample could impact on the generalisability of the findings; however, the EFA found the experiences of work stress and resilience to be similar across these groups. Future research needs to be conducted to get norms for various professions and other subgroups in the community for the WOSS-13 and the ReWoS-24.

4.1. Limitations of the study

These analyses used data from a survey of staff and working student experiences of work and study at an English university during the height of the COVID crisis, when stress levels were elevated [39]. Consequently, these data do not reflect usual stress levels among working students or staff and are therefore not considered normative samples. These circumstances will have introduced more variance in the data, increasing the likelihood of finding meaningful associations among the items and subscales under study. In addition, while the sample demographics reflect the wider staff population of the University of York in terms of gender, this may not be in line with the staff profile in other organisations and consequently limits the generalisability of findings. Future data collection among representative population samples is

required to assess norms and the applicability of these scales in other populations. Longitudinal data from clinical samples may be collected to assess responsiveness to therapeutic change of the instruments.

In conclusion, the findings suggest the WOSS-13 and ReWoS-24 to be reliable and valid tools for measuring the level and nature of work stress and resilience experienced by individuals and teams.

The WOSS-13 assesses both benign and harmful forms of work stress. The ReWoS-24 relates to individual general well-being, well-being at work, satisfaction with job performance and team resilience. These tools fill a gap. The WOSS-13 is the first questionnaire to discern benign from harmful work stress. The ReWoS-24 is the first questionnaire explicitly assessing resilience at work both at individual and team level. These measures could be useful in workplaces to assess for and mitigate against, harmful work stress experienced by employees.

Statement of ethics

This paper reports a sub-analysis of a larger study which was reviewed and approved by the University of York Health Sciences Research Governance Committee. Informed consent was provided by all participants.

Funding sources

Authors' contributions

CFC and EdB contributed to the conceptualization of this work. JS, EdB and CFC were involved in the data curation, methodology and formal analysis of the data. CFC, JS and EdB contributed to the investigation. CFC acquired funding and was project administrator. Resources were provided by CFC and IE. EdB provided software code. CFC and EdB provided supervision and validation of the data analysis. JS wrote the initial draft of this paper including visualization. All authors have contributed to the reviewing and editing processes of this work.

Data availability statement

Data are owned by the University of York. They were used for the validation of these scales, are part of ongoing research and are therefore not available. Analysis code is not available for this study.

Declaration of Competing Interest

The authors have no conflicts of interest to report.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2022.110989.

References

[1] Health and Safety Executive, Work-Related Stress, Anxiety or Depression Statistics in Great Britain, 2020, 2020.
[2] D. Stevenson, Thriving at Work: The Stevenson/Farmer Review of Mental Health and Employers, Department for Work and Pensions and Department of Health, London, 2017.
[3] Health and Safety Executive, Stress Risk Assessment, 2021.

[4] J. Guidi, M. Lucente, N. Sonino, G.A. Fava, Allostatic load and its impact on health: a systematic review, Psychother. Psychosom. 90 (1) (2021) 11–27.

[5] J. Li, H. Ding, W. Han, L. Jin, L.-N. Kong, K.-N. Mao, et al., The association of work stress with somatic symptoms in Chinese working women: a large cross-sectional survey, J. Psychosom. Res. 89 (2016) 7–10.

[6] Z. Bajorek, S. Bevan, Obesity and Work, 2019.

[7] M.A. Cavanaugh, W.R. Boswell, M.V. Roehling, J.W. Boudreau, An empirical examination of self-reported work stress among US managers, J. Appl. Psychol. 85 (1) (2000) 65.

[8] B. Brunner, I. Igic, A.C. Keller, S. Wieser, Who gains the most from improving working conditions? Health-related absenteeism and presenteeism due to stress at work, Eur. J. Health Econ. 20 (8) (2019) 1165–1180.

[9] N. Broderick, R. Vaughan, F. McNicholas, L. Feeney, Staff stress and burnout in a community adult mental health service, Ir. J. Psychol. Med. 1-9 (2021).

[10] M.D. Ruiz-Fernández, J.D. Ramos-Pichardo, O. Ibáñez-Masero, M.I Carmona-Rega, M.J. Sánchez-Ruiz, Á.M. Ortega-Galán, Professional quality of life, self-compassion, resilience, and empathy in healthcare professionals during COVID-19 crisis in Spain, Res. Nurs. Health 44 (4) (2021) 620–632.

[11] A. Frantz, K. Holmgren, The work stress questionnaire (WSQ)–reliability and face validity among male workers, BMC Public Health 19 (1) (2019) 1–8.

[12] B.W. Smith, J. Dalen, K. Wiggins, E. Tooley, P. Christopher, J. Bernard, The brief resilience scale: assessing the ability to bounce back, Int. J. Behav. Med. 15 (3) (2008) 194–200.

[13] F. Howard, Managing stress or enhancing wellbeing? Positive psychology's contributions to clinical supervision, Aust. Psychol. 43 (2) (2008) 105–113.

[14] G. Kinman, L. Grant, Exploring stress resilience in trainee social workers: the role of emotional and social competencies, Br. J. Soc. Work. 41 (2) (2010) 261–275.

[15] K.M. Connor, J.R. Davidson, Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC), Depress. Anxiety 18 (2) (2003) 76–82.

[16] E.E. Werner, J.M. Bierman, F.E. French, The Children of Kauai: A Longitudinal Study from the Prenatal Period to Age Ten, University of Hawaii Press, 1971.

[17] E.E. Werner, R.S. Smith, Kauai's Children Come of Age, University Press of Hawaii Honolulu, 1977.

[18] E.E. Werner, R.S. Smith, Vulnerable, but Invincible, Adams, Bannister, Cox, 1989.

[19] E.E. Werner, R.S. Smith, Overcoming the Odds: High Risk Children from Birth to Adulthood, Cornell University Press, 1992.

[20] E.E. Werner, R.S. Smith, Journeys from Childhood to Midlife: Risk, Resilience, and Recovery, Cornell University Press, 2001.

[21] J. Johnson, P.A. Gooding, A.M. Wood, N. Tarrier, Resilience as positive coping appraisals: testing the schematic appraisals model of suicide (SAMS), Behav. Res. Ther. 48 (3) (2010) 179–186.

[22] P.A. Hall, M. Lamont, Social Resilience in the Neoliberal Era, Cambridge University Press, 2013.

[23] C.M. van der Feltz-Cornelis, Stress Phenomenology, Nieuwezijds, Amsterdam, 2014.

[24] A.B. Bakker, E. Demerouti, The job demands-resources model: state of the art, J. Manag. Psychol. 22 (3) (2007) 309–328.

[25] S. Gandhi, G. Sangeetha, N. Ahmed, S. Chaturvedi, Somatic symptoms, perceived stress and perceived job satisfaction among nurses working in an Indian psychiatric hospital, Asian J. Psychiatr. 12 (2014) 77–81.

[26] W.B. Schaufeli, S. Desart, H. De Witte, Burnout assessment tool (BAT)—development, validity, and reliability, Int. J. Environ. Res. Public Health 17 (24) (2020) 9495.

[27] R. Elshout, E. Scherp, C.M. van der Feltz-Cornelis, Understanding the link between leadership style, employee satisfaction, and absenteeism: a mixed methods design study in a mental health care institution, Neuropsychiatr. Dis. Treat. 9 (2013) 823.

[28] M. Roczniewska, A.B. Bakker, Burnout and self-regulation failure: a diary study of self-undermining and job crafting among nurses, J. Adv. Nurs. 77 (8) (2021) 3424–3435.

[29] S.M. Bajaba, N.A. Alajhar, A.M. Bajaba, The bottom-up impact of proactive personality on employee job crafting: a serial mediation model, J. Psychol. (2021) 1–25.

[30] Z. Teuber, F.W. Nussbeck, E. Wild, The bright side of grit in burnout-prevention: exploring grit in the context of demands-resources model among Chinese high school students, Child Psychiatry Hum. Dev. 52 (3) (2021) 464–476.

[31] K.J. Page, A. Nastasi, E. Voyles, Did you get that thing I sent you? Mediating effects of strain and work-family conflict on the telepressure and burnout relationship, Stress. Health 37 (5) (2021) 928–939.

[32] L.K. Barber, A.L. Conlin, A.M. Santuzzi, Workplace telepressure and work–life balance outcomes: the role of work recovery experiences, Stress. Health 35 (3) (2019) 350–362.

[33] I. Elfeddali, E. Jacobs, C.M. van der Feltz-Cornelis, Harmful and benign work stress and work resilience: a Delphi-study in employees and experts, Eur. J. Psychiatry (2022) (In press).

[34] C.M. van der Feltz-Cornelis, D. Varley, V.L. Allgar, E. De Beurs, Workplace stress, presenteeism, absenteeism, and resilience amongst university staff and students in the COVID-19 lockdown, Front. Psychiatry 11 (2020) 1284.

[35] D.L. Streiner, G.R. Norman, J. Cairney, Health Measurement Scales: A Practical Guide to their Development and Use, Oxford University Press, USA, 2015.

[36] S. Levenstein, C. Prantera, V. Varvo, M.L. Scribano, E. Berto, C. Luzi, et al., Development of the perceived stress questionnaire: a new tool for psychosomatic research, J. Psychosom. Res. 37 (1) (1993) 19–32.

[37] W. Schlotz, I.S. Yim, P.M. Zoccola, L. Jansen, P. Schulz, The perceived stress reactivity scale: measurement invariance, stability, and validity in three countries, Psychol. Assess. 23 (1) (2011) 80.

[38] K. Kroenke, R.L. Spitzer, J.B. Williams, The PHQ-9: validity of a brief depression severity measure, J. Gen. Intern. Med. 16 (9) (2001) 606–613.

[39] R.L. Spitzer, K. Kroenke, J.B. Williams, B. Löwe, A brief measure for assessing generalized anxiety disorder: the GAD-7, Arch. Intern. Med. 166 (10) (2006) 1092–1097.

[40] K. Kroenke, R.L. Spitzer, J.B. Williams, The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms, Psychosom. Med. 64 (2) (2002) 258–266.

[41] W.R. Revelle, Psych: Procedures for Personality and Psychological Research, 2021.

[42] Rosseel Y. Lavaan, An R package for structural equation modeling and more. Version 0.5–12 (BETA), J. Stat. Softw. 48 (2) (2012) 1–36.

[43] J.B. Schreiber, A. Nora, F.K. Stage, E.A. Barlow, J. King, Reporting structural equation modeling and confirmatory factor analysis results: a review, J. Educ. Res. 99 (6) (2006) 323–338.

[44] T.A. Brown, Confirmatory Factor Analysis for Applied Research, Guilford Publications, 2015.

[45] N.S. Endler, J.D. Parker, Stress and anxiety: conceptual and assessment issues, Stress Med. 6 (3) (1990) 243–248.

[46] C. Hammen, Stress and depression, Annu. Rev. Clin. Psychol. 1 (2005) 293–319.

[47] K. Nomura, M. Nakao, M. Sato, H. Ishikawa, E. Yano, The association of the reporting of somatic symptoms with job stress and active coping among Japanese white-collar workers, J. Occup. Health 49 (5) (2007) 370–375.

[48] Y. Kawano, Association of job-related stress factors with psychological and somatic symptoms among Japanese hospital nurses: effect of departmental environment in acute care hospitals, J. Occup. Health 50 (1) (2008) 79–85.

[49] K. Glise, G. Ahlborg, I.H. Jonsdottir, Prevalence and course of somatic symptoms in patients with stress-related exhaustion: does sex or age matter, BMC Psychiatry 14 (1) (2014) 1–13.

[50] R.-D. Kocalevent, A. Hinz, E. Brähler, Standardization of a screening instrument (PHQ-15) for somatization syndromes in the general population, BMC Psychiatry 13 (1) (2013) 1–8.

[51] S. Maroufizadeh, R. Omani-Samani, A. Almasi-Hashiani, P. Amini, M. Sepidarkish, The reliability and validity of the patient health Questionnaire-9 (PHQ-9) and PHQ-2 in patients with infertility, Reprod. Health 16 (1) (2019) 1–8.

[52] A. Hinz, J. Ernst, H. Glaesmer, E. Brähler, F.G. Rauscher, K. Petrowski, et al., Frequency of somatic symptoms in the general population: normative values for the patient health Questionnaire-15 (PHQ-15), J. Psychosom. Res. 96 (2017) 27–31.

[53] SPSS I, Statistics for Macintosh (Version 26.0)[Computer Software], IBM Corp, Armonk, NY, 2019.

[54] M. Tavakol, R. Dennick, Making sense of Cronbach's alpha, Int. J. Med. Educ. 2 (2011) 53.

[55] J.C. Nunnally, Psychometric Theory 3E, Tata McGraw-Hill education, 1994.

[56] T.K. Koo, M.Y. Li, A guideline of selecting and reporting intraclass correlation coefficients for reliability research, J. Chiropractic Med. 15 (2) (2016) 155–163.

[57] D.V. Cicchetti, Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology, Psychol. Assess. 6 (4) (1994) 284.

[58] D.T. Campbell, D.W. Fiske, Convergent and discriminant validation by the multitrait-multimethod matrix, Psychol. Bull. 56 (2) (1959) 81.

[59] K. Kroenke, Patients presenting with somatic complaints: epidemiology, psychiatric co-morbidity and management, Int. J. Methods Psychiatr. Res. 12 (1) (2003) 34–43.

[60] K. Kroenke, R.L. Spitzer, J.B. Williams, B. Löwe, The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review, Gen. Hosp. Psychiatry 32 (4) (2010) 345–359.