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Numerous tools have been developed that attempt to measure work-related stress and working conditions, but few practical instruments in the literature have been found to have a reliable psychometric factor structure. In the UK, the Health and Safety Executive (HSE) Management Standards (MS) Indicator Tool is increasingly used by organizations to monitor working conditions that can lead to stress. In Health and Safety Executive (2004), a factor analysis was conducted demonstrating the reliability of the scales. However, the authors acknowledged that direct reassessment of the same factor structure was impossible as the questionnaire was split into two separate modules for data collection. Furthermore, the tool is designed to enable comparisons between as well as within organizations to take place, yet reliability has only previously been tested at the individual level. The current study is the first to examine the factor structure of the HSE MS Indicator Tool using organizational-level data. Data collected from 39 UK organizations ($N = 26,382$) was used to perform a first-order Confirmatory Factor Analysis (CFA) on the original 35-item seven-factor measurement scale. The results showed an acceptable fit to the data for the instrument. A second-order CFA was also performed to test if the Indicator Tool contains a higher order uni-dimensional measure of work-related stress. These findings also revealed an acceptable fit to the data, suggesting that it may be possible to derive a single measure of work-related stress. Normative data comprising tables of percentiles from the organizational data are provided to enable employers to compare their organizational averages against national benchmarks.

**Keywords:** work-related stress; confirmatory factor analysis, psychometrics; Health and Safety Executive; Indicator Tool; risk assessment

## Introduction

Work-related stress remains a significant problem in the UK, accounting for around a third of all new cases of work-related ill health. In total, an estimated 10.5 million working days were lost to work-related stress, depression and anxiety in the financial year 2005/06 (Health and Safety Executive, 2006). During that same period, an estimated 420,000 people were suffering from work-related stress to an extent that they felt they were being made ill. In addition to the effect on the individual, businesses suffer through increased staff absence and turnover, productivity and performance levels, and organizational image and reputation.

The assessment of stress in the workplace offers employers and others the opportunity to assess degree of excessive demand as indicated by emotional, behavioural, cognitive and physical symptoms. An assessment of stress can also assist in the identification of causes of

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such excessive demand and any consequent adverse reactions. A number of measures have been used to assess employees' experience of stress at work, including the Occupational Stress Indicator (Cooper, Sloan, & Williams, 1988), the Pressure Management Indicator (Williams & Cooper, 1998), Stress Diagnostic Survey (Ivancevic & Matteson, 1980), Work Environment Scale (Moos, 1994) and the Stress Profile (Setterlind & Larsson, 1995). A detailed review of such measures is given in Rick, Briner, Daniels, Perryman, and Guppy (2001), who found little sound evidence to support the reliability and validity of a range of measures of stress at work, and therefore questioned the utility of the available measures at that time.

In 2004, the UK government's health and safety division, the Health and Safety Executive (HSE), developed a process based around a set of Management Standards (MS) to help employers, employees and their representatives manage the issue of work-related stress. The Management Standards represent a set of conditions that reflect high levels of health, well-being and organizational performance. These conditions are split into six discrete but related areas, or potential stressors: Demands, Control, Support, Relationships, Role, and Change.

The "Demands" condition includes issues like workload, work patterns and the work environment. "Control" covers how much say the person has in the way they do their work. "Peer Support" includes the encouragement, sponsorship and resources provided by colleagues; "Managerial Support" is similar but focused on the support provided by the organization and line management. "Relationships" includes promoting positive working to avoid conflict and dealing with unacceptable behaviour. "Role" includes whether people understand their role within the organization and whether the organization ensures they do not have conflicting roles. "Change" includes how organizational change (large or small) is managed and communicated in the organization. For a more detailed discussion of the complete MS approach, see Cousins, Mackay, Clarke, Kelly, Kelly, and McCaig (2004), and Mackay, Cousins, Kelly, Lee, and McCaig (2004).

As part of the MS approach, the HSE produced a self-report survey scale called the Indicator Tool. The Indicator Tool was provided to help employers identify risks through an assessment of the psychosocial working conditions identified through the MS as leading to work-related stress. The first draft of the Indicator Tool was based on Karasek's (1979) demand, control and support model which had been adapted by Marmot et al. (1991) for the Whitehall II studies of stress and health outcomes. The name "Indicator Tool" was adopted in recognition of the known limitations of structured questionnaires and the observation that no single questionnaire, on its own, is sufficient to assess all risks of work-related stress. Following an extensive review of the work-related stress literature, the Indicator Tool was further developed and a 100-item "pool" questionnaire was piloted in the Children & Family Services (CFS) Division of Hertfordshire County Council, UK. An Exploratory Factor Analysis (EFA) approach was used to extract factors best representing the MS areas. The revised Indicator Tool consisted of 35 items and seven subscales. Full details of the methods involved in producing the revised and shortened questionnaire can be found in Cousins et al. (2004). Although the Indicator Tool appears to have face validity, it has been suggested that more psychometric analysis is required (Kompier, 2004).

The earlier validation of the HSE Indicator Tool (Health and Safety Executive, 2004) was conducted using a survey of individuals. However, the tool is designed to be used at an organizational level, and the distribution of data based on organizational means is likely to be different from that of individuals. For example, the Central Limit Theorem (see for example, Adams, 1978), dictates that the distribution of means tends towards a Normal Distribution, whereas data from individuals can be more skewed. In order for organizations to be able to benchmark their own performance, organizational data would be required for a reasonable

comparison between organizations. It is important therefore to test the validity of the Indicator Tool when applied to organizational data, which is one aim of the current study.

The HSE MS Indicator Tool was tested by Cousins et al. (2004) as a multidimensional measure of work-related stress. However, no analysis has examined whether the instrument could be used as a uni-dimensional measure. This would allow employers to calculate a global measure of stress based on average scores across the seven subscales (Demands, Control, Managerial Support, Peer Support, Relationships, Role and Change). For example, employers could use the results from the Indicator Tool to calculate individual scores for the seven subscales as well as a single overall score of general work-related stress.

The primary aim of the current paper is to test the factor structure of the HSE MS Indicator Tool by conducting first-order CFA using a large pooled dataset consisting of employees from 39 different organizations in the UK. This will test the EFA factor structure generated by Cousins et al. (2004). A secondary aim is to examine if the Indicator Tool has a higher order uni-dimensional measure of work-related stress, by conducting a second-order CFA. The present study also aims to provide a table of percentiles which will allow employers to determine where their organizations score overall in relation to psychosocial working conditions, when compared with average scores from other organizations.

## Method

### Participants

A total of 30,903 employees from 39 UK organizations completed the HSE MS Indicator Tool as a first step in risk assessment for work-related stress. The majority of these organizations were participants in HSE's piloting of the Management Standards approach. These organizations had volunteered to be assisted through their delivery of the MS process in return for sharing data and information on how the process had worked in practice. A small number of the participating organizations had been in contact with HSE for other reasons and had shared their data on request. None of the data was collected for the specific purpose of this study but all organizations involved have given their consent for it to be used here. The precise method of data collection was the responsibility of the individual organizations involved; however, general recommendations were given and each organization made use of a copy of the HSE Analysis Tool, a system which provides a simple data entry facility for the 35-item Indicator Tool. A user manual for the Analysis Tool is provided on the HSE website, and participating organizations were able to consult this for guidance on issues such as alternative data importing systems, recommended response rates and interpretation of results.

Of the 39 organizations who completed the Indicator Tool, 15 were National Health Service (NHS) trusts or hospitals; nine were local authorities; eight were universities or colleges. Seven other organizations included police, probation and prison services, a central government department, an energy supplier, an insurance company and an agricultural supplier. Detailed demographic information about the organizations is not available since the data was not originally collected for the purpose of this analysis but for the organizations' own internal risk assessments. However, it is known from the total 30,903 data set that sample sizes from each organization varied between 56 and 3,178 employees, with an average of 792 and a median of 568. Only four of the organizations had fewer than 200 responses. Response rates across organization varied between 15% and 75% (average 45%). This represents a very variable set of response rates, which is due to the organizations each using their own methods of enlisting employees to take part. Since the data were collected primarily for the

organizations' own use, the authors of this study had no control over response rates generated.

### Measures

The seven factor HSE MS Indicator Tool was used by 39 different organizations to assess employees' work-related stress. Respondents were asked on one of two 5-point scales the questions in Table 1 (1 = Never, Seldom, Sometimes, Often, 5 = Always, or 1 = Strongly Disagree, Disagree, Neutral, Agree, 5 = Strongly Agree). See Cousins et al. (2004) for the original scale development of the Indicator Tool.

#### Demands

This scale measures issues like workload, work patterns and the work environment and consists of eight items (see items 3, 6, 9, 12, 16, 18, 20 and 22 in Table 1). Cronbach's alpha reliability for the Demands scale was found to be .87, which is similar to the value of .89 found in the original analysis by Cousins et al. (2004).

#### Control

Control reflects how much say a person has in the way they do their work. This scale has six items (see items 2, 10, 15, 19, 25 and 30 in Table 1). Reliability analysis produced an alpha value of .82 for this factor. Alpha reported for this scale by Cousins et al. (2004) was .78.

#### Managerial Support

This factor measures encouragement, sponsorship and resources provided by the employer. The five items reflecting this scale can be seen in Table 1 (8, 23, 29, 33, and 35). Reliability analysis produced a value of .88 for the present data set, and for Cousins et al. (2004) this was .87.

#### Peer Support

Peer Support measures colleague encouragement and support at work. Questions 7, 24, 27, and 31 reflect this four-item scale (see Table 1). Cronbach's alpha showed a reliability value of .82, similar to the .81 reported by Cousins et al. (2004).

#### Relationships

Promoting positive working to avoid conflict and dealing with unacceptable behaviour is represented by the HSE factor Relationships. This scale consists of four items (5, 14, 21 and 34) shown in Table 1. Reliability value for this factor is .78, the same as for Cousins et al. (2004).

#### Role

This factor asks employees whether they understand their job role and whether their employer ensures that they do not have conflicting roles. Five questions reflect Role and are

Table 1.  List of items from the Health and Safety Executive Management Standards Indicator Tool, and scale reliabilities.

| Scale and item | α |
|---|---|
| *Demands* | .87 |
| Item 3: Different groups at work demand things from me that are hard to combine | |
| Item 6: I have unachievable deadlines | |
| Item 9: I have to work very intensively | |
| Item 12: I have to neglect some tasks because I have too much to do | |
| Item 6: I am unable to take sufficient breaks | |
| Item 18: I am pressured to work long hours | |
| Item 20: I have to work very fast | |
| Item 22: I have unrealistic time pressures | |
| *Control* | .82 |
| Item 2: I can decide when to take a break | |
| Item 10: I have a say in my own work speed | |
| Item 15: I have a choice in deciding how I do my work | |
| Item 19: I have a choice in deciding what I do at work | |
| Item 25: I have some say over the way I work | |
| Item 30: My working time can be flexible | |
| *Managerial Support* | .88 |
| Item 8: I am given supportive feedback on the work I do | |
| Item 23: I can rely on my line manager to help me out with a work problem | |
| Item 29: I can talk to my line manager about something that has upset or annoyed me about work | |
| Item 33: I am supported through emotionally demanding work | |
| Item 35: My line manager encourages me at work | |
| *Peer Support* | .82 |
| Item 7: If work gets difficult, my colleagues will help me | |
| Item 24: I get help and support I need from colleagues | |
| Item 27: I receive the respect at work I deserve from my colleagues | |
| Item 31: My colleagues are willing to listen to my work-related problems | |
| *Relationships* | .78 |
| Item 5: I am subject to personal harassment in the form of unkind words or behaviour | |
| Item 14: There is friction or anger between colleagues | |
| Item 21: I am subject to bullying at work | |
| Item 34: Relationships at work are strained | |
| *Role* | .83 |
| Item 1: I am clear what is expected of me at work | |
| Item 4: I know how to go about getting my job done | |
| Item 11: I am clear what my duties and responsibilities are | |
| Item 13: I am clear about the goals and objectives for my department | |
| Item 17: I understand how my work fits into the overall aim of the organization | |
| *Change* | .80 |
| Item 26: I have sufficient opportunities to question managers about change at work | |
| Item 28: Staff are always consulted about change at work | |
| Item 32: When changes are made at work, I am clear how they will work out in practice | |

shown in Table 1 (1, 4, 11, 13 and 17). Cronbach's alpha produced a value of .83 for this scale, the same as that reported by Cousins et al. (2004).

### Change

This scale measures how organizational change is managed and communicated at work. This final factor contains three questions which are shown in Table 1 (26, 28 and 32). Reliability analysis produced an alpha value of .80, whereas Cousins et al. (2004) reported a value of .83 for this scale.

The seven scales above all produce good internal reliabilities and compare well with findings produced by Cousins et al. (2004). Overall scale reliability for the 35 item measure was .92 which is high (De Vellis, 2003, p. 96), and provides strong evidence that the scale is reliable and consistent. Table 1 provides the list of 35 items from the HSE MS indicator tool along with individual scale reliabilities.

### Data collection procedure

Data collected for the 39 organizations were pooled together to conduct the analysis for the current research, providing a large sample size of 26,382. The original sample size across the 39 organizations was 30,903. Because of the large sample size, any cases with missing values were deleted rather than new values being imputed. Missing values were randomly distributed across the 35 items.

In order to avoid multilevel problems associated with merging all observations together, the data set has been standardized (by converting responses to Z-scores for each question within each organization) so that all between-organization differences in means and standard deviations are removed. This approach has been discussed in previous research (Taris, Bok, & Meijer, 1998).

### Results

#### Descriptive statistics

Table 2 shows the mean scores across the seven HSE factors, with higher scores reflecting better working conditions. The percentiles allow organizations to place themselves into categories based on their own mean scores. For example, if an organisation were to score at the 50th percentile, this would mean their score was as good as or better than the score obtained by half of the organizations in the sample. This would indicate that their psychosocial working conditions, on average, were as good as or better than the conditions in half of the organizations sampled and that the organization is therefore likely to compare similarly to all organizations. It should be borne in mind that such an organization may still have a high number of individuals with poor working conditions, and thorough investigation of the dataset would be required to establish this.

#### Confirmatory factor analysis

Confirmatory Factor Analysis (CFA) is a statistical technique that tests hypothesized models. Simultaneous analyses of all variables in a model are examined to explore whether the model is consistent with the data. Conducting CFA on the current data to examine the Indicator Tool's factor structure goes one stage further than previous analyses. For example, Cousins

Table 2.  Descriptive statistics and percentiles for the seven-factor 35-item Health and Safety Executive Management Standards Indicator Tool.

|  | Demands* | Control | Management Support | Peer Support | Relationships* | Role | Change | Overall HSE |
|---|---|---|---|---|---|---|---|---|
| Mean | 3.05 | 3.42 | 3.47 | 3.80 | 3.77 | 4.18 | 3.00 | 3.53 |
| SD | 0.15 | 0.32 | 0.19 | 0.11 | 0.44 | 0.12 | 0.24 | 0.03 |
| Percentiles |  |  |  |  |  |  |  |  |
| 5 | 2.74 | 2.78 | 3.11 | 3.60 | 2.07 | 3.96 | 2.51 | 3.11 |
| 10 | 2.87 | 3.07 | 3.23 | 3.64 | 3.52 | 4.05 | 2.69 | 3.32 |
| 25 | 2.97 | 3.25 | 3.36 | 3.73 | 3.75 | 4.10 | 2.83 | 3.43 |
| 50 | 3.04 | 3.41 | 3.49 | 3.79 | 3.84 | 4.18 | 3.00 | 3.55 |
| 75 | 3.13 | 3.67 | 3.57 | 3.88 | 3.98 | 4.25 | 3.19 | 3.66 |
| 90 | 3.28 | 3.70 | 3.71 | 3.94 | 4.06 | 4.34 | 3.32 | 3.69 |
| 95 | 3.31 | 3.91 | 3.75 | 3.98 | 4.07 | 4.42 | 3.36 | 3.72 |

*The questions in the questionnaire for this factor are negatively phrased, but to help comparison across the other factors in this table the scores have been reversed so that a higher value in the table indicates *less risk* of stress at work, as is the case in the other factors.

et al. (2004) performed an EFA on the instrument; but this multivariate approach is descriptive by nature which does not allow hypothesis testing (Stevens, 1996). In addition, CFA allows models to be driven both statistically and theoretically, which traditional multivariate procedures like EFA are unable to do. Maximum likelihood estimation to the co-variances using AMOS 7.0 was applied to conduct the current CFA (AMOS; Arbuckle & Wothke, 1999). The Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Normed Fit Index (NFI) and Root Mean Square Error of Approximation (RMSEA) were used to test model fit (Tabachnik & Fidell, 2001).

### First-order confirmatory factor analysis (seven-factor model)
Model 1 was calculated to test the factor structure of the 35-item Indicator Tool using the current organizational data set. Although the Chi-square test produced a statistically significant value of 37,928.71 ($df = 539$, $N = 26,382$), $p < .01$, the other fit statistics were acceptable (CFI $= 0.91$, GFI $= 0.92$, NFI $= .91$ and RMSEA $= 0.05$). Figure 1 shows the 35-item factor loadings and correlations between the seven subscales for Model 1.

### First-order confirmatory factor analysis (single-factor model)
An additional first-order Model 1a in which all 35-items load on one single factor was estimated to examine the Indicator Tool. This analysis was performed so that Model 1 and Model 1a could be compared to test the instrument's factor structure. Chi-square exhibited a significant value of 198,998.96 ($df = 560$), $p < .01$. Goodness-of-fit statistics were poor, indicating that Model 1a did not fit the data set in the present study (CFI $= 0.53$, GFI $= 0.58$, NFI $= .53$ and RMSEA $= 0.12$). A Chi-square difference test revealed a significant enhancement in fit for Model 1 over Model 1a ($\chi^2$ (21) $= 161,070.25$, $p < .01$). This shows that the Indicator Tool is better represented by a seven-factor structure than a single factor, thus providing evidence that the HSE measure has good discriminant validity.
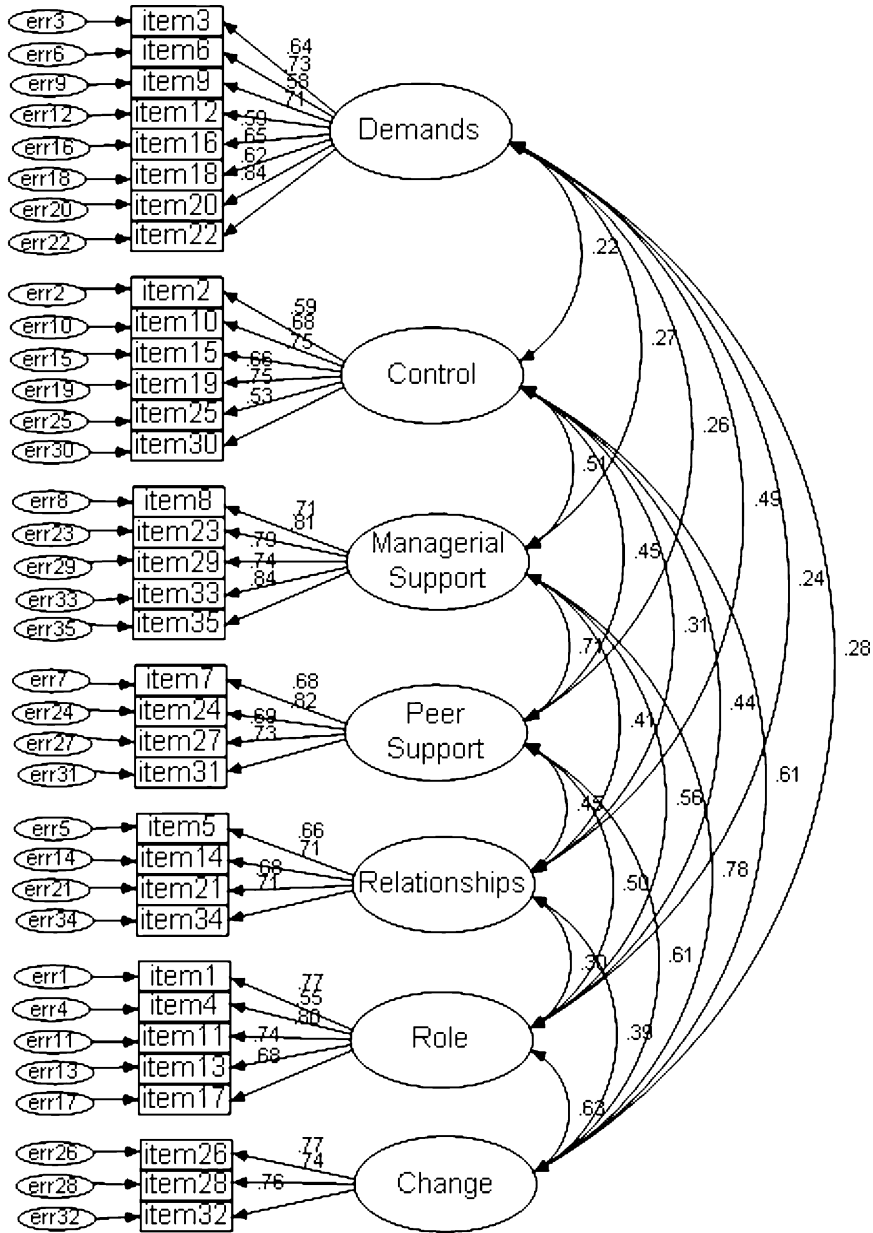
Figure 1. Model 1: 35-item Health and Safety Executive Management Standards Indicator Tool; seven-factor first-order confirmatory factor analysis.

## Second-order confirmatory factor analysis

A second CFA (Model 2) was performed to establish whether the HSE scale contains a higher order factor component. The current analysis hypothesizes that the HSE MS diagnostic Indicator Tool can be explained by seven first-order factors (Demands, Control, Managerial Support, Peer Support, Relationships, Role and Change) and one second-order factor
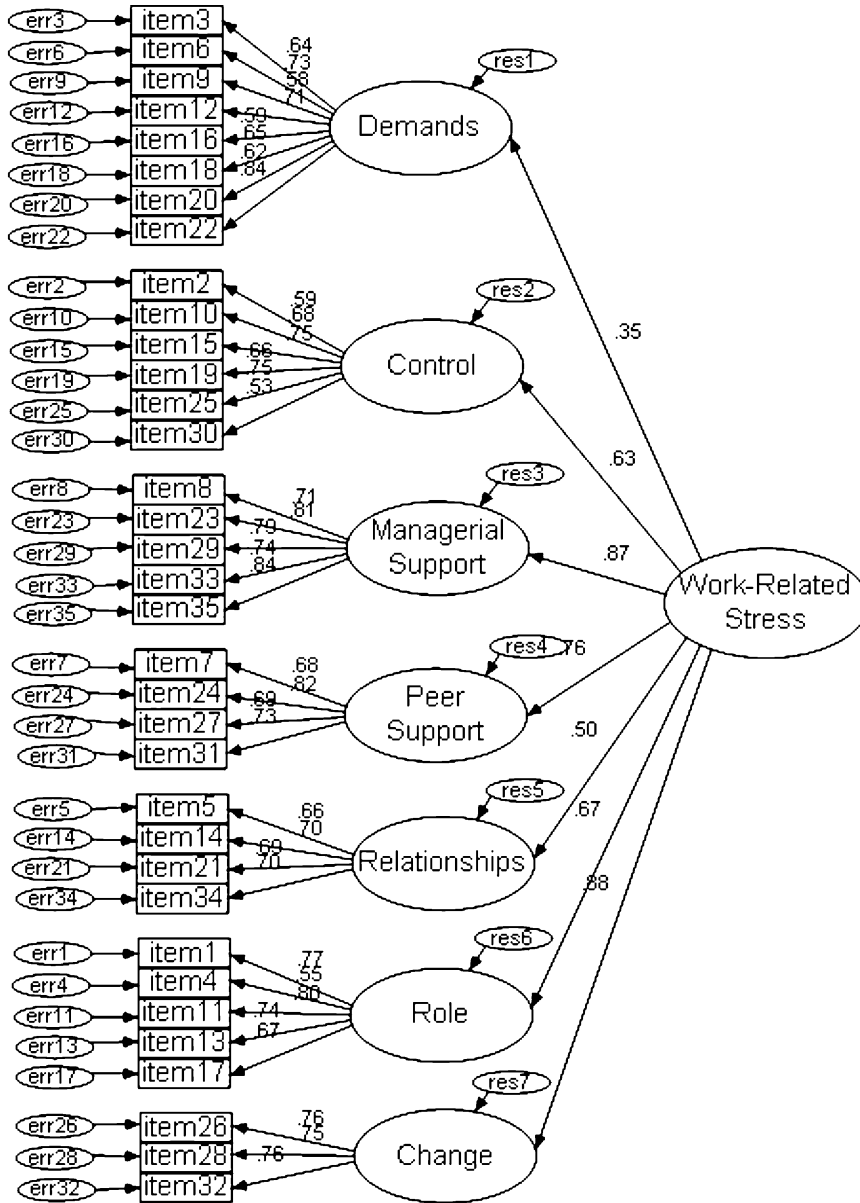
Figure 2. Model 2: 35-item Health and Safety Executive Management Standards Indicator Tool; second-order confirmatory factor analysis.

(general work-related stress). This hypothesis would appear acceptable considering the results from the previous first-order CFA. For example, it would be expected that the seven sub-scales would measure overall aspects of work-related stress (Model 1) as opposed to all 35-items measuring overall stress (Model 1a). The Chi-square test for Model 2 produced a statistically significant value of 42,330.19 ($df = 553$, $N = 2136$), $p < .01$. Goodness-of-fit statistics produced an acceptable to good fit to the data (CFI $= 0.90$, GFI $= 0.91$, NFI $= .90$

and RMSEA =0.05). The model shows that the factor loadings are again strong for this scale. Overall, the factor loadings from the seven sub-scales on the second-order factor are also strong (see Figure 2).

## Discussion

The current research examines the factor structure of the HSE MS Indicator Tool, which is used by organizations in the UK to assess employee work-related stress. The primary aim of the current study was to assess the validity and psychometric properties of the HSE Indicator Tool when applied to organizational data. This has never been tested before and is important if organizations are to use their data to compare and benchmark themselves against others. The current study also provides the means for them to do so, through the percentiles listed in Table 2. The authors conclude that the current 35-item model for the Indicator Tool fits the data (first-order seven-factor CFA). A second-order CFA produced an acceptable fit to the data, indicating that the instrument has a hierarchical factor structure; although the seven subscales test distinct concepts, at the same time they tap aspects of the same underlying concept of work stress.

The results reveal that the 35-item seven-factor measure is a psychometrically robust instrument. This finding builds on previous work by providing evidence to support the factor structure based on organizational data as opposed to individual response data used by Cousins et al. (2004). Since the current analysis was based on data across 39 different organizations, this provides evidence to suggest that the Indicator Tool can be used by employers across most industries as a reliable and representative measure of work-related stress.

Model 2, the good fitting second-order model shown in Figure 2, suggests that the MS Indicator Tool could be used by employers to calculate an overall work-related stress score for their organization. This analysis builds on previous work by further exploring the factor structure of the scale. Figure 2 also shows that the Model 2 Change and Management Support factors produce the greatest regression weights for the higher order hierarchical latent construct. These two first-order factors therefore represent overall work-related stress mostly based on responses across 39 organizations. An overall scale reliability of .92 provides further evidence to support the argument that the Indicator Tool can alternatively be used as a uni-dimensional measure of work-related stress. The Overall HSE column in Table 2 shows the uni-dimensional score percentiles based on the average of the seven factors of the MS, which organizations may wish to compute and use to compare in addition to the factor benchmarks.

Table 2 has been drafted within the current study so that employers can compare their working conditions against the average percentile scores from workers across other organizations. This will enable employers to identify "hotspots" within their organization that may need attention. It should be noted that by comparing mean scores, it is possible to overlook individuals who believe they have poor working conditions. Organizations are encouraged to consider not only areas where the mean score is low but also where there are some individuals recording low scores.

Although data used in the current research was derived from 39 different organizations, the majority of these were public sector. It would therefore be useful to test Models 1 and 2 using data collected from the private sector. It would be anticipated that working conditions within private sector organizations will be distinct in various ways, and further research to

explore such potential differences would be desirable. This would also allow the present results to be replicated using data from a different source.

Closer inspection of the results produced by Model 1 indicates that a number of items produced factor loadings as low as .53. If a better model fit were required in the future then items with loadings less than approximately .6 could be removed from the scale. This item deletion procedure is similar to the process used by Cousins et al. (2004) in their attempt to reduce the instrument's scale length, in which they removed items that failed to load greater than .5 during the development of the scale. It can be observed from Model 1 that items 9 and 16 (Demands), 2 and 30 (Control), and 4 (Role) all have factor loadings less that .6. When these items were removed, the instrument produced a better fit to the data than Model 1 (CFI = 0.93, GFI = 0.93, NFI = .93 and RMSEA = 0.05). Future research could further explore this finding by replicating this analysis using an alternative data set.

Longitudinal studies are also required to help further develop the Indicator Tool. This would help determine what long-term effects the MS has upon employees and employers. Intervention programmes to combat work-related stress could be evaluated over time using longitudinal designed studies. Predictive validity of the sub-scales could also be examined by testing the influence the MS has upon fundamental organizational outcomes such as work performance, turnover, absenteeism and productivity. Van Laar, Edwards, and Easton (2007) have proposed that a full understanding of stress at work will require examination of the broader context of the work setting, and they have presented data to help explore the links between stress at work and other factors such as the home–work interface and job and career satisfaction within a model of Quality of Working Life. Further exploration of the relationships between the HSE MS Indicator Tool factors and other factors contributing to the broader experience of Quality of Working Life would seem to offer further opportunity for understanding the experience and effects of stress in the workplace.

Rick et al. (2001) found little sound evidence to support the reliability and validity of a range of measures of stress at work, and therefore the evidence presented here in support of the HSE's promotion of the Indicator Tool as a psychometrically robust instrument is of practical as well as theoretical relevance. The current research provides psychometric evidence to support the factor structure of the 35-item, seven-factor HSE MS Indicator Tool. Overall, these results support continued use and further research into the HSE MS Indicator Tool to determine where stress-related risks are located in organizations.

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