The development and validation of the Office Work Screen

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Background
The prevalence and costs to both employers and individuals of musculoskeletal disorders and associated psychosocial factors are well documented. There is increasing evidence that early identification is the key to the prevention of chronicity and sickness absence.

Aims
The study aimed to develop and validate a screening questionnaire, capturing relevant psychosocial issues and musculoskeletal symptoms, to measure work instability (WI) in office workers.

Methods
The staged methodology was based upon Rasch analysis and included item banking from existing Work Instability scales and analysis of new data from postal surveys. The criterion validity of the emerging scale was examined using vocational assessments by occupational physiotherapists.

Results
A 62-item questionnaire was returned by 153 employees from two different settings. The data were fitted to the Rasch model and 26 items were found to fit model expectations (chi-square $P = 0.07$), satisfy strict requirements for unidimensionality and discriminate across expert defined levels of WI. Reliability was 0.9, indicating suitability for use at the individual level. Absence of item bias was shown for age, gender and if the individual had been off sick from work in the past 3 months, suggesting the scale is robust to variations in workforce composition and sickness absence rates.

Conclusions
The Office Work Screen is a short questionnaire incorporating both musculoskeletal symptoms and relevant psychosocial factors in one dimension. This new questionnaire may facilitate workforce screening, individual monitoring and proactive targeting of interventions (for example, vocational rehabilitation) to prevent or minimize sickness absence in office workers.

Key words
Work instability; sickness absence; screening questionnaire; office workers; Rasch analysis.

Introduction
Musculoskeletal disorders (MSDs) and related psychosocial factors are the most common causes of work-related ill health in the UK [1,2]. The cost to both individuals and employers is well documented. There is increasing evidence that early identification is the key to the prevention of chronicity and sickness absence in these conditions [3]. However, until recently there have been no validated tools to help identify individuals ‘at risk’ before these types of health problems start to impact on productivity and work attendance. Our understanding of the underlying contributory factors for work related MSDs has improved in recent years, particularly in relation to the importance of related psychosocial factors. This has been helped by the acceptance of the biopsychosocial approach to pain management of musculoskeletal and other pain disorders [4–7].

Work instability (WI) has been defined as a state in which the consequences of a mismatch between an individual’s functional and cognitive abilities and the demands of his or her job can threaten continuing employment if not resolved [8]. The term was introduced in the context of an interruption or cessation of work associated with rheumatoid arthritis [9]. Even for those individuals who do eventually stop working, this may be the final outcome of a long and sometimes complex process involving adaptations within work and changes in employment [10]. If people are experiencing this process of adaptation or job change, this is indicative of a mismatch between their functional capabilities and the demands of the job. Consequently, the vocational impact of any functional incapacity must relate to the interaction between that incapacity and the individual’s work demands.
WI has recently been explored in a number of long-term clinically defined health problems. The first clinical or disease-specific work instability scale (WIS) to be developed was for rheumatoid arthritis [11]. Similar psychometrically robust, validated WISs for ankylosing spondylitis [12] and traumatic brain injury [8] have also been developed. The concept of WI in a specific occupational group has also been explored in a study of job retention in nurses, which included the development of a WIS for nurses with musculoskeletal symptoms (the Nurse-WIS) [13].

Measuring clinical outcomes is an essential aspect of developing evidence-based practice in occupational health. Encouraging employers to adopt work systems that include early identification of health issues is at the heart of the government’s Occupational Health Strategy for Great Britain [14] and appropriate health surveillance as a requirement under European Health and Safety at Work legislation. However, there is a lack of psychometrically robust measures to assist occupational health clinicians and employers to meet these responsibilities. The focus of traditional measures has been on function, disability and health-related quality of life. More recently, some measures focusing on psychosocial variables and stress have been developed including the Health & Safety Executive indicator tool for work-related stress [15]. The recently developed pain disability questionnaire does have a psychosocial component but is essentially a measure of functional status [16]. Some instruments have been published which either focus on the ‘on-the-job’ impact across a range of chronic health problems [17] or on presenteeism [18].

As far as we are aware, the Nurse-WIS [13] is the first occupation-specific scale to be developed. In developing the Nurse-WIS, which captures all the factors relevant to the biopsychosocial model, we have proof that it is possible to develop occupation-specific WISs. Furthermore, we have found that such scales need not be focused purely on functional limitations. The focus on occupations rather than clinical conditions has been continued in the development of a new questionnaire which is reported in this paper. The aim of this project was to develop and validate a WIS specific to office workers to provide employers with a simple to use screening tool to assist early identification of staff experiencing WI. We have called this the Office Work Screen.

**Methods**

The study design was in five stages (see Figure 1)

The methodology adopted was based on the standard methods used in all the previous studies developing disease-specific WISs [8,11,12]. All the previous WISs developed, including the Nurse-WIS, met both traditional and modern psychometric standards of measurement.

These include aspects such as unidimensionality and absence of item bias (differential item functioning).

In all the previous studies, semi-structured, in-depth, taped interviews were undertaken with the participants on a one-to-one basis to identify relevant issues of WI relating to work attendance and job retention and to identify potential items for the scale under development. In each study, the interviewees were from a variety of occupations, a significant proportion of whom were office workers. As common items were identified in different WISs, these were used to link scales into an item bank [19], providing a common calibration for all items on a single metric scale of WI, so giving comparability across disease or occupational group. The WI item bank provided a pool of items to act as the basis of the Office Work Screen.

All the scales incorporated into the item bank use simple statements identified from the interview transcripts with a ‘True’ ‘Not True’ response format. All the items were kept as close to the original wording of interviewees as possible, and all are general items, each covering a single concept. The initial draft Office Work Screen was developed from the item bank by a researcher previously involved in the qualitative interviews of all the previous projects. Some items were not included on the basis of lack of generalizability to a population of office workers.

The initial draft Office Work Screen was tested for face validity in cognitive debriefing sessions with participants who worked in an office environment. Each individual completed the scale in the presence of a researcher and were then asked to comment on the relevance of the items, ease of completion and to identify any items they

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**Figure 1. Stages of the study.**
Two organizations, one in the public sector (university department) and one in the private sector (manufacturing company) agreed to participate in the postal stage of the scale development which involved sending out the draft 62-item Office Work Screen to the same group of office workers on two separate occasions 3–4 months apart. The survey forms also included information on any sickness absence in the previous 3 months.

The data from the draft questionnaire were then assessed by the Rasch model [20], which is the current standard for the development of unidimensional scales delivering metric quality outcomes in health care [21]. The model defines how responses to items should be if measurement (at the metric level) is to be achieved. A variety of fit statistics determine if this is the case [22]. Reliability of the item set is assessed using the person separation index [23].

Within the framework of Rasch measurement, the psychometric properties of the scale should be invariant across attributes that describe individuals within the group, for example age or gender [24]; therefore, younger and older age groups should have the same probability of affirming an item within the scale if they have the same level of WI. If this does not occur, then the item displays differential item function (DIF) and would violate the requirement of unidimensionality [25]. Consequently, every item is checked for DIF by age and gender and, in this study, level of sickness absence. RUMM2020 software [26] was used to determine the fit of data to the Rasch measurement model.

As there is no other equivalent measure of WI (except in specific clinical groups), the only way to compare the new Office Work Screen was against a full vocational assessment by an occupational physiotherapist. Participants completed the draft Office Work Screen and then completed a vocational assessment by one of three occupational physiotherapists who were using an agreed format. An outline of the contents of these assessments is shown in Table 1. To ensure consistency between the assessors, an initial session to ensure inter-rater reliability was undertaken.

The physiotherapists completed the vocational assessments blind to the results of the participants’ responses to the draft Office Work Screen. They scored each individual a WI level of 0–4, representing increasing mismatch between functional capacity and job demands (see Table 2). This scoring system was devised and used successfully in the development of the previous clinical WISs. The main objective for this stage of the study was to generate data for Rasch analysis which would identify which items on the scale discriminate across the different levels of WI.

### Results

Sixty-nine items thought relevant to the office environment were selected from the existing item bank. Initial face validity sessions with two participants (one male, one female) led to the removal of five items, four for lack of generalizability and one where it was felt the concept was duplicated in another item. In addition, the wording of a further seven items was amended to remove references

| Table 1. Outline of areas covered in the vocational assessments used in stage 5 |
|-------------------|---------------------------------|
| **Health**        |                                  |
| Medical history   | Current condition                |
| Current symptoms  | Aggravating and easing factors   |
|                   | Limitations                      |
|                   | Patterns of symptoms             |
| **Work situation**|                                 |
| Job description   |                                 |
| Task analysis     |                                 |
| Postural analysis |                                 |
| Work organization/task variety/control | |
| Hours worked/shift pattern/rest breaks | |
| Management culture/style | |
| Tools/equipment  |                                 |
| Environment       | Getting to and from work and access in and around the workplace |
| Hobbies           |                                 |
| Other perceived stressors | |

| Table 2. Levels of WI used by physiotherapists during vocational assessments |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Zero WI         | Level 1 WI      | Level 2 WI      | Level 3 WI      | Level 4 WI      |
| No problems at work | Minor problems at work requiring advice only | Modifications to work practices and/or provision of alternative equipment required. | Some aspects of the job are unsuitable. For the remainder modifications to work practices and/or provision of alternative equipment required. | Mismatch is such that even with changes, modifications and alternative equipment, the majority of the job is unsuitable and the individual is unlikely to cope with current work tasks. |
to pain or symptoms. The word ‘health’ was substituted in three cases as this was felt to be more generic and less clinical. For example, ‘I worry that my symptoms will affect my job prospects’ became ‘I worry that my health will affect my job prospects.’

Further cognitive debriefings were then conducted with five participants using a new draft of the scale with the remaining 63 items. At this stage, one further item was removed as it was felt it lacked relevance for office workers and the wording of one further item was amended slightly. Overall feedback was good with the draft scale displaying excellent face validity.

The university department had 62 employees. The response rate to the questionnaires was 64%. The manufacturing company had 71 office workers. The response rate to the questionnaires was 52%. The respondents had a median age of 40 years (range 21–63) and 53% were male. Just over one-quarter reported one or more episode of sickness absence in the previous 3 months; the majority reported just one episode, but almost one in 12 employees reported more than one episode. Where an episode of sickness absence was taken, the average time off work was 3.2 days.

The data from the questionnaires were fitted to the Rasch model. Of the original 62 items 47 were found to fit the Rasch model. Total chi-square item trait interaction probability was 0.61 showing non-significant deviation from model expectation. Person separation reliability was 0.88 indicating suitability for use at the individual level. Invariance of items was shown for age, gender and whether or not the individual had been off sick from work in the previous 3 months. Furthermore, only one item showed a lack of invariance across time in a test–retest stage. This demonstrates an absence of item bias for these groups suggesting that it is robust to variations in workforce composition, sickness absence rates and for repeated assessment.

Sixteen vocational assessments were performed. Further analysis based on the item set of 47 that had previously been shown to fit the Rasch model found 26 items which discriminated over the levels of WI used by the assessors. The data retained showed fit to the Rasch model (chi-square interaction $P = 0.07$), good reliability (0.82) and absence of DIF. This 26-item scale, despite its mix of physical and psychosocial items, demonstrated strict unidimensionality (independent t-test rate = 5%)

The scale can be scored in three bands indicating high, medium and low WI. Cut points at 8, to move from low risk to medium risk, and 17, to move into the high risk band, gave 91% sensitivity and 100% specificity to medium risk and 100% sensitivity and 93% specificity to high risk of WI. These levels of risk also discriminate over days lost to sickness absence, giving 1.0; 1.9 and 3.4 days, respectively, over the last 3 months (analysis of variance $F = 3.3; P = 0.038$). Just 4% of the respondents in the postal surveys were categorized at high risk.

**Discussion**

When individuals experience increasing difficulties with some or all their work tasks because of their health problems, they could be said to be experiencing WI. Until now there has been no reliable way of screening for or monitoring individuals experiencing WI in the office environment. The Office Work Screen has been developed to address this shortfall. It has 26 dichotomous items and satisfies the criteria of modern psychometric theory including strict unidimensionality and freedom from DIF.

There are a number of strengths and weaknesses of the study. Its strengths are the use of qualitative methods to derive the item set and the use of the Rasch measurement model to refine the item set. Its weaknesses derive from the fact that the instrument was developed and tested on a comparatively small sample. Consequently, it requires further testing in larger groups. The responsiveness of the instrument across interventions also needs to be tested, although its reliability and ability to discriminate across clinically defined groups suggests that it will be able to detect change.

There is increasing evidence to suggest that early identification and management of health problems at work is both effective and cost-effective [27–29]. Occupational health services and resources for ergonomics interventions are always limited; therefore, it is important that they are targeted at those most in need. If employees with problems are not identified early and well managed, the consequences are seen in loss of the ability to work with associated sickness absence. In addition to the direct costs of sickness absence, additional costs to the employer can arise from overtime payments, lost production, missed deadlines and the cost of recruitment and retraining.

The Office Work Screen offers the prospect of proactive management to prevent or minimize sickness absence in Office Workers. There are a number of settings in which the Office Work Screen could be useful, for example it could be used as a self-report screening tool to identify employees experiencing WI. In this way, the Office Work Screen could act to alert the occupational health team/employer to the need for more detailed clinical/functional work assessment for specific individuals as appropriate. The Office Work Screen could also facilitate a better understanding of the extent of risk of WI and work loss in an individual employee and therefore facilitate appropriate and cost-effective targeting of occupational health and/or rehabilitation resources. The Office Work Screen may also be useful as a comparative measure, for example monitoring individual performance and reporting when returning to work after a period off work or after appropriate interventions have taken place. In practice, the effectiveness of the Office Work Screen will be linked to how results are used and the action taken for those identified at medium or high risk. Interventions
need to be timely and evidence based: as an objective outcome measure, the Office Work Screen could also help in assessing the effectiveness of interventions.

In conclusion, a simple 26-item Office Work Screen, meeting current standards for scale development, is available to occupational health physicians and other staff to screen for the risk of WI among office workers. Using cut points, different levels of risk can indicate the need for interventions to reduce sickness absence. In addition to ongoing work to complete testing the reliability of the Office Work Screen, there are other work areas which are recognized as being associated with a higher risk of MSDs where a similar screening questionnaire would be useful. Development of an additional Work Screen is underway for manual workers.

Key points
- MSDs and associated psychosocial factors are the most common cause of work-related ill health and sickness absence in the UK; however, we have yet to see primary prevention strategies having a major impact on the prevalence of MSDs at work.
- The Office Work Screen is based on the concept of WI (the mismatch between functional and cognitive abilities and job demands) and is designed specifically for Office Workers.
- The Office Work Screen measures the impact of both physical and psychosocial factors in one scale and offers the prospect of the proactive management of employees at risk of sickness absence and job loss associated with health problems.

Conflicts of interest
None declared.

References