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Better Display Screen Equipment (DSE) work-related ill health data

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Research Report

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Better Display Screen Equipment (DSE) work-related ill health data

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A variety of ill-health symptoms have been associated with work with Display Screen Equipment (DSE) including musculoskeletal disorders; mental stress; and visual fatigue. The project sought information about the extent of such ill-health in DSE workers through a survey of employees. It compared the data with those in the scientific literature. An extensive literature review sought to identify consistent evidence on any possible causal role of workplace factors.

The survey found high prevalences in DSE users of self-reported symptoms, eg. headaches (52%), eye discomfort (58%), and neck pain (47%); other symptoms such as back (37%) and shoulder (39%) pain were also frequently reported. Most of those reporting symptoms did not take any time off work. These findings are broadly consistent with other studies in the literature.

The results showed a significant influence of DSE work in that the prevalences of symptoms were higher among those who spent more time at their computer at work and among those who worked for longer without a break. All symptoms were more common among respondents who had indications of stress, anxiety and/or depression. These findings are again consistent with the published literature. Although many studies have examined possible causal factors, methodological differences make it hard to draw any firm conclusions about causation of symptoms.

Comparing these results with those of earlier research provides no positive evidence that the introduction of legislation on DSE work in 1993 has reduced ill-health in DSE workers. However there are substantial uncertainties, not least over the extent to which the provisions of the legislation have been fully implemented, and it cannot be safely concluded that the legislation has had no effect. The report discusses the significance of its detailed results in the context of relevant factors in the workplace, and makes recommendations.

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EXECUTIVE SUMMARY

A variety of ill-health symptoms have been associated with intensive work with Display Screen Equipment (DSE) including musculoskeletal disorders (MSDs) (upper limb disorders; back pain); mental stress; and visual fatigue. In 2003/04, MSDs (bone, joint or muscle problems) were by far the most commonly reported work-related illnesses in Great Britain, with an estimated 1,108,000 people ever employed affected.

The risks of substantial ill-health to any individual user of DSE, is believed to be relatively low, particularly if regulatory provisions are adequately complied with. However, the very large number of people exposed to such work means that, even at a low level of incidence, DSE work potentially makes a significant contribution to the estimated total of working days lost to MSDs in the UK each year.

Against this background, the Health and Safety Executive (HSE) identified a need for improved data relating to the levels of DSE work-related ill health in UK office workers. In addition, targets for reducing work-related ill health and absence from work meant that up to date information was required of the scientific evidence on the extent to which such ill-health could be caused or exacerbated by work and to establish significant risk factors relating to the health problems identified. The research reported here was commissioned as a result.

The study involved a questionnaire survey of a sample of DSE users in organisations of different sizes and sectors across the UK to determine the prevalence of work-related ill health. This was followed by a statistical analysis of additional information on work exposure factors collected during the questionnaire survey. In parallel with this, an in-depth literature review was conducted to determine levels of ill-health in other comparable working populations and to establish the evidence-base for potential causal factors for DSE-related ill health.

The survey results are based on the study group of 1327 DSE users who replied to the survey carried out during 2006 (representing an estimated response rate of 40-45%). These were drawn from a total of 130 organisations randomly selected from throughout the UK. Small businesses were particularly well represented with 108 of the 130 being drawn from this size group. Key findings were:

- 73% of all respondents to the questionnaire survey reported one or more musculoskeletal symptom.
- 12 month prevalence of individual musculoskeletal symptoms ranged from 12% for elbow and forearm symptoms to 47% for neck symptoms. Symptoms involving the shoulder, neck and back were most frequently reported together.
- Slightly over half of all respondents reported symptoms affecting the head and/or eyes.
- As expected from the literature, symptoms were reported more frequently by women than men.
- There was little evidence of differences in prevalence between companies of different sizes or different industry sectors.
- Prevalence of these symptoms was higher among those who spent more time at their computer at work and among those who worked for more than one hour without a break.
- All symptoms were more common among respondents who also had indications of stress, anxiety and/or depression.
- 12 month incidence of musculoskeletal symptoms ranged from 2.7% for forearm and leg symptoms to over 6% for hand and neck symptoms. Incidence of eye discomfort was higher than for all the musculoskeletal symptoms at 9.5%.

- Occurrence of anxiety, depression and distress was marginally more common among younger respondents and anxiety occurred more frequently in women than men. There was little consistent difference in the occurrence of distress, anxiety or depression between companies of different sizes or sectors.
- Occurrence of anxiety, depression and distress was more frequent among those who typically worked more than 5 hours over their contracted hours each week; distress was more common among those who worked more than one hour without a break; and anxiety and depression were more common among those who spent longer per week at the computer.
- The majority of those reporting symptoms (at least 82% depending upon the symptom) took no time off work related to that symptom.
- Expressed as a proportion of those reporting symptoms, the most frequent absences from work were for headaches, back pain and leg pains unrelated to back pain, where more than 10% of those reporting the symptoms had taken some time off work.
- Expressed as the absolute numbers of people reporting absence, the most frequent absences from work were for headaches (105) followed by back pain (65) and neck pain (39).

The recorded prevalences of MSD symptoms are broadly similar to those reported in the published scientific literature, although differences in survey design make accurate comparisons difficult.

- Prevalences of any musculoskeletal symptoms (mainly aches and pains) over the last 12 months in UK-based studies of computer users ranged from 65% - 86%. The value for the present study (73%) is almost mid-way within this range.
- One UK-based study reported wrist/hand symptoms over a 12 month period with prevalences of 49% (left) and 52% (right) compared to 35% in the current study and a lower figure from another UK-based study of 11% (males) and 15% (females) over a one-week time frame.
- For neck and shoulder symptoms, no UK-based studies are available for comparison although values in the literature from other countries of 60% and 43% can be compared to that of 55% in the present study.
- Finally, a 12 month prevalence of back pain of 47% in the present study is lower than that in the only other UK-based study of computer users over the same time frame of 58%.

These prevalences are also broadly similar to those determined in an earlier IOM survey using the same question set. Certainly they are not noticeably lower. For example, a figure of 55% from the current study reporting upper limb symptoms within the last year can be compared to levels of 49% in the preceding three months and 55% lifetime prevalence reported from the earlier IOM study.

The two surveys span the period of currency of the Health and Safety (Display Screen Equipment) Regulations 1992 suggesting that these regulations may not have had a major impact on the prevalence of reported MSD symptoms. However, there are signs in the questionnaire responses (for example in the proportion reportedly not receiving information and training) that implementation of the DSE Regulations may be incomplete, although this was not formally explored in the research reported here. Care should therefore be taken in making judgements on the effectiveness of the regulations based on these findings.

In the present study, the prevalences of MSD symptoms were higher among those who reported spending more time at their computer at work. This is consistent with the scientific literature which shows a reasonably strong and consistent exposure-response relationship between computer work and symptoms. The relationship appears to vary with the type of input device used.

For keyboard use, odds ratios for MSD symptoms are generally moderate (< 2.0) and are associated with more than about 20 hours use a week. For the mouse, the risks can be markedly higher (with several papers reporting odds ratios in excess of 4.0) and a doubling of risk is probably associated with around ten hours of mouse use a week. These estimates are necessarily vague as they reflect differences in the design and analysis of different studies and vary with the anatomical site of any symptoms. Although the evidence is less strong, the literature also includes a number of prospective studies which suggest that this relationship is possibly causal.

The published literature does not allow any clear assessments of which specific aspects of computer work or workstation design (including psychosocial factors) result in the observed relationship between computer work and MSD symptoms. Although many papers report a wide variety of workplace factors, often showing statistically significant relationships with symptoms, these findings are rarely duplicated across studies. This is often more due to differences in study design and the parameters assessed in any one study rather than any failure of one study to replicate earlier findings.

One possible explanation for this is that MSD symptoms develop as a result of the relatively static nature of computer work *per se* rather than any specific deficiency in the workplace. The idea of the adverse affects of static loading on muscles and other structures is not new and, although there is no specific evidence from the current study to support this hypothesis, it would certainly seem to merit further consideration and exploration.

- The 12-month prevalence of headaches of 52% reported in the present study is higher than those of 43% and 30% reported in other UK studies of computer users (using the same time frame) and all are higher than the value for non-users of 12% reported in the second of these two studies. However, they are within the cited population range of 38-68%.

- The 12-month prevalence of visual discomfort of 58% reported in the present study is similar to one other UK-based study (59%) but higher than another which reported a prevalence of 47% amongst computer users but only 23% in non-users (using the same time frame). However, they can be compared to the range for computer users in the literature of 38% (one week prevalence) to 72% (period not given). No population-based data could be found.

- There is insufficient reliable information in the literature to draw even tentative conclusions regarding any associations between computer work in general or specific work characteristics and either headaches or visual problems.

- The level of psychological distress recorded in the present study using the General Health Questionnaire (GHQ-12) was considerably higher than the documented levels for a UK non-clinical population and a UK industrial population but, in turn, considerably lower than that reported for another predominantly white collar workplace based study (not specifically computer users) using the same instrument.

- The levels of anxiety and depression recorded in the present study using the Hospital Anxiety and Depression scale (HADS) were marginally higher than those reported for a UK non-clinical population using the same scale.

The findings from the current survey of an association between distress, anxiety and depression and work characteristics (e.g. work duration) are consistent with the current concerns regarding psychosocial and psychological factors and MSDs. However, it is not possible to differentiate between cause and effect on the basis of this cross-sectional study.

Although almost three-quarters of respondents reported at least one musculoskeletal symptom the vast majority also reported that they had not taken any time off work as a consequence of any symptoms reported. The symptoms most commonly leading to time off work were headaches (absence reported by 7.9% of all respondents) followed by back pain (where the equivalent figure was 4.9%).

On the basis of the findings of the survey and literature review recommendations were made to:

- examine the current implementation and consequent effectiveness of the DSE Regulations, particularly the issue of breaks from DSE work;
- explore the implications of the finding of an exposure-response relationship between mouse use and MSD symptoms for the guidance given in respect of jobs involving intensive mouse use;
- examine the scientific literature on muscle physiology etc. to establish whether the concept of 'postural fixity' provides a plausible mechanism to explain the apparent exposure-response curve between time spent working at a keyboard (particularly without a break) and the incidence of MSD symptoms in the absence of any clear evidence for specific causal factors;
- explore the scope for reducing headaches and visual symptoms as a cause of absence from DSE work, possibly by better implementation of breaks;
- explore the issue of stress and computer-based work within the context of the Working Time Directive and its implementation;
- examine the provisions of the Data Protection Act and their implications in relation to the use of email and other internet technologies as an aid to workplace surveys in order to facilitate future studies.

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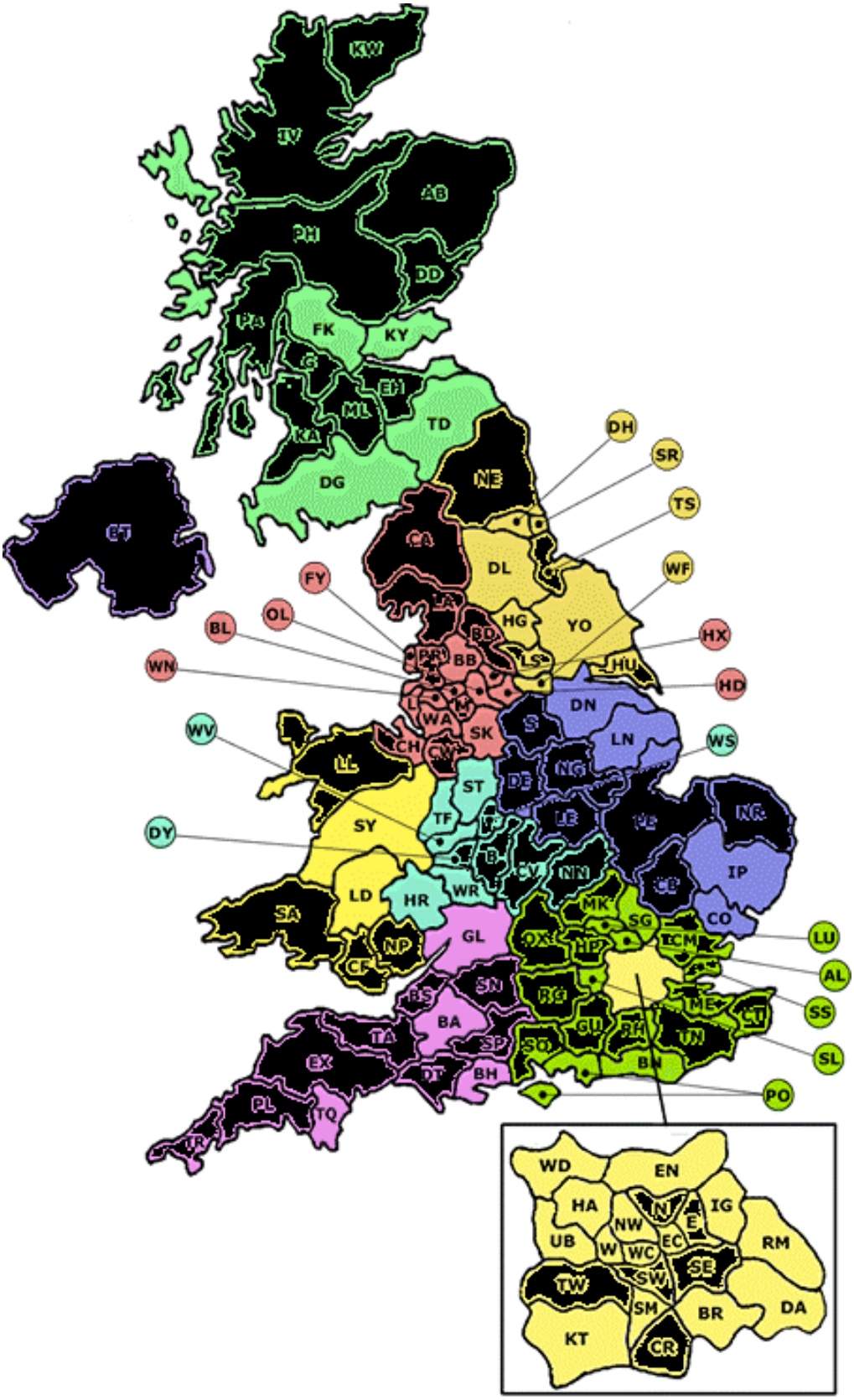

Figure 8.1 Distribution of all participant companies (shaded black)

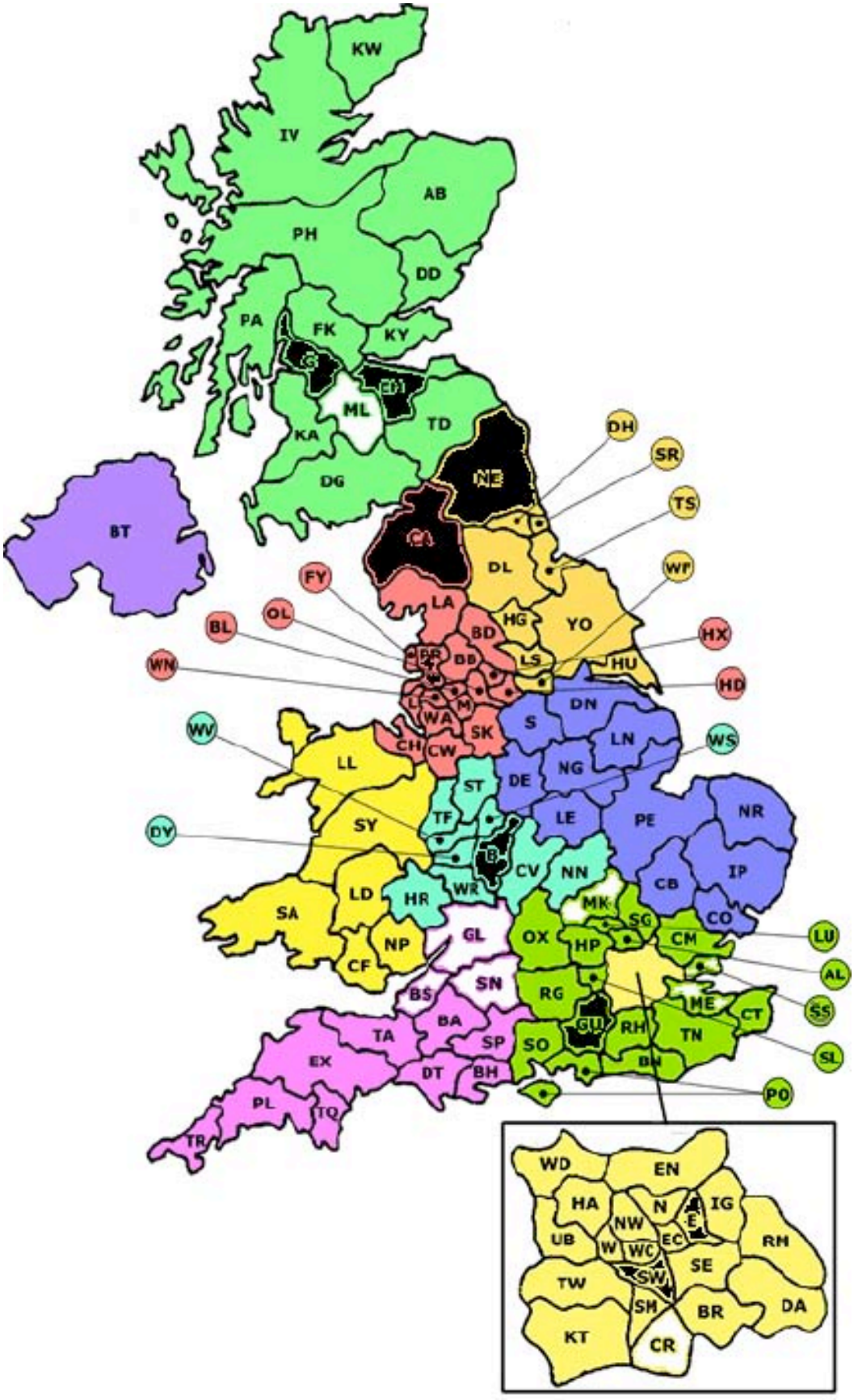

Figure 8.2 Geographical distribution of large companies (shaded black) and medium companies (shaded white)

Table 8.7 Results from logistic regression analyses of personal and company characteristics and type of questionnaire. Results are shown as Odds Ratios (OR) and 95% confidence intervals (CI). Confidence intervals which exclude the value 1 indicate statistical significance at the 5% level and are indicated in bold type.

	Hands		Wrists		Forearms		Elbows		Shoulders	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Age (per 10 yrs)	0.93	(0.8,1.0)	**0.85**	**(0.8,1.0)**	1.05	(0.9,1.2)	1.00	(0.9,1.2)	**0.88**	**(0.8,1.0)**
Female vs male	**1.62**	**(1.2,2.1)**	**1.69**	**(1.3,2.3)**	**2.14**	**(1.4,3.2)**	1.08	(0.8,1.6)	**2.38**	**(1.8,3.1)**
Web v Paper Qs	**1.58**	**(1.2,2.1)**	**1.41**	**(1.0,1.9)**	**1.48**	**(1.0,2.1)**	**1.54**	**(1.0,2.3)**	**2.10**	**(1.6,2.7)**
Small v Medium/Large	0.84	(0.6,1.1)	0.87	(0.6,1.2)	0.91	(0.6,1.3)	0.83	(0.6,1.2)	**0.75**	**(0.6,1.0)**
Public v Other	1.25	(0.9,1.7)	1.16	(0.8,1.6)	**1.68**	**(1.0,2.7)**	1.10	(0.7,1.7)	1.23	(0.9,1.7)

	Neck		Back		Legs		Headaches		Eye discomfort	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Age (per 10 yrs)	**0.86**	**(0.8,1.0)**	**0.82**	**(0.7,0.9)**	1.09	(0.9,1.2)	**0.71**	**(0.6,0.8)**	**0.79**	**(0.7,0.9)**
Female vs male	**1.86**	**(1.5,2.4)**	**1.62**	**(1.3,2.1)**	**1.50**	**(1.1,2.1)**	**2.23**	**(1.7,2.9)**	**1.57**	**(1.2,2.0)**
Web v Paper Qs	**1.37**	**(1.1,1.7)**	**1.44**	**(1.1,1.9)**	**1.52**	**(1.1,2.2)**	1.26	(1.0,1.6)	1.25	(1.0,1.6)
Small v Medium/Large	0.87	(0.7,1.1)	0.96	(0.7,1.2)	1.00	(0.7,1.4)	0.80	(0.6,1.0)	0.83	(0.6,1.1)
Public v Other	1.03	(0.8,1.4)	1.03	(0.8,1.4)	1.30	(0.9,2.0)	1.20	(0.9,1.6)	1.23	(0.9,1.6)

Table 8.8 Results from logistic regression analyses of patterns of work. Results are shown as Odds Ratios (OR) and 95% confidence intervals (CI) for each variable entered singly into a model adjusting for age (where appropriate), gender and questionnaire type. Confidence intervals which exclude the value 1 indicate statistical significance at the 5% level and are indicated in bold type.

	Hands		Wrists		Forearms		Elbows		Shoulders	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Weekly total PC use (per 10 hrs)	**1.22**	**(1.1,1.4)**	**1.17**	**(1.0,1.4)**	1.11	(0.9,1.3)	1.14	(0.9,1.4)	1.06	(0.9,1.2)
Weekly work PC use (per 10 hrs)	**1.28**	**(1.1,1.5)**	1.13	(0.9,1.4)	1.04	(0.8,1.3)	**1.33**	**(1.0,1.7)**	**1.21**	**(1.0,1.4)**
Break at 1hr+ v Break every hour	**1.60**	**(1.2,2.1)**	1.33	(1.0,1.8)	1.28	(0.9,1.8)	1.26	(0.9,1.8)	**1.52**	**(1.2,2.0)**
Hours spent working (per 10 hrs)	1.01	(0.9,1.2)	0.97	(0.8,1.2)	0.89	(0.7,1.1)	**1.37**	**(1.1,1.7)**	1.07	(0.9,1.2)
Work > 48hrs v Work ≤ 48 hrs	0.80	(0.4,1.5)	1.13	(0.6,2.1)	1.05	(0.5,2.4)	1.09	(0.5,2.4)	0.76	(0.4,1.4)
Hours over contracted hours (per 10 hrs)	1.04	(0.8,1.4)	1.07	(0.8,1.4)	0.86	(0.6,1.3)	1.31	(0.9,1.8)	1.24	(1.0,1.6)
Work 5+ hrs extra v Work <5 hrs extra	0.84	(0.6,1.2)	0.88	(0.6,1.3)	0.87	(0.5,1.4)	1.46	(0.9,2.3)	**1.46**	**(1.0,2.1)**

	Neck		Back		Legs		Headaches		Eye Discomfort	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Weekly total PC use (per 10 hrs)	**1.15**	**(1.0,1.3)**	1.13	(1.0,1.3)	1.12	(0.9,1.3)	**1.24**	**(1.1,1.4)**	**1.29**	**(1.1,1.5)**
Weekly work PC use (per 10 hrs)	**1.27**	**(1.1,1.5)**	1.15	(1.0,1.4)	1.17	(0.9,1.5)	**1.38**	**(1.2,1.6)**	**1.49**	**(1.3,1.8)**
Break at 1hr+ v Break every hour	**1.65**	**(1.3,2.1)**	**1.55**	**(1.2,2.0)**	**1.49**	**(1.1,2.1)**	**1.83**	**(1.4,2.3)**	**1.86**	**(1.5,2.4)**
Hours spent working (per 10 hrs)	1.11	(1.0,1.3)	1.04	(0.9,1.2)	1.19	(1.0,1.4)	1.15	(1.0,1.3)	**1.22**	**(1.1,1.4)**
Work > 48hrs v Work ≤ 48 hrs	0.88	(0.5,1.5)	0.83	(0.5,1.5)	1.09	(0.5,2.3)	1.36	(0.8,2.3)	1.27	(0.8,2.1)
Hours over contracted hours (per 10 hrs)	1.25	(1.0,1.6)	1.13	(0.9,1.5)	1.06	(0.8,1.5)	1.12	(0.9,1.5)	1.11	(0.9,1.4)
Work 5+ hrs extra v Work <5 hrs extra	1.27	(0.9,1.8)	1.27	(0.9,1.8)	1.06	(0.7,1.7)	1.15	(0.8,1.6)	1.07	(0.8,1.5)

Table 8.11 Results from logistic regression analyses of distress, anxiety and depression. Results are shown as Odds Ratios (OR) and 95% confidence intervals (CI) for each variable entered singly into a model adjusting for age (where appropriate), gender, questionnaire type, duration of computer use and frequency of breaks. Confidence intervals which exclude the value 1 indicate statistical significance at the 5% level and are indicated in bold type.

	Hands		Wrists		Forearms		Elbows		Shoulders	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Distress	**1.57**	**(1.2,2.1)**	**1.63**	**(1.2,2.2)**	1.41	(1.0,2.0)	**1.56**	**(1.1,2.2)**	**2.12**	**(1.6,2.8)**
Anxiety	**1.91**	**(1.5,2.5)**	**2.21**	**(1.7,2.9)**	**1.49**	**(1.1,2.1)**	**1.47**	**(1.0,2.1)**	**1.91**	**(1.5,2.4)**
Depression	**2.08**	**(1.5,3.0)**	**2.04**	**(1.4,3.0)**	1.40	(0.9,2.2)	**2.13**	**(1.4,3.3)**	**1.63**	**(1.1,2.3)**

	Neck		Back		Legs		Headaches		Eye Discomfort	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Distress	**2.86**	**(2.2,3.8)**	**1.96**	**(1.5,2.5)**	**1.72**	**(1.2,2.4)**	**1.96**	**(1.5,2.6)**	**2.09**	**(1.6,2.8)**
Anxiety	**2.60**	**(2.0,3.3)**	**2.31**	**(1.8,2.9)**	**1.91**	**(1.4,2.6)**	**2.39**	**(1.9,3.1)**	**2.39**	**(1.9,3.1)**
Depression	**2.29**	**(1.6,3.3)**	**1.71**	**(1.2,2.4)**	**2.53**	**(1.7,3.7)**	**3.04**	**(2.0,4.6)**	**2.00**	**(1.4,2.9)**

Table 8.12 Number taking time off work - details

Symptom	No. with symptom	No. responding to Q25	Number taking time off work						
			None	≤ 1 day	2-3 days	4-7 days	8days-1 month	1-3 months	4 months-1 year
Pain, swelling or tingling in hands	394	360	337	10	4	3	4	0	2
Pain or swelling in wrist	291	265	247	7	3	2	4	0	2
Pain, swelling or tingling in forearms	169	154	141	7	1	2	1	0	2
Aches or pains in either elbow	162	147	138	4	0	2	1	1	1
Pain in shoulders	519	477	436	13	13	9	4	0	2
Pain in neck	619	551	512	11	13	10	3	0	2
Aches or pains in back	482	439	374	18	19	14	10	2	2
Aches or pains in legs unrelated to back pain	200	180	159	7	6	1	4	2	1
Headaches	659	582	477	52	39	9	3	1	1
Eye discomfort	747	664	632	21	4	3	3	0	1

APPENDIX 2: SUMMARY OF KEY POINTS OF PAPERS AND 'NIOSH' RATING

Ref	Author& Date	Limitations, benefits and notes	>70% Participation rate	Physical examination	Investigators blind to health outcomes	Independent examination (workplace)	Number of criteria met
1	Rocha et al (2005)	**Limitations** 1. Cross sectional design 2. Analysis was undertaken in only one call centre linked to a bank in Brazil. 3. Small sample size (108 call centre operators completed questionnaire from 131 staff at the call centre a response rate of 82.4%). All informed of the objectives of study and agreed to participate voluntarily. 4. Predominately female (88%, n=95) working 6 hours per day with one 30 min break. 5. Analysis of statistical association limited to females only 6. Difference in jobs between male and female respondents. Men telemarketing, females in customer service – task analysis was undertaken (interviews and observing staff at job). But only ten respondents analysed in this manner. 7. Age group also predominately younger workers (18-23 made up 67% of respondents) with workers seated 95% of the time typing and answering telephones. 8. Self administered questionnaire so potential for over-reporting of symptoms. Average length of time to complete = 20 mins. 9. Perceived characteristics of work rather than actual. However, incoming calls monitored which showed operator received 90-140 calls per day lasting approx 2 mins each. Males answered fewer calls. 10. Prevalence of symptoms greater among women (suggests age of men, number of years in job and job control as reason but lacks evidence to support this). 11. The prevalence of reported symptoms located on the neck/shoulder and wrists/hands was estimated for both male and female respondents. 12. Although figures were presented for ergonomic issues such as chair height, noise etc – no actual measurements were taken (only perceived view of good/excellent, regular or bad/very bad).	YES	NO	NO	NO	1

		13. As the respondents were informed of the objectives of the study there may have been an over reporting of symptoms in the questionnaire. 14. No medical examinations performed to correlate data. **Benefits** 1. Response rate high (82.4%) 2. Ergonomic observations were undertaken but not for all respondents. **Note** Comparison with another studies (Hales et al 1994 and Norman et al 2004) suggested their results showed a higher prevalence for MSD's in call centre staff compared with telephone operators or VDT terminal workers.					
2	Anderson et al (2003) **[NUDATA Study – related to ref 19, 20 & 21]**	**Limitations** 1. Overrepresentation of non-respondents at follow-up of young men with executive jobs. 2. Study based on questionnaire and clinical interview rather than nerve conduction tests. 3. Media interest in the study may have led to over-reporting of symptoms (even though study was introduced as a general study on work environment) with 2 occupational groups (technical assistants or draftsmen and machine technicians). 4. In all multivariate analysis those who used both hands were excluded from the study (n=623) 5. Overall self-reported incidence of tingling/numbness in right hand at baseline 1.9% - interviews confirmed 4.8% with median nerve numbness (1.4% with night symptoms). At follow-up this was 5.5% (n=198) but interviews only identified 41 cases (1.2%). 6. Unclear whether the clinical interviews were conducted with all those in those in the survey or whether the results only correspond with the questionnaire responses. 7. Small number of incident cases with extensive median nerve symptoms (n=35) so focus on mouse and keyboard use only. **Benefits** 1. Large number of Danish companies studied (n=3500) 2. Good response rate with questionnaire sent to 9480 (all trade union members – 73% response at baseline, 82% at follow-up a year later) 3. Wide range of exposure and simultaneous analysis of physical	YES	YES	YES & NO* [details not provided in this study, however according to ref 19 – 2 groups with one group blind, other informed]	NO	3*