

# Use of keyboards and symptoms in the neck and arm: evidence from a national survey

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The objective of this study was to examine the relationship between upper limb symptoms and keyboard use in a population survey. A questionnaire was mailed to 21 201 subjects aged 16–64 years, selected at random from the registers of 34 British general practices. Information was collected on occupation and on regular use of keyboards (for >4 h in an average working day), pain in the upper limbs and neck, numbness or tingling in the upper limbs, headaches, and feelings of tiredness or stress. Associations were explored by logistic regression, with the resultant odds ratios converted into prevalence ratios (PRs). Among 12 262 respondents, 4899 held non-manual occupations. These included 1871 regular users of keyboards (e.g. computer operators, data processors, clerks, administrators, secretaries and typists). Pain in the neck or upper limbs and sensory symptoms were common in the non-manual workers overall (with 1 week period prevalences of 30 and 15%, respectively), and were associated with older age, smoking, headaches and tiredness or stress. After adjustment for these factors, regular keyboard use was significantly associated with pain in the past week in the shoulders (PRs 1.2–1.4) and the wrists or hands (PR 1.4), but not with elbow pain or sensory symptoms over the same period, or with neck or upper limb pain that prevented normal activities in the past year. Disabling symptoms were somewhat less prevalent among symptomatic keyboard users than among other symptomatic workers. We conclude that use of keyboards was associated with discomfort at the shoulder and wrist or hand, but risk estimates were lower than generally reported in workplace surveys. Previous estimates of risk in the occupational setting may have been biased by shared expectations, concerns, or other aspects of illness behaviour.

**Key words:** Neck and upper limb pain; population; typing.

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## Introduction

Musculo-skeletal disorders of the upper limbs are associated both with occupational use of the upper limbs and with psychosocial risk factors [1]. In this respect, workplace surveys have often reported an association between keyboard use and discomfort in the upper limbs or neck [2], but most of these studies have focused on workforces where a problem was already suspected. In

these circumstances, prior awareness and expectations may have modified subjects' health beliefs, favouring positive associations.

Less opportunity for this bias exists in surveys based upon community samples, as subjects tend to be drawn from many different workplaces. Recently, we conducted a large postal survey of working-aged men and women from the general population [3]. The survey's main purpose was to assess occupational exposures to vibration, but one item in the 24-page questionnaire concerned the regular use of keyboards. This provided an opportunity to examine the relationship of upper limb symptoms to keyboard use in a context where bias was less likely.

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## Method

In 1997–1998, we mailed a questionnaire to 21 201 men and women aged 16–64 years who had been selected at random from the age–sex registers of 163 general practitioners in 34 general practices across Britain. A single reminder was sent to non-responders after 5 weeks. Details of the mailing [3,4] and the survey's questions [5] have been published elsewhere.

As well as asking about regular use of keyboards (for 4 h or more in an average working day), the questionnaire included sections from the Standardised Nordic Questionnaire of musculo-skeletal symptoms on the 1 week and 1 year prevalence of pain in the neck and upper limbs [6]. It also asked about numbness or tingling in the upper limbs during the previous week, smoking habits, and frequency of headaches and feeling tired or stressed.

The occupations of respondents were coded to the latest revision of the Standardised Occupational Classification (SOC90) [7] and according to social class. To minimize the potential for confounding by other physical occupational activities and any response bias related to the use of powered vibratory tools, analysis was restricted to the subset of men and women who were working in non-manual occupations when the questionnaire was completed. Associations with keyboard use were examined by logistic regression and were summarized by prevalence ratios (PRs) with 95% confidence intervals (CIs). These were derived from the corresponding odds ratios (ORs) as proposed by Zocchetti *et al.* [8].

## Results

Responses were received from 12 262 subjects (58% of those selected), with a higher response rate in women and older subjects. Altogether, 4889 respondents (2279

men and 2610 women) held non-manual occupations, of whom 790 men and 1081 women reported using a keyboard for >4 h in an average working day. The occupations in which this activity was most often reported included: computer operators, analysts and programmers; data processors; clerks, cashiers and book keepers; administrative officers and assistants; design engineers; brokers; financial managers; secretaries and typists.

Altogether, 30% of non-manual workers reported pain at one or more sites in the neck or upper limbs during the previous week and 15% described tingling or numbness in the upper limbs that had lasted >3 min. All of these symptoms were significantly associated with increasing age, history of smoking, complaints of frequent headaches and frequently feeling tired or stressed. Table 1 shows the relationship between keyboard use and the 1 week prevalence of symptoms in the neck and upper limbs after adjustment for these other factors. The highest risks were for pain in the wrist or hands (PRs of 1.4 in both men and women) and for shoulder pain (PR 1.4 in men and 1.2 in women). For neck pain, there was a significant association in women but not in men. Associations with elbow pain and with numbness or tingling in the upper limbs were weak and not statistically significant.

Table 2 shows the frequency with which pain in the neck and upper limbs had prevented normal activities such as work, hobbies or housework. This analysis was limited to subjects who reported pain at the relevant anatomical site during the previous week. (As the questionnaire asked about prevention of activities during the previous year and not specifically in the previous week, the prevalence of disability among the cases in this table is for the previous year.) Disabling symptoms were somewhat less prevalent among symptomatic keyboard users than among other symptomatic workers.

**Table 1.** Associations of symptoms in the neck and upper limbs with keyboard work

Symptom <sup>a</sup>	Men			Women		
	Symptom prevalence (%)			Symptom prevalence (%)		
	Keyboard users <sup>b</sup> (n = 762)	Others (n = 1437)	PR <sup>c</sup> (95% CI)	Keyboard users <sup>b</sup> (n = 1036)	Others (n = 1461)	PR <sup>c</sup> (95% CI)
Neck pain	14.8	13.8	1.1 (0.9–1.4)	22.9	18.3	1.3 (1.1–1.5)
Shoulder pain	16.4	12.3	1.4 (1.1–1.7)	21.2	17.5	1.2 (1.0–1.5)
Elbow pain	6.0	5.8	1.2 (0.8–1.7)	4.6	4.9	1.0 (0.7–1.5)
Wrist or hand pain	10.6	7.9	1.4 (1.0–1.8)	15.1	11.0	1.4 (1.1–1.7)
Tingling or numbness in upper limb lasting at least 3 min	13.3	12.9	1.1 (0.8–1.3)	18.1	16.4	1.1 (0.9–1.3)

<sup>a</sup>All symptoms relate to the previous week.

<sup>b</sup>Use of a keyboard for ≥4 h in an average working day.

<sup>c</sup>Prevalence ratios adjusted for age (in five strata), smoking (ever versus never), report of frequent headaches (yes versus no) and frequent tiredness or stress (yes versus no).

**Table 2.** Disability associated with upper limb pain according to use of keyboards at work

Site of pain	Number and proportion of subjects in whom pain prevented activity			
	Men		Women	
	Keyboard users	Others	Keyboard users	Others
Neck	30/117 (26%)	66/201 (33%)	79/239 (33%)	99/271 (37%)
Shoulder	37/127 (29%)	68/179 (38%)	81/223 (36%)	93/258 (36%)
Elbow	15/47 (32%)	27/86 (31%)	16/48 (33%)	24/74 (32%)
Wrist or hand	27/83 (33%)	38/117 (32%)	53/157 (34%)	66/165 (40%)

Analysis was restricted to subjects who reported pain at the relevant anatomical site during the previous week. (However, the interference with activities could have been at any time in the previous year—see the text.)

Discussion

Use of keyboards has been reported to be an important risk factor for neck and upper limb pain in many occupational surveys. For example, in an investigation of computer operators and data processors, the risks of neck and shoulder pain were increased around 4-fold in those who used the keyboard regularly (4–6 h per day versus minimally) [9]; in a second survey, the risk of neck and shoulder complaints was raised nearly 4-fold in typists and 10-fold in data entry operators in comparison with other office workers [10]; and in a study of bank employees from Hong Kong, the OR for neck pain was 28.9 in frequent as compared with infrequent users of visual display terminals [11]. Several other cross-sectional surveys have found ORs of 1.7–2.3 for neck and shoulder pain [12–14]; a case-control study of elbow pain in newspaper employees reported an OR of 2.8 for frequent typing (50–100% versus 0–19% of the time) [15]; and, in a second survey of newspaper workers, the OR for hand and wrist pain was 2.5 in those typing for 6–8 h per day as compared with 0–2 h per day [16].

In our survey, regular occupational use of keyboards was also associated with an increased prevalence of pain in the upper limbs, particularly in the wrist or hand and at the shoulder. However, the elevation of risk was modest and lower than that generally reported. Our inability to detect higher risks did not arise from failure to consider more disabling disease, as the proportion with complaints severe enough to limit normal activities was no higher among symptomatic keyboard users than in other symptomatic subjects.

Our study sample was large, with a broad geographical coverage, and it is likely to have been fairly representative of people of working age in Britain. The response rate was only 58%, but use of keyboards was not the main focus of the questionnaire and we therefore would not expect major response bias in relation to their association with symptoms. It is possible, however, that people with upper limb pain were more aware of keyboard use, and as a consequence reported it more often. Similarly, key-

board users may have been more aware of symptoms in the neck and arm, and therefore had a lower threshold for reporting them. In either of these situations, the effect would have been to exaggerate rather than obscure associations.

On the other hand, because of the cross-sectional nature of the survey, risks could have been underestimated if keyboard users who develop upper limb symptoms tend selectively to transfer to other types of work. However, such redeployment would have to occur on a large scale to have had an important impact on our results.

Overall, the findings from this large community survey suggest that the use of keyboards is associated with discomfort at the shoulder and wrist or hand, but that risk estimates are lower than generally reported in occupational surveys. It seems possible that previous estimates of risk in keyboard users derived from the occupational setting have been biased by shared expectations, concerns, or other aspects of illness behaviour.

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