
Design: Prospective cohort study

Population/sample size/setting:
- 5658 workers (3616 women, 2042 men, mean age 42) in a Danish trade union for professional technicians followed for 1 year of employment beginning in January 2000
- These were drawn from a population of 9480 unionized workers in more than 3500 workplaces; 6943 participated at the outset of the study, and 5658 completed the study 1 year later

Main outcome measures:
- 3 outcomes related to the carpal tunnel were chosen: (1) any tingling or numbness in the fingers within the last 3 months, (2) tingling or numbness in the median nerve distribution in the past 3 months, confirmed by clinical interview and (3) criterion #2 combined with symptoms at night
- Information on 5 potential occupational causes of CTS was gathered by self-administered questionnaires regarding possible work-related factors relevant to carpal tunnel syndrome: (1) hours per week using a computer keyboard, (2) hours per week using a computer mouse, (3) posture-related variables such as the position of the mouse in relation to the shoulder and the edge of the desk, keyboard position, and forearm/wrist support, (4) desk chair adjustment, and (5) overall satisfaction with the physical work environment
- Psychosocial work factors were assessed by a separate questionnaire; these included job demands, job control, social support in the workplace, and time pressure for deadlines
- Questions about personal characteristics included age, sex, height, weight, tendency to worry or to be competitive, leisure-time physical activity, social network support outside work, and concurrent medical diagnoses of diabetes, rheumatologic diseases, thyroid disease, and disorders of the nervous system
- Main follow-up was done at 1 year, following workers who were free of symptoms at baseline, looking for new cases of possible CTS
- Possible CTS was not explicitly defined, but appears to have been the onset of tingling or numbness in the right hand at least once a week in the past 3 months, including but not limited to symptoms in the median nerve distribution
- At baseline, possible CTS was present in 10.9% of the study sample; median nerve distribution was present in 4.8%, and median nerve symptoms at night were present in 1.4%; these workers were excluded from the analysis of new cases of CTS that occurred over the following year
- At baseline, mouse use was associated with CTS symptoms, but the relationship between increasing hours of mouse use and increased risk of CTS was irregular, and a threshold level of mouse use and increased risk was not obtainable
During the 1 year follow-up, 198 workers (5.5% of those who did not have CTS at baseline) developed new or aggravated hand symptoms; these were analyzed using multivariable logistic regression in order to estimate the effect of computer use on the development of CTS symptoms, when adjusted for other factors (such as age, sex, and other personal characteristics).

- Keyboard use was not related to the development of CTS under this analysis.
- Mouse use was related to CTS; higher levels of mouse use increased the risk of becoming a new case of possible CTS, with mouse use greater than 25 hours per week associated with approximately a threefold increase in CTS compared to mouse use less than 2.5 hours per week.
- The threshold for increased CTS with mouse use appeared to be about 20 hours per week.
- Other factors that increased CTS risk were smoking, female sex, and accidental injury.
- Posture and psychosocial risk factors were not associated with CTS at baseline, nor with the development of CTS during the 1-year follow-up.

Authors’ conclusions:

- CTS incidence as estimated by symptoms would be much lower (perhaps one third of the symptom-based incidence) if nerve conduction studies had been done as part of the case definition.
- Keyboarding is unlikely to be an important risk factor for CTS.
- The lack of association between keyboarding and CTS could be partly explained by the fairly small variation in keyboard use in the study population; with few workers at the highest levels of keyboard use, there may have been too few observations to give an accurate estimate of the risk associated with intensive keyboarding.
- Mouse use appeared to be associated with CTS in both the baseline and follow-up analyses, but, because the study was known by the workers to have been initiated by media discussions of mouse use, information bias may have accounted for some of the association.
- Smoking and accidental injury were associated with CTS symptoms.
- Most tingling and numbness are caused by factors other than nerve entrapment.

Comments:

- A clear definition of what constituted an incident case of possible CTS was lacking.
- On one definition, in Table 2, there are 2 categories of “more frequent CTS symptoms,” whose sum is 198; this appears to be the basis for the analysis in Table 4 (allowing for some incomplete data on exposure); median nerve symptoms appear not to be required for an incident case to be defined as such.
- However, Table 2 also lists 331 cases of mild CTS symptoms in workers who had no symptoms at baseline; these are called “incident” cases, but do not appear to be used in any analyses of computer use.
- The 9480 workers in the trade union worked in 3500 workplaces, but it is not clear what constitutes a “workplace;” there would be fewer than 3 workers per workplace.
- Because workers in a single workplace may have some similarities with one another, this creates a clustering effect; since a key assumption of logistic regression is that all the observations are independent of one another, this clustering is likely to mean that the confidence intervals quoted are too small, and that the uncertainty in the estimates of the regression coefficients is greater than it appears from the tables.
- This is one of a very few studies using logistic regression to use dummy variables for levels of occupational exposure to potential predictors (mouse and keyboard in this case) of the musculoskeletal condition of interest; this at least makes it possible to detect a threshold of exposure in terms of hours per week, and it also helps to deal with possible nonlinear relationships between the exposure and the risk function being studied.
- The discussion section is fairly well thought out, and acknowledges that information bias may have made the association between mouse use and CTS greater than it might really be (the actual amount of bias, and the actual inflation of the effect of mouse use on CTS, cannot be estimated from the data).
- A threshold dose for mouse use depends on which definition of CTS is used; for the questionnaire and median nerve symptom definitions, the threshold would be 20 hours per week (4 hours per day); for median nerve symptoms at night, the threshold would be 30 hours per week (6 hours per day).

Assessment: Adequate for an evidence statement that keyboard use is unlikely to be strongly related to hand numbness and tingling, or to CTS. Adequate for an evidence statement that mouse use of 20 hours per week (4 hours per day) or more is likely to be associated with CTS symptoms; or that mouse use of 30 hours per week (6 hours per day) with CTS symptoms at night.