Palmer KT, Harris EC, Coggon D. Carpal tunnel syndrome and its relation to occupation: a systematic literature review. Occupational Medicine 2007;57:57-66.

Design: Systematic review of observational studies

Databases/selection and rating of articles:

- 38 observational studies of the relationship between work and CTS
- MEDLINE and EMBASE were searched from the inception of the databases through the end of 2004
- Key words included “carpal tunnel syndrome,” “median nerve entrapment/neuropathy,” and separate term entries for exposures of interest (“repetitive,” “occupation,” “work-related,” “cumulative trauma disorder” etc)
- Search was restricted to English language, with specified epidemiological terms in the abstract: risk, odds, incidence, prevalence, cohort, case-control, etc; papers that did not include a comparison group (e.g., case series) were noted but not scrutinized

Main outcome measures:

- Two summaries of the association of CTS and occupation were reported: one by job title and one by occupational activity
- Assembly work doubled the reported risk of CTS in four studies; food packaging work doubled the risk of CTS in four studies
- Repeated flexion and extension of the wrist more than doubled the risk of CTS in four studies
- Flexion and extension were particularly important when the self-reported time was at least 20 hours per week; one study reported that this led to a 5 to 8-fold increased risk for CTS
- Short cycle times (< 30 seconds or < 10 seconds per repetition) were also associated with increased risk of CTS in three studies
- Computer keyboard use does not show an increased risk of CTS, but mouse use was reported to be associated with self-reported sensory symptoms in the median nerve distribution
- Hand-held vibrating tool use was associated with CTS in six studies which had a comparison group; in some of the studies, the exposures were relatively prolonged and intense (cases using vibrating tools for 10 years and more)

Authors’ conclusions:

- There is reasonable evidence that prolonged hand-held vibratory tool use doubles the risk of CTS
- A substantial body of evidence shows an association between highly repetitious flexion and extension of the wrist and CTS, especially when accompanied by forceful grip
- Keyboard and computer use on balance does not show an important association with CTS

- Many studies had limitations affecting their estimate of CTS risk; most were retrospective, which introduces information bias; some were small, and some may have failed to control for age and sex as confounders
- In addition, diagnostic misclassification was another source of error; some studies defined cases based on nerve conduction studies, and others defined cases on the basis of symptoms and physical signs
- Selective publication of positive studies may have occurred, and the present study did not search for non-published studies or for literature in languages other than English
- However, the stronger studies, including those that undertook direct assessments of exposure, came to conclusions that supported an association between work activity and CTS
- In addition, biomechanical studies (including cadaver studies) show that wrist flexion and extension can increase carpal tunnel pressure, providing support for biological plausibility of an association with CTS
- Highly repetitive wrist-hand use should be avoided by ergonomic design of tools and by avoidance of vibrating tool use

Comments:

- The study was done in the UK, where the social insurance system limits work-relatedness of CTS to hand-held vibrating tool use
- Some of the selected studies did not focus on CTS but on vibratory white finger syndrome (Chatterjee 1982 in Table 1), and others used unclear comparison groups
- The authors make a valid point in stating that age and sex are the factors most likely to be confounders, and that other factors (obesity, smoking) are less important to be adjusted for
- It is true that case definition (clinical vs. nerve conduction) can be a source of error, but it should be added that this is especially the case when the specificity of CTS definition is weakened
- When sensitivity of CTS definition is weakened, the effect on the estimate of relative risk is not biased, but when specificity is weakened, the estimate of relative risk tends to be biased in the direction of showing no association
- This would suggest that when CTS is diagnosed clinically (lower specificity), the relative risk of CTS is likely to be lowered, if the loss of specificity is independent of the measurement of work exposure
- If the loss of diagnostic specificity is associated with the measurement of exposure, however, the estimate of relative risk may be inflated rather than lowered; this would happen if persons classified as exposed were more likely to receive a CTS diagnosis from a physician on clinical criteria
- One odds ratio in Table 1 is not correct; Chatterjee's study is entered as having an odds ratio of 10.9 with confidence intervals between 1.0 and 5.2; this should be between 1.14 and 103.4

Assessment: Adequate for an evidence statement that repetitive flexion and extension of the wrist, especially when combined with forceful grip, significantly increases the risk of CTS.

Adequate for an evidence statement that prolonged use of hand-held vibrating tools increases the risk of CTS

Adequate for an evidence statement that computer keyboarding is unlikely to be strongly associated with CTS