Personal, psychosocial, and biomechanical risk factors for work disability from carpal tunnel syndrome: a pooled prospective study.

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Introduction: Carpal tunnel syndrome (CTS), the most common peripheral entrapment neuropathy, results from compression of the median nerve at the wrist. It is an important occupational health problem because the frequency and severity lead to more disability than most other upper extremity disorders (Foley 2007). In the US the median lost work time from CTS is relatively long, 28 days, making CTS an important driver of overall workers compensation costs (US Bureau of Labor & Statistics 2010; Foley 2007). To address this problem, NIOSH funded the Upper Extremity Musculoskeletal Disorder Consortium to pool raw data from six separate prospective studies to examine the associations between personal and workplace psychosocial and biomechanical factors to the development of CTS and related work disability.

Method: 4321 workers were evaluated at baseline and followed up to 7 years with repeated symptom surveys and nerve conduction studies to identify prevalent and incident cases of CTS. This analysis was restricted to the subset with prevalent or incident CTS who also had detailed workplace exposure assessment for biomechanical factors (N=318). CTS case criteria included symptoms in a median nerve distribution of the digits (1-3) and an abnormal electrodiagnostic study. The outcome was work disability defined as: (1) a change in work pace or quality due to symptoms, (2) lost time due to symptoms, or (3) job change due to hand symptoms, derived from SF12 and quickDASH questionnaires. Workplace psychosocial exposure was assessed using the Karasek Job Content Questionnaire. Occupational biomechanical exposures were measured by observers and video analysis of work tasks and included peak hand force, HAL repetition scale, total repetition rate, forceful repetition rate, % time all hand exertions, % time in forceful hand exertions, % time spent >30° wrist extension, % time in >30° wrist flexion, the presence of hand vibration, and the ACGIH TLV for HAL. Forceful hand exertions were quantified as those requiring ≥1kg-pincher or ≥4kg-grip. Job level biomechanical exposures for each worker were time weighted averages of exposures measured at the task level. Adjusted hazard ratios were estimated using Cox proportional hazards models. All models were adjusted for age, gender, BMI and study site, and biomechanical exposure models were adjusted for other, non-overlapping physical exposures.

Results: Of the 318 workers with prevalent or incident CTS, 57.5% (N=183) reported a work disability. The most common disability was a change in work pace (n=124), followed by job change (n=71), and lost-time (n=56). Being female was associated with increased work disability (HR= 1.75; 95% CI: 1.23-2.5). There was no association with age (over 40 vs under 40 years) (HR=0.83; 95%CI: 0.59-1.15), education (HR=0.76; 95%CI: 0.48-1.20), or BMI (HR_{obese}=1.40; 95%CI: 0.89-2.19; HR_{obese}=1.23; 95%CI=0.80-1.87). Medical conditions including diabetes, thyroid disease or being pregnant, were not associated with increased work disability; however, having rheumatoid arthritis was (HR=1.85; 95%CI: 1.04-3.26). High job strain compared to low job strain more than doubled the rate of disability (HR=2.38; 95%CI: 1.03-5.51).

The biomechanical factors associated with any type of work disability were the HAL repetition scale (HR_{middle}=1.79; 95% CI: 1.23-2.63; HR_{upper} =1.32; 95% CI: 0.83-2.10), total repetition rate (HR_{middle} =1.45; 95% CI: 0.96-2.19; HR_{upper}=1.61; 95% CI: 1.07-2.43) and the % time in forceful exertions (HR_{middle}=1.50; 95% CI: 1.02-2.21; HR_{upper} =1.38; 95% CI: 0.89-2.12). The biomechanical factors associated with job change due to hand symptoms were similar and included the HAL repetition Scale (HR_{middle} =3.91; 95% CI: 1.82-8.38; HR_{upper}=3.20; 95% CI: 1.43-7.19), total repetition rate (HR_{middle}=2.30; 95% CI: 1.15-4.58;
HR_{upper} = 2.58; 95% CI: 1.23-5.38), % time in forceful exertions (HR_{upper} = 2.03; 95% CI: 1.02-4.05) and % time in all exertions (HR_{upper} = 2.53; 95% CI: 1.17-5.43). The only biomechanical factors associated with lost time was forceful repetition rate (HR_{middle} = 2.46; 95% CI: 1.11-5.48; HR_{upper} = 1.86; 95% CI: 0.91-3.83). The factors associated with pace change due to hand symptoms were the HAL repetition Scale (HR_{middle} = 1.97; 95% CI: 1.24-3.12) and % time in all exertions (HR_{upper} = 1.94; 95% CI: 1.17-3.24).

Discussion: These results indicate that personal and workplace psychosocial and biomechanical factors are associated with an increased rate of work disability from CTS. A change in job was more strongly associated with biomechanical factors than either work pace change or lost time at work. Several recent publications using this pooled data set showed strong exposure response relationships between the personal factors age and BMI and incident CTS. In this analysis of CTS-related disability, age and BMI were not related to disability but female gender and rheumatoid arthritis were. High job strain was associated with work disability due to CTS; it was also found to be a risk factor for incident CTS. Prior analyses found that various measures of force (peak force, forceful repetition rate, % time forceful exertion) but not repetition, per se, were strongly associated with incident CTS. However, in these analyses measures of forceful hand activity and measures of hand repetition were associated with work disability.

Keywords: epidemiology, incidence; carpal tunnel syndrome; disability; exposure response

References
