

# **Are work pace, overtime, job rotation or secondary employment associated with work related musculoskeletal disorders?**

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## **1. Introduction**

Work related upper extremity musculoskeletal disorders (WRMSDs) are prevalent and impactful. For example, lost time cases had a severity rate of 2,647 lost workdays for Carpal Tunnel Syndrome (CTS), and 765.5 for epicondylitis (EPI) per 10,000 FTEs<sup>1,2</sup>. CTS is the most common peripheral entrapment mononeuropathy, and is associated with significant lost time, lost productivity, and disability. In the U.S., the annual incidence rate of CTS is 3.0/10,000 workers with a median of 28 days away from work<sup>2</sup>, mean worker's compensation cost of \$20,405 and a mean of \$10,000 in lost wages per CTS case<sup>3</sup>. Occupational factors increase the risk of these disorders, yet little is known about the relationship between WRMSDs and common work organizational factors including work pace, overtime, job rotation, and secondary employment. It is important to understand the influence of workplace organizational factors and the influence they have on physical and psychosocial risk factors associated with WRMSDs.

## **2. Method**

This is a pooled study using data from three large prospective epidemiologic research studies: (Washington State Department of Labor & Industries (LNI), University of Utah (UU), and University of Wisconsin-Milwaukee (UWM)). Workers in these studies were employed across a wide variety of manufacturing and service industries. The three research groups collected detailed, individualized job physical exposure and health data on 1,973 workers from 35 workplaces. Overall, there were 1834 participants (male: 738 or 40.2%, female: 1096 or 59.8%) in the pooled dataset at the baseline used in this analysis. Collected data include physical assessments, survey of non-occupational factors (e.g., hobbies, obesity, health history, gender), and work organizational factors (e.g., work pace, job rotation, overtime). Descriptive statistics were calculated for all work organizational and biomechanical variables. Correlation analyses were performed among the job biomechanical exposure data and psychosocial variables.

## **3. Results**

### **3.1 Work pace**

Work pace (machine, piece, self) had significant associations with biomechanical measures. Piece rate tasks had lower forceful exertions but longer durations than machine based tasks ( $p < 0.0001$ ). Approximately half of the jobs were machine-paced (46.7%) and the other half were self-paced (48.0%). A small group of participants at the same workplace (5.3% or 97) worked at piece rate reporting high frequency low intensity efforts.

### **3.2 Overtime**

The majority of workers (1460 or 79.6%) did not work overtime ( $\leq 40$  hours/week). Those who worked overtime usually had higher job biomechanical stressors as measured by the Strain Index method.

### 3.3 Rotation

There were 710 workers (or 38.7%) with job rotations (i.e.  $\geq 2$  tasks). Job rotation had a significant effect on biomechanical stressors. Those with job rotation reported lower job satisfaction. However, those with job rotation were more likely to agree that their “employer cared about their health and safety”.

### 3.4 Second Job

Information about second job was unavailable for most workers, but 7.5% of those with data reported having a second job. Having a second job did not seem to have any statistically significant association with any of the biomechanical measures.

## 4. Discussion

Previous reports indicate that piece rate work is more hazardous than machine paced work<sup>5</sup>. The results of this study in part support this, but there are additional competing risk factors including psychosocial factors that make interpreting these findings challenging. For example, piece rate work had higher repetitions of forceful exertions, but overall lower force than machine paced jobs.

Dembe et al. (2005) found that job schedules with long working hours have greater associated risks because people working long hours spend more total time at risk for a work injury<sup>4</sup>. This study supports this, but also suggest that workers may have greater satisfaction with longer working shifts. This might be influenced by additional financial compensation that accompanies overtime and irregular shifts.

Our results showed that those workers who had job rotations had both higher job biomechanical stressors and higher levels of several individual job physical factors compared to those who had only one job task. Workers with rotation were also less likely to be satisfied with their jobs. This would suggest that job rotation may not be implemented as intended and does not result in decreased exposure.

In summary, there is a complex relationship between workplace organizational factors and WRMSDs. Future research should focus on implementing strategies to understand these relationships and provide guidelines for factors including work pace, shift length, job rotation and secondary employment.

**Keywords:** work pace, shift length, overtime, job rotation, work related musculoskeletal disorders

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