IS JOB ROTATION A RISK FACTOR FOR CARPAL TUNNEL SYNDROME OR NOT?

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Introduction: Carpal tunnel syndrome

- Multifactorial risk model for CTS
  - Personal risk factors
    - Often not modifiable: age, female gender,
  - Work-related risk factors:
    - Could be modified by preventive interventions

- Biomechanical risk factors (Palmer, 2007; VanRijn, 2009; Barcenilla, 2011)
  - Repetitive wrist movements
  - Forceful manual exertion
  - Repeated bending / twisting of the wrist
  - Sustained exposure to hand-arm vibration

- Combination +++

- Psychosocial factors at work:
  - Conflicting epidemiological data (VanRijn, 2009)

- Factors related to the work organization
  - Few epidemiological data
  - Structural organizational level aspects of the work process
  - Indirect risk factor via the nature of the work activities, the duration of mechanical exposure, and psychosocial factors
Aim of the study

• To assess the personal, biomechanical, psychosocial and organizational risk factors for carpal tunnel syndrome (CTS)

• in workers exposed to various levels of work-related constraints,

• by using the data of the surveillance program for MSDs in the French Pays de la Loire region
Materials and Methods

• Cross-sectional study:
  - 3,710 workers (2,161 men; 1,549 women),
  - Randomly included by 83 occupational physicians in 2002-2005,
  - Representative of the regional workforce according to age, gender, activity sectors and occupational categories.

• Symptomatic CTS (Criteria for the evaluation of the work-relatedness of MSDs: Sluiter et al, 2001)
  - intermittent paresthesias or pain in (at least) two of the first three digits; The symptoms may be present at night, as well)
  - symptoms present during the medical examination (or during at least 4 days the week preceding the medical examination)

• Self administered questionnaire:
  - Medical history, personal factors and work-related risk factors

• Statistical analysis
  - Logistic regression models for each gender.
  - Sensitivity analysis: only clinically-diagnosed CTS (symptomatic CTS WITH at least one positive physical examination sign)
# Multivariate statistical model of CTS

- 156 cases of CTS diagnosed (89 women and 67 men)

<table>
<thead>
<tr>
<th></th>
<th>Men (n=59)</th>
<th>Women (n=82)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td><strong>Age</strong> (1-year increment)</td>
<td></td>
<td>1.05 [1.02–1.08]</td>
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<tr>
<td><strong>Body mass index</strong> (1 kg/m² increment)</td>
<td></td>
<td>1.05 [1.02–1.17]</td>
</tr>
<tr>
<td><strong>Work pace / quantified target</strong></td>
<td>41/1,054</td>
<td>1.9 [1.1-3.5]</td>
</tr>
<tr>
<td><strong>Job/task rotation</strong> (≥1 job rotation per week)</td>
<td>36/768</td>
<td>2.5 [1.5-4.2]</td>
</tr>
<tr>
<td><strong>Work with temporary workers</strong></td>
<td></td>
<td>39/444</td>
</tr>
<tr>
<td><strong>&lt;10 min break possible / hour</strong> (in case of highly repetitive task)</td>
<td>6/87</td>
<td>2.0 [0.8-5.1]</td>
</tr>
<tr>
<td><strong>Wrist bending (≥2 h/day) and high physical demand</strong> (ref = 0)</td>
<td>24/626</td>
<td>1.6 [0.9-3.1]</td>
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<tr>
<td>- 1 factor</td>
<td>15/260</td>
<td>2.2 [1.0-4.7]</td>
</tr>
<tr>
<td>- 2 factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vibrating hand tools (≥2 h/day)</strong></td>
<td>17/364</td>
<td>1.5 [0-8-2.9]</td>
</tr>
<tr>
<td><strong>Low skill discretion</strong></td>
<td>38/972</td>
<td>1.8 [1.0-3.1]</td>
</tr>
<tr>
<td><strong>High psychological demand</strong></td>
<td></td>
<td>54/728</td>
</tr>
</tbody>
</table>

In analyses only restricted to clinically-diagnosed CTS: job/task rotation: OR=2.9 [1.5–5.5]
Discussion

• This study showed that several factors related to the work organization and psychosocial constraints were associated with CTS, after adjustment for personal and biomechanical risk factors.

• Three factors were related to the work organization:
  – High paced work dependent on strictly quantified targets:
    • Major determinant of repetitive movements
  – Work with temporary workers for women:
    • Increased work load of experienced women because of the working time spent to train less qualified temporary colleagues
  – Contrary to our expectations, job rotation between several workstations on various days of the week (≥1/week) was highly associated with CTS among men.
Discussion: job rotation as a preventive measure?

- **Job rotation between several workstations often proposed to:**
  - decrease the mechanical load on the hand/wrist region by *varying the biomechanical stresses*,
  - *broadened the area of application* of the mechanical load
  - *increase the variability* of hand movements (only in case of job enlargement) (Hagberg *et al*, 1995; Wells, 2010).

- **However, the epidemiological data supporting the preventive impact of job rotation on CTS are scarce and conflicting:**
  - **Protective effects:**
    - Roquelaure *et al* (1997): case control study of industrial workers,
    - Maghsoudipour *et al*. (2008): study in automotive workers (univariate analysis)
    - Wand *et al* (2007): neck and shoulder disorders in the garment industry
  - **Negative effects:**
    - Kuijer *et al* (2005): job-rotation may reduce the need for recovery and thus increase the risk of cumulative trauma of soft tissue in refuse collector workers.
Discussion: job rotation as a risk factor for CTS?

• **Job rotation can also have adverse effects:**
  – increases the task complexity and the number of actions to be learn,
  – requires longer training periods to develop efficient skills and gestures.

• **In lack of adequate planning and training periods:**
  – workers can be insufficiently skilled to cope with all dimensions of the tasks
  – leading them to adopt unsafe working techniques, that may increase the mechanical exposure.

  – **Job rotation without adequate training** may therefore be less effective than expected to reduce the risk of CTS;

• **Our results should be interpreted with caution:**
  – Cross sectional design of the study
  – No information on the existence of training periods before job rotation.
  – We cannot exclude that some workers suffering from CTS before the cross sectional study may have been allocated to enlarged jobs.
Conclusion

• This study showed that several factors related to the work organization were associated with increased risk of CTS

• Job rotation may be less effective than expected to reduce the risk of CTS

• Increasing understanding of the impact of work organization on the risk of CTS is a major issue

• In the context of globalization of the economy, rationalization of production and flexibility of employment leading to “work intensification”.
Work organization and CTS: conceptual ergonomic model

**Social environment**
(work regulation, compensation system, …)

**Economic environment**
(market, customer demand, …)

**WORK ORGANIZATION (Company level)**

**Technical process** (lean, just-in-time, assembly line, paced work) Flexibility of customers demand; etc…

**WORK ORGANIZATION (Job situation level)**

**Job station design** (work procedure, cycle time, recovery time, job rotation, room of manoeuver, …)

**Biomechanical factors**
(forceful and/or repetitive movements, extreme wrist postures, vibration)

**Psychosocial factors**
(Stress at work)

**Personal factors**

**MSDs**
Thank you for your attention