Personal, psychosocial, and biomechanical risk factors associated with work disability from carpal tunnel syndrome: Findings from the NIOSH Consortium Studies.

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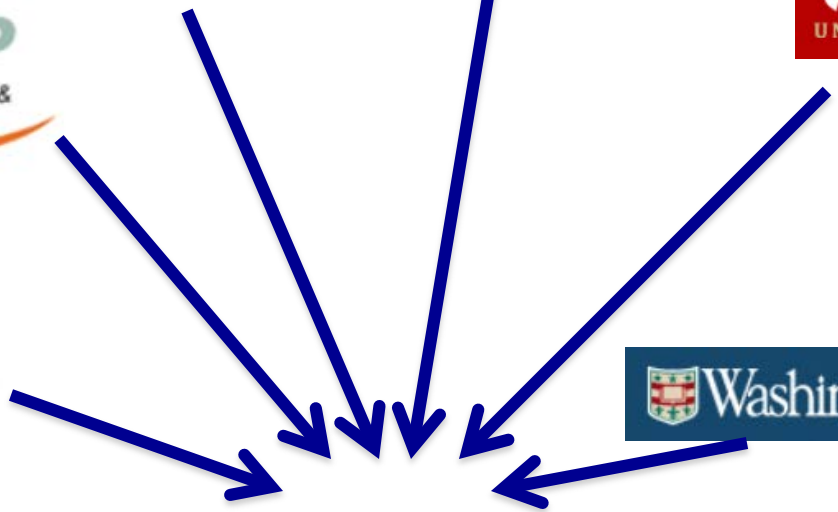
Background & Aims

- CTS direct medical costs exceed $2 billion each year (Stapleton, 2006)
- Median lost time from work is 27 days (Foley et al, 2007)
- 18% report leaving job within 18 months (Faucett et al, 2000)

Exposure-response relationships between physical and psychosocial risk factors and work disability from CTS

NIOSH Upper Extremity Consortium



Pooled Data Set

Study Population

Workers (55 companies in 10 states) employed full-time in manufacturing, production, service, or construction industries,

with CTS:

- Symptoms
  - Numbness, tingling, burning, pain in 1 of the first 3 digits since prior symptom collection
- Median Mononeuropathy
  - Peak median sensory latency **>3.7ms** (onset MSL>3.2ms), *and/or*
  - Motor latency **>4.5ms**, *and/or*
  - Transcarpal sensory difference of **> 0.85ms**, *and/or*
  - Absent latency value consistent with an abnormal NCS

Personal Factors & Work Psychosocial Exposure

Personal Factors

- Demographic
- Socio-economic
- Medical/Health

Work Psychosocial

- Job Strain Index (Karasek, 1998)
  - Psychological Demand
  - Decision Latitude

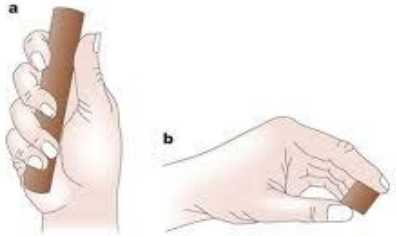
Job Strain	Low Demand	High Demand
Low Control	Passive	High Strain
High Control	Low strain	Active

Biomechanical Exposure

	Exposure Measurement	Method
FORCE	Peak Force (Borg CR-10 scale)	Analyst
REPETITION	Hand Activity Level (Rating scale) Total Repetition Rate	Analyst Video Analysis
POSTURE	% time spent in >30° Ext % time spent in >30° Flx	Video Analysis Video Analysis
% TIME	% time all Hand Exertions	Video Analysis
% TIME & FORCE	% time Forceful Hand Exertions	Video Analysis
REPETITION & FORCE	Forceful (Hand Exertion) Repetition Rate	Video Analysis

[Forceful Exertion = ≥9N pinch or ≥45N of power grip]

$$X_{TWA} = \Sigma [(X_1 * p_1) + (X_2 * p_2) + \ldots. (X_{12} * p_{12})]$$

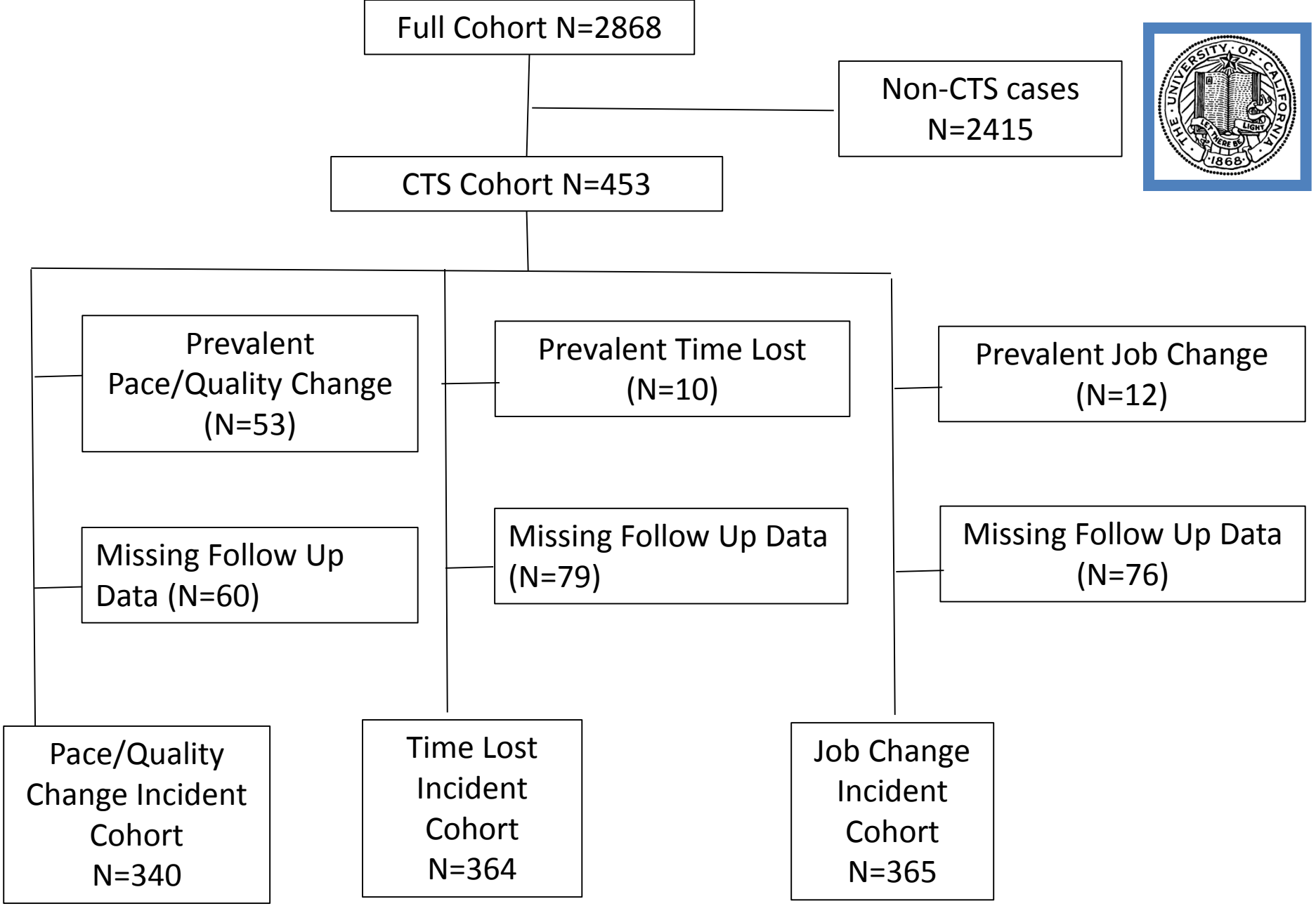


Work Disability Case Definition

- Derived from SF-12 and quickDASH questionnaires
- Defined as:
  - Pace/Quality Change due to hand symptoms,
  - Lost Time due to hand symptoms, or
  - Job Change due to hand symptoms

Statistical Analysis

- Categorical splits based on exposure distribution at baseline
- Cox Proportional Hazards model using robust confidence intervals
- Adjusted for age, gender BMI, study site, & non-overlapping biomechanical exposures
  - Peak force (adj. for posture, repetition, duty cycle)
  - Total Repetition Rate (adj. for posture, peak force)
  - Forceful Repetition Rate (adj. for posture)

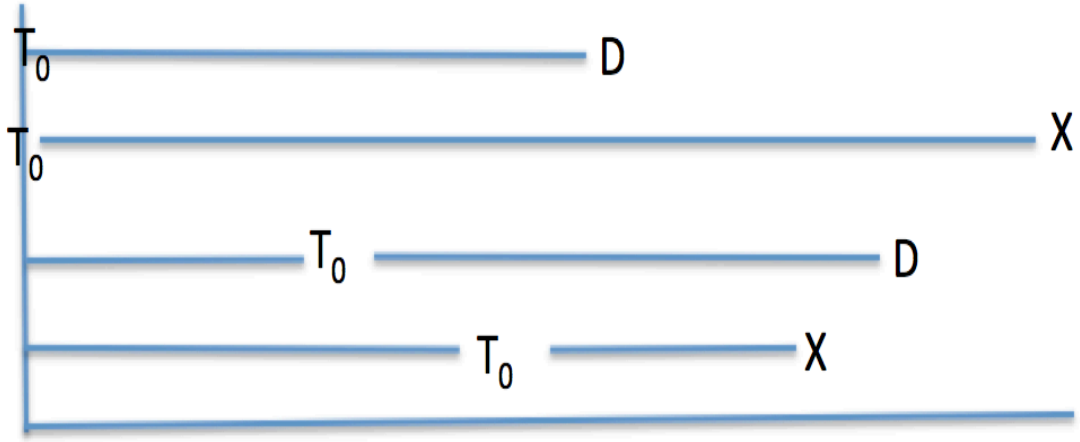

Full Cohort N=2868
Non-CTS cases N=2415
CTS Cohort N=453
Prevalent Pace/Quality Change (N=53)
Prevalent Time Lost (N=10)
Prevalent Job Change (N=12)
Missing Follow Up Data (N=60)
Missing Follow Up Data (N=79)
Missing Follow Up Data (N=76)
Pace/Quality Change Incident Cohort N=340
Time Lost Incident Cohort N=364
Job Change Incident Cohort N=365

Demographic Characteristics

Female	67 %
Caucasian race	57 %
Medical Condition	17%
Obese (BMI≥30)	51 %
Smoking	22%
< High School Diploma	12%
Mean Age	43.5 years
Median time in job	6.5 years

Incidence Rate

Outcome	IR
Pace/Quality Change	25.3/100p-yrs
Time Lost	12.1/100p-yrs
Job Change	14.9/100p-yrs



Person time started at time of CTS diagnosis

Full Cohort Start

End of Study

Personal /Psychosocial Factors & Any Work Disability

Covariate	HR
Female	1.75 [1.23-2.5]
Age (≥40 years)	0.83 [0.59-1.15]
BMI (≥30 kg/m^2)	1.23 [0.80-1.87]
Rheumatoid Arthritis	1.85 [1.04-3.26]
High Job Strain$_{\text{(High Demand, Low Control)}}$	2.38 [1.03-5.51]

*adjusted for gender, age, BMI & study site

Physical Factors

Exposure	N=340 (n=178)	HR*
Pace Change		
Hal Scale$_{>4 \& \leq 6}$		1.87 [1.19-2.94]
Hal Scale$_{>6}$		1.69 [0.97-2.93]
% time in All Exertions$_{>58\% \& \leq 76\%}$		0.81 [0.50-1.31]
% time in All Exertions$_{>76\%}$		1.96 [1.20-3.20]

*All models adjusted for gender, age, BMI, study site & non-overlapping exposures

Physical Factors

Exposure	N=364 (n=100)	HR*
Lost Time		
Total Repetition Rate$_{>14 \& \leq 24}$		2.33 [1.02-5.34]
Total Repetition Rate$_{>24}$		2.16 [0.97-4.79]
Forceful Repetition Rate$_{>3 \& \leq 8}$		2.23 [1.01-4.95]
Forceful Repetition Rate$_{>8}$		1.83 [0.88-3.77]

*All models adjusted for gender, age, BMI, study site & non-overlapping exposures

Physical Factors

Exposure	N=365 (n=118)	HR*
Job Change		
Hal Scale$_{>4 \& \leq 6}$		3.45 [1.60-7.43]
Hal Scale$_{>6}$		3.25 [1.46-7.25]
Total Repetition Rate$_{>14 \& \leq 24}$		2.24 [1.13-4.44]
Total Repetition Rate$_{>24}$		2.47 [1.21-5.06]
% time in All Exertions$_{>58\% \& \leq 76\%}$		1.27 [0.65-2.48]
% time in All Exertions$_{>76\%}$		2.76 [1.35-5.66]
% time in Forceful Exertions$_{>11\% \& \leq 28\%}$		1.27 [0.65-2.48]
% time in Forceful Exertions$_{>28\%}$		2.76 [1.02-4.05]

*All models adjusted for gender, age, BMI, study site & non-overlapping exposures

Conclusions

- Being female or having RA increased risk
- High job strain increased risk
- A change in pace/quality of work had the highest incidence rate
- Repetition and Force were important factors associated with disability from CTS.

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