Onset of Vibration-Induced White Finger: Insight Derived from a Meta-Analysis of Exposed Workers

Magdalena Scholz,1 Anthony J. Brammer,2 and Steffen Marburg1

1Technical University of Munich
Chair of Vibro-Acoustics of Vehicles and Machines
2University of Connecticut Health
Department of Medicine
Outline

• Motivation

• Meta-Analysis by Nilsson et al. [1]

• Models and Results

• Issues

• Next Steps
Motivation

Based on meta-analysis by Nilsson et al. [1]:

• correct prediction for 10% prevalence of VWF by ISO 5349-1?

• fitting for percussive tools?

• multiple tools used per day equally well predicted as one tool per day?

• all necessary aspects considered in [1]?
Meta-Analysis by Nilsson et al.
Literature Analysis

- Studies used by Nilsson et al.
- Participants
- Evaluation methods
- Health issues
- Exposure time and latency
- Tools used – impact and non-impact tools
- Vibration data
Analysis – First Data Set

• Include all studies reporting values for prevalence of VWF (>10%), duration of exposure $D_y$ (years) & $A(8)$

• Linear interpolation to exposure time at 10% prevalence assuming 0% prevalence at 0 exposure time

• Plot of exposure time versus $A(8)$

• Regression analysis: $D_{y,10} = a \cdot A(8)^b$

• 95% confidence intervals for regression line
Regression Analysis – First Data Set

![Graph showing data from literature, ISO 5349-1, Nilsson model, regression line, and 95% confidence interval. ]
Analysis – Additional Data

Total operating time in h:

\[ t_{exposed} = N^o \times \frac{h}{\text{day}} (t_{workday}) \times \text{days exposed} (N_{workdays}) \]

\[ \downarrow \]

Exposure time in years:

\[ D_y = \frac{t_{exposed}}{t_{workday}} \div N_{workdays \ per \ year} \]
Regression Analysis – Additional Data
### Comparison

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<tr>
<td>parameter a</td>
<td>20.6</td>
<td>31.8</td>
<td>≈ 22</td>
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<td>parameter b</td>
<td>-0.74</td>
<td>-1.06</td>
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\[ D_{y,10} = a \cdot A(8)^b \]
Regression Analysis – Single Tool Studies

![Graph showing the relationship between Exposure Time (years) and $A8$ (m/s²). The graph includes data from literature for 10% prevalence, ISO 5349-1, Nilsson model, regression line, and 95% confidence interval of model 2.](imageURL)
Conclusion – Part 1

several issues have been uncovered by this analysis
Issues

• large data spread
• interpolation versus extrapolation
• determination of daily & lifetime exposure
• measurement of vibration
• characterization of exposure
• different information in papers used
Conclusion – Part 2

![Graph showing exposure time versus vibration level]

- ISO 5349-1
- Nilsson model
- Different prevalence levels (10% to 40%)
- Confidence intervals

[2]
Next Steps

- extend data set using studies not used by Nilsson et al.
- **different interpolation than linear**
- other metrics of exposure (vibration magnitude & duration)
- different frequency weighting (e.g. ISO/TR 18570 [4])
- unify health effects from exposure to single and multiple tools
Sources


