Raynaud’s phenomenon and hand-arm vibration exposure in the general population of northern Sweden

Albin Stjernbrandt
Introduction

- This presentation is based on a previously published article with added unpublished data on hand-arm vibration exposure.
Introduction

- Raynaud’s phenomenon (RP) is a very common condition in Sweden with a prevalence of around 12–14%.
- Vibration-induced RP is the most commonly compensated occupational injury in Sweden.
- Apart from vibration, cold climate exposure is likely both a causal factor and a trigger factor.
- The natural course of RP has not been thoroughly studied since longitudinal studies are scarce, especially cohorts on the general population.
- The remission rate of RP has relevance for workers’ compensations claims.
Introduction

• A US study with a mean follow-up of seven years reported a cumulative incidence of 1.5–2.2% and a remission proportion of 64% [1]
• A French study with 14 years of follow-up reported a cumulative incidence proportion of 3.5% and a remission proportion of 33% [2]
• The primary aim of our study was to determine the incidence, persistence and remission proportions of RP in the general population of northern Sweden

Methods

- Cold and Health In Northern Sweden (CHINS)
- A population-based prospective closed-cohort study conducted between 2015 and 2021
- Recruitment was based on the Swedish population register
- Repeated surveys (paper and digital)
- Data was collected on general health status, occurrence of RP, as well as exposure to hand-arm vibration and cold climate
- Annual incidence, remission and persistence proportions were calculated
- Multiple logistic regression was used to investigate factors that could influence the course
Methods

Do you have white fingers?
The picture displays white fingers, also called Raynaud's phenomenon

Does one or several of your fingers turn white as shown on the picture when you are exposed to moist or cold?

- Yes
- No

What year did it occur the first time?

- [ ]

What year did it most recently occur?

- [ ]

Does the pale area affect the fingertips with a clear demarcation?

- Yes
- No
- Don’t know

Compared to the onset, how large area of the fingers are affected now?

- A smaller area
- A similar area
- A larger area
- Don’t know

The sketch shows the hands, with different parts of the fingers marked with textures

Approximately what part of the fingers are affected on your LEFT hand?

- Not affected
- Only the most distal parts of the fingers (dotted area)
- Including the middle parts of the fingers (striped area)
- All the way towards the palm of the hand (grey area)
- Don’t know

Approximately what part of the fingers are affected on your RIGHT hand?

- Not affected
- Only the most distal parts of the fingers (dotted area)
- Including the middle parts of the fingers (striped area)
- All the way towards the palm of the hand (grey area)
- Don’t know
Methods

Baseline survey
N=12,627
(February–May 2015)

Follow-up sample
N=11,739
(March–April 2021)

Deceased or moved from study region (2015–2021)
N=888

Undeliverable mail
N=31

Incomplete or incorrect social security number
N=111

Matched data from both surveys
N=5,017

No response
N=6,500

Multiple responses
N=80

Follow-up survey returned
N=5,208
(response rate 44.4%)
Results

- 5,017 subjects
- 46% men and 54% women
- Mean age 58 years (SD 13)
- RP was reported by 290 men and 390 women at follow-up
- Occupational exposure to HAV at follow-up was reported by 31% of men and 5.6% of women
- Sustaining a local cold injury affecting the hands during the study period was associated with incident RP (adjusted OR 3.92; 95% 2.60–5.90)
Results

Proportion of working time using vibrating tools

- None
- One tenth of time
- One quarter of time
- Half the time
- Three quarters of time
- Almost always

Men
Women
### Results

<table>
<thead>
<tr>
<th>Tool category</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrating tools</td>
<td>32.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Forestry and gardening tools</td>
<td>31.2%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Heavily vibrating tools</td>
<td>27.6%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Vehicles with vibrating controls</td>
<td>27.3%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Impact tools</td>
<td>25.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Rapidly rotating tools</td>
<td>5.6%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>
## Results

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<td>Rapidly rotating tools</td>
<td>5.6%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

### Number of exposure sources (tool categories)

- None: 100%
- One: 0%
- Two: 0%
- Three: 0%
- Four: 0%
- Five: 0%
- Six: 0%

**Legend:**
- Men
- Women
## Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Men %</th>
<th>Women %</th>
<th>Gender difference</th>
<th>p value</th>
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<tbody>
<tr>
<td>Baseline RP</td>
<td>11.5</td>
<td>14.7</td>
<td></td>
<td>&lt;0.01</td>
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<tr>
<td>Incident RP (per year)</td>
<td>5.5</td>
<td>4.2</td>
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<td>0.04</td>
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<tr>
<td>Remitted RP (per year)</td>
<td>33.2</td>
<td>26.3</td>
<td></td>
<td>0.05</td>
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<tr>
<td>Persistent RP</td>
<td>66.0</td>
<td>73.0</td>
<td></td>
<td></td>
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</tbody>
</table>

**Diagram:**

- **Baseline:**
  - RP– → Healthy
  - RP+ → Incident
- **Follow-up:**
  - RP– → Remitted
  - RP+ → Persistent
### Results

<table>
<thead>
<tr>
<th>Baseline variable</th>
<th>OR for incident Raynaud’s phenomenon</th>
<th>OR (95% CI) *</th>
<th>OR (95% CI) b</th>
<th>OR for remitted Raynaud’s phenomenon</th>
<th>OR (95% CI) *</th>
<th>OR (95% CI) b</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18-31</td>
<td>24</td>
<td>420.1.00</td>
<td>817.0.00</td>
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<tr>
<td>32-44</td>
<td>51</td>
<td>699.1.28</td>
<td>0.77–2.11</td>
<td>26</td>
<td>84</td>
<td>0.66 (0.26–1.70)</td>
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<tr>
<td>45-57</td>
<td>68</td>
<td>1282.0.93</td>
<td>0.58–1.50</td>
<td>53</td>
<td>182</td>
<td>0.62 (0.25–1.51)</td>
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<td>58-70</td>
<td>65</td>
<td>1650.0.69</td>
<td>0.43–1.11</td>
<td>105</td>
<td>181</td>
<td>1.23 (0.51–2.95)</td>
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<td>–</td>
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<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt;20</td>
<td>13</td>
<td>139.1.44</td>
<td>0.79–2.04</td>
<td>4</td>
<td>31</td>
<td>0.35 (0.12–1.05)</td>
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<td>20-25</td>
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<td>1558.1.00</td>
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<td>99</td>
<td>271</td>
<td>1.00</td>
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<td>25-30</td>
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<td>133</td>
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<td>&gt;30</td>
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<td>679.0.59</td>
<td>0.38–0.92</td>
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<td>26</td>
<td>2.63 (1.45–4.77)</td>
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<td>Daily smoker</td>
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<td>Never or former</td>
<td>197</td>
<td>3790.1.00</td>
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<td>178</td>
<td>445</td>
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<td>Current</td>
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<td>0.47–1.63</td>
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<td>17</td>
<td>1.91 (0.91–4.02)</td>
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<td>Current</td>
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<td>Hypertension</td>
<td>No</td>
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<td>3064.1.00</td>
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<td>130</td>
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<td>28</td>
<td>945.0.52</td>
<td>0.34–0.77</td>
<td>64</td>
<td>84</td>
<td>2.11 (1.43–3.10)</td>
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<td>Diabetes mellitus</td>
<td>No</td>
<td>199</td>
<td>3841.1.00</td>
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<td>453</td>
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<tr>
<td>Yes</td>
<td>7</td>
<td>185.0.73</td>
<td>0.34–1.57</td>
<td>9</td>
<td>8</td>
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<tr>
<td>Migraines</td>
<td>No</td>
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<td>3675.1.00</td>
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<tr>
<td>Yes</td>
<td>16</td>
<td>322.0.77</td>
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<td>20</td>
<td>56</td>
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<td>Psychological stress</td>
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<td>3200.1.00</td>
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<td>High</td>
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<tr>
<td>Cold injuryIndex</td>
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<td>1.00</td>
<td>127</td>
<td>322</td>
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<tr>
<td>Yes</td>
<td>36</td>
<td>257.313</td>
<td>1.42–5.05</td>
<td>290 (1.97–4.27)</td>
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<td>Work cold exposure</td>
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<td>NRS ≤10</td>
<td>112</td>
<td>2348.1.00</td>
<td>1.00</td>
<td>98</td>
<td>254</td>
<td>1.00</td>
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<td>NRS &gt;10</td>
<td>87</td>
<td>1573.1.16</td>
<td>0.87–1.55</td>
<td>88</td>
<td>190</td>
<td>1.20 (0.85–1.68)</td>
</tr>
<tr>
<td>Continuous</td>
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<td>–</td>
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<td>–</td>
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<tr>
<td>Continuous working</td>
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<tr>
<td>Leisure cold exposure</td>
<td>NRS ≤10</td>
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<td>1.00</td>
<td>75</td>
<td>199</td>
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<td>NRS &gt;10</td>
<td>115</td>
<td>1962.1.34</td>
<td>1.01–1.78</td>
<td>114</td>
<td>257</td>
<td>1.18 (0.83–1.66)</td>
</tr>
<tr>
<td>Continuous</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

BMI: body mass index, NRS: numerical rating scale, OR: odds ratio, 95% CI: ninety-five percent confidence interval

* Adjusted for gender and age (continuous)

b Adjusted for gender and age and continuous variables (continuous)

c Dichotomized based on the 50th percentile
d Only working subjects (N = 3841), excluding students, pensioners, unemployed, and those on sick or parental leave
Discussion

- The annual incidence of RP in our study was higher than previous US and French studies
  - Colder climate in Sweden
  - Different case definitions
- The incidence was higher among men than women in our study
  - Novel result
  - Could be related to more frequent hand-arm vibration exposure among men
- The annual remission proportion in our study was lower than the 9% in the US study but higher than the 3% in the French study
  - RP should not necessarily be considered a chronic condition
Conclusions

• Raynaud’s phenomenon is a common but variable condition in the general population of northern Sweden, and symptoms may remit over time

• Contracting a local cold injury increases the probability of incident Raynaud’s phenomenon

• Men were more commonly exposed to hand-arm vibration than women and had a higher incidence proportion of Raynaud’s phenomenon
Acknowledgements

**VECTOR research group:** Vibration, Ergonomics, Climate and Translational Occupational Research

[Image of a group of people]