A practical tool for risk assessment of arm, neck shoulder disorders in manual tasks

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Aim

Two projects in assignment of the Dutch Ministry of Social Affairs and Employment:

2007 develop a risk assessment tool of arm, neck or shoulder complaints due to hand-arm tasks, that is:
  • quantitative
  • easy to apply

2008 test the reliability and validity and improve the tool

The risks are not always as obvious as in this case…
2007: Tool development

Development process:
1. Defining criteria
2. Study epidemiologic literature (reviews)
3. Evaluation of existing tools: KIM MO* fits our criteria best starting point
4. Adjustment of KIM: redefine risk factors (adding postures and vibrating tools), cut off points and weighing factors from
   • KIM MO
   • Literature (OR/RR) +
   • Expert judgements
5. Development of a paper version
6. Test in 10 companies and improving of the tool
7. Development of prototype internet application

*Steinberg et al., 2007
2008: Test of reliability and validity

Intertester reliability
Target group of 11 occupational safety and health practitioners and managing directors from companies and labour inspectors used HARM for risk assessment of 5 hand arm tasks

Validity (aspects)
Compare results of 5 tasks with expert risk evaluation using more extensive measurements (goniometers, videorecording, force measurements)

5 tasks
- cutting issue
- processing electric cord
- meat packing
- cassier tasks
- working with microscope

Vibration not tested
An impression of HARM (in Dutch)

Hand Arm Risicobeoordelings Methode

Meest voorkomende hand-arm taken en tijdsbesteding

Let op! Breder werkzaamheden behoren niet tot de hand-arm taken.
Step 1: Task duration

Task duration score depends on:
- Average daily duration of the task (minimum 1 hour a day)
- Number of days a week the task is performed
- Number/ duration of breaks
Step 2: Most active hand

- Select most active hand/arm
- Focus on this hand/arm
**Step 3: Force exertion**

<table>
<thead>
<tr>
<th>Which forces are applied?</th>
<th>Stap 3A</th>
<th>Stap 3B</th>
<th>Stap 3C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>duration (sec per min)</td>
<td>frequency (times per min)</td>
<td></td>
</tr>
<tr>
<td><strong>Hoeveelheid kracht</strong></td>
<td>&lt; 4</td>
<td>4-30</td>
<td>30-60</td>
</tr>
<tr>
<td>Small (&lt;100g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (100-1000g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fairly high (1-3 kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (3-6 kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak force</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Stap 3D**  
**Krachtscore** = hoogste omcirkelde score = ..........  

*Bij zeer groot: Let op! Als er krachtuitoefeningen van meer dan 6 kg voorkomen, moeten deze via een andere methode (bv. voor tillen of duwen/trekken) beoordeeld worden.*
Step 4: Posture

Two ‘Posture risk scores’ depending on:

- unfavourable lower arm/wrist postures
- 7 unfavourable neck/upper arm postures and
- duration of these postures (0-10%, 10-50%, >50% of the task duration)
Step 5: hand-arm vibration

- Quantitative and qualitative descriptions
- Based on the new EU directive 2002/44/EG

- $< 2.5 \text{ m/s}^2$
- $2.5 – 5 \text{ m/s}^2$
- $5 – 10 \text{ m/s}^2$
- $\geq 10 \text{ m/s}^2$

- Vibrations felt / observed by worker and/or occupational health practitioner
Step 6: Other factors

- Five ‘other’ risk factors:
  - not being able to take autonomous breaks
  - an unfavorable working climate
  - disturbing disruptions
  - bad gripping conditions (e.g. because of gloves)
  - high precision demands
Step 7: Overall risk score

- Add up scores of step 3-6
- Multiply this sum with task duration (step 1)
- Total score:
  - < 25 points: no increased risk
  - 25-50 points: increased risk
  - ≥ 50 points: seriously increased risk

**Example Table**

<table>
<thead>
<tr>
<th>Step 7. Totale risicoscore berekenen:</th>
<th>Scores:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neem de scores over van stap 1 t/m 6</td>
<td></td>
</tr>
<tr>
<td>Krachtscore (stap 3)</td>
<td>........</td>
</tr>
<tr>
<td>Houdingscore nek/schouder (stap 4A)</td>
<td>........</td>
</tr>
<tr>
<td>Houdingscore onderarm/pols (stap 4B)</td>
<td>........</td>
</tr>
<tr>
<td>Trillingenscore (stap 5)</td>
<td>........</td>
</tr>
<tr>
<td>Score andere factoren (stap 6)</td>
<td></td>
</tr>
<tr>
<td>Bereken somscore (A):</td>
<td>+</td>
</tr>
<tr>
<td>Vul taakduurscore in (uit stap 1) (T)</td>
<td>X</td>
</tr>
<tr>
<td>Bereken risicoscore</td>
<td></td>
</tr>
<tr>
<td>(taakduurscore (T) x somscore (A))</td>
<td></td>
</tr>
</tbody>
</table>
Results of validity test (1)

Mean difference: 0.23 (practitioners lower than experts)
Mean absolute difference: 10.9

Dresden, October 17
Results of validity test per step and total (2)

- Force score: 0.75
- Posture neck sh.: 0.38
- Posture wrist: h.: 1.08
- Other factors: 0.22
- Total risk score: 0.23

Difference compared to golden standard:
- Force: Underestimation
- Posture neck-sh.: Overestimation
- Posture wrist-hand: Underestimation
- Other factors: Overestimation
- Total Score: Underestimation
## Results of validity and reliability test per factor

<table>
<thead>
<tr>
<th>Part of the tool</th>
<th>Reliability: ICC (interpretation*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force exertion</td>
<td>0.47 (fair)</td>
</tr>
<tr>
<td>Neck/shoulder posture</td>
<td>0.36 (slight)</td>
</tr>
<tr>
<td>Wrist/elbow posture</td>
<td>0.12 (slight)</td>
</tr>
<tr>
<td>Vibrating tools**</td>
<td>0.55 (fair)</td>
</tr>
<tr>
<td>Other factors</td>
<td>0.55 (fair)</td>
</tr>
<tr>
<td>Overall risk evaluation</td>
<td>0.73 (moderate)</td>
</tr>
</tbody>
</table>

* according to Shrout, 1998  
** separate test of improved descriptions
Improvements made

- explanations of ‘sufficient breaks’ and ‘precision’ (one of the ‘other factors’) were improved
- pictures to explain the postures were improved
- Less answering categories were used for:
  - force exertion: level, duration and frequency
  - arm elevation
- Vibration: descriptions of effects on worker, not only levels
Current activities and future plans

HARM is now freely available for all companies in the Netherlands:
http://www.arboportaal.nl/instrumenten/fysieke-belasting
select “Hand Arm Risicobeoordelingsmethode”

We are now developing:
• a video instruction for HARM
• a ‘step 1 method’ to use before HARM (step 2) to improve applicability for small companies
• a development procedure for risk assessment of working postures

In the future we hope to:
• test the improved HARM again (comparison with other methods)
• test the concurrent and predictive validity of HARM
• Develop an English version of HARM?
Thank you for your attention!

Questions?

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Criteria

Scope
All branches and tasks except VDU-work
Adult working population, males and females

Input
Evidence based risk factors
Easy and quick to collect

Usability
Easy to use, without training
Both paper and internet application

Results
Easy to understand (traffic light)
Insight in most important risks