Upper limb expert tool by Ketola

General description and development of the method

A semiquantitative time-based method for the assessment of existence ('yes'/no') of risk factors for the upper limb disorders. The limits for 'yes'/no' are defined by the proportion the exposure exists of the cycle duration. The higher the total of 'yes' answers is the greater is the risk.

The method was developed in Finland and described in literature in 2001. (Ketola 2001)

Exposure descriptors

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Description of exposure</th>
<th>magnitude/amplitude</th>
<th>duration</th>
<th>frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>posture</td>
<td>Non-neutral wrist posture &gt;20º, elevation of upper arms &gt;20º for &gt;1/3 of cycle time</td>
<td>✗</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>movements</td>
<td>Repetitive use of hand (cycle duration &lt;30s OR similar actions for &gt;50% of the cycle time)</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(external) force</td>
<td>Use of hand force (&gt;4.5kg) Pinch grip &gt;1/3 of cycle time</td>
<td>✗</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>vibration</td>
<td>use of vibrating tools (yes/no)</td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>contact forces</td>
<td></td>
<td>✗</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional items: temperature, use of gloves

Resource demands and usability

Equipment needed

Checklist and its use described in publication (Ketola 2001)

Stopwatch and force gauge for measurement of time and weights/forces

Process of coding and analysis

- Break down the selected jobs into work cycles
- Measure the duration and repetition of each cycle
- Weight the objects handled
- Make the observations
- Calculate the amount of the "yes" answers.
- If other risk factors (e.g. the use of vibrating tool and factors hindering gripping) are included, increase the value by one. The higher the total, the more strenuous the work for the upper extremities
Output type/level (risk assessment)
A profile of items

Criteria to help the evaluator to make decision
All items with 'yes' have to be considered for potential changes

*Fields of the working life where the method has been used*
Food processing plant and paper mill (Ketola 2001)

Validity

Face validity / Contents validity
Does the method seem to be valid for the aimed purpose?

<table>
<thead>
<tr>
<th>Ketola et al. 2001</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The contents of the method is such that a relevant assessment can be expected</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>2. Items to be observed have a sound basis</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Comments: Based on the epidemiological literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Sound operationalization of the items to be observed</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Comments: Selection of cut-off limits for the categories is arbitrary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sound process to collect data</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>5. Sound process to get the output of the collected data</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Comments: Duration and other risk factors were assessed separately; local pressure, vibration, gloves and cold air are not taken into account when calculating the sum value. An arithmetic sum is used to combine items, even though it is not known if the combination is linear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Output can help in decision making</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Comments: No clear rules given for the actions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Concurrent validity
How well does the method correspond with more valid method/s?

Field observations vs. video and technical measures (EMG, goniometers) (Ketola et al 2001)

"Validity ranged from moderate to good for repetitive use of hand, use of hand force, pinch grip and non-neutral wrist posture when expert observation was used as reference standard. When observations were validated against force estimations (EMG) and wrist goniometer data, validity was poor."

see p. 124-126, tables 1-3.

For validity of comparisons see discussion p.128, paragraph 2.

Comments: The validity of "expert" as a reference can be questioned. With technical measures the functional extension in gripping will be registered as "hazardous" extension if the simultaneous position of the fingers is not considered.
"Predictive validity"
How well has the risk-estimation of the method been shown to be associated with or predicting musculoskeletal disorders (MSDs)?
- No formal studies

Intra-observer repeatability (within observers)
- No formal studies

Inter-observer repeatability (between observers)
Two observers in the field (Ketola et al 2001)
"Interobserver repeatability was good or moderate for repetitive use of hand, hand force, pinch grip (range $\kappa = 0.58 - 0.71$ on the right; 0.60 - 0.61 on the left side). Interobserver repeatability was moderate or poor for non-neutral wrist posture, elevation of the upper arm and local mechanical pressure."

Conclusions

Strengths of the method
- Quick, easy to use

Limitations in the use of the method
- Does not combine the duration and other risk factors
- Estimation of wrist postures is difficult

To whom can this method be recommended?
- Occupational safety/health practitioners who assess work tasks, which involve repetitive use of hand

References