RULA (Rapid Upper Limb Assessment)

General description and development of the method

RULA is aimed to make a rapid assessment on neck and upper-limb loading in mainly sedentary tasks. Positions of individual body segments will be observed and the more there is deviation from the neutral posture the higher will the score of each body part be. Summary scores are first counted separately for upper arms, lower arms, and wrists (group A), and trunk and neck, and legs (group B). These groups are combined and transformed to a general postural score ("grand score"). Additional weights are given to the postures by forces/loads handled and by static/repetitiv muscular activity. These scores are compared to tables stating risk on four levels and actions needed ("acceptable" -- "immediate investigation and change needed").

(McAtamney 2005)

Developed as a survey method for use in ergonomics investigations of workplaces where work-related upper limb disorders are reported. Of particular assistance in fulfilling the assessment requirements of both the European Community Directive (90/270/EEC) on the minimum safety and health requirements for work with display screen equipment and the UK Guidelines on the prevention of work-related upper limb disorders. Developed in Institute for Occupational Ergonomics, University of Nottingham, in the beginning of 90tees. Postures based on OWAS (McAtamney 1993)

A proposed modification for computer work (Lueder 1996); not formally tested

An automated optoelectronic application tested in surgery (Person 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>2 to 5 classes for each body part; Posture score is increased by 1 if the posture is mainly static, that is, held for longer than 1 min. The muscle use is defined as repetitive if the action is repeated more than four times in a minute (McAtamney 1993).</td>
<td>x</td>
<td>.</td>
<td>x</td>
</tr>
<tr>
<td>movements</td>
<td>no</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>(external) force</td>
<td>Load handled: 3 classes (No, 2-10kg, &gt;10kg)</td>
<td>x</td>
<td>.</td>
<td>x</td>
</tr>
<tr>
<td>vibration</td>
<td>no</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>contact forces</td>
<td>no</td>
<td>.</td>
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</tr>
</tbody>
</table>
Resource demands and usability

Equipment needed
Free software (http://www.rula.co.uk/) or paper version (http://ergo.human.cornell.edu/ahRULA.html)

RULA can be observed from photographs or videorecordings.

A weight scale, push/pull force gauge, and/or a hand grip/pinch grip force gauge are recommended to measure the forces/loads required for the task. Stopwatch may also be used but is not required.

Process of coding and analysis

- Observing and selecting the posture(s) to assess
- Decide whether the left, right or both upper arms are to be assessed. Score the posture of each body part using the software.
- The grand score can be compared to the Action Level List. (http://www.rula.co.uk)
- If you use the paper version, follow the score sheet to calculate posture scores (the software version does this). Use the calculation button on the software or use Table C to calculate the Grand Score. (Hignett & McAtamney 2006)

Output type/level (risk assessment)

A risk score

Criteria to help the evaluator to make decision

Scores are compared to tables stating risk on four levels and actions needed ("acceptable" -- "immediate investigation and change needed")

Fields of the working life where the method has been used

- Computer work at schools (Breen 2007); (Shuval 2005)
- Sewing machine operators (McAtamney 1993),
- Restaurants: bartenders, waitresses and cooks (Jones 2005)
- Industry workers (Drinkaus 2003, Kee 2007),
- Driving postures of truck drivers (Massaccesi 2003),
- Saw-filers (Jones 2007),
- Dentistry (Chaikumarn 2005) (deSá 2006) (Gandavadi 2007)
- Carpet mending (Choobineh 2004)
- Car industry (Drinkaus 2003)
- Metal industry (Gonzalez 2003)
- Truck drivers (Massaccesi 2003); Forklift truck drivers (Hoy 2005)
- Simulation of surgical endoscopic operation (Lee 2005)
- Biomedical laboratory (Kilroy 2000)
- Simulated ergonomic laboratory study on tool handles (McGorry 2007)
**Validity**

**Face validity / Contents validity**

Does the method seem to be valid for the aimed purpose?

<table>
<thead>
<tr>
<th></th>
<th>yes</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The contents of the method are such that a relevant assessment can be expected</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Comments: Duration of exposures is not included</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Movements have a low impact on the score, i.e. the effect of this risk factor is presumably underestimated.</td>
<td></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: See comments on movements above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Sound operationalization of the items to be observed</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Comments: The categories for wrist flexion, and for head flexion are not quite “sound”. Both are too sensitive to small deviations from the neutral position, which both may be hard to distinct from observations, and not imply any considerable risk</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>4. Sound process to collect data</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Comments: Great number of items to be observed simultaneously gives demands for the observer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The choice of sampling strategy “assessing posture with longest duration” or “assessing worst case posture” presumably leads to quite different scores. These differences are not well defined/described/evaluated in the method, and may lead to incomparability between studies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sound process to get the output of the collected data</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Comments: With the additional risk score the weights given for each item is arbitrary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The calculations of the summary scores seem “sound”. However, they imply assumptions about the interactions of the individual exposures that are not based on evidence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Output can help in decision making</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

**Concurrent validity**

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

1) RULA vs Strain Index (Drinkaus 2003)
   - Low correlation between the methods
2) RULA vs REBA (deSá 2006)
   - RULA gave generally higher “action” scores than REBA
3) RULA vs EMG (Fountain 2003)
   - There was no association with RULA score and EMG. Perceived discomfort was associated with RULA
5) RULA, REBA, ACGIH TLV, Strain Index and OCRA (Jones 2007) NOTE! Estimations of risk level based on data of technical measurements

- NOT a comparison of observational methods but of the category limits of the methods
- RULA component scores, but not risk index and risk level, were sensitive to posture variable definition.

6) RULA, OWAS, REBA (Kee 2007)

- "It would remain unknown which method better reflects the underlying risks for varying tasks, unless some measures of morbidity are brought into analysis"

"Predictive validity"

How well has the risk-estimation of the method been shown to be associated with or predicting musculoskeletal disorders (MSDs)?

Laboratory studies

1) Association between RULA scores and pain/discomfort during a data entry task (McAtamney 1993)

2) Study on associations of RULA postures with psychophysiological measures (three experimental postures of low (1), medium (2) and high (3) held for 30 min). A statistically significant difference was found in perceived discomfort from posture 1 to posture 3, no difference was found between postures 1 and 2, and between 2 and 3. The perceived discomfort results suggest that RULA's scoring system may be too general in nature to differentiate various levels of risk in computer work. RULA was able to identify high-risk postures. (Fountain 2003)

Cross-sectional field studies

3) In a study of children's posture and discomfort during computer use, a poor working posture, as measured by RULA, were associated with discomfort measured by body discomfort cart (BDC) and visual analogue scale (VAS). (Breen 2007).

4) Subjects with hand/wrist/finger symptoms in the last year had a higher RULA arm/wrist score, indicating poor posture of the region (Shuval 2005).

Intra-observer repeatability (within observers)

1) RULA was presented as a methodology during the training of over 120 physiotherapists, industrial engineers, safety and production engineers. Videotaped examples of operators performing screen-based keyboard operations, packing, sewing and brick sorting were shown and each subject completed a RULA assessment. Comparison of their results indicated a high consistency of scoring amongst subjects. (McAtamney 1993)

- Results not documented in literature

2) An ergonomist assessed 301 postures by RULA. The postures were reassessed after 3 weeks. Intra-rater repeatability was 91.7%. ((Kee 2007): p 5).

Inter-observer repeatability (between observers)

1) "Videotaped examples of operators performing screen-based keyboard operations, packing, sewing and brick sorting were shown and each subject completed a RULA assessment. Comparison of their results indicated a high consistency of scoring amongst subjects. Discrepancies only occurred when a body segment posture was at a border between two ranges, usually when assessing the lower arm posture." ((McAtamney 1993), p. 98)

- Results not documented in literature

2) "Three researchers simultaneously observed the same five children over a 30- min period. They made observations at 3-min intervals, and independently awarded Investigation of children’s posture
and discomfort during computer use RULA scores. Inter-rater reliability was established at 94.6%.
"((Breen 2007), p. 1584-5)

**Conclusions**

**Strengths of the method**

RULA focus on upper limb, neck and shoulder, which is the most relevant body segments in many types of work with a high prevalence of MSDs. The method is easy to use. For tasks with high action scores, it is possible to identify the underlying factors relevant for intervention.

Public computerized software available

**Limitations in the use of the method**

Not applicable for tasks involving manual materials handling and whole body movements

Right and left hands have to be assessed separately. No method available to combine these scores.

Does not consider duration of exposures

To perform correct classification of wrist postures, the observation of the hands requires special attention. RULA is less suitable for varied long-cyclic work that can not be broken down to tasks. RULA is presumably less suitable for evaluating increases in risk due to increases in movements/repetitiveness.

**To whom can this method be recommended?**

To OHS practitioners for identifying risk for MSDs of neck shoulder and upper limb.

**References**


IFPR – ABEPRO - PUCPR - PPGEPS, 2006. Available from: [http://www.produtronica.pucpr.br/icpr-am06/Accepted%20but%20not%20coming%20for%20presentation/Paper%20067.pdf](http://www.produtronica.pucpr.br/icpr-am06/Accepted%20but%20not%20coming%20for%20presentation/Paper%20067.pdf)


