

Technical note

Rapid Entire Body Assessment (REBA)

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Received 20 July 1998; accepted 17 June 1999

Abstract

This technical note details the preliminary stage in the development of a postural analysis tool, Rapid Entire Body Assessment (REBA). REBA has been developed to fill a perceived need for a practitioner's field tool, specifically designed to be sensitive to the type of unpredictable working postures found in health care and other service industries. A team of ergonomists, physiotherapists, occupational therapists and nurses collected and individually coded over 600 postural examples to produce a new tool incorporating dynamic and static postural loading factors, human-load interface (coupling), and a new concept of a gravity-assisted upper limb position. Initial reliability for inter-observer coding shows promise but further work is needed to establish the validity of the tool. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Postural analysis; Manual handling; Physical work load; Hospital ergonomics

1. Introduction

Postural analysis can be a powerful technique for assessing work activities. The risk of musculoskeletal injury associated with the recorded posture(s), in the context of a full ergonomic workplace assessment, can be a major factor for implementing change, so the availability of task-sensitive field techniques is of great assistance for the ergonomics practitioner.

Most postural analysis techniques have two, usually contradictory, qualities of generality and sensitivity (Fransson-Hall et al., 1995). High generality in a postural analysis method may be compensated by low sensitivity, for example; the Ovako Working posture Analysis System (OWAS, Karhu et al., 1977) has a wide range of use but the results can be low in detail (Hignett, 1994). In contrast NIOSH (Waters et al., 1993) requires detailed information about specific parameters of the posture, to give high sensitivity with respect to the defined indices, but has a limited application in health care in particular with respect to animate load handling.

A need was perceived within the spectrum of postural analysis tools, specifically with sensitivity to the type of

unpredictable working postures found in health care (e.g. animate load handling) and other service industries. This led to the development of the following postural analysis tool: Rapid Entire Body Assessment, REBA (Hignett, 1998; McAtamney and Hignett, 1995).

2. Aims

The development of REBA aimed to:

- Develop a postural analysis system sensitive to musculoskeletal risks in a variety of tasks.
- Divide the body into segments to be coded individually, with reference to movement planes.
- Provide a scoring system for muscle activity caused by static, dynamic, rapid changing or unstable postures.
- Reflect that coupling is important in the handling of loads but may not always be via the hands.
- Give an action level with an indication of urgency.
- Require minimal equipment – pen and paper method.

3. Development

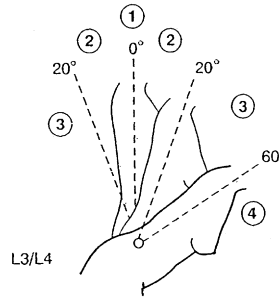
To define the initial body segment codes, specified simple tasks were analysed with variations in the load, movement distance and height. Data were collected using

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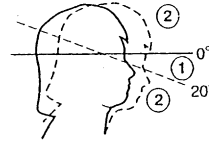
Trunk

Movement	Score	Change score: +1 if twisting or side flexed
Upright	1	
0°–20° flexion 0°–20° extension	2	
20°–60° flexion >20° extension	3	
>60° flexion	4	



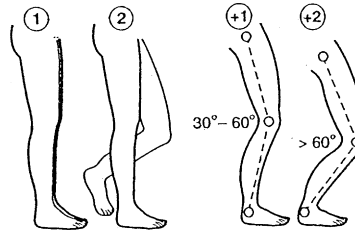
Neck

Movement	Score	Change score: +1 if twisting or side flexed
0°–20° flexion	1	
>20° flexion or in extension	2	



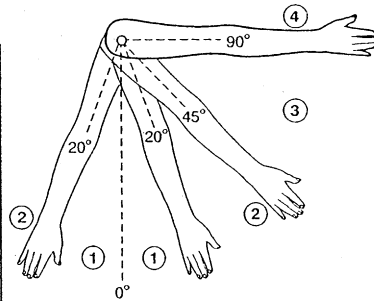
Legs

Position	Score	Change score: +1 if knee(s) between 30° and 60° flexion +2 if knee(s) are >60° flexion (n.b. Not for sitting)
Bilateral weight bearing, walking or sitting	1	
Unilateral weight bearing Feather weight bearing or an unstable posture	2	



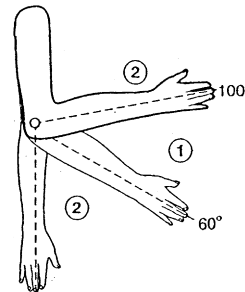
Upper arms

Position	Score	Change score: +1 if arm is: • abducted • rotated +1 if shoulder is raised –1 if leaning, supporting weight of arm or if posture is gravity assisted
20° extension to 20° flexion	1	
>20° extension 20°–45° flexion	2	
45°–90° flexion	3	
>90° flexion	4	



Lower arms

Movement	Score
60°–100° flexion	1
<60° flexion or >100° flexion	2



Wrists

Movement	Score	Change score: +1 if wrist is deviated or twisted
0°–15° flexion/extension	1	
>15° flexion/extension	2	

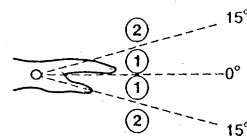


Fig. 1. Group A and B body part diagrams.

REBA - Scoring Sheet

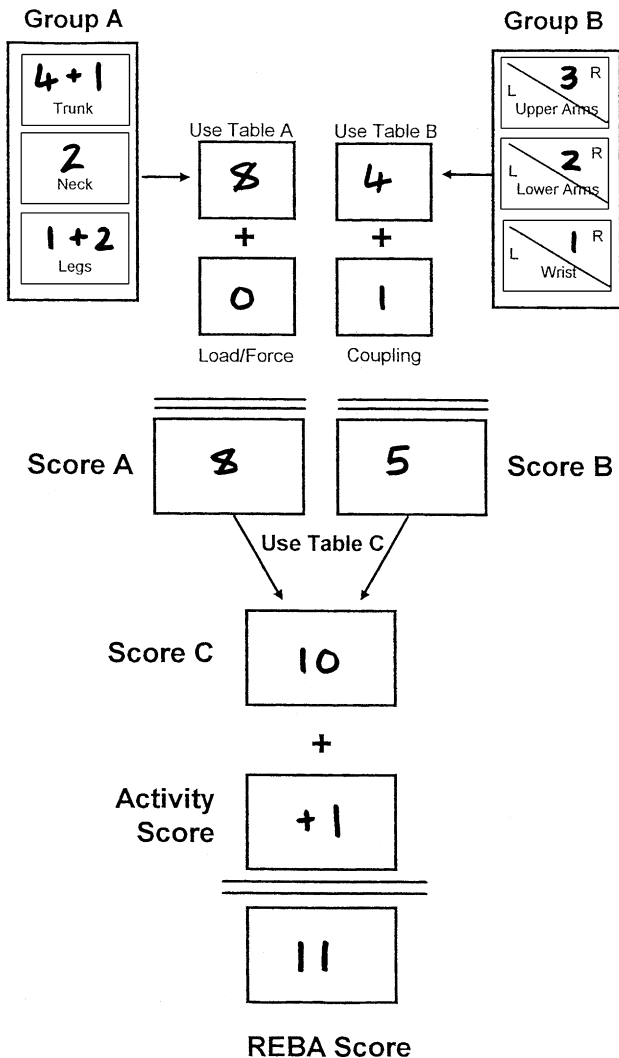


Fig. 2. REBA score sheet.

several techniques including NIOSH (Waters et al., 1993), Rated Perceived Exertion (Borg, 1985), OWAS, Body Part Discomfort Survey (Corlett and Bishop, 1976) and Rapid Upper Limb Assessment (McAtamney and Corlett, 1993). The analyses were used to establish the body part ranges shown in the Group A and B diagrams (Fig. 1) based on the body part diagrams from RULA (McAtamney and Corlett, 1993). Three ergonomists/physiotherapists independently coded the 144 posture combinations and then incorporated the sensitising concepts of load, coupling and activity scores to produce the final REBA score (1–15), with accompanying risk and action levels.

Additionally, two workshops were held for 14 professionals (occupational therapists, physiotherapists, nurses and ergonomists) involving the collection and individual coding of over 600 examples of postures from

health care, manufacturing and electricity industries. The results from these sessions were used to further refine REBA and begin an analysis of inter-observer reliability of body part coding.

Group A has a total of 60 posture combinations for the trunk, neck and legs. This reduces to nine possible scores to which a 'Load/Force' score is added. Group B has a total of 36 posture combinations for the upper arms, lower arms and wrists, reducing to nine possible scores to which a 'Coupling' score is added. The A and B scores are combined in Table C to give a total of 144 possible combinations, and finally an activity score is added to give the final REBA score.

The following example shows REBA being used to assess the working posture of a physiotherapist involved in treating a patient with a right hemiplegia (stroke).



Group A diagrams: The scores shown in Fig. 2 (REBA score sheet) are obtained from the Group A diagrams:

- Trunk is flexed more than 60° and side flexed (4 + 1).
- Neck is extended (2).
- Legs are both weight bearing and flexed more than 60° (1 + 2).

Table 1
Table A and Load

Table A													
Trunk		Neck											
		1				2♦				3			
1 2 3 4 5♦	Legs	1	2	3	4	1	2	3	4	1	2	3	4
		1	2	3	4	1	2	3♦	4	3	3	5	6
		2	3	4	5	3	4	5	6	4	5	6	7
		2	4	5	6	4	5	6	7	5	6	7	8
		3	5	6	7	5	6	7	8	6	7	8	9
	4	6	7	8	6	7	8	9	7	8	9	9	

Load/Force			
①	1	2	+ 1
< 5 kg	5–10 kg	> 10 kg	Shock or rapid build up of force

Table 2
Table B and Coupling

Table B							
Upper arm		Lower arm					
		1			2♦		
Wrist		1	2	3	1♦	2	3
1		1	2	2	1	2	3
2		1	2	3	2	3	4
3♦		3	4	5	④	5	5
4		4	5	5	5	6	7
5		6	7	8	7	8	8
6		7	8	8	8	9	9

Coupling			
0 Good	① Fair	2 Poor	3 Unacceptable
Well-fitting handle and a mid-range, power grip	Hand hold acceptable but not ideal or coupling is acceptable via another part of the body	Hand hold not acceptable although possible	Awkward, unsafe grip, no handles Coupling is unacceptable using other parts of the body

The patient has sitting balance so the LOAD/FORCE score is zero (< 5 kg exerted). Table 1 is used to find the subtotal (8) and the LOAD/FORCE score (0) added to get Score A (8).

The Group B diagrams are used to score the right upper limb as follows:

- Upper arm flexed between 45° and 90° (3), abducted (+ 1) and gravity assisted (– 1) due to the position of the trunk.
- Lower arm is flexed less than 60° (2)
- Wrist is between 0° and 15° flexion/extension with no deviation or twist (1).

Table 2 is used to find the subtotal (4) and the COUPLING score (1) is added to get Score B (5).

Score C (10) is obtained from Table 3 and the ACTIVITY score (+ 1) added as there has been a large range change in posture as the physiotherapist reaches forward to the floor to re-position the patient's foot.

The total REBA score is 11, this refers to a REBA action level of 4 (Table 4), indicating a very high risk of injury to the physiotherapist and that action is necessary NOW to further assess this task with the aim of reducing the risk level.

Table 3
Table C and Activity Score

		Table C												
		Score B												
Score		1	2	3	4	5	6	7	8	9	10	11	12	
	1	1	1	1	2	3	3	4	5	6	7	7	7	7
	2	1	2	2	3	4	4	5	6	6	7	7	8	8
	3	2	3	3	3	4	5	6	7	7	8	8	8	8
	4	3	4	4	4	5	6	7	8	8	9	9	9	9
	5	4	4	4	5	6	7	8	8	9	9	9	9	9
	6	6	6	6	7	8	8	9	9	10	10	10	10	10
	7	7	7	7	8	9	9	9	10	10	11	11	11	11
	8	8	8	8	9	10	10	10	10	10	11	11	11	11
	9	9	9	9	10	10	10	11	11	11	12	12	12	12
	10	10	10	10	11	11	11	11	12	12	12	12	12	12
	11	11	11	11	11	12	12	12	12	12	12	12	12	12
	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Activity score

- | | |
|--------|--|
| • +1 | • 1 or more body parts are static, e.g. held for longer than 1 min |
| • +1 | • Repeated small range actions, e.g. repeated more than 4 times per minute (not including walking) |
| • (+1) | • Action causes rapid large range changes in postures or an unstable base |

Table 4
REBA action levels

Action level	REBA score	Risk level	Action (including further assessment)
0	1	Negligible	None necessary
1	2–3	Low	May be necessary
2	4–7	Medium	Necessary
3	8–10	High	Necessary soon
④	11–15	Very high	Necessary NOW

4. Discussion

During the second workshop there was a change in one of the body part ranges, the Upper Arm category, to introduce the gravity assisted score (–1) for upper limb flexion with trunk flexion. The inter-observer reliability of the 14 participants for coding achieved between 62 and 85% agreement (omitting the Upper Arm category).

Although the initial development of REBA shows promise as a useful postural analysis tool, further validation needs to be carried out. Others may be better placed to carry out this validation, perhaps in cross reference with other tools (OWAS, NIOSH, Posture targeting, biomechanical models) or through empirical measurement in a laboratory setting.

Acknowledgements

Many thanks to our development collaborators for their hard work and lateral thinking during the work-

shops – Val Noble, Linda Allen, Pat Alexander, Nigel Corlett, Joan Gabbett, Aileen Hunter, Nicky Hunter, Harvey Lee, Katherine Metters, Polly Redfern, Sue Ruszala, Deborah Southworth and Elizabeth Thompson.

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