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Technical note

Rapid Entire Body Assessment (REBA)

Sue Hignett[a,*], Lynn McAtamney[b]

[a]*Ergonomist, Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB, UK*
[b]*Director, COPE, Occupational Health and Ergonomic Services Ltd, Nottingham NG8 2RB, UK*

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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.

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 lead 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

* Corresponding author. Tel.: +44(0)-115-969-1169; fax: +44(0)-115-962-8061.
E-mail address: shignett@ncht.org.uk (S. Hignett)

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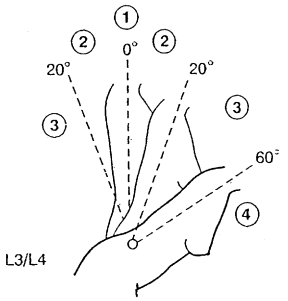
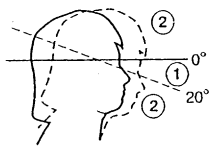
Trunk

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



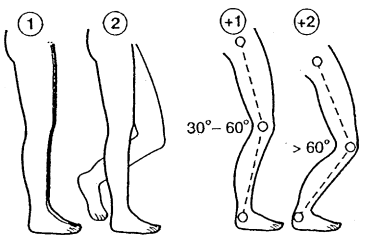
Neck

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



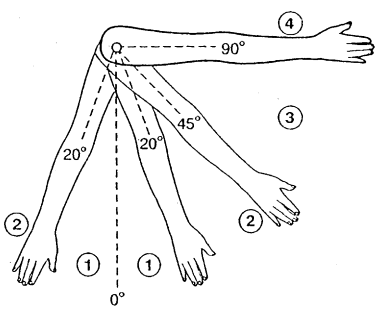
Legs

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



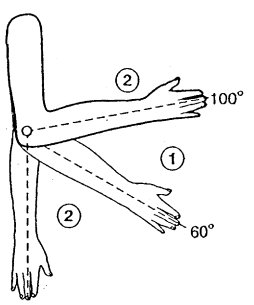
Upper arms

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



Lower arms

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



Wrists

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

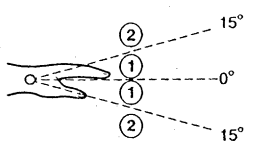


Fig. 1. Group A and B body part diagrams.

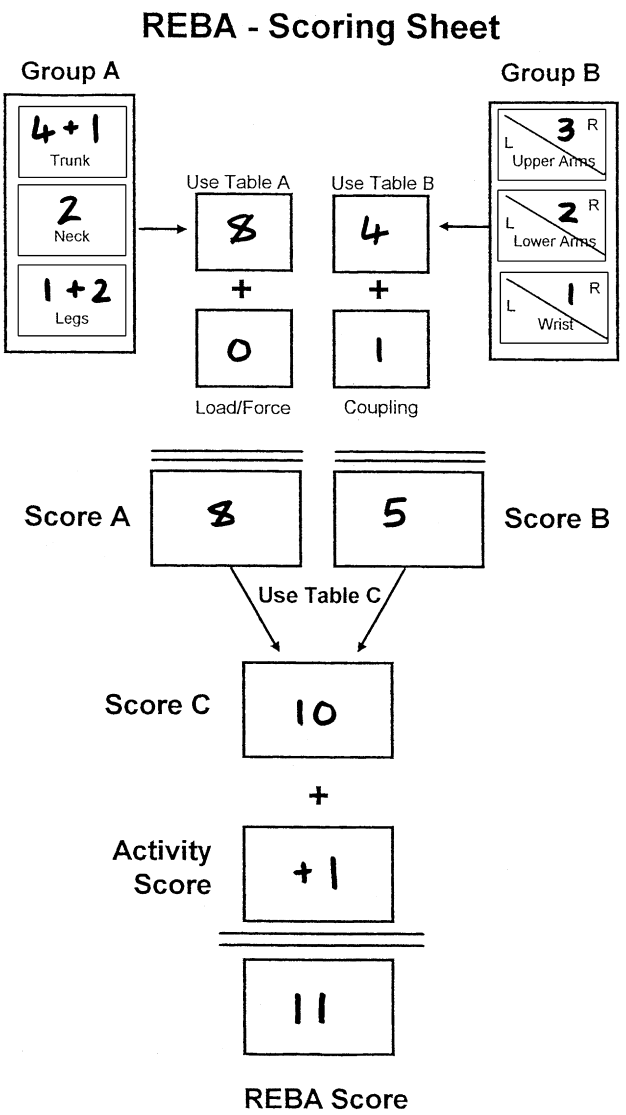


Fig. 2. REBA score sheet.

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				Neck 2◆				Neck 3			
	Legs	1	2	3	4	1	2	3◆	4	1	2	3	4
1		1	2	3	4	1	2	3	4	3	3	5	6
2		2	3	4	5	3	4	5	6	4	5	6	7
3		2	4	5	6	4	5	6	7	5	6	7	8
4		3	5	6	7	5	6	7	8	6	7	8	9
5◆		4	6	7	8	6	7	⑧	9	7	8	9	9

Load/Force

⓪	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			Lower arm 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 A		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
	2	1	2	2	3	4	4	5	6	6	7	7	8
	3	2	3	3	3	4	5	6	7	7	8	8	8
	4	3	4	4	4	5	6	7	8	8	9	9	9
	5	4	4	4	5	6	7	8	8	9	9	9	9
	6	6	6	6	7	8	8	9	9	10	10	10	10
	7	7	7	7	8	9	9	9	10	10	11	11	11
	8◆	8	8	8	9	⑩	10	10	10	10	11	11	11
	9	9	9	9	10	10	10	11	11	11	12	12	12
	10	10	10	10	11	11	11	11	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

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.

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References

Borg, G., 1985. An Introduction to Borg's RPE-Scale. Movement Publications, Ithaca, NY.

Corlett, E.N., Bishop, R.P., 1976. A technique for assessing postural discomfort. Ergonomics 19 (2), 175–182.

Fransson-Hall, C., Gloria, R., Kilbom, A., Winkel, J., 1995. A portable ergonomic observation method (PEO) for computerised on-line recording of postures and manual handling. Appl. Ergon. 26 (2), 93–100.

Hignett, S., 1994. Using computerised OWAS for postural analysis of nursing work. In: Robertson, S. (Ed.), Contemporary Ergonomics. Taylor & Francis, London, pp. 253–258.

Hignett, S., 1998. Ergonomics. In: Pitt-Brooke, J., Reid, H., Lockwood J., Kerr, K. (Eds.), Rehabilitation of Movement. Theoretical Basis of Clinical Practice. W.B Saunders Company Ltd, London, pp. 480–486 (Chapter 13).

Karhu, O., Kansi, P., Kuorinka, I., 1977. Correcting working postures in industry: a practical method for analysis. Appl. Ergon. 8 (4), 199–201.

McAtamney, L., Corlett, E.N., 1993. RULA: a survey method for the investigation of work-related upper limb disorders. Appl. Ergon. 24 (2), 91–99.

McAtamney, L., Hignett, S., 1995. REBA: a rapid entire body assessment method for investigating work related musculoskeletal disorders. Proceedings of the Ergonomics Society of Australia, Adelaide, pp. 45–51.

Waters, T.R., Putz-Anderson, V., Garg, A., Fine, L.J., 1993. Revised NIOSH equation for the design and evaluation of manual lifting tasks. Ergonomics 36 (7), 749–776.