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QUESTIONNAIRE REVIEW

The Borg Rating of Perceived Exertion (RPE) scale

The study of human performance and perceived exertion during physical activity has been an area of considerable scientific interest and research over the last 50 years. The symptom of exertion is unique to an individual and can be used as a subjective estimate of the work intensity undertaken across a variety of populations. The intensity of work is important because of the risks of musculoskeletal injuries and disorders arising from a mismatch between the worker's capability and the physical demands of their job.

The Borg Rating of Perceived Exertion (RPE) scale, developed by Swedish researcher Gunnar Borg [1], is a tool for measuring an individual's effort and exertion, breathlessness and fatigue during physical work and so is highly relevant for occupational health and safety practice.

In its simplest terms, it provides a measure of how hard it feels that the body is working based on the physical sensations that the subject experiences, including increased heart rate, increased respiration or breathing rate, increased sweating and muscle fatigue [2].

Borg RPE	
Score	Level of exertion
6	No exertion at all
7	
7.5	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Taken from Borg [1]: Copyright Gunnar Borg. www.cdc.gov./physicalactivity/everyone/measuring/exertion.html.

Scoring and interpretation

The scale is a very simple numerical list. Participants are asked to rate their exertion on the scale during the activity, combining all sensations and feelings of physical stress and fatigue. They are told to disregard any one factor such as leg pain or shortness of breath but to try to focus on the whole feeling of exertion. This number gives an indication of the intensity of activity allowing the participant to speed up or slow down movements. The scale takes seconds to complete and can be researcher or self-administered and used on a single occasion or multiple times.

'9' corresponds to 'very light' exercise which, for a healthy person, is equivalent to walking slowly at his or her own pace for several minutes.
'13' feels 'somewhat hard' but the individual still feels able to continue.
'17' is 'very hard'. A healthy person can continue but must push themselves beyond their feeling of being very fatigued.
'19' is extremely strenuous exercise—for most people, the hardest they have ever experienced.

The unusual scaling, ranging not from '0' to '20' but from '6' to '20' is related to the high correlation between the scale and heart rate [2]. Thus, a Borg RPE scale of 6 corresponds to a heart rate of 60 beats/min in a healthy adult, 8–80 beats/min and so on although for individuals on beta blocker therapy (e.g. for hypertension) studies have suggested that the therapy increases the RPE due to altered metabolism in the muscles. This increase in intensity occurs at all work rates [3]. Borg also developed the Borg CR10, a Category-Ratio (CR) scale anchored at number 10, representing an extreme intensity of activity. It is a general intensity scale with special anchors to measure exertion and pain [4]. The individual is asked to circle or tick the number that best describes breathlessness, on average, over the last 24 h.

Clinical usage and validity

The use of the Borg RPE scale either on its own or in combination with other measures, such as the Borg CR10, a Visual Analogue Scale (VAS) and Likert scales, is widespread across the world in many scientific studies but particularly in the field of sports medicine, where it is used by trainers to plan the intensity of training regimes, and in the workplace, where it is used to assess the exertion used in manual handling and physically active work.

A Danish study by Jakobsen *et al.* [5] looked at the use of the Borg CR10 scale in assessing levels of fatigue at midday and at the end of the shift in ~200 workers and compared the findings with subjective measurements of muscular and cardiovascular load. They found that over

Borg CR10 scale	
Score	Level of exertion
0	No exertion at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	Slight
3	Moderate
4	Somewhat severe
5	Severe
6	
7	Very severe
8	
9	Very, very severe (almost maximal)
10	Maximal

the course of a working day, high neck muscle tension correlated well with high perceived levels of physical exertion. A score of at least 4 on the Borg CR10 scale seemed to indicate high muscular loading was occurring.

Borg scales have also been applied in a wider context than just whole body exertion. They have been used in studies of hand grip [6,7] and in assessing the value of cognitive activities during breaks as a means of accelerating recovery from fatigue [8].

Laboratory versus workplace studies of exertion

Jacobsen *et al.*'s [5] work is one of the comparatively few studies to compare physiological measurements (although these are usually undertaken in a laboratory setting) with actual lifting tasks in the workplace. Studies performed in controlled environments have shown a close relationship between perceived physical exertion and work demands expressed as percentage of the individual physical capacity. This is true for both cardiovascular [9] and muscular work [10]; however, studies comparing laboratory findings and real workplace scenarios remain relatively uncommon. Work has, however, been undertaken by Balogh *et al.* [11] and Village *et al.* [12] which suggests that there is only a weak association between perceived physical exertion and relative physical load making the application of data about workload from laboratory to workplace potentially problematic.

Comparisons

The Borg RPE scale has been compared with other linear scales such as the VAS and Likert scales. The sensitivity and reproducibility of the results are broadly similar although work by Grant *et al.* [13] suggests that the Borg may outperform the Likert scale in some scenarios.

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