

PROPOSED INCLUSION OF WORK PHYSIOLOGY IN FCE

HEART RATE RESERVE METHOD

Guided Discussion by
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Background

- A Functional Capacity Evaluation (FCE) should predict full time work tolerance
 - There are no universally accepted standards, methods, or procedures for predicting work time tolerance
- Commercial FCE protocols do not include scientific formulas for projection to an eight hour day (King, 1998)
 - Use of 85% heart rate max (HR_{max}) as cut off during FCE
- While some FCE reports mention heart rate responses during testing, we have found that FCE conclusions were not based on objective physiological responses during testing (Becker, 2015)

Background & Purpose

- Analysis of heart rate response to activity is not a standard method in the determination of full time work tolerance in FCE protocols at this time
- The purpose of this guided discussion is to spark a conversation about the use of heart rate data in determining full time work tolerance during FCE testing

Historical Perspectives

- Heart rate response can be used to determine if work can be maintained throughout working time (Bonjer, 1962)
- Heart rate has been established as the preferred determinant of full time work tolerance as is a well established indicator of work physiology response (Garg & Hagglund, 1983)
- There are formulas to predict full time work that are completely independent of exercise fitness testing (Davies, 1966)

Heart Rate & FCE Testing

- A work physiology test is designed to impose strain upon the individual that is correlated with the demands of their work environment and the worker's ability
 - Because typical day-to-day work is not performed at maximum aerobic capacity, there is no need to determine VO_{2max} for FCE
- Measuring the physiological response to required work tasks can assess the heaviness of a task and the sustainable capacity for the task completion
 - Heart rate is one of the best indexes for this assessment because of the linear relationship between heart rate and stress of task (Davies 1966, Booyens 1960)
 - Heart rate is also less invasive to test than VO_2

Physiological Strain and Work Duration

- Astrand (1960) reported that the upper limit of work tolerance for an eight hour work day is 50% of physical work capacity
 - Since industrial work may involve both high and low intensities throughout the day, the upper limit of work tolerance should be less than 50% of physical work capacity (Jiang, 1984; Kaudawitz 1998)

Workload	Percent Work	Work Duration	Heart Rate (bpm)
Moderate	<33%	8 hrs	90-110
Heavy	34-50%	1-8 hrs	111-130
Very Heavy	51-75%	20 min – 1 hour	131-150
Extremely Heavy	>75%	<20 min	>150

From Jiang (1984)

See also: Astrand (1960), Kodak (1986), AIHA (1971), Kroemer (2001), Williams (1964), Wilson (1995)

HRR Utility

- Have worker perform an individualized circuit matching the job demands and measure HR every 5 minutes
- The circuit should be longer than 5 minutes to ensure steady state heart rate
 - **If the circuit HR is at or below** the expected work heart rate, the worker meets the cardiorespiratory requirement of the job.
 - **If the circuit HR is above** the expected work heart rate or closer to max capacity, the shorter the length of time an individual can work

Conclusion

- FCE's should predict full time work tolerance
 - Average expenditure for 8 hour work day is 33%
- Heart rate response to activity during FCE's is not standard practice
 - BUT it is informative in making conclusions about work tolerance
- The HRR method takes resting heart rate into account (rather than simple $\%HR_{max}$) so FCE conclusions are more reflective of the individual

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