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Sensitivity and diagnosticity of the 0.1 Hz component of heart rate variability for the assessment of mental strain

Abstract

Under a corrective and a preventive occupational health and safety perspective and with regard to legal requirements mental work-load is a relevant criterion to evaluate the quality of work system design. Among available heart rate variability (HRV) measures the 0.1 Hz component of HRV is – according to some studies – considered a valid and standard indicator of mental strain to be used in laboratory and field settings. Other studies, on the other hand, have raised some doubts about the psychometric qualities of this measure and therefore a detailed investigation into the psychometric properties was conducted.

In laboratory studies levels and types of mental stress were varied in order to investigate the sensitivity and the diagnosticity of HRV, together with performance and perceived difficulty parameters as measures of mental strain. The results showed no support for any acceptable sensitivity and/or diagnosticity of this HRV measure. In a study based on a concept on the effects of pacing, the results provided evidence that HRV merely indicates levels of arousal. Therefore, HRV might indicate emotional strain or general activation (through time pressure, threat by potential failure of task performance, frustration, stress responses) rather than mental or cognitive strain. Results of former studies fit into such an explanation without any problems.

It is concluded that since the 0.1 Hz component of HRV does not meet conventional psychometric requirements it should not be used in (also legally required) mental work-load evaluation, and particularly not for practical purposes, where some occupational risks may be at stake.

Key words

mental work-load, mental stress, mental strain, activation, arousal, pacing, time pressure, heart rate variability, 0.1 Hz component of HRV, sensitivity, diagnosticity