Validation of a Heart Rate Derived from a Physiological Status Monitor-Embedded Compression Shirt against Criterion ECG

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ABSTRACT

Ten apparently healthy, college age males were equipped with Zephyr BioHarness™, an ECG, and firefighter PPE. Motorized treadmill test beginning at 2.7 km/h and 5% grade. Speed and grade were incrementally increased until participant reached 85% predicted max HR. Simulated search activity in which participants crawled on hands and knees for approximately 4 minutes at a quick pace, sweeping with arm every 3 steps. Outdoor fast pace walk. Participants walked up stairs, ramps, as well as level ground during late morning with comfortable temperature and humidity. Results: All four firefighting simulation tasks had small mean differences (r, 5 b/min) coupled with very tight confidence intervals between the PSM-embedded compression shirt and ECG-derived HR’s. There was very strong HR agreement with SEEs of less than 1 b/min (overall was .84) and high correlations (r > .99) during all activities. The nearly superimposed small standard errors indicate close agreement between the devices over a wide range of HR frequencies. Narrow levels of agreement and mean difference scores in heart rate detection between the criterion and PSM-embedded compression shirt (Figure 3).

RESULTS

• All four firefighting simulation tasks had small mean differences (r, 5 b/min) coupled with very tight confidence intervals between the PSM-embedded compression shirt and ECG-derived HR’s.
• There was very strong HR agreement with SEEs of less than 1 b/min (overall was .84) and high correlations (r > .99) during all activities. The nearly superimposed small standard errors indicate close agreement between the devices over a wide range of HR frequencies.
• Narrow levels of agreement and mean difference scores in heart rate detection between the criterion and PSM-embedded compression shirt (Figure 3).

CONCLUSIONS

1. Data indicate very high agreement between PSM-embedded compression shirt obtained measures of HR and criterion measures of HR during all tasks
2. Using face validity this garment meets or exceeds many of the following criteria that other PSM shirts lack: (i) wearable, (ii) functionality, (iii) durability, (iv) maintainability and (v) practicality in field.
3. Robust results in comparison to other studies is likely due to material of shirt, which is better able to wick away sweat (which has been shown to interfere with conduction). Additionally, the material is elastic which provides a more even distribution of force, leading to better adherence to the chest during awkward posturing than conventional monitors that use unidirectional straps.
4. When coupled with the strong validation results, the durability and simple design of the Zephyr BioHarness™ make it both a useful and practical device for field monitoring in fire fighters.

REFERENCES

Available upon request

CONTRIBUTION

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