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Calibration of Activity Monitors for the Assessment of Physical Activity in Children

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ABSTRACT

Accelerometry-based activity monitors offer promise for assessing free-living physical activity patterns. Most studies to date have used treadmill protocols and/or continuous activity to calibrate monitors, but these protocols are not appropriate for assessing children's intermittent physical activity patterns. The purpose of this study is to calibrate the CSA (Computer Science Application) monitor using a direct observation technique which allows for continuous coding of physical activity behavior.

The participants in the study were 29 children ages 8-12 years enrolled in a summer fitness camp at a University location. Children wore a CSA activity monitor and a heart rate (HR) monitor during both structured (seven specific tasks: sit, stand/dribble a ball, walk lap/dribble, walk continuous, jog lap/dribble, walk lap/jog lap, jog continuous) and unstructured (active games) activities. The monitors were synchronized and programmed to record data at 5-s intervals during one of the days at the camp. Videotaped recordings of the sessions were coded using a computerized observation tool (BEST) that was programmed to work with the Children's Activity Record System (CARS). The activities were coded into four categories and the mean activity level in each 5-s interval was computed (Obs) and matched with the HR and CSA data by time. Regression analyses were conducted using the averaged data from the structured activities to predict the observed activity levels. This equation was then applied to the data from the unstructured activities to cross-validate the results. Pair wise correlations were computed separately for each individual to assess the temporal matching of the data.

The correlation between Obs and CSA ranged from .62 to .94 while the correlation between HR and CSA ranged from .56 to .81. The group-based regression equation that predicted observation scores from averaged CSA data yielded an R^2 of .61 and a SEE of .56. When the equation was applied to the separate cross validation sample, the correlation between measured and predicted observation scores was moderate. The difference between measured and predicted scores was not significant but Altman Bland plots revealed a tendency to overestimate lower intensity activities and underestimate higher intensity activities. In conclusion, this study provides preliminary support for the use of the calibration equation but additional work is recommended to test its use in other populations and for different activities.