

Title: Quantifying moderate to vigorous physical activity using heart rate in children and young people with CF

Authors: HD, ER, KK, NC, GD, MB, EM

Objectives: Children and young people with CF (CYPwCF) are recommended to undertake 60minutes of moderate-vigorous physical activity (MVPA) daily. Objective measurement through continuous heart rate (HR) monitoring may prove useful in assessing MVPA levels in CYPwCF, however there is no gold standard method for this. We aimed to compare minutes in MVPA in CYPwCF using 4 published methods for establishing MVPA threshold.

Methods: Continuous HR data were collected from CYPwCF (6-16yrs) wearing a Fitbit Alta HR for at least 8 daytime hours for 21days. Comparisons were made between minutes spent in MVPA per day as defined by: (a) any $HR > 120\text{bpm}$; (b) $HR > (220 - \text{age}) \times 0.5$; (c) $HR > (208 - (0.7 \times \text{age})) \times 0.5$; and (d) $HR > (0.4 \times \text{Heart rate reserve (HRR)})$, where $HRR = (\text{peak HR} - \text{resting HR})$.

Results: 819 days of HR data were analysed from 39 CYPwCF (med: 8.9yrs range: 6-15, 17/22 male/female). Average minutes in MVPA per day (mean \pm SD) varied by definition, and were significantly higher using the age-related methods (b),(c): (235.3mins \pm 146.7) and (313.1mins \pm 170.5) respectively, compared with (a),(d): (51.5mins \pm 51.8) and (53.9mins \pm 56.3). Comparison of minutes in MVPA per day resulted in significant differences between all methods ($p < 0.001$), except (a) and (d) ($p = 0.18$). Despite similarities in MVPA minutes using definitions (a) and (d), individual average discrepancies over 21 days ranged between -66.5 to 77.2mins.

Conclusions: MVPA guidance is often based on age-related HR calculation, yet these results suggest widely discrepant estimates of time spent in MVPA per day for CYPwCF according to method. Personalised definitions of MVPA using HRR may provide the most accurate estimates, however the simple measure of $>120\text{bpm}$ is comparable and may be easiest to use in clinical practice. Further work is needed to understand the discrepancies between different methods of measuring minutes in MVPA in individual CYPwCF.