Peak Height Velocity Maturity Offset Estimated from Cross-sectional vs. Longitudinal Growth Data

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Appropriate evaluation of pediatric health indices relies on assessment based on physical maturity status. Regression equation methods have been developed to estimate maturity offset (MO) relative to age at peak height velocity (APHV) using cross-sectional anthropometric data, with extensive application in pediatric exercise research. **PURPOSE:** We evaluated agreement of these estimates against standards calculated using superimposition, translation and rotation models (SITAR) of longitudinal data, targeting specific time windows relative to PHV and menarche. **METHODS:** Height data were drawn from a longitudinal dataset evaluating female bone growth in 141 participants for whom SITAR-based APHV had been calculated using ≥3 datapoints. Two subsamples were selected based on available repeated measures in target maturity ranges based on SITAR APHV and menarche: **PRE PHV** (-2.5 to -1.5yr), **POST PHV** (+1.5 to +2.5yr); **CIRCA PHV** (-0.5 to +0.5yr) & **POST MEN** (0 to +1.0yr). Mirwald et al. and Moore et al. regression equations were used to calculate APHV and MO, yielding MO₁ and MO₂ (respectively) for comparison against SITAR MO. Spearman’s rho evaluated correlations, and Bland-Altman plots evaluated agreement with SITAR MO in each target maturity range. **RESULTS:** For **PRE PHV** and **POST PHV** comparisons, n= 58, with mean SITAR MO -2.1yr (sd 0.3) and +2.1yr (sd 0.3), respectively. For **CIRCA PHV** & **POST MEN** comparisons, n=108, with mean gynecological ages -1.1yr (sd 0.7) and +0.6yr (sd 0.3) and mean SITAR MO -0.1yr (sd 0.4) and +1.6yr (sd 0.7), respectively. Except **POST MEN**, on average, MO₁ underestimated SITAR MO [**PRE PHV** - 1.5yr, **POST PHV** -2.8yr; **CIRCA PHV** = -2.3yr, **POST MEN**= +0.5yr]. Mean discrepancies for MO₂ vs. SITAR MO were subtle, near zero [**PRE PHV**= +0.4yr, **POST PHV**= +0.1yr; **CIRCA PHV**= -0.1yr, **POST MEN**= -0.01yr]. **CONCLUSION:** MO₁ maturity estimates are flawed; <50% of estimates were within 1yr of SITAR MO for assessed maturity ranges. MO₂ provides better SITAR MO estimates using cross-sectional data. However, it is unclear whether MO₂ is an improvement over chronological age for most individuals, as MO₂ effectively assesses whether girls are short or tall for their age. In many cases, height for age may primarily reflect genetic height potential rather than maturity status, particularly at older maturity stages.

Supported by funding from NIH/NIAMS (R03 AR047613-03; R01 AR54145-5); Orthopaedic Research & Education Foundation; SUNY Upstate Medical University; University of Wisconsin-Madison Department of Orthopedic Surgery; 233-PRJ87IH Bridge Funding- University of Wisconsin-Madison School of Medicine & Public Health; Ballantine Orthopedic Surgery Research Professorship (University of Wisconsin-Madison); Grants to Binghamton University [Howard Hughes Medical Institute (HHMI) through the Precollege and Undergraduate Science Education Program; New York State Regional Economic Development Council; SUNY Investment & Performance program].