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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 SITARAPHV and menarche: PREPHV (-2.5 to -1.5yr), POSTPHV (+1.5 to +2.5yr); CIRCAPHV (-0.5 to +0.5yr) & POSTMEN (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 SITARMO. Spearman's rho evaluated correlations, and Bland-Altman plots evaluated agreement with SITARMO in each target maturity range. **RESULTS:** For PREPHV and POSTPHV comparisons, n= 58, with mean SITARMO -2.1yr (sd 0.3) and +2.1yr (sd 0.3), respectively. For CIRCAPHV & POSTMEN comparisons, n=108, with mean gynecological ages -1.1yr (sd 0.7) and +0.6yr (sd 0.3) and mean SITARMO -0.1yr (sd 0.4) and +1.6yr (sd 0.7), respectively. Except POSTMEN, on average, MO₁ underestimated SITARMO [PREPHV -1.5yr, POSTPHV -2.8yr; CIRCAPHV= -2.3yr, POSTMEN= +0.5yr]. Mean discrepancies for MO₂ vs. SITARMO were subtle, near zero [PREPHV= +0.4yr, POSTPHV= +0.1yr; CIRCAPHV= -0.1yr, POSTMEN= -0.01yr]. **CONCLUSION:** MO₁ maturity estimates are flawed; <50% of estimates were within 1yr of SITARMO for assessed maturity ranges. MO₂ provides better SITARMO 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.

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