Exploring usefulness of a new type of pubertal height references based on growth aligned for onset of Pubertal growth

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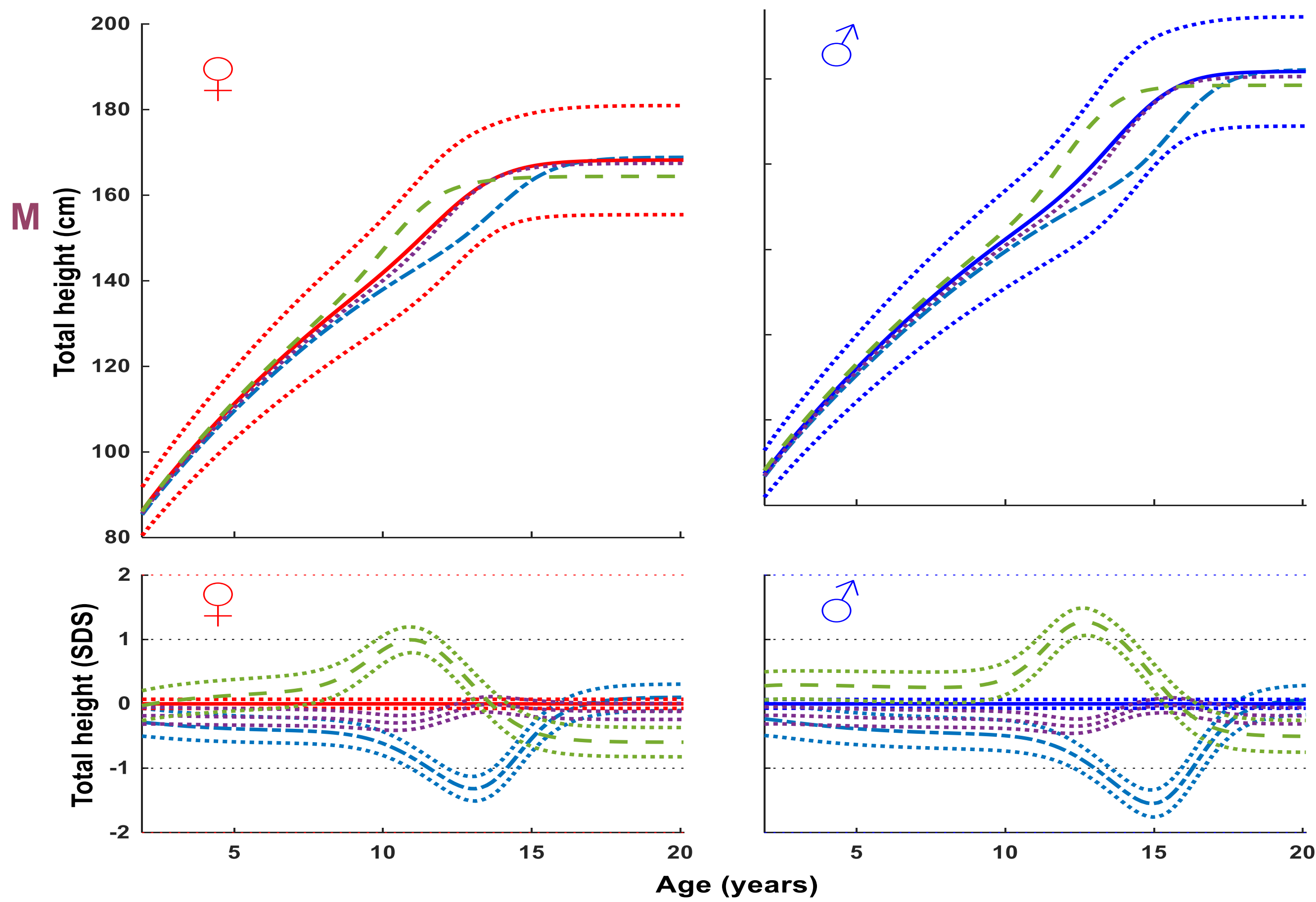UNIVERSITY OF GOTHENBURG

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Rational

Height references have so-far been available only related to chronological age and not considering the broad individual variation in the timing and tempo of pubertal maturation and growth. Therefore, growth references and growth charts for the adolescent period have been of limited usefulness both for monitoring growth in individuals and for research.

Here we explore the usefulness of a new type of pubertal height reference allowing alignment of individuals' growth curves based on timing of pubertal growth spurt.

Conclusion

The new pubertal growth reference
- was able to identify differences in the underlying growth functions that translate into differences in
- total pubertal height gain for children of varying
- BMI, height, and different pubertal timings.

- a paradigm shift for monitoring growth during puberty by using references for pubertal height aligned for the individual onset of pubertal growth.

Results

Early/Average/Late maturers: When using height reference according to chronological age, the height curve was left-shifted for early and right-shifted for late maturers, high-lightening the minimal usefulness of ordinary references only considering age.
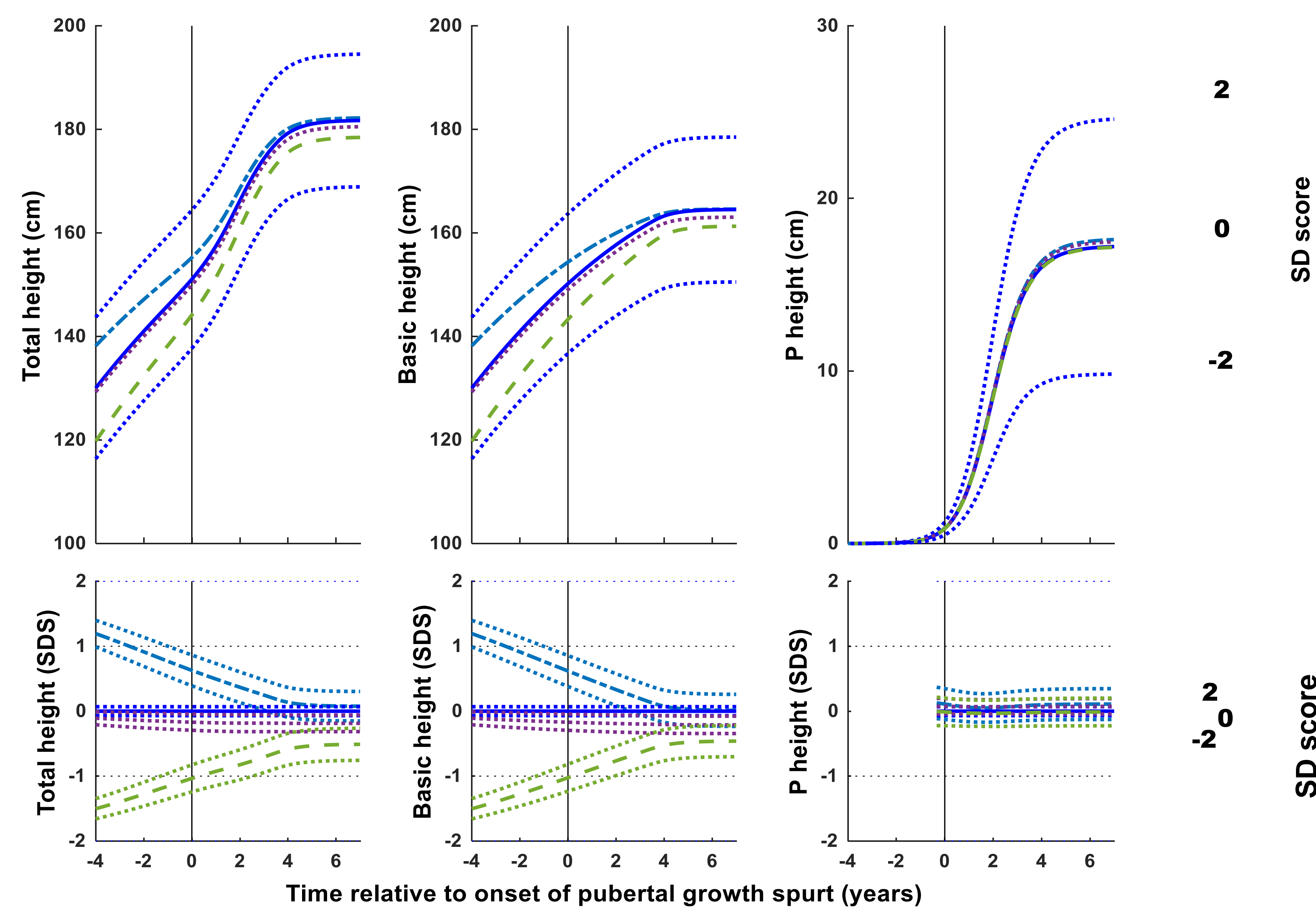
Tall children gain more height during puberty owing to more basic growth despite less specific pubertal growth, whereas short children gain less height during puberty due to less basic growth despite more specific pubertal growth (compared to reference).
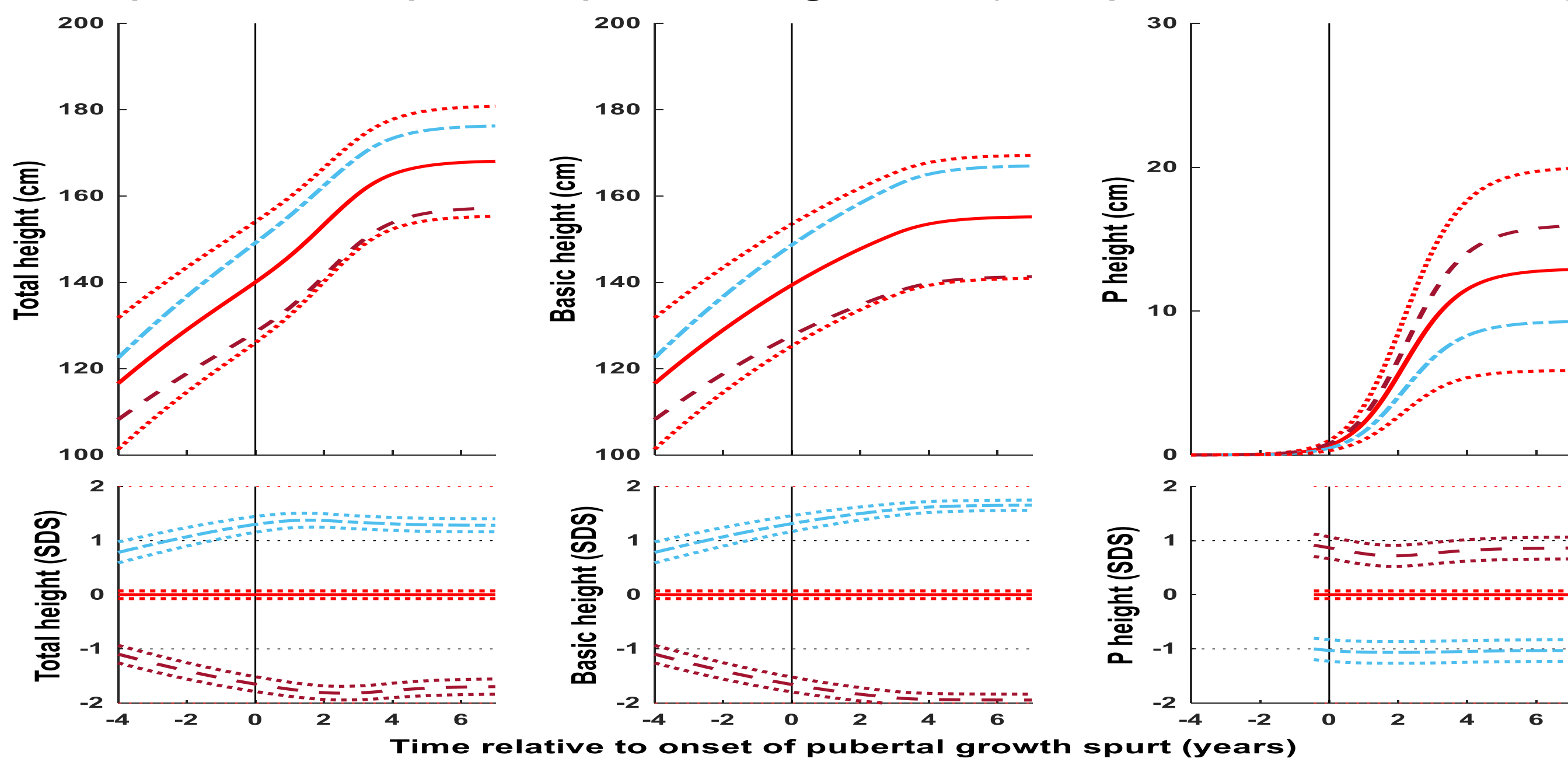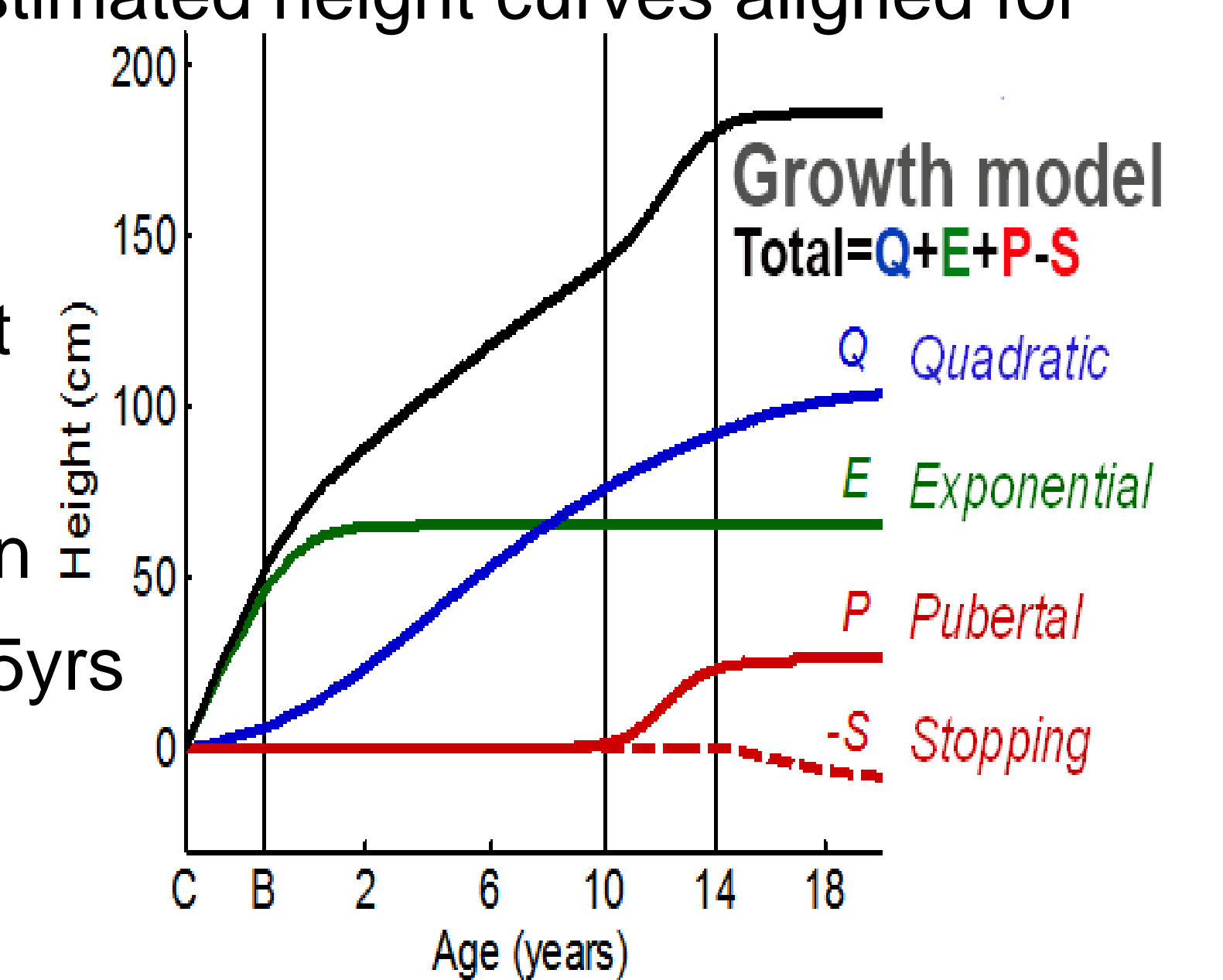

Obese children have less specific pubertal height gain than thin children with an underlying low amount of specific P-function growth and more basic growth before puberty that was maintained during puberty (compared to reference population) whereas the opposite was found in thin children.

Results
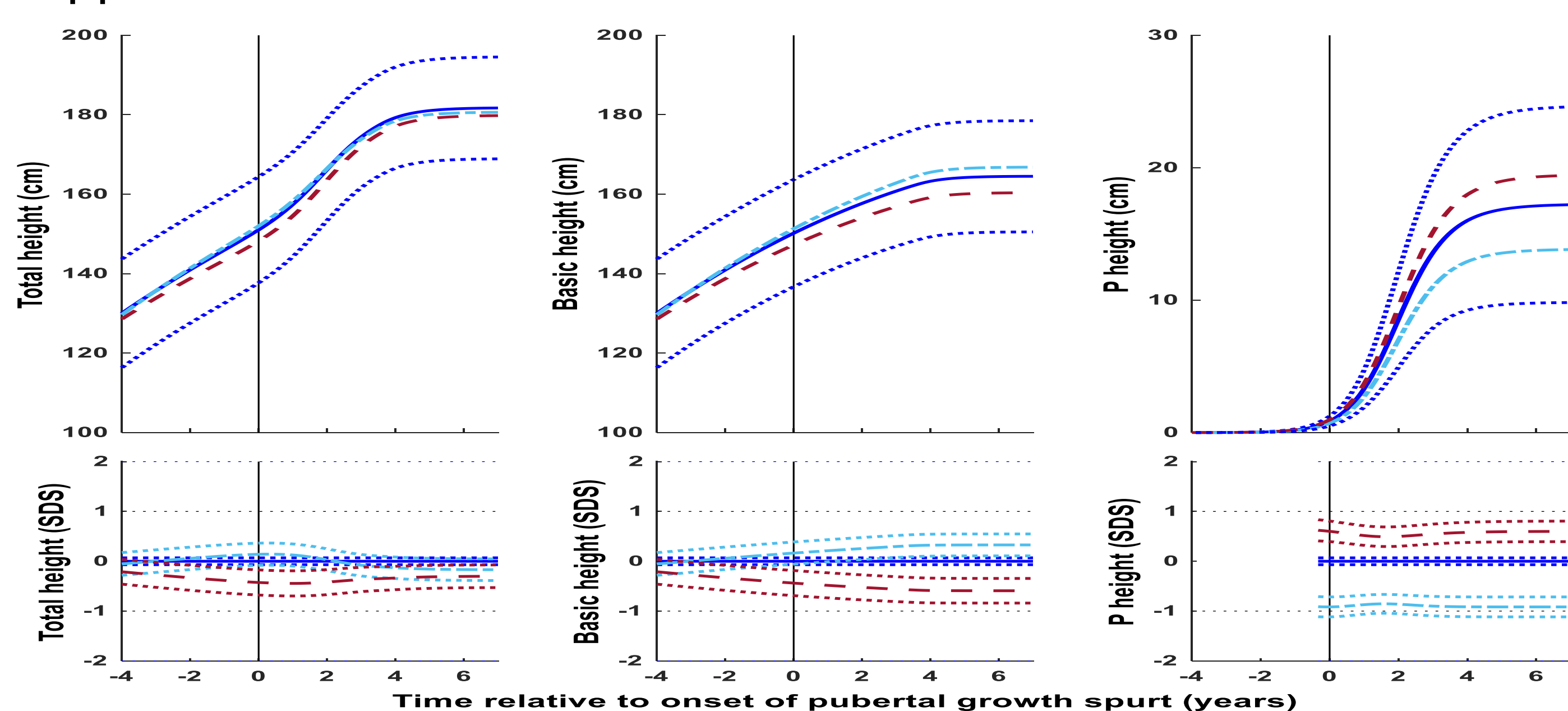
Early/Average/Late maturers: When using the new puberty-adjusted references, the variation in total pubertal height gain (early maturers gaining more, late maturers gaining less compared to average pubertal maturers) was owing to differences between the three groups in basic growth whereas height gained owing to the specific pubertal function did not differ between the three groups. Duration of pubertal growth was longer in early and shorter in late maturers and at adult height early matures were shorter whereas late male maturers were taller than those in the average group.

Methods & Material

References for total-height, specific-pubertal-height$_{SDS}$ (P-function) and basic-height$_{SDS}$ (QES-function) was constructed from QEPS (Quadratic-Exponential-Puberty-Stop)-function-estimated height curves aligned for time/age at onset of pubertal growth (defined as 5% P-function) from 1572 healthy GrowUp$_{1990}$Gothenburg-cohort Usefulness were explored using GrowUp$_{1974}$Gothenburg-cohort children with different pubertal timing (early <1.5yrs average ±0.25yrs, late >+1.5yrs); tall/short stature; high/low BMI.

Growth model
Total=Q+E+P-S
Q Quadratic
E Exponential
P Pubertal
-S Stopping

C=about 6 weeks after conception, B=birth.

References:
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3. Holmgren et al. Ped Res, 2018;
4. Sjöberg et al. Acta Paed, 2012:101(99:964-72

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