Poster P1-162
Growth B
Sept. 26th
13.15-14.00 CEST

ESPE 2021
The 59th Annual Meeting Online
22-26 September 2021

EVALUATION OF GROWTH PATTERNS FROM THE EDINBURGH AND GOTHENBURG COHORTS BY THE QEPS MODEL

Anton Holmgren[1, 2*], Aimon Niklasson[1], Andreas F.M Nierop[3, 4], Gary Butler[5*] and Kerstin Albertsson-Wikland[3*]

1. GP-GRC, Department of Pediatrics, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.
2. Department of Pediatrics, Halland Hospital, Halmstad, Sweden.
3. Department of Physiology/Endocrinology, Institute of Neuroscience and Physiology, The Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.
4. Muvara bv, Multivariate Analysis of Research Data, Leiderdorp, The Netherlands.
5. UCL Great Ormond Street Institute of Child Health, and University College London Hospital, London, United Kingdom. * = ESPE member

NHS University College London Hospitals NHS Foundation Trust
UCL GREAT ORMOND STREET INSTITUTE OF CHILD HEALTH
UNIVERSITY OF GOTHENBURG
Region Halland Hallands sjukhus

INTRODUCTION

Growth patterns are dynamic processes both for the developing individual and at the population level over time. Patterns of growth differ between individuals, sexes and populations. Over the last decade, humans in affluent countries have become progressively taller and puberty and the pubertal growth spurt has started earlier. These changes are referred as secular changes or trends[1].

The QEPS growth model can analyse and describe growth patterns in a detailed way with precise growth estimates[2,3]. The QEPS growth model, developed and validated in GrowUpGothenburg cohorts, used for developing growth references and investigating healthy/pathological growth, lacks external validation from other longitudinal cohorts of healthy individuals.

Fig 1. QEPS Growth model (left) , with pubertal growth functions (right).

AIM

The aim of this study was to investigate if the QEPS-model fits the longitudinal Edinburgh growth study of another design than GrowUpGothenburg cohorts.

To compare growth patterns in two longitudinal growth cohorts born in mid-1970s in North-Western Europe.

RESULTS

The main QEPS-height estimates (Emax/Qmax/Pmax) had confidence intervals of 1.1-2.1cm in the Edinburgh cohort compared to 1.9-4.3cm in the Gothenburg group.

Despite 2.8cm shorter stature (due to less QE-function growth) in the Scottish cohort, the growth patterns of the cohorts were similar. The timing of pubertal growth, showed no statistical differences between the study groups (Table 1).

Table 1.A QEPS growth estimates, girls.

Gothenburg cohort, girls (n 1165) Edinburgh, girls (n 68)

Variable	Mean Gothenburg	Mean Edinburgh	Difference	p–value
Emax(cm)	62.85	61.40	1.45	<.0001
Qmax(cm)	97.59	96.21	1.38	0.14
AgeP5% [1](years)	9.87	9.97	0.10	0.49
Age at PHV(years)	11.84	11.92	-0.08	0.61
Pmax(cm)	12.80	12.90	-0.10	0.83
Pubertal height gain(cm)	26.37	25.80	0.57	0.24
Tmax[2](cm)	167.26	164.44	2.82	<.0001

Table 1.B QEPS growth estimates, boys

Gothenburg cohort, boys (n 1174) Edinburgh, boys (n 89)

Variable	Mean Gothenburg	Mean Edinburgh	Difference	p–value
Emax(cm)	65.07	63.95	1.12	<.0001
Qmax(cm)	104.05	102.26	1.79	0.042
AgeP5% [1](years)	11.82	11.98	-0.16	0.13
Age at PHV(years)	13.69	13.86	-0.17	0.12
Pmax(cm)	17.38	16.98	0.40	0.31
Pubertal height gain(cm)	28.97	28.09	0.88	0.026
Tmax[2](cm)	180.53	177.66	2.87	<.0001

1=Age at 5% of pubertal growth. 2 =Calculated adult height by QEPS.

Table 2. The contribution to adult height (percentage explained variance) from QEPS-functions.

	Emax	Emax Qmax	Emax Qmax Pmax	Emax Qmax Pmax AgeP50%[1]
Girls Gothenburg	12.3	67.7	86.5	99.5
Girls Edinburgh	4.9	58.9	77.9	98.4
Boys Gothenburg	9.0	69.7	89.9	99.5
Boys Edinburgh	11.8	66.9	91.1	99.5

1=Age at 50% of the pubertal growth.

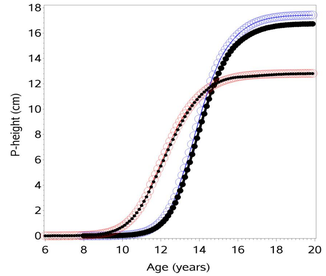

Figure 3. QEPS Pubertal height functions (medians) for Gothenburg girls (red open circles) and Edinburgh girls (black dots), for Gothenburg boys (open blue circles) and for Edinburgh boys (black dots) in relation to chronological age.

MATERIAL & METHODS

The Longitudinal growth data was obtained from the Edinburgh and the GrowUp1974Gothenburg cohorts[4,5]. The QEPS-model was used to describe length/height from birth to adult height with confidence intervals and multivariate regression was performed to estimate the contribution of different QEPS-functions to adult height. Analyses of growth patterns were done with the QEPS-growth model[2, 3].

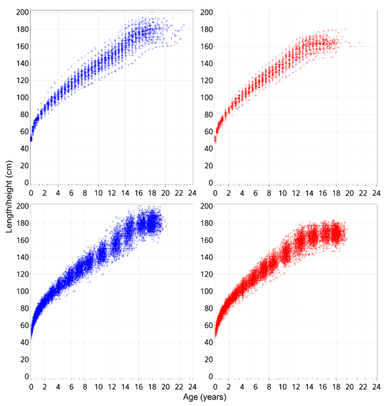

Figure 2. Distribution of length/height by age (upper panel Edinburgh longitudinal cohort, lower panel GrowUp 1974 Gothenburg cohort; male, left, blue; female, right, red.

Edinburgh longitudinal Growth Study consisted of children born 1972 to 1976. The present analysis included data from 157 healthy individuals (68 girls), with growth data evenly distributed through all ages, median of 34/37 measurements for girls/boys, with a median age of 7.6/8.5 years for girls and boys (Figure 1).

The GrowUp 1974 Gothenburg cohort consisted of individuals born at full term around 1974 in Sweden, with longitudinal growth data. The present analysis included data from 2339 healthy individuals (1165 girls). Growth data was most frequently collected in the first 6 years of life. There was a median of 22 measurements per individual (same for both sexes), with a median age for both sexes of 2.0 years (Figure 2).

CONCLUSIONS

The QEPS-model now validated for the first time in another longitudinal study than Swedish growth cohorts of healthy individuals[6], fitted the Edinburgh cohort well, with high accuracy and narrow confidence intervals (CI) indicating high precision. The CI has become shorter due to regular and shorter intervals between measurements.

The Scottish and Western-Swedish cohorts born in mid-1970s showed for both sexes strikingly similar growth patterns, especially for pubertal growth.

REFERENCES

1. Holmgren A. *Human growth patterns -with focus on pubertal growth and secular changes*. Dissertation. University of Gothenburg; 2018. http://hdl.handle.net/2077/58087
2. Nierop A.F.M, et.al. *Modelling individual longitudinal human growth from fetal to adult life - QEPS I.* J.Theoretical.Biology,406(2016)143–165.
3. Holmgren A, et.al. *Insight into human pubertal growth by applying the QEPS growth model.* BMC.Pediatrics,2017;Apr19;17(1):107
4. Butler GE, et al. *The cyclical nature of prepubertal growth.* Annals of human biology. 1990; 17:177-98
5. Albertsson-Wikland K, et al. *Swedish population-based longitudinal reference values from birth to 18 years of age for height, weight and head circumference*. Acta Paediatr. 2002; 91:739-54
6. Holmgren A, et al. *Estimating secular changes in longitudinal growth patterns underlying adult height with the QEPS model: the Grow Up Gothenburg cohorts.* Pediatric research. 2018; 84:41-9

Contact: anton.holmgren@regionhalland.se

Poster Session Online
Presented at: ESPE 2021
Growth and syndromes (to include Turner syndrome)
Anton Holmgren
P1-162